SULLIVAN, MOUNTJOY, STAINBACK & MILLER PSC

ATTORNEYS AT LAW

ald M. Sullivan
Jesse T. Mountjoy
Frank Stainback
James M. Miller
Michael A. Fiorella
Allen W. Holbrook
R. Michael Sullivan
Bryan R. Reynolds
Tyson A. Kamuf
Mark W. Starnes
C. Ellsworth Mountjoy
Susan Montalvo-Gesser

RECEIVED

NOV 15 2010

PUBLIC SERVICE
COMMISSION

Case No 2010-00443

November 12, 2010

Jeff DeRouen
Executive Director
Public Service Commission
211 Sower Boulevard, P.O. Box 615
Frankfort, Kentucky 40602-0615

Re: Big Rivers Electric Corporation's 2010 Integrated Resource Plan

Dear Mr. DeRouen:

Enclosed in connection with the 2010 Integrated Resource Plan ("IRP") of Big Rivers Electric Corporation are the following:

1. Petition of Big Rivers Electric Corporation for confidential treatment of portions of its 2010 IRP;

2. One sealed and bound copy of the IRP with the confidential material highlighted or on a CD marked confidential;

3. Ten copies of the IRP with the confidential material redacted; and

4. One additional, unbound copy of the IRP with the confidential material redacted.

Although there were no intervenors to the proceeding regarding Big Rivers' 2005 IRP, that proceeding was dismissed without a review of the IRP. Therefore, a copy of the items listed in this letter, and attachments, have been served on each of the parties to the 2002 Big Rivers' IRP proceeding, as shown on the attached service list. If you have any questions regarding this filing, please do not hesitate to contact Albert Yockey, VP Governmental Relations & Enterprise Risk Management at Big Rivers, or me.

Sincerely yours,

Tyson Kamuf

TAK/ej
Enclosures

cc: w/enclosures: Service List
Sanford Novick
Burns Mercer
Kelly Nuckols

Telephone (270) 926-4000
Telecopier (270) 683-6694

100 St. Ann Building
PO Box 727
Owensboro, Kentucky
42302-0727

SERVICE LIST

Dennis Howard, Esq.
Assistant Attorney General
1024 Capital Center Drive
Suite 200
Frankfort, KY 40601

Office of the Attorney General of the Commonwealth of Kentucky

John Stapleton
Director of Energy
663 Teton Trail
Frankfort, KY 40601

Hon. Iris Skidmore
Hon. Ronald P. Mills
Office of Legal Services
Fifth Floor, Capital Plaza Tower
Frankfort, KY 40601

Counsel for Natural Resources and Environmental Protection

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

2010 INTEGRATED RESOURCE PLAN

November 2010

Prepared by

GDS ASSOCIATES, INC

Executive Summary

This report presents the Integrated Resource Plan ("IRP") for Big Rivers Electric Corporation ("Big Rivers" or "the Company"). GDS Associates, Inc. ("GDS") provided analysis and evaluation in the preparation of this report. Big Rivers filed its last IRP with the Kentucky Public Service Commission ("KPSC" or "the Commission") in 2005 (Case 2005-00485). However, due to activities associated with the Unwind Transaction[1], Case 2007-00455, the Commission granted Big River's Motion to Dismiss Case 2005-00485 and, as part of the Unwind Transaction, Big Rivers committed to file an IRP by November 15, 2010.

The Unwind Transaction represents a significant change in how Big Rivers must plan for its expected load growth. Therefore, this 2010 IRP incorporated a change in the level of analytical detail relative to the 2005 IRP in the area of supply side analysis. A complete resource assessment was conducted using Strategist optimization software and a full Demand Side Management ("DSM") screening assessment was completed. As a result of the DSM assessment, Big Rivers and its member distribution cooperatives are planning implementation of several Energy Efficiency ("EE") Programs.

The Unwind Transaction significantly improved Big Rivers' financial health. Big Rivers recorded an Unwind gain in the 2009 Statement of Operations, resulting in 2009 net margins of $531.3 million, as compared to $27.8 million in 2008. Big Rivers' equity position improved greatly as well, going from a deficit of $155 million in 2008 to a positive $379 million in 2009. Furthermore, Big Rivers was able to deposit nearly $218 million into reserve funds to be used for member rate mitigation. Big Rivers' cash and cash equivalents balance was $60.3 million at the end of 2009, over $20 million more than the 2008 balance of $38.9 million. All operating and capital expenditures in 2009 were funded without any new debt issuance.

Big River's 2010 IRP includes the following highlights:

- Big Rivers currently owns and operates 1,444 MW of generating capacity. An additional 385 MW are available from Henderson Municipal Power and Light ("HMP&L") (207 MW) and from the Southeastern Power Administration ("SEPA") (178 MW), for a total capacity availability of 1,829 MW. Currently, Big Rivers' Reid 1 unit has been configured such that co-firing coal and gas is possible. In this configuration, the unit can generate 50 MW using only coal as opposed to its maximum capacity of 65 MW when configured to burn coal and gas. However, the gas line to the unit is currently not in service and the unit does not have the required environmental permits to burn gas. Additionally, a force majeure has been declared by SEPA due to dam

[1] The Unwind was the term used for the transaction that ended the agreements under which E. ON U.S. subsidiary Western Kentucky Energy Corp. had been operating the generating stations owned by Big Rivers. The agreements, signed in 1998, were set to run through 2023, but both companies agreed after several years of negotiation to "unwind" the arrangement and Big Rivers assumed operational control of its generating units as well as the HMP&L William L. Newman Station Two facility. The Unwind was completed in July 2009.

safety issues at the Wolf Creek and Center Hill Dams, near Jamestown, Kentucky, and Lancaster, Tennessee, respectively, on the Cumberland River System. Currently SEPA is providing a run-of-river schedule. During the time the force majeure has been in effect, the run-of-river schedule has provided up to approximately 100 MW. Based on current estimates from the Army Corps of Engineers, which is responsible for repairs, the termination of the force majeure, and hence the ability of Big Rivers to schedule its full SEPA allocation of 178 MW, is expected to occur in mid-year 2013. The lower capacity currently available from Reid 1 and SEPA reduces Big Rivers' total of 1,829 MW by 93 MW to a current total capacity of 1,736 MW.

- Big Rivers owns and operates a transmission system containing 1,262 miles of transmission line and 80 substations.
- Big Rivers' Equivalent Forced Outage Rate[2] ("EFOR") was 3.7% in 2009. The industry average for comparable generating units is 6.9%, according to the North American Electric Reliability Corporation ("NERC").
- The system peak demand is projected to grow by 117 MW from 2010 through 2025, reaching 1,613 MW (0.5% average annual growth).
- The resource assessment analysis was produced using a minimum reserve margin criteria equal to 14%. The selection of this value was based on NERC's suggested 15% reserve margin target for predominantly thermal systems. A minimum of 14% was used to recognize that actual margins could vary above and below the target over the term of the IRP. [redacted]
- Big Rivers plans to launch Energy Efficiency Programs beginning in 2011. For the IRP study, a case representing 2011 expenditures of $1 million on DSM is assumed. The programs under this case are expected to save a cumulative 49,160 MWh by 2025, with a 14 MW reduction in winter peak demand and a 10 MW reduction in summer peak demand[3]. The programs may include, but are not limited to:
    - Residential Efficient Lighting Program
    - Residential Efficient Products Program
    - Residential Advanced Technologies Program
    - Residential Weatherization Program

[2] The percentage of time a generating unit is off-line unexpectedly.
[3] Savings would vary based on expenditure levels for EE programs. For details on savings estimates, see Section 8.3(e) and Appendix B herein.

  - Residential New Construction Program
  - Commercial and Industrial ("C&I") Prescriptive Lighting Program
  - C&I Prescriptive Heating, Ventilation and Air Conditioning ("HVAC") Program

- The DSM analysis conducted as part of the 2010 IRP evaluation includes screening of demand response ("DR") programs. The DR programs analyzed were not cost effective in the DSM screening analysis[4]. Big Rivers will continue to monitor the cost effectiveness of DR programs.

- Sensitivities were run to address uncertainties in the resource assessment. The list below describes the assumptions made for each sensitivity case. The table shows the optimal plans for each scenario.

  a) High Fuel Price Case
     i) Base case assumptions for all variables except for:
        (1) 20% increase in all fuel prices and market prices
  b) High Load case
     i) Base Case assumptions for all variables except for:
        (1) High load and energy requirements forecast
  c) Renewable Portfolio Standard case
     i) Base Case assumptions for all variables except for:
     ii) RPS requirements of:
        (1) 15% of total Big Rivers energy provided by renewable resources by 2015
        (2) 20% of total Big Rivers energy provided by renewable resources by 2020
        (3) 25% of total Big Rivers energy provided by renewable resources by 2025
     iii) Specific resources as sources of energy as follows:
        (1) 80% of RPS energy generated by wind projects,
        (2) 15% of RPS energy generated by biomass projects,
        (3) 5% of RPS energy generated by photovoltaic projects.
     iv) Carbon reduction costs are assumed to be in place beginning 2015 (carbon cost projections included herein as Appendix J)
  d) Environmental Compliance case
     i) Base Case assumptions for all variables except that:
        (1) Carbon reduction costs are assumed to be in place beginning in 2015,
        (2) there is a 1% Reduction in capacity at R.D. Green units 1 & 2 and at K.C. Coleman units 1, 2, & 3 to account for installation of SCRs, and
        (3) R.A. Reid unit 1 retires at the end of 2011.
  e) Big Rivers MISO case
     i) Base Case assumptions for all variables except that:

[4] See Appendix B for further details on the screening of demand response programs.

(1) Big Rivers' generating resource capacities are adjusted for purposes of reserve margin calculations according to MISO defined Equivalent Forced Outage Rates,
(2) the Planning Reserve Margin used for the development of the expansion plan is equal to 4.5%. This percentage is MISO's Non-Coincident Load Based Planning Reserve margin as defined in the MISO Business Practices Manual: Resource Adequacy effective June 1, 2010

Table ES 1: Optimal Expansion Plans

[redacted]

1. General Provisions
(807 KAR 5:058, Section 1)

(1) This administrative regulation shall apply to electric utilities under commission jurisdiction except a distribution company with less than $10,000,000 annual revenue or a distribution cooperative organized under KRS Chapter 279

Big Rivers Electric Corporation ("Big Rivers") is a generation and transmission cooperative organized under Kentucky Revised Statutes ("KRS") Chapter 279.000. As such, Big Rivers is subject to the Commission's jurisdiction pursuant to KRS 279.210. Accordingly, Big Rivers is filing this 2010 IRP with the Commission pursuant to the relevant Kentucky Administrative Regulations ("KAR"), i.e., 807 KAR 5:058.

(2) Each electric utility shall file triennially with the commission an integrated resource plan. The plan shall include historical and projected demand, resource, and financial data, and other operating performance and system information, and shall discuss the facts, assumptions, and conclusions, upon which the plan is based and the actions it proposes

Big Rivers previously filed IRPs in 1991 (Case No. 1991-00331, filed on September 16, 1991), 1993 (Case No. 1993-00341, filed on September 14, 1993), 1999 (Case No. 1999-00429, originally due in 1999 but filed on March 22, 2000), 2002 (Case No. 2002-00428, filed November 27, 2002) and 2005 (Case No. 2005-00485, filed November 30, 2005). As a result of activities associated with the Unwind Transaction, Case No. 2007-00455, the Commission granted Big Rivers' Motion to Dismiss Case No. 2005-00485 on August 5, 2009. In Case No. 2007-00455, Big Rivers committed to filing a new IRP no later than November 15, 2010.[5]

This 2010 IRP presents Big Rivers' resource plan for meeting projected power requirements through 2025. This report presents the basis for the plan and the resulting actions Big Rivers will undertake with respect to meeting future load requirements through a portfolio of supply-side and demand-side resources. Supporting documents, figures, and tables are provided in the Appendices.

(3) Each electric utility shall file ten (10) bound copies and one (1) unbound, reproducible copy of its integrated resource plan with the commission

By November 15, 2010, Big Rivers filed ten (10) bound copies, plus one (1) unbound copy of this 2010 IRP.

[5] http://psc.ky.gov/PSCSCF/2005%20cases/2005-00485/20090723_Big_Rivers_Motion_to_Dismiss.PDF

2. Filing Schedule
(807 KAR 5:058, Section 2)

(1) Each electric utility shall file its integrated resource plan according to a staggered schedule which provides for the filing of integrated resource plans one (1) every six (6) months beginning nine (9) months from the effective date of this administrative regulation.

(a) The integrated resource plans shall be filed at the specified times following the effective date of this administrative regulation:

(b) The schedule shall provide at such time as all electric utilities have filed integrated resource plans, the sequence shall repeat

(c) The schedule shall remain in effect until changed by the commission on its own motion or on motion of one (1) or more electric utilities for good cause shown. Good cause may include a change in a utility's financial or resource condition

(d) If any filing date falls on a weekend or holiday, the plan shall be submitted on the first business day following the scheduled filing date.

Once the administrative regulation governing the filing of integrated resource plans (807 KAR 5:058) was effective in 1990, the Company's initial IRP was due within thirty-three (33) months of that effective date. As noted in Big Rivers' response to the General Provisions above (807 KAR 5:058 Section 1(2)), the Company's first IRP was filed on September 16, 1991.

(2) Immediately upon filing of an integrated resource plan, each utility shall provide notice to interveners in its last integrated resource plan review proceeding, that its plan has been filed and is available from the utility upon request.

Concurrent with the filing of its 2010 IRP, Big Rivers notified the following interveners from the previous IRP filing (Case No. 2002-00428):

- Office of the Attorney General of the Commonwealth of Kentucky
- Energy and Environment Cabinet, Department of Energy Development and Independence (*formerly* Natural Resources and Environmental Protection Cabinet, Division of Energy)

Pending the outcome of the Unwind Transaction (Case No. 2007-00455), the Company's 2005 IRP (Case No. 2005-00485) was held in abeyance. There were no interveners in the 2005 IRP proceeding. As noted in the response to the General Provisions above (807 KAR 5:058 Section 1(2)), the Commission closed Case No. 2005-00485 when it granted Big Rivers' Motion to Dismiss.

(3) Upon receipt of a utility's integrated resource plan, the commission shall establish a review schedule which may include interrogatories, comments, informal conferences, and staff reports.

3. Waiver

(807 KAR 5:058, Section 3)

A utility may file a motion requesting a waiver of specific provisions of this administrative regulation. Any request shall be made no later than ninety (90) days prior to the date established for filing the integrated resource plan. The commission shall rule on the request within thirty (30) days. The motion shall clearly identify the provision from which the utility seeks a waiver and provide justification for the requested relief which shall include an estimate of costs and benefits of compliance with the specific provision. Notice shall be given in the manner provided in Section 2(2) of this administrative regulation.

Big Rivers is aware of its rights under this particular administrative section. However, with this 2010 IRP filing, Big Rivers is not filing any motion requesting a waiver of any specific provisions of the IRP administrative regulation, 807 KAR 5:058.

4. Format
(807 KAR 5:058, Section 4)

(1) The integrated resource plan shall be clearly and concisely organized so that it is evident to the commission that the utility has complied with reporting requirements described in subsequent sections.

Each section of Big Rivers 2010 IRP corresponds to a section of the Kentucky Administrative Regulation governing the filing of Integrated Resource Plans, 807 KAR 5:058 Sections 1 through 11. In doing so, Big Rivers is responding to those subsections within the regulation which require a response.

(2) Each plan filed shall identify the individuals responsible for its preparation, who shall be available to respond to inquiries during the commission's review of the plan.

This 2010 IRP was prepared for Big Rivers by GDS. The 2010 IRP was completed in October 2010, approved by Big Rivers' Board of Directors in October 2010, and filed with the KPSC on or before November 15, 2010. A number of people from Big Rivers and GDS contributed to the completion of the 2010 IRP. These individuals, and their area of expertise, are presented in Table 4.1 below. Input was also solicited from Big Rivers' member distribution cooperatives: Jackson Purchase Energy Corporation ("JPEC"), Kenergy Corp. ("Kenergy"), and Meade County Rural Electric Cooperative Corporation ("MCRECC").

Table 4.1: Big Rivers 2010 IRP Responsible Individuals

Company	*Name*	*Area of Expertise*
Big Rivers Electric Corporation	*Mark Bailey, President*	
201 Third Street	*Bill Blackburn, S.V.P*	*Project Management*
Henderson, KY 42420	*Mike Mattox*	*Power Supply, Load Forecast*
	Duane Brauneckerx	*Production*
270-827-2561	*Mike Thompson*	*Power Supply*
	Chris Bradley	*Transmission*
	Travis Siewert	*Finance*
	Roger Hickman	*Regulatory Affairs*
	Steve Noland	*Environmental/Emissions*
	Russ Pogue	*DSM/Energy Efficiency*
GDS Associates, Inc.	*Brian Smith*	*Power Supply, Resource Planning and Modeling*
1850 Parkway Place	*Amber Roberts*	
Suite 800	*Jeffrey Huber*	*DSM/Energy Efficiency*
Marietta, GA 30067	*Jacob Thomas*	
770-425-8100	*John Hutts*	*Load Forecast*

Big Rivers requests that all KPSC Staff inquiries be directed to Big Rivers' Staff.

5. Plan Summary
(807 KAR 5:058, Section 5)

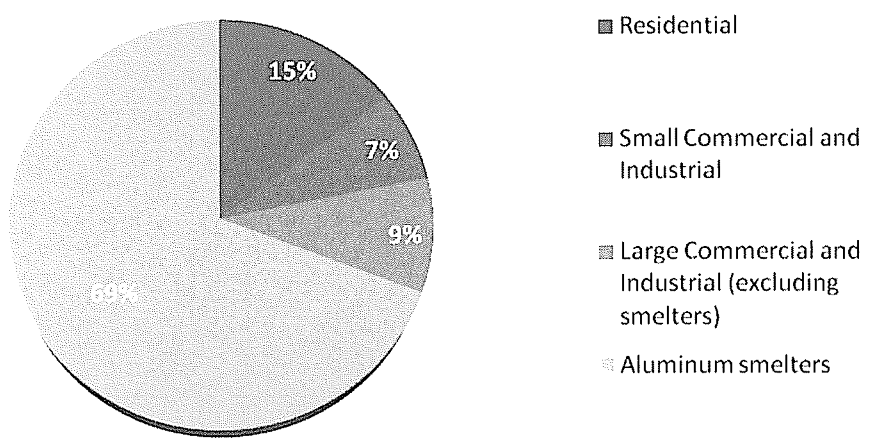
The plan shall contain a summary which discusses the utility's projected load growth and the resources planned to meet that growth. The summary shall include at a minimum:

(1) Description of the utility, its customers, service territory, current facilities, and planning objectives

Big Rivers is a generation and transmission cooperative headquartered in Henderson, Kentucky, which provides wholesale electric power to three member distribution cooperatives: Kenergy, JPEC, and MCRECC, all of which provide retail electric service to consumers located in western Kentucky. Big Rivers provides full power requirements for each of its three member cooperatives, including two aluminum smelters served by Kenergy. Big Rivers' wholesale rates are presented in its tariff, *Big Rivers Electric Corporation of Henderson, Kentucky Rates, Rules and Regulations for Furnishing Electric Service*, effective July 17, 2009, which is on file with the Commission and in certain wholesale power contracts with Kenergy for service to its smelter customers.

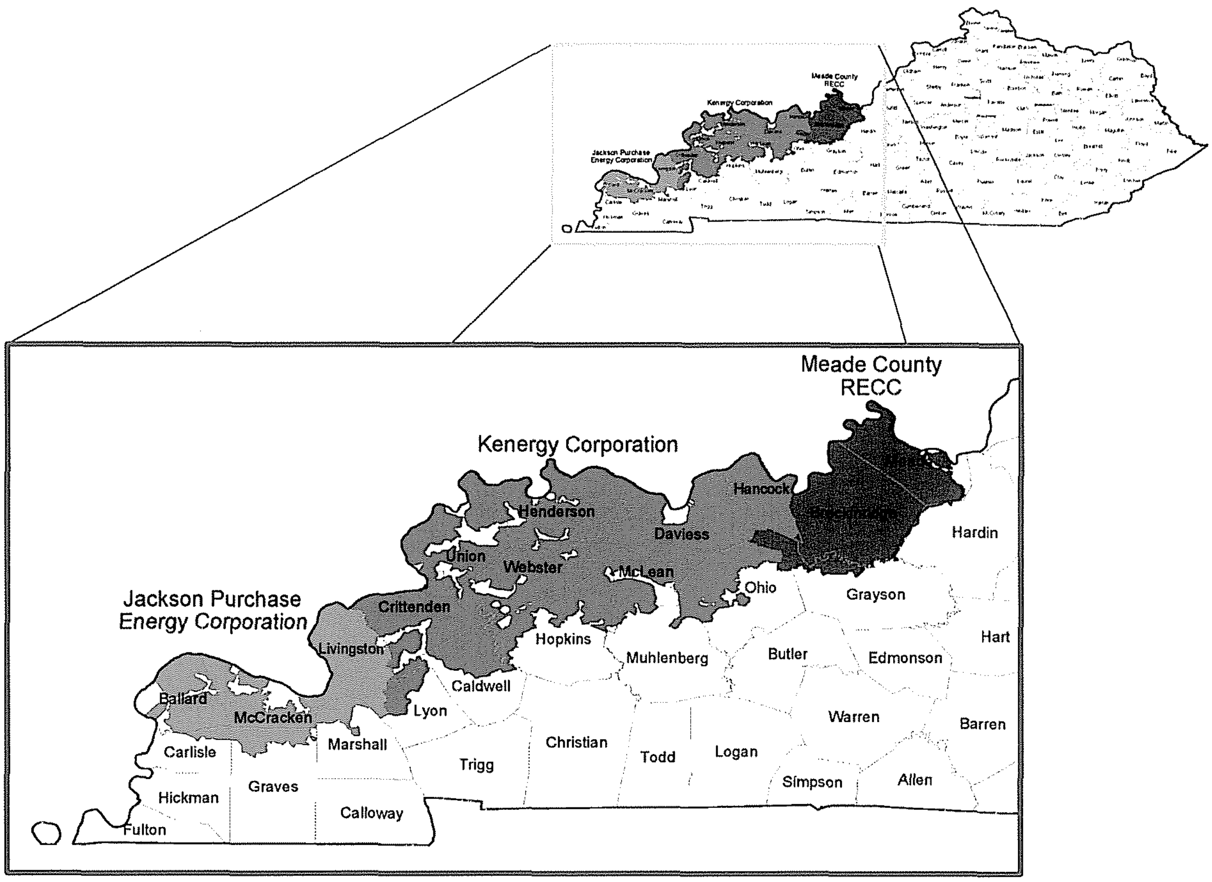
Approximately 90% of the accounts served by the member cooperatives are residential. The breakdown of aggregate member cooperative energy sales by class are presented in Figure 5.1 below. The most distinguishing characteristic of the Big Rivers system is service to two aluminum smelters, which together consume nearly 7,500 GWH per year and have the ability to peak at approximately 850 MW.

Figure 5.1: Retail Class Energy Sales Proportions



Big Rivers' member cooperatives provide electric service in 22 counties located in western Kentucky, which are presented in Figure 5.2 below.

Figure 5.2: Big Rivers Service Area Map



The topography of Big Rivers' member cooperatives' service areas ranges from rolling, sandy embayment areas to flat plateau areas with low relief and subterranean drainage. Typical elevations range from approximately 340 to 1,000 feet above sea level. The climate in the area is humid, temperate and continental.

Total energy requirements for 2010 are projected at 10,696 GWH. The winter peak for 2010 is projected at 1,482 MW, and the summer peak is projected at 1,470 MW.

Capacity Resources

Total generation resources are 1,829 MW, currently including rights to 207 MW at Henderson Municipal Power & Light's William L. Newman Station Two facility ("HMP&L Station Two" or

"Henderson Station Two")[6] and 178 MW of dependable capacity from the Southeastern Power Administration ("SEPA"). As noted earlier, force majeure conditions on the SEPA system, and the available capacity at Reid 1 associated with a coal/gas co-firing configuration has reduced Big Rivers' total generation capacity to 1,736 MW at the present time.

Transmission System

Big Rivers owns, operates and maintains its 1,262 mile transmission system and provides for the transmission of power to its members and third party entities served under the Open Access Transmission Tariff. A map of the transmission system is provided in Figure 5.3 on the following page and in Appendix M.

Figure 5.3: Transmission System Map

[redacted]

Voluntary Load Curtailment Rider

Big Rivers works with its member cooperatives and their larger industrial customers to reduce load during times of peak demand. On March 10, 2000, Big Rivers, in conjunction with JPEC, Kenergy, and MCRECC, filed a Voluntary Curtailment Rider with the KPSC. The Commission approved the Volutary Curtailment Rider as filed in its Order, dated April 6, 2000, in Case No. 2000-00116.

[6] HMP&L has the contractual right to increase or decrease its capacity reservation from HMP&L Station Two by up to 5 MW each year.

Planning Goals and Objectives

Big Rivers' primary planning goal in its 2010 IRP is to reliably provide for its customer's electricity needs over the next 15 years through an appropriate mix of supply and demand side options, at the lowest reasonable cost. To meet this goal, Big Rivers has established the following planning objectives:

- Maintain a current and reliable load forecast
- Consider expanding Demand Side Management ("DSM") Programs
- Identify potential new supply side resources and DSM Programs
- Provide competitively priced power to its members
- Maintain adequate planning reserve margins
- Maximize reliability while minimizing costs, risks, and environmental impacts
- Meet North American Electric Reliability Corporation ("NERC") guidelines and requirements
- Provide assistance to its member cooperatives regarding new technologies, mapping and planning, safety training and programs, economic development, and customer support

(2) Description of models, methods, data, and key assumptions used to develop the results contained in the plan

Load Forecast

The load forecast is based on a series of econometric and statistically adjusted end-use models ("SAE model"). The forecast is developed using a "bottom-up" approach, as forecasts are developed individually for each of Big Rivers' three member distribution cooperatives and aggregated to the Big Rivers level. For each distribution cooperative forecast, econometric models were developed to project the number of residential customers, number of small commercial customers, and small commercial energy use per customer. Total small commercial sales represent the product of number of customers and energy use per customer. SAE models were developed to project energy consumption per customer. Total residential sales represent the product of number of customers and energy consumption per customer. The number of customers and corresponding energy sales for the large commercial classification are developed individually for each customer and based on historical trends and information obtained by distribution cooperative management from the customers.

The models incorporate a combination of electric system, economic, weather, price, end-use characteristics and housing characteristics data. The sources of the data are summarized in Section 7.7(a).

Resource Assessment

Big Rivers' resource assessment was developed using the Strategist Integrated Planning System. This model, which is licensed to GDS by Ventyx, has the capability to simulate production operations and develop least cost expansion plans. The production operations simulation establishes the optimal dispatch of generating resources and calculates the associated costs. The development of least cost expansion plans includes comparisons of all combinations of potential resource additions in order to determine the portfolio of expansion units necessary to achieve planning reserve margin criteria at the lowest cost. Big Rivers' existing generating resources were modeled using the Strategist Generation and Fuel module ("GAF".) The existing units were dispatched against the 2010 Load and Energy Forecast which is described in Section 7. The Load and Energy Forecast was modeled using the Strategist Load Forecast Adjustment module ("LFA".) In order to address uncertainties related to several variables, the production simulation and expansion planning analysis was conducted for a Base Case and several sensitivity cases. The Base Case includes (1) the base Load and Energy Forecast, (2) the Energy Efficiency ("EE") Programs included in the $1 million annual energy efficiency expenditure case, (3) base fuel price projections, and (4) base market price projections as a source of economy energy purchases.

Sensitivity cases are listed below along with a description of major assumptions.

1) High Fuel Price Case
    a) Base Case assumptions for all variables except for:
        i) 20% increase in all fuel prices and market prices

2) High Load case
    a) Base Case assumptions for all variables except for:
        (1) High load and energy requirements forecast
3) Renewable Portfolio Standard case
    a) Base Case assumptions for all variables except for:
        i) RPS requirements of:
            (1) 15% of total Big Rivers energy provided by renewable resources by 2015
            (2) 20% of total Big Rivers energy provided by renewable resources by 2020
            (3) 25% of total Big Rivers energy provided by renewable resources by 2025
        ii) Specific resources as sources of energy as follows:
            (1) 80% of RPS energy generated by wind projects
            (2) 15% of RPS energy generated by biomass projects
            (3) 5% of RPS energy generated by photovoltaic projects
        iii) Carbon reduction costs are assumed to be in place beginning 2015 (carbon cost projections included herein as Appendix J)
4) Environmental Compliance case

a) Base Case assumptions for all variables except that:

i) Carbon reduction costs are assumed to be in place beginning in 2015

ii) There is a 1% Reduction in capacity at R.D. Green units 1 & 2 and at K.C. Coleman units 1, 2, & 3 to account for installation of Selective Catalytic Reduction ("SCR")

iii) R.A. Reid unit 1 retires at the end of 2011

5) Big Rivers MISO case

a) Base Case assumptions for all variables except that

i) Big Rivers' generating resource capacities are adjusted for purposes of reserve margin calculations according to MISO defined Equivalent Forced Outage Rates

ii) The Planning Reserve Margin used for the development of the expansion plan is equal to 4.5%. This percentage is MISO's Non-Coincident Load Based Planning Reserve margin as defined in the MISO Business Practices Manual: Resource Adequacy effective June 1, 2010.

Demand Side Management

DSM measure lists were developed in an effort to address different customer classifications and end-use types. Technologies were pre-screened to eliminate those that did not pass the cost effectiveness test. The measure scope was also restricted to DSM measures and practices that are currently commercially available. These are measures that are of most immediate interest to program planners.[7]

Significant detail is needed to estimate the average and total savings potential for individual measures or programs. Estimates of annual measure savings, measure costs, and measure useful lives were developed using various energy modeling software, energy calculations, meter data, DSM database (*i.e.* DEER Database), and evaluation reports. Program participation rates were developed using building characteristic data from current Big Rivers appliance saturation studies, Energy Information Administration ("EIA") regional data, and budgeting parameters.

Big Rivers evaluated the cost-effectiveness of specific DSM measures when determining which DSM programs to implement. The net present value of costs vs. benefits is assessed, *i.e.*, the costs to implement the measures are valued against the savings or avoided costs. The resultant benefit/cost ratios, or tests, provide a summary of the measure's cost-effectiveness relative to the benefits of its projected load impacts. Measures were screened using the GDS Benefit/Cost Screening Model, which is an analysis tool designed to evaluate the costs, benefits, and risks of DSM programs and services.

[7] About 100 individual measures were analyzed in the DSM portion of the IRP. Although, after accounting for adjustments to different building types, housing characteristics and measures targeting the space heating and cooling end-use, the number grew to exceed 200 measure permutations.

The main criterion Big Rivers used to screen DSM measures was the Total Resource Cost ("TRC") Test. The TRC Test measures the net costs of an energy measure or program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. The benefits include the avoided electric supply costs, the reduction in transmission, distribution, generation, and capacity costs valued at the marginal cost for the period when there is an electric load reduction, as well as the savings of other resources such as fossil fuels and water. All equipment costs, installation, operation and maintenance, cost of removal, and administration costs are included in this test. The TRC test includes only direct costs and benefits, not externalities or non-monetized factors. Results are typically expressed as either net benefits or benefit-to-cost ratio.

A complete list of the DSM programs, their annual impacts and long-term savings potential are presented in greater detail in Section 8. The analysis performed to prepare this IRP represents the period 2011-2025, although the primary analytical focus for DSM programs is during the first three years. This technique was used in order to concentrate on the near-term, while recognizing that course corrections due to evolving markets, technologies and regulations may be made along the way.

(3) Summary of forecasts of energy and peak demand, and key economic and demographic assumptions or projections underlying these forecasts

Energy and peak demand requirements are projected to increase at average compounds rates of 0.4% and 0.5%, respectively, per year from 2010 through 2025. The relatively low growth rates are significantly influenced by two industrial customers, whose combined load is projected to remain level at 850 MW throughout the forecast horizon. Peak demand is projected to increase by approximately 8 MW per year from 2010 through 2025. The load forecast is summarized in Table 5.1.

Table 5.1: 2010 Load Forecast/IRP

	Total Energy Requirements (MWH)	*Winter Peak Demand (MW)*	*Summer Peak Demand (MW)*
2005	*10,603,749*	*1,413*	*1,469*
2006	*10,609,828*	*1,414*	*1,486*
2007	*10,697,157*	*1,467*	*1,511*
2008	*10,747,493*	*1,476*	*1,475*
2009	*9,856,285*	*1,536*	*1,469*
2010	*10,695,669*	*1,496*	*1,478*
2011	*10,729,241*	*1,498*	*1,485*
2012	*10,782,940*	*1,504*	*1,491*
2013	*10,793,126*	*1,510*	*1,497*
2014	*10,827,941*	*1,517*	*1,503*
2015	*10,867,352*	*1,525*	*1,511*
2016	*10,926,611*	*1,533*	*1,519*
2017	*10,951,812*	*1,542*	*1,527*
2018	*10,996,403*	*1,551*	*1,536*
2019	*11,041,551*	*1,560*	*1,544*
2020	*11,101,517*	*1,568*	*1,552*
2021	*11,127,454*	*1,578*	*1,561*
2022	*11,171,403*	*1,587*	*1,569*
2023	*11,214,923*	*1,595*	*1,578*
2024	*11,278,601*	*1,604*	*1,586*
2025	*11,323,317*	*1,613*	*1,595*

The forecast is heavily influenced by the large Commercial and Industrial ("C&I") class, which represents approximately two-thirds of total system peak demand and energy requirements. Energy and peak projections for the large C&I class include only those customers that are currently on line, and energy and peak values are held constant at 2009 levels. No new customers, and no new growth in energy sales and peak demand for existing customers in the class, are included in the forecast.

Growth in the number of customers for the residential class is influenced by increases in the number of households, which is projected to increase at an average rate of 0.5% per year through 2025. Growth in the number of small commercial customers is driven by employment, which is also projected to increase at an average rate of 0.5% per year.

Average household consumption is projected to show very little growth in future years. Factors limiting growth in consumption include: increases in price, continued replacement of older inefficient appliances with newer high efficient units, continued decline in the number of people per household, and increases in building efficiencies and general consumer conservation awareness. Factors contributing to increases in average household consumption include: larger homes, increases in electric appliance market shares, and continued growth in miscellaneous plug loads. Average use per small commercial customer is projected to be relatively flat over the forecast horizon.

The key economic and demographic assumptions upon which the load forecast is based are discussed in Section 7.7(b) of this IRP report.

(4) Summary of the utility's planned resource acquisitions including improvements in operating efficiency of existing facilities, demand-side programs, nonutility sources of generation, new power plants, transmission improvements, bulk power purchases and sales, and interconnections with other utilities

Big Rivers' Base Case acquisition plan includes the addition of 50 MW of CT capacity in 2022. This addition is necessary in order to maintain a planning reserve margin of 14%. No additions are necessary during the term of the IRP if planning reserve criteria were reduced to 12%. In addition to existing capacity, Big Rivers has access to the wholesale power markets to buy and sell power as needed, subject to market availability.

Figure 5.4: Projected Capacity and Peak Demand Requirements (MW)

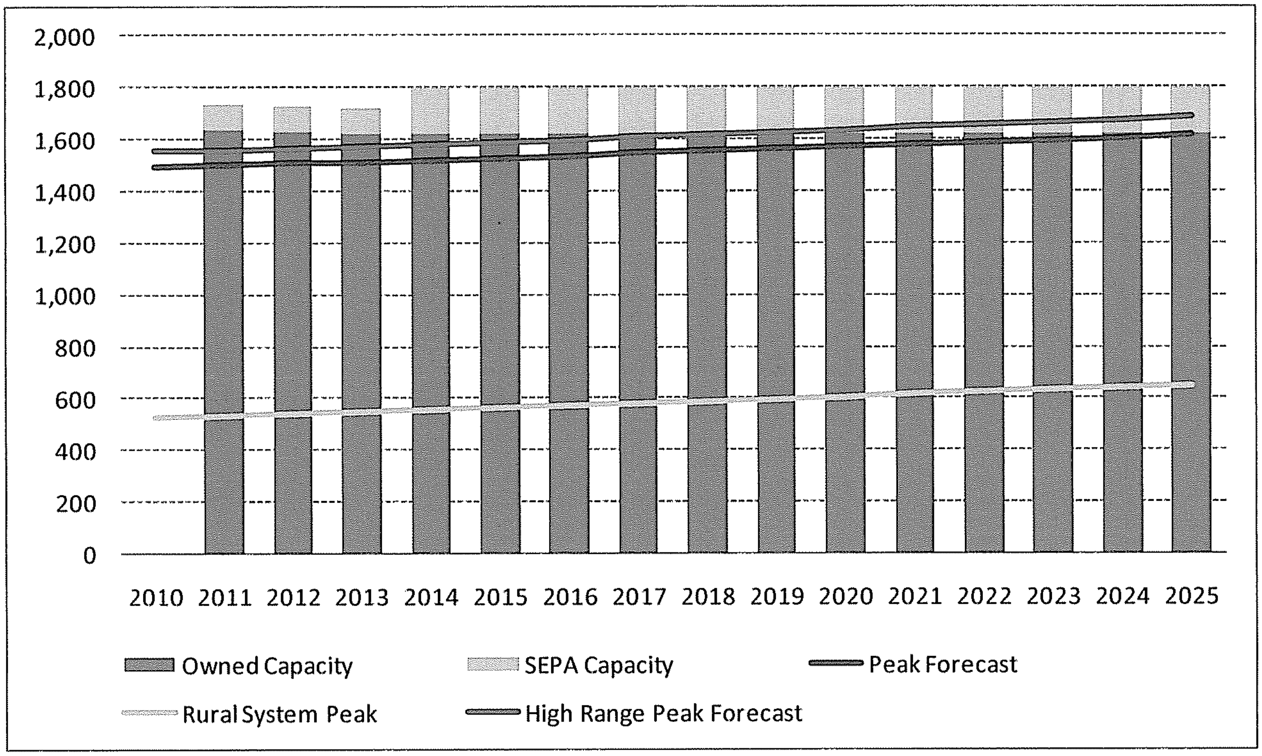


Table 5.2: Projected Capacity and Peak Demand Requirements (MW)

Year	*System Peak Demand (MW)*	*Energy Efficiency Programs (MW)*	*Owned Capacity (MW)*	*SEPA Contract Maximum Capacity (MW)*	*Total Capacity (MW)*	*Capacity Surplus (MW)*
2010	1,496					
2011	1,498	(1.00)	1,632	100	1,732	235
2012	1,504	(2.07)	1,626	100	1,726	223
2013	1,510	(3.19)	1,544	178	1,722	215
2014	1,517	(4.21)	1,616	178	1,794	281
2015	1,525	(5.26)	1,616	178	1,794	274
2016	1,533	(6.33)	1,616	178	1,794	267
2017	1,542	(7.41)	1,616	178	1,794	259
2018	1,551	(8.35)	1,616	178	1,794	251
2019	1,560	(9.34)	1,616	178	1,794	243
2020	1,568	(10.28)	1,616	178	1,794	236
2021	1,578	(11.21)	1,616	178	1,794	228
2022	1,587	(12.05)	1,616	178	1,844	270
2023	1,595	(12.90)	1,616	178	1,844	262
2024	1,604	(13.76)	1,616	178	1,844	254
2025	1,613	(14.64)	1,616	178	1,844	246

For the development of the Base Case plan, as well as for sensitivity cases, a list of potential resource additions was developed for the resource assessment modeling process. This list of resources defines the options that the model is able to choose in order to meet planning reserve criteria. The list of potential additions includes traditional supply-side options, renewable supply-side options, and EE Programs that were selected in the EE screening process. The complete list of options is shown below.

1. Nuclear
2. Coal
3. Gas-fired Combined Cycle
4. Gas-fired Combustion Turbine
5. Biomass
6. Landfill Gas
7. Wind
8. Photovoltaic
9. Coal Bed Methane
10. EE program portfolio

Operating characteristics and associated costs for supply-side resources listed above were taken from the EIA's 2010 Annual Energy Outlook with modifications to certain variables based on GDS' involvement in recent generation feasibility analyses and construction monitoring. Tables in Section 8 contain cost and operational characteristics associated with potential supply-side options.

(5) Steps to be taken during the next three (3) years to implement the plan

No generating resource acquisition steps are necessary over the next 3 years of the IRP. No additional resources are required to maintain adequate reliability.

The initial step in the program design and implementation process for DSM programs in the Big Rivers service territory will be to determine actual costs and benefits using local products and services. There are currently a number of pilot projects planned and underway to determine the feasibility of partnering with local contractors and testing available products for efficacy. The pilot projects will be used to determine and outline the requirements for effective program administration and marketing, incentive processing, tracking, and evaluating program performance.

For the majority of the first year, program design, marketing, consumer education, retailer communication and developing a contractor infrastructure will be the focus. Once those pieces are in place, Big Rivers and its members will continue to market, educate and grow DSM programs, but more emphasis will be on marketing to consumers in order to increase participation in the programs. Effective media and marketing approaches are a vital component for any DSM program and can be placed in all forms of media. Examples include bill inserts, member newsletters, Kentucky Living (statewide magazine), public service announcements, radio, newspaper, trade shows, special events, civic groups, etc.

Finally, Big Rivers will perform on-going program impact evaluations over the life of each program. An assessment will be conducted once the program has been operating for a period of time to determine program efficacy and cost. Other limited process evaluations will also be conducted to examine issues such as: member participation rates, free ridership and program contractors and participant satisfaction with the program. Results from evaluations will be used to refine the program and increase program savings, participation and cost effectiveness.

(6) Discussion of key issues or uncertainties that could affect successful implementation of the plan

Uncertainties in several key variables were addressed by using a sensitivity case approach. In addition to the Base Case, cases were developed that factored in (1) higher than base fuel prices, (2) high load and energy projections, (3) enactment of a Renewable Portfolio Standard, (4) uncertainties related to environmental compliance issues, and (5) MISO resource adequacy standards. Table 8.1 contains expansion plans associated with each of the sensitivity cases and demonstrates the changes in timing and resource types associated with resource additions.

6. Significant Changes
(807 KAR 5:058, Section 6)

All integrated resource plans, shall have a summary of significant changes since the plan most recently filed. This summary shall describe, in narrative and tabular form, changes in load forecasts, resource plans, assumptions, or methodologies from the previous plan. Where appropriate, the utility may also use graphic displays to illustrate changes.

Big Rivers' most recent IRP was filed with the KPSC on November 30, 2005, and was assigned Case No. 2005-00485. On January 10, 2006, Big Rivers filed a motion for the KPSC to hold the case in abeyance as a result of Big Rivers' signing a letter of intent with E.ON U.S. LLC and its subsidiaries to pursue termination of various agreements that had been in place since 1998 ("the 1998 Lease Agreements"). The 1998 Lease Agreements, approved by the Commission in its Order dated April 30, 1998, in Case No. 1997-00204, had given E.ON U.S. LLC affiliates operational control of Big Rivers' power plants, and ownership of the electricity generated by them. The Unwind Transaction dramatically altered the resources available to Big Rivers and the issues relevant to Rig Rivers' IRP filed in Case 2005-00485. On January 18, 2006, the KPSC ruled that Case 2005-00485 be held in abeyance until further Order of the Commission. The transaction terminating the 1998 Lease Agreements (the "Unwind Transaction") was completed in July 2009, and Big Rivers resumed control of its generation facilities and ownership of all the power generated by those facilities.

The Unwind Transaction is the most significant change in Big Rivers' resource planning since filing the 2005 IRP. In addition, Big Rivers has revised portions of its load forecasting methodology, updated its load forecast, updated its DSM analysis and methodology, and updated its capacity resource modeling methodology.

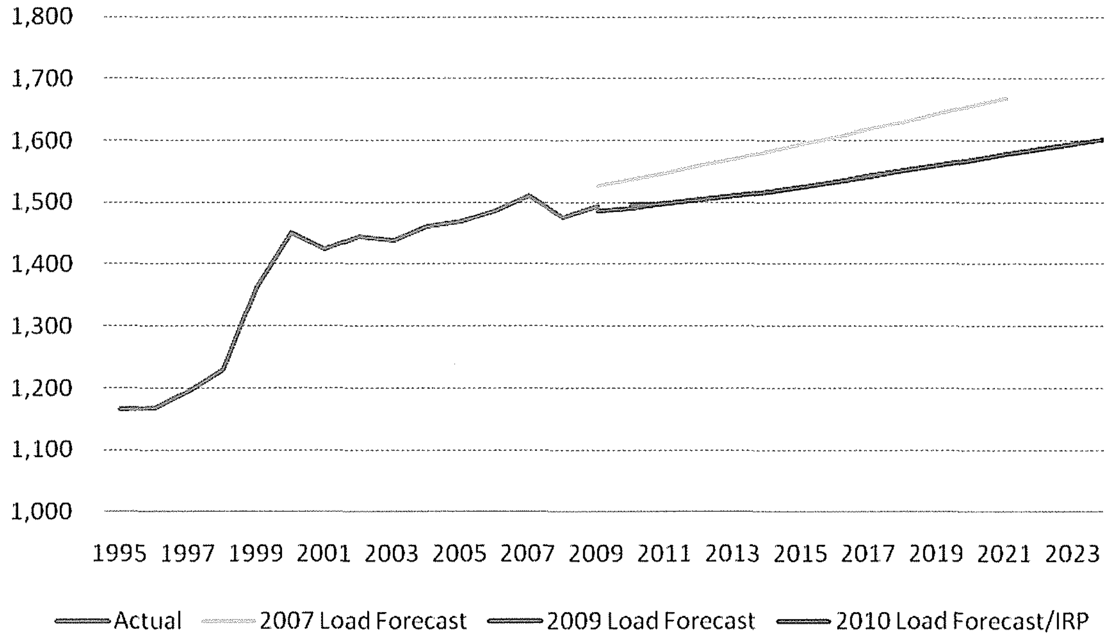
Load Forecasting Methodology

Since filing its last IRP in 2005, Big Rivers has updated portions of its load forecast methodology. Beginning with the 2007 Load Forecast, the method for forecasting residential sales changed from a traditional econometric model to a SAE model. SAE models combine the benefits of both end-use and econometric models and provide a means for quantifying many relevant factors that influence household consumption. Refer to Appendix A, Section 8.3, for a description of SAE models. Beginning with the 2009 Load Forecast, the economic outlook was based on projections developed by Moody's Economy.com. Moody's updates its economic forecasts more frequently than other providers, and they have proven to be a reliable and respected entity in the utility industry.

Updates to the Load Forecast

As a result of the Unwind Transaction, Big Rivers resumed primary responsibility as power supplier for electricity sold to two aluminum smelters under wholesale contracts with Kenergy Corp. As a result, Big Rivers' power supply requirements contractually increased by approximately 850 MW and 7,300 GWH per year. Figure 6.1 presents projected peak demand requirements from the 2007 Load Forecast, the 2009 Load Forecast, and the 2010 Load Forecast/IRP. Amounts for all forecasts include requirements for the two aluminum smelters. The 2007 Load Forecast did not reflect the 2008-2009 economic recession impacts that are included in the 2009 and 2010 forecasts. There are no significant differences between the 2009 Load Forecast and the 2010 Load Forecast/IRP.

Figure 6.1: Comparison of 2007, 2009 and 2010 Load Forecasts (MW)



Resource Assessment

At the time the 2005 IRP was prepared, Big Rivers purchased the majority of its requirements in excess of power provided through its SEPA contract from LG&E Energy Marketing, Inc. ("LEM"). Under the arrangement with LEM, Big Rivers had no need for additional capacity during the term of the 2005 IRP. Quantitative analyses filed with the 2005 IRP were produced using Excel models developed by GDS. As there was no need for additional resources, no sophisticated expansion planning tools were required.

In 2009, Big Rivers completed the Unwind Transaction under which it regained control of the generating assets and terminated its power purchase agreement with LEM. Due to this change in circumstances, a comprehensive analysis was required for the production of the 2010 IRP. Big Rivers' resource assessment was developed using the Strategist Integrated Planning System. This model, which is licensed to GDS by Ventyx, has the capability to simulate production operations and develop least cost expansion plans. The production operations simulation establishes the optimal dispatch of generating resources and calculates the associated costs. The development of least cost expansion plans includes comparisons of all combinations of potential resource additions in order to determine the portfolio of expansion units necessary to achieve planning reserve margin criteria at the lowest cost. Big Rivers' existing generating resources were modeled using the Strategist GAF module. The existing units were dispatched against the 2010 Load and Energy Forecast which is described in Section 7 below. The Load and Energy Forecast was modeled using the Strategist LFA module.

Demand Side Management

In the 2005 IRP, Big Rivers relied primarily on educational programs to help consumers make educated decisions to save energy and money by being more efficient users. In the current IRP, the plan now involves consideration of several Energy Efficiency Programs.

Although most Demand Response Programs were determined not to be cost effective at this time, Big Rivers will continue to monitor them for cost effectiveness.

The methodology employed for screening DSM programs is the same as the methodology used in the 2005 IRP.

Transmission System

With respect to the improvement and more efficient utilization of existing transmission facilities in the period from 2005 through August of 2010, Big Rivers constructed and placed in service approximately 17 miles of new 69 kV transmission lines to connect to six new delivery point substations of its member systems. An additional five miles of new 69 kV line was constructed to strengthen the sub-transmission network and improve reliability. To increase transmission line current ratings, approximately 25 miles of 69 kV and approximately 27 miles of 161 kV lines were re-conductored with higher current capacity conductors. The existing Wilson to Coleman extra high voltage ("EHV") 345 kV circuit was interconnected with Kentucky Utilities' ("KU") system at the newly constructed Daviess County EHV substation. This expansion was completed to increase Big Rivers' transmission capacity for off system sales. This would also serve to increase Big Rivers' import capabilities to purchase power as an alternative to building additional generation capacity.

Big Rivers upgraded its microwave communications infrastructure with the expansion of the East and West loops picking up the three member cooperatives plus a new broadband digital microwave overbuild addition to all three power plant locations for voice and data networking needs providing high speed network connectivity.

Big Rivers has been working on the engineering and license procurement to replace the two-way radio system used by Big Rivers and the three member co-operatives. Each of the four companies will have their own two-way radio system sharing a common backbone infrastructure. This new system will accommodate two-way radio communications between the four companies during emergency situations. In service date is projected for 2012.

Work toward completion of other transmission system improvements is a continuous process. A list of completed and planned improvements to the Big Rivers system for 2005-2025 is included in Tables 6.1 and 6.2 below.

Table 6.1: Completed Transmission System Additions

Completed System Additions (2005 - 2010)

Project Description	*Year*
Madisonville 69 kV line addition	*2005*
Cumberland 69 kV line addition	*2007*
Niagara Portal 69 kV line addition	*2008*
Skillman – Meade Co. 161 kV line addition	*2008*
Midway Mine 69 kV line addition	*2008*
Reid – Onton Jct. 69 kV reconductor	*2008*
Providence – S. Hanson Tap 69 kV reconductor	*2008*
E.ON Daviess Co. 345 Interconnection	*2008*
Olivet Church Rd. 69 kV line addition	*2009*
Reid – Davies Co. 161 kV reconductor	*2009*
Coleman – Coleman EHV 161 kV line 1 reconductor	*2010*
Coleman – Coleman EHV 161 kV line 2 reconductor	*2010*
Coleman – Newtonville 161 kV line reconductor	*2010*

Table 6.2: Planned Transmission System Additions

Planned System Additions (2010 - 2024)

Project Description	*Year*
Falls of Rough – McDaniels 69 kV line addition	*2010*
Wilson – New Hardinsburg/Paradise 161 kV tap line	*2011*
Paradise 161 kV reconductor from new tap point	*2011*
Wilson 161 kV terminal for new tap line	*2011*
Wilson 161/69 kV transformer addition	*2012*
Wilson – Centertown 69 kV line	*2012*
Meade – Garrett 69 kV line reconductor	*2012*
Payneville area tap line & metering	*2013*
Cumberland – Caldwell Springs 69 kV line	*2013*
Garrett – Flaherty 69 kV line project	*2013*
White Oak 161/69 kV substation addition	*2013*
Rome Junction – West Owensboro 69 kV reconductor	*2017*
Hardinsburg 161/69 kV transformer replacements (2)	*2017*
Wilson – Sacramento 69 kV line addition	*2018*
Thruston Junction – East Owensboro 69 kV reconductor	*2018*
Rome Junction – Philpot Tap 69 kV reconductor	*2018*
HMP&L Sub 4 161/69 kV transformer addition	*2018*
Olivet Church Road tap 69 kV line reconductor	*2020*
Meade County 161/69 kV transformer addition	*2020*
Brandenburg area 69 kV capacitor addition	*2020*
Ensor 161/69 kV substation addition	*2022*
Reid EHV 161/69 kV transformer addition	*2022*
Hardinsburg No. 1 to Harned 69 kV line reconductor	*2022*
White Oak 161/69 kV transformer addition	*2024*

7. Load Forecasts
(807 KAR 5:058, Section 7)

The plan shall include historical and forecasted information regarding loads.

Big Rivers updates its long-term load forecast every two years.[8] The 2009 Load Forecast was completed in July 2009 and approved by the Board of Directors in August 2009. The base historical year in the 2009 Load Forecast is 2008, and the forecast horizon spans years 2009 through 2023.

A review of the 2009 Load Forecast was completed during 2010, which included an analysis and comparison of energy and peak demand projections for 2009 to actual values for the year. Actual 2009 energy and peak demand values were weather adjusted to provide for a comparison of data on the same basis (projections reflect normal weather). The energy requirements forecast variance for 2009 was approximately 7 percent, the winter peak variance for 2009/2010 was 0.8 percent, and the summer peak variance for 2009 was 1.2 percent. The large energy requirements forecast variance was due primarily to the shutting down of a pot line at an aluminum smelter for an extended period. The pot line, while not in operation as of September 2010, is projected to operate throughout the forecast horizon.

The forecast supporting the modeling analysis completed during the development of the IRP, referenced in this report as the 2010 Load Forecast/IRP, is the 2009 forecast adjusted to reflect portions of the forecast variance for calendar year 2009 and to extend projections of total system energy and demand requirements through 2025. The 2010 Load Forecast/IRP is presented in Table 7.1 on the following page. The base year in the 2010 Load Forecast/IRP is 2009.

The system modeling analysis completed for the IRP incorporated projected energy requirements and peak demands at the total system level; therefore, the 2010 Load Forecast/IRP contains updated projections for the aggregate Big Rivers system. All discussion and presentation of forecasts by customer classification are those projections contained in the 2009 Load Forecast.

[8] Big Rivers secures financing from the Department of Energy, Rural Utilities Services ("RUS"). RUS requires Big Rivers to update its load forecast every two years and to submit the forecast to RUS for review and approval. RUS approved the 2009 Load Forecast on November 10, 2009.

Table 7.1: Historical and Projected Power Requirements

	2009 Load Forecast			*2010 Load Forecast /IRP*		
	Total Energy Requirements (MWH)	*Winter Peak Demand (MW)*	*Summer Peak Demand (MW)*	*Total Energy Requirements (MWH)*	*Winter Peak Demand (MW)*	*Summer Peak Demand (MW)*
2005	10,603,749	1,413	1,469	10,603,749	1,413	1,469
2006	10,609,828	1,414	1,486	10,609,828	1,414	1,486
2007	10,697,157	1,467	1,511	10,697,157	1,467	1,511
2008	10,747,493	1,476	1,475	10,747,493	1,476	1,475
2009	10,724,973	1,494	1,488	9,856,285	1,536	1,469
2010	10,757,127	1,499	1,492	10,695,669	1,496	1,478
2011	10,791,625	1,505	1,498	10,729,241	1,498	1,485
2012	10,846,240	1,512	1,505	10,782,940	1,504	1,491
2013	10,857,274	1,518	1,511	10,793,126	1,510	1,497
2014	10,893,049	1,525	1,517	10,827,941	1,517	1,503
2015	10,933,548	1,533	1,525	10,867,352	1,525	1,511
2016	10,993,876	1,541	1,533	10,926,611	1,533	1,519
2017	11,020,338	1,550	1,541	10,951,812	1,542	1,527
2018	11,066,160	1,559	1,550	10,996,403	1,551	1,536
2019	11,112,553	1,568	1,559	11,041,551	1,560	1,544
2020	11,173,608	1,576	1,567	11,101,517	1,568	1,552
2021	11,200,827	1,586	1,576	11,127,454	1,578	1,561
2022	11,245,989	1,594	1,584	11,171,403	1,587	1,569
2023	11,290,709	1,603	1,592	11,214,923	1,595	1,578
2024	n/a	n/a	n/a	11,278,601	1,604	1,586
2025	n/a	n/a	n/a	11,323,317	1,613	1,595

Note: Shaded year represents base year in each forecast.

(1) The information shall be provided for the total system and, where available, disaggregated by the following customer classes:

a) **Residential heating-** Big Rivers does not maintain or forecast the information at this level of disaggregation.

b) **Residential non-heating-** Big Rivers does not maintain or forecast the information at this level of disaggregation.

c) **Total residential (total of paragraphs (a) and (b) of this subsection)**

Combined residential sales for Big Rivers' three member distribution cooperatives are projected to increase at an average rate of 1.4 percent per year from 2010 through 2023. Growth in the number of customers, projected at 1.2 percent per year, is the primary influence on growth in total residential sales. Consumption per customer is projected to be relatively flat over the forecast horizon, increasing at an average rate of 0.2 percent through 2023. Historical and projected residential sales are presented in Table 7.2 below. Historical and projected residential customers are presented in Table 7.3 below.

d) **Commercial**

The Commercial class, referenced as Small C&I in Big Rivers' load forecast, is defined as all commercial and industrial customers with annual peak demand less than 1,000 kW. Combined small C&I sales for Big Rivers' three member distribution cooperatives are projected to increase at an average rate of 1.8 percent per year from 2010 through 2023. Growth in the number of customers, projected at 1.6 percent per year, is the primary influence on growth in total residential sales. Like the residential class, consumption per small C&I customer is projected to be relatively flat, increasing at an average rate of 0.2 percent through 2023. Historical and projected residential sales are presented in Table 7.2. Historical and projected commercial customers are presented in Table 7.3.

e) **Industrial**

The Industrial class, referenced as Large C&I in Big Rivers' load forecast, is defined as all commercial and industrial customers with annual peak demand equal to or exceeding 1,000 kW. Combined large C&I sales for Big Rivers' three member distribution cooperatives are projected to be level throughout the forecast period, as the forecast includes no new customers for this classification. Historical and projected residential sales are presented in Table 7.2. Historical and projected large C&I customers are presented in Table 7.3.

f) **Sales for resale**

No sales for resale are included in the load forecast.

g) Utility use and other

Other energy includes sales for street lighting and irrigation. Sales for both classes combined represent less than 0.1 percent of total system sales. Utility use is not addressed directly in the load forecast; rather, it is addressed indirectly as utility own use is included in distribution losses.

Table 7.2: Energy Requirements (MWH)

	Residential	Small Commercial and Industrial	Large Commercial and Industrial	Other	Distribution Losses	Generation & Transmission Losses	Total Energy Requirements
2004	1,362,667	659,726	8,333,132	3,161	102,659	95,907	10,557,251
2005	1,452,182	695,491	8,266,561	3,191	101,991	84,333	10,603,749
2006	1,415,359	708,219	8,299,372	3,168	97,619	86,091	10,609,828
2007	1,534,506	753,591	8,215,950	4,243	108,695	80,171	10,697,157
2008	1,529,478	749,573	8,279,522	3,719	96,358	88,842	10,747,493
2009	1,532,007	742,024	8,247,595	3,532	116,161	83,655	10,724,973
2010	1,554,028	750,285	8,247,595	3,586	117,727	83,906	10,757,127
2011	1,572,789	764,031	8,247,595	3,640	119,396	84,175	10,791,625
2012	1,592,872	776,424	8,267,587	3,694	121,063	84,601	10,846,240
2013	1,610,370	788,300	8,247,595	3,748	122,575	84,687	10,857,274
2014	1,630,346	802,035	8,247,595	3,802	124,306	84,966	10,893,049
2015	1,653,291	817,260	8,247,595	3,856	126,264	85,282	10,933,548
2016	1,675,448	832,973	8,267,587	3,910	128,206	85,752	10,993,876
2017	1,703,587	848,778	8,247,595	3,964	130,457	85,959	11,020,338
2018	1,730,837	864,724	8,247,595	4,018	132,669	86,316	11,066,160
2019	1,758,431	880,869	8,247,595	4,072	134,909	86,678	11,112,553
2020	1,780,719	897,137	8,267,587	4,126	136,885	87,154	11,173,608
2021	1,808,999	913,514	8,247,595	4,180	139,173	87,366	11,200,827
2022	1,835,124	929,962	8,247,595	4,234	141,356	87,719	11,245,989
2023	1,860,804	946,437	8,247,595	4,288	143,518	88,068	11,290,709

Table 7.3: Number of Customers

	Residential	*Small Commercial and Industrial*	*Large Commercial and Industrial*	*Other*	*Total System*
2004	94,768	11,539	20	87	106,414
2005	94,877	12,897	19	91	107,883
2006	95,028	14,187	19	94	109,329
2007	95,993	14,478	19	95	110,585
2008	96,886	14,692	20	95	111,693
2009	97,518	14,860	19	94	112,492
2010	98,400	14,984	19	94	113,497
2011	99,540	15,218	19	94	114,870
2012	100,796	15,502	19	94	116,410
2013	102,075	15,787	19	94	117,975
2014	103,337	16,068	19	94	119,519
2015	104,588	16,346	19	94	121,046
2016	105,827	16,619	19	94	122,559
2017	107,062	16,889	19	94	124,064
2018	108,304	17,157	19	94	125,574
2019	109,554	17,421	19	94	127,088
2020	110,801	17,682	19	94	128,596
2021	112,028	17,940	19	94	130,081
2022	113,213	18,195	19	94	131,521
2023	114,345	18,448	19	94	132,906

h) The utility shall also provide data at any greater level of disaggregation available

The data as provided above is at the greatest level of disaggregation available.

(2) The utility shall provide the following historical information for the base year, which shall be the most recent calendar year for which actual energy sales and system peak demand data are available, and the four (4) years preceding the base year:

a) Average annual number of customers by class as defined in subsection (1) of this section

Historical and projected number of customers by class are presented in Table 7.3 above.

b) Recorded and weather-normalized annual energy sales and generation for the system, and sales disaggregated by class as defined in subsection (1) of this section

Recorded and weather-normalized annual energy sales and generation for the system, and sales disaggregated by class, are presented in Table 7.4 below.

Table 7.4: Actual vs. Weather Normalized Energy Sales and Requirements (MWH)

		Residential	*Small Commercial and Industrial*	*Large Commercial and Industrial*	*Other*	*Distribution & Generation Losses*	*Rural System*	*Total Energy Requirements*
2004	*Actual*	*1,362,667*	*659,726*	*8,333,132*	*3,161*	*198,566*	*2,133,190*	*10,557,251*
2005	*Actual*	*1,452,182*	*695,491*	*8,266,561*	*3,191*	*186,324*	*2,262,017*	*10,603,749*
2006	*Actual*	*1,415,359*	*708,219*	*8,299,372*	*3,168*	*183,710*	*2,232,581*	*10,609,828*
2007	*Actual*	*1,534,506*	*753,591*	*8,215,950*	*4,243*	*188,866*	*2,404,515*	*10,697,157*
2008	*Actual*	*1,529,478*	*749,573*	*8,279,522*	*3,719*	*185,200*	*2,399,889*	*10,747,493*
2009	*Actual*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*2,298,205*	*9,971,120*
2004	*Normal*	*1,418,933*	*667,663*	*8,333,132*	*3,161*	*200,106*	*2,198,343*	*10,622,996*
2005	*Normal*	*1,439,717*	*691,092*	*8,266,561*	*3,191*	*186,029*	*2,244,994*	*10,586,591*
2006	*Normal*	*1,460,129*	*717,180*	*8,299,372*	*3,168*	*184,643*	*2,286,805*	*10,664,492*
2007	*Normal*	*1,468,932*	*736,207*	*8,215,950*	*4,243*	*187,589*	*2,320,907*	*10,612,922*
2008	*Normal*	*1,509,186*	*746,941*	*8,279,522*	*3,719*	*184,668*	*2,376,625*	*10,724,037*
2009	*Normal*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*2,328,269*	*10,001,435*
2004	*Impact*	*(56,267)*	*(7,937)*	*0*	*0*	*(1,541)*	*(65,153)*	*(65,745)*
2005	*Impact*	*12,465*	*4,399*	*0*	*0*	*295*	*17,023*	*17,158*
2006	*Impact*	*(44,770)*	*(8,960)*	*0*	*0*	*(933)*	*(54,223)*	*(54,663)*
2007	*Impact*	*65,574*	*17,384*	*0*	*0*	*1,276*	*83,608*	*84,235*
2008	*Impact*	*20,292*	*2,633*	*0*	*0*	*532*	*23,264*	*23,456*
2009	*Impact*	*n/a*	*n/a*	*n/a*	*n/a*	*n/a*	*(30,064)*	*(30,315)*

Rural System energy is represented as total system requirements less direct-serve customer loads.
Large Commercial and Other classifications are not weather sensitive.

c) Recorded and weather-normalized coincident peak demand in summer and winter for the system

Recorded and weather-normalized annual energy sales and generation for the system, and sales disaggregated by class, are presented in Table 7.5 below.

Table 7.5: Actual vs. Weather Normalized Peak Demand Requirements (MW)

		System Net of Smelter Summer	*System Net of Smelter Winter*	*Smelters Summer*	*Smelters Winter*	*Total System Summer*	*Total System Winter*
2004	*Actual*	*604*	*539*	*857*	*856*	*1,461*	*1,395*
2005	*Actual*	*618*	*562*	*851*	*851*	*1,469*	*1,413*
2006	*Actual*	*631*	*555*	*855*	*859*	*1,486*	*1,414*
2007	*Actual*	*660*	*610*	*851*	*857*	*1,511*	*1,467*
2008	*Actual*	*616*	*619*	*858*	*857*	*1,474*	*1,476*
2009	*Actual*	*611*	*673*	*858*	*864*	*1,469*	*1,537*
2004	*Normal*	*609*	*542*	*857*	*856*	*1,466*	*1,398*
2005	*Normal*	*617*	*563*	*851*	*851*	*1,468*	*1,414*
2006	*Normal*	*634*	*598*	*855*	*859*	*1,489*	*1,457*
2007	*Normal*	*638*	*612*	*851*	*857*	*1,489*	*1,469*
2008	*Normal*	*624*	*626*	*858*	*857*	*1,482*	*1,483*
2009	*Normal*	*612*	*619*	*858*	*864*	*1,470*	*1,483*
2004	*Impact*	*(5)*	*(3)*	*0*	*0*	*(5)*	*(3)*
2005	*Impact*	*1*	*(1)*	*0*	*0*	*1*	*(1)*
2006	*Impact*	*(3)*	*(43)*	*0*	*0*	*(3)*	*(43)*
2007	*Impact*	*22*	*(2)*	*0*	*0*	*22*	*(2)*
2008	*Impact*	*(8)*	*(7)*	*0*	*0*	*(8)*	*(7)*
2009	*Impact*	*(1)*	*54*	*0*	*0*	*(1)*	*54*

d) Total energy sales and coincident peak demand to retail and wholesale customers for which the utility has firm, contractual commitments

Refer to Table 7.1 above.

e) Total energy sales and coincident peak demand to retail and wholesale customers for which service is provided under an interruptible or curtailable contract or tariff or under some other nonfirm basis

Big Rivers does not provide electric service to any retail or wholesale customers under an interruptible or curtailable contract or tariff. Big Rivers offers a Voluntary Curtailment Rider, which provides a means for potentially reducing system peak demand during peak periods. Since the rider is voluntary it is not considered as a means for reducing load in this IRP. In the last ten years (2000-2009), there have been four curtailments utilizing the Voluntary Curtailment Rider, one in 2008 and three in 2009, affecting two customers. See Table 7.6 below.

Table 7.6: 1999-2010 Voluntary Industrial Curtailment Results

Year	*Number of Curtailments*	*Load Reduction (MW)*
2000	*0*	*n/a*
2001	*0*	*n/a*
2002	*0*	*n/a*
2003	*0*	*n/a*
2004	*0*	*n/a*
2005	*0*	*n/a*
2006	*0*	*n/a*
2007	*0*	*n/a*
2008	*1*	*20*
2009	*3*	*1 to 25*
*2010**	*0*	*n/a*

** Includes January through August of 2010*

f) Annual energy losses for the system

Refer to Table 7.2 above.

g) Identification and description of existing demand-side programs and an estimate of their impact on utility sales and coincident peak demands including utility or government sponsored conservation and load management programs

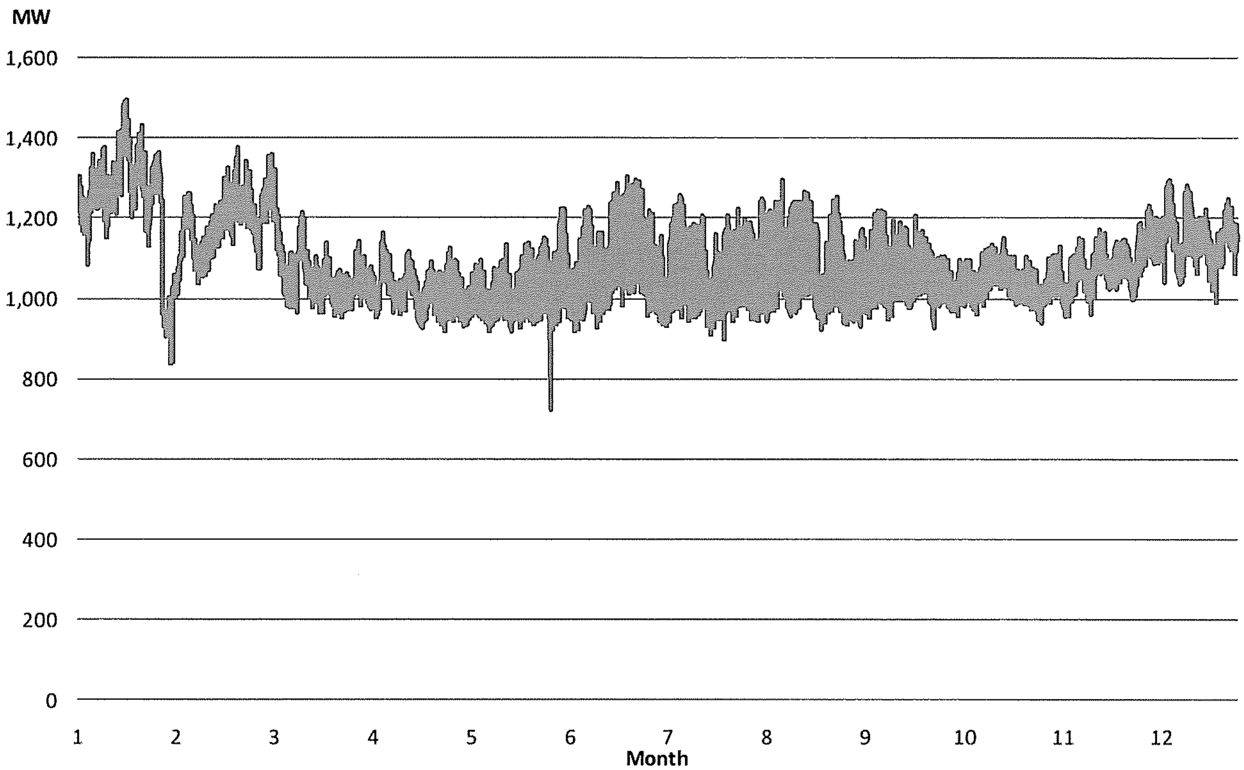
Big Rivers and its three distribution member cooperatives provide primarily education about energy efficiency, except for distributing compact fluorescent light ("CFL") bulbs at no cost to members. To date, approximately 109,000 CFL bulbs have been distributed. The impacts from the CFL program include annual energy reduction estimates of 8,400 MWh and a potential demand reduction of 5.1 MW.

h) Any other data or exhibits, such as load duration curves or average energy usage per customer, which illustrate historical changes in load or load characteristics

Big Rivers' hourly load shape for 2009 is presented in Figures 7.1 through 7.3 below.[9] The system can be either summer or winter peaking year to year depending on the severity of seasonal temperatures. The market shares of electric space heating and electric water heating are expected to continue increasing; therefore, the system is expected to be predominately winter peaking in future years.

[9] 2009 loads presented in Figures 7.1 through 7.3 reflect outages from 01/27/09 through 02/17/09 due to ice storm

Figure 7.1: Annual Load Shape - 2009



Annual load duration curves are presented in Figures 7.2 and 7.3 below. Big Rivers' load characteristics are unique due to a high proportion of very high load factor customers. Two aluminum smelters typically operate at a combined load of 850 MW at close to 100 percent load factor. However, the smelters were not taking full load in 2009 due to the soft market for aluminum. In addition, there are approximately 20 direct-serve industrial customers with a combined load of 140 MW and operating at approximately 90 percent load factor.

Figure 7.2: Annual Load Duration Curve – System - 2009

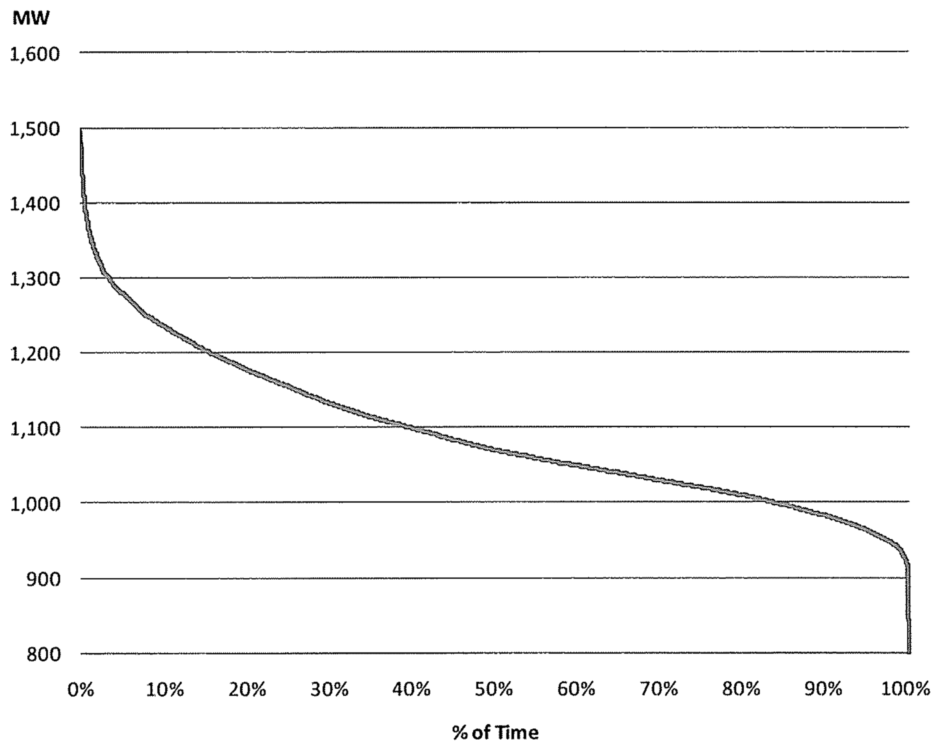


Figure 7.3: Annual Load Duration Curve – Sectors - 2009

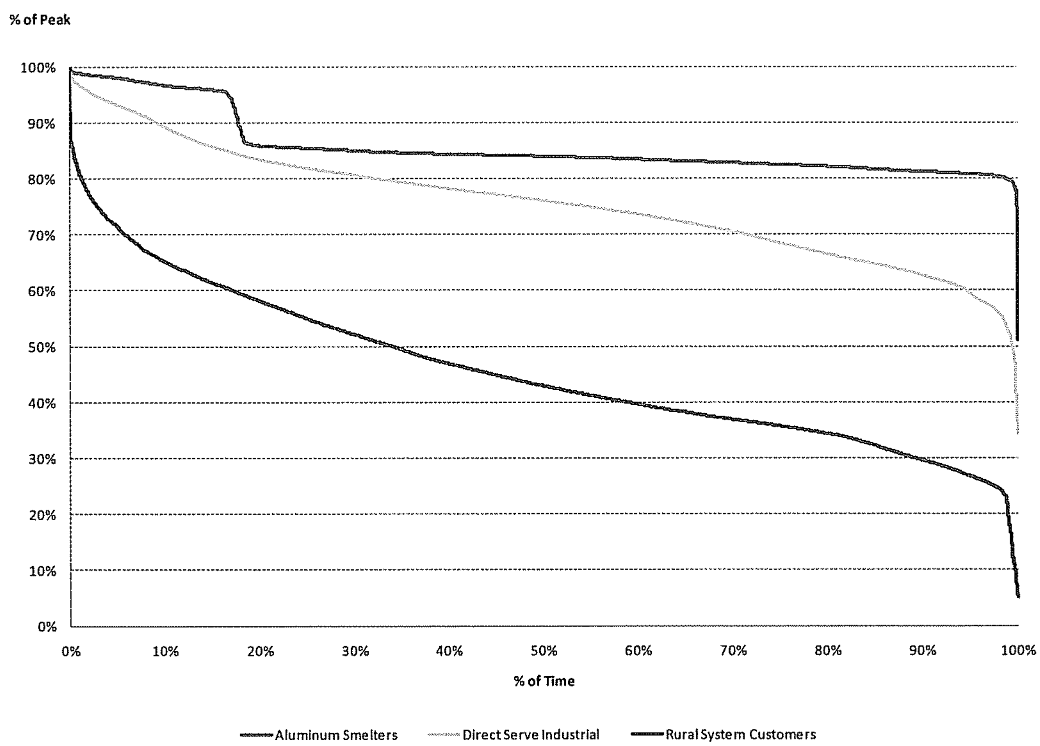
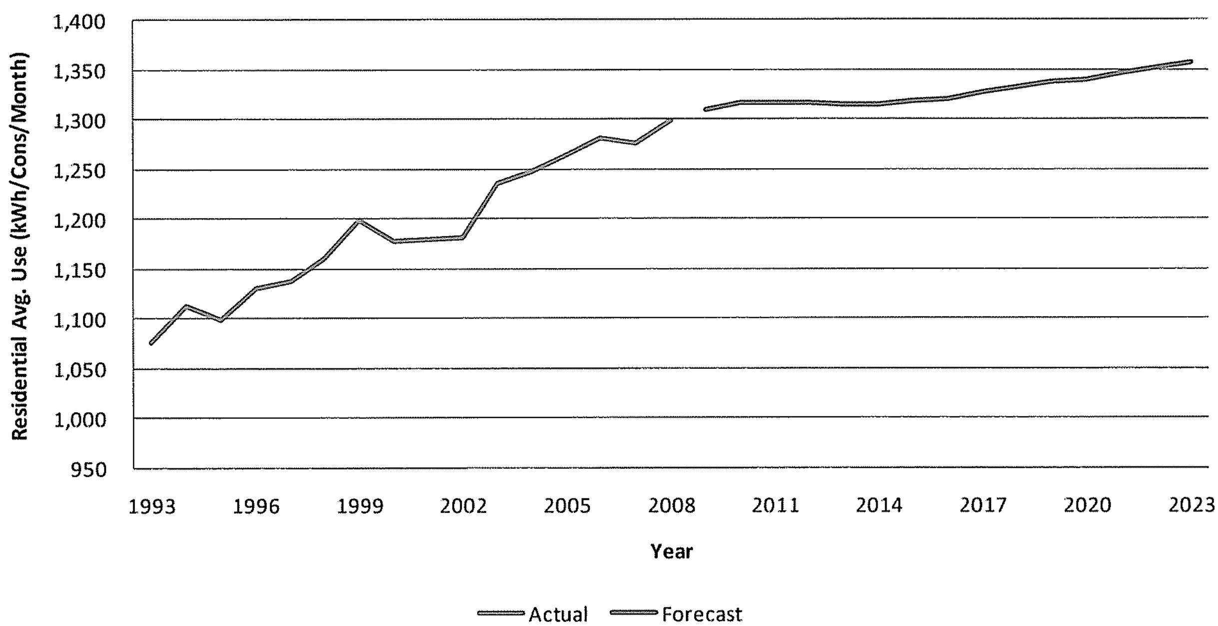


Figure 7.4 presents average monthly kWh use per customer for historical and projected periods. The figure indicates a leveling of average use in the forecast period. The leveling in the near term is due primarily to retail price increases at the distribution cooperative level, slow economic recovery from recent recessionary conditions, reductions in lighting consumption associated with the Energy Independence and Securities Act of 2007 ("EISA 2007"), and greater consumer awareness of energy conservation by customers. The replacement of older major appliances with new energy efficient units will also contribute to the leveling of consumption over the entire forecast horizon.

Figure 7.4: Average Monthly Residential kWh Consumption per Customer by Year



(3) For each of the fifteen (15) years succeeding the base year, the utility shall provide a base load forecast it considers most likely to occur and, to the extent available, alternate forecasts representing lower and upper ranges of expected future growth of the load on its system. Forecasts shall not include load impacts of additional, future demand-side programs or customer generation included as part of planned resource acquisitions estimated separately and reported in Section 8(4) of this administrative regulation. Forecasts shall include the utility's estimates of existing and continuing demand-side programs as described in subsection (5) of this section.

The base load forecast, described in detail in Sections 7.1 and 7.2 above, and range forecasts are presented in Appendix A. Range forecasts were prepared to represent optimistic and pessimistic economic growth and extreme and mild weather.

(4) The following information shall be filed for each forecast:

(a) Annual energy sales and generation for the system and sales disaggregated by class as defined in subsection (1) of this section

Refer to Tables 7.1 and 7.2 above.

(b) Summer and winter coincident peak demand for the system

Refer to Table 7.1 above.

(c) If available for the first two (2) years of the forecast, monthly forecasts of energy sales and generation for the system and disaggregated by class as defined in subsection (1) of this section and system peak demand

Tables 7.7 and 7.8 below present monthly forecasts of energy sales, generation, and peak demand for the first two years of the forecast. As noted in the opening paragraphs of Section 7, the forecast used for modeling purposes in the IRP reflects adjustments to the 2009 Load Forecast with respect to total system sales, generation and peak demand. Individual class projections were not updated. Monthly projections of energy sales by customer class are presented in the 2009 Load Forecast, Appendix A – Short-Term Forecast. The 2009 Load Forecast is contained in Appendix A of this IRP.

Table 7.7: Energy Sales by Sector and Total Generation
2010 Load Forecast/IRP

Year	Month	Rural Energy Requirements (MWH)	Direct Serve Energy Requirements (MWH)	Smelter Energy Requirements (MWH)	Total System Energy Requirements (MWH)
2011	1	243,090	78,893	619,752	949,616
2011	2	215,652	73,190	559,776	855,720
2011	3	196,343	76,992	619,752	900,561
2011	4	155,718	79,843	599,760	842,312
2011	5	163,290	79,843	619,752	870,107
2011	6	201,130	79,843	599,760	888,105
2011	7	229,998	82,695	619,752	940,249
2011	8	227,769	83,645	619,752	938,960
2011	9	177,160	81,744	599,760	865,851
2011	10	157,463	80,794	619,752	865,190
2011	11	184,341	76,992	599,760	868,300
2011	12	240,638	76,041	619,752	944,269
2012	1	246,469	78,893	619,752	953,024
2012	2	218,650	73,190	579,768	878,902
2012	3	199,072	76,992	619,752	903,314
2012	4	157,882	79,843	599,760	844,495
2012	5	165,560	79,843	619,752	872,396
2012	6	203,926	79,843	599,760	890,924
2012	7	233,196	82,695	619,752	943,473
2012	8	230,936	83,645	619,752	942,153
2012	9	179,623	81,744	599,760	868,335
2012	10	159,652	80,794	619,752	867,397
2012	11	186,904	76,992	599,760	870,884
2012	12	243,984	76,041	619,752	947,642

1. Rural Energy represents residential and small commercial customers for Big Rivers' three member distribution cooperatives and includes distribution losses.
2. Direct Serve represents all large commercial and industrial customers with annual peak demand equal to or exceeding 1,000 kW. Smelter requirements are broken out from Direct Serve customers in this table.
3. Total Generation includes transmission and generation losses.

Table 7.8: Peak Demand by Sector and Total System

Year	*Month*	*Rural Demand Requirements (MW)*	*Direct Serve Demand Requirements (MW)*	*Smelter Demand Requirements (MW)*	*Total System Demand Requirements (MW)*
2011	*1*	*534*	*113*	*850*	*1,498*
2011	*2*	*467*	*113*	*850*	*1,430*
2011	*3*	*444*	*112*	*850*	*1,406*
2011	*4*	*341*	*113*	*850*	*1,304*
2011	*5*	*367*	*116*	*850*	*1,333*
2011	*6*	*459*	*116*	*850*	*1,425*
2011	*7*	*514*	*120*	*850*	*1,485*
2011	*8*	*499*	*118*	*850*	*1,467*
2011	*9*	*476*	*115*	*850*	*1,441*
2011	*10*	*346*	*119*	*850*	*1,314*
2011	*11*	*414*	*112*	*850*	*1,376*
2011	*12*	*528*	*112*	*850*	*1,490*
2012	*1*	*541*	*113*	*850*	*1,504*
2012	*2*	*472*	*113*	*850*	*1,436*
2012	*3*	*450*	*112*	*850*	*1,412*
2012	*4*	*345*	*113*	*850*	*1,308*
2012	*5*	*371*	*116*	*850*	*1,338*
2012	*6*	*465*	*116*	*850*	*1,431*
2012	*7*	*521*	*120*	*850*	*1,491*
2012	*8*	*505*	*118*	*850*	*1,473*
2012	*9*	*482*	*115*	*850*	*1,447*
2012	*10*	*350*	*119*	*850*	*1,319*
2012	*11*	*420*	*112*	*850*	*1,382*
2012	*12*	*535*	*112*	*850*	*1,497*

1. Rural Demand represents residential and small commercial customers for Big Rivers' three member distribution cooperatives and includes distribution losses.
2. Direct Serve represents all large commercial and industrial customers with annual peak demand equal to or exceeding 1,000 kW. Smelter requirements are broken out from Direct Serve customers in this table.
3. Total System Demand includes transmission and generation losses.

(d) The impact of existing and continuing demand-side programs on both energy sales and system peak demands, including utility and government sponsored conservation and load management programs

Big Rivers and its three distribution member cooperatives currently primarily provide education about energy efficiency, with the exception being distribution of CFL lighting at no cost to members. Listed below are activities and programs intended to educate and inform retail members of available energy efficiency opportunities. The plan for implementing new demand-side programs is presented in Section 8 of this report.

1. **Distribution cooperative websites:** Each of the distribution cooperative websites provides easy to use Home Energy Suites. The Suites provide methods to improve efficiency and save energy in the

home. Adjustable inputs specific to a home allows customers to compare their current energy use to estimated energy use resulting from various improvements in efficiency.

2. **Marketing and promotion:** Historically, the majority of communications between the distribution cooperatives and their customers focused on energy efficiency education. Their advertising efforts focus on promoting Touchstone Energy Homes and the use of ENERGY STAR® appliances and lighting, insulation, and high efficiency heating ventilation and air conditioning ("HVAC").

3. **Home Energy Efficiency Expo:** Each of the member cooperatives has hosted residential energy efficiency expos that provide education and outreach to customers focusing on energy efficiency in the home.

4. **Distribution of DOE/EPA "Home Efficiency Tips" booklet:** The distribution member cooperatives have provided thousands of "Home Energy Tips" booklets to new and existing customers that visit the cooperative offices. A U.S. Department of Energy ("DOE") and U.S. Environmental Protection Agency ("EPA") partnership produced a "Home Energy Tips" booklet which has been used to train customer service representatives ("CSRs") on energy efficiency, and to help the CSRs educate customers.

5. **CFL distribution:** CFL's are distributed to customers of JPEC, MCRECC, and Kenergy. Each of the distribution cooperatives has provided the high efficiency lamps to customers at their annual meetings as well as to customers who visit during cooperative month in October. To date, approximately 109,000 CFL bulbs have been provided to retail customers at no cost. The impacts from the CFL program include annual energy reduction estimates of 8,400 MWh and a potential demand reduction of 5.1 MW.

6. **Energy Use Assessments:** These assessments are provided to commercial and industrial customers upon request. Walk through energy audits help identify simple and low cost efficiency measures that customers can install or implement themselves. Educational programs are also available for employees of commercial and industrial members.

7. Big Rivers offers **renewable energy** to the member cooperatives. Big Rivers has purchased energy from an ENERGY STAR® certified Combined Heat and Power ("CHP") project operated by Domtar, Inc., a specialty paper manufacturer. The power is generated from wood chips that are waste by products of the paper manufacturing process. Customers wishing to purchase this renewable energy can contract with any of the distribution cooperatives.

8. JPEC and Big Rivers Electric Corp. upgraded their **facility lighting** to high efficiency electronic ballasts and fluorescent lighting.

9. Big Rivers provided **energy saving analyses** to industrial and large commercial members by combining efforts with the member-systems, the DOE, and the University of Louisville's Kentucky Pollution Prevention Center.

10. Big Rivers provided support to member-system school districts to promote the construction of **high performance schools**. Hancock County school district renovated three older schools, with a focus on energy efficiency, and completed a new high performance school in 2006. Meade County school district completed construction of a new high performance school in 2007.

11. Big Rivers provided assistance to develop and continues to provide reliability support and back-up power for the Domtar (previously Weyerhaeuser) **combined heat and power** project in Hancock County. The 50 MW renewable generator produces electricity from wood chips that are not used in the manufacturing of paper. The project won the ENERGY STAR® CHP award in 2005 for efficiency.

(e) Any other data or exhibits which illustrate projected changes in load or load characteristics

Changes in seasonal load are presented in Table 7.1 above. Big Rivers has traditionally been a summer peaking system; however, the system peaked during the winter season in 2008, 2009 and 2010, and the system is projected to be winter peaking throughout the forecast horizon.[10] There are no other significant changes projected in seasonal load factor in terms of long-term trends or in differences between summer and winter based load factors.

(5) The additional following data shall be provided for the integrated system, when the utility is part of a multistate integrated utility system, and for the selling company, when the utility purchases fifty (50) percent of its energy from another company:

(a) For the base year and the four (4) years preceding the base year:

1. **Recorded and weather normalized annual energy sales and generation**
2. **Recorded and weather-normalized coincident peak demand in summer and winter**

(b) For each of the fifteen (15) years succeeding the base year:

1. **Forecasted annual energy sales and generation**
2. **Forecasted summer and winter coincident peak demand**

Big Rivers is not part of a multi-state, integrated utility system with one corporate owner. Therefore, this section is not applicable to Big Rivers.

(6) A utility shall file all updates of load forecasts with the commission when they are adopted by the utility

Big Rivers' most recently approved load forecast, the 2009 Load Forecast (approved by the Board of Directors in July 2009) is included in this IRP filing as Appendix A.

[10] For purposes of seasonal peaks, the summer is June through September and winter is December through March.

(7) The plan shall include a complete description and discussion of:

(a) All data sets used in producing the forecasts

A number of datasets were used in development of the forecast and are summarized in Table 7.9 below.

Table 7.9: Load Forecast Database Summary

Data Category	*Data Source*	*Data Element*
Electric System	*Big Rivers and its three member distribution cooperatives*	*Number of customers, kWh sales and revenues by class* *System peak demand*
Economic	*Moody's Economy.com* *Woods & Poole Economics*	*Number of households* *Total employment* *Average household income* *Retail sales* *Personal consumption expenditure index*
Weather	*National Oceanic and Atmospheric Administration*	*Heating and cooling degree days* *Temperature*
Price	*Big Rivers and its three member distribution cooperatives*	*Average cents per kWh*
End-use	*Big Rivers* *Energy Information Administration*	*Appliance saturations* *Appliance efficiencies* *Appliance unit energy consumption (kWh)*
Housing Characteristics	*Big Rivers* *Energy Information Administration*	*Size of home* *Number of people per home* *Thermal shell index*

(b) Key assumptions and judgments used in producing forecasts and determining their reasonableness

The key assumptions made during the development of the forecast focused on changes in each of the data elements identified in Table 7.9 above. The assumptions apply broadly to each of the three distribution cooperatives and to Big Rivers.

Economic Outlook – It was assumed that changes in economic activity are most reasonably represented by the projections obtained from Moody's Economy.com. Economic outlooks were developed individually for each distribution cooperative. Assumptions regarding the economic outlook and projections for each of the data series are presented in Appendix A, 2009 Load Forecast, Section 4.2 and Table 4.1 (page18).

Weather – The forecast is based on the assumption that heating and cooling degree days during the forecast horizon would be equal to the most recent 20-year averages. It was assumed that degree days for Paducah, Kentucky and Evansville, Indiana provided reliable coverage of weather conditions for the Big Rivers service area. Assumptions regarding projected heating and cooling degree days are presented in Appendix A, 2009 Load Forecast, Section 4.3. Historical and projected degree days are presented in Appendix A, 2009 Load Forecast, Table 2.1 (page10).

Retail Electricity Prices – It was assumed that real (adjusted for inflation) electricity prices would transition from a declining historical trend to a slightly increasing trend during the forecast horizon. It is assumed that average electric bills for customers served by the three distribution cooperatives will increase over the long term at rates similar to increases in Big Rivers' average wholesale cost to the distribution cooperatives.

End-Use Characteristics – Assumptions regarding future changes in appliance saturation levels are based on historical trends developed from Big Rivers' appliance saturation surveys and data obtained from the Energy Information Administration. It was assumed that the market shares for central electric space heating, central air conditioning, and electric water heating would continue to increase over time, but at a declining rate as their respective maximum saturation levels were approached. Assumptions regarding changes in appliance efficiencies are based on information obtained from the Energy Information Administration.

Housing Characteristics – Assumptions regarding housing characteristics are based on appliance surveys conducted by Big Rivers and on information obtained from the Energy Information Administration.

(c) The general methodological approach taken to load forecasting (for example, econometric, or structural) and the model design, model specification, and estimation of key model parameters (for example, price elasticities of demand or average energy usage per type of appliance)

Big Rivers' 2009 Load Forecast was developed using methods recognized in the industry today as the standards, including end-use, econometrics, informed judgment, and historical trends. The residential class accounts for the majority of rural system requirements; therefore, considerable time and effort were devoted to development of SAE models for each of Big Rivers' three distribution member cooperatives to forecast energy consumption for the class. Econometric models were used to project the number of residential customers. Similarly, econometric models were developed to project small commercial energy use per customer and number of customers. Large commercial demand and energy projections were developed using information provided by cooperative management regarding local industrial operations. Energy sales projections for all other classifications (street lighting and irrigation) were based on linear trends.

Econometric models were developed to project rural system coincident peak ("CP") demand. Projections of rural system non-coincident peak ("NCP") demand were developed by applying an average coincident factor to projections of rural CP demand. Total system NCP demand was computed as the sum of rural system CP demand and direct-serve NCP demand. Demand was projected on a summer and winter seasonal basis for each year of the forecast period. The summer season includes months May to October, and the winter season includes months January, February, March, November and December in the same calendar year.

The energy sales forecast is based on a bottom-up approach. Projections were developed at the customer class level, by distribution cooperative, and aggregated to the total system level. Projections of peak demand were developed at the rural system and total system levels by distribution cooperative. The forecast is based on an analysis of data and information for a historical period covering the 1980 through 2008 period, and the forecast period covers years 2008-2023. The base case forecast assumes normal weather conditions for each year, and the averages were computed using heating and cooling degree days for the twenty years ending 2008.

Big Rivers contracted with a consultant to assist the cooperative in developing the load forecast. The consultant developed preliminary economic outlooks and load forecasts for each of the Big Rivers' three distribution member cooperatives. The preliminary forecasts were reviewed with management from the member cooperatives and a Rural Utilities Service ("RUS") General Field Representative. The forecasts were revised as necessary, and finalized. Once the distribution cooperative forecasts are approved by their respective Board of Directors, the Big Rivers forecast is based on the aggregate distribution cooperative forecasts.

Refer to Appendix A of this IRP, the 2009 Load Forecast, for more details regarding Big Rivers' forecasting process and model specifications.

(d) The utility's treatment and assessment of load forecast uncertainty

Big Rivers' base case forecast reflects expected economic growth for the area and normal weather conditions. To address the inherent uncertainty related to these factors, long-term high and low range projections are developed. The range forecasts reflect the energy and demand requirements corresponding to more optimistic or pessimistic economic growth and to mild or extreme weather conditions. Four forecast scenarios were generated: (i) base case economics and mild weather, (ii) base case economics and extreme weather, (iii) optimistic economics and normal weather, and (iv) pessimistic economics and normal weather. These scenarios are based on current RUS guidelines.[11]

Tables 7.10 and 7.11, and Figures 7.5 and 7.6, below present the range forecasts in table and graphic forms.

[11] *Federal Register,* March 20, 2000, Department of Agriculture, Rural Utilities Services, 7 CFR Part 1710, RIN 0572-AB05, Load Forecasts

Table 7.10: Range Forecasts – Energy Requirements (MWH)

Total System

Year	History	Base	Optimistic	Pessimistic	Extreme	Mild
2004	10,490,039					
2005	10,545,342					
2006	10,549,818					
2007	10,642,115					
2008	10,686,263					
2009		10,667,608	10,689,353	10,636,928	10,765,515	10,587,849
2010		10,699,762	10,732,681	10,658,856	10,798,448	10,619,339
2011		10,734,261	10,784,643	10,682,122	10,833,839	10,653,108
2012		10,788,718	10,861,036	10,726,541	10,889,204	10,706,797
2013		10,799,909	10,895,882	10,727,875	10,902,183	10,716,536
2014		10,835,685	10,954,274	10,752,541	10,939,133	10,751,336
2015		10,876,183	11,017,125	10,781,123	10,980,819	10,790,848
2016		10,936,354	11,100,152	10,829,428	11,042,036	10,850,143
2017		10,962,974	11,150,618	10,843,876	11,070,056	10,875,607
2018		11,008,795	11,220,863	10,877,442	11,117,130	10,920,387
2019		11,055,188	11,292,313	10,911,370	11,164,817	10,965,707
2020		11,116,086	11,378,572	10,959,846	11,226,969	11,025,568
2021		11,143,463	11,432,466	10,974,522	11,255,927	11,051,647
2022		11,188,624	11,504,629	11,007,405	11,302,466	11,095,673
2023		11,233,345	11,576,549	11,039,965	11,348,516	11,139,296

Rural System

Year	History	Base	Optimistic	Pessimistic	Extreme	Mild
2004	2,133,190					
2005	2,262,017					
2006	2,232,581					
2007	2,404,515					
2008	2,399,889					
2009		2,393,723	2,413,546	2,364,759	2,492,942	2,312,961
2010		2,425,627	2,456,773	2,386,277	2,525,623	2,344,201
2011		2,459,856	2,508,715	2,409,123	2,560,752	2,377,695
2012		2,494,052	2,565,166	2,433,147	2,595,864	2,411,116
2013		2,524,992	2,620,077	2,454,083	2,628,610	2,440,590
2014		2,560,489	2,678,484	2,478,303	2,665,292	2,475,104
2015		2,600,671	2,741,306	2,506,393	2,706,672	2,514,292
2016		2,640,536	2,804,319	2,534,219	2,747,593	2,553,275
2017		2,686,785	2,874,717	2,568,119	2,795,254	2,598,357
2018		2,732,249	2,944,913	2,601,151	2,841,982	2,642,771
2019		2,778,280	3,016,314	2,634,539	2,889,320	2,687,719
2020		2,818,867	3,082,577	2,662,528	2,931,172	2,727,259
2021		2,865,866	3,156,415	2,696,651	2,979,768	2,772,948
2022		2,910,675	3,228,539	2,729,015	3,025,967	2,816,613
2023		2,955,047	3,300,414	2,761,066	3,071,678	2,859,879

Table 7.11: Range Forecasts - Peak Demand (kW)

Total System

Year	History	Base	Optimistic	Pessimistic	Extreme	Mild
2004	1,461,329					
2005	1,468,971					
2006	1,486,253					
2007	1,510,700					
2008	1,475,966					
2009		1,494,163	1,498,271	1,488,366	1,551,622	1,445,487
2010		1,498,612	1,504,817	1,490,903	1,556,313	1,449,711
2011		1,505,369	1,514,868	1,495,539	1,563,703	1,455,935
2012		1,512,119	1,525,759	1,500,392	1,571,085	1,462,152
2013		1,518,226	1,536,334	1,504,635	1,577,765	1,467,777
2014		1,525,233	1,547,617	1,509,540	1,585,428	1,474,231
2015		1,533,165	1,559,779	1,515,214	1,594,103	1,481,537
2016		1,541,034	1,571,977	1,520,834	1,602,709	1,488,785
2017		1,550,163	1,585,627	1,527,654	1,612,693	1,497,193
2018		1,559,137	1,599,235	1,534,300	1,622,508	1,505,459
2019		1,568,223	1,613,079	1,541,018	1,632,446	1,513,828
2020		1,576,235	1,625,907	1,546,668	1,641,208	1,521,207
2021		1,585,512	1,640,226	1,553,528	1,651,354	1,529,752
2022		1,594,357	1,654,206	1,560,035	1,661,028	1,537,899
2023		1,603,115	1,668,141	1,566,476	1,670,608	1,545,966

Rural System

Year	History	Base	Optimistic	Pessimistic	Extreme	Mild
2004	476,409					
2005	502,064					
2006	505,405					
2007	536,611					
2008	516,082					
2009		521,766	526,087	515,452	576,838	476,293
2010		528,063	534,844	519,497	583,723	482,094
2011		534,820	545,443	523,789	591,111	488,317
2012		541,570	557,012	528,345	598,492	494,535
2013		547,677	568,301	532,297	605,170	500,160
2014		554,684	580,245	536,880	612,832	506,614
2015		562,615	593,040	542,220	621,506	513,919
2016		570,484	605,869	547,515	630,111	521,167
2017		579,613	620,156	554,014	640,095	529,575
2018		588,588	634,400	560,346	649,910	537,840
2019		597,674	648,881	566,752	659,847	546,208
2020		605,685	662,348	572,093	668,610	553,586
2021		614,962	677,309	578,652	678,757	562,130
2022		623,807	691,931	584,874	688,431	570,275
2023		632,566	706,496	591,042	698,011	578,341

Figure 7.5: Range Forecast – Rural System Energy (MWH)

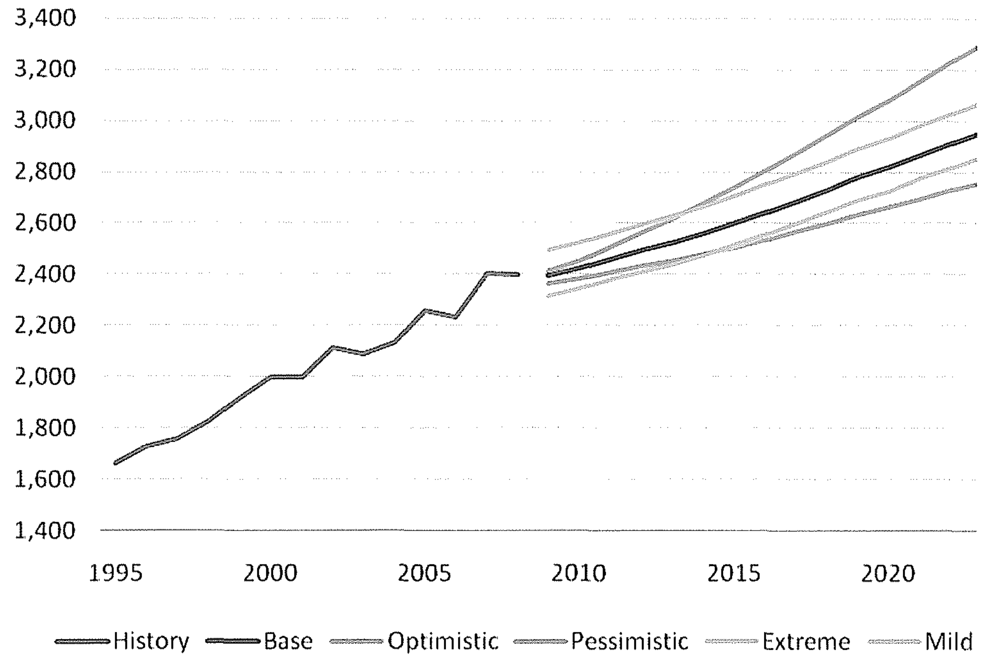
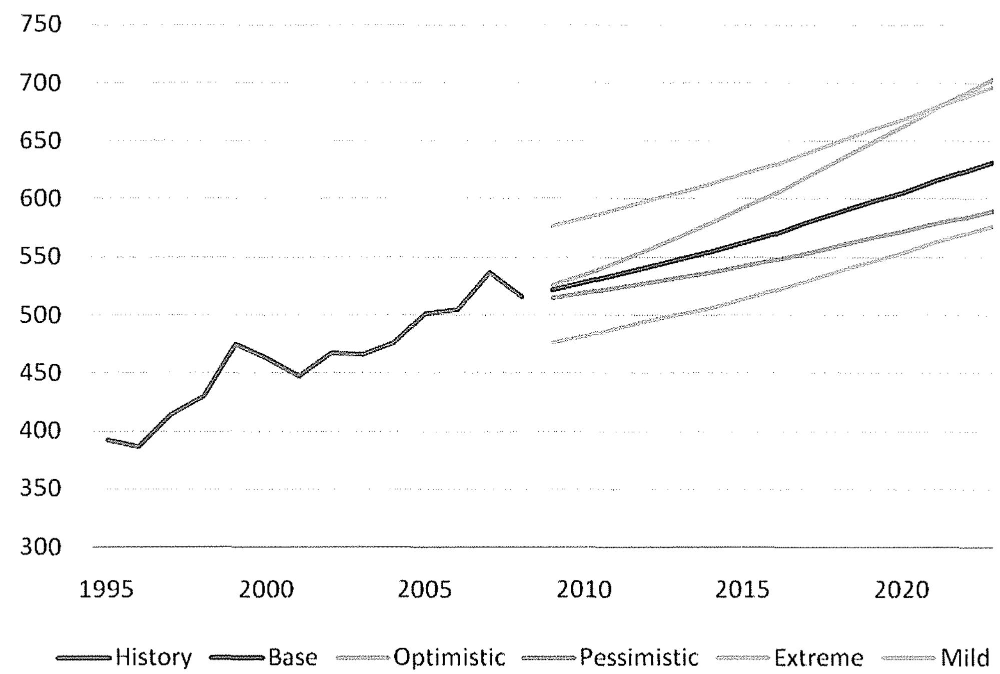


Figure 7.6: Range Forecast – Rural System Peak Demand (MW)



Refer to Appendix A, 2009 Load Forecast, Section 7, for more details regarding Big Rivers' treatment and assessment of load forecast uncertainty.

(e) The extent to which the utility's load forecasting methods and models explicitly address and incorporate the following factors

1. Changes in prices of electricity and prices of competing fuels

The forecasts developed for each of Big Rivers' three distribution member cooperatives include the impacts of projected increases in the real price of electricity over the forecast horizon. The forecast does not explicitly address the impacts of competing fuels available to retail customers (*e.g.*, the ability to heat with natural gas versus electricity). Table 7.12 presents an average of distribution cooperative retail prices for the residential and commercial classifications. The prices represent average cents per kWh.

Table 7.12: Real Average Electricity Price (¢ per kWh)

Year	*Residential*	*Commercial*
2005	*5.58*	*5.46*
2006	*5.44*	*5.37*
2007	*5.37*	*5.21*
2008	*5.48*	*5.17*
2009	*5.82*	*5.52*
2010	*5.86*	*5.55*
2011	*5.89*	*5.58*
2012	*5.93*	*5.62*
2013	*5.97*	*5.65*
2014	*6.00*	*5.68*
2015	*6.04*	*5.72*
2016	*6.08*	*5.75*
2017	*6.11*	*5.79*
2018	*6.15*	*5.82*
2019	*6.19*	*5.86*
2020	*6.22*	*5.89*
2021	*6.26*	*5.93*
2022	*6.30*	*5.96*
2023	*6.34*	*5.99*
2024	*6.37*	*6.03*

2. Changes in population and economic conditions in the utility's service territory and general region

The forecast captures changes in number of households, average household income, total employment, and retail sales. Number of households is the independent variable in the residential customer models. Household income is one of the driver variables specified in the residential use per customer models. Employment is the driver variable in the small commercial customer models and retail sales is an independent variable in the small commercial energy sales models. The projected values for each of these demographic and economic variables were obtained from Moody's Economy.com.[12] The economic outlook takes into account the impacts of the 2008-2009 economic recession. Refer to Appendix A, 2009 Load Forecast, Section 4, Table 4.1, for the weighted Big Rivers average values.

3. **Development and potential market penetration of new appliances, equipment, and technologies that use electricity or competing fuels; and**

   The distribution cooperative forecasts incorporate service area specific market shares of electric appliances and changes in technology. Projections of market share are based on Big Rivers' appliance saturation survey data, census data, and data obtained from the Energy Information Administration. The market shares for electric heating, electric water heating, and electric air conditioning are all projected to increase throughout the forecast horizon, but at a decreasing rate as maximum saturation levels are approached.

4. **Continuation of existing company and government sponsored conservation and load management or other demand-side programs**

   The forecast implicitly includes the impacts of Big Rivers' current educational and conservation programs (see Section 7.4.d) through the historical load data. The forecast includes no direct impacts of new Energy Efficiency or Demand Side Management programs. The forecast does include the impacts of reduced lighting consumption associated with the Energy Independence and Securities Act of 2007. Refer to Section 8 of this IRP for a description of the potential impacts of new Energy Efficiency Programs.

(f) Research and development efforts underway or planned to improve performance, efficiency, or capabilities of the utility's load forecasting methods

Big Rivers conducts residential surveys to monitor changes in household major appliances and various end-uses. Results from the surveys will continually incorporate the latest approaches addressing performance efficiency and capability into the forecasting models as new data becomes available.

(g) Description of and schedule for efforts underway or planned to develop end-use load and market data for analyzing demand-side resource options including load research and market research studies, customer appliance saturation studies, and conservation and load management program pilot or demonstration projects

Big Rivers conducts residential surveys to monitor changes in household major appliances and various end-uses. This schedule is expected to continue in future years. For load forecasting purposes, Big Rivers obtains end-use data from the EIA. Currently, Big Rivers has no plans to develop end-use data through an internal load research or end-use metering project. Big Rivers will continue to utilize end-use data and information available from the Energy Information Administration and any other sources that may become available in the future. Big Rivers is currently working with its three distribution member cooperatives to implement Energy Efficiency Programs. Refer to Section 8 of this IRP for a description of those programs.

[12] Moody's Economy.com, February 2009

Technical discussions, descriptions, and supporting documentation shall be contained in a technical appendix

The full 2009 Load Forecast report is contained in Appendix A of this 2010 IRP.

8. Resource Assessment and Acquisition Plan
(807 KAR 5:058, Section 8)

(1) The plan shall include the utility's resource assessment and acquisition plan for providing an adequate and reliable supply of electricity to meet forecasted electricity requirements at the lowest possible cost. The plan shall consider the potential impacts of selected, key uncertainties and shall include assessment of potentially cost-effective resource options available to the utility.

Big Rivers' resource assessment was developed using the Strategist Integrated Planning System. This model, which is licensed to GDS Associates by Ventyx, has the capability to simulate production operations and develop least cost expansion plans. The production operations simulation establishes the optimal dispatch of generating resources and calculates the associated costs. The development of least cost expansion plans includes comparisons of all combinations of potential resource additions in order to determine the portfolio of expansion units necessary to achieve planning reserve margin criteria at the lowest cost. Big Rivers' existing generating resources were modeled using the Strategist GAF module. The existing units were dispatched against the 2010 Load and Energy Forecast which is described in full in Section 7. The Load and Energy Forecast was modeled using the Strategist LFA module. In order to address uncertainties related to several variables, the production simulation and expansion planning analysis was conducted for a Base Case and several sensitivity cases. The Base Case includes (1) the base Load and Energy Forecast, (2) the Energy Efficiency Programs included in the $1 million annual energy efficiency expenditure case, (3) base fuel price projections, and (4) base market price projections as a source of economy energy purchases.

Sensitivity cases are listed below along with a description of major modeling input assumptions.

a) High Fuel Price Case
   - i) Base case assumptions for all variables except for:
     - (1) 20% increase in all fuel prices and market prices

b) High Load case
   - i) Base Case assumptions for all variables except for:
     - (1) High load and energy requirements forecast

c) Renewable Portfolio Standard case
   - i) Base Case assumptions for all variables except for:
   - ii) RPS requirements of:
     - (1) 15% of total Big Rivers energy provided by renewable resources by 2015
     - (2) 20% of total Big Rivers energy provided by renewable resources by 2020
     - (3) 25% of total Big Rivers energy provided by renewable resources by 2025
   - iii) Specific resources as sources of energy as follows:
     - (1) 80% of RPS energy generated by wind projects,
     - (2) 15% of RPS energy generated by biomass projects,

(3) 5% of RPS energy generated by photovoltaic projects

iv) Carbon reduction costs are assumed to be in place beginning 2015 (carbon cost projections included herein as Appendix J)

d) Environmental Compliance case

i) Base Case assumptions for all variables except that:

(1) Carbon reduction costs are assumed to be in place beginning in 2015,

(2) there is a 1% Reduction in capacity at R.D. Green units 1 & 2 and at K.C. Coleman units 1, 2, & 3 to account for installation of SCRs, and

(3) R.A. Reid unit 1 retires at the end of 2011

e) Big Rivers MISO case

i) Base Case assumptions for all variables except that:

(1) Big Rivers' generating resource capacities are adjusted for purposes of reserve margin calculations according to MISO defined Equivalent Forced Outage Rates,

(2) The Planning Reserve Margin used for the development of the expansion plan is equal to 4.5%. This percentage is MISO's Non-Coincident Load Based Planning Reserve margin as defined in the MISO Business Practices Manual: Resource Adequacy effective June 1, 2010

Strategist output for the Big Rivers Base Case and each sensitivity case is included with this filing as Appendices D through I.

Big Rivers operates two units owned by HMP&L. These two units, HMP&L Station Two Units 1 and 2, were included at their full capacity values in the analysis. HMP&L's capacity allocation requests associated with these units were included in the analysis as a load obligation. The net impact of this configuration is that capacity beyond that requested for use by HMP&L is available to serve Big Rivers' requirements. Similarly, HMP&L's SEPA allocation was included as a capacity resource and a load obligation equal to the SEPA capacity was also modeled. HMP&L's capacity resources were assumed to be firm, *i.e.*, the load served by these resources does not require reserve capacity provided by Big Rivers. The reserve margin criteria utilized for the analysis for the combined Big Rivers and HMP&L model is the target reserve margin defined by the NERC in its 2009 Long-Term Reliability Assessment. That target reserve margin is 15% for predominately thermal systems. Although this value was used as a target for the modeling process, a minimum acceptable margin of 14% was utilized in the modeling process to recognize that actual annual margins could vary above and below the target during the term of the IRP. [redacted]

Big Rivers did not control its generating assets for a recent historical year; therefore, data was not available for a defined base year. Because of that fact and because of the late 2010 filing date for this IRP, production cost projections were developed for each year of the 2011 through 2025 period. In July 2009, a lease termination agreement ended an arrangement under which Western Kentucky

Energy Corporation had been operating generating resources owned by Big Rivers. As a result of the lease termination agreement (the Unwind) Big Rivers took control of its owned generating capacity and the capacity at HMP&L Station Two that is in excess of HMP&L's requested capacity allocations from the station.

Table 8.1 below shows capacity expansion plans for the Base Case and each sensitivity case, along with the 2010 present value of costs associated with each plan. The present value of costs includes (1) costs associated with EE programs, (2) fuel costs and variable O&M costs for all generating resources, both existing and new, (3) fixed O&M costs for all new generating resources, and (4) annual carrying costs associated with capital costs for all new generating resources. The present value of costs was calculated using a discount rate of 6.33%, Big Rivers' current cost of debt.

Table 8.1: Optimal Expansion Plans[13]

[redacted]

[13] The RPS Case and the Environmental Compliance Cases include a projection of carbon allowance costs. The relatively small difference in the present value of costs associated with the RPS Case and the Environmental Compliance Cases results from the higher capital costs in the RPS case being off-set by lower carbon allowance costs due to generation from non-carbon producing assets.

(2) The utility shall describe and discuss all options considered for inclusion in the plan including:

(a) Improvements to and more efficient utilization of existing utility generation, transmission, and distribution facilities

(b) Conservation and load management or other demand-side programs not already in place

(c) Expansion of generating facilities, including assessment of economic opportunities for coordination with other utilities in constructing and operating new units

(d) Assessment of nonutility generation, including generating capacity provided by cogeneration, technologies relying on renewable resources, and other nonutility sources

A list of potential resource additions was developed for the Strategist modeling process. This list of resources defines the options that the model is able to choose in order to meet planning reserve criteria. The list of potential additions includes traditional supply-side options, renewable supply-side options, and EE programs that were selected in the EE screening process.[14] The complete list of options is shown below.

1. Nuclear
2. Coal
3. Gas-fired Combined Cycle
4. Gas-fired Combustion Turbine
5. Biomass
6. Landfill Gas
7. Wind
8. Photovoltaic
9. Coal Bed Methane
10. EE program portfolio

Operating characteristics and associated costs for supply-side resource listed above were taken from the EIA's 2010 Annual Energy Outlook with modifications to certain variables based on GDS' involvement in recent generation feasibility analyses and construction monitoring.

Table 8.2 below shows key variables associated with the supply-side options.

[14] Demand Response programs were not included in the development of the IRP expansion plan because they did not pass preliminary screening tests. Refer to Appendix B for further details on Demand Response ("DR") screening.

Table 8.2: Operating Characteristics of Supply-Side Options

Potential Resource Additions

	Capacity (MW)	2010 Overnight Capital Cost ($/kW)	Construction Lead Time (Yrs)	Operating Life (Yrs)	2010 Fixed O&M Rate ($/kW-Yr)	2010 Variable O&M Rate ($/MWh)	Heat Rate (MMBtu/MWh)	Availability (%)	SO2 Emissions (lbs/MWh)	NOx Emissions (lbs/MWh)	CO2 Emissions (lbs/MWh)
Nuclear	50	4,400.00	6	30	93.42	0.51	10.49	90%	0.00	0.00	0.00
Coal	50	3,050.08	4	30	28.57	4.76	9.20	93%	0.75	0.47	1,929.99
Combined Cycle	50	1,294.13	3	30	47.86	4.61	7.20	90%	0.00	0.14	885.50
Combustion Turbine	50	832.30	2	30	12.57	3.70	10.79	90%	0.00	0.25	1,190.25
Biomass	50	3,906.74	4	20	66.88	6.96	9.45	90%			
Landfill Gas	5	2,637.99	3	20	118.56	0.01	13.65	90%			
Wind	50	1,995.49	3	25	31.44	0.00		30%			
Photovoltaic	5	6,263.57	2	25	12.12	0.00		25%			
Coal Bed Methane	5	2,637.99	3	20	118.56	0.01	13.65	90%			

Table 8.3 below shows fuel cost projections associated with the potential expansion units.

Table 8.3: Fuel Cost Projections

[redacted]

(3) The following information regarding the utility's existing and planned resources shall be provided. A utility which operates as part of a multistate integrated system shall submit the following information for its operations within Kentucky and for the multistate utility system of which it is a part. A utility which purchases fifty (50) percent or more of its energy needs from another company shall submit the following information for its operations within Kentucky and for the company from which it purchases its energy needs.

(a) A map of existing and planned generating facilities, transmission facilities with a voltage rating of sixty-nine (69) kilovolts or greater, indicating their type and capacity, and locations and capacities of all interconnections with other utilities. The utility shall discuss any known, significant conditions which restrict transfer capabilities with other utilities

While heavy north to south power transfers can restrict regional transfer capabilities, Big Rivers has identified no specific operating conditions which restrict transfer capabilities with other utilities.

Figure 8.1: Big Rivers Electric Corporation Transmission System

[redacted]

(b) A list of all existing and planned electric generating facilities which the utility plans to have in service in the base year or during any of the fifteen (15) years of the forecast period, including for each facility:

1) Plant name;

2) Unit number(s);

3) Existing or proposed location;

4) Status (existing, planned, under construction, etc.);

5) Actual or projected commercial operation date;

6) Type of facility;

7) Net dependable capability, summer and winter;

8) Entitlement if jointly owned or unit purchase;

9) Primary and secondary fuel types, by unit;

10) Fuel storage capacity;

11) Scheduled upgrades, deratings, and retirement dates;

12) Actual and projected cost and operating information for the base year (for existing units) or first full year of operations (for new units) and the basis for projecting the information to each of the fifteen (15) forecast years (for example, cost escalation rates). All cost data shall be expressed in nominal and real base year dollars.

    1. Capacity and availability factors;
    2. Anticipated annual average heat rate;
    3. Costs of fuel(s) per millions of British thermal units (MMBtu);
    4. Estimate of capital costs for planned units (total and per kilowatt of rated capacity);
    5. Variable and fixed operating and maintenance costs;
    6. Capital and operating and maintenance cost escalation factors;
    7. Projected average variable and total electricity production costs (in cents per kilowatt-hour).

Table 8.4 on the following page shows characteristics and costs associated with all existing units in place in the Big Rivers Base Case IRP.

Table 8.4: Operating Characteristics of Existing Resources

1	2	3	4	5	6	7		8	9		10	11
Plant	Unit	Location	Status	Commercial Operation Date	Type of Facility	Net Dependable Capability		Entitlement	Fuel Type		Fuel Storage Capability	Retirement Date
						Summer	Winter		Primary	Secondary [1]		
K.C. Coleman	1	Hancock County, Kentucky	Existing	November 1969	Steam Turbine	150	150		Coal	Natural Gas	30 days	
K.C. Coleman	2	Hancock County, Kentucky	Existing	September 1970	Steam Turbine	138	138		Coal	Natural Gas	30 days	
K.C. Coleman	3	Hancock County, Kentucky	Existing	January 1972	Steam Turbine	155	155		Coal	Natural Gas	30 days	
R.D. Green	1	Webster County, Kentucky	Existing	December 1979	Steam Turbine	231	231		Coal	Oil	60 days	
R.D. Green	2	Webster County, Kentucky	Existing	January 1981	Steam Turbine	223	223		Coal	Oil	60 days	
Henderson 2	1	Henderson County, Kentucky	Existing	June 1973	Steam Turbine	159	159		Coal	Oil	60 days	
Henderson 2	2	Henderson County, Kentucky	Existing	April 1974	Steam Turbine	156	156		Coal	Oil	60 days	
R.A. Reid	1	Henderson County, Kentucky	Existing	January 1966	Steam Turbine	50	50		Coal	Oil	60 days	
R.A. Reid CT		Henderson County, Kentucky	Existing	March 1978	Combustion Turbine	65	65		Gas			
D.B. Wilson	1	Ohio County, Kentucky	Existing	November 1986	Steam Turbine	417	417		Coal	Oil	60 days	

[1] *Fuels listed as Secondary are used for Start-Up*

A table showing costs and parameters for each Big Rivers generating unit for each year of the 2011 through 2025 period is included as Appendix K.

(c) Description of purchases, sales, or exchanges of electricity during the base year or which the utility expects to enter during any of the fifteen (15) forecast years of the plan

In the preparation of the IRP, interaction with an economy energy market was modeled. The economy energy market was defined using the average of projected prices at three pricing hubs: Cinergy, Southern Company, and the Tennessee Valley Authority ("TVA"). The price projections were developed by ACES Power Marketing.

Monthly on and off-peak prices for each hub are included with this filing as Appendix L.

Capacity purchases from the market were not explicitly modeled in the production of the IRP. When new capacity is required, potential sources of that capacity could include self-build or unit participation by Big Rivers, or purchases of capacity from appropriate resources owned by others. For instance, the base case expansion plan includes additional peaking capacity in 2022 which could be provided by a new Big Rivers combustion turbine or a purchase of peaking capacity from another party.

(d) Description of existing and projected amounts of electric energy and generating capacity from cogeneration, self-generation, technologies relying on renewable resources, and other nonutility sources available for purchase by the utility during the base year or during any of the fifteen (15) forecast years of the plan

Big Rivers Base Case IRP plan includes capacity and energy from its members' SEPA allocations. Those allocations are shown in Table 8.5 on the following page. No other renewable resources, cogeneration or self-generation resources, or nonutility sources are indicated in the Base Case plan. Presently a force majeure has been declared by SEPA due to dam safety issues at the Wolf Creek and Center Hill Dams, near Jamestown, Kentucky, and Lancaster, Tennessee, respectively, on the Cumberland River System. Currently SEPA is providing a run-of-river schedule. During the time of the force majeure has been in effect, the run-of-river schedule has provided approximately 100 MW. Based on current estimates from the Army Corps of Engineers, which is responsible for repairs, the termination of the force majeure, and hence the ability of Big Rivers to schedule its full SEPA allocation of 178 MW is expected to occur in mid-year 2013.

Table 8.5: SEPA Allocations

	SEPA Capacity (MW)	*SEPA Energy (MWh)*
2011	*100*	*301,930*
2012	*100*	*301,930*
2013	*100*	*292,889*
2014	*178*	*267,000*
2015	*178*	*267,000*
2016	*178*	*267,000*
2017	*178*	*267,000*
2018	*178*	*267,000*
2019	*178*	*267,000*
2020	*178*	*267,000*
2021	*178*	*267,000*
2022	*178*	*267,000*
2023	*178*	*267,000*
2024	*178*	*267,000*
2025	*178*	*267,000*

(e) For each existing and new conservation and load management or other demand-side programs included in the plan:

1. Targeted classes and end-uses

Based on the results of the energy efficiency savings potential analysis, the possible wide-spread application of the measures identified, and a review of Energy Efficiency Programs currently offered by other electric cooperatives, investor-owned electric utilities, and energy efficiency organizations (*e.g.*, Wisconsin Focus on Energy, ActOnEnergy (Illinois), Midwest Energy Efficiency Alliance) located in or around Kentucky, Big Rivers has elected to evaluate the following residential and C&I DSM programs in conjunction with the 2010 IRP:

1. Residential Efficient Lighting Program
2. Residential Efficient Products Program
3. Residential Advanced Technologies Program
4. Residential Weatherization Program
5. Residential New Construction Program
6. C&I Prescriptive Lighting Program
7. C&I Prescriptive HVAC Program

Residential Efficient Lighting Program

This program is designed to encourage residential customers to install high efficiency bulbs in their homes, replacing incandescent bulbs. Initially, Big Rivers will purchase CFL bulbs and distribute the bulbs to its members at no cost. Bulbs will continue to be available at member offices, annual meetings, and other special community events throughout the year. Distributing bulbs at no cost to members helps to stimulate interest in high efficiency lighting, produce significant energy savings, and allows Big Rivers and its members a direct opportunity to educate members about other DSM programs.

As the EISA 2007 mandates requiring incandescent lighting to become approximately 30% more efficient become effective, Big Rivers plans to consider additional advanced lighting options, such as light emitting diodes ("LED"), as the technologies mature. It is hoped that over time, the initial cost of LED lighting and the number of residential applications will become more palatable to consumers.

Residential Efficient Products Program

This program provides financial incentives and market support via retailers to increase the market share and sales of efficient home appliances. The program targets purchases of select technologies through retail stores and other special sales events. Initially, the program may offer incentives for high efficiency water heaters, refrigerators, and clothes washers.

Members will submit a rebate application form following the purchase of any qualified high efficiency product along with a proof of purchase. Incentives are paid after all completed documentation is received.

Residential Advanced Technologies Program

The Big Rivers Advanced Technologies Program is designed to promote the purchase of efficient products with significant energy savings potential that are currently available in the market place but continue to have low market saturation. The primary offerings may include rebates for the purchase and installation of heat pump water heaters ("HPWH") and Ground Source Heat Pumps.

Under this program HVAC contractors and plumbers would perform the installations and submit all necessary paperwork while program staff would oversee the administration and outreach components. Promotion of the incentives would be done cooperatively with HVAC and water heating supply houses, distributors and contractors. To ensure the quality of installations and to increase awareness, periodic training sessions will be provided by Big Rivers to the HVAC and water heating distributors, contractors, retailers, and consumers focusing on the benefits to the consumer of the high efficiency equipment and installation procedures.

Residential Weatherization Program

This program is designed to encourage residential customers to upgrade and install energy efficient building shell measures in homes that are currently inadequately insulated or weatherized. The most important energy efficiency measures for this program include air infiltration, sealing of heating/cooling ducts, increasing attic insulation and/or floor insulation in homes with inadequate levels currently installed, and an energy savers care kit package that includes easy-to-install and low cost energy saving equipment including CFL bulbs, low flow devices, and a water heater insulation blanket.

Financial incentives will be paid to the homeowner after all completed documentation is received by Big Rivers. Incentives may be available for improved air sealing, duct sealing as well as increased attic insulation and floor insulation.

Over time, the individual components of this program may be altered, based on experience and evaluation, to maximize overall cost-effectiveness and target aspects of the building envelope that are likely to benefit the most from efficient technologies and practices.

Residential New Construction Program

The objective of this program is to support energy efficient design and the installation of energy efficient appliances during the construction of new residences. The program will be targeted to the residential new construction market, particularly to residential customers and home builders in the process of designing and constructing new homes. The target for this program is to build new homes so that they are significantly more energy efficient than a standard new home built to meet the specifications of the current residential energy code in Kentucky.

Under the current design of the program, residential new home buyers can submit a Home Energy Rating System ("HERS") Rating Certificate that certifies the new home as 15% more efficient (Tier 1) than a new home built to the current residential building code. A new home that is certified as 30% more efficient than a standard new home would qualify as a Tier 2 home.

Energy savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of the following: high performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems, high efficiency water heating equipment, and high efficiency building envelope standards. Energy-efficient lighting and appliances will also be encouraged. These features contribute to improved home quality and homeowner comfort, and to lower energy demand.

C&I Prescriptive Lighting Program

This program is designed to encourage commercial and industrial customers to install high efficiency lighting technologies in their businesses to replace inefficient technologies. Initially, Big Rivers will launch the program with only a few lighting measures such as CFL's, LED exit signs, T8 fixtures and occupancy sensors, but will evaluate the program's effectiveness often in order to update the technologies offered as needed. Big Rivers will work in conjunction with contractors and members to encourage participation in the program

C&I Prescriptive HVAC Program

This program is designed to encourage commercial and industrial customers to install efficient HVAC equipment. The technologies offered at the start of the program may include low cost Packaged Terminal AC and Packaged Terminal Heat Pump measures. HVAC Tune-up and Variable Frequency Drives for HVAC motors and fans may also be offered. As the program matures, Big Rivers will evaluate the market and introduce new technologies such as Split AC systems and Air Cooled Chillers.

2. **Expected duration of the program**

   The Big Rivers Energy Efficiency Programs have been specifically analyzed for three years of implementation, but were carried through the 15 year IRP forecast under the assumption that similar programs with the same savings would be an investment that Big Rivers will continue to make. The three-year programs presented here are based upon an annual EE expenditure of approximately $1 million dollars in the first year, rising by 2.5% per year thereafter. It is important to note that current energy efficiency technologies may become standard practice over time and that there will be new advancements in energy efficiency. As a result, the recommended programs may need to be adapted after the initial 3 year period by changing the specific measures that are currently recommended for each program. As an example, compact fluorescent lighting may achieve high levels of market penetration within 5 to 10 years, but the emergence of LED lighting may allow for the continued operation of a residential lighting program.

3. **Projected energy changes by season, and summer and winter peak demand changes**

   The projected energy and peak demand savings for the residential and C&I DSM programs to be implemented in 2011 have been analyzed to calculate cost savings and to determine benefit/cost ratios for each program. Total energy savings in the first year of program implementation (2011) are projected to be 3,767 MWH with cumulative energy savings reaching 49,160 MWH in 2025, and total Winter Peak demand savings for all programs is projected to be 1,003 kW in the first year with cumulative savings reaching almost 14 MW in year 15. Likewise, Summer Peak demand savings for all programs is 623 kW in the first year, with cumulative savings reaching over 10 MW in 2025.

Table 8.6: Cumulative Annual Energy Savings by Season (kWh)

Residential	2011	2012	2013	2015	2020	2025
Winter	1,396,493	2,876,202	4,390,133	6,774,499	11,644,086	15,985,949
Summer	891,348	1,846,502	2,821,191	4,463,884	8,133,936	11,621,059
Total Annual kWh	2,287,840	4,722,703	7,211,324	11,238,382	19,778,022	27,607,008
Commercial						
Winter	540,483	1,159,350	1,793,708	3,242,895	7,222,235	10,347,885
Summer	587,917	1,256,650	1,956,692	3,527,505	7,844,965	9,932,515
Total Annual kWh	1,128,400	2,416,000	3,750,400	6,770,400	15,067,200	20,280,400
Residential & Commercial	**2011**	**2012**	**2013**	**2015**	**2020**	**2025**
Winter	1,936,975	4,035,552	6,183,841	10,017,394	18,866,321	26,333,834
Summer	1,479,265	3,103,152	4,777,883	7,991,389	15,978,901	21,553,574
Total Annual kWh	3,416,240	7,138,703	10,961,724	18,008,782	34,845,222	47,887,408

Table 8.7: Cumulative Annual Peak Demand Savings by Season (kW)

Residential	2011	2012	2013	2015	2020	2025
Winter	712	1,469	2,256	3,611	6,741	10,076
Summer	291	603	921	1,465	2,707	3,923
Commercial						
Winter	204	436	679	1,224	2,721	3,392
Summer	333	713	1,104	1,996	4,443	6,262
Residential & Commercial						
Winter	916	1,905	2,935	4,835	9,462	13,468
Summer	623	1,316	2,025	3,461	7,151	10,185

The residential programs account for a little over 60% of first year winter energy savings, and about 65% of winter peak demand savings. Of the winter energy savings that the residential sector is projected to achieve, one third comes from the lighting program. Weatherization is the program with most of the winter peak demand savings, with over 40% coming only from it.

Table 8.8: Residential Program Cumulative Annual Energy Savings by Season (kWh)

Lighting	2011	2012	2013	2015	2020	2025
Winter Energy	469,438	938,877	1,408,315	1,626,779	812,496	1,484,070
Summer	235,742	471,483	707,225	816,933	408,018	745,268
Efficient Appliances						
Winter	199,151	417,467	640,575	1,104,306	2,369,357	3,236,505
Summer	89,137	186,837	286,693	494,254	1,060,424	1,445,271
Advanced Technologies						
Winter	261,093	536,731	832,856	1,446,922	3,092,145	3,945,382
Summer	107,134	220,404	341,815	593,839	1,269,327	1,608,191
Weatherization						
Winter	391,154	825,882	1,268,878	2,185,512	4,488,596	5,906,925
Summer	413,126	872,029	1,339,450	2,307,924	4,856,287	6,957,615
New Construction						
Winter	75,655	157,246	239,509	410,980	881,492	1,413,068
Summer	46,209	95,749	146,008	250,933	539,879	864,714

Table 8.9: Residential Cumulative Annual Peak Demand Savings by Season (kW)

Lighting	2011	2012	2013	2015	2020	2025
Winter Peak kW	164	328	493	569	284	519
Summer Peak kW	72	144	216	250	125	228
Efficient Appliances						
Winter Peak kW	13	26	41	70	150	204
Summer Peak kW	16	33	51	88	190	251
Advanced Technologies						
Winter Peak kW	169	340	535	930	1,977	2,970
Summer Peak kW	26	53	82	142	304	358
Weatherization						
Winter Peak kW	312	659	1,011	1,741	3,684	5,347
Summer Peak kW	148	312	480	827	1,749	2,542
New Construction						
Winter Peak kW	55	116	176	302	646	1,036
Summer Peak kW	29	60	92	158	339	544

The commercial programs account for the remaining 40% of the first year winter energy savings, and about 35% of winter peak demand savings. Of the winter energy savings that the commercial and industrial sector is projected to achieve, over half comes from the HVAC program. However, Lighting is the main driver when looking at Winter Peak demand savings.

Table 8.10: C&I Program Cumulative Annual Energy Savings by Season (kWh)

Lighting	2011	2012	2013	2015	2020	2025
Winter	232,362	495,706	774,540	1,394,172	3,098,160	3,640,338
Summer	469,638	1,001,894	1,565,460	2,817,828	6,261,840	7,357,662
HVAC						
Winter	308,121	663,644	1,019,168	1,848,723	4,124,075	6,707,547
Summer	118,279	254,756	391,232	709,677	1,583,125	2,574,853

Table 8.11: C&I Cumulative Annual Peak Demand Savings by Season (kW)

Lighting	2011	2012	2013	2015	2020	2025
Winter Peak kW	172	366	572	1,030	2,289	2,689
Summer Peak kW	160	342	535	962	2,138	2,512
HVAC						
Winter Peak kW	32	70	107	194	432	703
Summer Peak kW	172	371	570	1,033	2,305	3,749

The full DSM study is provided in Appendix B. Detailed breakouts of energy and demand savings by sector, program and year are included in Appendix C.

4. **Projected cost, including any incentive payments and program administrative costs**

The total Big Rivers investment for the mentioned DSM programs under evaluation is estimated to be up to $1 million in 2011. The DSM expenditures were assigned an annual increase of 2.5%, raising the total in 2025 to approximately $1.4 million. In 2011 incentives account for $632,450 (63%) of the expenditures for this analysis, with the remaining $365,600 set aside for administrative purposes. Administrative costs include program design, program implementation, reporting and tracking, marketing, incentive fulfillment, and labor costs. Additional participant costs incurred by residential and C&I members to purchase and install energy efficient equipment are not represented in the tables below.

Table 8.12: Energy Efficiency Program Costs

All Residential Programs Combined	2011	2012	2013	2015	2020	2025
Incentives	$486,150	$526,725	$543,975	$565,350	$643,225	$724,825
Administration	$186,750	$158,700	$164,250	$174,050	$197,850	$223,050
Total Big Rivers Cost	$672,900	$685,425	$708,225	$739,400	$841,075	$947,875
All C&I Programs Combined	**2011**	**2012**	**2013**	**2015**	**2020**	**2025**
Incentives	$146,300	$167,300	$172,200	$198,800	$224,700	$256,200
Administration	$178,850	$167,300	$172,200	$162,650	$183,850	$209,650
Total Big Rivers Cost	$325,150	$334,600	$344,400	$361,450	$408,550	$465,850
All Programs Combined	**2011**	**2012**	**2013**	**2015**	**2020**	**2025**
Incentives	$632,450	$694,025	$716,175	$764,150	$867,925	$981,025
Administration	$365,600	$326,000	$336,450	$336,700	$381,700	$432,700
Total Big Rivers Cost	$998,050	$1,020,025	$1,052,625	$1,100,850	$1,249,625	$1,413,725

The residential programs require estimated expenditures of $672,900 in 2011 growing to $947,875 by 2025. In the first year, incentives account for $486,150 (72%) of the total Big Rivers residential DSM programs expenditures. The remaining $186,750 (28%) of the residential expenditures is reserved for administrative functions. By 2025 incentives account for an even greater portion of the overall EE expenditures, $724,825 (76%) compared to administrative costs of $223,050 (24%).

Table 8.13: Residential Energy Efficiency Program Costs

Lighting	2011	2012	2013	2015	2020	2025
Incentives	$42,550	$42,550	$42,550	$41,000	$46,250	$52,250
Administration	$7,500	$7,500	$7,500	$10,250	$11,550	$13,050
Total Big Rivers Cost	$50,050	$50,050	$50,050	$51,250	$57,800	$65,300
Residential Efficient Appliances						
Incentives	$70,000	$76,825	$78,475	$82,750	$93,475	$105,425
Administration	$30,000	$25,600	$26,150	$27,600	$31,150	$35,150
Total Big Rivers Cost	$100,000	$102,425	$104,625	$110,350	$124,625	$140,575
Residential Advanced Technologies						
Incentives	$88,750	$92,250	$101,500	$105,000	$117,750	$134,000
Administration	$38,050	$30,750	$33,850	$35,000	$39,250	$44,650
Total Big Rivers Cost	$126,800	$123,000	$135,350	$140,000	$157,000	$178,650
Weatherization						
Incentives	$223,950	$250,000	$254,950	$266,400	$304,850	$342,950
Administration	$96,000	$83,350	$85,000	$88,800	$101,600	$114,300
Total Big Rivers Cost	$319,950	$333,350	$339,950	$355,200	$406,450	$457,250
New Construction						
Incentives	$60,900	$65,100	$66,500	$70,200	$80,900	$90,200
Administration	$15,200	$11,500	$11,750	$12,400	$14,300	$15,900
Total Big Rivers Cost	$76,100	$76,600	$78,250	$82,600	$95,200	$106,100

Big Rivers' C&I programs have annual expenditures of $325,150 in 2011 growing to $465,850 by 2025. In the first year, incentives account for $146,300 (45%) of the total Big Rivers C&I DSM programs expenditures. The remaining $178,850 (55%) is reserved for administrative functions. By 2025, incentives account for an even greater proportion of the overall expenditures, $256,200 (55%), compared to administrative costs of $209,650 (45%).

Table 8.14: C&I Energy Efficiency Program Costs

Commercial/Industrial Lighting Program	2011	2012	2013	2015	2020	2025
Incentives	$73,500	$83,300	$88,200	$98,000	$112,700	$127,400
Administration	$89,850	$83,300	$88,200	$80,200	$92,200	$104,250
Total Big Rivers Cost	$163,350	$166,600	$176,400	$178,200	$204,900	$231,650
Commercial/Industrial HVAC Program						
Incentives	$72,800	$84,000	$84,000	$100,800	$112,000	$128,800
Administration	$89,000	$84,000	$84,000	$82,450	$91,650	$105,400
Total Big Rivers Cost	$161,800	$168,000	$168,000	$183,250	$203,650	$234,200

Additional detail on program costs by sector and year are included in Appendix C.

5. **Projected cost savings, including savings in utility's generation, transmission and distribution costs**

   Costs that could be avoided by implementing DSM programs were calculated for use in the screening process. Avoided demand costs were assumed to be, for years beginning with 2015, the fixed costs associated with a new peaking resource. Peaking resource fixed costs were based on the costs of a new combustion turbine resource as published by the EIA in its 2010 Annual Energy Outlook. Fixed costs include interest expense, depreciation expense, and fixed O&M costs.

Prior to 2015, avoided demand costs were estimated to more closely represent prices associated with current market capacity transactions. A price of $2/kW-Month was used for 2010, and this value was assumed to grow with linear increases until convergence was reached with the price of a new combustion turbine in 2015.

Avoided energy costs were assumed to be those associated with potential economy energy purchases. The economy energy market was defined using the average of ACES Power Marketing price projections for the Cinergy, Southern Company, and TVA pricing hubs.

Table 8.15: Avoided Energy Costs

[redacted]

Table 8.16: Avoided Demand Costs

	Demand				
	Generation			*Trans.*	*Dist.*
	Annual	*Summer*	*Winter*		
	$/kW-Yr	*$/kW-Yr*	*$/kW-Yr*	*$/kW-Yr*	*$/kW-Yr*
2010	24.00	10.00	14.00	0.00	0.00
2011	37.40	15.58	21.82	0.00	0.00
2012	50.80	21.17	29.63	0.00	0.00
2013	64.20	26.75	37.45	0.00	0.00
2014	77.60	32.33	45.27	0.00	0.00
2015	91.00	37.92	53.08	0.00	0.00
2016	92.73	38.64	54.09	0.00	0.00
2017	94.49	39.37	55.12	0.00	0.00
2018	96.29	40.12	56.17	0.00	0.00
2019	98.12	40.88	57.23	0.00	0.00
2020	99.98	41.66	58.32	0.00	0.00
2021	101.88	42.45	59.43	0.00	0.00
2022	103.82	43.26	60.56	0.00	0.00
2023	105.79	44.08	61.71	0.00	0.00
2024	107.80	44.92	62.88	0.00	0.00
2025	109.85	45.77	64.08	0.00	0.00

The avoided costs discussed above were then applied to the energy, demand, fuel and other fuel savings in order to produce benefits for each program. These benefits are what would be used in order to apply a benefit/cost ratio to each of the programs in the portfolio. Table 8.17 below shows the net present value benefits for each sector and fuel type.

Table 8.17: Energy Efficiency Program Net Present Value Benefits

	NPV Benefits			
	Electric	*Non-Electric*	*Other*	*Total*
Residential Lighting	$2,461,417	$0	$262,255	$2,723,672
Residential Efficient Appliances	$2,659,480	$808,082	$0	$3,467,562
Residential Advanced Technologies	$5,234,683	$0	$0	$5,234,683
Residential Weatherization	$10,722,359	$7,854,141	$168,112	$18,744,612
Residential New Construction	$2,243,779	$654,051	$0	$2,897,830
Commercial & Industrial Lighting	$7,801,299	$0	$0	$7,801,299
Commercial & Industrial HVAC	$4,943,438	$0	$0	$4,943,438
Total Benefits	$36,066,456	$9,316,273	$430,366	$45,813,096

(4) The utility shall describe and discuss its resource assessment and acquisition plan which shall consist of resource options which produce adequate and reliable means to meet annual and seasonal peak demands and total energy requirements identified in the base load forecast at the lowest possible cost. The utility shall provide the following information for the base year and for each year covered by the forecast:

(a) On total resource capacity available at the winter and summer peak:

1. Forecast peak load
2. Capacity from existing resources before consideration of retirements
3. Capacity from planned utility-owned generating plant capacity additions
4. Capacity available from firm purchases from other utilities
5. Capacity available from firm purchases from nonutility sources of generation
6. Reductions or increases in peak demand from new conservation and load management or other demand-side programs
7. Committed capacity sales to wholesale customers coincident with peak
8. Planned retirements
9. Reserve requirements
10. Capacity excess or deficit
11. Capacity or reserve margin

Table 8.18 below shows Big Rivers' Base Case capacity, demand and reserve information, for both winter and summer, for each year of the IRP.

Table 8.18: Base Case Resource Assessment Results – Capacity Requirements

[redacted]

(b) On planned annual generation

1. Total forecast firm energy requirements
2. Energy from existing and planned utility generating resources disaggregated by primary fuel type
3. Energy from firm purchases from other utilities
4. Energy from firm purchases from nonutility sources of generation
5. Reductions or increases in energy from new conservation and load management or other demand-side programs

Table 8.19 below shows Big Rivers' Base Case energy requirements and sources for each year of the IRP.

Table 8.19: Base Case Resource Assessment Results – Energy Requirements (MWH)

[redacted]

(c) For each of the fifteen (15) years covered by the plan, the utility shall provide estimates of total energy input in primary fuels by fuel type and total generation by primary fuel type required to meet load. Primary fuels shall be organized by standard categories (coal, gas, etc.) and quantified on the basis of physical units (for example, barrels or tons) as well as in MMBtu

Table 8.20 below shows energy input and generation by fuel type for each year of the IRP.

Table 8.20: Energy Generation by Fuel Type

[redacted]

(5) The resource assessment and acquisition plan shall include a description and discussion of:

(a) General methodological approach, models, data sets, and information used by the company

As described earlier in this document, the Strategist Integrated Planning System was used to produce the Big Rivers IRP. Strategist is a well-know planning system that is licensed to GDS by Ventyx. The system utilizes chronological load patterns and probabilistic production costing methods to determine unit dispatch and associated costs. The system also has the capability to develop least cost expansion plans. It determines what type of new resources should be added to a utility's existing portfolio in order to maintain reliability criteria at the least cost. Potential new resources are user-defined. New supply-side resources were defined for Big Rivers IRP process to include traditional options such as nuclear units, coal units, combined-cycle units, and combustion turbine units. Renewable resources were also defined to allow selection if economically appropriate. The list of potential renewable resources included biomass, landfill gas, wind, photovoltaic, and coal bed methane. Additionally, the EE programs that passed prior screening efforts were defined as potential options for selection. These programs were selected by Strategist as part of the as options that facilitated a least cost plan. They were also included in all sensitivity cases.

(b) Key assumption and judgments used in the assessment and how uncertainties in those assumptions and judgments were incorporated into analyses.

Uncertainties in several key variables were addressed by using a sensitivity case approach. In addition to the Base Case, cases were developed that factored in (1) higher than base fuel prices, (2) high load and energy projections, (3) enactment of a Renewable Portfolio Standard, (4) uncertainties related to environmental compliance issues, and (5) MISO resource adequacy standards. The development of the sensitivity cases identifies the economic impacts to Big Rivers and potential capital expansion obligations associated with varying production environments.

(c) Criteria (for example, present value of revenue requirements, capital requirements, environmental impacts, flexibility, diversity) used to screen each resource alternative including demand-side programs, and criteria used to select the final mix of resources presented in the acquisition plan

The final mix of resources associated with the Base Case and with each sensitivity case is based on the lowest present value of costs.

(d) Criteria used in determining the appropriate level of reliability and the required reserve or capacity margin, and discussion of how these determinations have influenced selection of options

The reserve margin target criteria used in the development of the Big Rivers resource mix is based on the NERC's target as shown in its 2009 Long-Term Reliability Assessment. That target reserve margin is 15% for predominately thermal systems. This value was used to define a range of reserve margins for use in the modeling process. Annual reserve margin values fall above and below this value over the term of the study. [redacted]

(e) Existing and projected research efforts and programs which are directed at developing data for future assessments and refinements of analyses

Big Rivers and its members will continue to regularly evaluate technologies and programs that provide cost effective energy savings for electricity consumers. Additional programs will be developed to encourage energy savings for more specific applications as the DSM program matures. Big Rivers will also continue to monitor customer appliance, home, and demographic characteristics through surveys. As member cooperatives implement Automated Metering Infrastructure ("AMI"), Big Rivers will have greater access to load data and consumption patterns and can evaluate demand control approaches.

(f) Actions to be undertaken during the fifteen (15) years covered by the plan to meet the requirements of the Clean Air Act amendments of 1990, and how these actions affect the utility's resource assessment

The Big Rivers' system consists of seven coal-fired units of various size and vintage and one combustion turbine. Big Rivers also operates and has the contractual right to certain amounts of the capacity and energy from two coal- fired units owned by HMP&L. The table below represents a brief description of the operating units:

Table 8.21: Environmental Controls on Existing Units

(See further details in Appendix N)

Unit	*Net Capacity*	*Commercialized*	*SO2 Control*	*NOx Control*
Reid 1	*65 MW*	*1966*	*See below*	*See below*
Coleman 1	*150 MW*	*1969*	*FGD Retrofit in 2006*	*Air*
Coleman 2	*138MW*	*1970*	*FGD Retrofit in 2006*	*Over-fired Air*
Coleman 3	*155 MW*	*1972*	*FGD Retrofit in 2006*	*Over-fired Air*
Henderson 1	*153 MW*	*1973*	*FGD Retrofit in 1995*	*SCR Retrofit in 2004*
Henderson 2	*159 MW*	*1974*	*FGD Retrofit in 1995*	*SCR Retrofit in 2004*
Green 1	*231 MW*	*1979*	*FGD*	*Coal Re-burn*
Green 2	*223 MW*	*1981*	*FGD*	*Coal Re-burn*
Wilson 1	*417 MW*	*1986*	*FGD*	*SCR Retrofit in 2004*
Reid CT	*65 MW*	*1976*	*See below*	*See below*

The upper 4 of 8 burners on the Reid 1 coal-fired unit were retrofitted with the ability to burn natural gas (as well as coal) in 2001 for SO_2 and NOx control. However, the actual gas line connection was delayed and required environmental permits to burn natural gas in this unit have not been obtained. In addition, at that time the price of natural gas escalated. With the gas burners open and additional air flow for cooling effect, an over-fire air effect for NOx control was gained. Since that time, the unit has realized a 50% reduction of NOx emission rates from the bottom 4 coal-fired burners. The Reid CT fuel oil unit was retrofitted to burn natural gas (as well as fuel oil) in 2001 for SO2 and NOx control.

The Environmental Protection Agency has finalized the agency's endangerment finding, which opened the door to using the Clean Air Act ("CAA") to regulate Green House Gasses ("GHG") from motor vehicles. However, any regulation of GHG under the mobile source provisions of the existing CAA must recognize the cascading regulatory effects on other programs, including the prevention of significant deterioration ("PSD") and Title V permitting programs, and how those effects would impact the electric power and other sectors.

Bills introduced March 4, 2010 in the House and the Senate would allow Congress time to determine how to deal with the climate change issue rather than allowing the EPA through the CAA to make that determination.

Carbon capture and sequestration for power plants involves the removal of carbon dioxide from either the input fuel (carbon) or the exit gas (carbon dioxide) from the combustion of the carbon fuel. Changes to input fuel involve the gasification of coal and the burning of hydrogen with pure O_2. The capture and collection of CO_2 in the exit gas has been demonstrated on a limited scale using amine absorbers and compressors. The U.S. Department of Energy estimates the use of this technology to remove and compress CO_2 will cost on the order of $150 per ton. This cost does not reflect the additional cost of storage, transportation and sequestration. Due to the high cost of this process, several other systems and technologies are being developed. These systems include chemical and physical absorption/adsorption, low temperature distillation, gas separation membranes, mineralization and biomineralization.

Biological systems such as algae and other genetically modified plant sources to utilize the CO_2 as a food or fuel source are also being studied. Any process utilized to capture CO_2 will be driven based upon the real or artificial cost established for the release of a ton of CO_2. Legislation which passed in the U.S. House during 2009 (the Waxman-Markey bill) failed to pass in the Senate. That legislation would have set both non-binding economy-wide emission reductions and a mandatory cap on covered greenhouse gases. Similar legislation in the U.S. Senate has made little progress to date.

Meanwhile, the Environmental Protection Agency has finalized the agency's endangerment finding, which opened the door to using the CAA to regulate CHGs from motor vehicles. However, any regulation of Green House Gases under the mobile source provisions of the existing CAA must recognize the cascading regulatory effects on other programs, including the prevention of significant deterioration ("PSD") and Title V permitting programs, and how those effects would impact the electric power and other sectors.

Bills introduced March 4, 2010 in the House and the Senate would have allowed Congress time to determine how to deal with the climate change issue rather than allowing the EPA through the CAA to make that determination. These bills were not passed, but the funding necessary to implement the regulations could be impacted if either house of Congress has a Republican majority after the November 2010 elections.

The remaining known methods to reduce CO_2 involve replacement of fossil fuel generated power with lower carbon neutral, or non carbon sourced fuel, increased boiler efficiency or reduced demand. Lower carbon content fuel includes natural gas. Sources that could possibly be considered carbon neutral (there has been recent debate on whether burning biomass is actually carbon neutral) include the conversion of one or more units to burn biomass. Non carbon sources would hydroelectric, wind, solar or nuclear. Limitations affecting hydroelectric generation include sufficient water flow and siting problems. Currently solar power panels have low conversion rates and high installation costs. Wind power sources are a challenge in our area due to low sustained wind speeds. In Kentucky, nuclear facilities are prohibited by State law.

The University of Kentucky's Center for Applied Energy Research ("CAER") has formed a consortium called the Carbon Management Research Group ("CMRG"). The CMRG has established a program to research cost-effective technologies for reducing and managing CO_2 in coal-fired electric power plants. Utilities currently participating in CMRG and contributing

\$200,000 each year are Big Rivers, East Kentucky Power, American Electric Power, Duke-KY, and E.ON.

The development of a CO_2 compliance plan is not possible at this time given the uncertainties surrounding actions of EPA, bills in Congress to limit the EPA, other actions Congress may take to limit CO_2 and the current options available to utilities for removal.

Clean Air – Mercury, NOx, SO_2 and Particulate

Mercury

The Clean Air Mercury Rule ("CAMR") was vacated by the U.S. Court of Appeals D.C. Circuit on February 8, 2008. EPA instituted an Information Collection Request ("ICR") for toxic air pollutants. The associated information including unit data and stack testing results have been submitted by all affected utilities. The EPA is mandated by consent decree to have a final regulation by November of 2011 to regulate utilities for hazardous air pollutants under Maximum Achievable Control Technology ("MACT") applicable regulations. The final rule is expected to then be published in early 2012 and will mandate compliance within three years for toxic pollutants, which will include mercury. Under CAMR Big Rivers' units as a system were projected to comply with the emission allocations. Should mercury control under a MACT rule be on a unit by unit basis, all of Big Rivers' coal-fired units would likely require additional controls. With the installation of SCRs and scrubbers, previous test results showed that all of Big Rivers' coal-fired units were in compliance with CAMR Phase I and II (i.e. no mercury allowance purchases would have been necessary for compliance).

NOx

The Clean Air Interstate Rule ("CAIR") was overturned on July 8, 2008 based on a challenge by North Carolina, which claimed the rule did not adequately reduce emissions of NOx and SO_2 from upwind states. Although the rule was remanded, it was restored on a temporary basis until EPA can rework the rule to address the court's issues. The annual NOx limitations along with the ozone season (May 1 through September 30) are now in effect. This means for 2010, during the ozone season, allowances are drawn from both the Annual NOx accounts and Ozone season accounts. Big Rivers previously installed SCRs on Wilson Station and HMP&L Units 1 and 2 and low NOx burners at Coleman and Green. The Coleman Units also have computer controlled over-fired air for NOx control. Coleman Unit 1 NOx control differs from Units 2 and 3 with the addition of a separate air source for NOx control, not from the combustion source. The Reid Unit 1 has an effective over-fire air reduction from the top four burners intended for gas fire but currently left open with additional air flow through the burners to keep them cool. Green Units 1 and 2 have a coal re-burn system in place to reduce NOx emissions through the injection of coal at the top end of the boiler furnace. In 2010, with utilization of vintage year and previously banked allowances, Big Rivers is projecting the system to have a sufficient number of allowances for the ozone season and for the annual baseline based on the projected generation from the SIMMS production model.

The EPA released its proposed Clean Air Transport Rule ("CATR") on July 6, 2010 as a replacement for CAIR. The rule is specifically designed to address the deterioration of air quality in non-attainment areas downwind from emitting sources. Generating units in Kentucky are subject to both the ozone (seasonal NOx) and PM2.5 (annual NOx and SO_2) provisions of the proposed rule. The proposed rule is to become effective January 1, 2012. The table below shows the proposed CATR SO_2, Annual NOx and Seasonal NOx allocations for Big Rivers generating units. It will be incumbent upon Big Rivers to determine whether these allowance allocations are adequate to offset emissions under anticipated emission rates with existing emission control equipment. If an insufficient number of allowances have been allocated, Big Rivers will need to determine whether to purchase allowances (EPA's preferred rule generally limits allowance trading to intra-state transaction) or install additional emissions controls.

Table 8.22: Clean Air Transport Rule Allowance Allocations for Big Rivers and Associated Units

Resource	*2012 SO2 Allocation (Tons)*	*Annual NOx Allocation (Tons)*	*Ozone Season NOx Allocation (Tons)*	*2014 and Beyond SO2 Allocation (Tons)*
Coleman 1	*624*	*1,646*	*704*	*1,569*
Coleman 2	*854*	*1,671*	*715*	*1,569*
Coleman 3	*1,003*	*1,713*	*733*	*1,621*
Green 1	*1,774*	*1,530*	*595*	*1,018*
Green 2	*1,352*	*1,505*	*585*	*1,027*
Reid 1	*1,136*	*734*	*284*	*1,872*
Reid GT 1	*0*	*0*	*0*	*0*
D.B. Wilson	*8,195*	*697*	*305*	*7,866*
HMP&L Henderson 2-1	*1,647*	*293*	*114*	*959*
HMP&L Henderson 2-2	*2,750*	*305*	*118*	*997*

SO_2

Big Rivers currently has Flue Gas Desulphurization Systems ("FGD") otherwise known as scrubbers on all units except Reid 1 and the Reid combustion turbine. With this level of SO_2 reduction Big Rivers has an annual surplus of CAA SO_2 allowances that can be sold or banked for future use. This annual surplus will continue until the new CATR noted above changes the requirements for SO_2 allowances. Beginning with 2010 the CAIR retirement ratio for SO_2 allowances increases from 1:1 allowances per ton emitted to 2:1 allowances per ton emitted. As the CATR is currently proposed (and as directed by the courts), new CATR allowances will be entirely separate from CAA/CAIR allowances. Since CATR allowance allocations may differ significantly from CAA/CAIR allocations, Big Rivers will re-assess its SO_2 compliance options in light of the allocations noted above and of any final allocations issued with the rule's eventual implementation.

Particulate

The Big Rivers coal-fired units are fitted with high efficiency electrostatic participators. The units are in compliance with the current permit particulate limits.

In the production of this IRP, costs associated with the production of NOx and SO_2 were included in all cases. Additionally, a carbon allowance cost was included in the production of the RPS and Environmental Compliance Cases. Big Rivers' Base Case plan includes the addition of new capacity, but the addition is not required until 2022. Big Rivers has time to adjust its planning decisions related to new capacity additions as changes in environmental regulations occur.

(g) Consideration given by the utility to market forces and competition in the development of the plan

In the preparation of the IRP, interaction with an economy energy market was modeled. The economy energy market was defined using the average of projected prices at three pricing hubs: Cinergy, Southern Company, and TVA. The price projections were developed by ACES Power Marketing.

Capacity purchases from the market were not explicitly modeled in the production of the IRP. For sensitivity cases where new capacity is required, potential sources of that capacity could include self-build or unit participation by Big Rivers, or purchases of capacity from appropriate resources owned by others. [redacted]

Technical discussion, descriptions and supporting documentation shall be contained in a technical appendix

Details on the Demand Side Management and Resource Assessment analyses are provided in Appendices B and C.

9. Financial Information
(807 KAR 5:058, Section 9)

The integrated resource plan shall, at a minimum, include and discuss the following financial information:

(1) Present (base year) value of revenue requirements stated in dollar terms

As shown in Table 9.1, the present value of revenue requirements over the next fifteen years is $5.6 billion.

(2) Discount rate used in present value calculations

A discount rate of 6.33% is used for present value calculations in the 2010 IRP. Big River's cost of debt in 2008 and 2009 was 6.33% and is the basis for the discount factor in this study.

(3) Nominal and real revenue requirements by year

Revenue requirements by year are shown in Table 9.1. Several assumptions were made in estimating member revenues:

- Member base rates remain constant throughout the forecast
- Smelters remain at their maximum contractual charge for Times-Interest Earned Ratio ("TIER") adjustment
- The Large C&I load factor remains constant throughout the forecast
- No allowance costs are included, it is assumed allocated and banked allowances cover emissions
- It is assumed the current smelter contracts extend beyond 2023
- Energy sales are reduced by the expected DSM energy and demand savings from the Base Case
- [redacted]
- Inflation is projected using the Purchase Consumption Expenditure Deflator, as projected by Woods & Poole, Economics, Inc.

(4) Average system rates (revenues per kilowatt hour) by year

Average system rates by year are shown as member revenues per MWH sales in Table 9.1. The table is a general estimate that makes several broad assumptions in estimating member revenues thru 2025, not the least of which is that member rates remain constant. A more thorough and detailed analysis will be in a future cost of service study separate from this IRP.

Table 9.1: Revenue and Rate Projections

[redacted]

** Represents energy sales to members including projected DSM impacts from new programs as shown in Table 8.6.*

*** Based on Purchase Consumption Expenditure deflator, Woods & Poole Economics, Inc.*

10. Notice
(807 KAR 5:058, Section 10)

Each utility which files an integrated resource plan shall publish, in a form prescribed by the commission, notice of its filing in a newspaper of general circulation in the utility's service area. The notice shall be published not more than thirty (30) days after the filing date of the report.

Big Rivers will provide notice of its 2010 IRP in accordance with 807 KAR 5:058.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Big Rivers Electric Corporation

Henderson, Kentucky

2009 Load Forecast

July 2009

In Cooperation with
Meade County Rural Electric Cooperative Corporation
Jackson Purchase Energy Corporation
Kenergy Corp.

GDS Associates, Inc.
Engineers and Consultants

Table of Contents

APPENDICES

1. Executive Summary

Big Rivers Electric Corporation (Big Rivers) is an electric generation and transmission cooperative headquartered in Henderson, Kentucky. The 2009 Load Forecast was completed in July 2009 and updates the most recent forecast that was completed in July 2007. The forecast contains projections of energy and demand requirements for a forecast horizon spanning years 2009-2023. High and low range forecast scenarios were developed to address uncertainties regarding the factors expected to influence energy consumption in the future. In addition to the energy and demand projections, this report presents the assumptions upon which the forecast is based and the methodologies employed in development of the forecast.

1.1 Forecast Results

Total system energy and coincident peak demand requirements are projected to increase at average compound rates of 1.1% and 1.2% per year, respectively, from 2008 through 2023 Rural system energy and demand requirements, which are represented as total system requirements less direct-serve customer loads, are both projected to increase at average rates of 1.4% per year over the same period.

The forecast is summarized in Tables 1.1 and 1.2 on the following page. The primary influences on growth in the rural system requirements over the forecast period will continue to be growth in residential sales, which is primarily a function of growth in number of customers. Projected growth is lower than the previous forecast due primarily to the continued leveling of average energy consumption per household. Big Rivers is projected to continue a recent trend of being a winter peaking system, as growth in electric heating and electric water heating market shares are expected to outpace increases in air conditioning market share.

Table 1.1
Load Forecast Summary

		Total System		Rural System	
Year	Consumers	Energy Requirements (MWH)	Peak Demand (CP)	Energy Requirements (MWH)	Peak Demand (CP)
1998	96,154	6,208,552	1,230,000	1,828,160	430,240
2003	104,764	3,087,548	585,549	2,089,678	466,551
2008	111,693	3,340,321	618,676	2,399,889	516,082
2013	117,975	3,502,829	660,907	2,524,992	547,677
2018	125,574	3,711,715	701,818	2,732,249	588,588
2023	132,906	3,936,265	745,796	2,955,047	632,566

Table 1.2
Load Forecast – Average Annual Growth Rates

Description	2008-2013	2008-2023
Total System Energy Requirements	1.0%	1.1%
Total System Peak Demand (NCP)	1.1%	1.2%
Rural System Energy Requirements	1.2%	1.5%
Rural System Peak Demand (CP)	1.2%	1.4%
Residential Energy Sales	1.3%	1.4%
Residential Consumers	1.0%	1.1%
Small Commercial Energy Sales	2.3%	1.9%
Small Commercial Consumers	1.4%	1.5%
Large Commercial Energy Sales	0.4%	0.1%
Large Commercial Consumers	-1.0%	-0.3%
Public Street Lighting Sales	1.7%	1.5%
Irrigation Sales	-16.1%	-5.7%

Section 2 of the report presents a brief summary of the cooperative background and service area characteristics. Section 3 identifies the sources of the data used to prepare the forecast. Section 4 presents the assumptions made during the forecasting process. Sections 5 and 6 present the short and long-term base case forecasts. Section 7 presents four forecast scenarios, which address optimistic/pessimistic economic growth and extreme/mild weather conditions. Section 8 describes the forecasting methodologies used in developing the forecasting models.

1.2 Forecast Assumptions

The forecast is based upon a number of assumptions regarding factors that impact energy consumption, including: demographics, economic activity, price of electricity and competing fuels, electric market share, and weather conditions. The assumptions were developed by GDS Associates and discussed with cooperative management prior to development of the final forecast. The economic outlook for the base case forecast was formulated using information collected from Woods & Poole Economics, Inc., NPA Data Services, and the University of Louisville.

- Population will increase at an average rate of 0.2% per year from 2008-2023.
- Number of households will increase at an average rate of 0.5% per year from 2008-2023.
- Employment will increase at an average rate of 0.5% per year from 2008-2023.
- Gross regional product will increase at an average rate of 1.1% per year from 2008-2023.

- Real average income per household will increase at an average rate of 0.4% per year from 2008-2023.
- Real retail sales will increase at an average rate of 1.3% per year from 2008-2023.
- Inflation, as measured by the Personal Consumption Expenditure Index, will increase at an average compound rate of 1.6%.
- The real price of electricity to residential and small commercial customers will increase between 0.5% and 0.9% per year from 2008-2023.[1]
- Weather conditions, as measured by heating and cooling degree days for the Evansville, Indiana and Paducah, Kentucky stations, will be equal to the averages computed for the 20 years ending 2008.
- The forecast includes no new demand-side management programs that will have a significant impact on system peak demand.

1.3 Industry Restructuring

At the time this forecast was completed, legislation had been introduced in Congress to deregulate and/or restructure the nation's electric utility industry. Currently 14 states, plus the District of Columbia, are offering some sort of retail choice and a restructured environment. Eight states have suspended their restructuring activities.

In Kentucky, a 1998 bill providing for retail choice in 2000 was introduced, but the legislature instead passed legislation establishing the Electricity Restructuring Task Force, which released a study concluding that the average rate level in Kentucky would be similar under either a regulated or retail choice environment, and that customers would see higher prices in periods of tight capacity. The task force's final report, issued December 1999, recommended no restructuring action in the legislature for 2000, and monitoring of states in which retail choice has been enacted. During the 2000 legislative session, the task force was reauthorized, and HB 897, which addresses cost allocation and affiliate transactions, was enacted. In April 2002 the governor signed SB 257, which creates a plant siting board that must approve all merchant power plants. In March 2004 the governor signed SB 118, which allows cooperative utilities, upon public service commission approval, to sell wholesale power to municipal utilities. In April the governor signed SB 246, which requires utilities to obtain PSC approval for transmission projects 138 KV or greater in capacity and a mile or more in length

1.4 Forecasting Process

The forecast was developed using methods recognized in the industry today as the standards, including end-use, econometrics, informed judgment, exponential smoothing, and historical trends. The residential

---

[1] Range of projected average revenue/kWh for the three member cooperatives

class accounts for the majority of rural system requirements; therefore, considerable time and effort were devoted to development of a statistically adjusted end-use models (SAE) to forecast energy consumption for the class. Econometric models were used to project the number of residential customers. Similarly, econometric models were developed to project small commercial energy sales and number of customers. Large commercial demand and energy projections were developed using information provided by cooperative management regarding local industrial operations. Energy sales projections for all other classifications were based on linear trends. Econometric models were developed to project rural system CP demand. Projections of rural system NCP demand were developed by applying an average coincident factor to projections of rural CP demand. Total system NCP demand was computed as the sum of rural system CP demand and direct-serve NCP demand.

The energy sales forecast is based on a bottom-up approach. Projections were developed at the customer class level and aggregated to the total system level. Projections of peak demand were developed at the rural system and total system levels. The forecast is based on an analysis of data and information for a historical period covering the 1980 through 2008 period, and the forecast period covers years 2008-2023. The base case forecast assumes normal weather conditions for each year, and the averages were computed using heating and cooling degree days for the twenty years ending 2008.

1.5 Changes from Prior Load Forecast

The 2009 load forecast is lower than the 2007 forecast. Projected growth for all customer classifications are down, due primarily to the economic downturn. Rural system energy requirements are projected to increase at 1.5% per year, lower than the 2.1% rate projected in the 2007 load forecast. Rural system peak demand is projected to increase at 1.4% per year, lower than the 2.2% rate projected in the 2007 forecast. Residential energy sales are projected to increase at a rate of 1.4%, lower than the 2.0% growth rate projected in the 2007 Load Forecast. Small commercial energy sales are projected to increase at a rate of 1.6%, which is lower than the rate of 2.4% projected in the 2007 forecast.

1.6 Load Forecast Variance

Big Rivers' updates its load forecast every two years. The previous forecast was competed in July 2007. Table 1.3 presents a comparison of actual and forecasted power requirements for years 2007 and 2008. All sales values are presented in weather normalized units.[2]

[2] Weather normalization refers to the practice of estimating what actual energy sales or peak demand would have been for a given period had normal, or average, weather conditions occurred during the period.

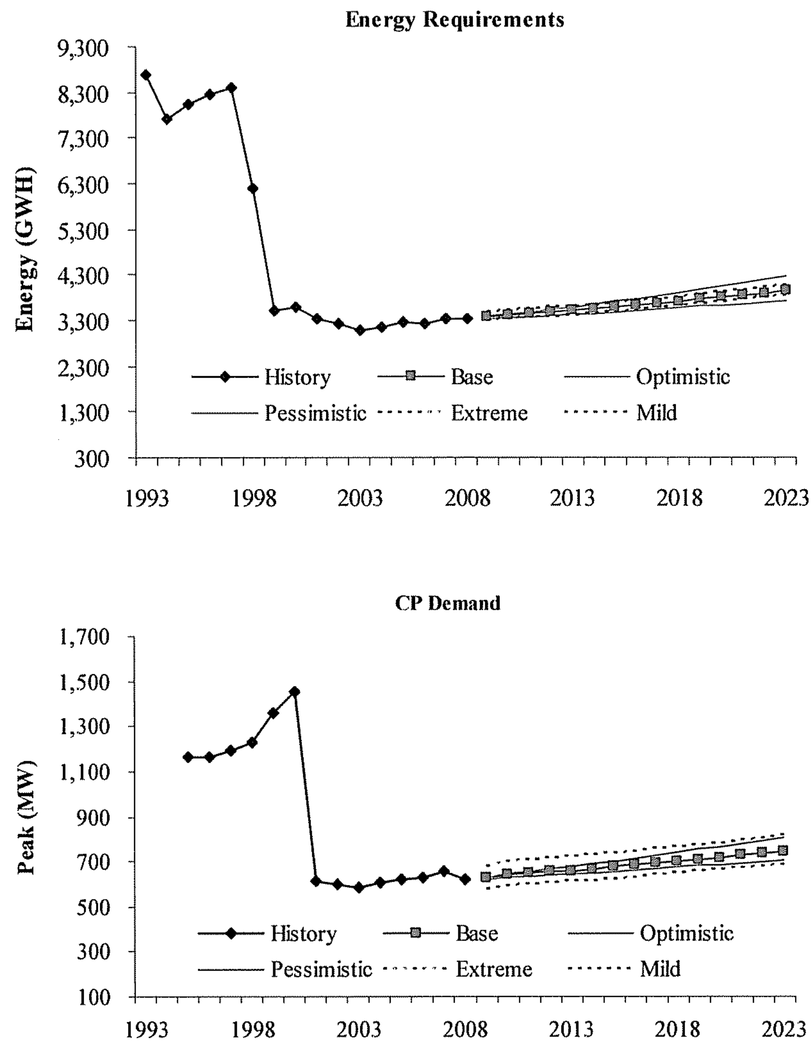
Table 1.3
Load Forecast Variance

Description	2007 Forecast	2007 Actual	2007 Normal	Error	2008 Forecast	2008 Actual	2008 Normal	Error
Residential								
Consumers	96,148	95,993		0.2%	97,444	96,886		0.6%
Average Use	1,273	1,332	1,275	-0.2%	1,284	1,316	1,298	-1.1%
Sales	1,468,965	1,534,506	1,468,932	0.0%	1,500,909	1,529,478	1,509,186	-0.5%
Small Commercial								
Consumers	14,452	14,478		-0.2%	14,727	14,692		0.2%
Sales	742,531	753,591	736,207	0.9%	770,097	749,573	746,941	3.1%
Large C/I Sales	965,362	926,769		4.2%	979,670	933,580		4.9%
Other Sales	3,158	3,175		-0.5%	3,213	3,287		-2.2%
Total Sales	3,294,909	3,327,805	3,246,143	1.5%	3,375,398	3,312,709	3,309,942	2.0%
Peak Demand MW	654,008	659,516	637,562	2.6%	665,405	616,264	623,659	6.7%
Rural Demand MW	527,173	536,611	525,907	0.2%	541,906	501,757	509,508	6.4%

1.7 Forecast Scenarios

The base case forecast was developed using the expected economic outlook and average weather conditions. Given the uncertainty with the forecast, four forecast scenarios were generated to evaluate varying economic and weather impacts from those contained in the base case forecast. Although these scenarios have lower probabilities of occurring than the base case forecast, they provide valuable information for system planning. Results from the four scenarios are presented graphically in Figure 1.1 and presented in detail in Section 7.

Figure 1.1
Total System Power Requirements



1.8 Comparison to Regional and National Forecasts

Table 1.4 compares Big Rivers' forecast to regional and national forecasts developed by the following entities.

Table 1.4
Forecast Comparison – Average Annual Growth Rates (2005-2015)

	Total Energy Consumption	Residential Energy	Commercial Energy
AEO2009	0.7%	0.3%	1.4%
GII	1.2%	1.4%	1.4%
AEO2009 - ESC	0.4%	0.3%	1.3%
IEE	2.2%	1.5%	2.5%
SERC	1.6%	N/A	N/A
Big Rivers	1.0%	1.3%	1.3%

Source: AEO2009: Annual Energy Outlook 2009 (U.S.)
GII: Global Insight, Inc. (AEO2009)
AEO2009: Annual Energy Outlook 2009 (East South Central Region)
IEE: Institute of Energy Economics (AEO2009)
SERC: TVA region (2007-2017)

Note: Cooperative values reflect rural system data for 2008-2015
Growth rate represents 2007-2015 unless specified otherwise

2. Introduction

The 2009 Load Forecast was conducted by representatives from Big Rivers, the member cooperatives of Big Rivers, and GDS Associates, Inc.

2.1 Purpose

The purpose of the long-term load forecast is to provide reliable load projections for the Cooperative's resource, distribution, and financial planning functions. This forecast of system requirements includes the following:

- Number of consumers by customer classification
- Energy sales by customer classification
- Distribution losses
- Total system energy requirements
- Total system seasonal peak demand
- Rural system energy sales
- Rural system seasonal peak demand

Five forecast scenarios were developed in the forecast: a base case, which focuses on expected economic conditions and normal weather, and two sets of high-range and low-range projections, both of which consider deviations from expected economic conditions and deviations from normal weather conditions.

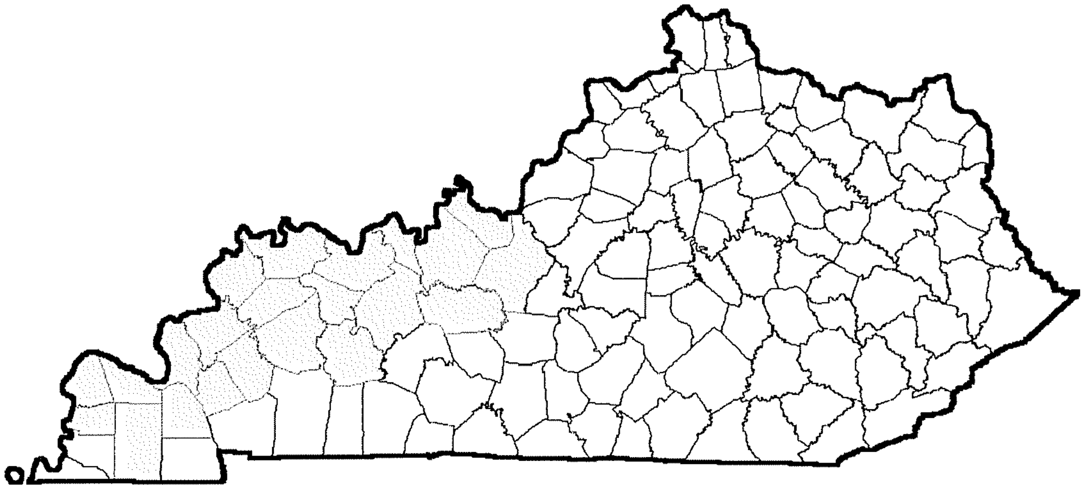
2.2 Cooperative Background

Big Rivers is headquartered in Henderson, Kentucky, and provides wholesale power to three member cooperatives: Kenergy Corp. ("Kenergy"), Jackson Purchase Energy Corporation ("JPEC"), and Meade County RECC ("MCRECC"), all of which provide retail electric service to consumers located in western Kentucky. Approximately 89% of the accounts the member cooperatives serve are residential. The data used in the modeling process was weighted based on the percentage of residential customers in each county that the cooperative services. This weighting system was used to better represent the growth in population, employment, and income of the cooperative's service area

2.3 Service Area

Big Rivers' member cooperatives provide electric service in 22 counties located in western Kentucky, which are presented in Figure 2.1.

Figure 2.1
Service Area Counties



2.3.1 Geography

The topography of Big Rivers' member cooperatives' service areas ranges from rolling, sandy embayment areas to flat plateau areas with low relief and subterranean drainage. Typical elevations range from approximately 340 to 1000 feet above sea level. The climate in the area is humid, temperate and continental.

2.3.2 Climate

Weather conditions are similar to those of Evansville, Indiana and Paducah, Kentucky. The climate in the area is humid, temperate and continental. Daily and seasonal changes in temperature, cloudiness, wind and precipitation may be sudden and extreme. The seasons are well defined, but changes between the seasons are gradual. Winters are harsh with sustained periods of very low temperatures. Snowfall provides minimal precipitation, averaging 10 inches per year. The frequent thunderstorms that occur in the spring bring rainfall, which is beneficial to area crops. Annual rainfall averages 46 to 50 inches. The summer season is long, humid and hot.

Heating and cooling degree days for Evansville, Indiana and Paducah, Kentucky were used in the forecasting models to quantify the impacts of weather on energy consumption. A degree day represents the difference between the average temperature for a given day and a base temperature. Positive differences represent cooling degree days, and negative differences represent heating degree days. For example, if the average temperature for a day is 80 degrees, and the base temperature used is 65 degrees[3], there would be 15 cooling degree days for that day. Cooling and heating degree days are presented in Table 2.1.

Table 2.1
Degree Days

	Evansville			Paducah		
Year	Heating Degree Days	Cooling Degree Days	Total Degree Days	Heating Degree Days	Cooling Degree Days	Total Degree Days
1989	4,830	1,396	6,226	4,443	1,492	5,935
1990	3,856	1,380	5,236	3,460	1,557	5,017
1991	4,253	1,757	6,010	3,713	1,965	5,678
1992	4,217	1,240	5,457	3,724	1,382	5,106
1993	4,652	1,613	6,265	4,531	1,686	6,217
1994	4,180	1,489	5,669	3,911	1,409	5,320
1995	4,314	1,773	6,087	4,129	1,615	5,744
1996	5,068	1,224	6,292	4,573	1,390	5,963
1997	4,901	1,119	6,020	4,445	1,271	5,716
1998	3,863	1,629	5,492	3,535	1,798	5,333
1999	4,149	1,284	5,433	3,650	1,531	5,181
2000	4,710	1,289	5,999	4,273	1,566	5,839
2001	4,233	1,377	5,610	3,921	1,540	5,461
2002	4,410	1,737	6,147	4,099	1,877	5,976
2003	4,529	1,143	5,672	4,150	1,289	5,439
2004	4,253	1,269	5,522	3,885	1,394	5,279
2005	4,320	1,544	5,864	3,904	1,685	5,589
2006	4,044	1,342	5,386	3,672	1,512	5,184
2007	4,159	1,888	6,047	3,823	1,958	5,781
2008	4,690	1,421	6,111	4,274	1,508	5,782
Average	4,382	1,446	5,827	4,006	1,571	5,577

2.4 Power Supply

Big Rivers provides wholesale power to three member cooperatives: Kenergy, JPEC, and MCRECC, all of which provide retail electric service to consumers located in western Kentucky. Two aluminum smelters, Alcan Primary Products Corporation ("Alcan") and Century Aluminum of Kentucky, LLC ("Century"), which are served under special contracts with Big Rivers and Kenergy. Big Rivers provides all of the power requirements of its three member cooperatives. Big Rivers' wholesale rate, approved by the Kentucky Public Service Commission (KPSC), is presented in its tariff, PSC KY No. 23, Big Rivers Electric Corporation of Henderson, Kentucky Rates, Rules and Regulations for Furnishing Electric Service. Effective July 19, 2007, Big Rivers implemented a Renewable Resource Tariff, under which Big Rivers makes available renewable

[3] The National Oceanic and Atmospheric Administration computes degree days using a base of 65 degrees.

resource energy available to its member cooperatives. In turn, the member cooperatives make renewable energy available to their retail customers.

During preparation of the 2009 Load Forecast, Big Rivers owned but did not operate any generation facilities. On July 15, 1998, Big Rivers entered into a 25-year lease arrangement with LG&E Energy Corp and four of LG&E's wholly owned subsidiaries: Western Kentucky Energy Corp. ("WKEC"), WKE Station Two, Inc. ("Station Two Subsidiary"), WKE Corp. ("LG&E Parties"), and LG&E Energy Marketing, Inc. ("LEM"). On July 17, 2009, this lease agreement was terminated.

Big Rivers owns and operates the 455 MW three unit coal-fired Coleman Plant, the 454 MW two unit coal-fired Green Plant, the Reid Plant, which consists of a 65 MW coal and natural gas-fired unit as well as a 65 MW natural gas or oil-fired combustion turbine, and the 420 MW coal-fired Wilson unit. Big Rivers also has contractual rights to a portion of 312 MW at Henderson Municipal Power and Light's ("HMP&L's") Station Two facility. Big Rivers has one purchase power agreement, that being with the Southeastern Power Administration ("SEPA").

2.5 Alternative Fuels

Electricity, natural gas, and propane are the primary heating fuels available in the service area. Some consumers use wood as a supplemental heating source as timber is readily available in western Kentucky. The use of wood stoves as a heating source is not expected to have significant impact on usage levels or peak demand as use of wood stoves has decreased in recent years. While alternative heating fuels are available in the member cooperative service territories, the market share of electric heating and electric water heating continues to increase.

2.6 Economic Conditions

Energy consumption is influenced significantly over the long-term by economic conditions. As the local economy expands, population and employment increase, which translate into new cooperative consumers and additional energy sales and peak demand. The economy of western Kentucky depends primarily upon mining, agriculture, manufacturing, services, and wholesale and retail trade. Coal mining and related operations are located throughout the state. Data used to represent economic activity for the service area was computed using county level information.

Economic growth in the cooperative service area during 1998-2008 was comparable to growth during the prior ten years. Population in the counties served by Big Rivers' members increased at an average compound rate of 0.2% per year from 1998 to 2008, reaching 243,000 in 2008. This rate of growth is lower than the 1988 to 1998 period and of the entire state over the same period. Employment in the cooperative service area increased at an average compound rate of 0.3% per year from 1998 to 2008, which is lower than the proceeding ten years and lower than that of the entire state over the same period. Real household income increased at a rate of 0.6% over the 1998 to 2008 period and retail sales increased at an average rate of 1.4% over the same period. Growth in gross regional product for the service area continues to lag growth at the state, region, and national levels. Refer to Table 2.2 for a summary of historical economic growth in the service area.

Table 2.2
Summary of Economic Data

Area	Period	Population (x1,000)	Households (x1,000)	Employment (x1,000)	GRP ($billions)	Household Income ($)	Retail Sales ($millions)
United States	1988	244,500	90,234	134,507	$7,502	$69,014	$2,252,416
	1998	275,854	103,369	159,628	$9,802	$81,019	$2,894,810
	2008	304,579	117,158	182,658	$12,949	$91,005	$3,649,916
Southeast	1988	58,121	21,722	30,732	$1,580	$60,069	$527,565
	1998	67,627	26,082	38,306	$2,147	$70,732	$711,010
	2008	76,810	30,503	44,966	$2,936	$79,753	$909,359
Kentucky	1988	3,680	1,365	1,827	$93	$53,740	$28,969
	1998	3,985	1,558	2,244	$123	$63,680	$38,975
	2008	4,269	1,731	2,485	$144	$70,381	$47,181
Big Rivers	1988	226	84	99	$4	$52,111	$1,632
	1998	239	94	121	$5	$59,939	$2,104
	2008	243	100	125	$6	$63,640	$2,415
Average Growth Per Year							
United States	1988-1998	1.2%	1.4%	1.7%	2.7%	1.6%	2.5%
	1998-2008	1.0%	1.3%	1.4%	2.8%	1.2%	2.3%
Southeast	1988-1998	1.5%	1.8%	2.2%	3.1%	1.6%	3.0%
	1998-2008	1.3%	1.6%	1.6%	3.2%	1.2%	2.5%
Kentucky	1988-1998	0.8%	1.3%	2.1%	2.8%	1.7%	3.0%
	1998-2008	0.7%	1.1%	1.0%	1.6%	1.0%	1.9%
Big Rivers	1988-1998	0.6%	1.1%	2.1%	2.3%	1.4%	2.6%
	1998-2008	0.2%	0.6%	0.3%	0.6%	0.6%	1.4%

3. Load Forecast Database

A load forecast database was created to house the data used in development of the load forecast. This section identifies the data collected and used in the study, sources from which the data were collected, and computations that were conducted. Four classes of data were collected for this study: (i) system data, (ii) price data, (iii) economic and demographic data, and (iv) meteorological data. The data elements collected under each category, as well as the source and time period, are presented in Table 3.1.

Table 3.1
Load Forecast Database

Class of Data	Source	Data Element	Units	Time Period
System	RUS Form 7	Number of Customers by RUS Classification	Meters	1970 – 2008
		Energy Sales by RUS Classification	kWh	1970 – 2008
		Revenue by RUS Classification	$	1970 – 2008
		Purchases	kWh	1970 – 2008
		Power Cost	$	1970 – 2008
		Peak Demand	NCP	1970 – 2008
Price Index	Bureau of Labor Statistics	Implicit Price Deflator, Gross National Product, 2004=100, Seasonally Adjusted	Index	1970.01 – 2008.12
Economic and Demographic	Woods & Poole Economic, Inc. Moody's Economy.com	Total Personal Income	Real $	1970 – 2028
		Retail Sales	Real $	1970 – 2028
		Gross Regional Product (GRP)	Real $	1970 – 2028
		Total Population	Number of People	1970 – 2028
		Households	Number of Households	1970 – 2028
		Total Employment	Number of Employees	1970 – 2028
End-Use Data	Energy Information Administration	Unit Energy Consumption	KWh	2005-2030
	U.S. Census	Electric Market Share	Percent	1990, 2000, 2005
Meteorological	National Oceanic and Atmospheric Administration	Heating and Cooling Degree Days	Base of 65°F	1970.01 – 2008.12
		Temperatures	Degrees F	1970.01 – 2008.12

3.1 Weighting Factors

Economic and demographic data were collected for each county in which Big Rivers' member cooperatives provide electric service. In most instances, a member cooperative provides electric service in only portions of each county served, and the remaining portions are served by other electric systems. Weighting factors were developed to estimate the cooperatives' market share of county population, employment, income, and retail sales.

The number of residential customers served by county and the total number of households located within each county were used to develop county weighting factors. These weighting factors represent the member cooperatives' market shares for each county served. County weights were computed using the formula presented in Equation 3.1.

$$CTYWGT_{it} = RCON_{it} \times HHOLD_{it} \qquad (3.1)$$

$CTYWGT_{it}$ = weight for $county_i$ in $year_t$
$RCON_{it}$ = number of residential consumers in $county_i$ in $year_t$
$HHOLD_{it}$ = number of households in $county_i$ in $year_t$

3.2 Historical Data Estimates

The historical values for population, total employment, and total personal income used in the modeling process were collected from Woods & Poole Economics, Inc. Per capita income was computed from personal income and population values. Population is based on census data for 1970, 1980, 1990, and 2000 with all interim years and years 2001-2008 based on estimates developed by the Department of Commerce, Bureau of Economic Analysis (BEA). Employment and total personal income amounts for 1970 through 2006 are final estimated values based upon quarterly surveys conducted by BEA. Data values for years 2007-2008 are projections based on Woods & Poole's forecasting models.

4. Forecast Assumptions

4.1 Forecast Methodology

Econometrics was the forecasting methodology employed in developing the energy sales forecasting models for the residential and small commercial classifications. When using econometric techniques to forecast energy sales, it is assumed that the relationships between energy consumption and those influential factors included in the models remain the same in both the historical and forecast periods.

4.2 Economic Outlook

It is assumed that growth in Big Rivers peak demand and energy requirements over time has been strongly influenced by economic conditions, including number of households, employment, total personal income, and retail sales. It is assumed that the influences of these factors will continue over the next fifteen years. The economic outlook used in developing the base case forecast were formulated using information obtained from Woods & Poole Economics, Inc. and Moody's Economy.com. The outlook presented in this forecast includes recessionary impacts in 2009 and 2010 and relatively steady growth thereafter. Projections for key economic data used in this forecast are presented in Table 4.1..

4.2.1 Population

Population captures the impacts of migration, birth rates, and mortality levels in the local area. Population growth in the member cooperative areas has been slightly lower than the state as a whole over the past ten years. Population in the counties served by member cooperatives is projected to increase at an average compound rate of 0.2% from 2008 through 2023 period, which is slightly higher than growth experienced over the previous 10 years. Projections for population are based on data obtained from Woods & Poole Economics.

4.2.2 Households

Number of households is an excellent measure of number of residential cooperative customers. The number of households in the service area has increased at approximately twice the rate of population, indicating that the average household size has declined over time. The number of households is projected to increase at an average rate of 0.5% per year from 2008 through 2023, which is comparable to growth over the past 10 years. The number of households forecast is based on data obtained from Woods & Poole Economics and Moody's Economy.com.

4.2.3 Employment

Employment is a measure of economic activity and, with respect to this forecast, captures growth in the number of commercial accounts over time. Employment is projected to increase at an average compound rate of 0.5% per year over the 15 year forecast horizon, which is higher than the growth over the most recent ten years. Employment projections are based on data obtained from Woods & Poole Economics and Moody's Economy.com.

4.2.4 Household Income

Household income, expressed in real dollars (adjusted for inflation using the personal consumption expenditures index), represents, at the household level, income received from all sources. Household income provides a measure of consumer spending potential, including electricity. Based on the information obtained from the sources identified in Section 3 of this report, household income is projected to increase at an average rate of 0.4% per year from 2008 to 2023. This rate of growth is lower than that of the previous 10 years and based on information collected from Woods & Poole Economics and Moody's Economy.com.

4.2.5 Gross Regional Output

Gross regional product (GRP) is expressed in real dollars and represents the monetary value of all the finished goods and services produced within the service area and includes private and public consumption, government outlays, investments and exports less imports. GRP is an indicator of commercial and industrial energy sales. GRP for the service area is estimated by allocating state GRP to counties on the proportion of total state earnings of employees originating in the respective counties. County GRP estimates are constrained to the state total for each year. GRP in the service area is projected to increase at an average rate of 1.1% per year from 2008 through 2023. Projected growth in GRP is higher than growth measured over the most recent 10 year period and based on data collected from Woods & Poole Economics and Moody's Economy.com.

4.2.6 Retail Sales

Retail sales represent all sales dollars (adjusted for inflation using the personal consumption expenditures index), for all business establishments, including mail order and on-line sales. Retail sales provide a measure of commercial activity in the service area. Retail sales are projected to increase at an average rate of 1.3% over the forecast period. This rate is lower than that of the most recent 10 years and based on data collected from Woods & Poole Economics and Moody's Economy.com.

4.3 Weather Conditions

It is assumed that the weather conditions measured at Evansville and Paducah are representative of western Kentucky. Heating and cooling degree days were used to represent weather conditions, and values for each year of the forecast period are based on the average amounts computed for the 20 year periods ending in 2008. For Evansville, normal cooling degree days are assumed constant at 1,446 per year, and heating degree days are assumed constant at 4,382 per year. For Paducah, normal cooling degree days are assumed constant at 1,571 per year, and heating degree days are assumed constant at 4,006 per year.

4.4 Retail Electricity Prices

The real price of electricity for each of Big Rivers' member cooperatives is expected to increase throughout the forecast horizon. Real prices to residential and small commercial customers are assumed to increase at an average rate between 0.5% and 0.9% per year from 2008 through 2023.

4.5 Alternative Fuel Prices

Natural gas and liquid propane are the two primary alternative heating fuels in the service area. Real prices for both are expected to decrease slightly over the long-term. This load forecast contains no direct impacts of changes in alternative fuel prices as it was assumed that the changes in alternative fuel prices would not be significant enough over the long term to impact electricity consumption.

4.6 Industry Restructuring

At the time this forecast was completed, no legislation had been passed regarding deregulation of the electric industry in Kentucky; as a result, the forecast includes no explicit impacts associated with industry restructuring. For more details on restructuring, refer to section 1.3 of this report.

Table 4.1
Key Economic Variables

Year	Total Population (x1000)	Households (x1000)	Employment (x1000)	Household Income ($Million)	Real Gross Regional Product ($Million)	Retail Sales ($Million)
1988	225.94	84.43	98.77	$52,111	$4,893	1,632.47
1989	226.21	85.56	101.82	$53,153	$4,943	1,658.52
1990	226.90	86.22	103.87	$53,193	$4,901	1,658.70
1991	227.00	86.78	103.37	$53,219	$4,895	1,605.58
1992	228.62	88.03	105.02	$54,812	$5,087	1,650.09
1993	230.85	88.84	107.91	$54,220	$5,211	1,734.52
1994	232.41	89.31	110.74	$55,803	$5,504	1,852.08
1995	234.60	90.78	114.99	$55,587	$5,609	1,916.86
1996	236.09	92.26	116.68	$56,845	$5,726	2,002.32
1997	237.85	93.22	119.56	$58,132	$6,067	2,061.73
1998	238.88	93.90	121.20	$59,939	$6,056	2,103.66
1999	239.79	94.79	122.80	$60,337	$6,077	2,212.54
2000	241.07	95.56	123.65	$63,293	$5,737	2,266.00
2001	240.72	95.70	119.88	$62,859	$5,588	2,239.28
2002	241.24	96.11	119.67	$61,752	$5,742	2,224.11
2003	241.60	96.62	119.73	$61,921	$5,801	2,252.82
2004	242.26	97.35	120.76	$62,994	$5,893	2,315.33
2005	243.04	98.13	122.00	$64,607	$5,968	2,368.88
2006	242.96	98.55	123.58	$65,055	$6,087	2,406.17
2007	243.04	99.06	124.79	$64,476	$6,137	2,421.31
2008	243.16	99.53	125.21	$63,640	$6,125	2,415.08
2009	243.47	100.09	123.73	$62,539	$5,954	2,447.15
2010	243.78	100.64	123.71	$61,991	$5,945	2,478.64
2011	244.28	101.25	124.92	$62,000	$6,067	2,510.07
2012	245.28	102.05	126.93	$62,843	$6,257	2,541.87
2013	246.05	102.73	128.54	$63,896	$6,374	2,574.19
2014	246.73	103.35	129.55	$64,453	$6,456	2,607.10
2015	247.36	103.93	130.32	$64,757	$6,537	2,640.77
2016	247.94	104.45	131.04	$65,092	$6,621	2,675.02
2017	248.59	104.98	131.79	$65,451	$6,711	2,710.08
2018	249.30	105.51	132.49	$65,812	$6,795	2,745.96
2019	250.00	106.01	133.16	$66,161	$6,874	2,782.56
2020	250.70	106.49	133.83	$66,512	$6,953	2,819.90
2021	251.15	106.88	134.49	$66,899	$7,033	2,858.01
2022	251.50	107.21	135.18	$67,380	$7,117	2,897.05
2023	251.78	107.48	135.88	$67,863	$7,200	2,936.77
Average Annual Compound Growth Rates						
1988 - 1998	0.6%	1.1%	2.1%	1.4%	2.2%	2.6%
1998 - 2008	0.2%	0.6%	0.3%	0.6%	0.1%	1.4%
2008 - 2013	0.2%	0.6%	0.5%	0.1%	0.8%	1.3%
2013 - 2018	0.3%	0.5%	0.6%	0.6%	1.3%	1.3%
2018 - 2023	0.2%	0.4%	0.5%	0.6%	1.2%	1.4%
2008 - 2023	0.2%	0.5%	0.5%	0.4%	1.1%	1.3%

5. Short-Term Energy Sales and Peak Demand Forecast

The short-term forecast contains energy and demand projections by month for years 2009 through 2012. The short-term forecast includes projections of energy sales by class, rural system energy sales, rural system coincident and non-coincident peak demand, total system energy sales, and total system non-coincident peak demand. A summary of projected growth rates is presented in Table 5.1. Projected energy sales and peak demand requirements are presented by month in Appendix A, Tables – Short-Term Forecast.

Table 5.1
Short-Term Forecast

Description	2009	2010
Residential Sales	1.5%	1.4%
Small Commercial Sales	-0.7%	1.1%
Large Commercial Sales	1.8%	0.0%
Street Lights Sales	2.0%	1.6%
Irrigation Sales	-58.5%	0.0%
Rural System Sales	1.1%	1.3%
Rural System CP	1.1%	1.2%
Rural System NCP	0.7%	1.2%
Total Energy Requirements	1.0%	1.0%
Total NCP	1.7%	0.7%

5.1 Short-Term Energy Sales Forecast

Statistically adjusted end-use and econometric models were developed to project monthly energy sales for the residential and small commercial classifications. Energy sales projections for the large commercial classification were developed individually for consumer by cooperative management based on historic trends, operating characteristics, and any information made available to the cooperative by individual consumers. Public street lighting energy sales projections were developed using historic trends. Projections of rural system energy sales were computed as total system sales less sales to direct-serve consumers, all of which are large commercial consumers.

5.2 Short-Term Peak Demand Forecast

Projections of rural system CP demand were developed for the summer and winter seasons using econometric models. An average load shape was applied to the seasonal projections to develop the monthly demands. An average coincidence factor, based on historical data, was applied to rural system CP demand to compute projections of rural system NCP demand. Projections of direct serve peak demand were developed by cooperative management and based on historic trends and information made available by individual direct-serve consumers. Total system NCP is equal to the sum of rural system CP and direct-serve NCP amounts.

6. Long-Term Energy Sales and Peak Demand Forecast

The load and energy projections presented in this section show that energy sales and peak demand requirements are expected to increase at average compound rates of 1.1% and 1.3%, respectively, from 2008 to 2023. Rural system energy sales and peak demand are projected to increase at average compound rates of 1.4% and 1.4%, respectively. The primary impact on growth in rural system sales will be the result of increases in the number of consumers, which are expected to increase at a rate of 1.3% per year. Tables presenting the long-term energy sales and peak demand forecast are included in Appendix B, Tables - Long-Term Forecast.

Table 6.1
Load Forecast – Average Annual Growth Rates

Description	2008-2013	2008-2023
Total System Energy Requirements	1.0%	1.1%
Total System Peak Demand (NCP)	1.1%	1.2%
Rural System Energy Requirements	1.3%	1.5%
Rural System Peak Demand (CP)	1.2%	1.4%
Residential Energy Sales	1.3%	1.4%
Residential Consumers	1.0%	1.1%
Small Commercial Energy Sales	1.1%	1.6%
Small Commercial Consumers	1.4%	1.5%
Large Commercial Energy Sales	0.4%	0.1%
Large Commercial Consumers	-1.0%	-0.3%
Public Street Lighting Sales	1.7%	1.5%
Irrigation Sales	-16.1%	-5.7%

6.1 Forecast Methodology

The forecast was developed using methods recognized in the industry today as the standards, including econometrics, end-use, informed judgment, and historical trends. Details for each methodology used in developing the forecast are presented in section 8 of this report.

Econometric models were used to project number of customers for the residential and small commercial classifications and energy sales for the small commercial classification. Statistically adjusted end-use models were used to project residential energy use per customer. Informed judgment was used to forecast energy sales for large commercial customers. Energy sales for the street lighting classification were projected using a historical trend.

Econometric models were developed to project rural system coincident peak demand. Demand was projected on a summer and winter seasonal basis for each year of the forecast period. The summer season includes months May to October, and the winter season includes months January, February, March, November and December in the same calendar year.

The energy sales forecast is based on a bottom-up approach. Projections were developed at the customer class level and aggregated to the total system level. Peak demand forecasts were developed at the total system and rural system levels.

6.2 Forecast Results

6.2.1 Residential

The residential class accounts for 87% of all accounts and 64% of rural system energy. Weather normalized class sales over the past ten years increased at an average rate of 2.3% per year. Sales are projected to increase at a rate of 1.4% per year, or just over 21,900 MWH per year from 2008 through 2023. Customer growth is projected to average 1,164 consumers per year over the forecast period, similar to historical long-term growth; however, growth in 2009 and 2010 is expected to be considerably lower than the average due to recessionary conditions.

Growth in average consumption per customer is expected to be low in future years due primarily to the vintaging of heating and cooling systems, rising electricity prices, energy conservation, and a slowing of increases in electric heating market share. Average monthly energy consumption per customer is projected *to increase at 0.3% per year from 2008 to 2023. The rate of growth is less than that over the most recent* ten years. Impacts contributing to continued long term growth in average use per consumer include:

- Increases in electric heating, electric air conditioning, and electric water heating market share;
- Increases in average home size, which result in higher heating and cooling load as well as increases in "plug-in" loads;
- Increases in "plug-in" loads, regardless of home size
- Growth in average household income, which increases disposable income available to purchase electric goods

Impacts influencing lower growth in household energy consumption include:

- Increased efficiencies in new electric appliances
- Regulatory energy standards
- Energy conservation

Projections of total residential sales were computed as the product of projected energy consumption per consumer and projected number of consumers.

The energy use per customer model quantifies the impacts of the following factors:

- Household income
- Price of electricity
- Weather conditions (heating and cooling degree days)
- Electric market share (heating, cooling, water heating)
- Appliance efficiencies
- Home size
- Thermal efficiency of home

The member cooperative consumer models quantify relationships between consumer growth and number of households. Statistical outputs for the average energy consumption and customer models are presented in the appendix.

6.2.2 Commercial & Industrial

The Commercial and Industrial (C/I) classification contains all commercial and industrial customers that are not direct serve customers of Big Rivers. The class represented about 31% of rural system energy sales in 2008 and consists of a wide variety of customers, from small establishments with demands less than 10 kW to larger industrial operations with demands exceeding 1,000 kW. Growth in class sales from 2008 through 2023 is projected to be 1.6% per year. The number of customers is projected to increase at a rate of 1.5% per year over the same period.

Econometric models were developed for each member cooperative to forecast sales for the group of customers whose peak demand falls below 1,000 kW. The econometric models specify relationships between monthly energy sales, a ratio of real retail sales to employment, heating degree days, and cooling degree days. The models developed to project small commercial consumers specify relationships between number of consumers and employment. The statistical output for the models is presented in the appendix.

Energy sales for those customers whose demand exceeds 1,000 kW were projected on an individual basis based on historical trends and input received from cooperative management about anticipated changes in operations. This forecast includes no new customers with demands exceeding 1,000 kW.

6.2.3 Direct Serve

The Direct Serve classification contains all non-rural commercial and industrial customers that are served directly by Big Rivers. These customers are usually large industrial operations, and there are currently 19 customers in this class, which represented 28% of total system energy sales in 2008. Projections of energy sales and peak demand were developed by cooperative management on an individual basis for each account. Energy sales for existing accounts are projected to exhibit little growth over the forecast horizon.

6.2.4 All Other Classifications

The public street lighting and irrigation classifications represent less than 1% of rural system sales. Energy sales have increased over the past ten years, and are projected to continue their increase at a rate of 1.0% per year from 2008 to 2023. This equates to an average of approximately 54 MWH per year.

6.3 Distribution and Transmission Losses

Distribution losses were projected for each member cooperative and added to member system energy sales to compute member system energy purchases. The sum of member system purchases, excluding smelter requirements, is equal to Big Rivers' native sales. Transmission losses are projected to be 0.78% per year throughout the forecast period. Total native system requirements are equal to Big Rivers' energy sales plus transmission losses.

6.4 Peak Demand

This forecast contains projections of rural system coincident peak (CP) demand, rural system non-coincident demand (NCP), and total system non-coincident peak demand. Coincident demand is the maximum aggregated simultaneous load of all rural substations on the Big Rivers' system. Rural system NCP demand is the sum of the highest rural system substation demands in a given month without respect to date or time. Peak demand projections were developed on a summer and winter seasonal basis. Big Rivers is projected to continue a recent trend of being a winter peaking system, as growth in electric heating and electric water heating market shares are expected to outpace increases in air conditioning market share.

Rural system CP demand is projected to increase at an average rate of 1.4% over the forecast period, reaching just above 633 MW by 2023. Coincident demand is expected to occur during the winter season. Rural NCP is projected to increase at an average rate of 1.3% over the forecast period and reach 638 MW by 2023.

Regression models were developed at the Big Rivers level to project rural system CP for the summer and winter seasons. The models quantify the relationship between peak demand, energy requirements, and extreme temperature. Projected load factor was computed using the energy and demand forecasts and compared to historical trends as a final test of reasonableness for the demand forecast. A coincidence factor, based on historical data, was applied to rural system CP to compute rural system NCP.

7. Range Forecasts

The base case projections reflect expected economic growth for the area as well as average weather conditions. To address the inherent uncertainty related to these factors, long-term high and low range projections were developed. The range forecasts reflect the energy and demand requirements corresponding to more optimistic or pessimistic economic growth and to mild or extreme weather conditions. Such forecast scenarios are useful for various planning functions. Four scenarios were generated: (i) base case economics and mild weather, (ii) base case economics and extreme weather, (iii) optimistic economics and normal weather, and (iv) pessimistic economics and normal weather. The range forecasts are presented in table and graphical form in Appendix C, Range Forecasts.

7.1 Weather Scenarios

7.1.1 Extreme Weather

The extreme weather forecast for energy is based on the aggregated results of the scenarios prepared for each member cooperative, which were developed by inputting extreme degree days into the residential energy sales per consumer models and the small commercial energy sales models. Energy sales for the large commercial, public street and highway lighting, and irrigation classes were assumed to be non-weather sensitive. Based on severe weather conditions, total system energy requirements are projected to reach 4,051 GWH by 2023, which would result in average growth of 1.3% per year over the forecast period. Rural system energy requirements would reach 3,072 GWH in 2023, resulting in an average growth rate of 1.7% per year.

To develop the extreme weather native system coincident peak demand scenario, an extreme load factor based on actual points from 1989 through 2008, was applied to the base case energy requirements forecast. This forecast indicates that native system coincident peak demand would reach 813 MW by 2023, resulting in an average growth rate of 1.8% over the forecast period. Rural system coincident peak demand is projected to reach 698 MW by 2023 under extreme weather conditions, resulting in an average growth rate of 2.0% per year from 2008 through 2023.

7.1.2 Mild Weather

The mild weather scenario for energy sales is based on the aggregated results of the scenarios prepared for each member cooperative, which were developed by inputting mild degree days into the residential energy sales per consumer models and the small commercial energy sales models. Based on mild weather conditions, total system energy requirements are projected to reach 3,842 GWH by 2023, which would result in average growth of 0.9% per year over the forecast period. Rural system requirements would grow at a rate of 1.2% per year, reaching 2,860 GWH in 2023.

To develop the mild weather native system coincident peak demand scenario, an extreme load factor based on data from 1981 through 2008, was applied to the base case energy requirements forecast. This forecast indicates that native system coincident peak demand will reach 689 MW by 2023, resulting in an average growth rate of 0.7% over the forecast period. Rural system coincident peak demand is projected to reach 578 MW by 2023 under mild weather conditions, resulting in an average growth rate of 0.8% per year from 2008 through 2023.

7.2 Economy Scenarios

High and low scenarios for energy requirements and peak demand were developed based on optimistic and pessimistic macroeconomic assumptions. Economic uncertainty was addressed for the economic factors specified in the econometric models, including population, employment, gross regional product, and income.

7.2.1 Optimistic Outlook

The optimistic economy energy forecast scenario is represented as the aggregate member cooperative energy forecast for the same scenario. The scenario was developed by applying the coefficients for population, employment, and total personal income from the econometric models to the optimistic forecasts of each economic factor. The assumptions made for each member cooperative regarding those factors are presented in each member cooperative's load forecast.

Based on the assumptions made in the optimistic economic outlook scenario, system energy requirements are projected to reach 4,279 GWH by 2023, resulting in an average annual growth rate 1.7% per year. Rural system energy requirements under this scenario would grow at an average rate of 2.1% per year, reaching 3,300 GWH in 2023.

To develop the corresponding native system coincident peak demand forecast, the base case system load factor was applied to the rural energy requirements forecast based on the optimistic economic outlook. This forecast indicates that native system coincident peak demand will reach 811 MW by 2023, resulting in an average annual growth rate of 1.8% per year. Rural system coincident peak demand will grow at an average rate of 2.1% per year over the forecast period, reaching 706 MW by 2023.

7.2.2 Pessimistic Outlook

The pessimistic economy energy forecast scenario is represented as the aggregate member cooperative energy forecast for the same scenario. The scenario was developed by applying the coefficients for population, employment, and total personal income from the econometric models to the pessimistic forecasts of each economic factor. The assumptions made for each member cooperative regarding those factors are presented in each member cooperative's load forecast.

Based on the assumptions made in the pessimistic economic outlook scenario, system energy requirements will reach 3,743 GWH by 2023, resulting in an average annual growth rate 0.8% per year. Rural system energy requirements under this scenario would increase by 0.9% per year from 2008 through 2023 and would reach 2,761 GWH in 2023.

To develop the corresponding native system coincident peak demand forecast, the base case system load factor was applied to the energy requirements forecast based on the pessimistic economic outlook. This forecast indicates native system coincident peak demand would reach 709 MW by 2023, resulting in an average annual growth rate of 0.9% per year. Rural system coincident peak demand would grow at an average rate of 0.9% per year over the forecast period, reaching 591 MW by 2023.

8. Forecast Methodology

A bottom-up approach was developed to project energy sales. Number of consumers and energy sales were projected at the customer class level and aggregated to produce the member cooperative and G&T system sales forecasts. Statistically adjusted end-use models were used to forecast residential energy use per customer. Econometrics was employed to forecast small commercial energy sales. Energy sales and peak demand for large commercial customers were developed by cooperative staff using historical trends and information made available by the individual customers. Energy sales and number of consumers for all other classifications were based on historical trends. Total system energy requirements were projected by applying average distribution and transmission line loss factors to projections of total system energy sales. The rural system peak demand forecast was developed using econometric models. The total system peak demand forecast is based on the sum of rural system peak demand and peak projections for the direct serve commercial and industrial customers.

8.1 Forecasting Process

Econometric models have the advantage of explicitly tracking the underlying causes of trends and patterns in historical data. They provide information that allows Cooperative management to estimate the impacts of certain factors on energy consumption. The methodology has proven very useful for simulation and "what-if" study. In addition, econometric models can be used to identify sources of forecasting error. On the other hand, econometric models require considerable amounts of data, and when used for forecasting, force the assumption that relationships developed during historical period will remain the same throughout the forecast horizon. Econometric models have been developed to project residential and small commercial requirements as these two consumer classifications account for the overwhelming majority of total system energy sales.

End-use modeling is an engineering approach to forecasting and disaggregates energy consumption into key end-use segments. End-use models require copious amounts of system-specific data including economic activity, housing characteristics, weather, market share of major electric end-uses, price of electricity, appliance size, and efficiency. Engineering equations equate these drivers to consumption by end-use. End-use models are valuable in that they allow the forecaster to identify specific trends in key drivers of electricity consumption. Their drawback is that they require detailed data that is difficult and often expensive to derive at the system level.

Statistically adjusted engineering (SAE) models combine the two traditional approaches to project long-term residential energy consumption: end-use engineering models and econometric regression models. SAE models incorporate the strengths of both approaches into predictions for consumption.

Expert opinion is used when other techniques are ineffective. This approach is utilized to project industrial requirements. Projections are made individually for each account and are based upon information collected from the account's management. The advantages of this method include simplicity and expert input. The major disadvantage is that forecasts based on expert opinion can be biased by one person's opinion.

8.2 Econometrics

Econometrics is a forecasting technique in which the relationship between a variable of interest and one or more influential factors is quantified. Econometrics is based on an area of statistical theory known as regression analysis. Regression analysis is a statistical technique for modeling and testing the relationship between two or more variables. The general form of an econometric model can be expressed as:

$$y_t = ß_0 + ß_1(x_{t1}) + ß_2(x_{t2}) + ß_3(x_{t3}) + \ldots ß_k(x_{tn}) + e_t$$

where:

t	= time element
y_t	= the dependent variable
$x_1, x_2, \ldots x_n$	= the set of independent variables
$ß_0, ß_1, \ldots ß_k$	= the set of parameter coefficients
e_t	= modeling error

8.2.1 Model Specification

In the context of this report, model specification refers to the process of defining: (i) the explanatory variables to incorporate in the model and (ii) the form of the model. Explanatory variables, also referred to as independent or exogenous variables, represent factors which are hypothesized to influence a change in the dependent, or endogenous variables. Definition of the explanatory variables should be based upon sound economic principles and assumptions. For example, it is reasonable to assume that local economic conditions produce significant impacts on energy consumption. Variables such as a gross state product and per capita income are often used as explanatory variables to represent, or indicate, the level of economic activity.

In the utility industry, an econometric model is usually developed using some combination of economic, demographic, price, and meteorological variables. It is desirable to also include specific information in the econometric model concerning the end-users, or consumers, of electricity; this information may be in the form of appliance saturation levels or indicators of consumer attitudes toward conservation. Inclusion of these types of explanatory variables in a model enables the forecaster to identify the major factors influencing periodic changes in a variable such as peak demand or energy sales. Inclusion of these variables also makes possible a better estimation of the impact these factors have on changes in consumption.

Models sometime include as an independent variable the lag of the dependent variable. Such models are commonly referred to as adaptive expectation or Koyck distributed lag models. L.M. Koyck demonstrated in 1954 that this specification is equivalent to an infinite geometric lag model. Under such a specification, the assumption is made that the impacts of the explanatory variables included in the model are significant over a period of years, with the current year weighted the heaviest, the previous year weighted less, and so on until the earliest year has no impact.

Econometric models can be specified in linear or log-linear form. When the model is specified in linear form, the assumption is made that elasticities are not constant, and that a unit change in a given explanatory variable will influence a change in the dependent variable equal to the unit change in the explanatory variable times the corresponding coefficient.

When the model variables are expressed in natural log form, it is assumed that elasticities are constant and that a percentage change in a given explanatory variable influences a constant percentage change in the dependent variable based upon the coefficient of the given explanatory variable. A second assumption made when specifying a log-linear model is that changes in the dependent variable are greater at lower levels of the explanatory variables than at higher levels. With respect to energy consumption, this assumption applies primarily to increases in income. Consumption increases rapidly when income increases from lower levels as consumers purchase electric goods and services; however, once income reaches a certain level, most high use electric end-uses have been purchased. As a result, additional increases in income tend to have less impact on consumption than the same level of increase from a lower level of income.

8.2.2 Model Estimation

Once a hypothesized relationship or model is specified, historical data are used to estimate the model parameters, β_0, β_1, β_2,... β_k and quantify the empirical relationship that exists between the variable of interest and the chosen set of explanatory variables. Investigation of the relationship between the dependent variable, y, and an independent variable, x, leads to one of three conclusions: (i) a change in variable x impacts no change in variable y, and a change in variable y impacts no change in variable x, (ii) a change in variable x impacts a change in variable y, while a change in variable y impacts no change in variable x, and (iii) a change in variable x impacts a change in variable y, and a change in variable y impacts a change in variable x. Under conclusion (i), no relationship exits and the explanatory variable should be omitted from further analysis. Under conclusion (ii) variable x is said to be exogenous; its value is determined outside of the marketplace. Under conclusion (iii), both variables x and y are said to be endogenous; both are determined within the marketplace.

The appropriate regression technique to employ in estimating the model depends upon the relationship between the dependent and independent variables. When all explanatory variables are exogenous, ordinary least squares is appropriate. When one or more of the explanatory variables are endogenous, two-stage least squares is appropriate.

8.2.3 Ordinary Least Squares (OLS)

Regression analysis is a statistical procedure that quantifies the relationship between two or more variables. Based upon available input data, a regression equation provides a means of estimating values of a dependent variable. The difference between the actual value of the dependent variables and its regression based estimated value is the error term, generally referred to as the residual. Ordinary least squares is the technique employed which minimizes the sum of the squared errors. A tentative least square model, for example, for residential usage, might be expressed as:

$$RUSE_t = ß_0 + ß_1(PCAP_t) - ß_2(RRPE_t) + ß_3(CDD_t) + ß_4(HDD_t) + e_t$$

$RUSE_t$	=	residential energy use in year t
$PCAP_t$	=	per capita income in year t
$RRPE_t$	=	price of electricity in year t
CDD_t	=	number of cooling degree days in year t
HDD_t	=	number of heating degree days in year t
e_t	=	represents the unexplained error in year t

8.2.4 Model Validation

In this study, the model validation process involved evaluation of the models for theoretical consistency, statistical validity, and estimating accuracy. From a theoretical standpoint, the model should be consistent with economic theory and specify a relationship that addresses those factors known to influence energy usage. For models that address customer growth, it is appropriate to include a demographic variable such as population, number of households, or employment to explain growth in the number of consumers. For models that address changes in energy sales, more types of variables are needed. An economic variable such as income explains customers' ability to purchase electric goods and services. Weather variables explain changes in consumption due to weather conditions. Price of electricity and price of electricity substitutes measure consumer conservation. Appliance saturation levels measure change in consumption due to changes in end-use equipment. Lagged dependent variables account for the lagged effect of all explanatory variables from previous periods.

The coefficients for each parameter included in the models were tested to insure the proper sign (+ or -). The number of customers increases with population or some other demographic variable; therefore, the sign of demographic variables in the customer model should be positive. There is a direct relationship between energy consumption and income; as income increases, consumption will increase as well. The sign on the income variable in the energy consumption model should be positive. The sign on the price of natural gas, or some other electricity substitute should be positive. Energy consumption increases as weather conditions, as measured by degree days, become more extreme; the sign of both the heating and cooling degree day variables should be positive. There is an indirect relationship between energy consumption and price of electricity. As price increases, consumers tend to conserve energy, and consumption decreases.

The statistical validity of each model is based on two criteria. One, each model was examined to determine the statistical significance of each explanatory variable. Two, tests were performed to identify problems resulting from autocorrelation and/or multicollinearity. An analysis of the models' residuals were performed to determine whether mathematical transformations of the independent variables were required.

Each model was evaluated with respect to its estimating accuracy. The standard error of regression, a statistic generated during the regression analysis, was used to measure accuracy. Tentative models that initially had low degrees of accuracy were tested using alternative specifications.

8.2.5 Model Building Process

The development of forecasts using econometric modeling is a multi-step process. A substantial portion of the effort involved in effective model building is the collection of reliable data for both the historical and projected periods. It is critical, in building models which explain changes in load growth, that the appropriate influential factors be considered, and that the correct explanatory variables be collected to quantify those influential factors.

There are many factors that influence consumers to change their usage levels of electricity. A partial list would include changes in the economy, new industry in an area, key industry leaving an area, population shifts, temperature, unemployment levels, attitudes toward conservation, precipitation amounts, improved appliance efficiencies, political events, inflation, and increases in the price of electricity. The relationship between these factors and energy usage is further complicated since most of these factors are interrelated; for example, when inflation is rampant, increases in the price of electricity may not significantly lower usage by the consumer.

After all necessary data are collected, the model building process begins. During this process, numerous models containing various combinations of candidate explanatory variables are estimated and tested. Each tentative model is examined to see if the explanatory variables included in that particular model specification contribute significantly to the "explanation" of the variable of interest. For those models that pass this preliminary examination, the appropriate regression diagnostic tools are used to test the validity of the underlying statistical assumptions. Included in this examination are tests for autocorrelation and multicollinearity.

The tentative models are tested, not only for statistical reliability, but also for reasonableness of practical interpretation. For example, the model should not show that the effect of extremely cold winter weather has been a reduction in usage. The potential performance of a tentative model for forecasting purposes is also investigated. A model that contained only one explanatory variable (one which measured only weather effects, for example) might not be a good predictive model.

If a tentative model is found to have significant statistical problems, or if the model is simply found to be misspecified, the model is discarded, and a new tentative model is specified. Analysis of the residuals (actual minus estimated values) from the discarded model are helpful in the reformulation of the model and might indicate whether some mathematical transformation of the existing set of explanatory variables is required. This process of specification, estimating, and reformulation continues until a model is found which is statistically sound and which has a sound practical interpretation as well.

8.2.6 Final Model Selection

If a model is found to be a good representation of the proposed relationship, and if it is also determined to be statistically sound, it can be used to estimate values of the variable of interest in future time periods. It is important to note that the forecaster makes the assumption that the modeled relationship between the response and explanatory variables remains the same in the forecast period as it was measured in the historical period. Forecasts are calculated by inserting projected values of the explanatory variables into the estimated model equation. Different forecast scenarios can also be considered by incorporating different values of forecasted explanatory variables. Managerial judgment, based on practical estimations of future trends, can then be used to select the most appropriate and reasonable forecast.

8.3 Statistically Adjusted End-Use Modeling

The SAE modeling structure combines the benefits of both end-use and econometric models. Three indices are developed that represent end-use factors and are run through a regression model to allow the end-use indices to be statistically weighted or adjusted to historical residential usage patterns. An index is developed for space heating, air conditioning, and base load appliances. The data requirements for a true end-use model are relaxed in the SAE framework, as regional or even national data on several inputs can be utilized because the regression procedure will weight these variables to fit system consumption. The response to key drivers of electricity can also be adjusted in the development of each index, eliminating the primary weakness of a traditional econometric model. Further, because a regression is developed, all the statistical diagnostic tools associated with regression are available for analyzing the SAE specification. The SAE regression model takes on the following form:

$$RUSE = \beta_0 + \beta_1 \times SHIndx + \beta_2 \times ACIndx + \beta_3 \times BaseIndx + e$$

where:

RUSE = Residential Average Use per Consumer per Month
SHIndx = Space Heating Index
ACIndx = Air Conditioning Index
BaseIndx = Base Appliance Index
$\beta 1$, $\beta 2$, $\beta 3$ = Weights for Each Index
e = Error Term

The indices are developed as described below. The coefficients, or weights, are determined using two-stage least squares regression procedures.

8.3.1 Space Heating Index

The space heating index combines several appliance, household, weather, and economic factors that directly impact the level of space heating electricity consumption in a home:

- Market share of electric space heating devices
- Average device efficiency
- Effective size of the envelope through which heat is lost in the home (including exterior walls, ceiling/roof, and the floor)
- Thermal heat loss characteristics of the home
- Real retail price of electricity
- Household income
- Heating degree days

These variables increase or decrease the index depending on how they impact space heating electricity consumption. Market share, size of home, income, and degree days all increase consumption as they increase. Device efficiency, home efficiency, and price of electricity decrease consumption as they increase. When it is available, system-level data is used for each of the heating factors. If system-specific data is not available, regional or national trends that are easier to obtain can be utilized. The index is developed on a monthly basis.

8.3.2 Air Conditioning Index

The air conditioning index is built in the exact manner as the space heating index, but focuses instead on air conditioning equipment. The key variables used to develop the air conditioning index include:

- Market share of electric air conditioning devices, including room units
- Average device efficiency
- Effective size of the envelope through which heat is gained in the home (including exterior walls, ceiling/roof, and the floor)
- Thermal heat gain characteristics of the home
- Real retail price of electricity
- Household income
- Cooling degree days

8.3.3 Base Load Index

The base load index captures the general trend associated with increased penetration of plug appliances, lighting, and water heating in the home. The base load index takes into account use associated with several appliances:

- Water heaters
- Refrigerators
- Separate freezers
- Electric ranges and ovens
- Electric clothes washers and driers
- Dishwashers
- Television sets
- Lighting

The index is modified to include impacts associated with price of electricity, household income, and number of people in the household. As the real price of electricity goes up, the base load index goes down. An increase in household income has a positive effect on the base load index as more money is available for plug load electronics. The number of people in the household also has a positive effect on usage. More people in the home leads to more loads of laundry, more showers, more loads of dishes, and more lighting usage. The impact of weather on use of these appliances is negligible, so weather is not included as a factor in the base load index.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Appendix A
Tables – Short-Term Forecast

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

TOTAL NATIVE SYSTEM REQUIREMENTS

Year	Month	Actual Sales (MWh)	Normal Sales (MWh)	Percent Growth	Actual Requirements (MWh)	Normal Requirements (MWh)	Percent Growth	Actual CP (MW)	Normal CP (MW)	Percent Growth	Actual Load Factor	Normal Load Factor
2008	Jan	319,613	319,346		328,880	321,773		619	622		70.8%	70.4%
2008	Feb	287,350	287,110	-10.1%	293,019	289,360	-10.1%	555	561	-9.8%	71.0%	70.2%
2008	Mar	268,716	268,492	-6.5%	272,584	270,937	-6.4%	535	540	-3.7%	68.8%	68.2%
2008	Apr	231,819	231,625	-13.7%	229,843	234,054	-13.6%	443	448	-17.0%	71.7%	70.9%
2008	May	244,476	244,272	5.5%	235,264	246,621	5.4%	477	485	8.4%	70.3%	68.9%
2008	Jun	279,818	279,585	14.5%	287,388	281,749	14.2%	562	573	18.0%	68.2%	66.8%
2008	Jul	301,732	301,480	7.8%	309,715	303,689	7.8%	616	624	8.9%	67.1%	66.2%
2008	Aug	312,437	312,176	3.5%	300,016	314,512	3.6%	595	611	-2.0%	72.0%	69.9%
2008	Sep	262,533	262,314	-16.0%	257,096	264,301	-16.0%	566	594	-2.9%	63.5%	60.5%
2008	Oct	236,043	235,846	-10.1%	242,631	238,016	-9.9%	443	466	-21.5%	72.9%	69.3%
2008	Nov	254,014	253,802	7.6%	264,279	256,109	7.6%	519	517	10.9%	67.1%	67.3%
2008	Dec	314,157	313,895	23.7%	319,606	316,410	23.5%	612	626	21.2%	70.3%	68.7%
2009	Jan		322,655	2.8%		325,191	2.8%		632	1.0%		69.9%
2009	Feb		290,085	-10.1%		292,366	-10.1%		570	-9.8%		69.7%
2009	Mar		271,274	-6.5%		273,406	-6.5%		549	-3.7%		67.7%
2009	Apr		234,025	-13.7%		235,865	-13.7%		455	-17.0%		70.4%
2009	May		246,803	5.5%		248,743	5.5%		490	7.6%		69.0%
2009	Jun		282,482	14.5%		284,702	14.5%		578	18.0%		66.9%
2009	Jul		304,604	7.8%		306,998	7.8%		629	8.9%		66.3%
2009	Aug		315,410	3.5%		317,890	3.5%		617	-2.0%		70.0%
2009	Sep		265,032	-16.0%		267,115	-16.0%		599	-2.9%		60.6%
2009	Oct		238,289	-10.1%		240,163	-10.1%		471	-21.5%		69.4%
2009	Nov		256,431	7.6%		258,447	7.6%		526	11.7%		66.8%
2009	Dec		317,148	23.7%		319,641	23.7%		637	21.2%		68.2%
2010	Jan		325,733	2.7%		328,293	2.7%		637	0.0%		70.1%
2010	Feb		292,852	-10.1%		295,155	-10.1%		574	-9.8%		69.9%
2010	Mar		273,862	-6.5%		276,015	-6.5%		553	-3.7%		67.9%
2010	Apr		236,258	-13.7%		238,115	-13.7%		459	-17.0%		70.6%
2010	May		249,158	5.5%		251,116	5.5%		493	7.5%		69.2%
2010	Jun		285,176	14.5%		287,418	14.5%		582	18.0%		67.1%
2010	Jul		307,510	7.8%		309,927	7.8%		634	8.9%		66.5%
2010	Aug		318,419	3.5%		320,923	3.5%		621	-2.0%		70.2%
2010	Sep		267,560	-16.0%		269,664	-16.0%		603	-2.9%		60.8%
2010	Oct		240,563	-10.1%		242,454	-10.1%		474	-21.5%		69.6%
2010	Nov		258,878	7.6%		260,913	7.6%		529	11.8%		67.0%
2010	Dec		320,173	23.7%		322,690	23.7%		641	21.2%		68.4%
2011	Jan		329,035	2.8%		331,622	2.8%		643	0.3%		70.1%
2011	Feb		295,822	-10.1%		298,147	-10.1%		580	-9.8%		69.9%
2011	Mar		276,638	-6.5%		278,813	-6.5%		558	-3.7%		67.9%
2011	Apr		238,653	-13.7%		240,529	-13.7%		463	-17.0%		70.6%
2011	May		251,684	5.5%		253,662	5.5%		498	7.5%		69.2%
2011	Jun		288,068	14.5%		290,332	14.5%		588	18.0%		67.1%
2011	Jul		310,627	7.8%		313,069	7.8%		640	8.9%		66.5%
2011	Aug		321,648	3.5%		324,176	3.5%		628	-2.0%		70.2%
2011	Sep		270,273	-16.0%		272,398	-16.0%		609	-2.9%		60.8%
2011	Oct		243,002	-10.1%		244,912	-10.1%		478	-21.5%		69.6%
2011	Nov		261,502	7.6%		263,558	7.6%		535	11.8%		67.0%
2011	Dec		323,419	23.7%		325,962	23.7%		648	21.2%		68.4%
2012	Jan		332,334	2.8%		334,947	2.8%		650	0.3%		70.0%
2012	Feb		298,788	-10.1%		301,137	-10.1%		586	-9.8%		69.8%
2012	Mar		279,412	-6.5%		281,609	-6.5%		564	-3.7%		67.8%
2012	Apr		241,046	-13.7%		242,941	-13.7%		468	-17.0%		70.5%
2012	May		254,207	5.5%		256,206	5.5%		503	7.5%		69.2%
2012	Jun		290,956	14.5%		293,244	14.5%		594	18.0%		67.1%
2012	Jul		313,742	7.8%		316,209	7.8%		647	8.9%		66.5%
2012	Aug		324,873	3.5%		327,427	3.5%		634	-2.0%		70.2%
2012	Sep		272,983	-16.0%		275,129	-16.0%		615	-2.9%		60.8%
2012	Oct		245,438	-10.1%		247,368	-10.1%		483	-21.5%		69.6%
2012	Nov		264,125	7.6%		266,201	7.6%		540	11.8%		66.9%
2012	Dec		326,662	23.7%		329,230	23.7%		655	21.2%		68.3%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

RURAL SYSTEM REQUIREMENTS

Year	Month	Actual Energy (MWh)	Normal Energy (MWh)	Percent Growth	CP (MW)	Percent Growth	Load Factor
2008	Jan	236,287	240,514		510		64.6%
2008	Feb	210,522	213,367	-11.3%	451	-11.6%	64.9%
2008	Mar	195,841	194,262	-9.0%	429	-4.8%	62.0%
2008	Apr	165,133	154,068	-20.7%	329	-23.3%	64.1%
2008	May	169,028	161,560	4.9%	368	11.9%	60.1%
2008	Jun	206,477	198,999	23.2%	461	25.2%	59.2%
2008	Jul	222,518	227,561	14.4%	516	12.0%	60.4%
2008	Aug	215,550	225,356	-1.0%	500	-3.0%	61.7%
2008	Sep	184,714	175,283	-22.2%	478	-4.5%	50.3%
2008	Oct	174,321	155,795	-11.1%	347	-27.4%	61.5%
2008	Nov	189,874	182,388	17.1%	400	15.3%	62.4%
2008	Dec	229,624	238,089	30.5%	516	29.0%	63.2%
2009	Jan		243,204	2.1%	516	-0.1%	64.6%
2009	Feb		215,754	-11.3%	455	-11.6%	64.9%
2009	Mar		196,436	-9.0%	434	-4.8%	62.0%
2009	Apr		155,791	-20.7%	333	-23.3%	64.2%
2009	May		163,367	4.9%	372	11.9%	60.1%
2009	Jun		201,225	23.2%	466	25.2%	59.2%
2009	Jul		230,107	14.4%	522	12.0%	60.4%
2009	Aug		227,877	-1.0%	506	-3.0%	61.7%
2009	Sep		177,244	-22.2%	483	-4.5%	50.3%
2009	Oct		157,538	-11.1%	351	-27.4%	61.5%
2009	Nov		184,428	17.1%	405	15.3%	62.5%
2009	Dec		240,752	30.5%	522	29.0%	63.2%
2010	Jan		246,446	2.4%	522	0.0%	64.7%
2010	Feb		218,629	-11.3%	461	-11.6%	65.0%
2010	Mar		199,054	-9.0%	439	-4.8%	62.1%
2010	Apr		157,868	-20.7%	337	-23.3%	64.2%
2010	May		165,545	4.9%	377	11.9%	60.2%
2010	Jun		203,907	23.2%	472	25.2%	59.2%
2010	Jul		233,174	14.4%	528	12.0%	60.5%
2010	Aug		230,914	-1.0%	512	-3.0%	61.8%
2010	Sep		179,606	-22.2%	489	-4.5%	50.3%
2010	Oct		159,637	-11.1%	355	-27.4%	61.6%
2010	Nov		186,886	17.1%	409	15.3%	62.5%
2010	Dec		243,961	30.5%	528	29.0%	63.3%
2011	Jan		249,923	2.4%	528	0.1%	64.8%
2011	Feb		221,714	-11.3%	467	-11.6%	65.1%
2011	Mar		201,863	-9.0%	445	-4.8%	62.2%
2011	Apr		160,095	-20.7%	341	-23.3%	64.3%
2011	May		167,881	4.9%	381	11.9%	60.3%
2011	Jun		206,785	23.2%	478	25.2%	59.3%
2011	Jul		236,464	14.4%	535	12.0%	60.6%
2011	Aug		234,173	-1.0%	519	-3.0%	61.9%
2011	Sep		182,141	-22.2%	495	-4.5%	50.4%
2011	Oct		161,890	-11.1%	360	-27.4%	61.7%
2011	Nov		189,523	17.1%	415	15.3%	62.6%
2011	Dec		247,403	30.5%	535	29.0%	63.4%
2012	Jan		253,398	2.4%	535	0.1%	64.9%
2012	Feb		224,797	-11.3%	473	-11.6%	65.1%
2012	Mar		204,669	-9.0%	450	-4.8%	62.3%
2012	Apr		162,321	-20.7%	345	-23.3%	64.4%
2012	May		170,215	4.9%	386	11.9%	60.4%
2012	Jun		209,659	23.2%	484	25.2%	59.4%
2012	Jul		239,752	14.4%	542	12.0%	60.6%
2012	Aug		237,428	-1.0%	525	-3.0%	61.9%
2012	Sep		184,673	-22.2%	501	-4.5%	50.5%
2012	Oct		164,140	-11.1%	364	-27.4%	61.7%
2012	Nov		192,158	17.1%	420	15.3%	62.7%
2012	Dec		250,843	30.5%	542	29.0%	63.4%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

RESIDENTIAL CLASSIFICATION

Year	Month	Consumers	Percent Growth	Actual Sales (MWh)	Normal Sales (MWh)	Percent Growth	Actual Average Use (kWh/Cust/Mo)	Normal Average Use (kWh/Cust/Mo)	Percent Growth
2008	Jan	96,628		166,593	164,917		1,724	1,707	
2008	Feb	96,674	0.0%	154,275	145,445	-11.8%	1,596	1,504	-11.8%
2008	Mar	96,748	0.1%	130,274	126,774	-12.8%	1,347	1,310	-12.9%
2008	Apr	96,770	0.0%	100,455	99,490	-21.5%	1,038	1,028	-21.5%
2008	May	96,716	-0.1%	90,775	96,689	-2.8%	939	1,000	-2.8%
2008	Jun	96,821	0.1%	125,503	122,242	26.4%	1,296	1,263	26.3%
2008	Jul	96,885	0.1%	140,793	138,378	13.2%	1,453	1,428	13.1%
2008	Aug	96,994	0.1%	140,004	146,850	6.1%	1,443	1,514	6.0%
2008	Sep	97,016	0.0%	112,726	113,898	-22.4%	1,162	1,174	-22.5%
2008	Oct	97,101	0.1%	91,402	88,511	-22.3%	941	912	-22.4%
2008	Nov	97,116	0.0%	115,930	109,406	23.6%	1,194	1,127	23.6%
2008	Dec	97,157	0.0%	160,748	156,587	43.1%	1,655	1,612	43.1%
2009	Jan	97,199	0.0%		159,580	1.9%		1,642	1.9%
2009	Feb	97,259	0.1%		149,410	-6.4%		1,536	-6.4%
2009	Mar	97,318	0.1%		131,333	-12.1%		1,350	-12.2%
2009	Apr	97,377	0.1%		107,804	-17.9%		1,107	-18.0%
2009	May	97,435	0.1%		97,145	-9.9%		997	-9.9%
2009	Jun	97,493	0.1%		117,662	21.1%		1,207	21.0%
2009	Jul	97,550	0.1%		145,182	23.4%		1,488	23.3%
2009	Aug	97,606	0.1%		148,273	2.1%		1,519	2.1%
2009	Sep	97,663	0.1%		119,963	-19.1%		1,228	-19.1%
2009	Oct	97,718	0.1%		98,805	-17.6%		1,011	-17.7%
2009	Nov	97,773	0.1%		112,115	13.5%		1,147	13.4%
2009	Dec	97,828	0.1%		144,736	29.1%		1,479	29.0%
2010	Jan	97,915	0.1%		160,887	11.2%		1,643	11.1%
2010	Feb	98,003	0.1%		151,310	-6.0%		1,544	-6.0%
2010	Mar	98,091	0.1%		133,146	-12.0%		1,357	-12.1%
2010	Apr	98,178	0.1%		109,475	-17.8%		1,115	-17.9%
2010	May	98,266	0.1%		98,741	-9.8%		1,005	-9.9%
2010	Jun	98,355	0.1%		119,405	20.9%		1,214	20.8%
2010	Jul	98,443	0.1%		147,148	23.2%		1,495	23.1%
2010	Aug	98,531	0.1%		150,311	2.1%		1,526	2.1%
2010	Sep	98,620	0.1%		121,842	-18.9%		1,235	-19.0%
2010	Oct	98,709	0.1%		100,581	-17.4%		1,019	-17.5%
2010	Nov	98,797	0.1%		114,087	13.4%		1,155	13.3%
2010	Dec	98,886	0.1%		147,096	28.9%		1,488	28.8%
2011	Jan	98,986	0.1%		162,904	10.7%		1,646	10.6%
2011	Feb	99,086	0.1%		153,377	-5.8%		1,548	-5.9%
2011	Mar	99,186	0.1%		134,970	-12.0%		1,361	-12.1%
2011	Apr	99,287	0.1%		110,939	-17.8%		1,117	-17.9%
2011	May	99,388	0.1%		99,918	-9.9%		1,005	-10.0%
2011	Jun	99,488	0.1%		120,565	20.7%		1,212	20.5%
2011	Jul	99,589	0.1%		148,436	23.1%		1,490	23.0%
2011	Aug	99,690	0.1%		151,656	2.2%		1,521	2.1%
2011	Sep	99,792	0.1%		123,087	-18.8%		1,233	-18.9%
2011	Oct	99,893	0.1%		101,868	-17.2%		1,020	-17.3%
2011	Nov	99,995	0.1%		115,754	13.6%		1,158	13.5%
2011	Dec	100,097	0.1%		149,316	29.0%		1,492	28.9%
2012	Jan	100,204	0.1%		165,584	10.9%		1,652	10.8%
2012	Feb	100,311	0.1%		154,480	-6.7%		1,540	-6.8%
2012	Mar	100,418	0.1%		136,353	-11.7%		1,358	-11.8%
2012	Apr	100,526	0.1%		112,793	-17.3%		1,122	-17.4%
2012	May	100,633	0.1%		101,435	-10.1%		1,008	-10.2%
2012	Jun	100,741	0.1%		122,108	20.4%		1,212	20.3%
2012	Jul	100,849	0.1%		150,166	23.0%		1,489	22.8%
2012	Aug	100,957	0.1%		153,325	2.1%		1,519	2.0%
2012	Sep	101,065	0.1%		124,486	-18.8%		1,232	-18.9%
2012	Oct	101,173	0.1%		103,183	-17.1%		1,020	-17.2%
2012	Nov	101,281	0.1%		117,420	13.8%		1,159	13.7%
2012	Dec	101,390	0.1%		151,539	29.1%		1,495	28.9%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

SMALL COMMERCIAL & INDUSTRIAL CLASSIFICATION

Year	Month	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
2008	Jan	14,617		67,194		3,695	
2008	Feb	14,646	0.2%	59,906	-10.8%	3,288	-11.0%
2008	Mar	14,634	-0.1%	53,924	-10.0%	2,962	-9.9%
2008	Apr	14,686	0.4%	48,008	-11.0%	2,628	-11.3%
2008	May	14,686	0.0%	53,349	11.1%	2,920	11.1%
2008	Jun	14,708	0.1%	70,739	32.6%	3,866	32.4%
2008	Jul	14,676	-0.2%	72,088	1.9%	3,948	2.1%
2008	Aug	14,719	0.3%	70,615	-2.0%	3,856	-2.3%
2008	Sep	14,699	-0.1%	62,069	-12.1%	3,394	-12.0%
2008	Oct	14,726	0.2%	57,657	-7.1%	3,147	-7.3%
2008	Nov	14,745	0.1%	63,472	10.1%	3,460	9.9%
2008	Dec	14,788	0.3%	70,552	11.2%	3,835	10.8%
2009	Jan	14,805	0.1%	63,610	-7.9%	3,526	-8.1%
2009	Feb	14,817	0.1%	60,859	-4.3%	3,371	-4.4%
2009	Mar	14,829	0.1%	58,042	-4.6%	3,212	-4.7%
2009	Apr	14,840	0.1%	54,249	-6.5%	3,000	-6.6%
2009	May	14,851	0.1%	56,071	3.4%	3,099	3.3%
2009	Jun	14,862	0.1%	66,237	18.1%	3,658	18.0%
2009	Jul	14,873	0.1%	73,764	11.4%	4,070	11.3%
2009	Aug	14,883	0.1%	72,213	-2.1%	3,982	-2.2%
2009	Sep	14,894	0.1%	60,860	-15.7%	3,354	-15.8%
2009	Oct	14,904	0.1%	54,915	-9.8%	3,024	-9.8%
2009	Nov	14,914	0.1%	57,775	5.2%	3,179	5.1%
2009	Dec	14,924	0.1%	63,430	9.8%	3,488	9.7%
2010	Jan	14,934	0.1%	64,325	1.5%	3,539	1.5%
2010	Feb	14,945	0.1%	61,552	-4.3%	3,384	-4.4%
2010	Mar	14,956	0.1%	58,711	-4.6%	3,226	-4.7%
2010	Apr	14,966	0.1%	54,888	-6.5%	3,014	-6.6%
2010	May	14,976	0.1%	56,725	3.3%	3,112	3.3%
2010	Jun	14,986	0.1%	66,965	18.1%	3,672	18.0%
2010	Jul	14,996	0.1%	74,542	11.3%	4,084	11.2%
2010	Aug	15,006	0.1%	72,974	-2.1%	3,996	-2.2%
2010	Sep	15,015	0.1%	61,534	-15.7%	3,367	-15.7%
2010	Oct	15,024	0.1%	55,543	-9.7%	3,038	-9.8%
2010	Nov	15,034	0.1%	58,419	5.2%	3,193	5.1%
2010	Dec	15,043	0.1%	64,107	9.7%	3,502	9.7%
2011	Jan	15,121	0.5%	65,377	2.3%	3,562	1.7%
2011	Feb	15,140	0.1%	62,676	-4.1%	3,411	-4.3%
2011	Mar	15,158	0.1%	59,816	-4.6%	3,251	-4.7%
2011	Apr	15,177	0.1%	56,021	-6.3%	3,041	-6.5%
2011	May	15,196	0.1%	57,833	3.2%	3,136	3.1%
2011	Jun	15,215	0.1%	68,201	17.9%	3,693	17.8%
2011	Jul	15,233	0.1%	75,944	11.4%	4,107	11.2%
2011	Aug	15,252	0.1%	74,280	-2.2%	4,013	-2.3%
2011	Sep	15,270	0.1%	62,716	-15.6%	3,384	-15.7%
2011	Oct	15,289	0.1%	56,513	-9.9%	3,045	-10.0%
2011	Nov	15,307	0.1%	59,449	5.2%	3,200	5.1%
2011	Dec	15,326	0.1%	65,205	9.7%	3,505	9.6%
2012	Jan	15,404	0.5%	66,544	2.3%	3,567	1.8%
2012	Feb	15,423	0.1%	63,800	-4.1%	3,416	-4.2%
2012	Mar	15,442	0.1%	60,871	-4.6%	3,255	-4.7%
2012	Apr	15,461	0.1%	57,009	-6.3%	3,045	-6.5%
2012	May	15,480	0.1%	58,818	3.2%	3,138	3.0%
2012	Jun	15,498	0.1%	69,337	17.9%	3,694	17.7%
2012	Jul	15,517	0.1%	77,200	11.3%	4,108	11.2%
2012	Aug	15,536	0.1%	75,458	-2.3%	4,011	-2.4%
2012	Sep	15,555	0.1%	63,683	-15.6%	3,381	-15.7%
2012	Oct	15,574	0.1%	57,319	-10.0%	3,039	-10.1%
2012	Nov	15,593	0.1%	60,283	5.2%	3,192	5.0%
2012	Dec	15,611	0.1%	66,102	9.7%	3,496	9.5%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

DIRECT SERVE CUSTOMERS

Year	Month	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
2008	Jan	20		76,164		3,808,215	
2008	Feb	20	0.0%	72,691	-4.6%	3,634,532	-4.6%
2008	Mar	20	0.0%	77,542	6.7%	3,877,100	6.7%
2008	Apr	20	0.0%	74,612	-3.8%	3,730,616	-3.8%
2008	May	20	0.0%	81,446	9.2%	4,072,278	9.2%
2008	Jun	20	0.0%	78,104	-4.1%	3,905,225	-4.1%
2008	Jul	20	0.0%	79,700	2.0%	3,984,998	2.0%
2008	Aug	20	0.0%	82,221	3.2%	4,111,027	3.2%
2008	Sep	20	0.0%	79,022	-3.9%	3,951,121	-3.9%
2008	Oct	20	0.0%	81,525	3.2%	4,076,226	3.2%
2008	Nov	20	0.0%	74,711	-8.4%	3,735,558	-8.4%
2008	Dec	20	0.0%	75,842	1.5%	3,792,123	1.5%
2009	Jan	19	-5.0%	75,525	-0.4%	3,975,014	4.8%
2009	Feb	19	0.0%	94,299	24.9%	4,963,095	24.9%
2009	Mar	19	0.0%	76,713	-18.6%	4,037,544	-18.6%
2009	Apr	19	0.0%	74,896	-2.4%	3,941,878	-2.4%
2009	May	19	0.0%	81,242	8.5%	4,275,873	8.5%
2009	Jun	19	0.0%	78,524	-3.3%	4,132,838	-3.3%
2009	Jul	19	0.0%	79,085	0.7%	4,162,390	0.7%
2009	Aug	19	0.0%	82,395	4.2%	4,336,583	4.2%
2009	Sep	19	0.0%	76,749	-6.9%	4,039,447	-6.9%
2009	Oct	19	0.0%	80,219	4.5%	4,222,035	4.5%
2009	Nov	19	0.0%	75,337	-6.1%	3,965,112	-6.1%
2009	Dec	19	0.0%	75,530	0.3%	3,975,287	0.3%
2010	Jan	19	0.0%	75,525	0.0%	3,975,014	0.0%
2010	Feb	19	0.0%	94,299	24.9%	4,963,095	24.9%
2010	Mar	19	0.0%	76,713	-18.6%	4,037,544	-18.6%
2010	Apr	19	0.0%	74,896	-2.4%	3,941,878	-2.4%
2010	May	19	0.0%	81,242	8.5%	4,275,873	8.5%
2010	Jun	19	0.0%	78,524	-3.3%	4,132,838	-3.3%
2010	Jul	19	0.0%	79,085	0.7%	4,162,390	0.7%
2010	Aug	19	0.0%	82,395	4.2%	4,336,583	4.2%
2010	Sep	19	0.0%	76,749	-6.9%	4,039,447	-6.9%
2010	Oct	19	0.0%	80,219	4.5%	4,222,035	4.5%
2010	Nov	19	0.0%	75,337	-6.1%	3,965,112	-6.1%
2010	Dec	19	0.0%	75,530	0.3%	3,975,287	0.3%
2011	Jan	19	0.0%	75,525	0.0%	3,975,014	0.0%
2011	Feb	19	0.0%	94,299	24.9%	4,963,095	24.9%
2011	Mar	19	0.0%	76,713	-18.6%	4,037,544	-18.6%
2011	Apr	19	0.0%	74,896	-2.4%	3,941,878	-2.4%
2011	May	19	0.0%	81,242	8.5%	4,275,873	8.5%
2011	Jun	19	0.0%	78,524	-3.3%	4,132,838	-3.3%
2011	Jul	19	0.0%	79,085	0.7%	4,162,390	0.7%
2011	Aug	19	0.0%	82,395	4.2%	4,336,583	4.2%
2011	Sep	19	0.0%	76,749	-6.9%	4,039,447	-6.9%
2011	Oct	19	0.0%	80,219	4.5%	4,222,035	4.5%
2011	Nov	19	0.0%	75,337	-6.1%	3,965,112	-6.1%
2011	Dec	19	0.0%	75,530	0.3%	3,975,287	0.3%
2012	Jan	19	0.0%	75,525	0.0%	3,975,014	0.0%
2012	Feb	19	0.0%	94,299	24.9%	4,963,095	24.9%
2012	Mar	19	0.0%	76,713	-18.6%	4,037,544	-18.6%
2012	Apr	19	0.0%	74,896	-2.4%	3,941,878	-2.4%
2012	May	19	0.0%	81,242	8.5%	4,275,873	8.5%
2012	Jun	19	0.0%	78,524	-3.3%	4,132,838	-3.3%
2012	Jul	19	0.0%	79,085	0.7%	4,162,390	0.7%
2012	Aug	19	0.0%	82,395	4.2%	4,336,583	4.2%
2012	Sep	19	0.0%	76,749	-6.9%	4,039,447	-6.9%
2012	Oct	19	0.0%	80,219	4.5%	4,222,035	4.5%
2012	Nov	19	0.0%	75,337	-6.1%	3,965,112	-6.1%
2012	Dec	19	0.0%	75,530	0.3%	3,975,287	0.3%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

STREET LIGHTING CLASSIFICATION

Year	Month	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
2008	Jan	89		294		3,309	
2008	Feb	89	0.0%	259	-12.1%	2,908	-12.1%
2008	Mar	89	0.0%	245	-5.4%	2,752	-5.4%
2008	Apr	89	0.0%	238	-2.8%	2,675	-2.8%
2008	May	89	0.0%	255	7.2%	2,869	7.2%
2008	Jun	89	0.0%	321	25.7%	3,607	25.7%
2008	Jul	87	-2.2%	293	-8.8%	3,365	-6.7%
2008	Aug	87	0.0%	275	-6.2%	3,155	-6.2%
2008	Sep	87	0.0%	245	-10.8%	2,815	-10.8%
2008	Oct	86	-1.1%	238	-2.7%	2,770	-1.6%
2008	Nov	87	1.2%	304	27.5%	3,492	26.0%
2008	Dec	83	-4.6%	321	5.5%	3,862	10.6%
2009	Jan	83	0.0%	300	-6.5%	3,613	-6.5%
2009	Feb	83	0.0%	264	-11.9%	3,183	-11.9%
2009	Mar	83	0.0%	250	-5.3%	3,016	-5.3%
2009	Apr	83	0.0%	243	-2.7%	2,934	-2.7%
2009	May	83	0.0%	261	7.1%	3,141	7.1%
2009	Jun	83	0.0%	326	25.2%	3,933	25.2%
2009	Jul	83	0.0%	298	-8.7%	3,592	-8.7%
2009	Aug	83	0.0%	280	-6.1%	3,373	-6.1%
2009	Sep	83	0.0%	250	-10.6%	3,016	-10.6%
2009	Oct	83	0.0%	244	-2.6%	2,936	-2.6%
2009	Nov	83	0.0%	309	26.9%	3,726	26.9%
2009	Dec	83	0.0%	326	5.4%	3,928	5.4%
2010	Jan	83	0.0%	304	-6.6%	3,667	-6.6%
2010	Feb	83	0.0%	269	-11.7%	3,238	-11.7%
2010	Mar	83	0.0%	255	-5.2%	3,070	-5.2%
2010	Apr	83	0.0%	248	-2.7%	2,988	-2.7%
2010	May	83	0.0%	265	6.9%	3,195	6.9%
2010	Jun	83	0.0%	331	24.8%	3,987	24.8%
2010	Jul	83	0.0%	303	-8.5%	3,647	-8.5%
2010	Aug	83	0.0%	284	-6.0%	3,427	-6.0%
2010	Sep	83	0.0%	255	-10.4%	3,070	-10.4%
2010	Oct	83	0.0%	248	-2.6%	2,991	-2.6%
2010	Nov	83	0.0%	314	26.4%	3,780	26.4%
2010	Dec	83	0.0%	331	5.3%	3,982	5.3%
2011	Jan	83	0.0%	309	-6.6%	3,721	-6.6%
2011	Feb	83	0.0%	273	-11.5%	3,292	-11.5%
2011	Mar	83	0.0%	259	-5.1%	3,124	-5.1%
2011	Apr	83	0.0%	252	-2.6%	3,042	-2.6%
2011	May	83	0.0%	270	6.8%	3,249	6.8%
2011	Jun	83	0.0%	335	24.4%	4,041	24.4%
2011	Jul	83	0.0%	307	-8.4%	3,701	-8.4%
2011	Aug	83	0.0%	289	-5.9%	3,481	-5.9%
2011	Sep	83	0.0%	259	-10.3%	3,125	-10.3%
2011	Oct	83	0.0%	253	-2.6%	3,045	-2.6%
2011	Nov	83	0.0%	318	25.9%	3,834	25.9%
2011	Dec	83	0.0%	335	5.3%	4,036	5.3%
2012	Jan	83	0.0%	313	-6.5%	3,776	-6.5%
2012	Feb	83	0.0%	278	-11.4%	3,346	-11.4%
2012	Mar	83	0.0%	264	-5.0%	3,178	-5.0%
2012	Apr	83	0.0%	257	-2.6%	3,096	-2.6%
2012	May	83	0.0%	274	6.7%	3,304	6.7%
2012	Jun	83	0.0%	340	24.0%	4,095	24.0%
2012	Jul	83	0.0%	312	-8.3%	3,755	-8.3%
2012	Aug	83	0.0%	293	-5.8%	3,536	-5.8%
2012	Sep	83	0.0%	264	-10.1%	3,179	-10.1%
2012	Oct	83	0.0%	257	-2.5%	3,099	-2.5%
2012	Nov	83	0.0%	323	25.5%	3,889	25.5%
2012	Dec	83	0.0%	340	5.2%	4,091	5.2%

BIG RIVERS ELECTRIC CORPORATION

2009 SHORT-TERM LOAD FORECAST - BASE CASE

IRRIGATION CLASSIFICATION

Year	Month	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
2008	Jan	6		0		0	
2008	Feb	6	0.0%	0	0.0%	0	0.0%
2008	Mar	6	0.0%	0	0.0%	0	0.0%
2008	Apr	6	0.0%	0	0.0%	0	0.0%
2008	May	6	0.0%	0	0.0%	0	0.0%
2008	Jun	6	0.0%	0	0.0%	0	0.0%
2008	Jul	6	0.0%	247	0.0%	41,231	0.0%
2008	Aug	7	16.7%	71	-71.3%	10,155	-75.4%
2008	Sep	7	0.0%	52	-27.1%	7,398	-27.1%
2008	Oct	7	0.0%	8	-84.0%	1,186	-84.0%
2008	Nov	7	0.0%	30	262.8%	4,302	262.8%
2008	Dec	3	-57.1%	23	-23.0%	7,727	79.6%
2009	Jan	3	0.0%	0	-100.0%	0	-100.0%
2009	Feb	3	0.0%	0	0.0%	0	0.0%
2009	Mar	3	0.0%	0	0.0%	0	0.0%
2009	Apr	3	0.0%	0	0.0%	0	0.0%
2009	May	3	0.0%	0	0.0%	0	0.0%
2009	Jun	3	0.0%	0	0.0%	0	0.0%
2009	Jul	3	0.0%	103	0.0%	34,232	0.0%
2009	Aug	3	0.0%	30	-71.3%	9,836	-71.3%
2009	Sep	3	0.0%	21	-27.1%	7,166	-27.1%
2009	Oct	3	0.0%	3	-84.0%	1,149	-84.0%
2009	Nov	3	0.0%	13	262.8%	4,167	262.8%
2009	Dec	3	0.0%	10	-23.0%	3,208	-23.0%
2010	Jan	3	0.0%	0	-100.0%	0	-100.0%
2010	Feb	3	0.0%	0	0.0%	0	0.0%
2010	Mar	3	0.0%	0	0.0%	0	0.0%
2010	Apr	3	0.0%	0	0.0%	0	0.0%
2010	May	3	0.0%	0	0.0%	0	0.0%
2010	Jun	3	0.0%	0	0.0%	0	0.0%
2010	Jul	3	0.0%	103	0.0%	34,232	0.0%
2010	Aug	3	0.0%	30	-71.3%	9,836	-71.3%
2010	Sep	3	0.0%	21	-27.1%	7,166	-27.1%
2010	Oct	3	0.0%	3	-84.0%	1,149	-84.0%
2010	Nov	3	0.0%	13	262.8%	4,167	262.8%
2010	Dec	3	0.0%	10	-23.0%	3,208	-23.0%
2011	Jan	3	0.0%	0	-100.0%	0	-100.0%
2011	Feb	3	0.0%	0	0.0%	0	0.0%
2011	Mar	3	0.0%	0	0.0%	0	0.0%
2011	Apr	3	0.0%	0	0.0%	0	0.0%
2011	May	3	0.0%	0	0.0%	0	0.0%
2011	Jun	3	0.0%	0	0.0%	0	0.0%
2011	Jul	3	0.0%	103	0.0%	34,232	0.0%
2011	Aug	3	0.0%	30	-71.3%	9,836	-71.3%
2011	Sep	3	0.0%	21	-27.1%	7,166	-27.1%
2011	Oct	3	0.0%	3	-84.0%	1,149	-84.0%
2011	Nov	3	0.0%	13	262.8%	4,167	262.8%
2011	Dec	3	0.0%	10	-23.0%	3,208	-23.0%
2012	Jan	3	0.0%	0	-100.0%	0	-100.0%
2012	Feb	3	0.0%	0	0.0%	0	0.0%
2012	Mar	3	0.0%	0	0.0%	0	0.0%
2012	Apr	3	0.0%	0	0.0%	0	0.0%
2012	May	3	0.0%	0	0.0%	0	0.0%
2012	Jun	3	0.0%	0	0.0%	0	0.0%
2012	Jul	3	0.0%	103	0.0%	34,232	0.0%
2012	Aug	3	0.0%	30	-71.3%	9,836	-71.3%
2012	Sep	3	0.0%	21	-27.1%	7,166	-27.1%
2012	Oct	3	0.0%	3	-84.0%	1,149	-84.0%
2012	Nov	3	0.0%	13	262.8%	4,167	262.8%
2012	Dec	3	0.0%	10	-23.0%	3,208	-23.0%

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Appendix B
Tables – Long-Term Forecast

Big Rivers ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

TOTAL NATIVE REQUIREMENTS

Year	Consumers	Percent Growth	Native Energy Sales (MWh)	Normal Sales (MWh)	Percent Growth	Gen. & Trans. Losses	Native Requirements (MWh)	Normal Requirements (MWh)	Percent Growth
1993	85,501		8,445,131	8,381,519		2.81%	8,688,975	8,623,527	
1994	87,257	2.1%	7,454,220	7,469,513	-10.9%	3.46%	7,721,677	7,737,518	-10.3%
1995	89,395	2.5%	7,961,435	7,917,225	6.0%	0.81%	8,026,476	7,981,905	3.2%
1996	91,546	2.4%	8,045,962	8,022,317	1.3%	2.30%	8,235,361	8,211,159	2.9%
1997	93,844	2.5%	8,127,361	8,149,577	1.6%	3.02%	8,380,094	8,403,001	2.3%
1998	96,154	2.5%	6,063,704	8,437,157	3.5%	2.33%	6,208,552	8,638,702	2.8%
1999	98,170	2.1%	3,468,648	9,133,449	8.3%	1.82%	3,532,841	9,302,479	7.7%
2000	100,272	2.1%	3,540,880	7,487,137	-18.0%	1.57%	3,597,500	7,606,858	-18.2%
2001	101,989	1.7%	3,284,322	3,311,328	-55.8%	1.41%	3,331,207	3,358,599	-55.8%
2002	103,482	1.5%	3,192,013	3,158,654	-4.6%	1.25%	3,232,553	3,198,771	-4.8%
2003	104,764	1.2%	3,052,358	3,167,921	0.3%	1.14%	3,087,548	3,204,443	0.2%
2004	106,414	1.6%	3,130,003	3,201,171	1.0%	0.91%	3,158,698	3,230,518	0.8%
2005	107,883	1.4%	3,233,941	3,225,791	0.8%	0.80%	3,259,867	3,251,651	0.7%
2006	109,329	1.3%	3,188,056	3,251,437	0.8%	0.81%	3,214,136	3,278,036	0.8%
2007	110,585	1.1%	3,327,805	3,246,143	-0.2%	0.75%	3,352,934	3,270,656	-0.2%
2008	111,693	1.0%	3,312,709	3,309,942	2.0%	0.83%	3,340,321	3,337,531	2.0%
2009	112,492	0.7%		3,344,238	1.0%	0.78%		3,370,528	1.0%
2010	113,497	0.9%		3,376,141	1.0%	0.78%		3,402,682	1.0%
2011	114,870	1.2%		3,410,371	1.0%	0.78%		3,437,181	1.0%
2012	116,410	1.3%		3,444,567	1.0%	0.78%		3,471,646	1.0%
2013	117,975	1.3%		3,475,507	0.9%	0.78%		3,502,829	0.9%
2014	119,519	1.3%		3,511,003	1.0%	0.78%		3,538,605	1.0%
2015	121,046	1.3%		3,551,186	1.1%	0.78%		3,579,103	1.1%
2016	122,559	1.2%		3,591,051	1.1%	0.78%		3,619,282	1.1%
2017	124,064	1.2%		3,637,300	1.3%	0.78%		3,665,894	1.3%
2018	125,574	1.2%		3,682,764	1.2%	0.78%		3,711,715	1.2%
2019	127,088	1.2%		3,728,795	1.2%	0.78%		3,758,108	1.2%
2020	128,596	1.2%		3,769,382	1.1%	0.78%		3,799,014	1.1%
2021	130,081	1.2%		3,816,381	1.2%	0.78%		3,846,383	1.2%
2022	131,521	1.1%		3,861,190	1.2%	0.78%		3,891,544	1.2%
2023	132,906	1.1%		3,905,562	1.1%	0.78%		3,936,265	1.1%

ANNUAL GROWTH RATES						
1993-1998	2.4%	-6.4%	0.1%	-3.6%	-6.5%	0.0%
1998-2003	1.7%	-12.8%	-17.8%	-13.3%	-13.0%	-18.0%
2003-2008	1.3%	1.7%	0.9%	-6.2%	1.6%	0.8%
2008-2013	1.1%		1.0%	-1.2%		1.0%
2013-2018	1.3%		1.2%	0.0%		1.2%
2018-2023	1.1%		1.2%	0.0%		1.2%
2008-2023	1.2%		1.1%	-0.4%		1.1%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE
TOTAL NATIVE ENERGY REQUIREMENTS
PLUS SMELTERS & FIRM OFF-SYSTEM CONTRACTS

Year	Native Energy Sales (MWh)	Smelters Energy Sales (MWh)	Native + Smelters (MWh)	Off-System Firm Sales (MWh)	Total Sales (MWh)
1993	2,478,362	5,966,768	8,445,131		8,445,131
1994	2,511,359	4,942,862	7,454,220		7,454,220
1995	3,153,395	4,808,040	7,961,435		7,961,435
1996	3,017,864	5,028,098	8,045,962		8,045,962
1997	3,094,475	5,032,885	8,127,361		8,127,361
1998	3,288,843	5,142,775	8,431,618		8,431,618
1999	3,468,648	5,606,178	9,074,826		9,074,826
2000	3,540,880	6,306,888	9,847,768		9,847,768
2001	3,284,322	6,983,985	10,268,307		10,268,307
2002	3,192,013	7,169,801	10,361,814	1,042,496	11,404,310
2003	3,052,358	7,306,866	10,359,224	1,508,516	11,867,740
2004	3,130,003	7,331,341	10,461,344	1,868,657	12,330,001
2005	3,233,941	7,285,475	10,519,416	2,021,365	12,540,781
2006	3,188,056	7,335,682	10,523,738	2,062,286	12,586,024
2007	3,327,805	7,289,181	10,616,986	2,835,789	13,452,775
2008	3,312,709	7,345,942	10,658,651	1,844,677	12,503,328
2009	3,344,238	7,297,080	10,641,318		10,641,318
2010	3,376,141	7,297,080	10,673,221		10,673,221
2011	3,410,371	7,297,080	10,707,451		10,707,451
2012	3,444,567	7,317,072	10,761,639		10,761,639
2013	3,475,507	7,297,080	10,772,587		10,772,587
2014	3,511,003	7,297,080	10,808,083		10,808,083
2015	3,551,186	7,297,080	10,848,266		10,848,266
2016	3,591,051	7,317,072	10,908,123		10,908,123
2017	3,637,300	7,297,080	10,934,380		10,934,380
2018	3,682,764	7,297,080	10,979,844		10,979,844
2019	3,728,795	7,297,080	11,025,875		11,025,875
2020	3,769,382	7,317,072	11,086,454		11,086,454
2021	3,816,381	7,297,080	11,113,461		11,113,461
2022	3,861,190	7,297,080	11,158,270		11,158,270
2023	3,905,562	7,297,080	11,202,642		11,202,642

ANNUAL GROWTH RATES

1993-1998					
1998-2003					
2003-2008	1.7%	0.1%	0.6%		1.0%
2008-2013	1.0%	-0.1%	0.2%		-2.9%
2013-2018	1.2%	0.0%	0.4%		0.4%
2018-2023	1.2%	0.0%	0.4%		0.4%
2008-2023	1.1%	0.0%	0.3%		-0.7%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE
TOTAL NATIVE DEMAND REQUIREMENTS
PLUS SMELTERS & FIRM OFF-SYSTEM CONTRACTS

Year	Native Demand (kW)	Smelters NCP (kW)	Native + Smelters (kW)	Off-System Firm Load (kW)	Total Demand (kW)
1993	521,147	700,279	1,217,000		1,217,000
1994	485,092	703,908	1,189,000		1,189,000
1995	588,872	587,779	1,166,000		1,166,000
1996	570,093	596,907	1,167,000		1,167,000
1997	596,198	598,802	1,195,000		1,195,000
1998	624,931	605,069	1,230,000		1,230,000
1999	663,890	698,947	1,362,837		1,362,837
2000	655,248	796,435	1,451,683		1,451,683
2001	614,496	821,866	1,425,496		1,425,496
2002	602,623	841,651	1,444,274		1,444,274
2003	585,549	856,713	1,440,619		1,440,619
2004	604,155	857,174	1,461,329		1,461,329
2005	617,787	851,328	1,468,971		1,468,971
2006	631,181	859,191	1,486,253		1,486,253
2007	659,516	856,974	1,510,700		1,510,700
2008	618,676	858,298	1,475,966		1,475,966
2009	636,844	850,000	1,494,163		1,494,163
2010	641,293	850,000	1,498,612		1,498,612
2011	648,050	850,000	1,505,369		1,505,369
2012	654,800	850,000	1,512,119		1,512,119
2013	660,907	850,000	1,518,226		1,518,226
2014	667,914	850,000	1,525,233		1,525,233
2015	675,846	850,000	1,533,165		1,533,165
2016	683,715	850,000	1,541,034		1,541,034
2017	692,844	850,000	1,550,163		1,550,163
2018	701,818	850,000	1,559,137		1,559,137
2019	710,904	850,000	1,568,223		1,568,223
2020	718,916	850,000	1,576,235		1,576,235
2021	728,193	850,000	1,585,512		1,585,512
2022	737,038	850,000	1,594,357		1,594,357
2023	745,796	850,000	1,603,115		1,603,115

ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008	1.1%	0.0%	0.5%		0.5%
2008-2013	1 3%	-0 2%	0.6%		0 6%
2013-2018	1 2%	0 0%	0 5%		0 5%
2018-2023	1.2%	0.0%	0.6%		0.6%
2008-2023	1.3%	-0.1%	0.6%		0.6%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

TOTAL SYSTEM REQUIREMENTS

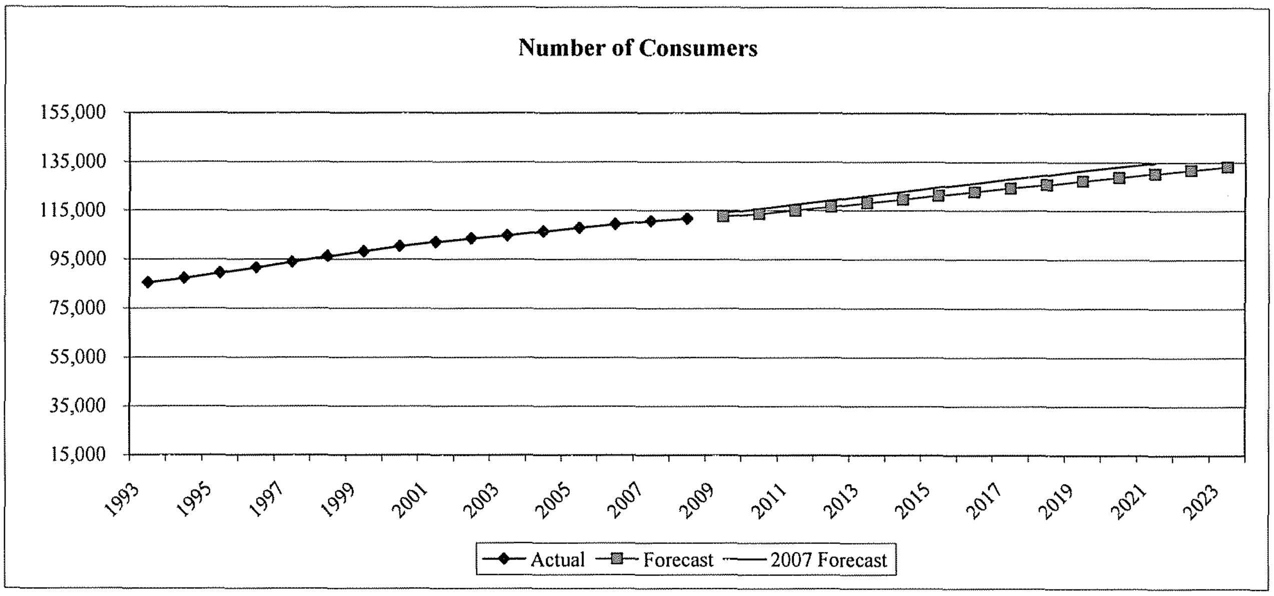
Year	Summer Actual CP (kW)	Summer Normal CP (kW)	Percent Growth	Normal Load Factor	Winter Actual CP (kW)	Winter Normal CP (kW)	Percent Growth	Normal Load Factor
1993	1,217,000	1,204,221		81.7%	1,137,000	1,130,741		87.1%
1994	1,055,000	1,045,865	-13.2%	84.5%	1,189,000	1,151,741	1.9%	76.7%
1995	1,166,000	1,143,959	9.4%	79.7%	1,080,000	1,082,112	-6.0%	84.2%
1996	1,167,000	1,165,118	1.8%	80.5%	1,154,000	1,133,453	4.7%	82.7%
1997	1,195,000	1,185,198	1.7%	80.9%	1,156,000	1,142,305	0.8%	84.0%
1998	1,230,000	1,227,569	3.6%	80.3%	1,123,000	1,126,308	-1.4%	87.6%
1999	1,362,837	1,352,028	10.1%	78.5%	1,188,715	1,180,612	4.8%	89.9%
2000	1,451,683	1,443,798	6.8%	60.1%	1,289,470	1,324,479	12.2%	65.6%
2001	596,310	595,509	-58.8%	64.4%	614,496	589,666	-55.5%	65.0%
2002	602,623	601,528	1.0%	60.7%	530,467	541,893	-8.1%	67.4%
2003	583,906	583,613	-3.0%	62.7%	585,549	574,244	6.0%	63.7%
2004	604,155	609,495	4.4%	60.5%	539,476	542,410	-5.5%	68.0%
2005	617,787	617,336	1.3%	60.1%	562,082	563,051	3.8%	65.9%
2006	631,181	633,837	2.7%	59.0%	555,303	598,487	6.3%	62.5%
2007	659,516	637,562	0.6%	58.6%	610,090	612,273	2.3%	61.0%
2008	616,264	623,659	-2.2%	61.1%	618,676	626,212	2.3%	60.8%
2009		629,426	0.9%	61.1%		636,844	1.7%	60.4%
2010		633,577	0.7%	61.3%		641,293	0.7%	60.6%
2011		640,080	1.0%	61.3%		648,050	1.1%	60.5%
2012		646,576	1.0%	61.3%		654,800	1.0%	60.5%
2013		652,453	0.9%	61.3%		660,907	0.9%	60.5%
2014		659,196	1.0%	61.3%		667,914	1.1%	60.5%
2015		666,829	1.2%	61.3%		675,846	1.2%	60.5%
2016		674,402	1.1%	61.3%		683,715	1.2%	60.4%
2017		683,188	1.3%	61.3%		692,844	1.3%	60.4%
2018		691,824	1.3%	61.2%		701,818	1.3%	60.4%
2019		700,568	1.3%	61.2%		710,904	1.3%	60.3%
2020		708,278	1.1%	61.2%		718,916	1.1%	60.3%
2021		717,206	1.3%	61.2%		728,193	1.3%	60.3%
2022		725,718	1.2%	61.2%		737,038	1.2%	60.3%
2023		734,147	1.2%	61.2%		745,796	1.2%	60.3%

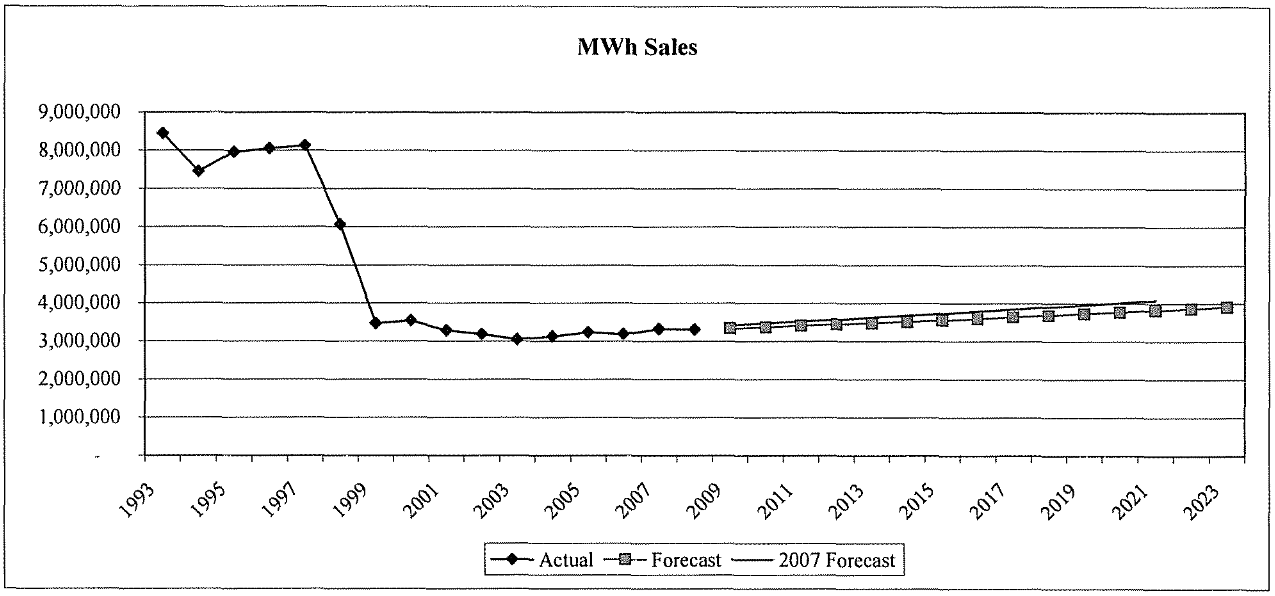
ANNUAL GROWTH RATES								
1993-1998								
1998-2003								
2003-2008	1.1%	1.3%		-0.5%	1.1%	1.7%		-0.9%
2008-2013		0.9%		0.1%		1.1%		-0.1%
2013-2018		1.2%		0.0%		1.2%		0.0%
2018-2023		1.2%		0.0%		1.2%		0.0%
2008-2023		1.1%		0.0%		1.2%		-0.1%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

TOTAL NATIVE REQUIREMENTS

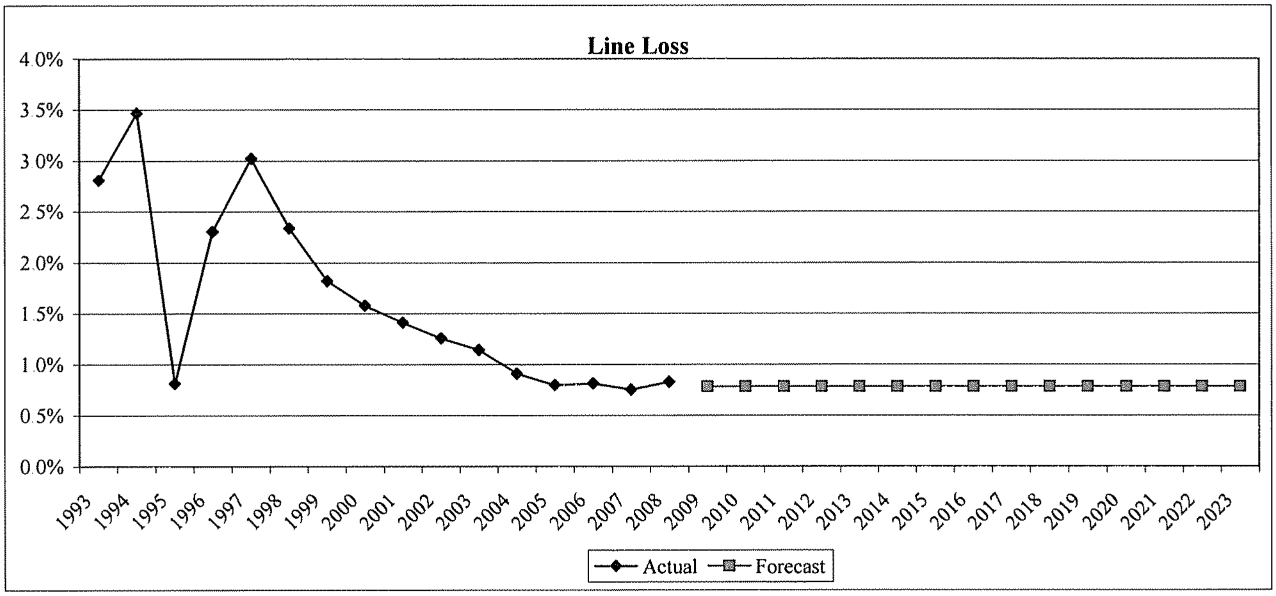




BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

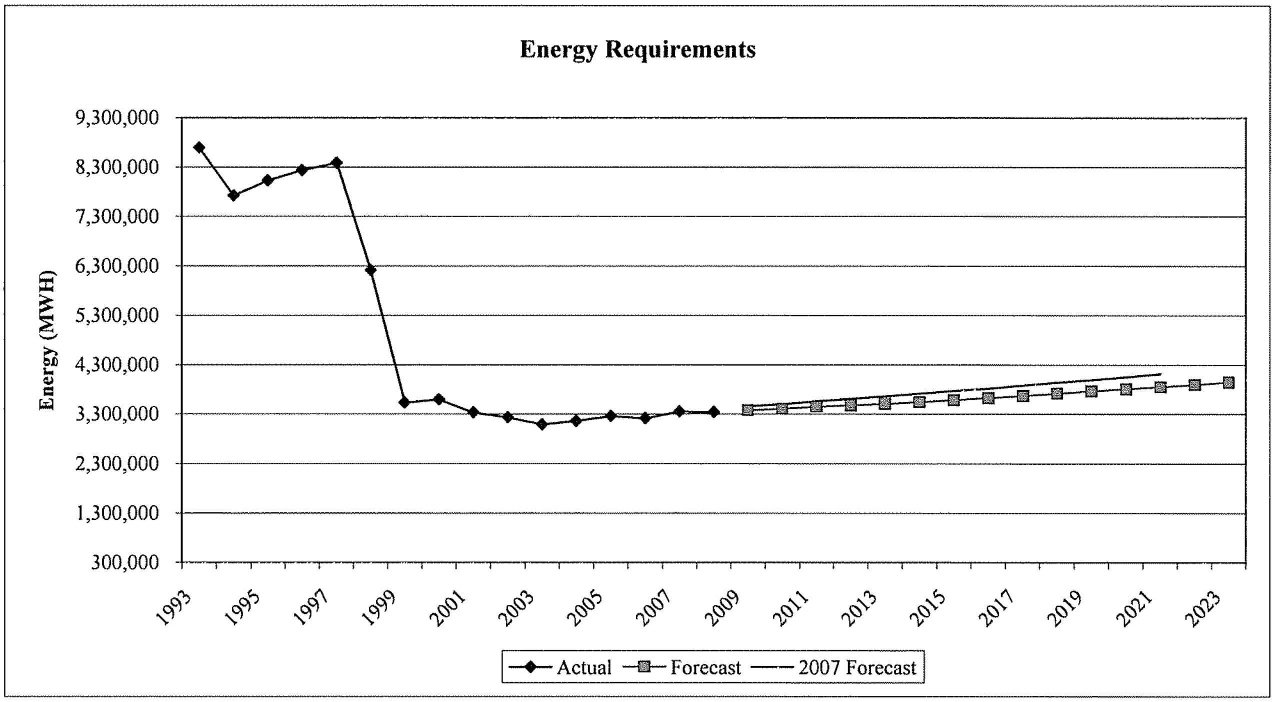
TOTAL NATIVE REQUIREMENTS

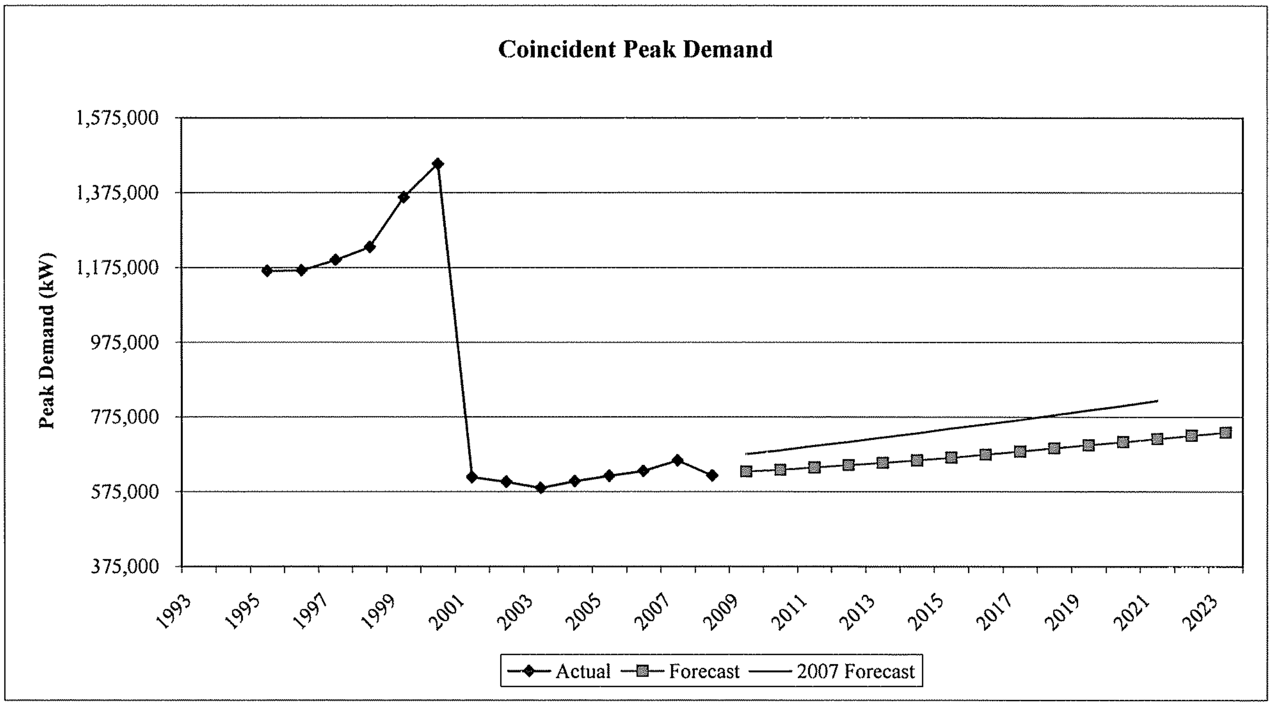


BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

TOTAL NATIVE REQUIREMENTS

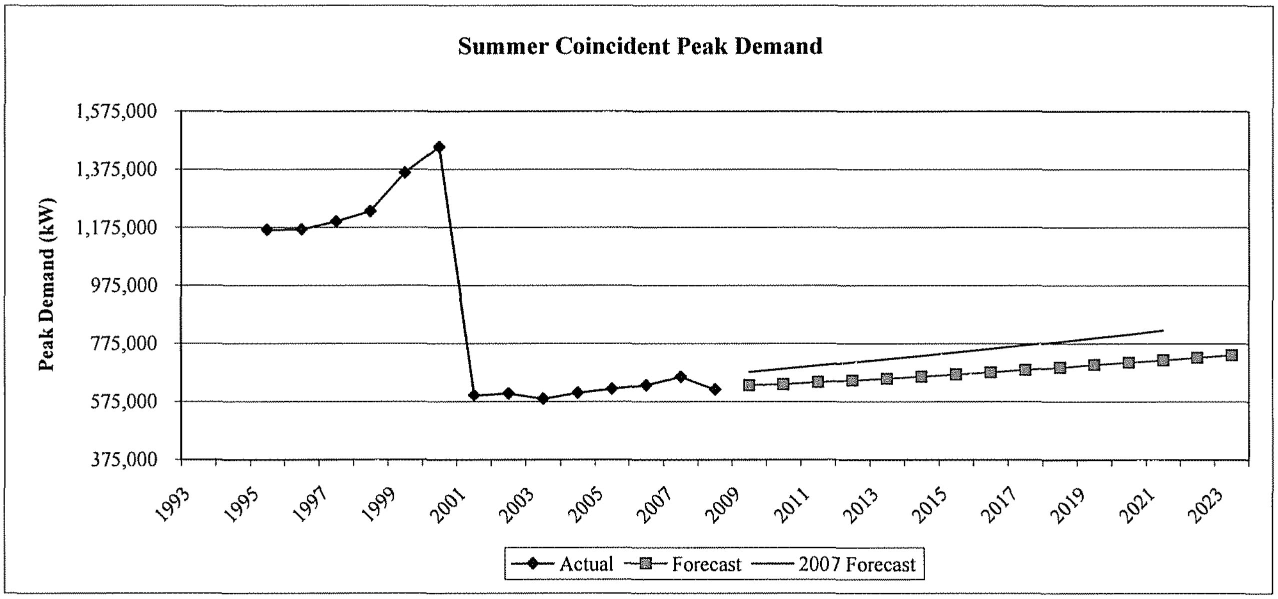


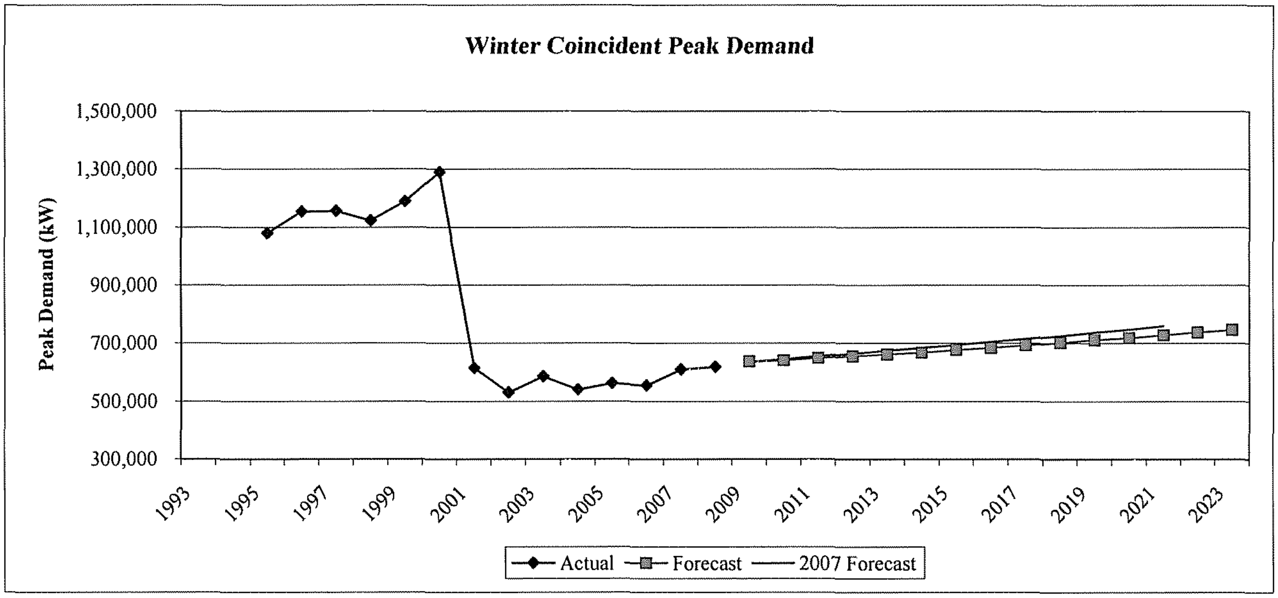


BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

TOTAL NATIVE REQUIREMENTS





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RURAL SYSTEM REQUIREMENTS

Year	Actual Energy (MWh)	Normal Energy (MWh)	Percent Growth	Summer CP (kW)	Percent Growth	Load Factor	Winter CP (kW)	Percent Growth	Load Factor
1993	1,580,290	1,518,099		375,226		46.2%	321,824		53.8%
1994	1,571,482	1,586,154	4.5%	359,472	-4.2%	50.4%	363,871	13.1%	49.8%
1995	1,665,313	1,621,664	2.2%	392,664	9.2%	47.1%	339,440	-6.7%	54.5%
1996	1,728,686	1,705,356	5.2%	384,892	-2.0%	50.6%	386,504	13.9%	50.4%
1997	1,758,397	1,780,100	4.4%	414,539	7.7%	49.0%	380,454	-1.6%	53.4%
1998	1,828,160	1,833,761	3.0%	430,240	3.8%	48.7%	376,868	-0.9%	55.5%
1999	1,921,792	1,981,769	8.1%	475,416	10.5%	47.6%	397,189	5.4%	57.0%
2000	2,001,539	2,009,144	1.4%	463,015	-2.6%	49.5%	385,384	-3.0%	59.5%
2001	2,000,877	2,010,304	0.1%	447,402	-3.4%	51.3%	429,854	11.5%	53.4%
2002	2,114,841	2,041,949	1.6%	467,498	4.5%	49.9%	385,501	-10.3%	60.5%
2003	2,089,678	2,144,105	5.0%	463,238	-0.9%	52.8%	466,551	21.0%	52.5%
2004	2,133,190	2,198,343	2.5%	476,409	2.8%	52.7%	434,995	-6.8%	57.7%
2005	2,262,017	2,244,994	2.1%	502,064	5.4%	51.0%	448,485	3.1%	57.1%
2006	2,232,581	2,286,805	1.9%	505,405	0.7%	51.7%	438,620	-2.2%	59.5%
2007	2,404,515	2,320,907	1.5%	536,611	6.2%	49.4%	493,267	12.5%	53.7%
2008	2,399,889	2,376,625	2.4%	501,757	-6.5%	54.1%	516,082	4.6%	52.6%
2009		2,393,723	0.7%	507,272	1.1%	53.9%	521,766	1.1%	52.4%
2010		2,425,627	1.3%	513,332	1.2%	53.9%	528,063	1.2%	52.4%
2011		2,459,856	1.4%	519,834	1.3%	54.0%	534,820	1.3%	52.5%
2012		2,494,052	1.4%	526,330	1.2%	54.1%	541,570	1.3%	52.6%
2013		2,524,992	1.2%	532,208	1.1%	54.2%	547,677	1.1%	52.6%
2014		2,560,489	1.4%	538,951	1.3%	54.2%	554,684	1.3%	52.7%
2015		2,600,671	1.6%	546,584	1.4%	54.3%	562,615	1.4%	52.8%
2016		2,640,536	1.5%	554,157	1.4%	54.4%	570,484	1.4%	52.8%
2017		2,686,785	1.8%	562,942	1.6%	54.5%	579,613	1.6%	52.9%
2018		2,732,249	1.7%	571,579	1.5%	54.6%	588,588	1.5%	53.0%
2019		2,778,280	1.7%	580,323	1.5%	54.7%	597,674	1.5%	53.1%
2020		2,818,867	1.5%	588,033	1.3%	54.7%	605,685	1.3%	53.1%
2021		2,865,866	1.7%	596,961	1.5%	54.8%	614,962	1.5%	53.2%
2022		2,910,675	1.6%	605,473	1.4%	54.9%	623,807	1.4%	53.3%
2023		2,955,047	1.5%	613,902	1.4%	54.9%	632,566	1.4%	53.3%

ANNUAL GROWTH RATES

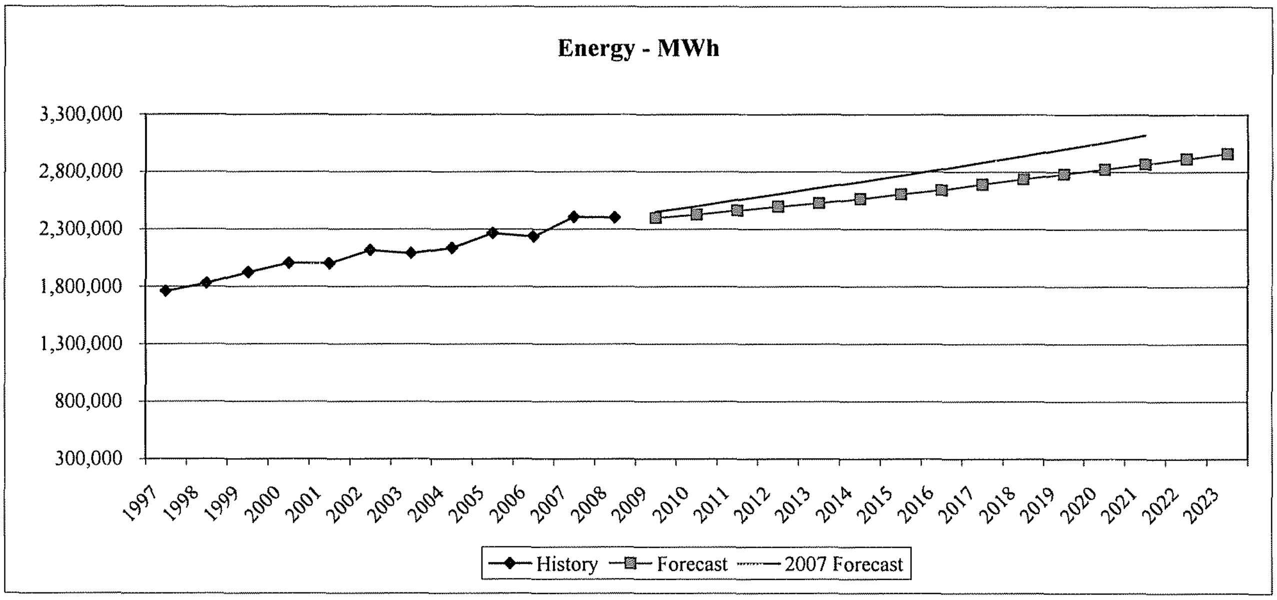
1998-2003	2.1%	2.0%	-0.6%	2.7%	4.1%	-2.0%
2003-2008	2.8%	2.1%	1.6%	0.5%	2.0%	0.0%
2008-2013		1.2%	1.2%	0.0%	1.2%	0.0%
2013-2018		1.6%	1.4%	0.2%	1.5%	0.1%
2018-2023		1.6%	1.4%	0.1%	1.5%	0.1%
2008-2023		1.5%	1.4%	0.1%	1.4%	0.1%

Summer season is May to October. Winter season is November of the prior year through April of the reported year.
For instance, the Winter CP for 2000 is the CP recorded between November 1999 and April 2000.

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

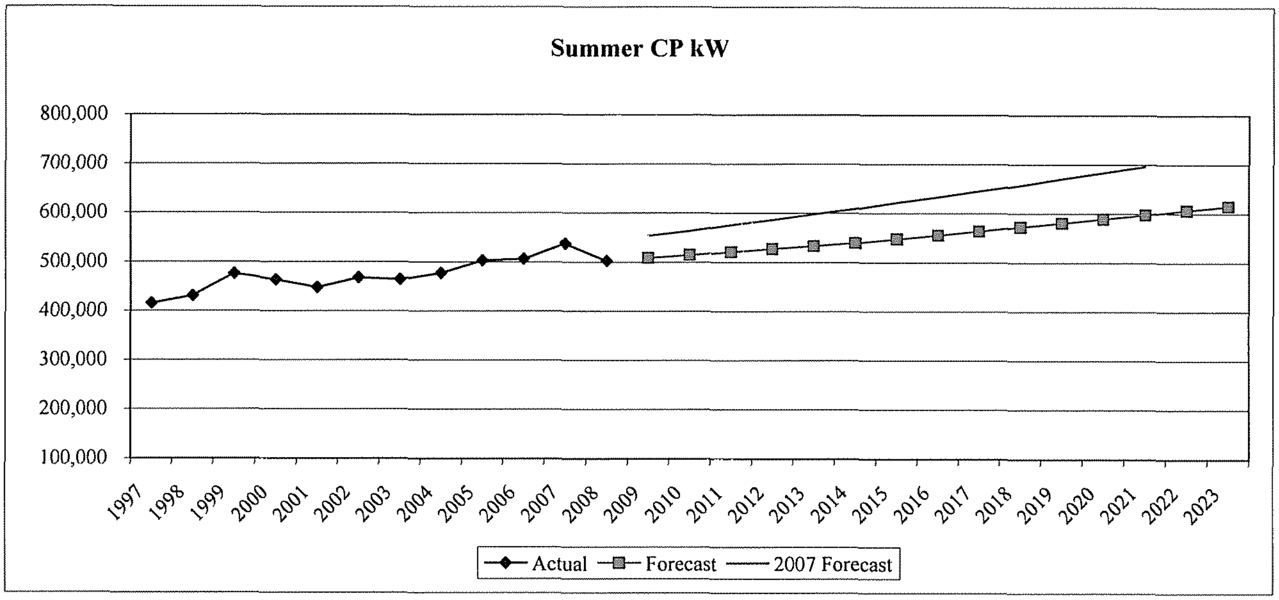
RURAL SYSTEM REQUIREMENTS

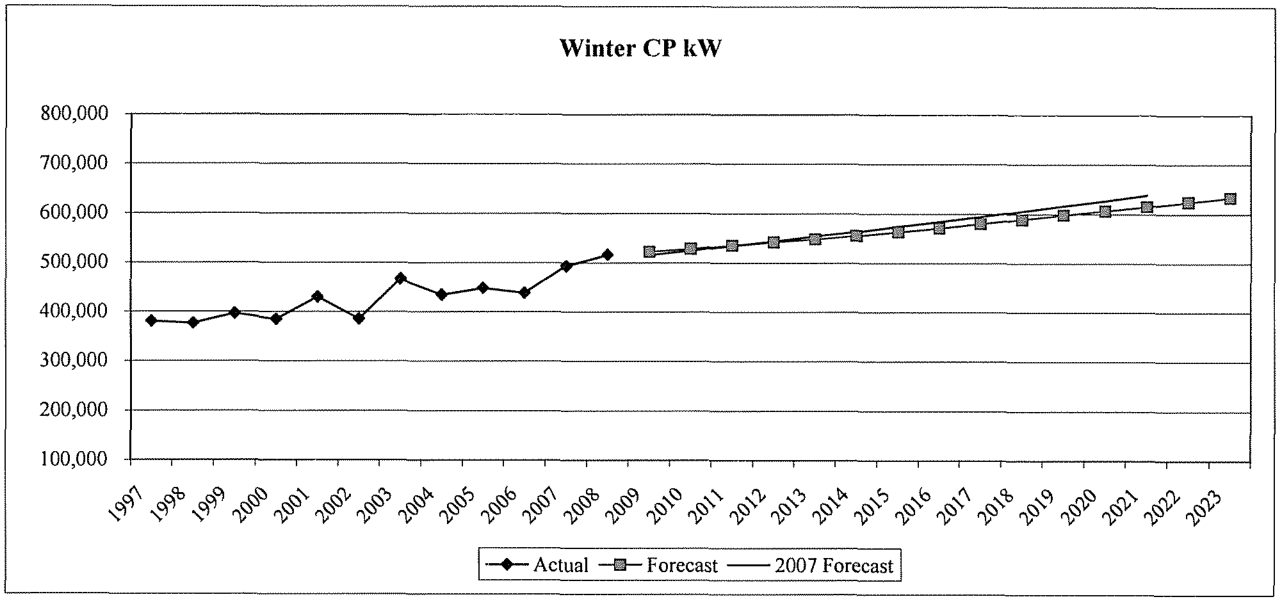


BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RURAL SYSTEM REQUIREMENTS





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RURAL SYSTEM REQUIREMENTS

Year	Actual Energy (MWh)	Normal Energy (MWh)	Percent Growth	Summer NCP (kW)	Percent Growth	Load Factor	Winter NCP (kW)	Percent Growth	Load Factor
1993	1,580,290	1,518,099		378,252		45.8%	324,747		53.4%
1994	1,571,482	1,586,154	4.5%	362,371	-4.2%	50.0%	367,176	13.1%	49.3%
1995	1,665,313	1,621,664	2.2%	395,831	9.2%	46.8%	346,348	-5.7%	53.4%
1996	1,728,686	1,705,356	5.2%	387,996	-2.0%	50.2%	390,014	12.6%	49.9%
1997	1,758,397	1,780,100	4.4%	417,882	7.7%	48.6%	383,909	-1.6%	52.9%
1998	1,828,160	1,833,761	3.0%	433,709	3.8%	48.3%	380,291	-0.9%	55.0%
1999	1,921,792	1,981,769	8.1%	478,973	10.4%	47.2%	398,037	4.7%	56.8%
2000	2,001,539	2,009,144	1.4%	462,255	-3.5%	49.6%	433,445	8.9%	52.9%
2001	2,000,877	2,010,304	0.1%	453,869	-1.8%	50.6%	415,376	-4.2%	55.2%
2002	2,114,841	2,041,949	1.6%	475,814	4.8%	49.0%	391,403	-5.8%	59.6%
2003	2,089,678	2,144,105	5.0%	464,483	-2.4%	52.7%	468,517	19.7%	52.2%
2004	2,133,190	2,198,343	2.5%	476,632	2.6%	52.7%	466,420	-0.4%	53.8%
2005	2,262,017	2,244,994	2.1%	505,996	6.2%	50.6%	452,390	-3.0%	56.6%
2006	2,232,581	2,286,805	1.9%	507,000	0.2%	51.5%	480,557	6.2%	54.3%
2007	2,404,515	2,320,907	1.5%	537,317	6.0%	49.3%	494,885	3.0%	53.5%
2008	2,399,889	2,376,625	2.4%	507,538	-5.5%	53.5%	522,167	5.5%	52.0%
2009		2,393,723	0.7%	511,362	0.8%	53.4%	525,974	0.7%	52.0%
2010		2,425,627	1.3%	517,472	1.2%	53.5%	532,322	1.2%	52.0%
2011		2,459,856	1.4%	524,026	1.3%	53.6%	539,133	1.3%	52.1%
2012		2,494,052	1.4%	530,575	1.2%	53.7%	545,937	1.3%	52.2%
2013		2,524,992	1.2%	536,500	1.1%	53.7%	552,094	1.1%	52.2%
2014		2,560,489	1.4%	543,297	1.3%	53.8%	559,157	1.3%	52.3%
2015		2,600,671	1.6%	550,992	1.4%	53.9%	567,153	1.4%	52.3%
2016		2,640,536	1.5%	558,626	1.4%	54.0%	575,085	1.4%	52.4%
2017		2,686,785	1.8%	567,482	1.6%	54.0%	584,288	1.6%	52.5%
2018		2,732,249	1.7%	576,188	1.5%	54.1%	593,334	1.5%	52.6%
2019		2,778,280	1.7%	585,003	1.5%	54.2%	602,494	1.5%	52.6%
2020		2,818,867	1.5%	592,775	1.3%	54.3%	610,570	1.3%	52.7%
2021		2,865,866	1.7%	601,775	1.5%	54.4%	619,922	1.5%	52.8%
2022		2,910,675	1.6%	610,356	1.4%	54.4%	628,838	1.4%	52.8%
2023		2,955,047	1.5%	618,853	1.4%	54.5%	637,667	1.4%	52.9%

ANNUAL GROWTH RATES						
1998-2003	2.1%	2.0%	-0.8%	2.8%	4.2%	-2.1%
2003-2008	2.8%	2.1%	1.8%	0.3%	2.2%	-0.1%
2008-2013		1.2%	1.1%	0.1%	1.1%	0.1%
2013-2018		1.6%	1.4%	0.2%	1.5%	0.1%
2018-2023		1.6%	1.4%	0.1%	1.5%	0.1%
2008-2023		1.5%	1.3%	0.1%	1.3%	0.1%

Summer season is May to October. Winter season is November of the prior year through April of the reported year.
For instance, the Winter CP for 2000 is the CP recorded between November 1999 and April 2000.

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RESIDENTIAL CLASSIFICATION

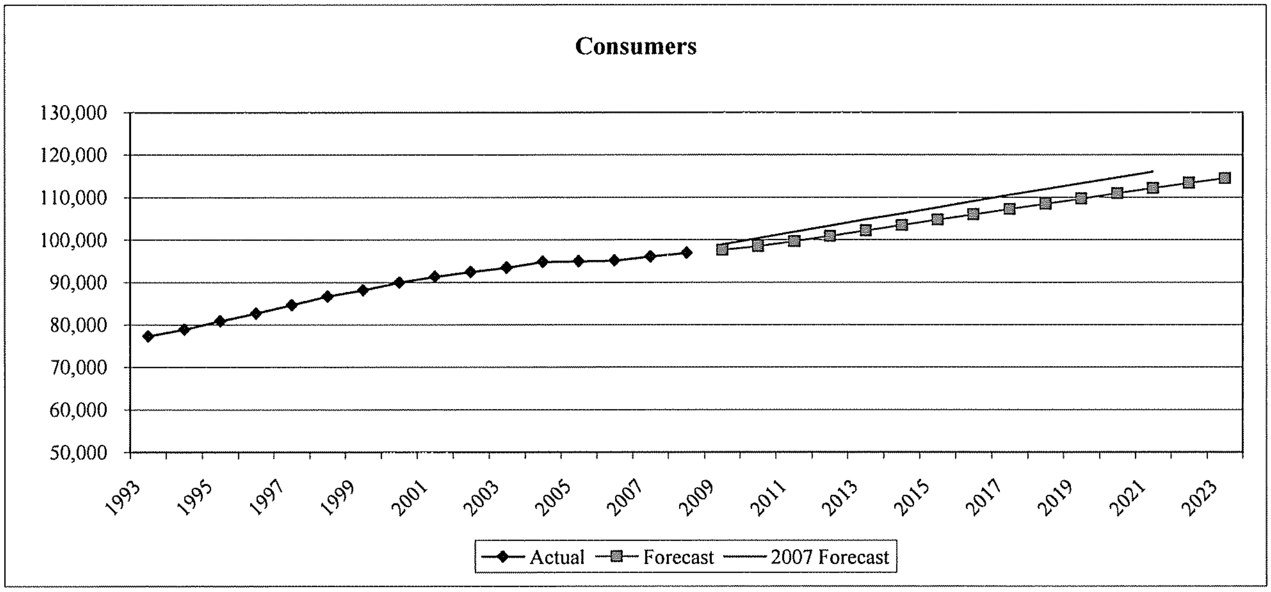
Year	Consumers	Consumer Growth	Percent Growth	Actual Sales (MWh)	Normal Sales (MWh)	Percent Growth	Actual Average Use (kWh/Cust/Mo)	Normal Average Use (kWh/Cust/Mo)	Percent Growth
1993	77,266			1,052,301	997,225		1,135	1,076	
1994	78,879	1,614	2.1%	1,040,652	1,053,541	5.6%	1,099	1,113	3.5%
1995	80,808	1,928	2.4%	1,101,490	1,065,098	1.1%	1,136	1,098	-1.3%
1996	82,658	1,851	2.3%	1,144,623	1,121,216	5.3%	1,154	1,130	2.9%
1997	84,622	1,964	2.4%	1,137,995	1,154,524	3.0%	1,121	1,137	0.6%
1998	86,615	1,993	2.4%	1,199,476	1,206,294	4.5%	1,154	1,161	2.1%
1999	88,092	1,477	1.7%	1,215,474	1,267,815	5.1%	1,150	1,199	3.3%
2000	89,860	1,768	2.0%	1,264,194	1,270,728	0.2%	1,172	1,178	-1.7%
2001	91,276	1,416	1.6%	1,286,139	1,292,137	1.7%	1,174	1,180	0.1%
2002	92,355	1,079	1.2%	1,371,067	1,309,841	1.4%	1,237	1,182	0.2%
2003	93,405	1,050	1.1%	1,340,451	1,384,962	5.7%	1,196	1,236	4.5%
2004	94,768	1,363	1.5%	1,362,667	1,418,933	2.5%	1,198	1,248	1.0%
2005	94,877	109	0.1%	1,452,182	1,439,717	1.5%	1,275	1,265	1.3%
2006	95,028	151	0.2%	1,415,359	1,460,129	1.4%	1,241	1,280	1.3%
2007	95,993	965	1.0%	1,534,506	1,468,932	0.6%	1,332	1,275	-0.4%
2008	96,886	893	0.9%	1,529,478	1,509,186	2.7%	1,316	1,298	1.8%
2009	97,518	633	0.7%		1,532,007	1.5%		1,309	0.9%
2010	98,400	881	0.9%		1,554,028	1.4%		1,316	0.5%
2011	99,540	1,140	1.2%		1,572,789	1.2%		1,317	0.0%
2012	100,796	1,256	1.3%		1,592,872	1.3%		1,317	0.0%
2013	102,075	1,280	1.3%		1,610,370	1.1%		1,315	-0.2%
2014	103,337	1,262	1.2%		1,630,346	1.2%		1,315	0.0%
2015	104,588	1,251	1.2%		1,653,291	1.4%		1,317	0.2%
2016	105,827	1,240	1.2%		1,675,448	1.3%		1,319	0.2%
2017	107,062	1,235	1.2%		1,703,587	1.7%		1,326	0.5%
2018	108,304	1,243	1.2%		1,730,837	1.6%		1,332	0.4%
2019	109,554	1,250	1.2%		1,758,431	1.6%		1,338	0.4%
2020	110,801	1,247	1.1%		1,780,719	1.3%		1,339	0.1%
2021	112,028	1,227	1.1%		1,808,999	1.6%		1,346	0.5%
2022	113,213	1,186	1.1%		1,835,124	1.4%		1,351	0.4%
2023	114,345	1,132	1.0%		1,860,804	1.4%		1,356	0.4%

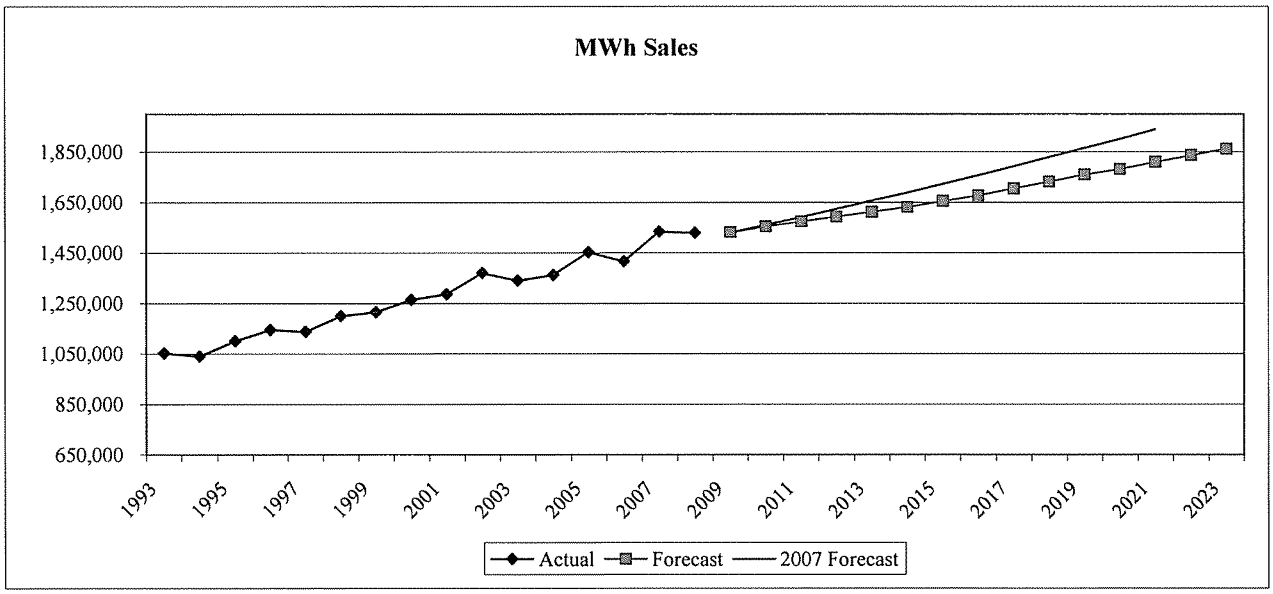
ANNUAL GROWTH RATES							
1993-1998	2.3%	1,870	2.7%	3.9%	0.3%	1.5%	
1998-2003	1.5%	1,358	2.2%	2.8%	0.7%	1.3%	
2003-2008	0.7%	696	2.7%	1.7%	1.9%	1.0%	
2008-2013	1.0%	1,038		1.3%		0.3%	
2013-2018	1.2%	1,246		1.5%		0.3%	
2018-2023	1.1%	1,208		1.5%		0.4%	
2008-2023	1.1%	1,164		1.4%		0.3%	

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RESIDENTIAL CLASSIFICATION

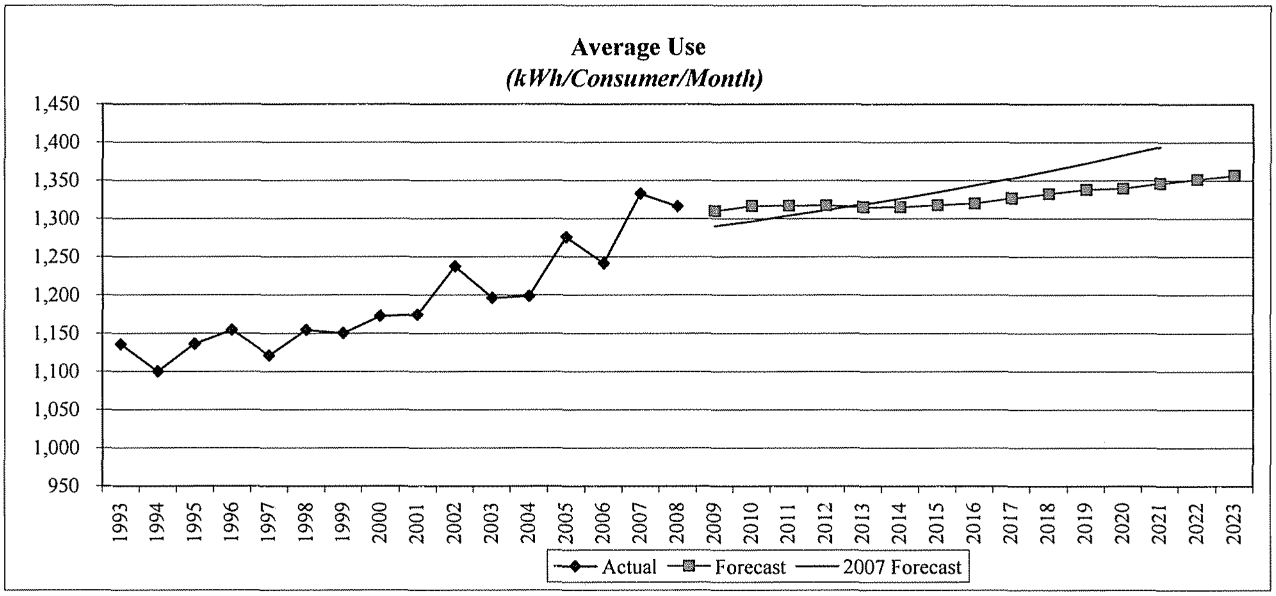




BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

RESIDENTIAL CLASSIFICATION



BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

COMMERCIAL & INDUSTRIAL CLASSIFICATION

Year	Consumers	Percent Growth	Actual Sales (MWh)	Normal Sales (MWh)	Percent Growth	Actual Average Use (kWh/Cust/Mo)	Normal Average Use (kWh/Cust/Mo)	Percent Growth
1993	8,085		417,266					
1994	8,222		429,603					
1995	8,430		448,782					
1996	8,707		466,450					
1997	9,035		502,803					
1998	9,346		513,762	512,266		4,581	4,568	
1999	9,879	5.7%	591,594	598,077	16.8%	4,991	5,045	10.5%
2000	10,206	3.3%	613,100	613,872	2.6%	5,006	5,012	-0.7%
2001	10,502	2.9%	602,412	605,828	-1.3%	4,780	4,807	-4.1%
2002	10,916	3.9%	627,652	616,869	1.8%	4,791	4,709	-2.0%
2003	11,185	2.5%	637,787	647,016	4.9%	4,752	4,820	2.4%
2004	11,539	3.2%	659,726	667,663	3.2%	4,764	4,822	0.0%
2005	12,897	11.8%	695,491	691,092	3.5%	4,494	4,466	-7.4%
2006	14,187	10.0%	708,219	717,180	3.8%	4,160	4,213	-5.7%
2007	14,478	2.0%	753,591	736,207	2.7%	4,338	4,238	0.6%
2008	14,692	1.5%	749,573	746,941	1.5%	4,251	4,237	0.0%
2009	14,860	1.1%		742,024	-0.7%		4,161	-1.8%
2010	14,984	0.8%		750,285	1.1%		4,173	0.3%
2011	15,218	1.6%		764,031	1.8%		4,184	0.3%
2012	15,502	1.9%		776,424	1.6%		4,174	-0.2%
2013	15,787	1.8%		788,300	1.5%		4,161	-0.3%
2014	16,068	1.8%		802,035	1.7%		4,159	0.0%
2015	16,346	1.7%		817,260	1.9%		4,167	0.2%
2016	16,619	1.7%		832,973	1.9%		4,177	0.2%
2017	16,889	1.6%		848,778	1.9%		4,188	0.3%
2018	17,157	1.6%		864,724	1.9%		4,200	0.3%
2019	17,421	1.5%		880,869	1.9%		4,214	0.3%
2020	17,682	1.5%		897,137	1.8%		4,228	0.3%
2021	17,940	1.5%		913,514	1.8%		4,243	0.4%
2022	18,195	1.4%		929,962	1.8%		4,259	0.4%
2023	18,448	1.4%		946,437	1.8%		4,275	0.4%

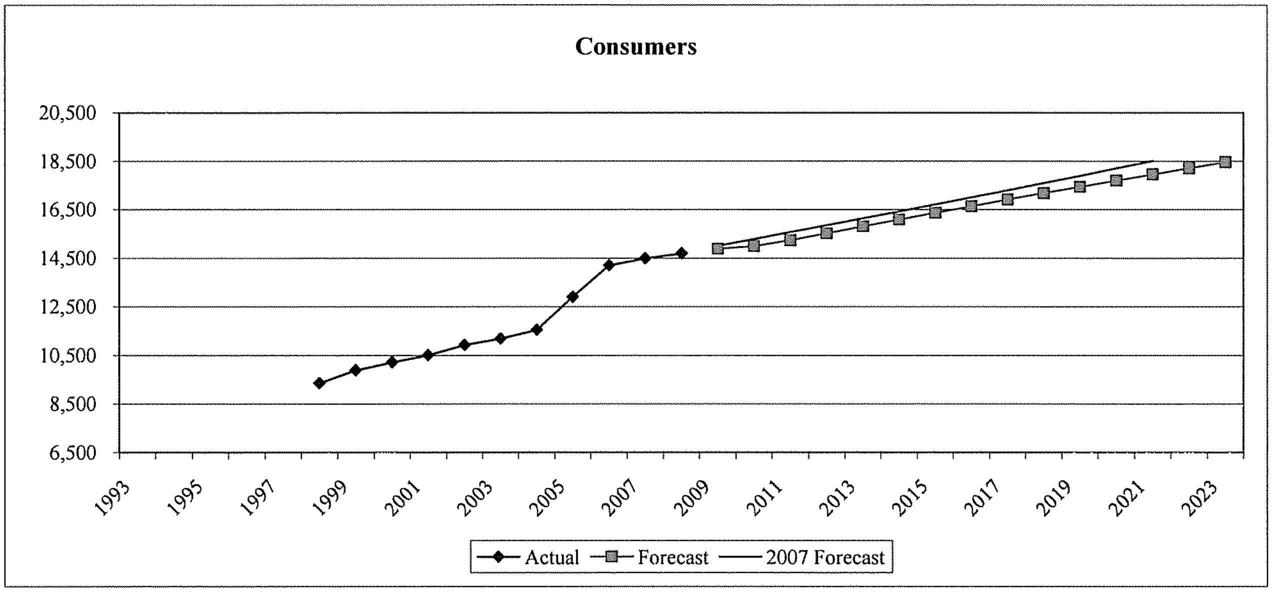
ANNUAL GROWTH RATES

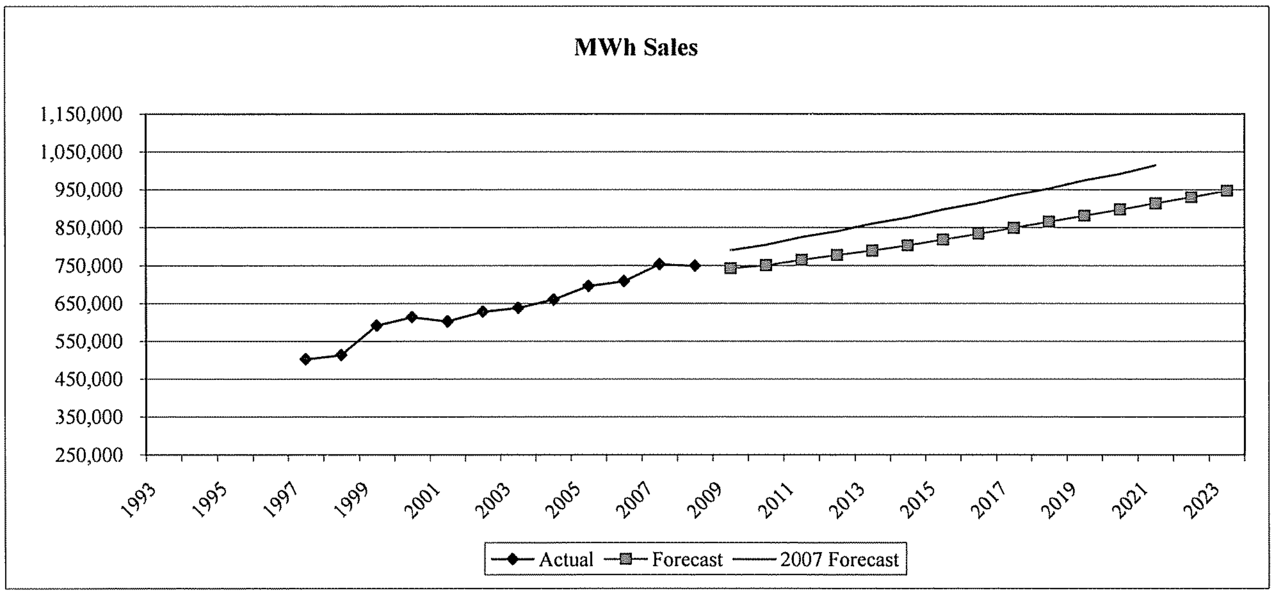
1993-1998								
1998-2003	3.7%		4.4%	4.8%		0.7%	1.1%	
2003-2008	5.6%		3.3%	2.9%		-2.2%	-2.5%	
2008-2013	1.4%			1.1%			-0.4%	
2013-2018	1.7%			1.9%			0.2%	
2018-2023	1.5%			1.8%			0.4%	
2008-2023	1.5%			1.6%			0.1%	

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

COMMERCIAL & INDUSTRIAL CLASSIFICATION





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

LARGE INDUSTRIAL - DIRECT SERVE CUSTOMERS

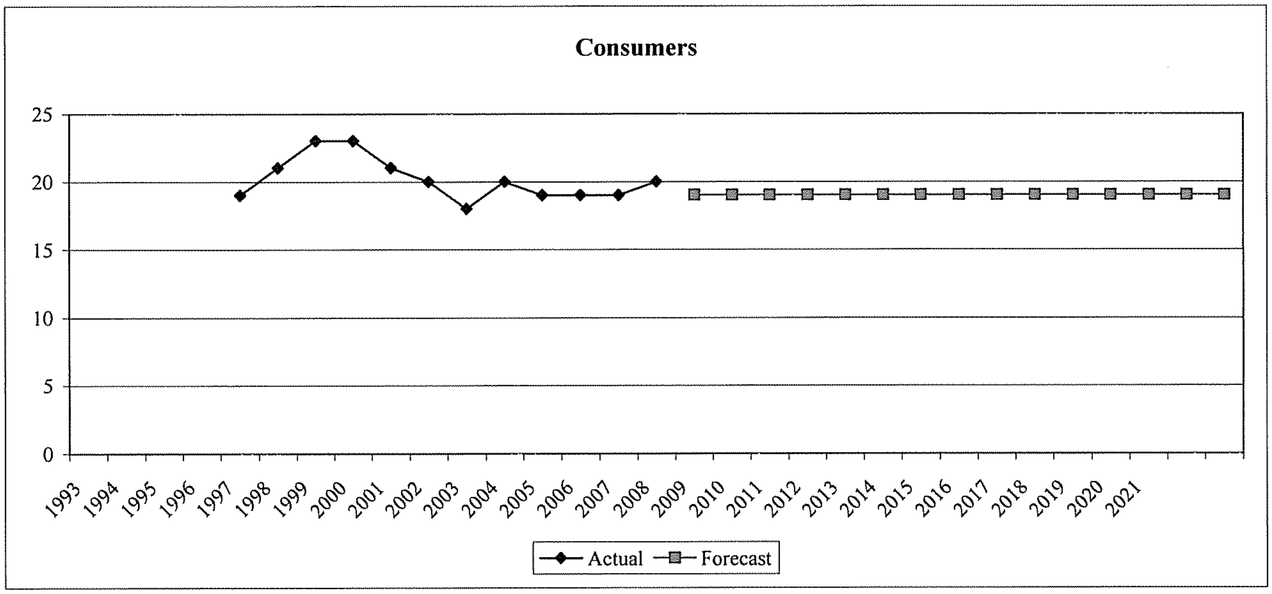
Year	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
1993	12		6,864,840		47,672,503	
1994	12	0 0%	5,882,738	-14.3%	40,852,349	-14 3%
1995	11	-8.3%	6,296,122	7.0%	47,697,892	16 8%
1996	20	81 8%	6,317,276	0.3%	26,321,982	-44 8%
1997	19	-5.0%	6,368,964	0 8%	27,934,051	6.1%
1998	21	10 5%	6,603,458	3 7%	26,204,199	-6.2%
1999	23	9.5%	7,150,766	8 3%	25,908,571	-1 1%
2000	23	0 0%	5,478,358	-23.4%	19,849,123	-23 4%
2001	21	-8 7%	1,300,686	-76.3%	5,161,452	-74 0%
2002	20	-4 8%	1,118,264	-14 0%	4,659,432	-9 7%
2003	18	-10.0%	1,022,803	-8.5%	4,735,200	1.6%
2004	20	11 1%	1,001,791	-2 1%	4,174,128	-11.8%
2005	19	-5 0%	981,086	-2 1%	4,303,010	3 1%
2006	19	0.0%	963,691	-1.8%	4,226,714	-1.8%
2007	19	0.0%	926,769	-3 8%	4,064,778	-3 8%
2008	20	5.3%	933,580	0.7%	3,889,918	-4.3%
2009	19	-5 0%	950,515	1.8%	4,168,925	7 2%
2010	19	0 0%	950,515	0 0%	4,168,925	0.0%
2011	19	0 0%	950,515	0.0%	4,168,925	0.0%
2012	19	0.0%	950,515	0 0%	4,168,925	0.0%
2013	19	0.0%	950,515	0.0%	4,168,925	0 0%
2014	19	0 0%	950,515	0 0%	4,168,925	0.0%
2015	19	0 0%	950,515	0 0%	4,168,925	0.0%
2016	19	0 0%	950,515	0 0%	4,168,925	0.0%
2017	19	0.0%	950,515	0 0%	4,168,925	0.0%
2018	19	0 0%	950,515	0 0%	4,168,925	0.0%
2019	19	0 0%	950,515	0 0%	4,168,925	0.0%
2020	19	0.0%	950,515	0 0%	4,168,925	0.0%
2021	19	0 0%	950,515	0.0%	4,168,925	0 0%
2022	19	0 0%	950,515	0 0%	4,168,925	0.0%
2023	19	0.0%	950,515	0.0%	4,168,925	0.0%

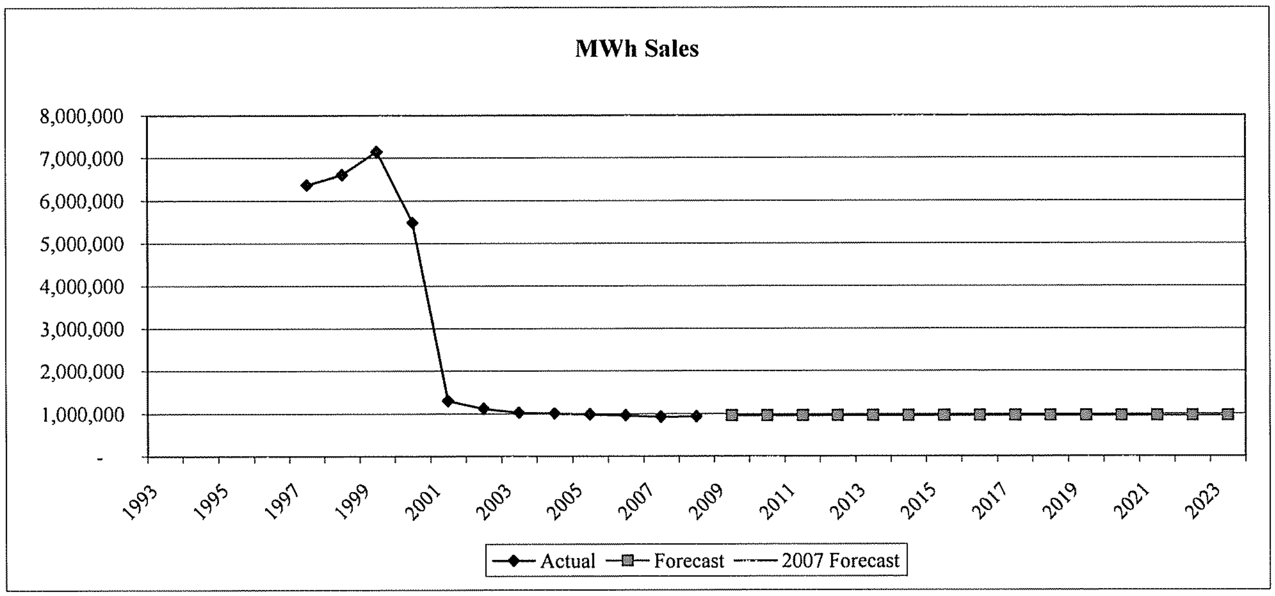
ANNUAL GROWTH RATES			
1993-1998			
1998-2003	-3 0%	-31 1%	-29 0%
2003-2008	2.1%	-1.8%	-3.9%
2008-2013	-1 0%	0.4%	1 4%
2013-2018	0 0%	0 0%	0 0%
2018-2023	0.0%	0.0%	0.0%
2008-2023	-0.3%	0.1%	0.5%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

LARGE INDUSTRIAL - DIRECT SERVE CUSTOMERS





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

STREET LIGHTING CLASSIFICATION

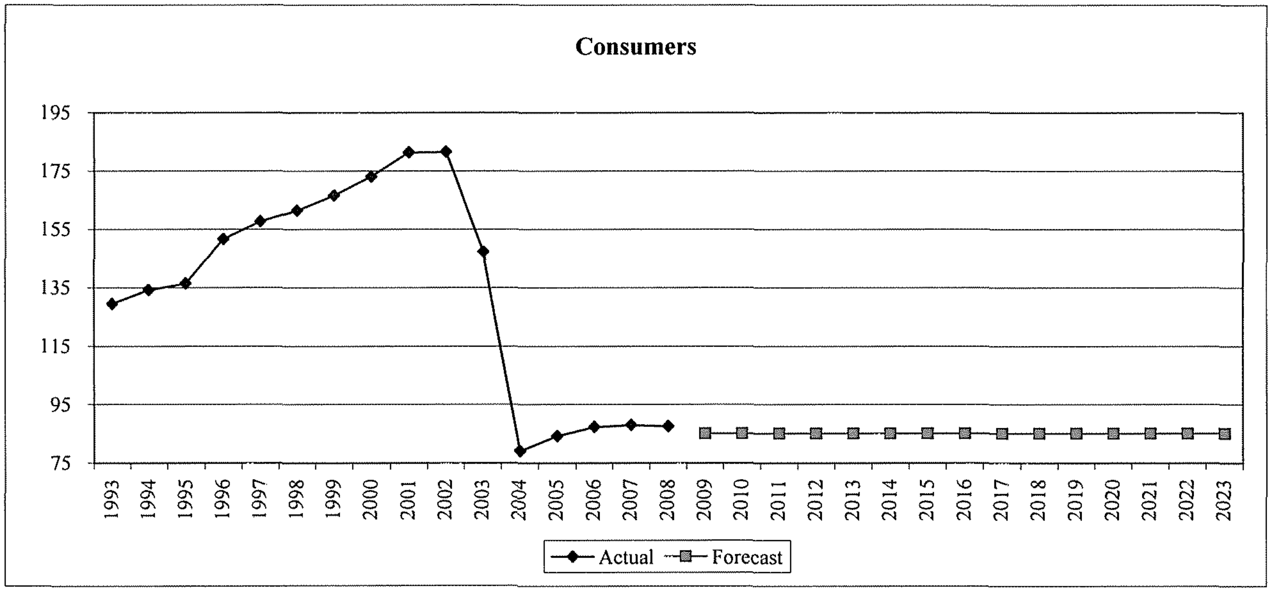
Year	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
1993	129		2,417		1,556	
1994	134	3.7%	2,509	3.8%	1,558	0.1%
1995	136	1.7%	2,641	5.2%	1,613	3.5%
1996	152	11.1%	2,661	0.8%	1,463	-9.3%
1997	158	4.0%	2,802	5.3%	1,481	1.2%
1998	161	2.3%	2,846	1.6%	1,470	-0.8%
1999	167	3.2%	3,138	10.3%	1,571	6.8%
2000	173	3.9%	3,191	1.7%	1,537	-2.1%
2001	181	4.8%	3,104	-2.7%	1,427	-7.2%
2002	182	0.1%	3,277	5.6%	1,505	5.4%
2003	147	-18.9%	3,235	-1.3%	1,831	21.7%
2004	79	-46.3%	2,997	-7.3%	3,158	72.5%
2005	84	6.4%	3,077	2.7%	3,047	-3.5%
2006	87	3.8%	3,104	0.9%	2,962	-2.8%
2007	88	0.8%	3,175	2.3%	3,007	1.5%
2008	88	-0.5%	3,287	3.5%	3,128	4.0%
2009	85	-2.9%	3,352	2.0%	3,287	5.1%
2010	85	0.0%	3,406	1.6%	3,340	1.6%
2011	85	0.0%	3,460	1.6%	3,393	1.6%
2012	85	0.0%	3,514	1.6%	3,446	1.6%
2013	85	0.0%	3,568	1.5%	3,498	1.5%
2014	85	0.0%	3,622	1.5%	3,551	1.5%
2015	85	0.0%	3,676	1.5%	3,604	1.5%
2016	85	0.0%	3,730	1.5%	3,657	1.5%
2017	85	0.0%	3,784	1.4%	3,710	1.4%
2018	85	0.0%	3,838	1.4%	3,763	1.4%
2019	85	0.0%	3,892	1.4%	3,816	1.4%
2020	85	0.0%	3,946	1.4%	3,869	1.4%
2021	85	0.0%	4,000	1.4%	3,922	1.4%
2022	85	0.0%	4,054	1.3%	3,975	1.3%
2023	85	0.0%	4,108	1.3%	4,028	1.3%

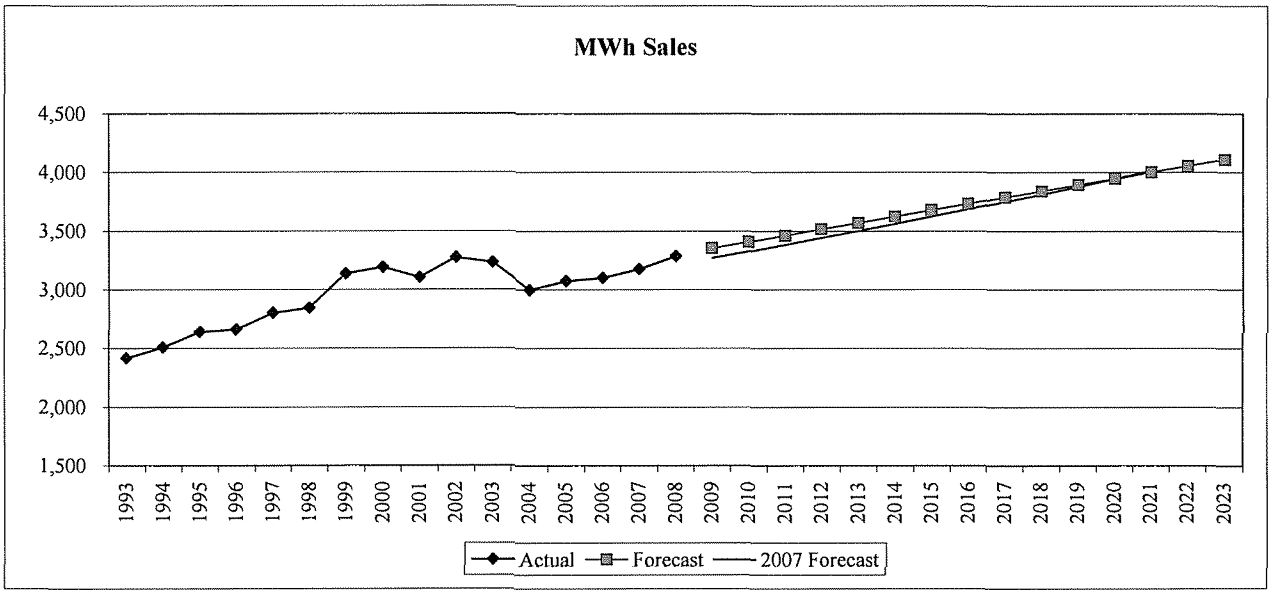
ANNUAL GROWTH RATES			
1993-1998	4.5%	3.3%	-1.1%
1998-2003	-1.8%	2.6%	4.5%
2003-2008	-9.9%	0.3%	11.3%
2008-2013	-0.6%	1.7%	2.3%
2013-2018	0.0%	1.5%	1.5%
2018-2023	0.0%	1.4%	1.4%
2008-2023	-0.2%	1.5%	1.7%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

STREET LIGHTING CLASSIFICATION





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

IRRIGATION CLASSIFICATION

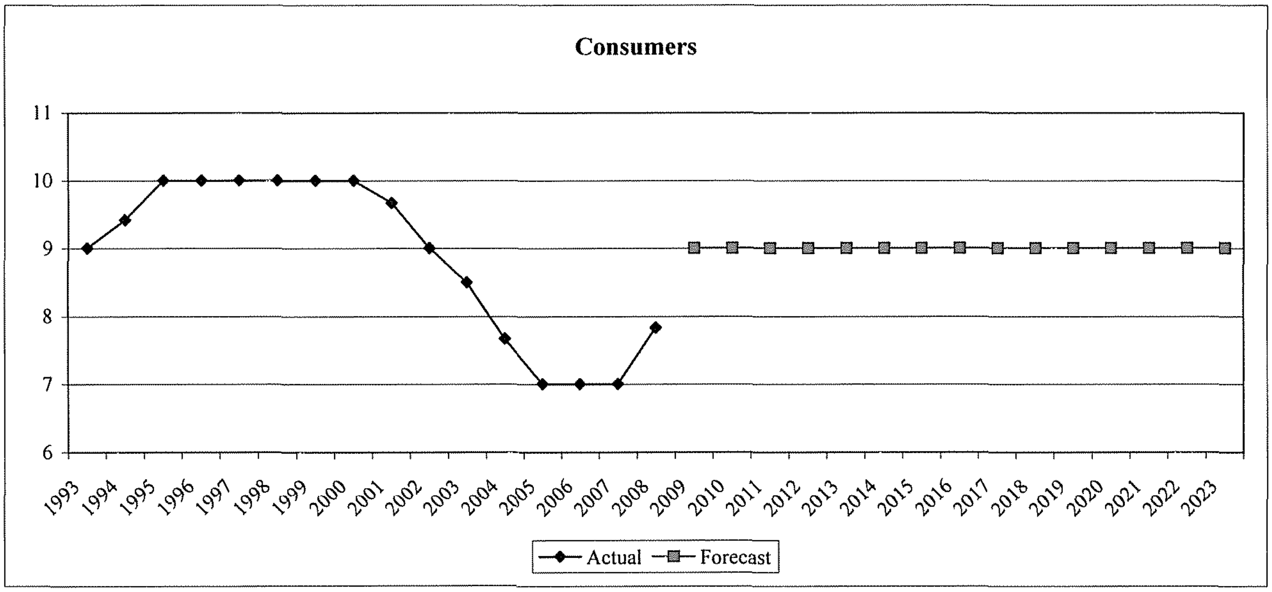
Year	Consumers	Percent Growth	Sales (MWh)	Percent Growth	Average Use (kWh/Cust/Mo)	Percent Growth
1993	9		78		724	
1994	9	4.6%	93	19.3%	826	14.0%
1995	10	6.2%	100	7.4%	835	1.1%
1996	10	0.0%	110	9.3%	913	9.3%
1997	10	0.0%	107	-2.6%	890	-2.6%
1998	10	0.0%	121	13.6%	1,010	13.6%
1999	10	0.0%	121	-0.2%	1,008	-0.2%
2000	10	0.0%	70	-42.0%	585	-42.0%
2001	10	-3.3%	75	6.5%	644	10.2%
2002	9	-6.9%	38	-49.1%	352	-45.4%
2003	9	-5.6%	113	196.9%	1,106	214.4%
2004	8	-9.8%	164	45.1%	1,780	60.9%
2005	7	-8.7%	114	-30.4%	1,356	-23.8%
2006	7	0.0%	65	-43.2%	770	-43.2%
2007	7	0.0%	1,068	1551.4%	12,715	1551.4%
2008	8	11.9%	432	-59.6%	4,594	-63.9%
2009	9	14.9%	179	-58.5%	1,660	-63.9%
2010	9	0.0%	179	0.0%	1,660	0.0%
2011	9	0.0%	179	0.0%	1,660	0.0%
2012	9	0.0%	179	0.0%	1,660	0.0%
2013	9	0.0%	179	0.0%	1,660	0.0%
2014	9	0.0%	179	0.0%	1,660	0.0%
2015	9	0.0%	179	0.0%	1,660	0.0%
2016	9	0.0%	179	0.0%	1,660	0.0%
2017	9	0.0%	179	0.0%	1,660	0.0%
2018	9	0.0%	179	0.0%	1,660	0.0%
2019	9	0.0%	179	0.0%	1,660	0.0%
2020	9	0.0%	179	0.0%	1,660	0.0%
2021	9	0.0%	179	0.0%	1,660	0.0%
2022	9	0.0%	179	0.0%	1,660	0.0%
2023	9	0.0%	179	0.0%	1,660	0.0%

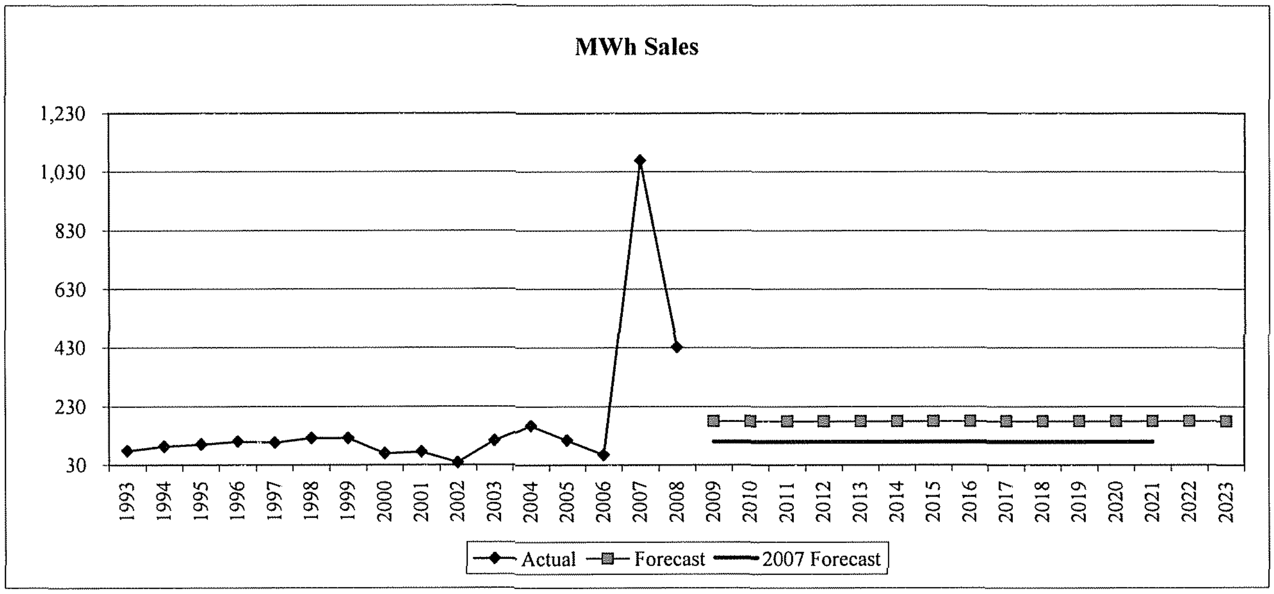
ANNUAL GROWTH RATES			
1993-1998	2.1%	9.2%	6.9%
1998-2003	-3.2%	-1.4%	1.8%
2003-2008	-1.6%	30.8%	32.9%
2008-2013	2.8%	-16.1%	-18.4%
2013-2018	0.0%	0.0%	0.0%
2018-2023	0.0%	0.0%	0.0%
2008-2023	0.9%	-5.7%	-6.6%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - BASE CASE

IRRIGATION CLASSIFICATION





Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Appendix C
Tables – Range Forecasts

Big Rivers
ELECTRIC CORPORATION
Your Touchstone Energy® Cooperative

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

TOTAL NATIVE REQUIREMENTS

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	ECONOMIC SCENARIOS Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	WEATHER SCENARIOS Mild (MWh)
1993	8,688,975				
1994	7,721,677				
1995	8,026,476				
1996	8,235,361				
1997	8,380,094				
1998	6,208,552				
1999	3,532,841				
2000	3,597,500				
2001	3,331,207				
2002	3,232,553				
2003	3,087,548				
2004	3,158,698				
2005	3,259,867				
2006	3,214,136				
2007	3,352,934				
2008	3,340,321				
2009	3,370,528	3,392,273	3,339,848	3,468,435	3,290,769
2010	3,402,682	3,435,601	3,361,776	3,501,368	3,322,259
2011	3,437,181	3,487,563	3,385,042	3,536,759	3,356,028
2012	3,471,646	3,543,964	3,409,469	3,572,132	3,389,725
2013	3,502,829	3,598,802	3,430,795	3,605,103	3,419,456
2014	3,538,605	3,657,194	3,455,461	3,642,053	3,454,256
2015	3,579,103	3,720,045	3,484,043	3,683,739	3,493,768
2016	3,619,282	3,783,080	3,512,356	3,724,964	3,533,071
2017	3,665,894	3,853,538	3,546,796	3,772,976	3,578,527
2018	3,711,715	3,923,783	3,580,362	3,820,050	3,623,307
2019	3,758,108	3,995,233	3,614,290	3,867,737	3,668,627
2020	3,799,014	4,061,500	3,642,774	3,909,897	3,708,496
2021	3,846,383	4,135,386	3,677,442	3,958,847	3,754,567
2022	3,891,544	4,207,549	3,710,325	4,005,386	3,798,593
2023	3,936,265	4,279,469	3,742,885	4,051,436	3,842,216

ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008					
2008-2013	1.0%	1.5%	0.5%	1.5%	0.5%
2013-2018	1.2%	1.7%	0.9%	1.2%	1.2%
2018-2023	1.2%	1.8%	0.9%	1.2%	1.2%
2008-2023	1.1%	1.7%	0.8%	1.3%	0.9%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

TOTAL SYSTEM CP DEMAND - SUMMER

Year	Base Case (kW)	ECONOMIC SCENARIOS Optimistic (kW)	ECONOMIC SCENARIOS Pessimistic (kW)	WEATHER SCENARIOS Extreme (kW)	WEATHER SCENARIOS Mild (kW)
1993					
1994					
1995	1,166,000				
1996	1,167,000				
1997	1,195,000				
1998	1,230,000				
1999	1,362,837				
2000	1,451,683				
2001	596,310				
2002	602,623				
2003	583,906				
2004	604,155				
2005	617,787				
2006	631,181				
2007	659,516				
2008	616,264				
2009	629,426	633,487	623,697	665,344	597,188
2010	633,577	639,707	625,961	669,621	601,216
2011	640,080	649,462	630,370	676,497	607,382
2012	646,576	660,044	634,995	683,368	613,543
2013	652,453	670,329	639,036	689,584	619,116
2014	659,196	681,288	643,707	696,715	625,511
2015	666,829	693,088	649,118	704,788	632,750
2016	674,402	704,923	654,478	712,798	639,932
2017	683,188	718,158	660,992	722,089	648,263
2018	691,824	731,351	667,341	731,223	656,453
2019	700,568	744,772	673,758	740,471	664,746
2020	708,278	757,215	679,149	748,626	672,057
2021	717,206	771,095	685,705	758,068	680,524
2022	725,718	784,649	691,923	767,071	688,597
2023	734,147	798,158	698,080	775,985	696,590

ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008					
2008-2013	1.1%	1.7%	0.7%	2.3%	0.1%
2013-2018	1.2%	1.8%	0.9%	1.2%	1.2%
2018-2023	1.2%	1.8%	0.9%	1.2%	1.2%
2008-2023	1.2%	1.7%	0.8%	1.5%	0.8%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

TOTAL SYSTEM CP DEMAND - WINTER

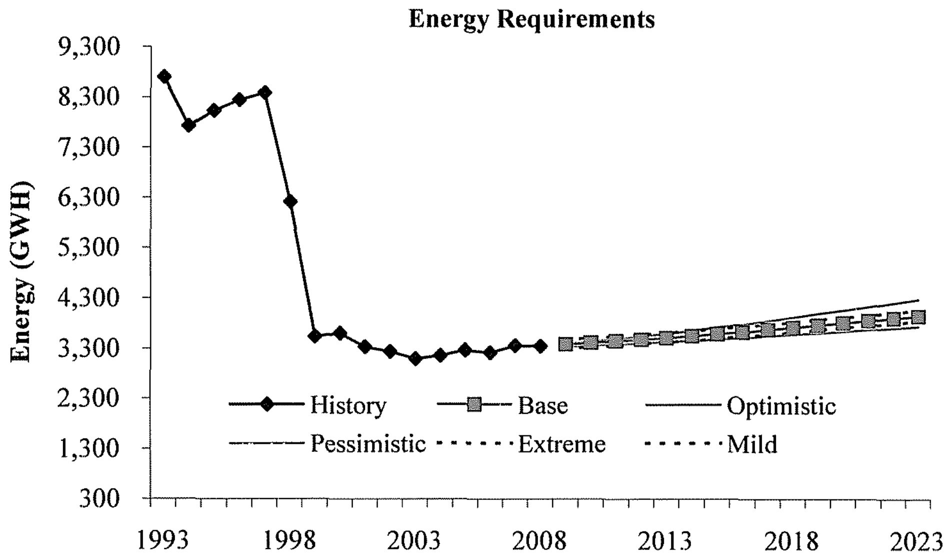
Year	Base Case (kW)	ECONOMIC SCENARIOS Optimistic (kW)	ECONOMIC SCENARIOS Pessimistic (kW)	WEATHER SCENARIOS Extreme (kW)	WEATHER SCENARIOS Mild (kW)
1993					
1994					
1995	1,080,000				
1996	1,154,000				
1997	1,156,000				
1998	1,123,000				
1999	1,188,715				
2000	1,289,470				
2001	614,496				
2002	530,467				
2003	585,549				
2004	539,476				
2005	562,082				
2006	555,303				
2007	610,090				
2008	618,676				
2009	636,844	640,952	631,047	694,303	588,168
2010	641,293	647,498	633,584	698,994	592,392
2011	648,050	657,549	638,220	706,384	598,616
2012	654,800	668,440	643,073	713,766	604,833
2013	660,907	679,015	647,316	720,446	610,458
2014	667,914	690,298	652,221	728,109	616,912
2015	675,846	702,460	657,895	736,784	624,218
2016	683,715	714,658	663,515	745,390	631,466
2017	692,844	728,308	670,335	755,374	639,874
2018	701,818	741,916	676,981	765,189	648,140
2019	710,904	755,760	683,699	775,127	656,509
2020	718,916	768,588	689,349	783,889	663,888
2021	728,193	782,907	696,209	794,035	672,433
2022	737,038	796,887	702,716	803,709	680,580
2023	745,796	810,822	709,157	813,289	688,647

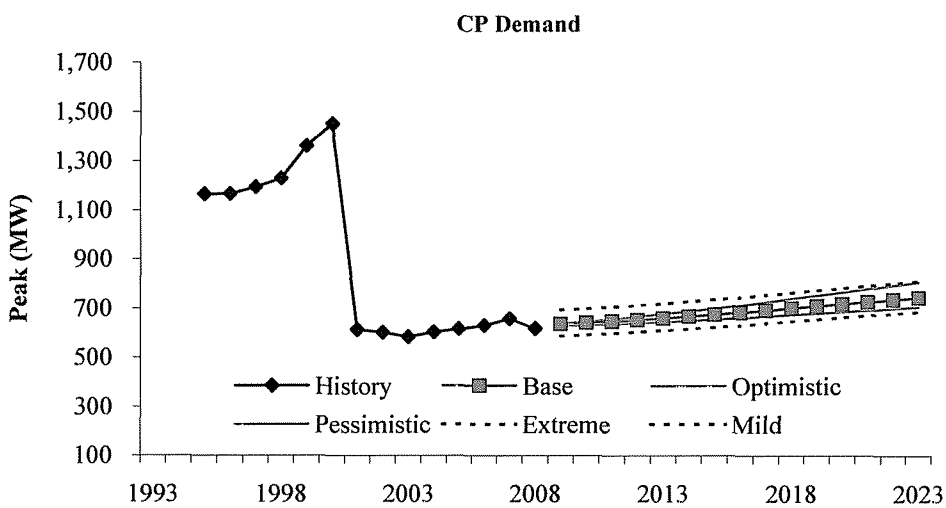
ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008					
2008-2013	1.3%	1.9%	0.9%	3.1%	-0.3%
2013-2018	1.2%	1.8%	0.9%	1.2%	1.2%
2018-2023	1.2%	1.8%	0.9%	1.2%	1.2%
2008-2023	1.3%	1.8%	0.9%	1.8%	0.7%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

TOTAL NATIVE REQUIREMENTS





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

RURAL SYSTEM REQUIREMENTS

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	ECONOMIC SCENARIOS Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	WEATHER SCENARIOS Mild (MWh)
1993					
1994					
1995	1,665,313				
1996	1,728,686				
1997	1,758,397				
1998	1,828,160				
1999	1,921,792				
2000	2,001,539				
2001	2,000,877				
2002	2,114,841				
2003	2,089,678				
2004	2,133,190				
2005	2,262,017				
2006	2,232,581				
2007	2,404,515				
2008	2,399,889				
2009	2,393,723	2,413,546	2,364,759	2,492,942	2,312,961
2010	2,425,627	2,456,773	2,386,277	2,525,623	2,344,201
2011	2,459,856	2,508,715	2,409,123	2,560,752	2,377,695
2012	2,494,052	2,565,166	2,433,147	2,595,864	2,411,116
2013	2,524,992	2,620,077	2,454,083	2,628,610	2,440,590
2014	2,560,489	2,678,484	2,478,303	2,665,292	2,475,104
2015	2,600,671	2,741,306	2,506,393	2,706,672	2,514,292
2016	2,640,536	2,804,319	2,534,219	2,747,593	2,553,275
2017	2,686,785	2,874,717	2,568,119	2,795,254	2,598,357
2018	2,732,249	2,944,913	2,601,151	2,841,982	2,642,771
2019	2,778,280	3,016,314	2,634,539	2,889,320	2,687,719
2020	2,818,867	3,082,577	2,662,528	2,931,172	2,727,259
2021	2,865,866	3,156,415	2,696,651	2,979,768	2,772,948
2022	2,910,675	3,228,539	2,729,015	3,025,967	2,816,613
2023	2,955,047	3,300,414	2,761,066	3,071,678	2,859,879

ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008	2.8%				
2008-2013	1.0%	1.8%	0.4%	1.8%	0.3%
2013-2018	1.6%	2.4%	1.2%	1.6%	1.6%
2018-2023	1.6%	2.3%	1.2%	1.6%	1.6%
2008-2023	1.4%	2.1%	0.9%	1.7%	1.2%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

RURAL SYSTEM CP DEMAND - SUMMER

Year	Base Case (kW)	ECONOMIC SCENARIOS Optimistic (kW)	ECONOMIC SCENARIOS Pessimistic (kW)	WEATHER SCENARIOS Extreme (kW)	WEATHER SCENARIOS Mild (kW)
1993					
1994					
1995	392,664				
1996	384,892				
1997	414,539				
1998	430,240				
1999	475,416				
2000	463,015				
2001	447,402				
2002	467,498				
2003	463,238				
2004	476,409				
2005	502,064				
2006	505,405				
2007	536,611				
2008	501,757				
2009	507,272	511,472	501,133	539,309	478,827
2010	513,332	519,923	505,004	545,705	484,585
2011	519,834	530,160	509,113	552,568	490,762
2012	526,330	541,338	513,477	559,424	496,933
2013	532,208	552,249	517,262	565,628	502,517
2014	538,951	563,787	521,652	572,745	508,922
2015	546,584	576,141	526,769	580,802	516,174
2016	554,157	588,529	531,844	588,795	523,367
2017	562,942	602,318	538,079	598,069	531,713
2018	571,579	616,067	544,153	607,185	539,917
2019	580,323	630,043	550,298	616,416	548,223
2020	588,033	643,044	555,420	624,555	555,546
2021	596,961	657,482	561,713	633,979	564,027
2022	605,473	671,594	567,684	642,965	572,112
2023	613,902	685,651	573,603	651,864	580,118

ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008	1.6%				
2008-2013	1.2%	1.9%	0.6%	2.4%	0.0%
2013-2018	1.4%	2.2%	1.0%	1.4%	1.4%
2018-2023	1.4%	2.2%	1.1%	1.4%	1.4%
2008-2023	1.4%	2.1%	0.9%	1.8%	1.0%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

RURAL SYSTEM CP DEMAND - WINTER

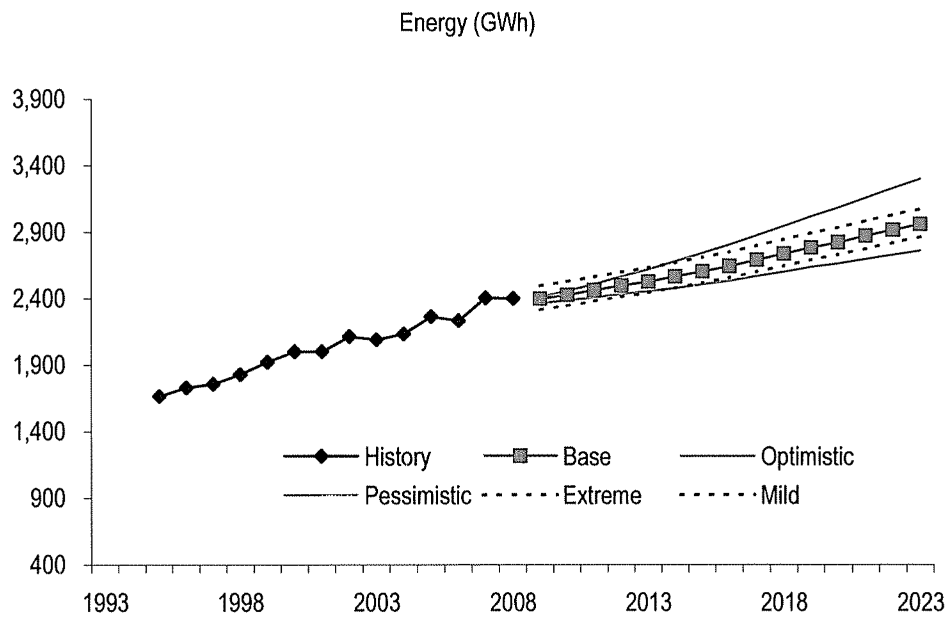
Year	Base Case (kW)	ECONOMIC SCENARIOS Optimistic (kW)	Pessimistic (kW)	WEATHER SCENARIOS Extreme (kW)	Mild (kW)
1993					
1994					
1995	339,440				
1996	386,504				
1997	380,454				
1998	376,868				
1999	397,189				
2000	385,384				
2001	429,854				
2002	385,501				
2003	466,551				
2004	434,995				
2005	448,485				
2006	438,620				
2007	493,267				
2008	516,082				
2009	521,766	526,087	515,452	576,838	476,293
2010	528,063	534,844	519,497	583,723	482,094
2011	534,820	545,443	523,789	591,111	488,317
2012	541,570	557,012	528,345	598,492	494,535
2013	547,677	568,301	532,297	605,170	500,160
2014	554,684	580,245	536,880	612,832	506,614
2015	562,615	593,040	542,220	621,506	513,919
2016	570,484	605,869	547,515	630,111	521,167
2017	579,613	620,156	554,014	640,095	529,575
2018	588,588	634,400	560,346	649,910	537,840
2019	597,674	648,881	566,752	659,847	546,208
2020	605,685	662,348	572,093	668,610	553,586
2021	614,962	677,309	578,652	678,757	562,130
2022	623,807	691,931	584,874	688,431	570,275
2023	632,566	706,496	591,042	698,011	578,341

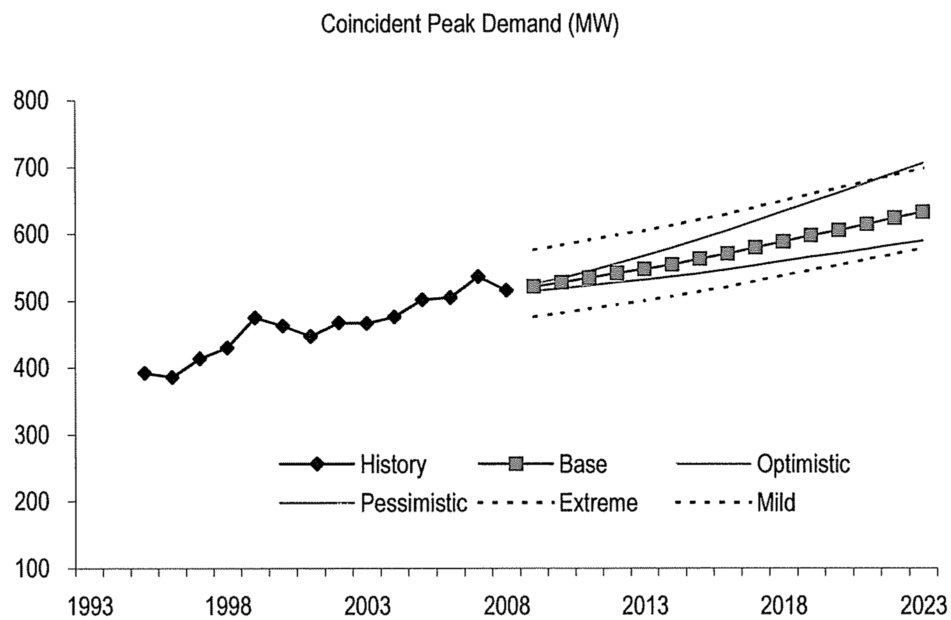
ANNUAL GROWTH RATES					
1993-1998					
1998-2003					
2003-2008	2.0%				
2008-2013	1.2%	1.9%	0.6%	3.2%	-0.6%
2013-2018	1.5%	2.2%	1.0%	1.4%	1.5%
2018-2023	1.5%	2.2%	1.1%	1.4%	1.5%
2008-2023	1.4%	2.1%	0.9%	2.0%	0.8%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

RURAL SYSTEM REQUIREMENTS





BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

RESIDENTIAL ENERGY SALES

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	Mild (MWh)
1993	1,052,301				
1994	1,040,652				
1995	1,101,490				
1996	1,144,623				
1997	1,137,995				
1998	1,199,476				
1999	1,215,474				
2000	1,264,194				
2001	1,286,139				
2002	1,371,067				
2003	1,340,451				
2004	1,362,667				
2005	1,452,182				
2006	1,415,359				
2007	1,534,506				
2008	1,529,478				
2009	1,532,007	1,532,511	1,522,796	1,610,598	1,467,493
2010	1,554,028	1,562,450	1,536,401	1,633,272	1,488,959
2011	1,572,789	1,592,583	1,547,119	1,652,636	1,507,225
2012	1,592,872	1,627,546	1,560,706	1,673,378	1,526,746
2013	1,610,370	1,661,523	1,571,886	1,692,230	1,543,146
2014	1,630,346	1,696,937	1,584,354	1,713,048	1,562,420
2015	1,653,291	1,735,036	1,599,036	1,736,838	1,584,658
2016	1,675,448	1,772,818	1,612,989	1,759,711	1,606,208
2017	1,703,587	1,817,530	1,632,633	1,788,899	1,633,475
2018	1,730,837	1,861,898	1,651,314	1,817,072	1,659,953
2019	1,758,431	1,907,206	1,670,144	1,845,622	1,686,748
2020	1,780,719	1,947,488	1,683,721	1,868,787	1,708,307
2021	1,808,999	1,994,857	1,703,029	1,898,254	1,735,608
2022	1,835,124	2,040,515	1,720,597	1,925,385	1,760,899
2023	1,860,804	2,085,895	1,737,844	1,952,029	1,785,779

ANNUAL GROWTH RATES					
1993-1998	2.7%				
1998-2003	2.2%				
2003-2008	2.7%				
2008-2013	1.0%	1.7%	0.5%	2.0%	0.2%
2013-2018	1.5%	2.3%	1.0%	1.4%	1.5%
2018-2023	1.5%	2.3%	1.0%	1.4%	1.5%
2008-2023	1.3%	2.1%	0.9%	1.6%	1.0%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

SMALL COMMERCIAL ENERGY SALES

	Base	ECONOMIC SCENARIOS		WEATHER SCENARIOS	
	Case	Optimistic	Pessimistic	Extreme	Mild
Year	(MWh)	(MWh)	(MWh)	(MWh)	(MWh)
1993					
1994					
1995	448,782				
1996	466,450				
1997	502,803				
1998	513,762				
1999	591,594				
2000	613,100				
2001	602,412				
2002	627,652				
2003	637,787				
2004	659,726				
2005	695,491				
2006	708,219				
2007	753,591				
2008	749,573				
2009	742,024	746,829	737,219	757,855	729,681
2010	750,285	757,875	744,087	766,203	737,866
2011	764,031	777,035	755,118	780,201	751,408
2012	776,424	795,656	764,401	792,806	763,625
2013	788,300	813,793	773,151	805,046	775,205
2014	802,035	833,819	783,738	819,066	788,707
2015	817,260	855,361	795,796	834,586	803,694
2016	832,973	877,402	808,334	850,587	819,174
2017	848,778	899,539	820,961	866,686	834,741
2018	864,724	921,825	833,726	882,913	850,461
2019	880,869	944,319	846,682	899,344	866,373
2020	897,137	966,949	859,756	915,940	882,376
2021	913,514	989,698	872,934	932,648	898,487
2022	929,962	1,012,523	886,178	949,412	914,679
2023	946,437	1,035,386	899,446	966,198	930,903

ANNUAL GROWTH RATES					
1993-1998					
1998-2003	4.4%				
2003-2008	3.3%				
2008-2013	1.0%	1.7%	0.6%	1.4%	0.7%
2013-2018	1.9%	2.5%	1.5%	1.9%	1.9%
2018-2023	1.8%	2.4%	1.5%	1.8%	1.8%
2008-2023	1.6%	2.2%	1.2%	1.7%	1.5%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

LARGE INDUSTRIAL - DIRECT SERVE CUSTOMERS

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	ECONOMIC SCENARIOS Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	WEATHER SCENARIOS Mild (MWh)
1993					
1994					
1995	6,296,122				
1996	6,317,276				
1997	6,368,964				
1998	6,603,458				
1999	7,150,766				
2000	5,478,358				
2001	1,300,686				
2002	1,118,264				
2003	1,022,803				
2004	1,001,791				
2005	981,086				
2006	963,691				
2007	926,769				
2008	933,580				
2009	950,515	966,098	934,931	950,515	950,515
2010	950,515	966,173	934,856	950,515	950,515
2011	950,515	966,249	934,781	950,515	950,515
2012	950,515	966,325	934,705	950,515	950,515
2013	950,515	966,402	934,627	950,515	950,515
2014	950,515	966,480	934,549	950,515	950,515
2015	950,515	966,559	934,471	950,515	950,515
2016	950,515	966,638	934,391	950,515	950,515
2017	950,515	966,719	934,311	950,515	950,515
2018	950,515	966,800	934,230	950,515	950,515
2019	950,515	966,881	934,148	950,515	950,515
2020	950,515	966,964	934,065	950,515	950,515
2021	950,515	967,048	933,982	950,515	950,515
2022	950,515	967,132	933,898	950,515	950,515
2023	950,515	967,217	933,812	950,515	950,515

ANNUAL GROWTH RATES					
1993-1998					
1998-2003	-31.1%				
2003-2008	-1.8%				
2008-2013	0.4%	0.7%	0.0%	0.4%	0.4%
2013-2018	0.0%	0.0%	0.0%	0.0%	0.0%
2018-2023	0.0%	0.0%	0.0%	0.0%	0.0%
2008-2023	0.1%	0.2%	0.0%	0.1%	0.1%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

STREET LIGHTING ENERGY SALES

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	ECONOMIC SCENARIOS Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	WEATHER SCENARIOS Mild (MWh)
1993	2,417				
1994	2,509				
1995	2,641				
1996	2,661				
1997	2,802				
1998	2,846				
1999	3,138				
2000	3,191				
2001	3,104				
2002	3,277				
2003	3,235				
2004	2,997				
2005	3,077				
2006	3,104				
2007	3,175				
2008	3,287				
2009	3,352	3,499	3,206	3,352	3,352
2010	3,406	3,556	3,257	3,406	3,406
2011	3,460	3,612	3,309	3,460	3,460
2012	3,514	3,668	3,360	3,514	3,514
2013	3,568	3,725	3,412	3,568	3,568
2014	3,622	3,781	3,464	3,622	3,622
2015	3,676	3,838	3,515	3,676	3,676
2016	3,730	3,894	3,567	3,730	3,730
2017	3,784	3,950	3,618	3,784	3,784
2018	3,838	4,007	3,670	3,838	3,838
2019	3,892	4,063	3,722	3,892	3,892
2020	3,946	4,120	3,773	3,946	3,946
2021	4,000	4,176	3,825	4,000	4,000
2022	4,054	4,233	3,876	4,054	4,054
2023	4,108	4,289	3,928	4,108	4,108

ANNUAL GROWTH RATES					
1993-1998	3.3%				
1998-2003	2.6%				
2003-2008	0.3%				
2008-2013	1.7%	2.5%	0.7%	1.7%	1.7%
2013-2018	1.5%	1.5%	1.5%	1.5%	1.5%
2018-2023	1.4%	1.4%	1.4%	1.4%	1.4%
2008-2023	1.5%	1.8%	1.2%	1.5%	1.5%

BIG RIVERS ELECTRIC CORPORATION

2009 LONG-TERM LOAD FORECAST - RANGE FORECASTS

IRRIGATION ENERGY SALES

Year	Base Case (MWh)	ECONOMIC SCENARIOS Optimistic (MWh)	Pessimistic (MWh)	WEATHER SCENARIOS Extreme (MWh)	Mild (MWh)
1993	78				
1994	93				
1995	100				
1996	110				
1997	107				
1998	121				
1999	121				
2000	70				
2001	75				
2002	38				
2003	113				
2004	164				
2005	114				
2006	65				
2007	1,068				
2008	432				
2009	179	188	170	197	161
2010	179	188	170	197	161
2011	179	188	170	197	161
2012	179	188	170	197	161
2013	179	188	170	197	161
2014	179	188	170	197	161
2015	179	188	170	197	161
2016	179	188	170	197	161
2017	179	188	170	197	161
2018	179	188	170	197	161
2019	179	188	170	197	161
2020	179	188	170	197	161
2021	179	188	170	197	161
2022	179	188	170	197	161
2023	179	188	170	197	161

ANNUAL GROWTH RATES					
1993-1998	9.2%				
1998-2003	-1.4%				
2003-2008	30.8%				
2008-2013	-16.1%	-15.3%	-17.0%	-14.5%	-17.9%
2013-2018	0.0%	0.0%	0.0%	0.0%	0.0%
2018-2023	0.0%	0.0%	0.0%	0.0%	0.0%
2008-2023	-5.7%	-5.4%	-6.0%	-5.1%	-6.4%

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Appendix D
Econometric Model Specifications

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL SUMMER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Summer CP Demand

Model Type: Econometric

Model Specification:

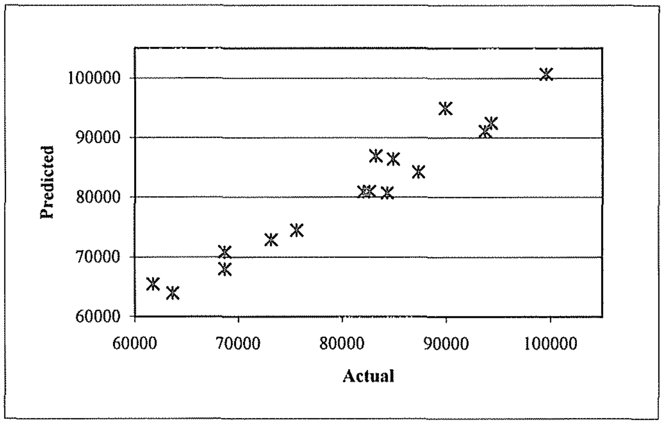
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	(62,732)	27,736	(2.3)	4.49%
Rural_kWh	Rural kWh Purchased	0.1720	0.0110	15.3	0.00%
Max_Temp	Maximum Temperature	806.470	270.400	3.0	1.25%

Summary Model Statistics:

R-Squared	0.948
Adjusted R-Squared	0.94
Durbin-Watson Statistic	1.239
Mean Abs. % Err. (MAPE)	2.59%

Adjusted Observations	16
Deg. of Freedom for Error	13
F-Statistic	118
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	16.16
Model Sum of Squares	1,800,021,403
Sum of Squared Errors	99,176,200
Mean Squared Error	7,628,938.48
Std. Error of Regression	2,762.05
Mean Abs. Dev. (MAD)	2,103.87

Predicted vs. Actual



MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL WINTER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Winter CP Demand

Model Type: Econometric

Model Specification:

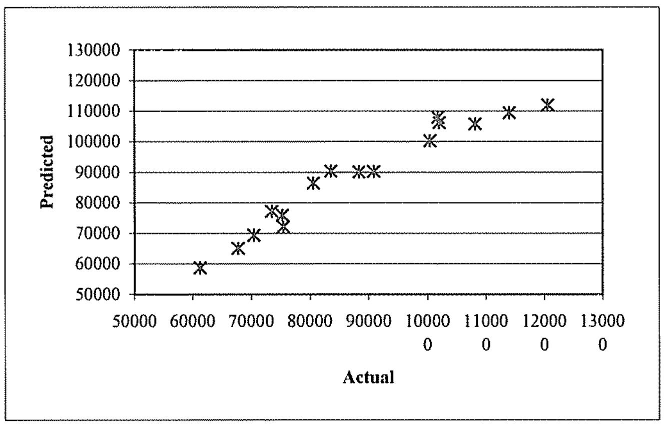
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	(15,791)	7,566	(2.1)	6.10%
Rural_kWh	Rural kWh Purchased	0.2760	0.0200	13.9	0.00%
Min_Temp	Minimum Temperature	(387.092)	188.731	(2.1)	6.49%

Summary Model Statistics:

R-Squared	0.941
Adjusted R-Squared	0.932
Durbin-Watson Statistic	0.954
Mean Abs. % Err. (MAPE)	3.87%

Adjusted Observations	16
Deg. of Freedom for Error	13
F-Statistic	104
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	17.20
Model Sum of Squares	4,465,560,024
Sum of Squared Errors	280,013,606
Mean Squared Error	21,539,508.15
Std. Error of Regression	4,641.07
Mean Abs. Dev. (MAD)	3,460.32

Predicted vs. Actual



MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Residential Consumers

Model Type: Econometric

Model Specification:

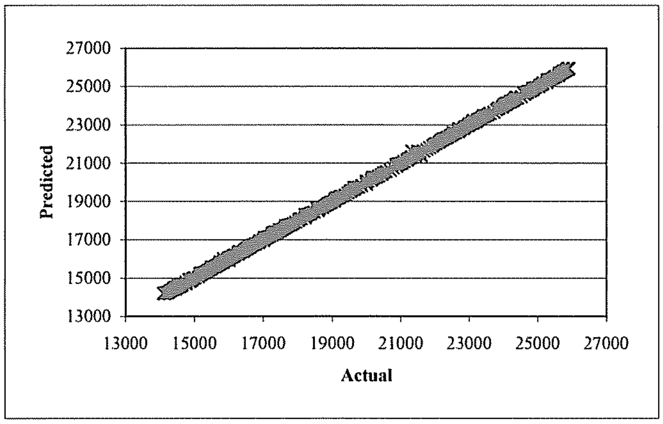
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	926,602	21,711,005	0.0	96.60%
HH	Households	312.252	143.943	2.2	3.08%
AR	Autoregressive Term	1.000	0.001	1,364.3	0.00%

Summary Model Statistics:

R-Squared	1
Adjusted R-Squared	1
Durbin-Watson Statistic	1.845
Mean Abs. % Err. (MAPE)	0.16%

Adjusted Observations	347
Deg. of Freedom for Error	344
F-Statistic	1,370,859
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	7.49
Model Sum of Squares	4,711,840,114
Sum of Squared Errors	591,189
Mean Squared Error	1,718.57
Std. Error of Regression	41.46
Mean Abs. Dev. (MAD)	30.60

Predicted vs. Actual



MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL USE - LONG-TERM FORECAST

Dependent Variable: Residential Use

Model Type: Econometric

Model Specification:

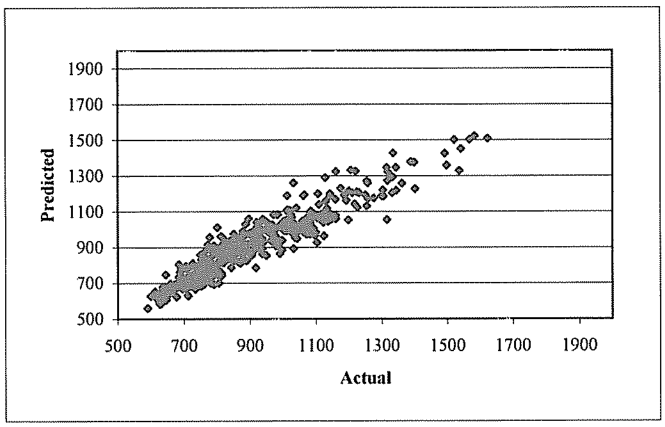
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(275.71)	37	(7.4)	0.00%
SAEData.Base_Index	Base Index	894.155	42.647	21.0	0.00%
SAEData.SH_Index	Space Heating Index	14.373	0.738	19.5	0.00%
SAEData.AC_Index	Air Conditioning Index	23.144	1.160	19.9	0.00%
RUSE_LT.Expr1	Lag of Space Heating Index	13.535	0.733	18.474	0.00%
RUSE_LT.Expr2	Lag of Air Conditioning Index	15.45	1.164	13.277	0.00%

Summary Model Statistics:

R-Squared	0.881
Adjusted R-Squared	0.879
Durbin-Watson Statistic	1.782
Mean Abs. % Err. (MAPE)	6.05%

Adjusted Observations	347
Deg. of Freedom for Erroı	341
F-Statistic	503
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	8.65
Model Sum of Squares	13,161,009
Sum of Squared Errors	1,785,059
Mean Squared Error	5,234.78
Std. Error of Regression	72.35
Mean Abs. Dev. (MAD)	56.33

Predicted vs. Actual



MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL COMMERCIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Small Commercial Consumers

Model Type: Econometric

Model Specification:

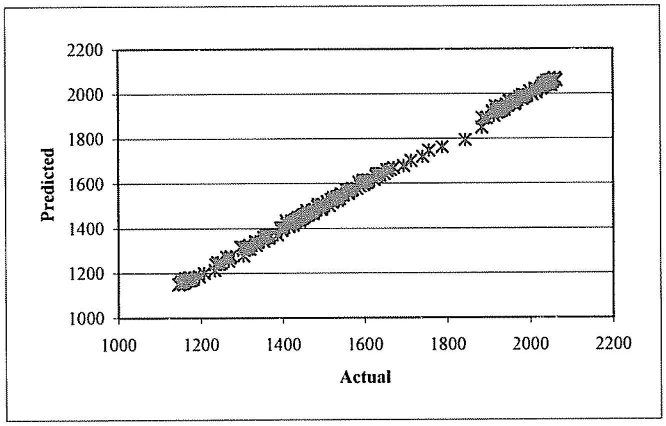
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(5)	6	(0.9)	35.20%
Monthly.EmpHHIndex	Employment per Household	1.395	0.829	1.7	9.35%
SCON_LT.LagDep(1)	Lag of Dependent Variable	0.991	0.006	164.895	0.00%

Summary Model Statistics:

R-Squared	0.999
Adjusted R-Squared	0.999
Durbin-Watson Statistic	1.753
Mean Abs. % Err. (MAPE)	0.40%

Adjusted Observations	299
Deg. of Freedom for Error	296
F-Statistic	152,414
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	4.35
Model Sum of Squares	22,556,441
Sum of Squared Errors	21,903
Mean Squared Error	74.00
Std. Error of Regression	8.60
Mean Abs. Dev. (MAD)	6.18

Predicted vs. Actual



MEADE COUNTY RECC

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL COMMERCIAL USE - LONG-TERM FORECAST

Dependent Variable: Small Commercial Use

Model Type: Econometric

Model Specification:

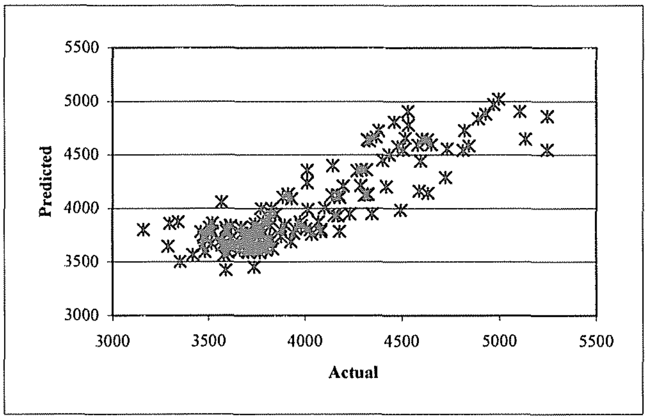
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	293	870	0.3	73.72%
Monthly.RetSalespEmp	Retail Sales per Employment	125.624	51.203	2.5	1.54%
CommData.HDD	Heating Degree Days	0	0	1.6	10.43%
CommData.CDD	Cooling Degree Days	1	0	5.4	0.00%
SCUSE_LT.Expr1	Lag of Heating Degree Days	0	0	2.8	0.62%
SCUSE_LT.Expr2	Lag of Cooling Degree Days	2	0	5.2	0.00%
SCUSE_LT.LagDep(1)	Lag of Dependent Variable	0	0	3.7	0.03%

Summary Model Statistics:

R-Squared	0.752
Adjusted R-Squared	0.741
Durbin-Watson Statistic	1.967
Mean Abs. % Err. (MAPE)	4.44%

Adjusted Observations	143
Deg. of Freedom for Error	136
F-Statistic	69
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	11.08
Model Sum of Squares	2.22E+07
Sum of Squared Errors	7,299,128
Mean Squared Error	53,670.06
Std. Error of Regression	231.67
Mean Abs. Dev. (MAD)	176.99

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL SUMMER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Summer CP Demand

Model Type: Econometric

Model Specification:

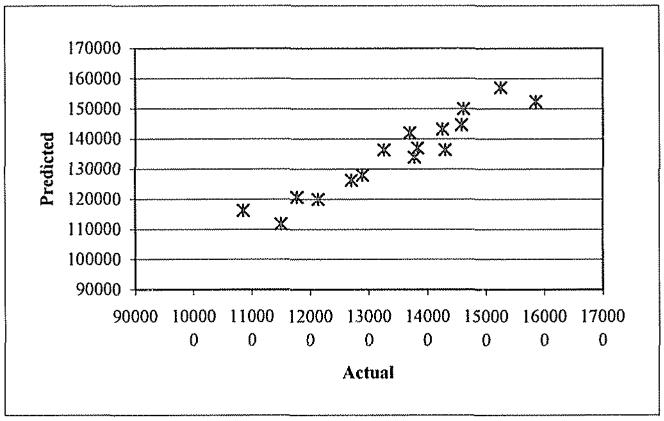
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	(48,180.2210)	86,889.4990	(0.5540)	0.5903
Jackson1.kwh_purc	Rural Energy Purchases	0.2060	0.0240	8.6890	-
Jackson.MAXTMP	Maximum Temperature	654.4270	786.0000	0.8330	0.4228

Summary Model Statistics:

R-Squared	0.91200000
Adjusted R-Squared	0.89900000
Durbin-Watson Statistic	2.58000000
Mean Abs. % Err. (MAPE)	2.55%

Adjusted Observations	16
Deg. of Freedom for Error	13
F-Statistic	68
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	17.11
Model Sum of Squares	2,673,534,480
Sum of Squared Errors	256,517,731
Mean Squared Error	19,732,133.12
Std. Error of Regression	4,442.09
Mean Abs. Dev. (MAD)	3,394.89

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL WINTER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Winter CP Demand

Model Type: Econometric

Model Specification:

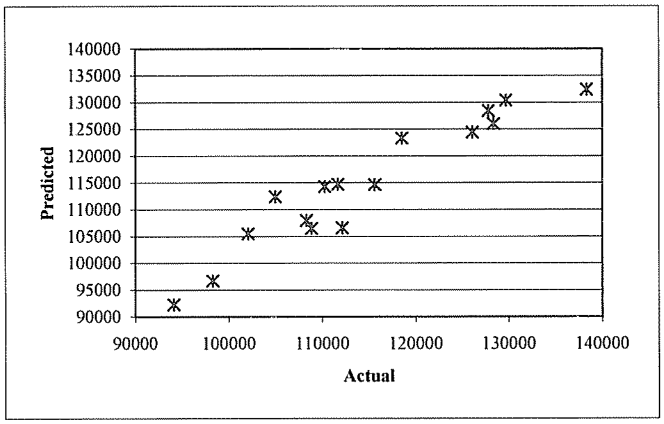
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	7,903	9,220	0.9	40.96%
Jackson1.kwh_purc	Rural Energy Purchases	0.187	0.016	11.6	0.00%
Jackson.MINTMP	Minimum Temperature	-475.206	151.374	-3.139	0.009

Summary Model Statistics:

R-Squared	0.914
Adjusted R-Squared	0.9
Durbin-Watson Statistic	1.934
Mean Abs. % Err. (MAPE)	2.58%

Adjusted Observations	16
Deg. of Freedom for Error	13
F-Statistic	69
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	16.87
Model Sum of Squares	2,139,031,347
Sum of Squared Errors	201,890,035
Mean Squared Error	15,530,002.68
Std. Error of Regression	3,940.81
Mean Abs. Dev. (MAD)	2,918.39

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Residential Consumers

Model Type: Econometric

Model Specification:

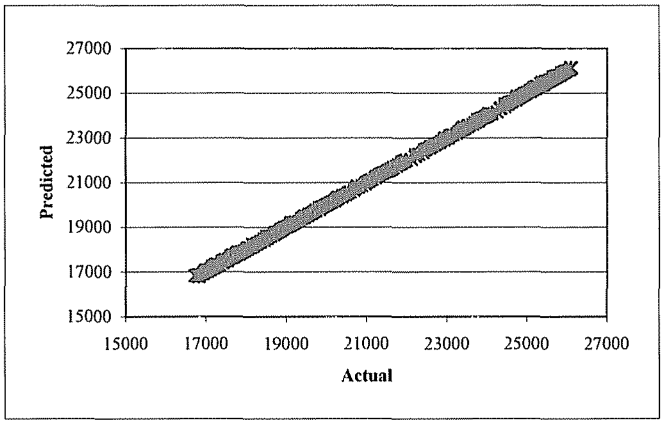
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	1,528,370.37	76,368,364.68	0.02	98.40%
ResData.HH	Number of Households	364.97	152.91	2.39	1.75%
AR(1)	Autoregressive parameter	1.00	0.00	1,391.23	0.00%

Summary Model Statistics:

R-Squared	1
Adjusted R-Squared	1
Durbin-Watson Statistic	1.692
Mean Abs. % Err. (MAPE)	0.12%

Adjusted Observations	347
Deg. of Freedom for Error	344
F-Statistic	1,606,106
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	6.99
Model Sum of Squares	3,349,207,599
Sum of Squared Errors	358,671
Mean Squared Error	1,042.65
Std. Error of Regression	32.29
Mean Abs. Dev. (MAD)	25.13

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL USE - LONG-TERM FORECAST

Dependent Variable: Residential Use

Model Type: Econometric

Model Specification:

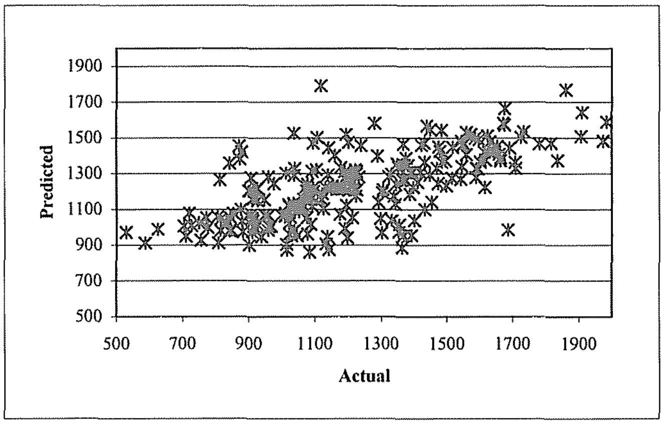
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
INT	Intercept	160.87	208	0.8	44.11%
MetrixND1.Base_Indx	Base Index	655.605	223.588	2.9	0.37%
MetrixND1.SH_Indx	Space Heating Index	23.349	2.184	10.7	0.00%
MetrixND1.AC_Indx	Air Conditioning Index	50.215	4.033	12.5	0.00%

Summary Model Statistics:

R-Squared	0.426
Adjusted R-Squared	0.418
Durbin-Watson Statistic	1.533
Mean Abs. % Err. (MAPE)	15.99%

Adjusted Observations	228
Deg. of Freedom for Error	224
F-Statistic	55
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	10.95
Model Sum of Squares	8,732,834
Sum of Squared Errors	11,786,841
Mean Squared Error	52,619.82
Std. Error of Regression	229.39
Mean Abs. Dev. (MAD)	181.94

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL COMMERCIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Small Commercial Consumers

Model Type: Econometric

Model Specification:

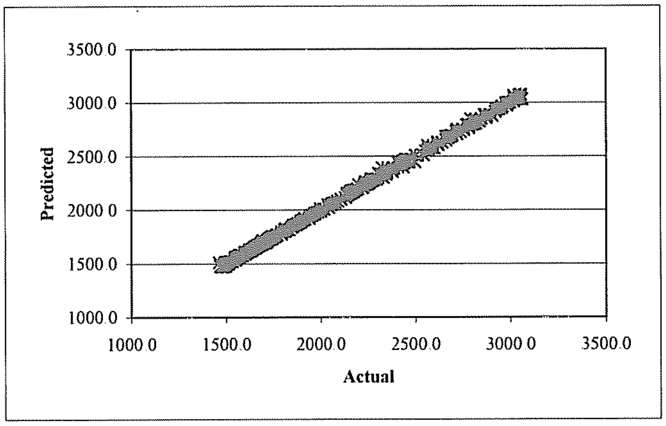
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(6.78800)	10.55100	(0.64300)	0.52050
CommData.Empl	Employment	0.37300	0.54700	0.68300	0.49550
SCON_LT.LagDep(1)	Lag Dependent Variable	1.00000	0.00400	234.44900	-

Summary Model Statistics:

R-Squared	0.999
Adjusted R-Squared	0.999
Durbin-Watson Statistic	2.342
Mean Abs. % Err. (MAPE)	0.42%

Adjusted Observations	275
Deg. of Freedom for Error	272
F-Statistic	182,027
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	5.19
Model Sum of Squares	61,814,632
Sum of Squared Errors	46,184
Mean Squared Error	169.79
Std. Error of Regression	13.03
Mean Abs. Dev. (MAD)	9.21

Predicted vs. Actual



JACKSON PURCHASE ENERGY CORPORATION

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL USE ENERGY - LONG-TERM FORECAST

Dependent Variable: Small Commercial Use

Model Type: Econometric

Model Specification:

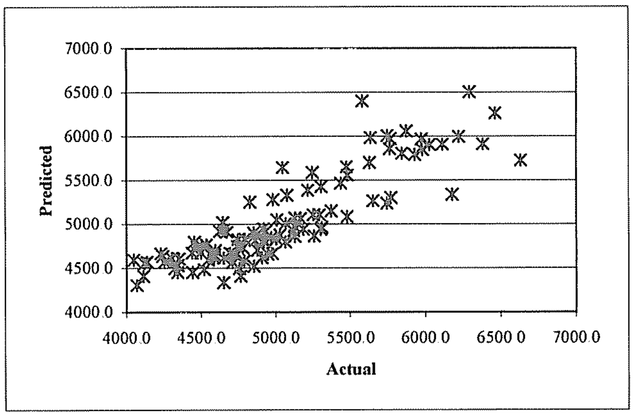
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	2,663	1,474	1.8	7.38%
Monthly.RetSalespEmp	Retail Sales per Employment	20.742	66.271	0.3	75.49%
CommData.HDD	Heating Degree Days	0.615	0.125	4.9	0.00%
CommData.CDD	Cooling Degree Days	3.012	0.321	9.4	0.00%
SCUSE_LT.LagDep(12)	Lag Dependent Variable	0.261	0.053	5.0	0.00%

Summary Model Statistics:

R-Squared	0.768
Adjusted R-Squared	0.759
Durbin-Watson Statistic	2.229
Mean Abs. % Err. (MAPE)	4.41%

Adjusted Observations	108
Deg. of Freedom for Error	103
F-Statistic	85
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	11.50
Model Sum of Squares	2.84E+07
Sum of Squared Errors	8.57E+06
Mean Squared Error	8.32E+04
Std. Error of Regression	288.37
Mean Abs. Dev. (MAD)	221.80

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL SUMMER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Summer CP Demand

Model Type: Econometric

Model Specification:

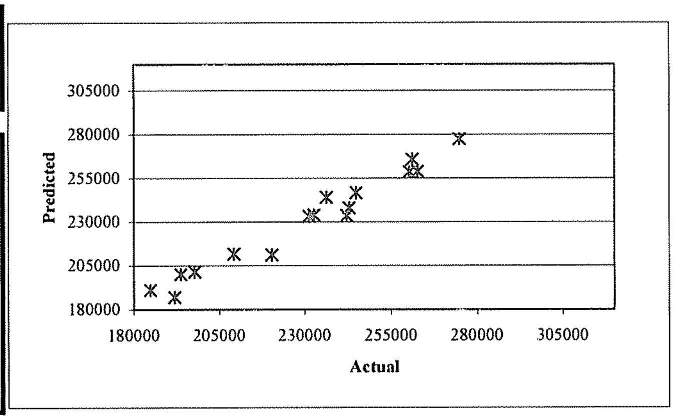
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(169,924)	58,482	(2.9)	1.43%
Rural_kWh	Rural System Energy Purchases	0.202	0.011	18.9	0.00%
Max_Temp	Maximum Temperature	1,992.227	557.711	3.6	0.44%

Summary Model Statistics:

R-Squared	0.965
Adjusted R-Squared	0.96
Durbin-Watson Statistic	1.66
Mean Abs. % Err. (MAPE)	1.96%

Adjusted Observations	16
Deg. of Freedom for Error	13
F-Statistic	181
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	17.59
Model Sum of Squares	11,474,058,266
Sum of Squared Errors	412,799,557
Mean Squared Error	31,753,812.04
Std. Error of Regression	5,635.05
Mean Abs. Dev. (MAD)	4,368.81

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RURAL WINTER COINCIDENT PEAK DEMAND - LONG-TERM FORECAST

Dependent Variable: Rural Winter CP Demand

Model Type: Econometric

Model Specification:

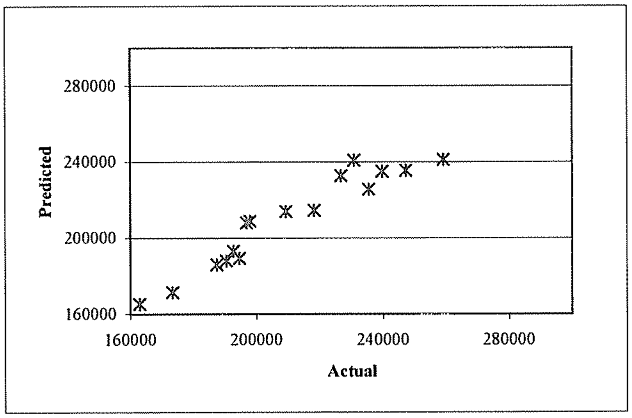
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	20,246	16,212	1.2	24.02%
Rural_kWh	Rural System Energy Purchases	0.1850	0.0160	11.6	0.00%
Min_Temp	Minimum Temperature	(833.987)	311.895	(2.7)	2.33%

Summary Model Statistics:

R-Squared	0.919
Adjusted R-Squared	0.905
Durbin-Watson Statistic	2.224
Mean Abs. % Err. (MAPE)	2.71%

Adjusted Observations	15
Deg. of Freedom for Error	12
F-Statistic	68
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	18.23
Model Sum of Squares	8,151,439,420
Sum of Squared Errors	718,509,866
Mean Squared Error	59,875,822.16
Std. Error of Regression	7,737.95
Mean Abs. Dev. (MAD)	5,803.49

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Residential Consumers

Model Type: Econometric

Model Specification:

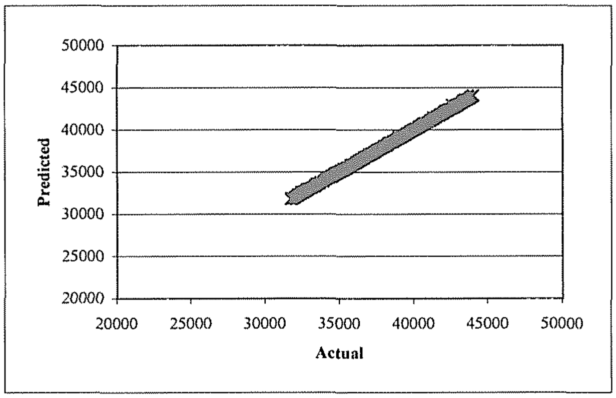
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(1,206)	592	(2.0)	4.24%
ResData.HH	Households	53.835	24.108	2.2	2.62%
Monthly_Indicators.D_HH	Binary Variable for Households	(63.821)	35.179	(1.8)	7.05%
RCON_LT.LagDep(1)	Lag of Households	0.967	0.014	67.76	0

Summary Model Statistics:

R-Squared	0.999
Adjusted R-Squared	0.999
Durbin-Watson Statistic	1.516
Mean Abs. % Err. (MAPE)	0.12%

Adjusted Observations	347
Deg. of Freedom for Error	343
F-Statistic	182,654
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	9.53
Model Sum of Squares	7,165,195,693
Sum of Squared Errors	4,485,087
Mean Squared Error	13,076.06
Std. Error of Regression	114.35
Mean Abs. Dev. (MAD)	49.03

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

RESIDENTIAL USE - LONG-TERM FORECAST

Dependent Variable: Residential Use

Model Type: Statistically Adjusted End-Use

Model Specification:

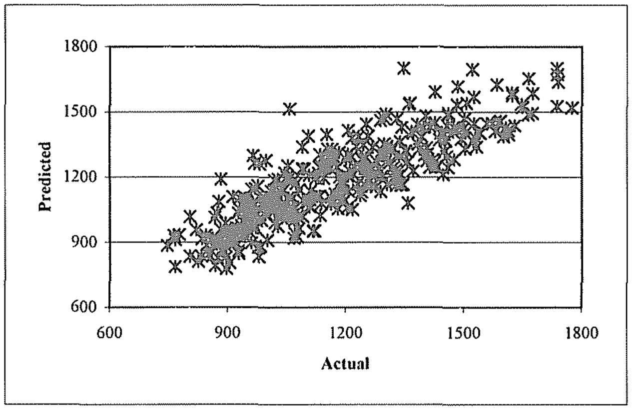
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	(151)	70	(2.2)	3.17%
SAEData.Base_Indx	Base Index	985	80	12.4	0.00%
SAEData.SH_Indx	Space Heating Index	12.606	1.313	9.6	0.00%
SAEData.AC_Indx	Air Conditioning Index	31.219	2.134	14.6	0.00%
RUSE_LT.Expr1	Lag of Space Heating Index	14.418	1.303	11.1	0.00%
RUSE_LT.Expr2	Lag of Air Conditioning Index	19.934	2.141	9.311	0

Summary Model Statistics:

R-Squared	0.710
Adjusted R-Squared	0.706
Durbin-Watson Statistic	1.365
Mean Abs. % Err. (MAPE)	8.15%

Adjusted Observations	347
Deg. of Freedom for Error	341
F-Statistic	167
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	9.86
Model Sum of Squares	14,683,118
Sum of Squared Errors	5,987,041
Mean Squared Error	17,557
Std. Error of Regression	133
Mean Abs. Dev. (MAD)	96.97

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL COMMERCIAL CONSUMERS - LONG-TERM FORECAST

Dependent Variable: Small Commercial Consumers

Model Type: Econometric

Model Specification:

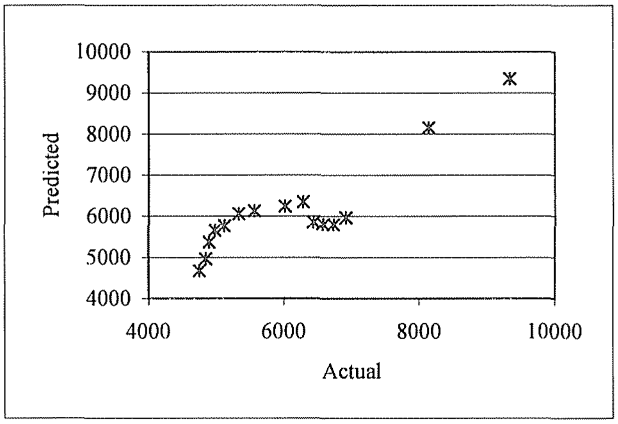
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	13,430	15,350	0.9	38.29%
Monthly.EmpHHIndex	Employment per Household	16	83	0.2	85.06%
Monthly.Reclass	Binary variable	1,836	46	39.9	0.00%
AR(1)	Autoregressive Parameter	0.998	0.004	241.7	0.00%

Summary Model Statistics:

R-Squared	0.801445276
Adjusted R-Squared	0.747293988
Durbin-Watson Statistic	0.379117122
Mean Abs. % Err. (MAPE)	7.77%

Adjusted Observations	15
Deg. of Freedom for Error	11
F-Statistic	15
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	13.39
Model Sum of Squares	19,248,329
Sum of Squared Errors	4,768,693
Mean Squared Error	433,517.56
Std. Error of Regression	658.42
Mean Abs. Dev. (MAD)	453.72

Predicted vs. Actual



KENERGY CORP.

2009 LOAD FORECAST

MODEL SPECIFICATIONS

SMALL COMMERCIAL ENERGY - LONG-TERM FORECAST

Dependent Variable: Small Commercial Energy

Model Type: Econometric

Model Specification:

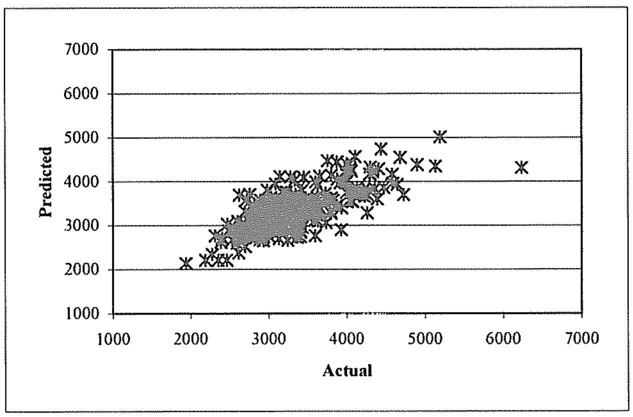
Variable	Description	Value	Standard Err.	t-Statistic	p-Value
CONST	Intercept	1,167	852	1.4	17.16%
Monthly.RetSalespEmp	Gross regional product	87	51	1.7	9.27%
CommData.HDD	Heating Degree Days	1	0	8.3	0.00%
CommData.CDD	Cooling Degree Days	3	0	12.0	0.00%
CommData.d7	Binary Variable July	(531)	141	(3.8)	0.02%
CommData.d8	Binary Variable August	(408)	157	(2.6)	0.99%
CommData.d9	Binary Variable September	239	159	1.5	13.35%
CommData.d10	Binary Variable October	599	155	3.9	0.01%
CommData.d11	Binary Variable November	547	131	4.2	0.00%
CommData.BAD	Binary Variable Bad Data	(5,177)	345	(15.0)	0.00%
Monthly.Reclass	Binary Variable Reclassification	(826)	183	(4.5)	0.00%
AR(1)	Autoregressive parameter	0.5490	0.0530	10.3	0.00%

Summary Model Statistics:

R-Squared	0.668
Adjusted R-Squared	0.655
Durbin-Watson Statistic	1.798
Mean Abs. % Err. (MAPE)	9.04%

Adjusted Observations	287
Deg. of Freedom for Error	275
F-Statistic	50
Prob (F-Statistic)	0%
Bayesian Information Criterian (BIC)	12.14
Model Sum of Squares	8.50E+07
Sum of Squared Errors	42,285,573
Mean Squared Error	153,765.72
Std. Error of Regression	392.13
Mean Abs. Dev. (MAD)	298.80

Predicted vs. Actual



Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix A
2009 Load Forecast

Appendix E
Weather Normalization

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

BIG RIVERS ELECTRIC CORPORATION

2009 LOAD FORECAST
NATIVE REQUIREMENTS - Actual vs. Weather Normalized

		Native System Energy Requirements (MWh)		Peak Demand (MW)	
Year	Month	Actual	Weather Normalized	Actual	Weather Normalized
2004	1	301,481	291,519	539	542
2004	2	269,384	265,559	497	498
2004	3	244,507	253,967	442	447
2004	4	221,929	234,255	424	426
2004	5	256,744	242,822	499	500
2004	6	272,105	269,775	546	555
2004	7	292,529	312,230	604	609
2004	8	278,782	303,399	561	577
2004	9	256,251	278,026	520	536
2004	10	228,447	242,150	395	402
2004	11	237,388	248,158	420	430
2004	12	299,151	288,658	562	563
2005	1	290,977	296,271	558	561
2005	2	250,859	269,363	494	507
2005	3	266,218	267,327	493	493
2005	4	222,137	227,625	396	403
2005	5	238,310	252,959	461	462
2005	6	282,028	275,035	582	579
2005	7	312,809	311,511	618	617
2005	8	321,920	306,095	613	610
2005	9	271,730	257,523	556	562
2005	10	244,275	239,487	495	488
2005	11	245,903	244,224	478	471
2005	12	312,704	304,232	555	598
2006	1	277,659	298,305	501	518
2006	2	268,204	272,161	527	520
2006	3	259,604	258,225	482	488
2006	4	221,233	230,968	416	420
2006	5	242,349	247,528	503	492
2006	6	277,493	277,584	593	597
2006	7	313,299	310,455	631	634
2006	8	322,137	318,367	629	631
2006	9	238,914	261,410	478	499
2006	10	248,768	250,327	472	465
2006	11	255,857	254,224	477	479
2006	12	288,620	298,481	593	595
2007	1	298,892	306,873	585	587
2007	2	298,575	284,078	610	612
2007	3	250,441	259,052	466	470
2007	4	239,323	242,364	442	436
2007	5	256,757	245,753	505	508
2007	6	284,246	272,793	558	562
2007	7	305,658	315,725	591	597
2007	8	347,855	306,425	660	638
2007	9	270,809	246,616	573	561
2007	10	250,135	237,103	526	502
2007	11	256,066	248,296	494	494
2007	12	294,176	305,577	520	534
2008	1	328,880	321,773	619	626
2008	2	293,019	289,360	555	560
2008	3	272,584	270,937	535	537
2008	4	229,843	234,054	443	445
2008	5	235,264	246,621	477	483
2008	6	287,388	281,749	562	566
2008	7	309,715	303,689	616	624
2008	8	300,016	314,512	595	602
2008	9	257,096	264,301	566	560
2008	10	242,631	238,016	443	440
2008	11	264,279	256,109	519	512
2008	12	319,606	316,410	612	609

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

DEMAND-SIDE MANAGEMENT (DSM) POTENTIAL REPORT FOR BIG RIVERS ELECTRIC CORPORATION

Prepared for:
BIG RIVERS ELECTRIC CORPORATION

By:
GDS ASSOCIATES, INC.

October 2010

GDS Associates, Inc. • 1850 Parkway Place • Suite 800 • Marietta, GA 30067 • **www.gdsassociates.com**
Marietta, GA • Austin, TX • Auburn, AL • Manchester, NH • Madison, WI • Indianapolis, IN

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

1 EXECUTIVE SUMMARY

In December 2009, the Big Rivers Electric Corporation ("Big Rivers" or "the Company") commissioned GDS Associates to conduct a study of the potential for electric energy efficiency programs to reduce electric consumption and peak demand throughout the Big Rivers member territory. Recent forecasts predict total electricity sales and peak demand in the Big Rivers member territory to increase at an average annual rate of more than 2% from 2011 through 2020. Improving energy efficiency and lowering electric demand in homes, businesses, and industries can be a cost effective way to address the challenges of increasing energy costs and the increasing demand for energy. Consequently, energy efficiency potential studies are important and helpful tools for identifying those energy efficiency measures that are the most cost effective and that have the most significant electricity savings potential. The results of this study provide a roadmap for the development of detailed program plans for cost effective energy efficiency measures. The authors of this report emphasize that only energy efficiency measures that cost less than new power supply resources are considered to be cost effective.

This detailed report presents results from the evaluation of opportunities for energy efficiency programs in the Big Rivers member's service territories. Estimates of technical potential, economic potential, and achievable potential by the year 2020 (a 10-year period) are provided for the 1) residential and commercial/industrial (C&I) sectors. Results from a program potential scenario are also presented to estimate the portion of the achievable potential that might be achieved given a specific funding level and program design.

All results were developed using customized residential and commercial/industrial (C&I) sector-level potential assessment computer models and Company-specific cost effectiveness criteria including the most recent Big Rivers avoided cost projections for electricity. To help inform these models, measure saturation data was primarily obtained from the 2007 Big Rivers End-Use and Energy Efficiency Survey for residential and the 2003 US Energy Information Administration ("EIA") Commercial Building Energy Consumption Survey ("CBECS") for the C&I sector. These surveys provided valuable insight regarding the current saturation of electrical equipment and baseline levels of energy efficiency throughout the Big Rivers service area.

The results of this study (summarized herein) provide detailed information on energy efficiency measures that are most cost effective and have the greatest potential kWh and kW savings. The data used for this report were the best available at the time this analysis was developed. As building and appliance codes and energy efficiency standards change, and as energy prices fluctuate, additional opportunities for energy efficiency may occur while current practices may become out-dated.

Actual energy and demand savings will depend upon the level and degree of voluntary member system participation in Demand-Side Management ("DSM") programs.

1.1 STUDY SCOPE

The study examines the potential to reduce electric consumption and peak demand through the implementation of energy efficiency technologies and practices in residential, commercial, and industrial facilities. The study assessed energy efficiency potential throughout Big Rivers members' service territories over ten years, from 2011through 2020.

The study had five main objectives:

- Evaluate the electric energy efficiency technical potential savings in Big Rivers member's territories;
- Calculate the Total Resource Cost ("TRC") benefit-cost ratio for potential electric energy efficiency measures and programs and determine the electric energy efficiency economic potential savings for the Big Rivers members;
- Evaluate the potential for achievable savings through electric efficiency programs over a ten-year horizon (2011-2020);
- Examine electric energy efficiency program designs and recommend example programs for consideration;
- Estimate the potential savings over a ten-year period from the delivery of a portfolio of example energy efficiency programs based on a specific funding level. The portfolio of programs has been designed based on a total budget of roughly $11.2 million dollars from 2011-2020 ($1 million in 2011, followed by an increase of 2.5% annually from 2012-2020).

The scope of this study distinguishes among four types of energy efficiency potential; (1) technical, (2) economic, (3) achievable, and (4) program potential. The definitions used in this study for energy efficiency potential estimates are as follows:

- **Technical Potential** is defined in this study as the complete and immediate penetration of all measures analyzed where they were deemed to be technically feasible from an engineering perspective, without regard to economics.
- **Economic Potential** is the subset of technical potential resources that are cost-effective based on the Total Resource Cost Test.
- **Achievable Potential** is the realistic penetration of cost effective energy efficiency measures taking into account real-world market and adoption barriers. This study provides a base case achievable potential scenario that targets 30% of the remaining market by 2020.
- **Program Potential** is the achievable potential possible given specific funding levels and program designs.

Limitations to the scope of study: As with any assessment of energy efficiency potential, this study necessarily builds on a large number of assumptions, including the following:

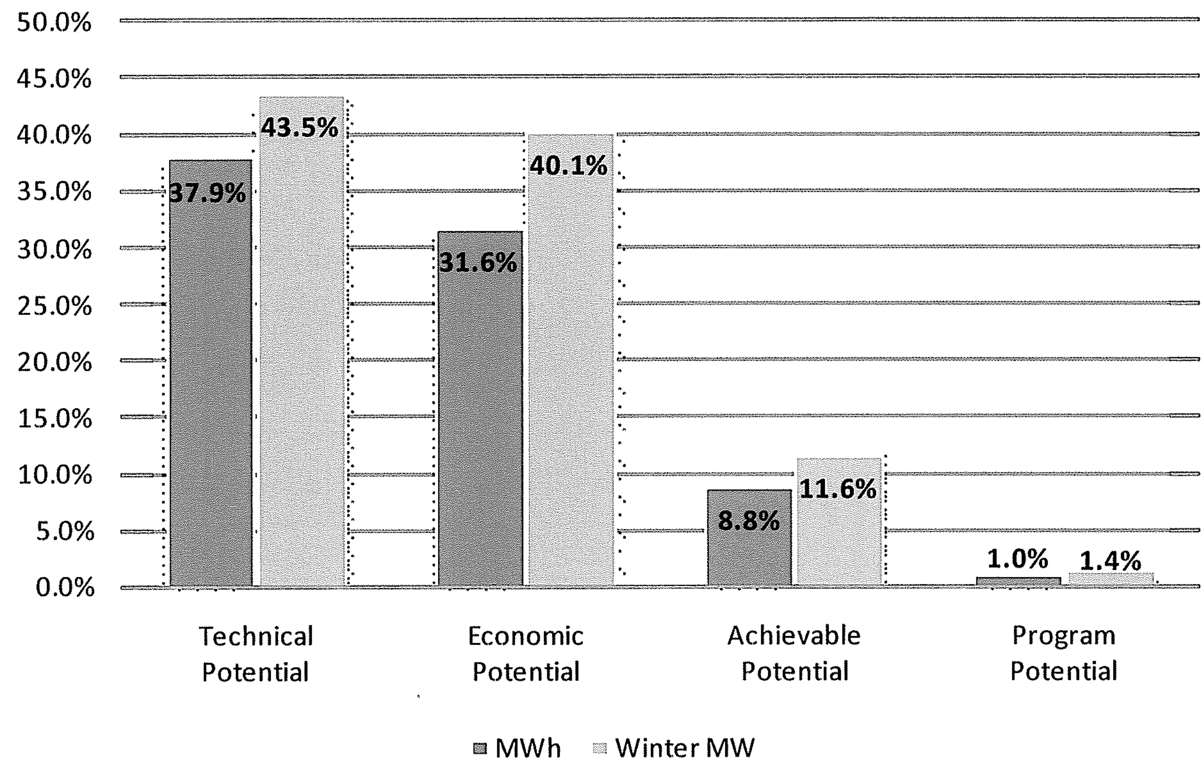
- Measure lives, measure savings and measure costs
- The discount rate for determining the net present value of future savings
- Projected penetration rates for energy efficiency measures
- Projections of electric generation avoided costs for capacity and energy
- Transmission and distribution avoided costs

While the authors have sought to use the best available data, there are many assumptions where there may be reasonable alternative assumptions that would yield somewhat different results. Furthermore, while the lists of measures examined in this study represent most commercially available measures, these measure lists are not exhaustive. Finally there was no attempt to place a dollar value on some difficult to quantify benefits arising from installation of some measures, such as increased comfort or increased safety, which may in turn support some personal choices to implement particular measures that may otherwise not be cost-effective or only marginally so.

1.2 RESULTS OVERVIEW

Figure 1.1, presented below, shows that cost effective electric energy efficiency resources can play a significantly expanded role in Big Rivers' energy resource mix over the next decade.

Figure 1.1: 2020 DSM Potential Savings Summary



This study examined over 200 energy efficiency measure permutations in the residential, commercial and industrial sectors combined. The findings suggest that the Company could save up to 31.6% of total energy sales and 40.1% of winter peak demand by pursuing ***"Economic Potential"*** energy efficient technologies. In the base case ***"Achievable Potential"*** scenario savings of approximately 8.8% of total energy sales (311,744 MWh) and 11.6% of winter peak demand (79.5 MW) are possible by 2020.[1]

The example programs analyzed in the ***"Program Potential"*** scenario achieve estimated savings in 2020 of 34,845 MWh and peak load reductions of 9.5 MW in the winter and 7.2 MW in the summer at the end-consumer level. This represents approximately 1.0% of total energy sales, 1.4% of peak demand in the winter, and 1.0% of peak demand in the summer by 2020.

[1] All energy and demand savings presented in this report are at the end-consumer (meter) level unless specifically noted in this report.

1.3 EXAMPLE PROGRAM POTENTIAL SUMMARY

A wide assortment of residential and commercial/industrial energy efficiency measures was found to be cost-effective and as a result, Big Rivers has numerous options regarding a potential DSM portfolio. GDS has provided an example portfolio of programs based on the detailed analysis of the cost effectiveness and market potential of a wide range of energy efficiency measures, and based on a thorough review of programs offered by other electric utilities. In addition to existing DSM programs, Big Rivers may consider expanding their current offerings or target areas, such as the appliance market, where there is significant potential for energy efficiency gains. In total, seven programs were detailed in the example programs and program potential summary.

Table 1.1, presented below, provides the energy savings, summer demand savings, dollar benefits, and costs for each recommended program. Costs represented in this table represent all costs included in the Total Resource Cost test, including all measure costs paid by the utility and/or participant as well as any administrative or overhead costs. Combined, the program potential is expected to achieve 34,845 MWh in energy savings in 2020, or 1.0% of the 2020 forecasted total energy sales. In addition, the programs are estimated to save approximately 9.5 MW (1.6% of winter peak demand). The programs represented in the program potential case can save Big Rivers' retail members $33.1 million over the ten-year period from 2011 to 2020, with an overall Total Resource Cost Test benefit/cost ratio of 1.91.

Based on these results, a portfolio of DSM programs was designed for Big Rivers that could achieve significant energy and demand savings at a pre-determined level of spending. The ***program potential*** portfolio is based on a scenario of $1 million dollar first year spending. In total, the combined budget from 2011-2020 in this case is approximately $17.4 million. The result is seven suggested programs that demonstrate electric energy efficiency can play an expanded role in Big Rivers' resource mix over the next decade.

Table 1.1: Program Summary

	Cumulative Annual MWh Savings - 2020	Cumulative Annual Winter MW Savings - 2020	NPV Benefits $2011	NPV Costs (Utility + Participants) $2011	TRC B/C Ratio
1 Residential Energy Efficiency Programs			*$ in millions*		
Residential Lighting Program	1,221	0.3	$2.0	$0.8	2.42
Residential Efficient Appliances	3,430	0.2	$2.4	$1.3	1.83
Residential Advanced Technologies	4,361	2.0	$4.7	$3.4	1.35
Residential Weatherization	9,345	3.7	$12.7	$5.2	2.44
Residential New Construction	1,421	0.6	$2.0	$1.1	1.71
2 Commercial/Industrial Programs					
C/I Prescriptive - Lighting	9,360	2.3	$5.3	$2.8	1.90
C/I Prescriptive - HVAC	5,707	0.4	$4.2	$2.7	1.56
Total Savings (End-Consumer)	***34,845***	***9.5***	***$33.1***	***$17.4***	***1.91***
Total Savings (@ Generation)	***38,631***	***10.5***			

2 GLOSSARY OF TERMS[2]

The following list defines many of the key energy efficiency terms used throughout this study.

Achievable potential: the amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible (*e.g.*, providing end-users with payments for the entire incremental cost of more efficient equipment). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.

Automated Metering Infrastructure: refers to systems that measure, collect and analyze energy usage and interact with advanced devices such as electricity, gas and water meters through numerous types of communication media either on-demand or on pre-defined schedules. This infrastructure includes hardware, software, communications, consumer energy displays and controllers, customer associated systems, supplier and network distribution business systems, etc.

Applicability factor: the fraction of the applicable dwelling units that is technically feasible for conversion to the efficient technology from an *engineering* perspective (e.g., it may not be possible to install CFLs in all light sockets in a home because the CFLs may not fit in every socket in a home).

Base Case Equipment End-Use Intensity: the electricity used per customer per year by each base-case technology in each market segment. This is the consumption of the electric energy using equipment that the efficient technology replaces or affects. For example, if the efficient measure is a high efficiency light bulb (CFL), the base end-use intensity would be the annual kWh use per bulb per household associated with an incandescent light bulb that provides equivalent lumens to the CFL.

Base Case Factor: the fraction of the end-use electric energy that is applicable for the efficient technology in a given market segment. For example, for residential lighting, this would be the fraction of all residential electric customers that have electric lighting in their household.

Coincidence factor: the fraction of connected load expected to be "on" and using electricity coincident with the system peak period.

Cost-effectiveness: a measure of the relevant economic effects resulting from the implementation of an energy efficiency measure. If the benefits outweigh the cost, the measure is said to be cost-effective.

Cumulative annual: refers to the overall savings occurring in a given year from both new participants and savings continuing to result from past participation with measures that are still in place. Cumulative annual does not always equal the sum of all prior year incremental values as some measures have relatively short lives and, as a result, their savings drop off over time.

Demand response: the ability to provide peak load capacity through demand management (load control) programs. This methodology focuses on curtailment of loads during peak demand times thus avoiding the requirement to find new sources of generation capacity.

[2] Potential definitions taken from "National Action Plan for Energy Efficiency (2007). Guide for Conducting Energy Efficiency Potential Studies. Prepared by Philip Mosenthal and Jeffrey Loiter, Optimal Energy, Inc.

Early replacement: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units

Economic potential: the subset of the technical potential screen that is economically cost-effective as compared to conventional supply-side energy resources. Both technical and economic potential screens are theoretical numbers that assume immediate implementation of efficiency measures, with no regard for the gradual "ramping up" process of real-life programs. In addition, they ignore market barriers to ensuring actual implementation of efficiency.

End-use: a category of equipment or service that consumes energy (*e.g.*, lighting, refrigeration, heating, process heat).

Energy efficiency: using less energy to provide the same or an improved level of service to the energy consumer in an economically efficient way. Sometimes "conservation" is used as a synonym, but that term is usually taken to mean using less of a resource even if this results in a lower service level (*e.g.*, setting a thermostat lower or reducing lighting levels). This recognizes that energy efficiency includes using less energy at any time, including at times of peak demand through demand response and peak shaving efforts.

Free Driver: individuals or businesses that adopt an energy efficient product or service because of an energy efficiency program, but are difficult to identify either because they do not receive an incentive or are not aware of the program.

Free Rider: participants in an energy efficiency program who would have adopted an energy efficiency technology or improvement in the absence of a program or financial incentive.

Incremental: savings or costs in a given year associated only with new installations happening in that specific year.

Lost-opportunity: refers to an energy efficiency measure or energy efficiency program that seeks to encourage the selection of higher-efficiency equipment or building practices than would typically be chosen at the time of a purchase or design decision.

Measure: any action taken to increase energy efficiency, whether through changes in equipment, control strategies, or behavior. Examples are higher-efficiency central air conditioners, occupancy sensor control of lighting, and retro-commissioning. In some cases, bundles of technologies or practices may be modeled as single measures. For example, an ENERGY STAR® ™ home package may be treated as a single measure.

MW: a unit of electrical output, equal to one million watts or one thousand kilowatts. It is typically used to refer to the output of a power plant.

MWh: one thousand kilowatt-hours, or one million watt-hours. One MWh is equal to the use of 1,000,000 watts of power in one hour.

Net-to-gross ratio: a factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts

Portfolio: Either a collection of similar programs addressing the same market, technology, or mechanisms; or the set of all programs conducted by one organization.

Program: a mechanism for encouraging energy efficiency that may be funded by a variety of sources and pursued by a wide range of approaches (typically includes multiple measures).

Program potential: the efficiency potential possible given specific program funding levels and designs. Often, program potential studies are referred to as "achievable" in contrast to "maximum achievable."

Remaining factor: the fraction of applicable units that have not yet been converted to the electric energy efficiency measure; that is, one minus the fraction of units that already have the energy efficiency measure installed.

Replace-on-burnout: a DSM measure is not implemented until the existing technology it is replacing fails. An example would be an energy efficient water heater being purchased after the failure of the existing water heater.

Retrofit: refers to an efficiency measure or efficiency program that seeks to encourage the replacement of functional equipment before the end of its operating life with higher-efficiency units (also called "early retirement") or the installation of additional controls, equipment, or materials in existing facilities for purposes of reducing energy consumption (e.g., increased insulation, low flow devices, lighting occupancy controls, economizer ventilation systems).

Savings factor: the percentage reduction in electricity consumption resulting from application of the efficient technology used in the formulas for technical potential screens.

Technical potential: the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end-users to adopt the efficiency measures. It is often estimated as a "snapshot" in time assuming immediate implementation of all technologically feasible energy saving measures, with additional efficiency opportunities assumed as they arise from activities such as new construction.

Total Resource Cost ("TRC") test: measures the net costs of an energy efficiency measure or program as a resource option based on the total costs of the program, including both the participant's and the utility's (or program administrator's) costs. The benefits include the avoided electric supply costs, the reduction in transmission, distribution, generation, and capacity costs valued at marginal cost for the period when there is an electric load reduction, as well as savings of other resources such as fossil fuels and water. The costs are the program costs paid both by the utility (or program administrator) and the participants. All equipment costs, installation, operation and maintenance, cost of removal, and administration costs are included in this test. The TRC test includes only direct costs and benefits, not externalities or non-monetized factors. Results are typically expressed as either net benefits or a benefit-to-cost ratio.

Useful Life: The number of years (or hours) that the new energy efficient equipment is expected to function. Useful life is also commonly referred to as "measure life."

3 INTRODUCTION

The territories and system loads for Big Rivers members are growing. From 1999 to 2008, the number of total members grew at a rate of nearly 1.4% annually. The current load forecast expects the number of members will continue to increase at an average rate of 1.3% from 2011 through 2020 (the timeframe for this study) creating further growth in system electricity sales and demand. This report assesses the potential for DSM programs to assist Big Rivers in meeting future energy service needs.

3.1 INTRODUCTION TO ENERGY EFFICIENCY

Efficient energy use, often referred to as energy efficiency, is using less energy to provide the same level of energy service. An example would be insulating a home or business to use less heating and cooling energy to achieve the same inside temperature. Another example would be installing fluorescent lighting in place of incandescent lights to attain the same level of illumination. In general, energy efficiency is achieved primarily through more efficient technologies and/or processes rather than by changes in individual behavior.

3.1.1 ENERGY EFFICIENCY ACTIVITY

Making homes and buildings more energy efficient is seen as a largely untapped resource for addressing energy security, and fossil fuel depletion. Faced with rapidly increasing energy prices, constraints in energy supply and demand, and energy reliability concerns, states are turning to energy efficiency as the most reliable, cost-effective, and quickest resource to deploy. For example, the state of California began implementing energy-efficiency measures in the mid-1970s, including building codes and appliance standards with strict efficiency requirements. During the following years, California's energy consumption has remained approximately flat on a per capita basis while national U.S. consumption doubled.[3] As part of its strategy, California implemented a three-step plan for new energy resources that puts energy efficiency first, renewable electricity supplies second, and new fossil-fired power plants last.

In 2004, The American Council for an Energy Efficient Economy (ACEEE) reviewed 11 studies on the technical, economic, and achievable potential for energy efficiency in the U.S. Overall, the findings suggest that substantial potential savings remain throughout the nation; the technical energy efficiency savings potential was estimated at 33% of total U.S. electric consumption. In early 2009, the Electric Power Research Institute (EPRI) estimated the maximum achievable potential for energy savings at 8% of total U.S. electric consumption.[4]

A more recent study by ACEEE offers information regarding the current savings and spending related to energy efficiency by state.[5] Based on self-reported data, the top energy efficient states spend roughly 2% of annual electric sales revenue on energy efficiency programs. In addition, the top states are currently achieving annual energy efficiency savings of roughly 1% of total electric sales. These findings suggest additional opportunities remain for energy efficiency in the state of Kentucky and throughout the U.S.

---

[3] Mufson, Steven. "In Energy Conservation, California Sees the Light." Washington Post. February 17, 2007. Page A01.

[4] Assessment of Achievable Potential from Energy Efficiency and Demand Response Programs in the U.S. (2010-2030). Completed by the Electric Power Research Institute (EPRI). January 2009.

[5] The 2009 State Energy Efficiency Scorecard. Report #E097. ACEEE. October 2009.

3.1.2 General Benefits of Energy Efficiency

There are a number of benefits for organizations that pursue energy efficiency programs. These benefits include avoided energy and capacity cost savings, non-electric benefits such as water and fossil fuel savings, environmental benefits, economic stimulus, job creation, risk reduction, and energy security.

Avoided energy and capacity costs are the costs of power an electric utility would incur to construct and operate new electric power plants or to purchase power from another source if not avoided due to the energy efficiency measures being studied. These avoided costs of electricity include both fixed and variable costs that can be directly avoided through a reduction in electricity usage. The energy component includes the costs associated with the production of electricity, while the capacity component includes costs associated with the capability to deliver electric energy and consists primarily of the capital costs of generation facilities.

At the consumer level, energy efficient products typically cost more than their standard efficiency counterparts, but this additional cost is balanced by lower energy consumption and lower energy bills. Over time, the money saved from energy efficient products will pay consumers back for their initial investment as well as save them money. Although some energy efficient technologies are complex and expensive, such as installing new high efficiency windows or a high efficiency boiler, many are simple and inexpensive. Installing compact fluorescent lighting or low-flow water devices can be done by most individuals.

Although the reduction in energy and capacity costs is the primary benefit to be gained from investments in energy efficiency, the utility, its consumers, and society as a whole can also benefit in other ways. Many electric efficiency measures also deliver non-energy benefits. For example, low-flow water devices and efficient clothes washers also reduce water consumption. Similarly, weatherization measures that improve the building shell not only save on air conditioning costs in the summer, but also can save the customer money on heating fuels, such as natural gas or propane. Reducing electricity consumption also reduces harmful emissions, such as SO_X, NO_X, and CO_2 into the environment.

Energy efficiency programs create both direct and indirect jobs. The manufacture and installation of energy efficiency products involves the manufacturing sector as well as research and development, service, and installation jobs. These are skilled positions that are not easily outsourced to other states and countries. The indirect jobs are more difficult to quantify, but result from households and businesses experiencing increased discretionary income from reduced energy bills. These savings produce multiplier effects, such as increased investment in other goods and services driving job creation in other markets.

Energy efficiency reduces risks associated with fuel price volatility, unanticipated capital cost increases, environmental regulations, supply shortages, and energy security. Aggressive energy efficiency programs can help eliminate or postpone the risk associated with committing to large investments for generation facilities a decade or more before they are needed. Energy efficiency is also not subject to the same supply and transportation constraints that impact fossil fuels. Finally, energy efficiency reduces competition between states and utilities for fuels, and dependence on fuels imported from other states or countries to support electricity production. Energy efficiency can help meet future demand increases and reduce dependence on out-of-state or overseas resources.

3.2 REPORT ORGANIZATION

The remainder of this report is organized in the following seven sections as follows:

Section 4: Characterization of Big Rivers Members' Territories provides an overview of the Big Rivers member territory and a brief discussion of the historical and forecasted electric energy sales as well as peak demand.

Section 5: Overall Project Implementation Approach details the development of technical, economic, and achievable potential for energy efficiency and demand response savings

Section 6: Residential Energy Efficiency Potential Estimates (2011-2020) provides a breakdown of the technical, economic, and achievable potential in the residential sector

Section 7: Commercial and Industrial Energy Efficiency Potential Estimates (2011-2020) provides a breakdown of the technical, economic, and achievable potential in the C&I sector

Section 8: Demand Response Analysis provides a breakdown of the demand response analysis for both residential and C&I.

Section 9: Example Programs and Program Potential Savings (2011-2020) provides example efficiency programs targeting areas of existing savings. The example programs include descriptions, savings, costs, measures included and benefits. A program potential estimate is included in this section based on a specific funding level.

Section 10: Conclusions presents the final discussion regarding potential for energy efficiency savings through 2020.

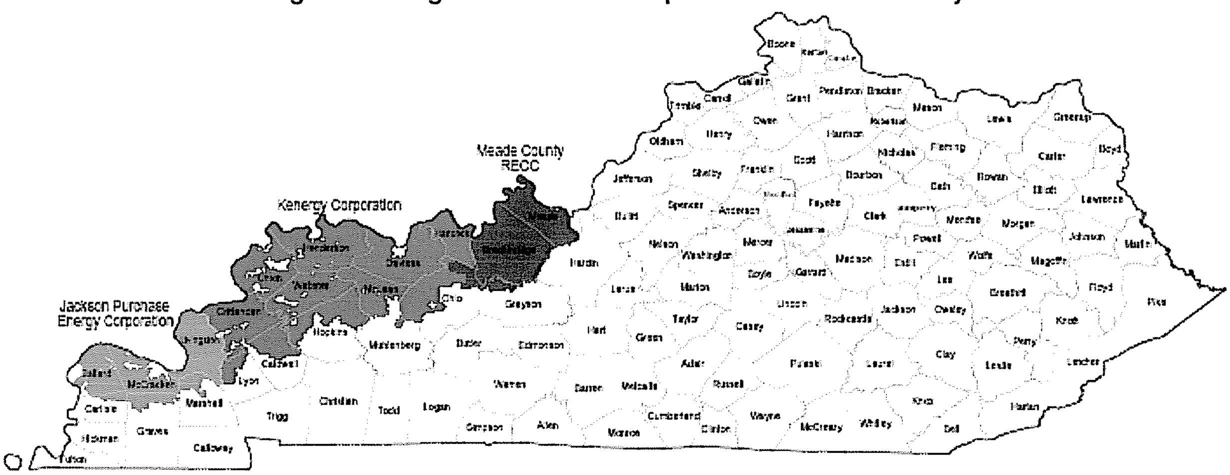
4 CHARACTERIZATION OF BIG RIVERS MEMBER TERRITORY

DSM potential studies and other market assessment studies that have appeared over the last five years are valuable sources of information for planning energy efficiency programs. In order to develop estimates of electricity savings potential, it is important to understand the extent to which electricity is used by households and businesses in Big Rivers service territory. This section provides a brief overview of the Big Rivers members' territories, the historical and forecasted electric energy sales and system peak demand, and the on-going energy efficiency efforts of Big Rivers member systems.

4.1 BIG RIVERS MEMBER SERVICE TERRITORY

Big Rivers is a generation and transmission cooperative headquartered in Henderson, Kentucky. which provides wholesale power to three member distribution cooperatives: Kenergy Corp. (Kenergy), Jackson Purchase Energy Corporation ("JPEC"), and Meade County Rural Electric Cooperative Corporation ("MCRECC"), all of which provide retail electric service to consumers located in western Kentucky. Big Rivers provides full power requirements for each of its three member cooperatives, including two aluminum smelters located in Kenergy's service area. Big Rivers' member cooperatives provide electric service in 22 counties located in western Kentucky. The climate in the area is humid, temperate and continental.

Figure 4.1: Big Rivers Electric Corporation Member Territory



Total generation capacity is 1,829 MW, including rights to 207 MW at Henderson Municipal Power and Light's William L. Newman "Station Two" facility and 178 MW of dependable capacity from the Southeastern Power Administration ("SEPA"). Big Rivers owns, operates and maintains its 1,262 mile transmission system and transmits power to its members and third party entities under it's the Open Access Transmission Tariff on file with the Federal Energy Regulatory Commission ("FERC").

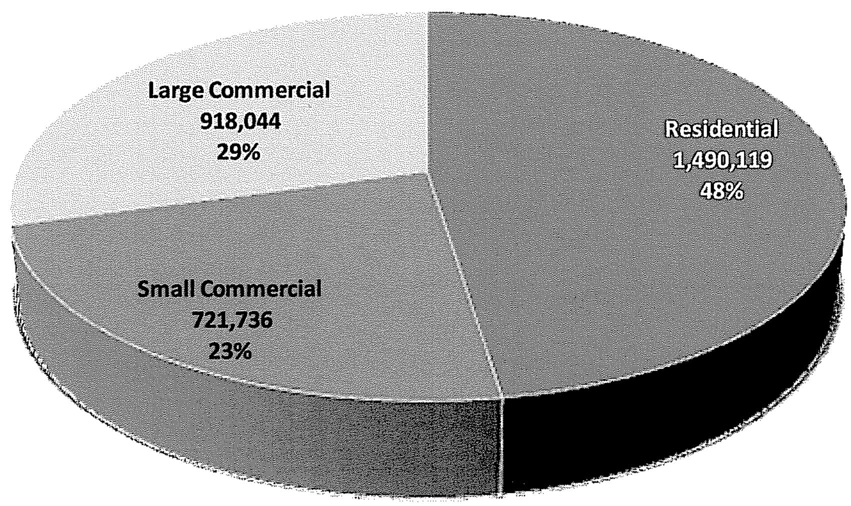
4.2 CUSTOMER CLASS OVERVIEW

According to 2009 historical sales data, the residential sector accounts for 48% of total energy sales while the small and large C&I sectors account for 23% and 29%, respectively.[6] Although the residential sector constitutes the greatest portion of total kWh sales, the industrial sector consumes the most energy on a

[6] These figures, and all future forecasts referenced in this document, do not include the sales from the two large smelters in the member service area. Together, the two smelters consumed more than 6.7 million MWh in 2009.

per member basis. In 2009, the average industrial facility consumed roughly 48.3 million kWh annually. Comparatively, the average commercial member used approximately 48,900 kWh per year, while residential members use 15,350 kWh per year on average. These numbers do not include the sales from the two large smelters in the service area. Together, the two smelters consumed more than 6.7 million MWh in 2009.

Figure 4.2: 2009 Historical Energy Sales by Customer Class (MWh)



*Note: The chart above does not include sales from the two large smelters in the service area.

The residential sector is dominated by single-family household consumers. According to the 2007 Big Rivers End-Use and Energy Efficiency Survey approximately 85% of households are single family homes, 13% are manufactured homes and 2% are considered multi-family homes. Electric cooling systems are present in 98% of all households. The most common type of electric cooling unit is the Central AC, representing 68% of homes; 16.5% are heat pumps, and the remaining 13.6% of households rely on room AC units to perform the primary cooling function in the home.

Meanwhile, 43% of households report electric heating as the primary fuel source for space heating in the Big Rivers members' territories. Natural gas and propane is the main source of heat in the majority of homes (51%). The two major electric heating appliances are electric furnaces (20%) and electric heat pumps (15%). Approximately two-thirds (68%) of all homes have electric water heating.

Because Big Rivers did not have any detailed information on the commercial and industrial sector, the breakout came from the EIA's Commercial Building and Energy Consumption Survey using the East South Central regional data. The East South Central region includes Kentucky, Tennessee, Mississippi and Alabama. Details on the breakout can be found in Section 7 of this study.

4.3 FORECAST OF CONSUMERS, ENERGY SALES & PEAK DEMAND (2011-2020)

Table 4.1, presented below, displays a reference case of forecasted data for the number of electric members and Table 4.2, presented below, presents annual MWh sales by sector. In these tables, MWh sales for the small commercial sector refer to small commercial/industrial loads at or less than 1,000 KW, while large commercial/industrial includes those customers whose peak demand exceeds 1,000 KW. These two categories were combined for the commercial/industrial sector analysis.

The Big Rivers load forecast for the member territories projects that total MWh sales at generation will grow by 352,117 MWh over the next decade, at a compound average annual growth rate of 1.1% a year (Table 4.2). The residential and commercial sectors are projected to grow at 1.4% and 1.8% a year, respectively, while the current load forecast does not predict growth from the large commercial sector.

Table 4.1: Forecast Number of Members from 2011-2020

TOTAL BIG RIVERS SYSTEM

Year	Residential	Small Commercial	Large Commercial/ Industrial	Total
2011	99,121	15,113	19	114,254
2012	100,377	15,397	19	115,794
2013	101,657	15,683	19	117,359
2014	102,919	15,964	19	118,902
2015	104,169	16,241	19	120,430
2016	105,409	16,515	19	121,943
2017	106,644	16,785	19	123,448
2018	107,886	17,052	19	124,958
2019	109,136	17,317	19	126,471
2020	110,382	17,578	19	127,979
Compound Annual Avg. Rate of Growth	*1.20%*	*1.69%*	*0.00%*	*1.27%*

Table 4.2: Forecast Sales Data from 2011-2020 (MWh)

TOTAL BIG RIVERS SYSTEM

Year	Residential	Small Commercial	Large Commercial/ Industrial	Total Native System	@ Generation
2011	1,529,810	743,153	950,515	3,223,478	3,371,088
2012	1,549,351	755,211	950,515	3,255,077	3,404,628
2013	1,566,383	766,768	950,515	3,283,666	3,434,973
2014	1,585,820	780,131	950,515	3,316,465	3,469,788
2015	1,608,140	794,941	950,515	3,353,595	3,509,200
2016	1,629,692	810,225	950,515	3,390,432	3,548,299
2017	1,657,057	825,595	950,515	3,433,166	3,593,659
2018	1,683,558	841,103	950,515	3,475,176	3,638,250
2019	1,710,391	856,804	950,515	3,517,710	3,683,398
2020	1,732,071	872,627	950,515	3,555,213	3,723,205
Compound Annual Avg. Rate of Growth	*1.39%*	*1.80%*	*0.00%*	*1.09%*	*1.11%*

Electric system winter peak load (at generation), as shown below in Table 4.3, is projected to grow from approximately 648 MW in 2011 to 718 MW by the year 2020 (an annual growth rate of 1.2%). The residential sector has the highest peak demand, approximately 64% of total peak load (395 MW) in 2011, and an annual growth rate of 1.4 percent. During 2011 through 2020, system peak demand is estimated to increase by 53 MW in the residential sector, with an additional 14 MW increase attributed to the small commercial/industrial sector. The summer peak demand, shown in Table 4.4, is also expected to grow from 2011-2020, but at a slightly lower annual rate.

Table 4.3: Forecast Winter Peak Demand from 2011-2020 (MW)

TOTAL BIG RIVERS SYSTEM

Year	Residential	Small Commercial	Large Commercial/ Industrial	Total Native System	@ Generation
2011	395	112	112	619	648
2012	400	113	112	626	654
2013	405	114	112	631	660
2014	410	116	112	638	667
2015	416	117	112	645	675
2016	422	119	112	653	683
2017	428	121	112	661	692
2018	435	123	112	670	701
2019	442	125	112	678	710
2020	448	126	112	686	718
Compound Annual Avg. Rate of Growth	*1.38%*	*1.38%*	*0.00%*	*1.14%*	*1.16%*

Table 4.4: Forecast Summer Peak Demand from 2011-2020 (MW)

TOTAL BIG RIVERS SYSTEM

Year	Residential	Small Commercial	Large Commercial/ Industrial	Total Native System	@ Generation
2011	366	122	119	607	635
2012	366	122	119	607	635
2013	370	123	119	613	641
2014	374	125	119	618	647
2015	379	126	119	624	653
2016	384	128	119	632	661
2017	390	130	119	639	669
2018	396	132	119	647	677
2019	402	134	119	655	686
2020	408	136	119	663	694
Compound Annual Avg. Rate of Growth	*1.22%*	*1.22%*	*0.00%*	*0.99%*	*1.01%*

4.4 CURRENT DSM OFFERINGS

Big Rivers and its three distribution member cooperatives provide DSM programs that are primarily education about energy efficiency, with the exception being distribution of CFL lighting at no cost to members. Listed below are the activities and programs that are currently in place and are intended to educate and inform retail members of available energy efficiency opportunities.

1. **Distribution cooperative websites:** Each of the distribution cooperative websites provides easy to use Home Energy Suites. The Suites provide methods to improve efficiency and save energy in the home. Adjustable inputs specific to a home allows customers to compare their current energy use to estimated energy use resulting from various improvements in efficiency.

2. **Marketing and promotion:** Historically, the majority of communications between the distribution cooperatives and their customers focused on energy efficiency education. Their advertising efforts focus on promoting Touchstone Energy Homes and the use of Energy Star® appliances and lighting, insulation, and high efficiency HVAC.

3. **Home Energy Efficiency Expo:** Each of the member cooperatives has hosted residential energy efficiency expos that provide education and outreach to customers focusing on energy efficiency in the home.

4. **Distribution of DOE/EPA "Home Efficiency Tips" booklet:** The distribution member cooperatives have provided thousands of "Home Energy Tips" booklets to new and existing customers that visit the cooperative offices. A U.S. Department of Energy ("DOE") and U.S. Environmental Protection Agency ("EPA") partnership produced a "Home Energy Tips" booklet which has been used to train customer service representatives ("CSRs") on energy efficiency, and to help the CSRs educate customers.

5. **CFL distribution:** CFL's are distributed to customers of JPEC, MCRECC, and Kenergy. Each of the distribution cooperatives has provided the high efficiency lamps to customers at their annual meetings as well as to customers who visit during cooperative month in October. To date, approximately 109,000 CFL bulbs have been provided to retail customers at no cost.

6. **Energy Use Assessments:** These assessments are provided to commercial and industrial customers upon request. Walk through energy audits help identify simple and low cost efficiency measures that customers can install. Educational programs are also available for employees of commercial and industrial members.

7. Big Rivers offers **renewable energy** to the member cooperatives. Big Rivers provides energy from an Energy Star® certified Combined Heat and Power ("CHP") project operated by Domtar, Inc., a specialty paper manufacturer. The power is generated from wood chips that are waste by products of the paper manufacturing process. Customers wishing to purchase this renewable energy can contract with any of the distribution cooperatives.

8. JPEC and Big Rivers Electric Corp. upgraded their **facility lighting** to high efficiency electronic ballasts and fluorescent lighting.

9. Big Rivers provided **energy saving analyses** to industrial and large commercial members by combining efforts with the member-systems, the DOE, and the University of Louisville's Kentucky Pollution Prevention Center.

10. Big Rivers provided support to member-system school districts to promote the construction of **high performance schools**. Hancock County school district renovated three older schools, with a focus on energy efficiency, and completed a new high performance school in 2006. Meade County school district completed a new high performance school in 2006.

11. Big Rivers provided assistance to develop and continues to provide reliability support and back-up power for the Domtar (previously Weyerhaeuser) **combined heat and power** project in Hancock County. The 50 MW renewable generator produces electricity from wood chips that aren't used in the manufacturing of paper. The project won the Energy Star® CHP award in 2005 for efficiency.

5 OVERALL PROJECT IMPLEMENTATION APPROACH

This section describes the overall methodology used to conduct this study and explains the general steps and methods used at each stage of the analytical process necessary to produce the various estimates of energy efficiency and demand response potential. Specific changes in methodology from one sector to another have been noted throughout the report.

Energy efficiency potential studies involve carrying out a number of analytical steps to produce estimates of each type of energy efficiency potential. This study utilizes the GDS Benefit/Cost Screening Tool, an Excel-based model that integrates technology-specific impacts and costs, customer characteristics, utility load forecasts, utility avoided forecasts and more. Excel was used as the modeling platform to provide transparency to the estimation process and allow for simple customization based on Big Rivers' unique characteristics and the availability of specific model input data.

5.1 MEASURE LIST DEVELOPMENT

Energy efficiency measure lists were based on the analysis team's existing knowledge and current databases of electric end-use technologies and energy efficiency measures, and were supplemented as necessary to include other technology areas of interest to Big Rivers' members. The study scope was restricted to measures and practices that are currently commercially available. These are measures that are of most immediate interest to energy efficiency program planners.

In addition, this study focused on measures that could be relatively easily substituted for or applied to existing technologies on a retrofit or replace-on-burnout basis. Replace-on-burnout applies to equipment replacements that are made normally in the market when a piece of equipment is at the end of its useful life. A retrofit measure is eligible to be replaced at any time in the life of the equipment or building. Replace-on-burnout measures are generally characterized by incremental measure costs and savings (*e.g.* the costs and savings of a high-efficiency versus standard efficiency air conditioner); whereas retrofit measures are generally characterized by full costs and savings (e.g. the full costs and savings associated with retrofitting ceiling insulation into an existing attic.)

5.2 MEASURE CHARACTERIZATION

A significant amount of data is needed to estimate the savings potential for individual energy efficiency measures or programs across the entire existing residential, commercial and industrial sectors. To this extent, considerable effort was expended to identify, review, and document all available data sources. This review allowed development of reasonable assumptions regarding measure lives; installed incremental and full costs (where appropriate); and electric energy and demand savings for each measure included in the final lists of measures in this study.

Savings: Estimates of annual measure savings as a percentage of base equipment usage were developed from a variety of sources, including:

- Building energy modeling software and engineering analyses
- Secondary sources such as American Council for an Energy-Efficient Economy ("ACEEE"), Department of Energy ("DOE"), Energy Information Administration ("EIA"), Energy Star® and other technical potential studies
- Program evaluations conducted by other utilities and program administrators
- Customer meter data

Measure Costs: Measure costs represent either incremental or full cost, and typically include the cost of installation. Cost estimates were derived from:

- Secondary sources such as ACEEE, Energy Star®, and other technical potential studies
- Retail store pricing and industry experts
- Evaluation reports

Measure Life: Represents the number of years (or hours) that energy-using equipment is expected to operate. Useful life estimates were derived from:

- Manufacturer data
- Savings calculators and Life-cycle cost analyses
- Secondary sources such as ACEEE, Energy Star®, and other technical potential studies
- The California Database for Energy Efficient Resources ("DEER") database
- Evaluation reports

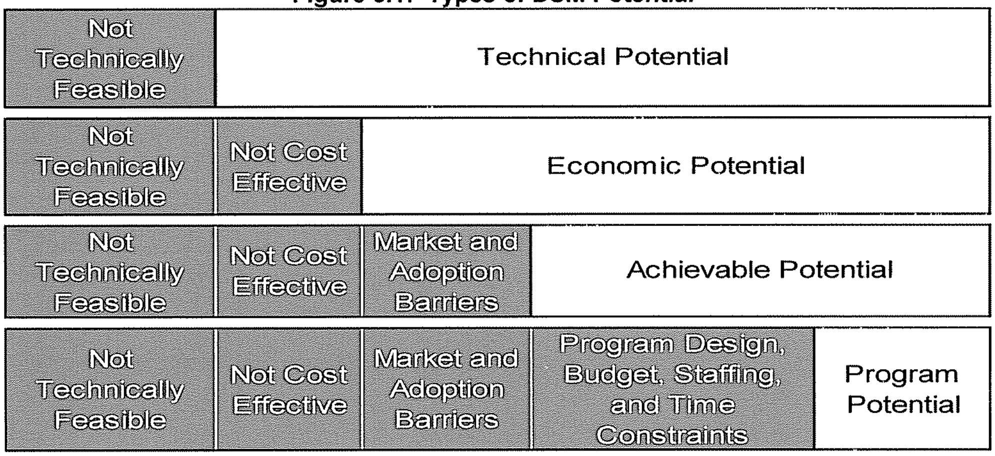
Baseline and Efficient Technology Saturations: In order to assess the amount of energy efficiency savings still available, estimates of the current saturation of baseline equipment and energy efficiency measures are necessary. The residential sector relied mainly on the latest End-Use and Energy Efficiency Survey completed by Big Rivers in 2007. The commercial sector utilized regional specific data available from the 2003 Commercial Buildings Energy Consumption Survey (CBECS) conducted by the US Energy Information Administration (EIA).

Further detail regarding the development of measure assumptions for energy efficiency in the residential and commercial/industrial sectors can be found later in this report. Additionally, refer to the individual sector appendices for a comprehensive listing of all energy efficiency measure assumptions and sources assessed in this report.

5.3 POTENTIAL SAVINGS OVERVIEW

Potential studies often distinguish between four different types of efficiency potential: technical, economic, achievable, and program. However, because there are often important definitional issues among studies, it is important to understand the definition and scope of each potential estimate as it applies to this analysis.

Figure 5.1: Types of DSM Potential[7]



The first two types of studies - technical and economic - provide a theoretical upper bound for energy savings. Still, even the best designed portfolio of programs is unlikely to capture 100 percent of the technical or economic potential. Therefore, achievable and program potential tend to be more useful in that they attempt to estimate what may realistically be achieved, when it can be captured, and how much it would cost to do so. Above, Figure 5.1 illustrates the four different types of efficiency potential.

5.4 TECHNICAL POTENTIAL

Technical potential is the maximum amount of energy use that could be saved by efficiency measures, assuming immediate implementation of all energy saving measures that are technically feasible from an engineering standpoint. For example, this would include the immediate replacement of every incandescent bulb with a compact fluorescent lamp or high-efficiency fixture, regardless of cost. Considerations of performance, willingness of end-users to adopt the technology, initiative strategies, or budget do not affect this potential estimate.

In general, this study uses a "bottom-up" approach to calculating the potential of an energy efficiency measure or set of measures. A bottom-up approach first starts with the savings and costs associated with replacing one piece of equipment with its efficient counterpart, and then multiplies these values by the number of measures available to be installed throughout the life of the program. The bottom-up approach is often preferred in the residential sector because of better data availability and greater homogeneity of the building and equipment stock to which measures are applied. However, this methodology was not able to be used in the C&I sector. The savings estimates per base unit are determined by comparing the high efficiency equipment to current installed equipment for existing construction retrofits or to current equipment code standards for replace-on-burnout and new construction scenarios.

[7] Reproduced from "Guide to Resource Planning with Energy Efficiency November 2007" written by the US EPA. Figure 2-1.

5.4.1 Core Equation for the Residential Sector

The core equation used in the residential sector technical potential analysis for each individual efficiency measure is shown below in Figure 5.2.

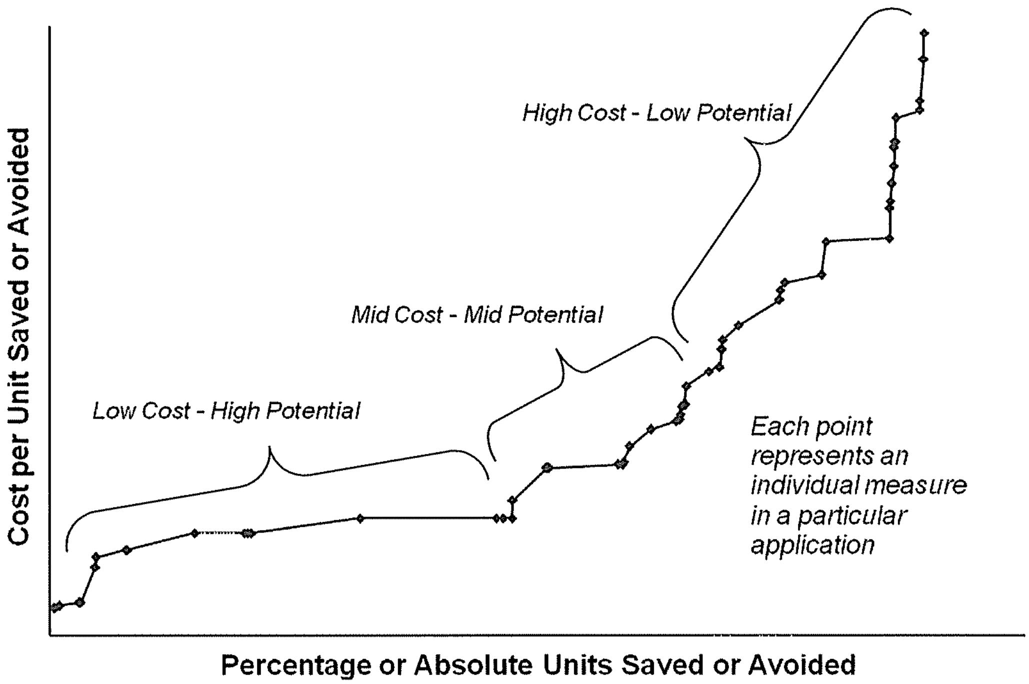
Figure 5.2: Core Equation for Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measure} = \text{Total Number of Households or Buildings} \times \text{Base Case Equipment End Use Intensity [kWh/unit]} \times \text{Base Case Factor} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Technical energy efficiency potential in the residential sector is calculated in two steps. In the first step, all measures are treated *independently*; that is, the savings of each measure are not reduced or otherwise adjusted for overlap between competing or interacting measures. By analyzing measures independently, no assumptions are made about the combinations or order in which they might be installed in customer buildings. However, the cumulative technical potential cannot be estimated by adding the savings from the individual savings estimates because some savings would be double-counted. For example, the savings from a measure that reduces heat loss from a building, such as insulation, are partially dependent on other measures that affect the efficiency of the system being used to heat the building, such as a high-efficiency furnace; the more efficient the furnace, the less energy saved from the installation of the insulation.

In the second step, cumulative technical potential is estimated using an energy efficiency supply curve approach. This method eliminates the double-counting problem mentioned above. A generic example of a supply curve is shown in Figure 5.3 on the following page. As shown in the figure, a supply curve typically consists of two axes; one that captures the cost per unit of saving a resource (e.g., dollars per kWh saved) and another that shows the amount of savings that could be achieved at each level of cost. The curve is typically built up across individual measures that are applied to specific base-case practices or technologies by market segment. Savings measures are sorted on a least-cost basis and total savings are calculated incrementally with respect to measures that precede them. Supply curves typically, but not always, end up reflecting diminishing returns, i.e., costs increase rapidly and savings decrease significantly at the end of the curve.

Figure 5.3: Generic Example of a Supply Curve



As noted above, the cost portion of this energy-efficiency supply curve is represented in dollars per unit of energy savings. Cost are annualized (often referred to as levelized) in supply curves. For example, energy-efficiency supply curves usually present levelized costs per kWh saved by multiplying the initial investment in an efficient technology or program by the capital recovery rate (CRR):

Therefore,

Levelized Cost per kWh Saved = Initial Cost x CRR/Annual kWh Savings

5.4.2 Core Equation for the Commercial and Industrial Sector

The core equation used in the commercial sector technical potential analysis for each individual efficiency measure is shown below in Figure 5.4.

Figure 5.4: Core Equation for Commercial Sector Technical Potential

Technical Potential of Efficient Measure	=	Total Number of Households or Buildings	X	Base Case Equipment End Use Intensity [kWh/unit]	X	Base Case Factor	X	Remaining Factor	X	Applicability Factor	X	Savings Factor

The technical energy efficiency potential in the C&I sector is calculated by the same two steps as described above in Section 5.4.1. Industrial energy efficiency potential is calculated on a more aggregated basis because of the lack of data available for the sector.

5.5 ECONOMIC POTENTIAL

Economic potential is typically used to refer to the subset of the technical potential that is cost effective when compared to either supply-side alternatives or the price of energy. Economic potential, like technical potential, is a theoretical number that assumes immediate implementation of measures with no regard for the time it takes to ramp-up a program. Economic potential takes into account the fact that many energy efficiency measures cost more to purchase initially than standard-efficiency equipment.

In practice, most technical and economic potential estimates produce similar results. Many analysts generally pre-screen possible efficiency technologies and practices based on an understanding of which measures are likely to be cost-effective and an interest in conserving time and effort for other aspects of the analysis. All measures that were not found to be cost-effective, based primarily on the results of the Total Resource Cost Test (TRC), were excluded from future analysis. The TRC Test is defined in greater detail in Section 5.8.

5.6 ACHIEVABLE POTENTIAL

Achievable potential is the amount of energy use that efficiency and demand response can realistically be expected to save assuming an aggressive market penetration and funding scenarios. Achievable potential takes into account barriers that hinder consumer adoption of energy efficiency measures such as financial, political and regulatory barriers, the administrative and marketing costs associated with efficiency programs, and the capability of programs and administrators to ramp up activity over time.

Achievable potential can also vary with energy efficiency program parameters, such as the magnitude of rebates or incentives offered to customers for installing energy efficiency measures. Thus, many different scenarios can be modeled.

For new construction, energy efficiency measures can be implemented when each new home or building is constructed, thus the rate of availability is a direct function of the rate of new construction. For existing homes and buildings, determining the annual rate of available savings is more complex. Achievable savings potential in the existing stock of buildings can be captured over time through two principle processes:

1) As equipment replacements are made in the market when a piece of equipment is at the end of its useful life (referred to as replace-on-burnout)

2) At any time in the life of the equipment or building (referred to as the retrofit case)

For the replace-on-burnout measures, existing equipment is assumed to be replaced with high efficiency equipment at the time a consumer is shopping for a new appliance or other energy consuming equipment, or if the consumer is in the process of building or remodeling. Using this approach, only equipment that needs to be replaced in a given year is eligible to be upgraded to energy efficient equipment. For the retrofit measures, savings can theoretically be captured at any time. However, in practice, it takes many years to retrofit an entire stock of buildings, even with the most aggressive of energy efficiency programs.

Because achievable potential factors in the necessity for energy efficiency programs to operate and impact markets over time, it is also important to recognize changing standards to energy-consuming equipment. When equipment is scheduled for federal or state code upgrades, these improvements to equipment performance result in decreased savings potential for the year the code is to be enacted and for all subsequent years. Consequently, it is important that equipment code changes, particularly planned improvements to incandescent lighting, be reflected in all achievable potential models for all sectors.[8]

5.7 PROGRAM POTENTIAL

Program potential refers to the potential energy efficiency savings that is possible given specific program funding levels and designs. The starting point for analyzing the savings and costs resulting from the implementation of the program scenario is the achievable potential. The following steps are used to estimate the program scenario potential:

- Defining eligible measures within each recommended program and projecting future measure penetrations
- Developing program incentive costs based on program incentive structure and designs and estimated participation rates for each measure
- Developing non-measure program budgets (costs for all programmatic activities except measure incentives)
- Analyzing the portfolio to develop estimates of overall costs, benefits, net benefits, and benefit cost ratios.

The programs presented in this section are based on an example funding level of $1 million in 2011, followed by an increase of 2.5% annually from 2012-2020. It is important to note that the measures included in the program potential scenario are a subset of those included in the achievable potential and that measure penetrations, savings, and incentive levels are occasionally tailored to reflect the goals of the program design, and to fit the allowable budget. As a result, program assumptions may vary slightly from the assumptions utilized for the achievable base case scenario.

5.8 DETERMINING COST-EFFECTIVENESS

For the economic and achievable potential, it is necessary to develop a method by which it can be determined that a measure or program is cost effective. There is a large body of literature debating the merits of different approaches to calculating whether an investment in energy efficiency is cost effective. The test selected for a potential study should ensure that results are comparable to the criteria being used to evaluate other options, either for electric supply or public funds.

There are several tests for evaluating energy efficiency's cost-effectiveness, each reflecting a different stakeholder perspective on the impact of energy efficiency. The Total Resource Cost test, which measures the regional net benefits, is the most common test used to evaluate energy efficiency and is the appropriate test from a regulatory perspective. All energy efficiency that passes the TRC Test will reduce the total costs of energy in a region, therefore it was used for this analysis.

The TRC Test measures the net costs of an energy efficiency measure or program as a resource option based on the total costs of the program, including both the participant's and the utility's costs. The

[8] *"The transition to more efficient lighting, largely due to the newly enacted standards, is estimated to exceed the combined energy and monetary savings of all 21 federal appliance standards since 2000."* Alliance to Save Energy. H.R. 6, Energy Independence and Security Act of 2007: Summary of Key Provisions.

benefits include the avoided electric supply costs, the reduction in transmission, distribution, generation, and capacity costs (valued at marginal cost for the period when there is an electric load reduction), and savings of other resources such as fossil fuels and water. The costs are the program costs paid both by the utility and the participants. All equipment costs (including: installation, operation and maintenance, cost of removal, and administration costs) are included in this test. The TRC test includes only direct costs and benefits, not externalities or non-monetized factors. Results are typically expressed as either net benefits or a benefit-to-cost ratio.

Other tests that are used in evaluating energy efficiency throughout the U.S. are discussed briefly below, but were not used to determine cost effectiveness for this study.

The Utility Cost Test ("UCT"): also called the Program Administrator's Test, considers only the avoided energy costs as benefits and counts only expenditures incurred by the utility.

The Participant Test ("PT"): uses retail energy rates and incentives received to value the benefits of energy savings and count only costs paid directly by participants

The Rate Impact Measure ("RIM) Test: uses the same benefits and costs as the utility test, but also counts the lost sales revenue as a cost.

The Societal Cost Test ("SCT"): uses the same costs as the TRC test, but includes societal benefits such as avoided participant costs for hypothesized change in medical expenses due to healthier surroundings

The TRC Test estimates the total costs of obtaining efficiency savings without considering who pays these costs. This approach does not address distributional equity, such as how costs and benefits would be shared among or within groups. In this regard, the TRC Test differs from other benefit-cost perspectives such as the utility test, participant test, and RIM Test.

5.9 AVOIDED COSTS

Costs that could be avoided by implementing DSM programs were calculated for use in the screening process. Avoided demand costs were assumed to be, for years beginning with 2015, the fixed costs associated with a new peaking resource. Peaking resource fixed costs were based on the costs of a new combustion turbine resource as published by the EIA in its 2010 Annual Energy Outlook. Fixed costs include interest expense, depreciation expense, and fixed O&M costs.

Prior to 2015, avoided demand costs were estimated to more closely represent prices associated with current market capacity transactions. A price of $2/kW-Month was used for 2010, and this value was assumed to grow with linear increases until convergence was reached with the price of a new combustion turbine in 2015. The NERC 2009 Reliability Assessment indicates that Reliability*First* Corporation reserve margins would be adequate with existing generation capacity until 2016 and that SERC margins would be adequate through 2013 with existing capacity. New capacity would be required in the regions at those points to maintain target margins. Since it is unlikely that new generation would enter the market if total fixed costs could not be recovered, an avoided demand cost equal to costs associated with a new generating resource was assumed appropriate for 2015 as new regional generators enter service. Avoided energy costs were assumed to be those associated with potential economy energy purchases. The economy energy market was defined using the average of ACES Power Marketing price projections for the Cinergy, Southern Company, and TVA pricing hubs. Tables 5.1 and 5.2 shown below, present the first 15 years of forecasted avoided costs for this study. Appendix 1 has all other general assumptions and the full forecast of avoided costs.

Table 5.1: Avoided Energy Costs

[redacted]

Table 5.2: Avoided Capacity Costs

Year	Annual ($/kW-Yr)	Summer ($/kW-Yr)	Winter ($/kW-Yr)
2010	24.00	10.00	14.00
2011	37.40	15.58	21.82
2012	50.80	21.17	29.63
2013	64.20	26.75	37.45
2014	77.60	32.33	45.27
2015	91.00	37.92	53.08
2016	92.73	38.64	54.09
2017	94.49	39.37	55.12
2018	96.29	40.12	56.17
2019	98.12	40.88	57.23
2020	99.98	41.66	58.32
2021	101.88	42.45	59.43
2022	103.82	43.26	60.56
2023	105.79	44.08	61.71
2024	107.80	44.92	62.88
2025	109.85	45.77	64.08

5.10 FREE-RIDERSHIP VERSUS FREE-DRIVERS

Free riders are defined as participants in a DSM program who would have implemented the program measure or practice in the absence of the program or monetary incentive. Free drivers, on the other hand, are those who adopt a program measure or practice as an indirect result of the program, but are difficult to identify either because they do not collect an incentive or are not aware of their exposure to the program. The presence of free riders in a program tends to overstate program energy savings results (because free riders would have taken the action in the absence of the program) and complicates the evaluation of the effectiveness of DSM programs. Conversely, if one does not assess the impact of free drivers, this can result in understating a program's energy savings and effectiveness. In determining whether a DSM program has had a direct impact on customer energy use, the focus should be on net savings – calculated by determining the share of free riders and free drivers and adjusting the associated energy savings accordingly.

Although the issue of free riders and free drivers is important, it is also one that is notoriously difficult to measure, and even more difficult to predict. Based on a review of the experiences and practices of energy efficiency program administrators and evaluators at New York State Energy Research and Development Authority ("NYSERDA"), National Grid, Wisconsin Focus on Energy, the Minnesota Public Service Commission and other organizations, this analysis has adopted the approach that free-riders and free-drivers offset each other. The result is an assumed net to gross ratio of 1.0 for most measures or programs considered in this analysis, where the energy savings that are eventually measured and verified will align exactly with the savings claimed. GDS has reviewed the results of free-rider and free-driver studies at such organizations and recommends this approach until programs can be implemented in the Big Rivers service area and follow-up studies conducted to assess these issues.

6 RESIDENTIAL ENERGY EFFICIENCY POTENTIAL ESTIMATES (2011 TO 2020)

Figure 6.1 and Table 6.1 presented below, summarize the technical, economic, and achievable savings potential for the Big Rivers service area by 2020. The achievable potential estimates are based primarily on a market penetration scenario that targets the installation of energy efficient equipment in 30% of the remaining eligible market by 2020. If 30% market penetration for all remaining eligible cost-effective measures can be reached over the next decade, the achievable potential for electric energy efficiency savings in this sector is approximately 7.9% of projected residential sales (136,312 MWh). Energy efficiency measures and programs can also serve to lessen peak demand, creating a reduction of roughly 12% of the 2020 residential winter peak in the achievable potential scenario.

Figure 6.1: 2020 Summary of Residential Energy Efficiency Potential

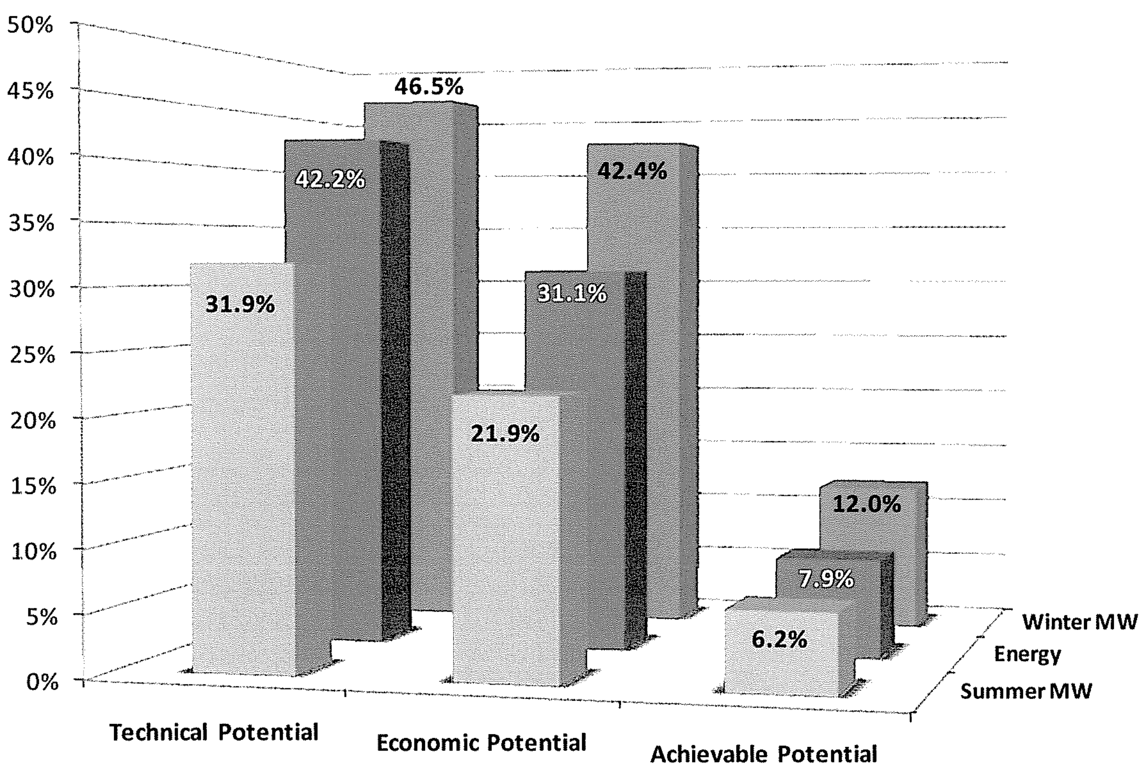


Table 6.1: 2020 Summary of Residential Energy and Demand Savings Potential

	Energy		Demand			
	MWh	% of 2020 MWh Sales	Summer MW	% of 2020 Summer Peak	Winter MW	% of 2020 Winter Peak
Technical Potential	730,626	42.2%	130	31.9%	208	46.5%
Economic Potential	538,754	31.1%	89	21.9%	190	42.4%
Achievable Potential	136,312	7.9%	25	6.2%	54	12.0%

6.1 ENERGY EFFICIENCY MEASURES EXAMINED

Forty-three residential electric energy efficiency programs or measures were included in the energy savings analysis for the residential sector.[9] Below, Table 6.2 provides a brief listing of the various residential energy efficiency programs or measures considered in this analysis. The list of energy efficiency measures examined was developed based on a review of the measures and programs included by other technical potential studies in Kentucky and similar climate regions as well other energy efficiency technical potential studies that have been conducted throughout the US. The set of energy efficiency programs or measures considered was pre-screened to only include those measures that are currently commercially available. Thus, emerging technologies and technologies with extremely low market availability were not included in the analysis. Appendix 2 provides a brief discussion of each measure or program as well as the savings, useful life, cost assumptions, and TRC benefit-cost ratios at the "measure" level.

Table 6.2: Measures and Programs Included in the Residential Sector Analysis

End-Use Type	End-Use Description	Measures/Program Included
Appliances	Home Appliances and Electronics	*Energy Star® Refrigerators, Freezers, and Dehumidifiers *Second Refrigerator and Second Freezer Turn-In *Small Consumer Electronics *Televisions *Computers and Computer Monitors
Lighting	Lighting	*CFL Bulbs *LED Bulbs
Hot Water	Water Heating Upgrades and Water Heating Equipment	*Water Heater Blanket and Pipe Wrap *Low Flow Showerheads and Faucet Aerators *Energy Efficient Water Heaters *Heat Pump Water Heaters *Solar Water Heating w/ Electric Back-Up *Clothes Washers and Dishwashers
HVAC Shell	Building Envelope Upgrades	*Ceiling Insulation *Floor Insulation *Radiant Barriers *Air Infiltration *Duct Sealing *Energy Star® Windows
HVAC Equipment	Heating/Cooling Equipment	*HVAC Tune Up *Energy Star® Room AC *Central AC, and Heat Pumps (Early Retirement / Replace-on-Burnout) *Ground Source Heat Pumps (Early Retirement / Replace-on-Burnout) *Replacing Electric Furnaces with Electric Heat Pumps (Early Retirement / Replace-on-Burnout) *Dual Fuel Heat Pumps
New Homes	New Homes Construction	*New Construction - 15% more efficient *New Construction - 35% more efficient *Energy Star® Manufactured Homes
Other	Miscellaneous Energy Consumptions	*High Efficiency Pool Pump Motors *In-Home Energy Displays *Pre-pay Metering *Multi-Family Homes Efficiency Kit

[9] After accounting for adjustments to different building types and housing characteristics, particularly for measures targeting the space heating and cooling end-use, the number grew to approximately 123 measure permutations.

6.2 RESIDENTIAL SECTOR SAVINGS METHODOLOGY OVERVIEW

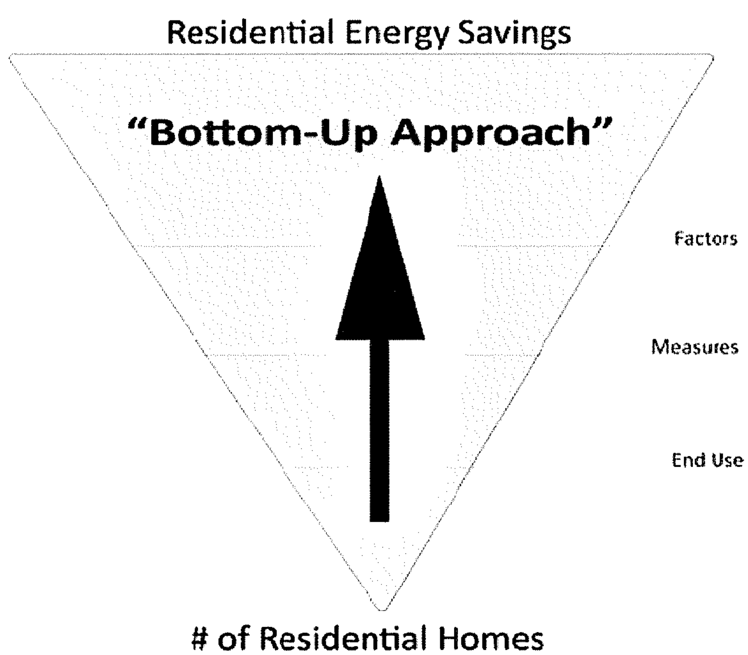
The portfolio of measures includes retrofit and replace-on-burnout programmatic approaches to achieve energy efficiency savings. In the residential sector, retrofit measures were typically limited to the application of supplemental measures (such as the addition of a low-flow device to a showerhead). Early retirement, a programmatic approach that replaces existing measures (for both higher savings and higher costs) prior to the end of their useful life was limited to a handful of space heating and cooling equipment. In all instances the early retirement approach resulted in a lower benefit/cost ratio than the replace-on-burnout programmatic approach, and was screened out of the economic and achievable potential scenarios.

Existing homes were divided into single family and manufactured home markets in order to account for differing equipment saturations and heating/cooling consumption. Multi-family homes make up a small percent of the overall residential sector (2%) and were analyzed independently from rest of the existing housing stock. Finally, new homes were also included in the analysis based on a forecast of the number of new customers each year.

The analysis of the potential for energy efficiency savings is based on the most recent residential electric sales forecasts for the Big Rivers member territory for the years 2011 through 2020.

The residential sector analysis was modeled using what is considered a "bottom-up approach." The methodology is illustrated in Figure 6.2 below:

Figure 6.2: Residential Sector Savings Methodology – Bottom Up Approach



As shown in Figure 6.2, the methodology started at the bottom based on the number of residential customers (dividing them into single-family and manufactured home customers, as well as existing vs. new construction). Estimates of the size of the eligible market in Big Rivers members' service territories were developed for each efficiency measure. For example, energy efficiency measures that affect electric space heating are only applicable to those homes in the Company's members' service territories that have electric space heating.

To obtain up-to-date appliance and end-use saturation data, the study made extensive use of the latest End-Use and Energy Efficiency Survey completed by Big Rivers in 2007. If available, estimates of energy efficient equipment saturations were also based on the Big Rivers survey data. As necessary, baseline and energy efficiency saturation estimates were also gathered from state data presented in the Midwest Energy Efficiency Alliance (MEEA) Residential Market Assessment and DSM Potential Study (2007) as well as regional data from EIA's latest Residential Energy Consumption Survey (RECS) conducted in 2005.

The full formula to determine savings at the measure level is shown below.

Technical Potential of Efficient Measure	=	Total Number of Households or Buildings	X	Base Case Equipment End-use Intensity [kWh/unit]	X	Base Case Factor	X	Remaining Factor	X	Applicability Factor	X	Savings Factor

The goal of the formula is to determine the number of households to which the measure applies (base case factor), then of that group, how many already have the efficient version of the measure being installed (remaining factor). In instances where technical reasons did not permit the installation of the efficient equipment in all eligible households, an applicability factor was used to limit the potential. For example, the technical potential for solar water heating was limited to 30% of the eligible market due to both technical and non-technical factors, including roof orientation, shading, minimum roof size and load bearing capability, aesthetics and local building codes and ordinances.[10] Alternative water heating technologies (efficient water heater tanks and heat pump water heaters) were utilized to meet the remaining market potential. The last factor to be applied was the savings factor, which is the percentage savings achieved from installing the efficient measure over a standard measure.

In developing the overall potential electricity savings, the analysis also took steps to account for the interactive effects of measures designed to impact the same end-use. For instance, if a home were to properly seal all ductwork, the overall space heating and cooling consumption in that home would decrease. As a result, the remaining potential for energy savings derived from additional thermal envelope efficiency measures would be reduced.

In this analysis, it was assumed that for those measures designed to impact the same end-use, the measure or program with the highest current market penetration would typically be installed first, followed by the measure(s) with the next highest market penetration. Presumably, the measures with the highest market penetrations are perceived as the most attractive based on costs, savings, or ease of implementation. Ranking the installation order in this manner also mimics the pattern of installation that is already occurring in the current market.

In instances where there were two (or more) competing technologies for the same electric end-use, such as heat pump water heaters and high efficiency electric storage water heaters, a percent of the available population was assigned to each measure using the applicability factor. In the event that one of the

[10] The Technical Potential of Solar Water Heating to Reduce Fossil Fuel Use and Greenhouse Gas Emissions in the United States. National Renewable Energy Laboratory (NREL). March 2007. Pg. 8. This NREL report limits technical potential to 40% of all residential buildings. The GDS analysis limits technical potential to 30% due to additional competing measures.

competing measures was not found to be cost-effective, the homes assigned to that measure were transitioned over to the cost effective alternative (if applicable).

Federal tax credits for renewable energy technologies (30% of installed costs) were also included in this analysis. These tax credits opportunities were applied to both solar water heating and geothermal heat pump devices. The federal tax credits for renewable energy currently extend until 2016. Current tax credits for energy efficiency measures, set to expire in December 2010, were not represented in this analysis.

Finally, the residential savings potential also takes into account scheduled federal upgrades to incandescent lighting. Recently enacted federal standards (*Energy Independence and Security Act of 2007*) require incandescent bulbs to be approximately 30% more efficient beginning in 2012.[11] These improvements to incandescent equipment performance result in decreased savings potential for CFL and Light Emitting Diode ("LED") technologies. While these new standards may shift the market even further towards wide-spread acceptance of compact fluorescent technologies, they do not necessary signal the end of incandescent bulbs. As a result, this analysis continues to include the potential savings from screw-in CFL and LED bulbs.

6.3 Technical and Economic Potential Savings

The technical potential represents the savings that could be captured if 100 percent of inefficient electric appliances and equipment were replaced instantaneously (where they are deemed to be technically feasible). As shown below in Table 6.3, total technical potential savings for the Big Rivers residential sector are 730,626 MWh, or 42.2% of forecast residential MWh sales in 2020. Heating Ventilation and Air Conditioning ("HVAC") shell and equipment upgrades represent the greatest technical potential for electric savings. The technical potential for summer peak demand savings is 130 MW, or 32% of 2020 forecast summer peak demand. The potential for winter peak savings is approximately 208 MW (46.5% of the 2020 winter peak demand forecast). The savings percentages are calculated using a forecast that excludes two large smelters in the service area (which consumed more than 6.7 MWh in 2009).

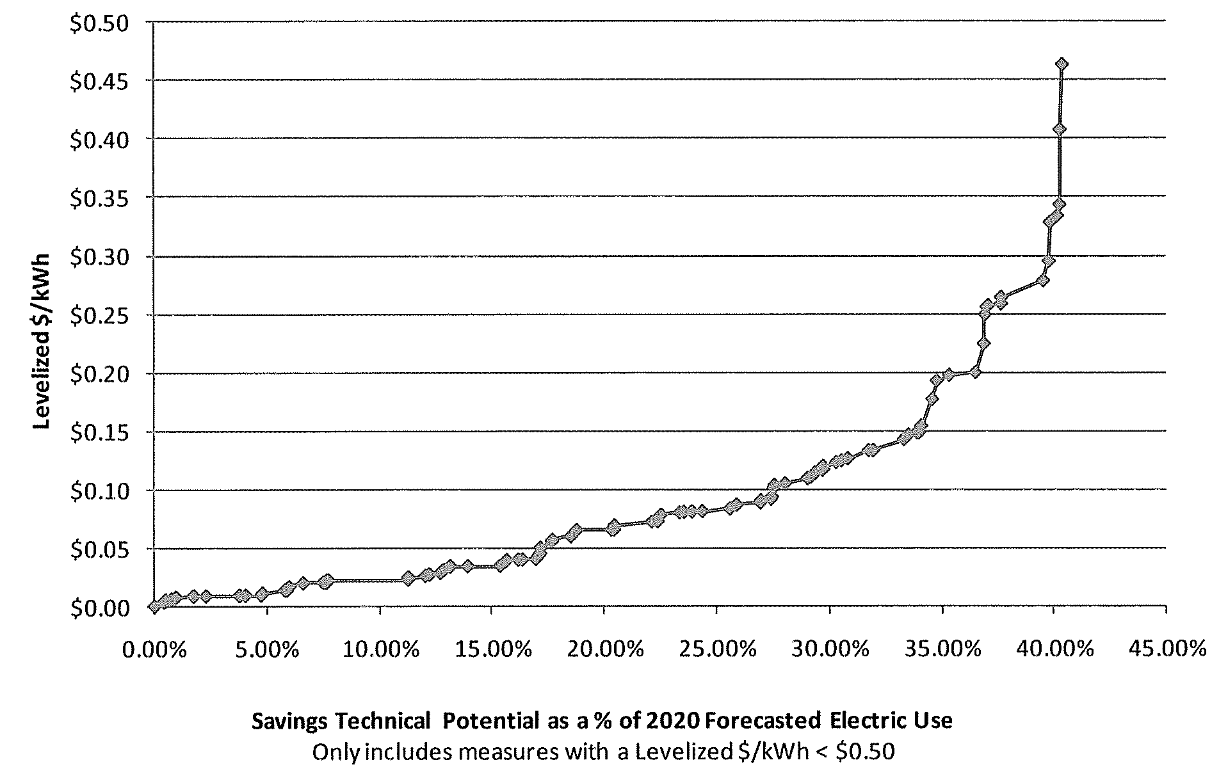
Table 6.3: Technical Energy and Demand Potential and Percentage Share of Residential Forecast Energy Sales and Summer/Winter Peak Demand in 2020

	Technical Potential		
End Use	**Energy (MWh)**	**Summer Demand (MW)**	**Winter Demand (MW)**
Appliances and Electronics	71,156	9	8
Lighting	89,105	12	28
Water Heating	61,485	7	4
HVAC Shell	213,055	59	95
HVAC Equipment	172,462	29	55
New Homes	19,384	4	9
Other	103,979	9	8
Total	**730,626**	**130**	**208**
Total as a % of 2020 Forecast	*42.2%*	*31.9%*	*46.5%*

[11] The mandated increase in the efficiency of incandescent bulbs is phased in over a 3-year period: 100-watt bulbs must be 30% more efficient beginning in 2012, 75-watt bulbs in 2013, and 60-watt and 40-watt bulbs in 2014. For ease of analysis, GDS took the increased standards for incandescent lighting into account throughout the entire period of study (2011-2020).

Below, in Figure 6.3 presents the electric energy efficiency technical potential results for the residential sector in the form of a supply curve. The supply curve demonstrates the technical potential savings (as a % of 2020 forecast kWh sales) at varied levelized costs per lifetime kWh saved amounts. For example, more than 28% savings can be achieved at a cost per lifetime kWh saved of $0.10 or less. To obtain increased electric energy from efficiency resources, it is necessary to move to the right on the curve and choose progressively more costly resources. It should be noted that the levelized costs are based on electric savings and do not factor in associated non-electric benefits, nor do they include program administrative costs.

Figure 6.3: Residential Electric Efficiency Supply Curve for Big Rivers



The economic potential calculations were made by incorporating the various measure assumptions (savings, cost, and useful life, etc) into the cost-effectiveness screening tool.[12] Any programmatic costs (e.g., marketing, analysis, and administration) were ignored in the economic potential analysis in order to screen whether energy efficient technologies were cost-effective on their own merit prior to any assistance or marketing endeavors from utilities or other organizations.

For the economic potential scenario, the study assumed 100% of all remaining cost-effective measures eligible for installation were installed. This produces an economic potential of 31% of forecast residential MWh sales in 2020. Economic summer peak demand savings are 89 MW, or 22% of forecast residential summer peak demand. Winter peak demand savings are approximately 190 MW, or 42% of the forecast residential winter peak.

[12] The cost-effectiveness of a measure is based on each measure's full savings potential, before any adjustments for interactive impacts. After identifying which measures passed screening, we made an additional adjustment for interactive effects in order to finalize estimates of overall economic potential.

Table 6.4: Economic Energy and Demand Potential and Percentage Share of Residential Forecast Energy Sales and Summer/Winter Peak Demand in 2020

	Economic Potential		
End Use	**Energy (MWh)**	**Summer Demand (MW)**	**Winter Demand (MW)**
Appliances and Electronics	69,137	9	8
Lighting	87,692	12	28
Water Heating	52,827	5	6
HVAC Shell	130,775	32	69
HVAC Equipment	102,847	21	64
New Homes	19,384	4	9
Other	76,093	7	6
Total	**538,754**	**89**	**190**
Total as a % of 2020 Forecast	*31.1%*	*21.9%*	*42.4%*

6.4 ACHIEVABLE POTENTIAL SAVINGS

The achievable potential is a subset of the economic potential and is limited by various market and adoption barriers.

6.4.1 ESTIMATING ACHIEVABLE SAVINGS IN THE RESIDENTIAL SECTOR

In the residential base case scenario, achievable potential represents the attainable savings if the market penetration of high efficiency electric appliances and equipment reaches 30% of the remaining eligible market between 2011 and 2020. The time-frame in which the market penetration target is met, however, differs between replace-on-burnout and retrofit measures.

1) For replace-on-burnout measures, a fraction of the 30% market penetration target is achieved annually over the course of the technology's useful life. For example, if a measure has a 20 year useful life, only half of the existing units would be expected to burnout during the 10 year timeframe; thus only 15% of the remaining market would be achieved by 2020.

2) For all retrofit measures the analysis assumes fewer adoption barriers, and the target market penetration is achieved by 2020 regardless of measure lifetime.

The methodology for estimating the total energy efficiency measure adoption from 2011- 2020 in the residential sector is based on the following core equation:

*Total Program Adoption = [(Population * Base Case Factor * Remaining Factor * Market Penetration Factor) / (Measure Useful Life)] * Program Time Frame*

Where

- Population = Total number of single family or manufactured homes in the Big Rivers service area.
- Base Case Factor = Percent of population with measure (standard or high efficiency).
- Remaining Factor = Percent of population currently equipped with energy efficient technology

- Market Penetration Factor = Desired market penetration over time. In the achievable potential scenario, this factor was assumed to be 30%.
- Measure Useful Life = Useful life of Measure
- Program Time Frame = # of Years included in Analysis

This equation was used to calculate the total program adoption of energy efficient measures based on the replace-on-burnout approach and was altered slightly for retrofit measures to ensure the desired market penetration was achieved over a period of 10 years regardless of actual measure life. Again, this is due to the idea that retrofit measures do not require original equipment to reach the end of its useful life prior to the energy efficient upgrade.

Once the total number of measures eligible to be installed over the 10-year analysis time frame was determined, one of three annual penetration curves (slow, average, and quick) was assigned to each measure. The curves were assigned based on measure cost and current market acceptance. For example, a measure with a low measure cost and a high market acceptance was assigned a penetration curve that had rapid adoption in early years and slowly leveled off. CFL lighting is an example of a measure that was determined to have a quick penetration curve. A measure with a high installed cost or low market acceptance (such as ground source heat pumps) was assigned a penetration curve with slow market adoption in early years and increasing over time. All three curves were tailored to ensure that the full desired market penetration was reached by the end of the analysis time frame (30% over 10 years, in the base case). For replace-on-burnout measures, the penetration curves were also limited to guarantee fewer participants in any given year than the natural turn-over rate of the measure would allow. Although this methodology simplifies what an adoption curve would look like in practice, it succeeds in providing a concise method for estimating achievable savings potential over a specified period of time.

Finally, a select few measures possess a useful life less than the analysis time frame. For example, a CFL bulb installed in 2011, with a measure life of seven years, might expire in 2017. In this analysis, expiring measures were reintroduced the following year.[13] This allows both the savings (and costs) to persist throughout the entire 10 year study.

6.4.2 RESIDENTIAL ACHIEVABLE SAVINGS POTENTIAL

Figure 6.4 provides a detailed breakdown of the electric end-use savings as a percent of the total achievable potential for the 30% achievable market penetration scenario. By 2020, the total residential energy efficiency achievable potential is 136,312 MWh, or 7.9% of forecast residential 2020 sales. The major opportunities for electricity efficiency resources are improved housing shell performance (i.e. duct sealing, insulation measures, reduced air infiltration, efficient windows, etc.) combined with more efficient heating and air conditioning equipment. As a fraction of total achievable savings potential in the residential sector, these efforts to reduce cooling and heating loads and improve HVAC system performance make up the largest majority (52%) of achievable savings potential.

There is also a large potential for efficiency savings by replacing regularly used household incandescent light bulbs with more efficient CFL and LED bulbs (approximately 19% of achievable potential in the residential sector), followed by home appliances and consumer electronics, water heating, and new construction.

[13] This methodology was not applied to residential energy efficiency measures dependent on voluntary behavior changes (i.e. In Home Energy Displays and Pre-Pay Metering) where the long-term persistence of savings is relatively unknown.

Figure 6.4: Residential Sector End-use Savings as a % of Total Achievable Potential

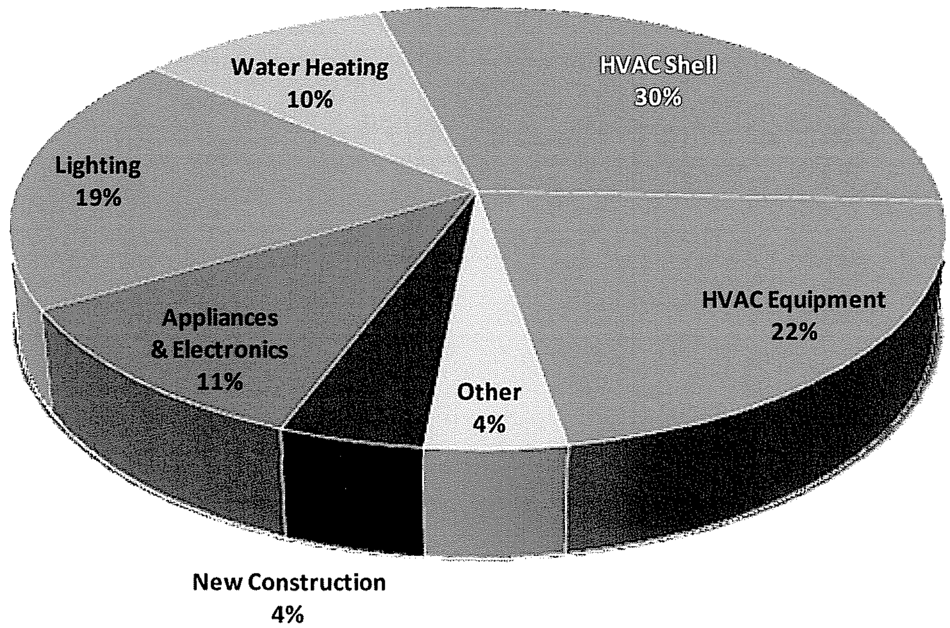
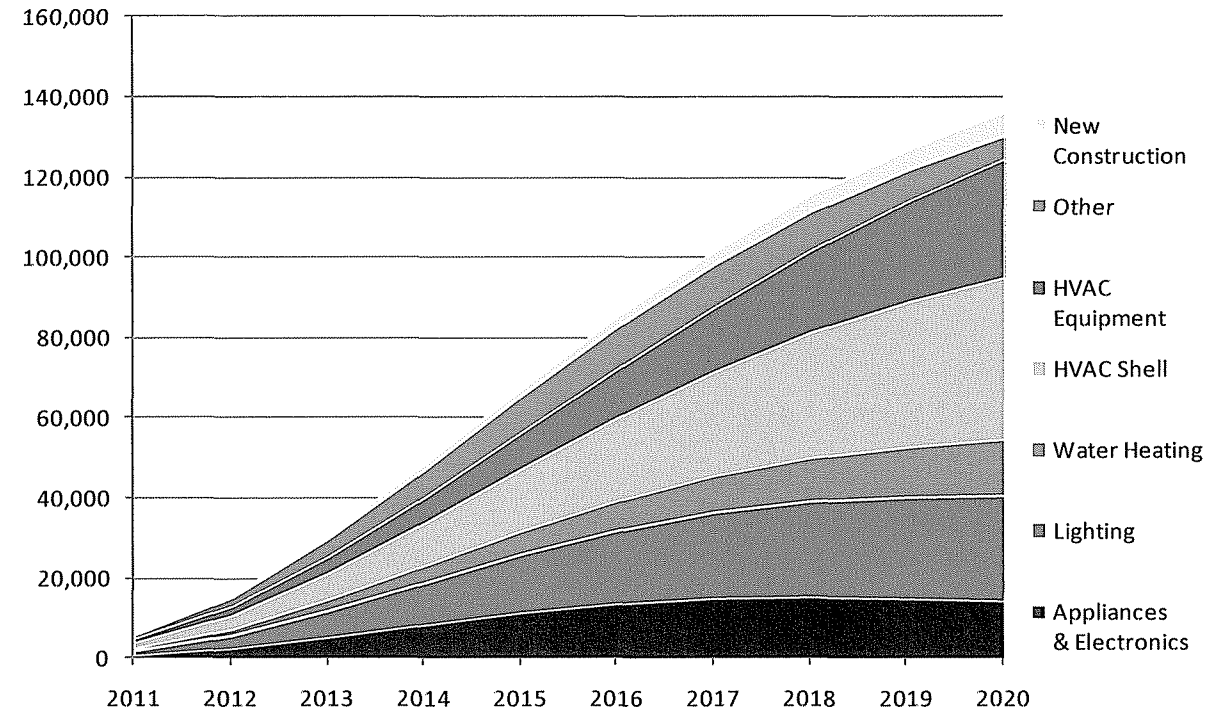


Figure 6.5 below is an area graph that illustrates the annual achievable potential over the 10 year study period and shows the shifting flow of measure group share over time.

Figure 6.5: Residential Achievable Potential Energy Savings under the 30% Penetration Scenario- Cumulative Annual (MWh)



In addition to 136,312 MWh, the 30% market penetration scenario also achieves 25 MW of summer peak savings, or 6% of the 2020 residential summer peak demand forecast. In the winter, the achievable savings represents 54 MW, or 12% of the 2020 winter peak. One of the main factors contributing to the increased potential for winter demand savings compared to summer demand is the presence of several efficiency measures that aim to eliminate the need for emergency strip heat (i.e. dual fuel heat pumps or geothermal systems) during winter peak periods.

Table 6.5: Achievable Energy and Demand Potential and Percentage Share of Residential Forecast Energy Sales and Summer/Winter Peak Demand in 2020

	Achievable Potential		
End Use	**Energy (MWh)**	**Summer Demand (MW)**	**Winter Demand (MW)**
Appliances and Electronics	14,592	2	2
Lighting	26,307	4	8
Water Heating	13,909	1	1
HVAC Shell	40,437	10	22
HVAC Equipment	29,532	7	17
New Homes	5,842	1	3
Other	5,692	1	0
Total	**136,312**	**25**	**54**
Total as a % of 2020 Forecast	*7.9%*	*6.2%*	*12.0%*

For the achievable potential, the 30% market penetration assumes that consumers would receive a financial incentive equal to approximately 35% of the incremental cost of the energy efficiency measure for most technologies. In addition, an overall non-incentive or administrative cost was assigned to each measure in order to run the achievable cost-effectiveness tests. In addition, an overall non-incentive or administrative cost per kWh saved was assigned to each measure in order to run the achievable cost-effectiveness tests. In year one (2011), administrative costs were equal to 25% of the total Big Rivers budget, including 5% for program design and development, 5% for evaluation, and 15% for all other administrative costs. In all subsequent years, the cost associated with program design and development was removed and administrative costs were capped to equal 20% of the total budget.

The overall benefit/cost screening results for the residential sector 30% market penetration scenario are shown below in Table 6.6. The net present value costs to Big Rivers of approximately $23 million dollars include both total incentive payments as well as the associated costs (i.e. marketing, labor, monitoring, etc) of administering energy efficiency programs between 2011 and 2020. The net present value benefits of $138.9 million dollars represent the lifetime benefits of all measures installed during the same time period. Although the achievable potential estimates would require a substantial investment in energy efficiency from both Big Rivers and its members ($56 million), the resulting energy and demand savings would result in a net savings of nearly $83 million dollars (present worth 2011).

Table 6.6: Overall Residential Sector Cost Effectiveness Screening Results *(dollars in millions)*

Benefit Cost Test	Present Value of Total Benefits ($2011)	Present Value of Big Rivers Costs ($2011)	Present Value of Participant Costs ($2011)	Present Value of Total Costs ($2011)	Benefit/Cost Ratio
TRC Test	$138.9	$23.0	$33.0	$56.0	2.48

6.5 MEASURE LEVEL DETAIL

Table 6.7 on the following page presents the measure-level technical, economic, and achievable MWh savings, sorted by end-use. Measures with significant remaining potential either possess significant per unit savings opportunities or are applicable to the majority of homes in the Big Rivers territory. For example, duct sealing has a very high remaining potential because it has high savings and assumes that most homes could benefit from proper duct sealing. By comparison, a second freezer turn-in also has a high per unit savings but is applicable to a smaller number of homes in the member territory. Measures with zero economic and achievable potential were not found to be cost effective.

In a few instances, a measure's economic potential is slightly greater than the technical potential. These adjusted savings in the economic potential scenario are due to a competing measure being dropped from the analysis after screening for cost-effectiveness. Additional measure detail for the technical, economic, and achievable potential in the residential sector can be found in Appendix 2.

Table 6.7: Residential Technical, Economic, and Achievable Potential Savings in 2020, by Measure (MWh)

Measure Name	Technical Potential	Economic Potential	Achievable Potential
Appliances and Electronics			
Home Electronics	17,812	17,812	5,341
Second Refrigerator Turn In	28,226	28,226	3,263
Televisions	7,654	7,654	2,296
Energy Star® Compliant Refrigerator	8,314	8,314	2,079
Computers	2,539	2,539	762
Monitors	1,200	1,200	360
Second Freezer Turn In	2,676	2,676	311
Energy Star® Dehumidifer	716	716	179
Energy Star® Compliant Freezer	2,020	0	0
Lighting			
CFL (vs. Incandescent)	58,623	58,623	17,586
LED (vs. Incandescent)	29,069	29,069	8,721
LED (vs. CFL)	1,413	0	0
Water Heating			
Heat Pump Water Heater	14,126	24,720	5,935
Energy Star® Clothes Washer	9,916	9,916	2,705
Pipe Wrap	5,525	5,525	1,695
Low Flow Showerhead	4,978	4,978	1,503
Efficient Water Heater	2,930	3,924	941
Low Flow Faucets	2,018	2,018	606
Energy Star® Dishwasher	1,747	1,747	525
Water Heater Blanket	0	0	0
Solar Water Heating	20,246	0	0
HVAC Shell			
Duct Sealing	53,847	59,730	18,840
Insulation -Ceiling (R-0 to R-19)	31,492	31,492	9,459
Insulation - Floor	21,724	21,692	6,536
Air Infiltration	19,908	17,861	5,602
Energy Star® Windows	51,705	0	0
Insulation - Ceiling (R-19 to R-38)	10,547	0	0
Radiant Barriers	23,831	0	0
HVAC Equipment			
HVAC Tune-Up	32,284	39,715	13,008
Dual Fuel HP (Replacing Electric Furnace)	35,510	40,981	10,031
Ground Source HP (Heat Pump Upgrade)	13,504	10,940	3,123
Dual Fuel HP (Replacing New ASHP)	8,944	10,442	3,118
Energy Star® Room A/C	790	768	252
Second Energy Star® Room A/C	349	0	0
High Efficiency Central AC	43,846	0	0
High Efficiency Heat Pump	7,856	0	0
Heat Pump (Replacing Electric Furnace)	29,378	0	0
New Homes			
New Construction - 15% more efficient	12,592	12,592	3,782
New Construction - 35% more efficient	6,792	6,792	2,060
Other			
Pre-Pay Metering	71,388	71,388	4,281
Pool Pump and Motor	4,407	4,407	1,326
Multi-Family Homes Package	298	298	86
In-Home Energy Displays	27,886	0	0

7 Commercial and Industrial Energy Efficiency Potential Estimates (2011 to 2020)

Figure 7.1 and Table 7.2 below summarize the technical, economic, and achievable savings potential by 2020. The achievable potential presented here is for a market penetration scenario which assumes the installation of efficient measures in 30% of the available commercial and industrial (C&I) market. If 30% market penetration for all cost-effective measures can be reached over the next decade, the achievable potential for electric energy efficiency savings in the commercial and industrial sector is 175,432 MWh (approximately 9.6% of projected commercial and industrial sales). Energy efficiency measures and programs can also serve to lessen summer and winter peak demand.

Figure 7.1: 2020 Summary of C&I Energy Efficiency Potential

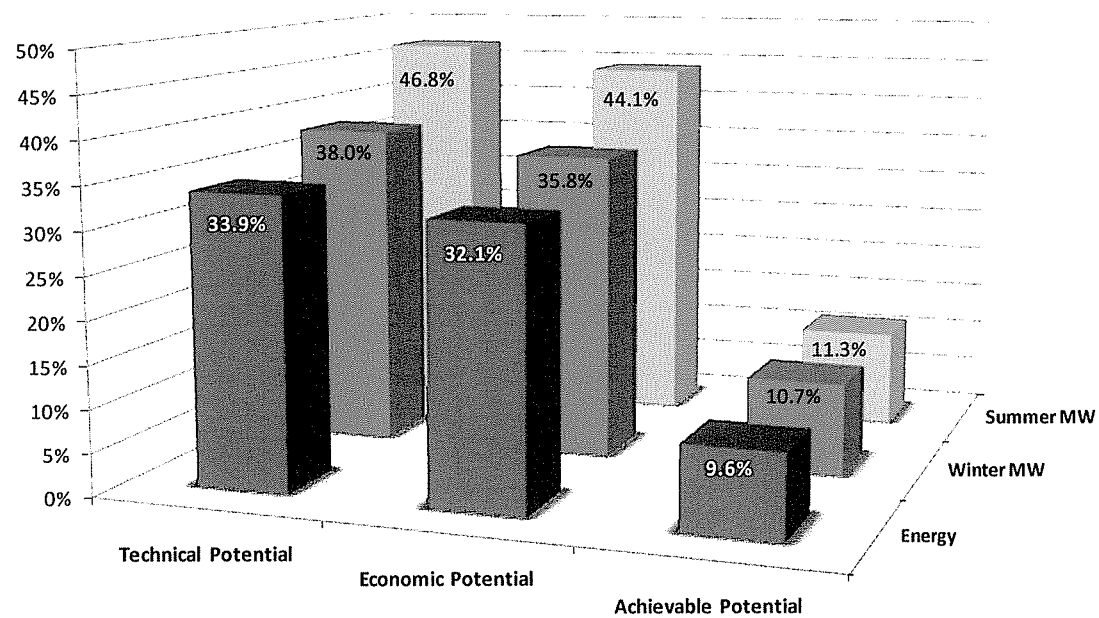


Table 7.1: 2020 Summary of C&I Energy and Demand Savings Potential

	Energy		Demand			
	MWh	% of 2020 MWh Sales	Summer MW	% of 2020 Summer Peak	Winter MW	% of 2020 Winter Peak
Technical Potential	617,149	33.9%	119	46.8%	91	38.0%
Economic Potential	584,774	32.1%	113	44.1%	85	35.8%
Achievable Potential	175,432	9.6%	29	11.3%	26	10.7%

7.1 Energy Efficiency Measures Examined

About eighty commercial and industrial electric energy efficiency measures were included in the energy savings analysis for the C&I sector. Below, Table 7.2 provides a brief listing of the various commercial and industrial energy efficiency programs or measures considered in this analysis. The list of energy efficiency measures examined was constrained by what we've found within our other studies and field experience. In cases where high-efficiency measures may be installed that aren't included in this study, a 'Custom Program' would be developed in order to capture energy efficiency savings. Appendix 3 shows measure level benefit/cost ratios for each of the measures.

Table 7.2: Measures and Programs Included in the Commercial/Industrial Sector Analysis

End-Use Type	Measures Included
Lighting	*Lighting Sensors *T5 and T8 Fluorescent Fixtures *CFL Fixtures and Screw-in Bulbs *LED Exit Sign *HID Fixtures
Space Cooling	*Air Cooled Chiller *DX Packaged AC *Split AC *Packaged Terminal AC (PTAC)
Space Heating	*High Efficiency Heat Pump *Packaged Terminal Heat Pump (PTHP)
Motors (Ventilation and Non-Ventilation)	*Variable Frequency Drives *Motors (1HP - 250HP)
Water Heating	*High Efficiency Storage Water Heater *Water Heater Tank Insulation *On Demand (Tankless) Water Heater *Pre-Rinse Low Flow Sprayer
Cooking	*Convection Oven *High Efficiency Fryer *Pasta Cookers
Refrigeration	*Anti-sweat Controls *Fan Controls *Economizers *Strip Curtains *Display Case Covers *Compressor Motors *Vending Misers
Other	*Fix Compressed Air Leaks *Engineered Nozzles for Blow-off Valves *Watt Sensors for Office Electronics

In developing the overall potential electricity savings GDS also took steps to account for the interactive effects of measures designed to impact the same end-use. For instance, if a building were to install high efficiency T8 lighting along with occupancy sensors, the entire measure savings from each measure could not be obtained. As a result, the remaining potential for energy savings derived from each additional lighting measure would be reduced. In this analysis, GDS assumed that for those measures designed to impact the same end-use, the measure or program with the lowest levelized cost per lifetime kWh saved would be installed first, followed by the measures with the next lowest levelized cost.

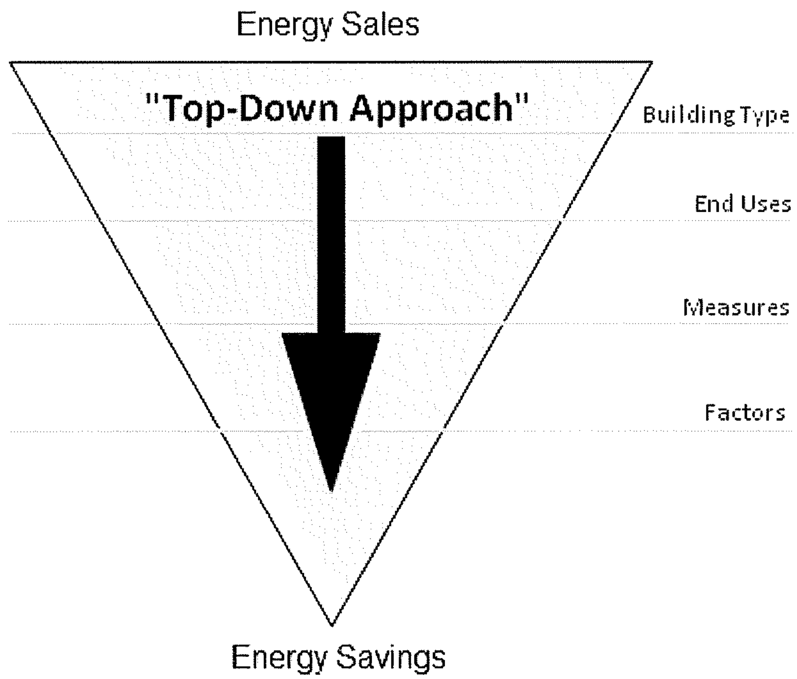
In instances where there were two or more competing technologies for the same electric end-use, such as multiple tonnages of packaged AC units, GDS assigned a percent of the available C&I population to each measure. In the event that one of the competing measures was not found to be cost-effective, the buildings assigned to that measure were switched over to the cost effective alternative (if any).

7.2 Commercial and Industrial Sector Savings Methodology Overview

In all areas of the country, the residential sector has benefited from significantly more studies done on energy conservation related issues than any other sector. Hard data for the commercial and industrial sectors in Kentucky, as is the case for most states, for many of the inputs needed for this analysis, were unavailable. In general, the preference for data sources in this study followed the order of: data given by Big Rivers, Kentucky-specific data, East South Central region specific data, national data and engineering estimates. In the absence of better data, estimates had to be made based on the engineers' and analysts' judgment derived from experience elsewhere and an understanding of the types of factors that may influence the saturation of a specific measure one way or the other in Kentucky.

The commercial and industrial sector analysis was modeled using what is called a "top-down" approach. A top-down potential estimate begins with a disaggregated energy sales forecast over the 2011-2020 time period and then determines what percentage of these sales a given efficiency measure will save.

Figure 7.2: Commercial/Industrial Sector Methodology – Top-Down Approach



As in comparable studies, the choice of building segments is driven by the need to facilitate the analysis and modeling of potential electrical efficiency improvements. Therefore, selected building segments need to be reasonably similar in terms of major design and operating considerations, such as building size, mechanical and electrical systems, annual operating hours, etc. In this study, the sales data are broken down by building type and end-use (see Tables 7.3 and 7.4 below) before the savings percent is applied. The breakdown for building types and end-uses in the Big Rivers service area comes from the EIA's quadrennial Commercial Building Energy Consumption Survey. Information is given by region; therefore the data that is used in this analysis includes Kentucky and surrounding states.

Table 7.3: 2020 Sales by Building Type

	Industry Type	MWh Sales	% of MWh Sales
1	Education	149,303	8.2%
2	Food Sales	83,555	4.6%
3	Food Service	86,294	4.7%
4	Health Care - Inpatient & Outpatient	198,614	10.9%
5	Lodging	94,513	5.2%
6	Mercantile	588,994	32.3%
7	Office	289,018	15.9%
8	Public Assembly	67,118	3.7%
9	Public Order and Safety	23,286	1.3%
10	Religious Worship	24,656	1.4%
11	Service	60,269	3.3%
12	Warehouse and Storage	98,622	5.4%
13	Other	53,420	2.9%
14	Vacant	5,479	0.3%
	Total	1,823,142	100.0%

The next step in a top-down approach is to gather data on end-use consumption for each C&I building segment. Many breakdowns of end-use, saturation and building information were derived from statistical analysis of raw data from the CBECS and through other data sources. Below, Table 7.4 shows the percent breakdown of end-use by building segment. A similar method to the building segment breakdown above was used to arrive at a final kWh number for each end-use using the Big Rivers sales forecast.

Table 7.4: 2020 Sales by End-Use

End-Use	MWh Sales	% of MWh Sales
Space Heating	85,763	4.7%
Cooling	274,089	15.0%
Ventilation	260,568	14.3%
Water Heating	66,461	3.6%
Lighting	728,957	40.0%
Cooking	10,161	0.6%
Refrigeration	165,892	9.1%
Office Equipment	22,750	1.2%
Other	208,503	11.4%
Total	1,823,142	100.0%

The end-uses were then broken down into measure categories, explained in the next section. After measures were examined and saturation data was gathered, the technical, economic and achievable cases were calculated using the formula below:

$$\text{Achievable Potential of C\&I Sector} = \text{Total End-Use MWh (by segment)} * \text{Base Case Factor} * \text{Remaining Factor} * \text{Convertible Factor} * \text{Savings Factor}$$

Where:

- **Total End-Use MWh** (by market segment) is the total annual electric energy used by electric end-use in each market segment. This is the end-use electricity consumption that the efficient technology replaces or affects. For example, if the efficient measure is a CFL, the total end-use MWh is all electricity used for lighting in the specific market segment.
- **Base Case factor** is the fraction of the end-use energy that is applicable for the efficient technology in a given market segment. For example, for a high-efficiency lighting technology, this would be the fraction of the energy use that is for fluorescent lighting.
- **Remaining factor** is the fraction of applicable dwelling units or floor space that has not yet been converted to the efficient measure; (*i.e.* one minus the fraction of households or floor space that already has the energy-efficiency measure installed).
- **Convertible factor** is the fraction of the applicable dwelling units (or floor space) that is technically feasible for conversion to the efficient technology from an *engineering* perspective (e.g., it may not be possible to apply water pipe insulation in all buildings due to access difficulties).
- **Savings factor** is the percentage reduction in end-use energy consumption resulting from application of the efficient technology.

7.3 TECHNICAL AND ECONOMIC POTENTIAL SAVINGS

The total technical potential savings for the Big Rivers commercial and industrial sector is 617,149 MWh, or 34.3% of forecast small and large commercial and industrial MWh sales in 2020. As shown in Table 7.5 on the following page, the greatest share of energy savings technical potential is expected from lighting measures providing 53% of the technical potential savings. Refrigeration measures are expected to constitute 14% of the technical potential, and space cooling almost 13%. Hot water measures are expected to constitute less than 3% of the technical energy potential.

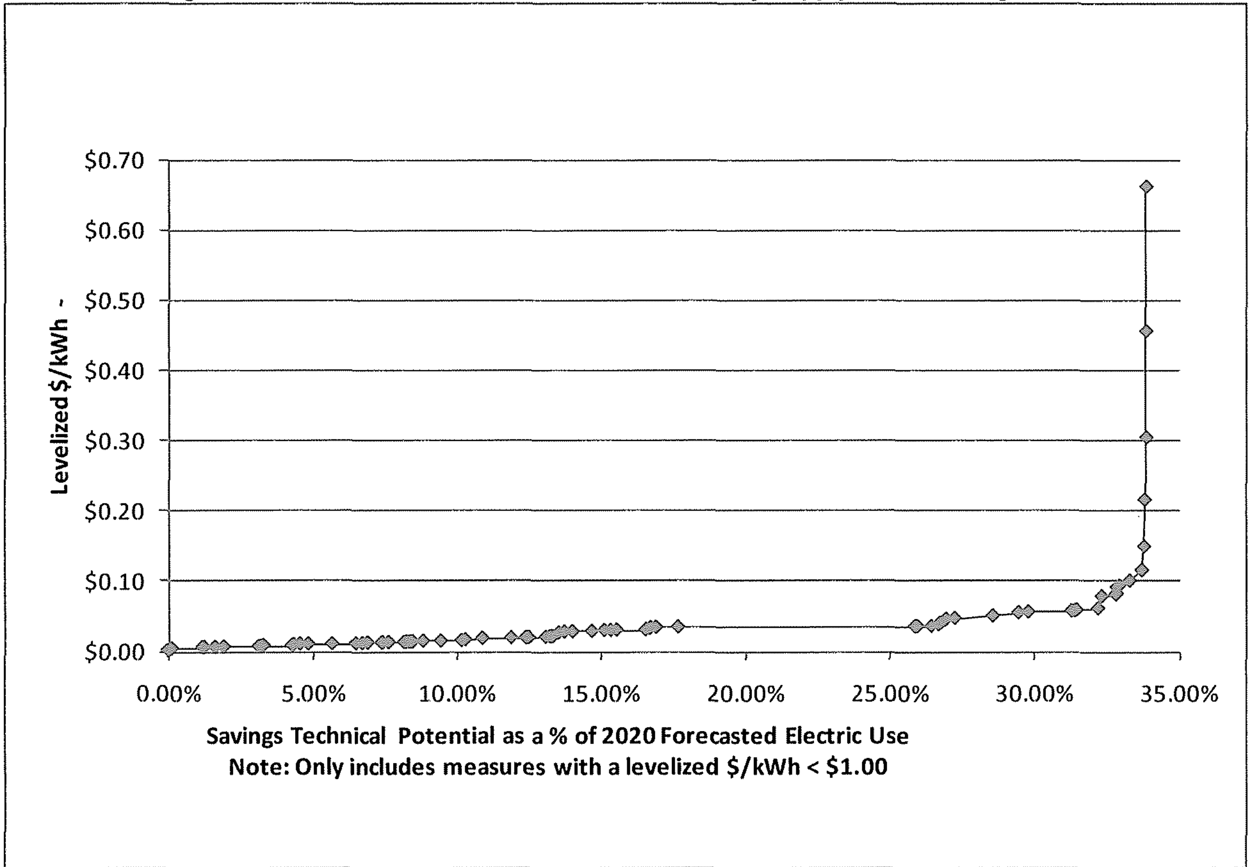
Table 7.5: Technical Energy and Demand Potential and Percentage Share of C&I Forecast Energy Sales and Summer Peak Demand in 2020

	Technical Potential		
	Energy (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Space Heating	4,033	0.0	0.2
Cooling	79,026	29.1	0.1
Ventilation	53,183	8.4	8.4
Water Heating	16,805	0.8	1.3
Lighting	328,160	64.9	66.9
Cooking	1,986	0.3	0.2
Refrigeration	86,886	8.6	6.0
Office Equipment	17,834	2.9	3.2
Other	29,237	4.4	4.4
TOTAL	**617,149**	**119**	**91**
% of 2020 Commercial/Industrial Sales	*33.9%*	*46.8%*	*38.0%*

The share of technical potential for peak demand savings from energy efficiency resources by measure group is relatively similar to that of energy savings. For peak demand savings, the greatest share of technical potential is provided by the lighting category at 49%. The cooling category provides the second largest share at approximately 21%. Hot water measures provide less than 2% of the technical peak demand potential.

Figure 7.3 on the following page presents the electric energy efficiency technical potential results for the C&I sector in the form of a supply curve. The supply curve demonstrates the technical potential savings (as a % of 2020 forecast kWh sales) at varied levelized costs per lifetime kWh saved amounts. For example, more than 30% of savings can be achieved at a cost per lifetime kWh saved of $0.10 or less. To obtain increased electric energy from efficiency resources, it is necessary to move to the right on the curve and choose progressively more costly resources. It should be noted that the levelized costs are based on electric savings and do not factor in associated non-electric benefits, nor do they include program administrative costs.

Figure 7.3: Commercial/Industrial Electric Efficiency Supply Curve for Big Rivers



For the economic potential scenario, the study assumed 100% of all cost-effective measures eligible for installation were installed. Cost-effectiveness was determined as all measures with a TRC benefit-cost ratio greater than 1.0. The economic potential, based on the result of the individual measure TRC tests, is 584,774 MWh, or 32.1% of forecast small and large commercial and industrial MWh sales in 2020. Economic peak demand savings is 156 MW, or 31.6% of forecast small and large commercial and industrial peak demand.

Note that the economic potential is similar to the technical potential savings because measures that were known to typically fail the TRC cost-effectiveness by wide margins were prescreened out of the list of measures analyzed for the technical potential. Therefore, almost every measure analyzed for technical potential passed the TRC test (refer to Table 7.6 below).

Table 7.6: Economic Energy and Demand Potential and Percentage Share of C&I Forecast Energy Sales and Summer Peak Demand in 2020

Economic Potential			
	Energy (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Space Heating	4,033	0.0	0.2
Cooling	79,026	29.1	0.1
Ventilation	53,183	8.4	8.4
Water Heating	16,603	0.8	1.3
Lighting	328,160	64.9	66.9
Cooking	1,374	0.0	0.1
Refrigeration	65,143	3.8	2.6
Office Equipment	8,841	1.3	1.4
Other	28,412	4.4	4.4
TOTAL	**584,774**	**113**	**85**
% of 2020 Commercial/Industrial Sales	*32.1%*	*44.1%*	*35.8%*

7.4 ACHIEVABLE POTENTIAL SAVINGS

7.4.1 ESTIMATING ACHIEVABLE SAVINGS IN THE COMMERCIAL & INDUSTRIAL SECTOR

In the base case scenario, the commercial and industrial achievable potential represents the attainable savings if the market penetration of high efficiency electric equipment reaches 30% of the remaining eligible market between 2011 and 2020. The methodology for estimating energy efficiency measure adoption in the commercial and industrial sector each year from 2011 through 2020 is based on a constant ramp in rate of 10% a year. Because of the "top-down" methodology, the number of customers is difficult to determine. Program implementation experience shows a more rapid increase of program participation in the first 4 years, tapering off in the remaining 6 years. With new technologies, there is often low awareness of the technology among consumers and there may be a hesitancy to purchase the technology because of its newness. A program could then be designed to not only provide incentives, but to increase awareness and promote the technology's reliability. In contrast, a mature technology may already have high willingness and awareness values and, thus, the adoption curve would follow a flatter trend over time.

7.4.2 COMMERCIAL AND INDUSTRIAL ACHIEVABLE SAVINGS POTENTIAL

The achievable potential is a subset of the economic potential and is limited by two main factors:

1) The achievable potential for this study represents the attainable savings if the market penetration of high efficiency electric equipment reaches 30% of the remaining market by the year 2020 (where measures are deemed to be technically feasible).

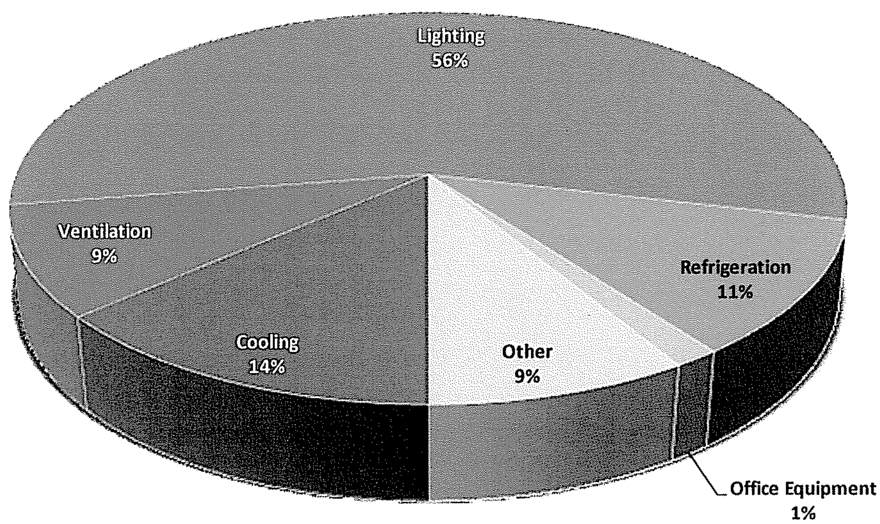
2) The 10 year program time period occasionally impacted the overall cost-effectiveness of a measure. Marginally cost-effective measures that were retained in the technical and economic potential screens (both of which assume immediate implementation) were excluded if the impacts of the discount rate, avoided costs forecast, and retail rate forecasts over the 10 year time period impacted a measure's cost-effectiveness in such a way that the 10 year costs were higher than the lifetime benefits.

Table 7.7: Achievable Energy and Demand Potential and Percentage Share of Commercial and Industrial Forecast Energy Sales and Peak Demand in 2020

	Achievable Potential		
	Energy (MWh)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Space Heating	1,210	2.5	0.1
Cooling	23,708	3.9	0.0
Ventilation	15,955	0.1	2.5
Water Heating	4,981	0.2	0.4
Lighting	98,448	19.5	20.1
Cooking	412	0.0	0.0
Refrigeration	19,543	2.3	0.8
Office Equipment	2,652	0.0	0.4
Other	8,523	0.4	1.3
TOTAL	**175,432**	**29**	**26**
% of 2020 Commercial/Industrial Sales	*9.6%*	*11.3%*	*10.7%*

For the 30% market penetration scenario the achievable potential savings are 175,432 MWh or 9.6% of projected 2020 kWh sales. The base case scenario also achieves 26 MW winter peak demand savings, or 10.7% of the 2020 small and large commercial and industrial winter peak demand forecast. Figure 7.4 provides a breakdown of the electric end-use savings as a percent of the total achievable potential for the 30% achievable scenario. Almost 60% of the achievable cost effective savings is from high efficiency lighting, followed by cooling and Refrigeration. Lighting is usually the dominant end-use for achievable savings because every commercial and industrial customer has lighting, whereas only a small portion have upgraded to energy efficient systems.

Figure 7.4: Sector End-use Savings as a % of Total Achievable Potential – 2020



* "Other" category includes: Space Heating, Water Heating, Cooking, Non-Ventilation Motors and Compressed Air

For the achievable potential, the base case market penetration assumes that consumers would receive a financial incentive equal to approximately 35% of the incremental cost of the energy efficiency measure for most technologies. In addition, an overall non-incentive or administrative cost per kWh saved was assigned to each measure in order to run the achievable TRC cost-effectiveness tests. In year one (2011), administrative costs were assumed to be 25% of the total Big Rivers budget, including 5% for program design and development, 5% for evaluation, and 15% for all other administrative costs. In all subsequent years, the cost associated with program design and development was removed and administrative costs were capped to equal 20% of the total budget. These percentage breakdowns of funding are based on actual budget estimates of programs currently running throughout the U.S.

The overall benefit/cost screening results for the base case is shown below in Table 7.8. The net present value costs to Big Rivers of approximately $14.8 million include both total incentive payments as well as the associated costs (i.e. marketing, labor, monitoring, etc) of administering energy efficiency programs between 2011 and 2020. The net present value benefits of $108.2 million represent the lifetime benefits of all measures installed during the same time period. Although the base case achievable potential estimates would require a substantial investment in energy efficiency from both Big Rivers and its commercial and industrial members ($20.4 million), the resulting energy and demand savings would result in a net savings of over $73.1 million (present worth 2011).

Table 7.8: Overall Commercial and Industrial Sector Cost Effectiveness Screening Results
(dollars in millions)

Benefit/Cost Test	Present Value of Total Benefits ($2011)	Present Value of BREC Costs ($2011)	Present Value of Participant Costs ($2011)	Present Value of Total Costs ($2011)	Benefit/Cost Ratio
TRC Test	$108.2	$14.8	$20.4	$35.1	3.08

7.5 MEASURE LEVEL DETAIL

Table 7.9 on the following page presents the measure-level technical, economic, and achievable MWh savings, sorted by end-use. Measures with significant remaining potential either possess significant per unit savings opportunities or are applicable to the majority of homes in the Big Rivers service area. For example, high efficiency lighting has a very high remaining potential because it has high savings and this analysis assumes that most commercial and industrial facilities could benefit from upgraded lighting. By comparison, some refrigeration measures have a high per unit savings but are applicable to a smaller number of commercial and industrial customers in the members' service territories. Measures with zero economic and achievable potential were not found to be cost effective. Additional measure detail for the technical, economic, and achievable potential in the residential can be found in Appendix 3.

Measure Name	Technical Potential	Economic Potential	Achievable Potential
Lighting			
Occupancy Sensors	154,218,124	154,218,124	46,265,437
Compact Fluorescents (12W-199W)	58,257,500	58,257,500	17,477,250
Standard & High Performance T8 (vs T12) 4ft	43,415,964	43,415,964	13,024,789
High performance T5 (replacing T8)	23,773,676	23,773,676	7,132,103
CFL Hard Wired Fixture	19,435,666	19,435,666	5,830,700
Pulse Start Metal Halide 100 - >300W	13,768,028	13,768,028	4,130,408
High Performance T8HO (vs T12) 8ft	13,541,104	13,541,104	4,062,331
LED Exit Sign	1,750,371	1,750,371	525,111
Space Cooling			
Air Cooled Chillers	30,012,718	30,012,718	9,003,815
DX Packaged Systems	29,756,797	29,756,797	8,927,039
Packaged Terminal AC	13,245,663	13,245,663	3,973,699
Split Air Conditioning	6,010,766	6,010,766	1,803,230
Space Heating			
Packaged Terminal Heat Pump	4,032,500	4,032,500	1,209,750
Motors (Ventilation and Non-Ventilation)			
Variable Frequency Drives	41,050,979	41,050,979	12,315,294
Motors (1HP - 250HP)	38,942,232	38,942,232	11,682,670
Water Heating			
Tank Insulation	6,534,367	6,534,367	1,960,310
Pre-Rinse Sprayer, Low flow, Commercial Application	5,482,897	5,482,897	1,644,869
High Efficiency Storage (tank)	4,585,779	4,585,779	1,375,734
On Demand (tankless)	202,200	0	0
Cooking			
Energy Star Hot Food Holding Cabinet	868,745	868,745	260,624
Electric Energy Star Steamers,3-6 pan	505,244	505,244	151,573
Electric Energy Star Fryers & Griddles	201,183	0	0
Energy Star Convection Ovens	410,749	0	0
Refrigeration			
Anti-sweat Heater Controls Refrigerators & Freezers	14,012,932	14,012,932	4,203,880
Permanent Split Capacitor Motor	13,975,831	13,975,831	4,192,749
Solid Door Refrigerators & Freezers	9,492,337	9,492,337	2,847,701
Humidity Door Heater Controls for freezers and coolers	8,807,905	8,807,905	2,642,371
Glass Door Refrigerators & Freezers	6,849,565	6,849,565	2,054,869
Brushless DC Motors for freezers and coolers	6,845,723	6,845,723	2,053,717
Vending Miser, Cold Beverage	3,917,612	3,917,612	1,175,284
Refrigerated Case Covers	837,336	837,336	251,201
Ice Machine, Energy Star, Self-Contained	403,796	403,796	121,139
Commercial Refrigeration Tune-Up	3,689,368	0	0
Zero Energy Doors for freezers and coolers	1,459,315	0	0
Evaporator Coil Defrost Control	7,573,846	0	0
Evaporator Fan Motor Control for freezers and coolers	6,732,168	0	0
LED Case Lighting (5 door case)	2,287,982	0	0
Office Equipment/Compressed Air			
Watt Sensors on Office Electronics	17,833,669	8,840,622	2,652,187
Fix Air Leaks	2,080,693	1,255,021	376,506
Engineered Nozzles for blow-off	346,069	346,069	103,821
Totals	**617,149,402**	**584,773,871**	**175,432,161**

8 DEMAND RESPONSE ANALYSIS

In an August 2006 report by staff to the FERC, a definition of "demand response" ("DR") was adopted by the Commission. This definition was used earlier by the U.S. Department of Energy ("DOE") in its February 2006 report to Congress:

> *Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.*[14]

In their August 2006 report FERC staff noted that demand response is an active response to prices or incentive payments. The changes in electricity use are designed to be short-term in nature, centered on critical hours when demand or market prices are high, or when reserve margins are low. This is contrasted to energy efficiency programs that are focused on longer-term responses or reduction in consumption through the investment in energy efficient equipment or change in behavior.

This chapter presents Big Rivers' screening analysis of demand response programs.

8.1 TYPES OF DEMAND RESPONSE

Most of the literature describes two primary categories of demand response programs – incentive-based response and price-based response.

- Incentive-based demand response
  - Direct load control
  - Interruptible/curtailable rates
  - Demand bidding/buyback programs
  - Emergency demand response programs
  - Capacity market programs
  - Ancillary-services market programs
- Price-based demand response
  - Time-of-use
  - Critical peak pricing
  - Real-time pricing ("RTP")

For incentive-based programs, generally the goal is for the load reduction to act as a resource, i.e., the demand reduction occurs via dispatch by the system operator. With this treatment, the demand reduction capability can be included in the resource portfolio. The resources can be dispatched for a number of reasons including peak load, low reserves, high energy costs, and transmission line loading.

The goal with price-based incentives is to provide a price signal that is reflective of current market conditions and the demand reductions occur as a voluntary response to the price signal. Generally, these types of responses are embedded in the load forecast, and not explicitly modeled. While it is often a

[14] U.S. Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005, February 2006 (February 2006 DOE EPAct Report).

concern that the load response is not as "firm" as with incentive-based programs, the response can become more predictable based on weather, foreknowledge of prices, and experience.

8.2 General Benefits of Demand Response

As a result of the information or signal provided by the utility under demand response programs, customer responses can either reduce or shift consumption during high cost periods. While all of the programs evaluated within this project result in reducing the load requirements of the system during certain peak periods, there are two distinct load impacts that result from the various programs.

"Load Shifting" – Projects that move energy consumption from one time to another (usually during a single day). For example, the control or interruption of water heaters typically turn off the units during the peak demand or high energy cost periods and allow the units to operate during off-peak and lower cost energy periods.

"Peak Clipping" – Projects that reduce energy consumption at certain critical times, typically when the electric system experiences peaks. These projects generally have only small, if any, effects on overall energy use but focus sharply on reducing energy use at critical times. Examples are customer-owned generation and dual-fuel heat pumps since they reduce the utility's peak load requirements, but there is no energy shift since the customer's requirements are being met by an alternative energy source.

Load-shifting and peak-clipping differ because the former shifts much of the energy use from one time to another, whereas the latter eliminates load without shifting it to another time period.

Also in its August 2006 report to FERC, staff noted that to a limited extent, generation, transmission, and demand response are substitutes, depending on the location of the generation or demand response.[15] As a substitute for generation, demand response can serve as a local peaking resource and thereby assist resource adequacy. However, it should be recognized that besides location issues, demand response may not be perfectly interchangeable with a generation resource with differences including:

- Seasonal unavailability of demand response; e.g., direct control of air conditioners is limited to summer periods vs. generation with planned and forced outages
- The number of hours of demand response is ordinarily limited by the agreement with the customer, vs generation run-hours that are likely limited by the environmental permit for the resource or the limit on the number of call hours according to the terms and conditions of a capacity purchase.
- Demand response under utility control is often considered to be as firm and dependable as a generation resource, but price-incentive demand response usually is not as firm.

As a substitute for transmission and distribution infrastructure, demand response can reduce the need for new transmission or distribution expansion. The report also points out that demand response is typically only indirectly included in the transmission planning process by modifications to expected

[15] U.S. Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A Report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005, February 2006 (February 2006 DOE EPAct Report).

system loads. Generally, if demand response is explicitly considered, it may be a temporary solution until a permanent transmission enhancement is in place.

Under conditions of tight electricity supply, demand response also has the potential to reduce energy supply costs and, in general, electricity price volatility. For load shifting programs, energy cost savings are the difference between avoided energy cost during peak periods and the incurred energy cost during the energy recovery periods.

Demand response can also serve as operating reserves. Several demand response programs such as certain interruptible industrial load and direct load control can provide the timely response necessary to provide these reserves. The eligibility of demand response resources to provide operating reserves has been limited in most regions and typically is restricted to providing supplemental (non-spinning) reserves.

8.3 ENHANCEMENT OF RESPONSE WITH TECHNOLOGY

Automated technology enhances the responsiveness of a facility participating in a demand response program by enabling the customer to achieve a higher percentage of its load reduction potential. Studies conducted by the Rocky Mountain Institute[16] indicate that technology appears to be an important driver in reducing load, especially the most critical peaks for consumers within a rate class that have the highest levels of consumption. Automated technology can help produce consistent load reductions across the cooling season. For example, large commercial and industrial customers show the greatest price elasticity with their ability and willingness to respond to incentives, but without automation the response is uneven, with the load reductions coming from backup generation, shifting operations, or manually shutting off loads in a less organized manner.

Automated metering infrastructure ("AMI") technology can combine load management capabilities with alternative retail rate structures, in addition to providing the benefits of improved meter reading, outage management and power quality, as well as reducing theft. AMI can provide the first step in having the necessary technology in place to support demand response efforts. As an example, with AMI, time-based rates can be offered without the additional cost of interval metering, normally a barrier in the implementation of Time-Of-Use ("TOU") rates. Additionally, with AMI, load control can be initiated via powerline carrier technology with -load control operations coinciding with on-peak or critical peak price periods achieving a greater load impact than if a manual response was required by the customer.

Direct control demand response programs, common especially in the residential sector, require dispatch capability from the utility to the retail customer. Therefore, the technology requirement is either a radio transmission system (towers or pagers capable of direct communication to residential location) or AMI. Two of Big Rivers member cooperatives have or are in the process of installing communication capable meter infrastructure. The third member is evaluating AMI through pilot projects.

8.4 CURRENT DEMAND RESPONSE PROGRAMS

Big Rivers does not currently operate any direct control programs and does not provide electric service to any retail or wholesale customers under an interruptible or curtailable contract or tariff. Big Rivers offers a Voluntary Curtailment Rider, which provides a means for potentially reducing system peak demand during peak periods. In the last ten years, there have been four curtailments affecting two

[16] "Demand Response: An Introduction", Rocky Mountain Institute, April 30, 2006

commercial customers. The maximum estimated load reduction due to the two voluntary curtailment customers is 20-25 MW.

Table 8.1: 2000-2012 Voluntary Industrial Curtailment Results

Year	*Number of Curtailments*	*Load Reduction (MW)*
2000	*0*	*n/a*
2001	*0*	*n/a*
2002	*0*	*n/a*
2003	*0*	*n/a*
2004	*0*	*n/a*
2005	*0*	*n/a*
2006	*0*	*n/a*
2007	*0*	*n/a*
2008	*1*	*20*
2009	*3*	*1 to 25*
*2010**	*0*	*n/a*

** Includes January through August of 2010*

8.5 DEMAND RESPONSE PROGRAMS EVALUATED

A list of potential DR programs representing the most common and most likely to be cost-effective were evaluated in this screening analysis. A more comprehensive list was not originally screened because the expectation for cost effectiveness for demand response was low given the low value associated with avoided peaking capacity. Therefore, Big Rivers focused the analysis on the most common types of programs that a utility might use in starting a demand response initiative. Had more of these programs passed the screening, the list of potential programs for screening would have been expanded. Programs not included initially, but that could have been considered if further analysis was warranted include, but are not limited to: dual fuel heat pumps, electric thermal storage ("ETS") heating units for residences, ETS cooling units for commercial buildings, direct control of swimming pool pumps, and direct control of agricultural applications such as irrigators and grain dryers.

A total of fifteen programs were evaluated, with a mix of both residential and commercial incentive-based and price-based programs. Consistent with the energy efficiency evaluation, DR programs are primarily evaluated based on the Total Resource Cost test, but Utility Cost Test ("UCT") and Participant Costs Tests ("PCT") were also calculated.

Table 8.2: Demand Response Programs Evaluated

Sector	Program	Basis	Peak Effect	Direct Control	Summer kW Savings per Unit	Winter kW Savings per Unit
Residential	Air Conditioner - 33% Cycling	Incentive	Peak Shift	Yes	0.8	0.0
	Air Conditioner - 50% Cycling	Incentive	Peak Shift	Yes	1.1	0.0
	Water Heater - 40/50 Gallon	Incentive	Peak Shift	Yes	0.4	0.6
	Time-of-Use (TOU) Rate	Price	Peak Shift	No	0.2	0.1
	Crticial Peak Pricing (CPP) Rate	Price	Peak Shift	No	1.0	0.5
	Smart Thermostat w/ CPP Rate	Incentive/Price	Peak Shift	Yes	1.4	0.5
Commercial	Distributed Generation	Incentive	Peak Clip	Yes	350	350
	Lighting - Small Application	Incentive	Peak Clip	Yes	2.1	2.1
	Lighting - Large Application	Incentive	Peak Clip	Yes	21	21
	Energy Management System (EMS)	Incentive	Peak Shift	No	12	12
	Time-of-Use (TOU) Rate	Price	Peak Shift	No	0.1	0.1
	Crticial Peak Pricing (CPP) Rate	Price	Peak Shift	No	0.6	0.6
Industrial	Distributed Generation	Incentive	Peak Clip	Yes	1,000	1,000
	Energy Management System (EMS)	Incentive	Peak Shift	No	150	150
	Interruptible Rate	Price	Peak Clip	No	1,000	1,000

8.6 Demand Response Program Cost-Effectiveness

Due to the low value currently associated with avoided production and transmission capacity, most of the DR programs evaluated are not cost effective under the TRC test. The table below presents the 10-year net present value benefits and costs under the total resource cost test for a single unit and shows the benefit/cost ratios for the TRC test, the utility cost test, and the participant cost test. The methodology employed in calculating these effectiveness tests is consistent with the methodology employed in evaluating energy efficiency as described earlier in this report. Further details on inputs into the analysis including load, benefit, and cost assumptions are described below.

Table 8.3: Cost-Effectiveness Screening Results per DR Measure Installed

		Total Resource Cost Test				
	Program	NPV Benefits	NPV Costs	TRCT	Utility Cost Test	Participant Cost Test
Residential	Air Conditioner - 33% Cycling	$287	$647	0.44	0.44	*
	Air Conditioner - 50% Cycling	$428	$740	0.58	0.58	*
	Water Heater - 40/50 Gallon	$429	$778	0.55	0.55	*
	Smart Thermostat	$890	$807	1.10	0.93	1.30
	Time-of-Use (TOU) Rate	$155	$250	0.62	0.62	*
	Crticial Peak Pricing (CPP) Rate	$650	$681	0.95	0.95	*
Commercial	Distributed Generation	$316,883	$143,715	2.20	1.71	1.29
	Lighting - Small Application	$1,800	$1,707	1.05	1.05	*
	Lighting - Large Application	$17,803	$12,260	1.45	1.45	*
	Energy Management System (EMS)	$9,079	$12,336	0.74	0.75	0.99
	Time-of-Use (TOU) Rate	$139	$784	0.18	0.18	*
	Crticial Peak Pricing (CPP) Rate	$591	$944	0.63	0.63	*
Industrial	Distributed Generation	$903,251	$459,962	1.96	1.67	1.18
	Energy Management System (EMS)	$114,441	$226,127	0.51	0.68	0.74
	Interruptible Rate	$863,918	$243,307	3.55	3.55	**

**All monetary costs are borne by the utility, therefore the participant cost test is not applicable.*

*** For the interruptible rate, each retail customer is likely to have some monetary cost associated with adjusting operations to curtail load. However, since it is site-specific, calculation of a participant cost test in general is difficult.*

8.7 KEY ASSUMPTIONS AND INPUTS

The Demand response analysis is consistent with the energy efficiency analysis in many respects. The same screening model is used to calculate the evaluation metrics for the Total Resource Cost Test. Key input system data such as the load forecast, loss factors, reserve margins, transmission and distribution avoided costs, and discount factors are also consistent between the studies. This section details the assumptions that are specific to demand response programs.

Load Impacts

One of the critical assumptions for screening demand response programs is the amount of load reduction possible at the time of the system peak. A body of secondary research sources (for a list of secondary sources, see Appendix 4 of this report) and GDS' experience with other cooperatives were used to develop load impact assumptions for Big Rivers.

Air Conditioners – For air conditioners, GDS used load impact estimates from potential studies for utilities in four other states. The load estimates were weather-adjusted by developing a linear regression relationship between normal cooling degree days and the load impact. The regression model and cooling degree days for Big Rivers were used to estimate air conditioner impacts in Kentucky. These were then checked for reasonableness with measurement and verification study results in the secondary literature. The impacts for the proxy utilities in other states were developed using system specific data including weather, size of home, and estimation techniques suggested by the Air Conditioning Contractors of America ("ACCA").[17]

Water Heaters – Water heaters are estimated in a manner similar to air conditioners, averaging load impacts seen in other GDS studies. However, water heaters are not as weather-sensitive at the estimates are very stable from region to region.

Residential and Commercial Rate Programs – There are three residential rate programs that build upon each other: TOU, Critical Peak Pricing ("CPP") interactive metering (manual control by consumer), and CPP smart thermostat (control by utility).

TOU rates have fixed prices for defined time periods. The CPP rates would have fixed prices for off-peak hours and defined on-peak periods. In addition, there are higher (critical) prices during select high energy cost hours. For this study, the top 100 energy cost hours are assumed for the CPP rate, consistent with programs at other utilities with which GDS has consulted. For the CPP manual program, the residential user has a programmable thermostat and can choose to respond to prices, but there is no control from the utility. With the smart thermostat program, the utility can control the air conditioner and, therefore, achieve load impacts consistent with an AC control program plus additional benefits associated with customer response to prices. Figure 8.1 on the following page demonstrates theoretical time-based rates for a summer day.

[17] "Manual S – Residential Equipment Selection." ACCA.

Figure 8.1: Example Time-Based Rates on a Summer Day

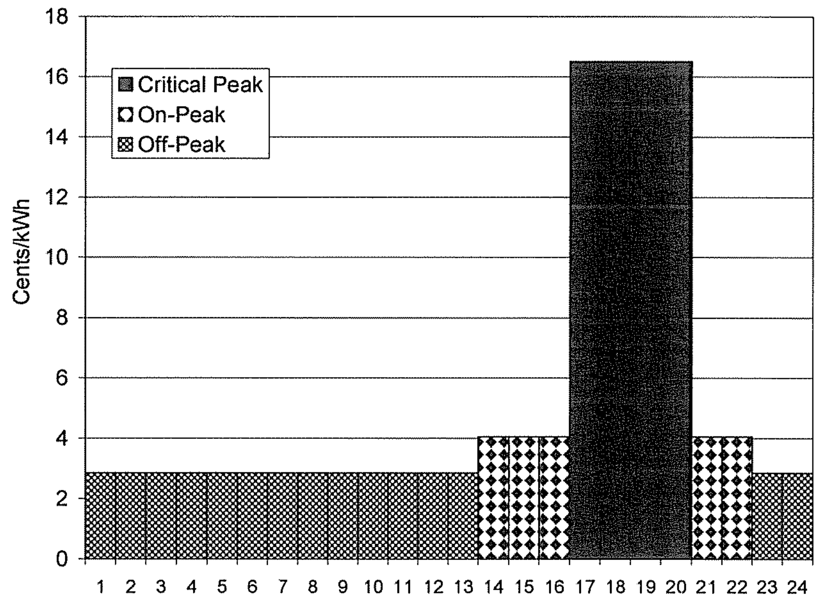
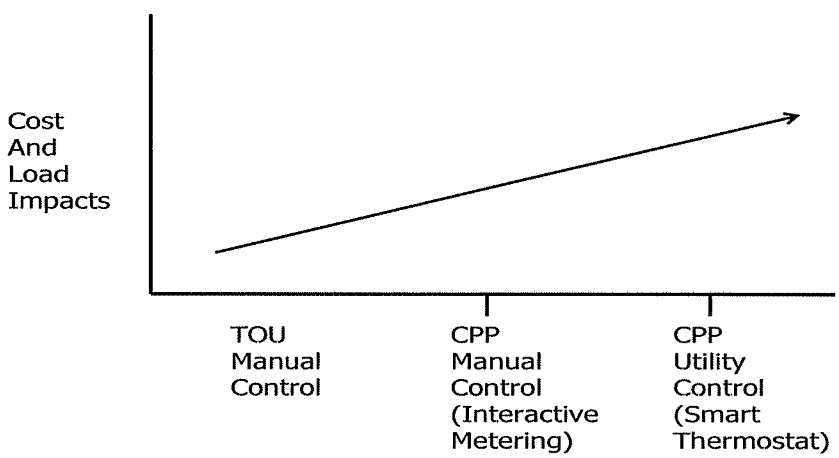


Figure 8.2 demonstrates the relationship between program costs and load impacts for the three rates. The TOU rate with manual control[18] has the lowest equipment and administrative costs but also provides the least demand response since it is based on voluntary response. The CPP rate with manual control provides a stronger price signal and therefore gets a slightly better energy and demand benefit, but costs are also higher than the TOU rate because of the need for equipment to send price signals during critical peak pricing hours. Finally, the addition of a smart thermostat that allows the utility to control air conditioning is the most costly alternative, but also provides the highest demand impact.

Figure 8.2: Illustration of the Build-Up Nature of the Time Based Residential Rates
(Note: Manual control indicates no utility control over thermostat; homeowner must manually change temperature setting voluntarily)



[18] Manual control means that the utility has no ability to control the thermostat, so any changes to the thermostat must be made by the homeowner by manually changing the temperature setting. Therefore, a manual control rate program requires voluntary response to price signals.

TOU and CPP impacts are estimated based on a macro-analysis performed by the Brattle Group, examining measured load impacts for several utilities throughout the country.[19] The industrial interruptible rate is simply an assumption that the retail consumer can somehow curtail 1 MW of load during interruption notices. These curtailments could be garnered through shutting down processes or moving shifts or by other means.

Distributed Generation – It is assumed that a commercial application would equal 350 kW and an industrial application would equal 1,000 kW.

Commercial Lighting Control - Load impacts for commercial lighting were estimated using commercial load profiles developed by GDS for other energy efficiency and demand response analyses. The load profiles include estimated internal lighting wattage per square foot for various building types. A report by Peter Morante of the Lighting Research Center indicates that control switches can be installed in buildings to interrupt 25% of the lighting load (*e.g.* dimming some areas, or shutting off every third hallway light).[20] The commercial lighting program was broken into small and large commercial applications, and the average load impact for each group was used for the benefit/cost analysis. It is assumed that the control strategy would mirror the standard capacity water heater program, resulting in 100 hours of control each year. The commercial energy lighting results in energy losses as indicated in the Table 8.4 below.

Table 8.4: Commercial Lighting Control Load Impacts

Type	*Square Footage*	*Watts per Sq. Ft.*	*Total Watts*	*25% kW Reduction*
SMALL COMMERCIAL				
Office	*6,600*	*1.33*	*8,778*	*2.19*
Retail Store	*6,400*	*0.87*	*5,568*	*1.39*
Restaurant	*5,250*	*0.92*	*4,830*	*1.21*
School	*16,000*	*0.88*	*14,080*	*3.52*
Group Average	***8,563***	***0.97***	***8,306***	***2.08***
LARGE COMMERCIAL				
Office	*90,000*	*0.87*	*78,300*	*19.58*
Retail Store	*79,000*	*0.87*	*68,730*	*17.18*
Hospital	*155,800*	*0.64*	*99,712*	*24.93*
Group Average	***108,267***	***0.76***	***82,247***	***20.56***

Energy Management Systems - Energy Management Systems ("EMS") can take on many forms, but the basic approach is that multiple end-uses are controlled on-site through an integrated system to achieve combined demand reductions. Typically, these systems include built-in logic to monitor loads and initiate control measures when needed. Extensive research indicates that such systems are very site-specific, thus, characterizing a "general" EMS set-up is difficult. However, a pilot study of small commercial applications was conducted by Southern California Edison in 2006[21] using a product

[19] *Rethinking Prices*. Faruqui, Ahmad, Ryan Hledik, and Sanem Sergici. *Public Utilities Fortnightly*. January 2010. Pp. 30-39.
[20] "Making Lighting Responsive to Demand Response." Peter Morante, Lighting Research Center. Rensselaer Polytechnic Institute.
[21] "Demand Response Enabling Technologies For Small-Medium Businesses." Lockheed Martin Aspen, April 12, 2006.

developed and sold by Dencor, Inc. (www.dencor.com). The system included control of rooftop air conditioners, walk-in coolers, walk-in freezers, reach-in coolers, ice makers, and electric water heaters. The pilot included retail stores, restaurants, beverage stores, offices, and small groceries, with loads ranging from 15 kW to 150 kW. The Dencor systems include the ability of the utility to monitor the system through the internet, dial-up, or GPS technology. The pilot program demonstrated an average 11.9 kW reduction for a customer with an average base load of 54.3 kW, a 22% reduction.

Both small commercial and larger industrial EMS were included in the benefit/cost analysis. For small commercial, GDS used the 11.9 kW impact from the Southern California Edison pilot study and assumed the same control strategy as a large capacity water heater program. With the significant upfront costs associated with an EMS, a customer is very likely willing to control for many more hours per year than a standard residential air conditioner or water heater strategy. For industrial applications, it is assumed the load is 1,000 kW and that 15% demand reductions can be achieved. Energy is assumed to be shifted and not lost due to control through the EMS.

Benefits

The benefits of avoided peaking demand and transmission demand are consistent with the energy efficiency analysis. Development of the avoided costs is detailed in Section 5.9 of the report. Avoided production demand is based on market price of capacity and growing into the value of a peaking unit. There is no benefit assumed for avoided transmission or distribution demand. For peak shifting programs, there is an avoided energy benefit associated with serving the load during the recovery periods that tend to have lower energy production costs. The benefit is the difference between the energy cost during peaking and recovery hours. For this study, the on- and off-peak avoided energy costs are used to estimate the benefit of shifting energy. For peak clipping programs in which energy is not recovered, the avoided energy cost is the on-peak energy charge.

Costs

The costs included in the Total Resource Cost Test benefit/cost analysis generally include equipment installation and carrying costs, program administration and marketing costs, and costs associated with delivery of the communication or price signal to the affected device or consumer. For direct control programs in which the participant incurs no cost, incentives are also included as program costs. Costs may be incurred by the G&T, member cooperative, or retail consumer. The TRC test does not include lost electric revenues that may arise from programs that reduce energy consumption.

Incentives

Incentives for demand response programs take on many forms and levels. For instance, some cooperatives are able to get participation for a water heater control program with little or no incentive, simply by appealing to the "cooperative spirit". Incentives include a one-time payment, monthly fixed payments, rate incentives, and contributions to equipment cost. For programs in which the participant has some share in equipment cost, incentives by the utility to offset that cost are excluded from the TRC test. However, in a program such as air conditioner control in which the participant has no monetary cost, incentives paid by the utility to the participant are included. The levels of incentive assumed in the Big Rivers screening analysis are shown in Table 8.5 below. Some are assumed to be monthly payments (e.g., $4 per month for water heaters) and others, such as distributed generation, are rate incentives ($6.50 per kW-month demand credit). However, the ultimate form of the incentive is not as important as the magnitude for purposes of a screening analysis.

Table 8.5: Incentive Amounts for TRC Test

	Program	TRC Annual Incentive	Nature
Residential	Air Conditioner - 33% Cycling	$36	Recurring
	Air Conditioner - 50% Cycling	$48	Recurring
	Water Heater - 40/50 Gallon	$48	Recurring
	Smart Thermostat	$0	
	Time-of-Use (TOU) Rate	$0	
	Crticial Peak Pricing (CPP) Rate	$0	
Commercial	Distributed Generation	$0	
	Lighting - Small Application	$500	One-Time
	Lighting - Large Application	$1,000	One-Time
	Energy Management System (EMS)	$0	
	Time-of-Use (TOU) Rate	$0	
	Crticial Peak Pricing (CPP) Rate	$0	
Industrial	Distributed Generation	$0	
	Energy Management System (EMS)	$0	
	Interruptible Rate	$31,455	Recurring

For some programs, it may be necessary for the utility to provide incentive to offset equipment costs for the participant. Those incentives do not appear in the TRC test, but would appear in the UCT. Lost revenues from energy savings also appear in the UCT. For major equipment purchases, such as distributed generation, it is assumed that the utility will make a one-time payment to off-set equipment costs in the amount of 25% of the capital cost.

Table 8.6: Incentive Amounts for UC Test

	Program	UC Annual Incentive	Nature	Annual Lost Revenue From Energy Savings	One-Time Contribution to Equipment Costs
Residential	Air Conditioner - 33% Cycling	$36	Recurring		
	Air Conditioner - 50% Cycling	$48	Recurring		
	Water Heater - 40/50 Gallon	$48	Recurring		
	Smart Thermostat	$48	Recurring		
	Time-of-Use (TOU) Rate	$0			
	Crticial Peak Pricing (CPP) Rate	$0			
Commercial	Distributed Generation	$18,200	Recurring	$2,864	$23,713
	Lighting - Small Application	$500	One-Time		
	Lighting - Large Application	$1,000	One-Time		
	Energy Management System (EMS)	$1,217	Recurring		$2,715
	Time-of-Use (TOU) Rate	$0			
	Crticial Peak Pricing (CPP) Rate	$0			
Industrial	Distributed Generation	$52,000	Recurring	$8,163	$78,750
	Energy Management System (EMS)	$8,782	Recurring		$100,000
	Interruptible Rate	$31,455	Recurring		

Carrying Costs for Capital Equipment
Two different carrying cost factors are used to expense capital items in the analysis. The first factor is when the utility will own and operate the equipment (direct control programs) and includes interest, depreciation at 10 years, operations and maintenance, and margins on the interest expense. Margins are a blended average of a G&T Times Interest Earned Ratio ("TIER") of 1.1 (25% weight) and a distribution cooperative TIER of 1.5 (75% weight). The second factor is when a commercial account owns the equipment. That factor includes interest, depreciation over 15 years, and operations and maintenance.

Table 8.7: Carrying Cost Factors

Item	*Utility Ownership*	*Commercial Ownership*
Interest	*5.00%*	*5.00%*
Depreciation	*10.00%*	*6.67%*
O&M	*3.00%*	*3.00%*
Insurance & Taxes	*0.00%*	*0.00%*
Margins on Interest	*2.00%*	*0.00%*
Total Carrying Cost	***20.00%***	***14.67%***

Capital Costs of Equipment

Cost of Load Control Switches and Infrastructure
Several programs involve installation of a load control switch to the application in order for the utility to signal the end-use to shut down or cycle. Programs that require such a switch include air conditioners, water heaters, smart thermostat, and commercial lighting. Since two of Big Rivers' members are expected to implement AMI in the near future, an AMI-based control system is evaluated in this study. Centralized hardware and software would be required for the system as well as devices in each distribution substation. GDS has conducted a Demand response Study for another G&T in which a cost analysis on a similar infrastructure had been recently performed. Therefore, we used the results from this recent analysis to provide estimated costs for Big Rivers to implement demand response at the G&T level. Capital and install cost for an air conditioner switch is $190 per unit and for all other direct control programs is $215 per switch.

Commercial lighting is also a direct control measure, but its costs are greater than the costs for the other programs listed above. A study conducted by the Lighting Research Center[22] estimated that the total install cost of control technology to shut off 25% of a commercial lighting load was $9 per ballast. The small commercial application assumes an average of 81.5 ballasts for a cost of $734 per location. The large commercial application assumes an average of 806.3 ballasts for an install cost of $7,257 per location.

Residential Rate Options
A residential TOU rate in which AMI has already been deployed would have no capital costs since the AMI system is able to register time-based energy consumption.

[22] "Making Lighting Responsive to Demand Response." Peter Morante, Lighting Research Center. Renesselaer Polytechnic Institute. 2005. PowerPoint presentation.

The CPP rate with interactive metering has capital costs associated with the installation of a device to send price signals to the consumers and associated software. GDS has concluded that the most cost-effective way to implement a CPP rate would be via an AMI system.[23] It is estimated that the installation of AMI technology and the communication equipment to facilitate a CPP rate would cost $275 per application.[24] Finally, the CPP rate with a Smart Thermostat application requires an additional $200 related to installation of the smart metering equipment.[25]

Energy Management Systems

GDS used an install cost of $200 per base kW for Energy Management Systems. This estimate was provided by the president of Dencor, Inc. (www.dencor.com). Dencor's estimate was a range of $160 to $210 per kW, depending on the level of penetration achieved. The cost includes installation of equipment and operator training provided by Dencor. For the commercial application, the total capital cost is $10,860. For an industrial application, the cost is $200,000.

Distributed Diesel Generators

Diesel generation installation costs are based on vendor data and GDS experience in analyzing such systems. The small commercial application is $156 per kW and the industrial application is $200 per kW. In addition, it is assumed that parallel switchgear will be required and would have a cost of $115 per kW.

Commercial Rate Options

As with residential, there is no capital cost for a TOU rate since AMI is deployed. The commercial CPP, RTP, and Interruptible rates have a simple $150 cost associated with communication equipment for the critical peak hours.

Administrative, Marketing, and Operating Costs

For the demand response programs, GDS assumes that there will be some benefit in administrative costs derived from the energy efficiency program efforts (some efforts would be duplicated). For this demand response analysis, GDS estimates that Big Rivers will have an employee spend approximately 60 hours per month on demand response activities during 8 peaking months and 40 hours per month during 4 non-peaking months (billing, determining when to control, member relations, etc). For the number of switches required to reduce peak demand by 5%, that levelized cost equals $2.12 per switch. Each member cooperative is assumed to dedicate the same number of hours per month to demand response as the Big Rivers staff. Furthermore, each member would have marketing costs of between $6,000 and $8,000 per year. The levelized cost per switch for member cooperatives for these administration and marketing costs equals $7.86.

Administrative costs for rate programs are based on customer service charges from retail rates for several cooperatives. The difference between the dynamic rate and the standard rate represents some indication of the costs associated with administration of the rate.

8.8 Conclusions and Recommendations for Demand Response

With Big Rivers and the region in and around MISO being long on capacity, the value of demand response programs is presently low. Furthermore, there are no benefits associated with avoided transmission facilities. Therefore, it is not surprising that most of the DR programs analyzed do not pass the TRC test. The following programs did pass the TRC test.

---

[23] Pulse meters for recording hourly interval data are assumed to be approximately $1,000 per installation.

[24] TWACS PowerStat In-Home Display (TWACS IHD™) by DCSI.

[25] "Solving Peak Issues Through Demand Response." Steve Saenz, Austin Energy.

Smart Thermostat with CPP Rate – This program had a benefit/cost ratio of only 1.10, meaning the NPV benefits exceeded the costs by only 10%. When looking at the utility and participant tests, the program is not cost effective for the utility.

C&I Distributed Generation – This program shows passing tests for TRC, UC, and PC tests. However, the PC tests are lower than the UC tests, indicating that a larger incentive may be necessary to encourage C&I consumers to front the high costs of generators and switchgear equipment (although this analysis already assumes the utility makes a one-time payment in support of the capital cost of 25%). This program should probably be further considered by Big Rivers but a key will be finding customers willing to take the risk for the incentives as estimated herein.

Commercial Lighting Control – This program is another program that passes the TRC test, but only by a very small margin. The smaller application has a benefit/cost ratio of 1.05 and the larger application is 1.45. These programs require intrusive installation such as wiring to individual fixtures throughout a building so that fixtures can be controlled by the utility. This would not be an ideal first program for DR, but may be considered and pursued by a utility with a mature DR portfolio and extensive experience in installation of control switches.

Interruptible Rate – This program is highly beneficial with very little cost. That is because the assumption is that the industrial customer is able to curtail 1 MW without additional equipment. An interruptible program looks highly beneficial in many DR studies even with low avoided cost benefits. Obviously, the challenge to the utility is finding candidates that meet these stringent criteria that would be willing to either change shifts or operations in order to reduce their power bills.

Recommendation

At this time, GDS recommends that Big Rivers not pursue a formal demand response program. Most of the typical DR programs analyzed in this screening are not cost-effective at this time and those that are cost effective are either difficult to implement or are only marginally cost effective. Big Rivers would be better served by using its DSM budgets pursuing higher value energy efficiency programs. However, as capacity tightens in the region, the value of capacity should increase, approaching the avoided cost of a peaking unit. At that time, demand response programs could become cost effective. Furthermore, two of the three member cooperatives have implemented AMI systems and the third is giving it consideration at this time. AMI makes implementation of DR programs easier. BREC should therefore continue to monitor the cost effectiveness of DR. In this regard, GDS makes the following recommendations:

- Do not pursue a full scale demand response program at this time.
- Continue to monitor opportunities for demand response, looking for reduction in costs or increases in the value of avoided peaking generation.
- Monitor the opportunity of new technologies that may provide peak demand reduction benefits, including Smart Grid technologies.
- Encourage the member cooperatives to consider whether any existing large commercial or industrial accounts would be benefitted by an interruptible rate arrangement or by Big Rivers' current Voluntary Curtailment Rider. If so, determine whether there is a desire on the part of the members to offer an interruptible rate arrangement.

9 EXAMPLE ENERGY EFFICIENCY PROGRAMS AND PROGRAM POTENTIAL SUMMARY

Based on the results of the DSM savings potential analysis, and based on a review of energy efficiency programs currently offered by other electric cooperatives, investor-owned electric utilities and energy efficiency organizations located in the region, GDS recommends that Big Rivers consider the following example energy efficiency programs when designing and implementing a DSM portfolio:

Residential Programs

1) Residential Lighting Program
2) Residential Efficient Appliances Program
3) Residential Advanced Technologies Program
4) Residential Weatherization Program
5) Residential New Construction Program

Commercial/Industrial Energy Efficiency Programs

6) C&I Lighting Program
7) C&I HVAC Program

These programs represent the end-uses and equipment that held significant opportunities for cost-effective savings in the residential and commercial/industrial sector. For each of the above programs GDS has provided an example program design that includes an overview of an existing energy efficiency program, the target market, eligible energy efficiency measures, and proposed financial incentives for participants. Also provided within each example program write-up are the potential savings, benefits, and costs for programs that could potentially be introduced to Big Rivers members.

Big Rivers example program potential savings are based on an example budget of $1 million in 2011, followed by an increase of 2.5% annually from 2012-2020. Actual energy and demand savings and program costs will depend upon many factors, including program funding levels and degree of voluntary member system participation in the DSM programs offered by Big Rivers. Table 9.1 presented below, displays the example program potential scenario annual budget for the residential and commercial/industrial sector.

Table 9.1: Example Program Potential Annual Budget

	Residential	Commercial/Industrial	Total
2011	$670,000	$330,000	$1,000,000
2012	$686,500	$338,000	$1,025,000
2013	$703,500	$346,500	$1,050,500
2014	$721,000	$355,000	$1,077,000
2015	$739,000	$364,000	$1,104,000
2016	$757,500	$373,000	$1,131,500
2017	$776,500	$382,500	$1,160,000
2018	$796,000	$392,000	$1,189,000
2019	$816,000	$402,000	$1,218,500
2020	$836,500	$412,000	$1,249,000
2011-2020	**$7,502,500**	**$3,695,000**	**$11,204,500**

9.1 EXAMPLE RESIDENTIAL ENERGY EFFICIENCY PROGRAM PLANS

9.1.1 RESIDENTIAL LIGHTING PROGRAM

A Residential Lighting Program for homeowners in the Big Rivers service area that encourages the installation of CFL and LED Lighting is one potential program where a significant amount of remaining potential remains. This program should be considered an early priority because CFL lighting is very cost effective, the electric energy savings potential is relatively large, and all households in the service area can benefit from such a program.

Measure description: The objective of this program is to encourage residential customers to install high efficiency bulbs in their homes, replacing incandescent bulbs. The incentive for residential customers to install compact fluorescent bulbs is the lower energy use and lower operating costs over the life of the bulb and the much longer life of the bulb, particularly LED bulbs. All lighting sockets not currently equipped with halogen, CFL or other fluorescent tube lighting are eligible for compact fluorescent lighting.

LED bulbs are also expected to be offered as part of the Residential Lighting Program. LED bulbs present several advantages over both incandescent and CFL bulbs, including lower energy consumption, longer lifetimes, and smaller size. To date, however, they remain relatively expensive and current bulb models are most suited for recessed or accent lighting and are not ideal for other residential applications. Over time, the initial cost of LED lighting and the number of residential applications are expected to become more palatable to consumers signifying this technology as a likely candidate for promotion through the lighting program.

Baseline Measure:	Efficient Measure:
Incandescent Bulb	Compact Fluorescent Light (CFL) Bulb
Incandescent Bulb	LED Light Bulb

Program incentives: There are various methods of promoting energy efficient lighting products. Incentives can be available at the point of sale, and can be in the form of mail-in rebates, instant rebates, and "at point-of-sale" markdowns. Of those programs providing incentives to purchase efficient lighting and other products the incentive for CFL bulbs are typically between $1 and $2 per bulb.

In lieu of lighting rebate coupons or in-store markdowns, Big Rivers could also choose to offer a limited supply of CFL bulbs to their members at no cost. Under this design scenario, shown below, the incentive would be the full cost of the compact fluorescent light bulb. In addition, Big Rivers should begin to promote LED bulbs through the use of partial incentives.

Measure	Measure Cost (per unit)	Utility Incentive (per unit)
CFL Bulb	$1.85	$1.85
LED Light Bulb	$30	$10

Program Participation: For the program potential scenario, CFL bulbs are donated to members in 2011-2013. 23,000 bulbs were projected to be distributed each year, totaling 69,000 over the three-year period. Beginning in 2014, the Residential Lighting Program is anticipated to provide partial incentives for LED bulbs in lieu of distributing CFL bulbs. In 2014, this scenario assumes 4,000 bulbs are purchased by residential members. From 2014-2020 a total of 30,125 LED bulbs are purchased.

Example Program Design: Although offering CFL bulbs at no cost to residential members is not the most utilized programmatic approach (residential lighting program design commonly employs coupons or markdowns), there are several benefits that can be achieved from this blueprint. First, the primary market barrier to widespread consumer acceptance- the initial cost of a CFL bulb - is negated. Eliminating the cost significantly reduces the risk to a consumer trying an unfamiliar product, which helps overcome the barrier of performance uncertainties. Second, Big Rivers and its member systems eliminate the need to count coupons to determine sales and subsequent reimbursements to the retailer. This can result in lowered administrative costs and increased program cost-effectiveness.

One caveat to this approach, however, is that offering CFL bulbs at no cost to residential consumers is essentially the utility purchasing load reduction. This may hinder the eventual goal of market transformation by confusing consumers as to the appropriate price points for energy-efficient products. This confusion could lead consumers to undervalue the energy-efficient features of the CFL bulbs and lead them to wait until additional "no-cost" CFL bulbs become available before purchasing the product through normal market channels. Consequently, it is also recommended that Big Rivers consider supplemental program strategies, such as advertising and education, which can lead to market transformation and reach a greater number of consumers per dollar than full-cost rebates alone.

Big Rivers should also consider a "point of sale" markdown approach for its LED lighting promotion. Under a markdown approach, consumers do not need any type of coupon or rebate form to buy the discounted products. The LED bulbs are already marked down by the retailer when they are stocked. Once again, consumers do not need any type of coupon or rebate form to buy the discounted products. The LED bulbs are already marked down by the retailer when they are stocked on the shelves and the need to count coupons to determine retailer reimbursement is eliminated.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
99,125 bulbs	1,221	0.13	0.28	$1,982,294	2.4

Annual MWh savings are based on annual savings of 30.7 kWh savings per CFL bulb and 40.5 kWh per LED bulb. Net Present Value ("NPV") Benefits represent the total avoided cost of energy and demand over the lifetime savings of the installed bulbs. Also included in the NPV benefits are the avoided incandescent bulb purchases due to the longer useful life of CFL and LED bulbs relative to incandescent lighting.

Example Program Budgets:

2011- 2020 Incentive $	2011-2020 Admin $	2011-2020 Participant $	NPV Big Rivers Cost ($2011)	NPV Total Costs ($2011)
$526,700	$97,800	$602,500	$402,375	$819,964

In this example, the Residential Lighting program has a total annual budget of $50,000 from 2011-2013 as CFL bulbs are distributed at no cost. As the focus of the program switches away from CFL bulbs to LED lighting, the budget increased by 2.5% annually from 2015-2020. Combined, the total Big Rivers budget from 2011-2020 is $526,700. Incentives account for roughly 85% of the lighting budget during the period of CFL giveaways and 80% during LED markdowns. The remaining Big Rivers budget is reserved for incentive fulfillment, program marketing, evaluation, and administrative labor.

This example program assumes CFL bulbs are distributed to members at no cost and a partial incentive paid towards the purchase of LED bulbs. The $602,500 for participant costs reflects the homeowner contribution towards the purchase of LED lighting.

9.1.2 RESIDENTIAL EFFICIENT APPLIANCES PROGRAM

A Residential Efficient Appliances Program has also been included in the proposed program potential scenario. This program includes incentives for installing measures designed to decrease the overall electric consumption of the residence. All homes in the service territory are eligible to participate in this program.

Measure description: The objective of this program is to encourage residential customers to purchase energy efficient appliances in lieu of standard efficiency appliances:

Energy Star® Compliant Refrigerators:
Homeowners can receive an incentive for installing a refrigerator at least 15% above the minimum federal standards. Top freezer, bottom mount freezer, and side by side refrigerators are eligible for an incentive.

Energy Star® Clothes Washers:
Homeowner receives an incentive for purchasing and installing an Energy Star® compliant clothes washer. In order to qualify as Energy Star®, clothes washers must have a Modified Energy Factor ("MEF") of 1.8 or greater and a Water Factor ("WF") less than 7.5.

High Efficiency Electric Water Heaters:
Homeowners can receive an incentive for installing a high efficiency electric water heater in their homes. In order to qualify, water heaters must have an Energy Factor (EF) of .93 or greater. Qualifying water heaters will range for 40 gallons to 80 gallons in capacity.

Baseline Measure:	Efficient Measure:
Standard Efficiency Refrigerator	Energy Star® Qualified Refrigerator
Standard Efficiency Clothes Washer	Energy Star® Qualified Clothes Washer
Standard Electric Storage Tank Water Heater	High Efficiency Electric Storage Water Heater

Program incentives: Incentives are paid to the homeowner after all completed documentation for the measure is received by the program administrator. The incentive is paid in the form of a check. Incentives are assumed to be approximately 40% of the measure incremental cost or greater.

Measure	Incremental Measure Cost (per unit)	Utility Incentive (per unit)
Energy Star® Qualified Refrigerator	$30	$25
Energy Star® Qualified Clothes Washer	$258	$100
High Efficiency Electric Storage Water Heater	$50	$35

Program Participation: This scenario assumes 11,670 refrigerators, 8,340 high efficiency storage tank water heaters, and 2,500 clothes washers will qualify for incentives from 2011-2020. The participation targets assume that the Efficient Appliances program will achieve 12% of the refrigerator market, 13% of homes with electric water heating, and 6% of homes with clothes washers.

Example Program Design: This program provides financial incentives and market support via retailers to increase the market share and sales of efficient home appliances. The program targets purchases of select technologies through retail stores and other special sales events. Initially, the program may offer incentives for high efficiency water heaters, refrigerators, and clothes washers.

Coordination with retailers and manufacturers will include cooperative marketing, consumer outreach and sales associate training on qualified energy efficient products. Program staff should be used to provide in-store training to sales staff on the features, use and benefits of energy efficient appliances, and education on how to address market barriers that limit the penetration rate of qualified appliances.

Members will submit a rebate application form following the purchase of any qualified high efficiency product along with a proof of purchase. Incentives are paid after all completed documentation is received.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
22,510 units	3,430	0.19	0.15	$2,366,069	1.8

Annual MWh savings are based on annual savings of 115.5 kWh savings per refrigerator, 184.7 kWh per Clothes Washer and 194.7 kWh for efficient electric waters. Net Present Value ("NPV") Benefits represent the total avoided cost of energy and demand over the lifetime savings of the efficient appliances. Also included in the NPV benefits are the avoided water savings from the efficient clothes washers.

Example Program Budgets:

2011- 2020 Incentive $	2011-2020 Admin $	2011-2020 Participant $	NPV Big Rivers Cost ($2011)	NPV Total Costs ($2011)
$833,650	$284,550	$578,450	$850,931	$1,290,820

In this example, the Efficient Appliances program has a total funding budget of $100,000 in 2011, followed by an increase of 2.5% annually from 2012-2020 Combined, the total Big Rivers budget from 2011-2020 is approximately $1.1 million. Incentives account for roughly 75% of utility budget. The remaining 25% is reserved for incentive fulfillment, program marketing, evaluation, and administrative labor. In the first year, the administrative costs represent 30% of the total Big Rivers budget to allow additional funds for program development. The $578,450 for participant costs reflects the homeowner contribution towards the purchase of efficient appliances.

9.1.3 RESIDENTIAL ADVANCED TECHNOLOGIES PROGRAM

A Residential Advanced Technologies Program has also been included in the proposed program potential scenario to serve to educate homeowners regarding current technologies that have a high potential for savings but low market penetration. Homes with electric water heating and space heating are eligible to participate in this program.

Measure description: The objective of this program is to educate and encourage residential customers to purchase energy efficient technologies with large savings potential and overcome the barrier of high up-front costs:

Geothermal Heat Pumps:
Ground Source heat pumps, or geothermal heat pumps, use the earth or groundwater as a heat source, instead of the outside air. Stable underground temperature allow geothermal systems to be rated for heating efficiency and cooling efficiency. Geothermal heat pumps may be 25-45% more efficient than air-source heat pumps, but are more expensive and difficult to install. Most geothermal systems include "loops" that are buried in the ground in shallow trenches or in vertical boreholes. As an alternative, other systems may draw in groundwater and pass it through a heat exchanger instead of refrigerant before returning the water to the aquifer. Geothermal systems should have a heating COP (efficiency rating) of 3.3 or higher. The most efficient geothermal systems will include desuperheaters to allow for additional water heating savings.

Electric Heat Pump Water Heaters:
Homeowners receive an incentive for installing a heat pump water heater. Heat pump water heaters use electricity to move heat from one place to another instead of generating heat directly and can be two to three times more energy efficient than conventional electric resistance water heaters. Heat pump water heaters should have a EF=2.0 or greater

Baseline Measure:	Efficient Measure:
Air Source Heat Pump (SEER 13)	Geothermal Heat Pump (COP=3.3 or greater)
Electric Storage Tank Water Heater (EF=.90)	Electric Heat Pump Water Heater (EF=2.0)

Program incentives: Incentives are paid to the homeowner after all completed documentation for the measure is received by the program administrator. . Measure costs and savings assume homeowners are replacing equipment that has reached the end of its useful life. The measure cost of the geothermal system is the incremental cost between a geothermal system and a standard efficiency heat pump. The $850 incremental cost for the heat pump water heater is the difference between installing the efficient heat pump water heater and a standard efficiency storage tank.

Measure	Incremental Measure Cost (per unit)	Utility Incentive (per unit)
Geothermal Heat Pump	$8,300	$1,500
Electric Heat Pump Water Heater	$850	$350

Program Participation: Under this example scenario, 30 geothermal heat pumps are estimated to be installed in 2011, and a total of 350 over the next decade. In addition, 125 heat pump water heaters are installed in 2011 (1,490 through 2020). As advanced technologies with a high-up front cost, these participation projections achieve relatively low market saturation over 10 years- 3% for heat pump waters and 2% for geothermal systems.

Example Program Design: Under this program HVAC contractors and plumbers would perform the installations and submit all necessary paperwork while program staff would oversee the administration and outreach components.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
1,840 units	4,361	0.30	1.98	$4,658,916	1.4

Annual MWh savings are based on annual savings of 3,658 kWh savings per geothermal system and 2,067.9 kWh per heat pump water heater. NPV Benefits represent the total avoided cost of energy and demand over the lifetime savings of the efficient technologies. Also included in the NPV benefits are the single year tax credit benefits for renewable technologies (i.e. geothermal systems). Federal tax credits for energy efficiency are set to expire in 2010 and were not included in this analysis.

Example Program Budgets:

2011- 2020 Incentive $	2011-2020 Admin $	2011-2020 Participant $	NPV Big Rivers Cost ($2011)	NPV Total Costs ($2011)
$1,046,500	$357,300	$3,125,000	$1,068,294	$3,442,216

In this example, the Advanced Technologies program has a total budget of $125,000 in 2011, followed by an increase of 2.5% annually from 2012-2020 Combined, the total Big Rivers budget from 2011-2020 is approximately $1.4 million. Incentives account for roughly 75% of utility budget. The remaining 25% is reserved for incentive fulfillment, program marketing, evaluation, and administrative labor. In the first year, the administrative costs represent 30% of the total Big Rivers budget to allow additional funds for program development. The $3.1 million for participant costs reflects the homeowner contribution towards the purchase of the efficient technologies.

9.1.4 RESIDENTIAL WEATHERIZATION PROGRAM

Big Rivers may also consider offering a Weatherization Program to their members and include financial incentives for installing energy efficiency measures designed to increase the thermal efficiency of a home's building envelope. This program is provided as an example for Big Rivers because this program is cost effective, the electric energy savings potential is relatively large, and all households in the service territory with electric cooling can benefit from such a program.

Measure description: The objective of this program is to encourage residential customers to upgrade and install energy efficient building shell measures in homes that are currently inadequately insulated or weatherized. The most important energy efficiency measures for this program include air infiltration, sealing of heating/cooling ducts, and improved attic and floor insulation. In addition Big Rivers members will be able to request a weatherization care package with low-cost, easy to install efficiency measures.

Over time, the individual components of this program may be altered, based on experience and evaluation, to maximize overall cost-effectiveness and target aspects of the building envelope that are likely to benefit the most from efficient technologies and practices.

Attic Insulation:
This measure includes installing attic insulation in homes that currently have either inadequate levels or no ceiling insulation. The installed insulation will meet an R-value of R-38. Two baselines are included in this scenario: R-9 and R-19.

Air Sealing:
Hidden air leaks cause some of the largest heating and cooling losses in older homes. Common air leakage sites include plumbing penetrations through insulated floors and ceilings, baseboard moldings, dropped ceilings above bathtubs and cabinets, attic access hatches, and doors, and around recessed lighting fixtures. The savings in this scenario were determined by modeling 10 ACH_{50} vs. 7 ACH_{50}.

Duct Sealing:
This measure includes duct sealing to improve the loss of heated (or cooled) air through the building shell and space conditioning ductwork. Ductwork should be sealed tightly with mastic and pass a level of duct tightness of at least 6% of the floor area.

Floor Insulation:
Floors over unheated areas, such as crawl spaces and basements, can contribute to heat loss in an otherwise well-insulated house. Single Family homes are assumed to have R-0 and no foundation insulation. These homes are improved to R-19 levels. For manufactured homes the belly insulation is improved from R-11 to R-30. Manufactured homes with damaged insulation could also qualify for improved insulation.

Weatherization Care Package:
The weatherization care package is a low cost measure that contains an assortment of small efficient measures that can minimally reduce energy consumption and also educate homeowners regarding additional improvements. Packages can either be provided as mailers or can be handed out at annual meetings or other special events. The packages include: CFL bulbs, water heater blankets, low flow showerheads, outlet gaskets, and energy efficiency literature.

Baseline Measure:	Efficient Measure:
Attic Insulation R-9 or Attic Insulation R-19	Attic Insulation R-38
Floor Insulation R-0 (Single Family)	Floor Insulation R-19
Floor Insulation R-11 (Manufactured homes)	Floor Insulation R-30
Leaky Building Envelope (10 ACH_{50} or greater)	Improved Air Sealing (7 ACH_{50} or less)
Leaky Ductwork	Improved Duct Sealing (6% of floor area)
N/A	Weatherization Care Package

Program incentives: Incentives are paid to the homeowner after all completed documentation for the measure is received by the program administrator. Incentives are assumed to be approximately 40% of the measure incremental cost or greater.

Measure	Measure Cost (per unit)	Utility Incentive (per unit)
Attic Insulation R19 to R38 (Single Family)	$882.30	$350
Attic Insulation R0 to R38 (Single Family)	$1,159.10	$450

Floor Insulation R-19 (Single Family)	$1,366.70	$550
Floor Insulation R-30 (Manufactured home)	$821.60	$350
Improved Air Sealing (Single Family)	$529	$200
Improved Air Sealing (Manufactured home)	$326	$200
Improved Duct Sealing (SF/MH)	$500	$200
Weatherization Care Package (SF/MH)	$60	$60

Program Participation: From 2011-2012, 2,875 homes are projected to receive rebates for improving their air sealing and/or duct sealing. This represents approximately 3% of homes with electric space cooling. Nearly 1,200 homes will improve their attic insulation and 1,055 homes will install improved floor insulation, or approximately 1% of homes with electric space cooling.

This example program also estimates that about 9,000 weatherization care package will also be distributed to homeowners from 2011-2020.

Example Program Design: The program is designed to help customers save energy and money by making their homes more energy-efficient. Independent contractors will deliver the program in a way that maximizes participation and energy saving goals. The cooperatives and contractors will cooperatively market the program, address customer intake, schedule work, conduct the initial home visit, install energy efficient measures, and perform quality assurance.

Contractor selection can come from numerous sources, including: private for profit companies that provide home energy ratings and weatherization services or private/public companies that provide weatherization services to publicly-funded rehab programs or low income homes. Participating contractors are then trained with a focus on:

- Duct sealing
- Air sealing in the attic
- Observational diagnostics to create a list of possible energy efficiency measures the homeowner might want to address in the near future.

Customers planning to install energy efficiency measures in their homes must use a contractor partnered approved for the program to install the eligible measures. Upon completion of the project, the customer will work with their contractor to complete the program application form, and provide the required paperwork, receipts, or invoices.

GDS also recommends increasing consumer awareness and education relating to the significant electricity savings due to weatherization and insulation measures by using strategically placed advertising messages in the following types of media: cooperative newsletters, local cable shows, public service announcements, radio, newspaper, trade shows, special events, community group presentations, booths at local county fairs and other events.
As part of the quality control process, Big Rivers should inspect a small subsample of participations homes to verify application information and proper installation.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
8,000 measures 8,985 Care Packages	9,345	1.75	3.68	$12,677,723	2.4

The average savings per participant, across all weatherization measures, is estimated at 722 kWh per year. In addition, the weatherization care package is assumed to save 433 kWh annually. NPV benefits represent the total avoided cost of energy and demand over the lifetime savings of the efficient technologies. Also included in the NPV benefits are the single year tax credit benefits for gas savings and water savings from low flow showerheads. Gas savings are present due to participants with electric space cooling and non-electric space heating. Electric savings would be higher if the program only included homes with electric heating.

Example Program Budgets:

2011- 2020 Incentive $	2011-2020 Admin $	2011-2020 Participant $	NPV Big Rivers Cost ($2011)	NPV Total Costs ($2011)
$2,700,000	$921,350	$3,222,302	$2,755,161	$5,202,267

The total Big Rivers budget from 2011-2020 is approximately $3.6 million ($320,000 in 2011). Incentives account for roughly 75% of utility budget. The remaining 25% is reserved for incentive fulfillment, program marketing, evaluation, and administrative labor. In the first year, the administrative costs represent 30% of the total Big Rivers budget to allow additional funds for program development and contractor education. The $3.2 million for participant costs reflects the homeowner contribution towards the purchase of the improved building envelope measures.

9.1.5 NEW HOMES CONSTRUCTION PROGRAM

Another potential program that Big Rivers might consider is a New Homes Construction program that supports energy efficient design and the installation of energy efficient equipment and building practices during the construction of new residences. The program will be targeted to the residential new construction market, particularly to residential customers and home builders in the process of designing and constructing new homes. The target for this program is to build new homes so that they are significantly more energy efficient than a standard new home.

Measure description: The objective of this program is to help reduce customer energy consumption through the building of energy efficient new homes.

Efficient New Home (Tier 1):
Builders would receive an incentive for constructing new homes designed to Energy Star® Energy Star® ® standards: at least 15 percent more energy efficient than those built to the current building codes. Energy Star® Energy Star® ® Homes also incorporate other energy savings features that typically make them 20–30% more efficient than standard homes. The US Environmental Protection Agency reports that 165 home builders have partnered with EPA to construct more than 1,200 Energy Star® qualified homes in the Commonwealth of Kentucky in 2010. Nationwide, over one million homes have earned the Energy Star® rating to date.

Energy savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of the following: high performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems, high efficiency water heating equipment, and high efficiency building envelope standards. Energy Star® Homes also encourage the use of energy-efficient lighting and appliances. These features contribute to improved home quality and homeowner comfort, and to lower energy demand and reduced air pollution.

Efficient New Home (Tier 2):
Similar to a Tier 1 home, builders would receive an incentive for constructing new homes designed to exceed Energy Star® standards: at least 30 percent more energy efficient than those built to the current residential code.

Baseline Measure:	Efficient Measure:
Standard New Home Construction (2006 International Building Code – with Kentucky amendments)	Efficient New Home (Tier 1) – Similar to Energy Star® standards (15% more efficient than code)
	Efficient New Home (Tier 2) – 30% more efficient than home built to code

Program incentives: Incentives can be paid to the homeowner after all completed documentation for the measure is received by the program administrator. The incentive is paid in the form of a check. The incentive is set to cover approximately 35% of the incremental cost of installing the increased efficiency measures and also includes the full cost of receiving a HERS home rating (assigned an $800 value).

Measure	Measure Cost (per unit)	Utility Incentive (per unit)
Efficient New Home (Tier 1)	$1,763 + $800 = $2,563	$600 + $800 =$1,400
Efficient New Home (Tier 2)	$4,300 + $800 = $5,100	$1,500 + $800 = $2,300

Projected Program Participation: 458 homes are expected to be certified as efficient new homes meeting or exceeding Energy Star® standards over the next decade. In this example, 380 meet the Tier 1 standard and an additional 78 would qualify as Tier 2 (30% more efficient). In 2011, 39 new homes would qualify for an incentive. These participation estimates would certify approximately 4% of the new homes built from 2011-2020 as efficient new homes.

Example Program Design: During the construction process, the builder or home buyer must contract with a certified HERS rater, who will review the building plans and conduct on-site inspections. If the home meets the requirements of a Tier 1 (HERS Index of 85 or less) or Tier 2 (HERS Rating of 70 or less) the home will be certified as an efficient new home. The homeowner would then complete the project application form and submit required documentation to verify eligibility.

Big Rivers may offer support to homeowners or builders to aid them during the application process. After verifying the home meets program specifications, the application and rebate would be processed.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
458 homes	1,421	.34	.65	$1,955,631	1.7

Over the 10 year period average savings per new home built to the Tier 1 standard is 2,758 kWh. The average savings per new home built to the Tier 2 standard is 4,786 kWh. The values reflect a weighted average of all-electric homes and homes built with non-electric heating systems. All electric homes save roughly 1,100 kWh annually than the weighted average for all home types.

Net Present Value (NPV) Benefits represent the total avoided cost of energy and demand over the lifetime savings of the efficient technologies. Also included in the NPV benefits are the gas (MMBTU) savings from a select number of homes with non-electric heating. Electric savings would be higher if program excluded homes with non-electric heating.

Example Program Budgets:

2011- 2020 Incentive $	2011-2020 Admin $	2011-2020 Participant $	NPV Big Rivers Cost ($2011)	NPV Total Costs ($2011)
$711,400	$130,150	$660,340	$640,152	$1,141,569

The total Big Rivers budget from 2011-2020 is approximately $841,500. Incentives account for roughly 85% of utility budget. The remaining 15% is reserved for incentive fulfillment, program marketing, evaluation, and administrative labor. In the first year, the administrative costs represent 20% of the total Big Rivers budget to allow additional funds for program development and contractor education. These administrative costs are low for a new construction program relative to other new homes programs operated elsewhere because Big Rivers intends to "piggyback" on the success of the current Energy Star® New Homes. This approach should minimize the need to educate home builders on new program standards and home certification protocols.

The $660,340 for participant cost reflects the homeowner's costs to purchase homes that are built above current residential code.

9.2 RECOMMENDED COMMERCIAL/INDUSTRIAL ENERGY EFFICIENCY PROGRAM PLANS

9.2.1 COMMERCIAL/INDUSTRIAL PRESCRIPTIVE LIGHTING PROGRAM

A commercial and industrial (C&I) Prescriptive Lighting Program for commercial and industrial customers in Big Rivers service area will encourage the purchase and installation of efficient lighting systems and controls. This program should be considered because a prescriptive approach to lighting is straightforward, can be implemented to include all business types and is easily expanded. A prescriptive program offers fixed levels of financial incentives for energy efficiency measures where the measure costs and savings have already been proven through extensive testing, and where the savings are typically consistent across installations.

Measure description:

Baseline Measure:	Efficient Measure:
Incandescent Bulb	CFL Bulb
Incandescent/Fluorescent Exit Sign	LED Exit Sign
Standard T12 Ballast and Lamps	Standard & High Performance T8 Ballast and Lamps
No Lighting Controls	Occupancy Sensors

Compact Fluorescent Lamp – Hard-Wired and Fixtures:
Compact fluorescent lamps are the most common alternative to standard incandescent lamps. CFLs are generally about four times as efficient as incandescent lamps, and last about 10 times as long. CFLs can either be screw-in replacements for incandescent lamps or plug-in lamps in fixtures specifically designed around CFL technology.

T8 Lamps and Electronic Ballasts- Premium:
Premium T8 lamps and electronic ballasts have the same market as regular T8 systems. They gain efficiency over regular T8 systems by the co-development of lamps and ballasts that optimize the efficiency of both when used together. Typically T8 lamps and ballasts replace T12 lamps and ballasts.

LED Exit Signs:
Light emitting diode (LED) exit signs are one of the most efficient types of exit signs on the market. They generally only draw about two to three watts of power, compared to 10 watts or more for CFLs, or 20 watts or more for incandescent exit signs.

Occupancy Sensors:
Occupancy sensors automatically turn off the lights in a room or an area when the area is unoccupied. Occupancy sensors are an alternative to standard wall mounted on/off lighting switches.

Program incentives: This prescriptive lighting program is a customer incentive program that provides incentives for the installation of energy efficient lighting measures in existing commercial and industrial facilities. GDS recommends that incentives be set to about 35% of the incremental measure cost for each of the measures available under the program.

Measure	Measure Cost (average per project)	Utility Incentive (average per project)
Lighting	$7,000	$2,450

Program Participation: In the commercial and industrial sectors, the lighting end-use represents about 55% of the potential for electricity savings. The program potential is based on achieving a penetration rate based on the available funding with 30 participants in the first year ramping up to 46 in 2020, with a total number of participants reaching 400 over the 10 years.

Example Program Design: The primary goal of this example program is to encourage C&I Members to install high efficiency lighting systems in existing facilities. More specifically, the program is designed to:

- Provide incentives to facility owners and operators for the installation of high-efficiency equipment and controls.
- Provide a marketing mechanism for equipment contractors and distributors to promote energy efficient equipment to end-users.
- Overcome market barriers, including:
  - Members' lack of awareness and knowledge about the benefits and costs of energy efficiency improvements.
  - Performance uncertainty associated with energy efficiency projects.
  - Additional first costs for energy efficient measures.
- Ensure that the participation process is clear, easy to understand and simple.

Certain barriers exist to the adoption of energy efficiency measures, including lack of investment capital, competition for funds with other capital improvements, lack of awareness/knowledge about the benefits and costs of energy efficiency measures, high transaction and information search costs, and technology performance uncertainties. This program is designed to help overcome these market barriers and encourage greater adoption of energy efficiency measures in the C&I market.

In addition to helping customers reduce and manage their energy costs, this program provides other societal and customer benefits. These include reduced greenhouse gas emissions, improved levels of service for energy expenditures, and lower overall rates and energy costs compared to other resource options.

The program is structured as a broadly applicable commercial/industrial prescriptive program since the energy and demand savings for many common energy efficiency measures are similar across many C&I market segments. Having a simple program structure and incentive schedule provides customers with certainty and ease of use regarding the incentives they will receive for installing a wide variety of efficiency measures.

The program's actual energy and demand savings will be determined through the program evaluation strategy discussed in a subsequent section. Evaluation activities should be planned at the same time as overall program planning, and implemented when the overall program is being implemented, as will be discussed in more detail in the evaluation section.

The C&I Prescriptive program is a customer incentive program that provides incentives for the installation of energy efficiency measures in existing non-residential facilities. More specifically, the program offers the following products and services:

- Educational and promotional materials, including educational brochures, program promotional material, and website content, aimed at building owners, managers and operators about the benefits of energy efficiency improvements and improved systems performance..

- Educational and promotional efforts aimed at trade allies such as equipment contractors, installers, building supply firms, and equipment distributors to help them promote efficiency measures to their customers.
- Incentives for building owners and managers to adopt the measures recommended by the program. Specific incentives for each size and type of DSM measure will be developed.

Program Allies: The program includes customer educational and promotional pieces designed to assist facility owners, operators and decision makers with the information necessary to improve the energy efficiency of the systems in their facilities. The program also includes customer and trade ally education to assist with understanding the technologies that are being promoted, the incentives that are offered, and how the program functions.

The marketing and communications strategy will be designed to inform customers of the availability and benefits of the program and how they can participate in the program. The strategy will include outreach to key partners and trade allies including the architecture/engineering and contractor community, relevant professional and trade associations and other parties of interest in the market. Possible strategies could include:

- Education seminars implemented in each market to provide details about how to participate in the program. The seminars will be tailored to the needs of business owners, building managers, architects, engineers, vendors, and contractors;
- A combination of strategies including media advertising, outreach and presentations at professional and community forums and events, and through direct outreach to key customers and customer representatives. Marketing activities may include:
    - Brochures that describe the benefits and features of the program including program application forms and worksheets. The brochures will be mailed upon demand and distributed through the call center and the Big Rivers website and will be available for various public awareness events (presentations, seminars etc).
    - Targeted direct mailings used to educate customers on the benefits of the program and explaining how they can apply.
    - Customer and trade partner outreach and presentations (e.g. BOMA and other customer organizations) informing interested parties about the benefits of the program and how to participate.
    - Print advertisements to promote the program placed in selected local media including area newspapers and trade publications.
    - Presence at conferences and public events used to increase general awareness of the program and distribute program promotional materials.
    - Presentations by the program manager to key customers and customer groups to actively solicit their participation in the program.
- The marketing strategy will identify key customer segments and groups for target marketing, and will prepare specific outreach activities for these customers.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
400	9,360	2.29	2.14	$5,262,817	1.90

With this example lighting program, about 9,360 MWh will be saved after 10 years based on the projected participation, with approximately 702 MWh saved in the first year. Additionally, projected participation will also result in a summer peak saving of 2.29 MW after 10 years. Additional detail, including annual energy and demand savings for this program can be found in Appendix 5.

9.2.1 COMMERCIAL AND INDUSTRIAL PRESCRIPTIVE HVAC PROGRAM

Measure description: A brief description for the key HVAC measures that would be included in the HVAC prescriptive program is presented below.

Baseline Measure:	Efficient Measure:
Inefficient Split AC Systems	High Efficiency Split AC
Inefficient Chillers	Air Cooled Chillers
Inefficient PTHP or PTAC	Packaged Terminal Heat Pump and AC
No Fan/Pump Controls	Variable Frequency Drives
All HVAC Systems	HVAC Tune-up

High Efficiency Air Cooled Chillers: Efficient chillers cover efficient reciprocating, screw, and centrifugal units. Air cooled units with condensers will have a minimum efficiency of1.23 KW/unit to qualify.

Packaged Terminal Heat Pumps and Air Conditioners: Packaged terminal air conditioners (PTAC) and heat pumps units are most commonly used in hotel rooms. Efficient units are defined as those having an efficiency of 10.5 EER or higher.

Variable Frequency Drives on Fans and Pumps: VFDs for HVAC applications are incentivized separately from other VFD's (such as industrial process motors) because they take advantage of the fluid affinity laws that show a cube relationship between speed and power. These applications also have a more predictable use pattern than VFDs in industrial processes and conveyance applications. The latter examples would be included with custom measures. The baseline technologies for HVAC VFDs are flow throttling for liquid systems and vortex dampers for air applications.

HVAC Tune-up:
AC system tune-ups help commercial and industrial customers save energy by ensuring their air conditioning systems are functioning at the optimal level. This is the least cost measure in the HVAC program.

Program incentives:

Measure	Measure Cost (average per project)	Utility Incentive (average per project)
HVAC Project	$7,800	$2,800

Program Participation: In the commercial and industrial sectors, the cooling end-use represents about 15% of the potential for electricity savings. The program potential is based on achieving a penetration rate based on the available funding with 26 participants in the first year ramping up to 40 in 2020, with a total number of participants reaching 348 over the 10 years.

Example Program Design: The program design for this example program would follow closely the design of the prescriptive lighting program.

Example Program Savings:

2011- 2020 Participation	2020 MWh Savings	2020 Summer MW Savings	2020 Winter MW Savings	NPV Benefits ($2011)	TRC B/C Ratio
348	5,707	0.43	2.31	$4,214,939	1.56

With this example HVAC program, about 5,707 MWh will be saved after 10 years based on the projected participation, with approximately 426 MWh saved in the first year. Additionally, projected participation will also result in a winter peak saving of 2.31 MW after 10 years. Additional detail, including annual energy and demand savings for this program can be found in Appendix 4.

9.3 DSM PROGRAM POTENTIAL SUMMARY

Table 9.2 presents summarized information regarding the annual participation, energy savings, demand savings, and Big Rivers budgets for the residential and C&I example energy efficiency programs. In total, the programs result in about 34,845 MWh of annual energy savings in 2020, or 1.0% of forecasted energy sales. The programs are also estimated to achieve demand savings of 11.2 MW, or 1.6% of the forecasted winter peak demand.

The sample funding used in this analysis for the complete portfolio of example residential and C&I programs ranges from $1.0 million in 2011 to $1.3 million in 2020. For this analysis, incentives account for 70% of the total budget, while administrative costs (marketing, program delivery, incentive fulfillment, and evaluation) account for the remaining 30%. Actual expenditure proportions may differ significantly from this analysis

Table 9.2: Residential, Commercial & Industrial Program Portfolio Detail: Annual Participation, Savings, and Budget by Program

ALL RESIDENTIAL PROGRAMS COMBINED	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Incremental Annual Participants	26,494	26,847	26,938	8,039	8,240	8,452	8,657	8,849	9,080	9,322
Cumulative Annual Participants	26,494	53,341	80,279	88,318	96,558	105,010	113,667	99,516	85,596	71,173
Cumulative Annual MWh Savings	2,288	4,723	7,211	9,201	11,238	13,329	15,464	16,937	18,493	19,778
Cumulative Annual Winter MW Savings	0.71	1.47	2.26	2.93	3.61	4.31	5.02	5.58	6.18	6.74
Cumulative Annual Summer MW Savings	0.29	0.60	0.92	1.19	1.47	1.75	2.04	2.26	2.50	2.71
Incentives	$486,150	$526,725	$543,975	$552,775	$565,350	$580,600	$591,725	$602,425	$627,600	$643,225
Administrative	$186,750	$158,700	$164,250	$170,250	$174,050	$178,600	$182,250	$185,250	$193,200	$197,850
Total Big Rivers	*$672,900*	*$685,425*	*$708,225*	*$723,025*	*$739,400*	*$759,200*	*$773,975*	*$787,675*	*$820,800*	*$841,075*

ALL C&I PROGRAMS COMBINED	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Incremental Annual Participants	57	65	66	75	77	79	81	83	85	87
Cumulative Annual Participants	56	94	130	174	216	258	302	346	394	440
Cumulative Annual MWh Savings	1,128	2,416	3,750	5,244	6,770	8,344	9,950	11,602	13,335	15,067
Cumulative Annual Winter MW Savings	0.20	0.44	0.68	0.95	1.22	1.51	1.80	2.10	2.41	2.72
Cumulative Annual Summer MW Savings	0.33	0.71	1.10	1.54	2.00	2.46	2.93	3.42	3.93	4.44
Incentives	$146,300	$167,300	$172,200	$193,200	$198,800	$203,700	$209,300	$214,200	$224,700	$224,700
Administrative	$178,850	$167,300	$172,200	$158,100	$162,650	$166,650	$171,250	$175,250	$183,850	$183,850
Total Big Rivers	*$325,150*	*$334,600*	*$344,400*	*$351,300*	*$361,450*	*$370,350*	*$380,550*	*$389,450*	*$408,550*	*$408,550*

ALL PROGRAMS COMBINED	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Incremental Annual Participants	26,551	26,912	27,004	8,114	8,317	8,531	8,738	8,932	9,165	9,409
Cumulative Annual Participants	26,550	53,435	80,409	88,492	96,774	105,268	113,969	99,862	85,990	71,613
Cumulative Annual MWh Savings	3,416	7,139	10,962	14,445	18,009	21,673	25,414	28,540	31,828	34,845
Cumulative Annual Winter MW Savings	0.92	1.90	2.93	3.88	4.83	5.82	6.82	7.68	8.59	9.46
Cumulative Annual Summer MW Savings	0.62	1.32	2.03	2.73	3.46	4.21	4.97	5.68	6.43	7.15
Incentives	$632,450	$694,025	$716,175	$745,975	$764,150	$784,300	$801,025	$816,625	$852,300	$867,925
Administrative	$365,600	$326,000	$336,450	$328,350	$336,700	$345,250	$353,500	$360,500	$377,050	$381,700
Total Big Rivers	*$998,050*	*$1,020,025*	*$1,052,625*	*$1,074,325*	*$1,100,850*	*$1,129,550*	*$1,154,525*	*$1,177,125*	*$1,229,350*	*$1,249,625*

10 OVERALL CONCLUSIONS AND RECOMMENDATIONS

In summary, the potential for electric energy efficiency and demand response in the Big Rivers Member's service territories by 2020 is significant. The estimated ***achievable potential*** electricity savings would amount to 311,744 MWh a year (a 8.8% reduction in projected 2020 MWh sales). Energy efficiency resources can also serve to reduce the overall winter peak demand over the same period by 79.5 MW, or 11.6% of the forecasted 2020 system peak. Achievable summer peak savings are 59.2 MW, or 8.6% of the total system peak in 2020.

Based on these results, a portfolio of DSM programs was designed for Big Rivers that could achieve significant energy and demand savings at a pre-determined level of spending. The ***program potential*** portfolio is based on a funding target of $1 million dollar first year spending. In total, the combined budget from 2011-2020 under this scenario is approximately $17.4 million. The result is seven suggested programs that demonstrate electric energy efficiency can play an expanded role in Big Rivers' resource mix over the next decade.

Table 10.1: Recommended Program Summary

	Cumulative Annual MWh Savings - 2020	Cumulative Annual Winter MW Savings - 2020	NPV Benefits $2011	NPV Costs (Utility + Participants) $2011	TRC B/C Ratio
1 Residential Energy Efficiency Programs			*$ in millions*		
Residential Lighting Program	1,221	0.3	$2.0	$0.8	2.42
Residential Efficient Appliances	3,430	0.2	$2.4	$1.3	1.83
Residential Advanced Technologies	4,361	2.0	$4.7	$3.4	1.35
Residential Weatherization	9,345	3.7	$12.7	$5.2	2.44
Residential New Construction	1,421	0.6	$2.0	$1.1	1.71
2 Commercial/Industrial Programs					
C/I Prescriptive - Lighting	9,360	2.3	$5.3	$2.8	1.90
C/I Prescriptive - HVAC	5,707	0.4	$4.2	$2.7	1.56
Total Savings (End-Consumer)	***34,845***	***9.5***	***$33.1***	***$17.4***	***1.91***
Total Savings (@ Generation)	***38,631***	***10.5***			

These programs achieve estimated savings in 2020 of 34,845 MWh and peak load reductions of 9.5 MW in the winter and 7.2 MW in the summer at the end-consumer level. This represents approximately 1.0% of total energy sales, 1.4% of peak demand in the winter, and 1.0% of peak demand in the summer by 2020.

The DSM potential estimates provided in this report are based upon the current load forecast as well as appliance saturation data, data on energy efficiency measure costs and savings, and measure lives available at the time of this study. Over time, additional and emerging technologies may serve to increase the potential for additional energy and demand savings and warrant additional attention at the program level.

Actual energy and demand savings will depend upon the level and degree of Big Rivers' system participation in the DSM programs offered by Big Rivers. In addition, the estimated savings are based upon the current forecast of Big Rivers' budget amounts for DSM programs over the 10 year period of 2011-2020. The budget amounts and programs are subject to annual Big Rivers' Board review and approval. Therefore, while the figures presented in this report represent best current estimates of savings and costs, actual results will be different.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Appendix 1
General Modeling Assumptions
and Avoided Costs

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

APPENDIX 1

GENERAL MODELING ASSUMPTIONS
AND AVOIDED COSTS

GENERAL MODELING ASSUMPTIONS & AVOIDED COSTS - ***Energy Efficiency & Demand Response***

	Electric Energy Seasonal Avoided Energy in Nominal $	Electric Capacity Seasonal Avoided Capacity in Nominal $	
		Summer Generation	Winter Generation
Year	[redacted]	($/kW)	($/kW)
2010		$10.00	$14.00
2011		$15.58	$21.82
2012		$21.17	$29.63
2013		$26.75	$37.45
2014		$32.33	$45.27
2015		$37.92	$53.08
2016		$38.64	$54.09
2017		$39.37	$55.12
2018		$40.12	$56.17
2019		$40.88	$57.23
2020		$41.66	$58.32
2021		$42.45	$59.43
2022		$43.26	$60.56
2023		$44.08	$61.71
2024		$44.92	$62.88
2025		$45.77	$64.08
2026		$46.64	$65.29
2027		$47.52	$66.53
2028		$48.43	$67.80
2029		$49.35	$69.09
2030		$50.29	$70.40
2031		$51.24	$71.74
2032		$52.21	$73.10
2033		$53.21	$74.49
2034		$54.22	$75.90
2035		$55.25	$77.35
2036		$56.30	$78.82
2037		$57.37	$80.31
2038		$58.46	$81.84
2039		$59.57	$83.39
2040		$60.70	$84.98
2041		$61.85	$86.59
2042		$63.03	$88.24
2043		$64.23	$89.92
2044		$65.45	$91.62
2045		$66.69	$93.36
2046		$67.96	$95.14
2047		$69.25	$96.95
2048		$70.56	$98.79
2049		$71.90	$100.67

Inflation Rate: **1.6%**

Discount Rate: **6.33%**

T&D Avoided Cost: **$0.00/kw-year**

Transmission and Distribution Line Loss Factor: **5.68%**

Reserve Margin: **15%**

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Appendix 2
Residential Sector Data
(Energy Efficiency)

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

APPENDIX 2

RESIDENTIAL SECTOR DATA
(ENERGY EFFICIENCY)

APPENDIX 2-1

RESIDENTIAL MEASURE DESCRIPTIONS,
ASSUMPTIONS, AND SOURCES

DESCRIPTIONS OF RESIDENTIAL ENERGY EFFICIENCY MEASURES

This technical appendix describes a broad range of residential sector energy efficiency measures and programs where GDS has assessed the technical and achievable potential for electric energy savings for Big Rivers. The purpose of this technical appendix is to briefly describe these efficiency measures and to provide data on their costs, energy savings and useful lives.

1. ELECTRIC APPLIANCES

The following section describes the energy efficiency measures that were included in this analysis for various household appliances in Big Rivers' homes. Five residential appliance energy efficiency measures/programs are covered in this section: Energy Star® Compliant Refrigerators, Energy Star® Compliant Freezers, Energy Star® Dehumidifiers, Second Refrigerator Turn-In, and Second Freezer Turn-In.[1] Complete assumptions and sources for the measures can be found at the end of the Appendix B.

(1) Energy Star® Compliant Refrigerators[2]*:* In April 2008, the Energy Star® criteria for refrigerators changed to require all qualifying, full-size models to be at least 20% above the minimum federal standard. High efficiency refrigerators use a number of technologies to achieve energy savings (more efficient compressors, insulation, door seals, etc.). There are a few variations of high efficiency refrigerator models: top freezer models, side by side models, and bottom freezer models.

(2) Energy Star® Compliant Freezers[3]*:* On January 1, 2003, the Energy Star® criteria for freezers was established, mandating all freezers 7.75 cubic feet or greater in volume must be at least 10% above the minimum federal standard to qualify for Energy Star®. Meanwhile, all freezers less than 7.75 cubic feet in volume and 36 inches or less in height must be at least 20% above the minimum federal standard to qualify for Energy Star®. Freezers come in two main styles: Chest and Upright. Chest style models have a door on top that opens upward while Upright models have the door on the front opening outward.

(3) Energy Star® Dehumidifiers[4]*:* Often used in the damp areas of a home, such as basements, dehumidifiers remove moisture from the air to maintain comfort and to limit the growth of mold and mildew. Energy Star® qualified models provide the same features as conventional models but they are more energy efficient. Energy Star® qualified models have more efficient refrigeration coils, compressors, and fans than conventional models. Energy Star® dehumidifiers operate at least 10 percent more efficiently than conventional models. This analysis compared replacing a standard 40 pint dehumidifier with a 40 pint Energy Star® dehumidifier that is used 1,620 hours/year.

(4) Second Refrigerator Turn-In: The goal of a refrigerator turn-in program is to get underutilized but operational second refrigerators out of service and properly dismantled. While appliance recycling programs are praised for handling the disposal of major appliances in an

---

[1] Dishwashers & Clothes Washers can be found under the section for Electric Hot Water Heaters due to the electric savings associated with reduced hot water use.

[2] Refrigerators & Freezers: Key Product Criteria. (www.energystar.gov)

[3] Refrigerators & Freezers: Key Product Criteria. (www.energystar.gov)

[4] Dehumidifiers. (www.energystar.gov)

environmentally sound manner, the programs must also provide energy savings on a cost-effective basis, which means that only operating units qualify for recycling.

(5) Second Freezer Turn-In: The freezer turn-in program is the same as the refrigerator turn-in program described above.

2. CONSUMER ELECTRONICS

Five residential energy efficiency measures are covered in this section: Standby Power, Energy Star® Televisions, Energy Star® Desktop Computers, Monitors, and Laptop Computers. Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1) Home Electronics[5]*:* Many consumer electronics continue to consume electricity when switched off or not performing their main function (stand-by mode). The most common sources of standby power consumption include products with remote controls, low-voltage power supplies, rechargeable devices, and continuous displays. A typical North American home may contain fifteen to twenty devices constantly drawing standby power. For this analysis, homes were assumed to replace fifteen devices consuming standby power to an energy saving model.

(2) Energy Star® Televisions[6]*:* In addition to the Home Electronics category defined above, this analysis looks at the most common electronics found in homes today: televisions and computers. Energy Star® televisions must consume 1 watt or less in standby mode. On mode power requirements vary according to screen area and whether the unit is non-high, high, or full-high definition. External power supplies (EPS) packaged with TV products must meet all Energy Star® requirements for EPS devices.

(3) Energy Star® Desktop Computers[7]*:* Today's Energy Star® criteria for personal computers include power supply efficiency standards, operational mode energy efficiency requirements, and power management requirements. Power management features place monitors and computers (CPU, hard drive, etc.) into a low-power "sleep mode" after a period of inactivity.

4) Energy Star® Computer Monitors: Similar to computers, Energy Star® Monitors also are equipped with power management features that enable monitors to switch into a low-power mode after a period of inactivity.

5) Energy Star® Laptop Computers: See Energy Star® Desktop Computers.

3. LIGHTING

Two residential energy efficiency measures are covered in this section: Compact Fluorescent Lighting and LED Lighting. Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1)Compact Fluorescent Lighting[8]*:* Residential fluorescent bulbs and fixtures present a significant opportunity for energy and maintenance savings. On a per lamp basis, compact fluorescent

---

[5] Emerging Energy Saving Technologies & Practices for the Buildings Sector as of 2004. ACEEE Report# AO42. October 2004. Pg. 41.
[6] Televisions (www.energystat.gov)
[7] Computers. (www.energystar.gov)
[8] Compact Fluorescent Bulbs. (www.energystar.gov)

lamps are generally 75 percent more efficient than incandescent bulbs and last up to ten times longer. In addition, CFL bulbs produce about 75 percent less heat, so they're safer to operate and can cut energy costs associated with home cooling. CFL bulbs vary in size and shape. Their appearance can be a spiral-shaped fluorescent tube or they can appear as a standard shape, such as the R-30 floodlight used in recessed cans. Dimmable CFL bulbs and 3-way CFL bulbs are also available.

The lighting sockets eligible for CFL replacement were designated as either high use (>5 hrs/day), medium use (1-5 hrs/day), and low use (1 hrs or less/day). In single family homes, more than half (57%) were considered low use bulbs. In manufactured homes, the percent of low use sockets was even greater (80%). Only 10.5% of sockets in single family homes were assumed to be high use bulbs, and less than 4% of bulbs in manufactured homes were estimated to be on 5 hours per day or greater.

(2)LED Lighting[9]: Light emitting diode (LED) lights are more efficient than both CFL and incandescent lighting. LED lighting uses at least 75% less energy, lasts 25 times longer than incandescent lighting, and provides optimal light color. LED lights are more rugged and damage-resistant than compact fluorescents and incandescent bulbs. LED lights don't flicker. In addition, LEDs do not produce heat like incandescent bulbs. However, current LEDs have primarily directional output in single direction and are better at placing light in a single direction than incandescent or fluorescent bulbs and may be limited to certain applications, such as under counter or recessed lighting. This analysis compared the savings potential of replacing both incandescent and CFL lighting with the more efficient LED lights.

4. ELECTRIC WATER HEATING

Nine residential water heating energy efficiency measures are covered in this section: Low Flow Showerhead, Low Flow Faucet Aerators, Water Heater Blanket, Pipe Wrap, Electric Water Heaters (stand-alone), Heat Pump Water Heaters(SF), Solar Water Heater with Electric Water Heating Back Up(SF), Energy Star® Dishwashers, and Energy Star® Clothes Washers.[10] Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1) Low Flow Showerheads/Faucets[11,12]*:* An existing showerhead is replaced with a new unit that has a low-flow rate (<2.5 gallons/minute). Significant savings in hot water use can be achieved by installing low-flow showerheads and faucets. The single best action is to replace old showerheads as showers use 37% of the hot water in typical U.S. homes.

(2) Low Flow Faucet Aerators[13]*:* An existing faucet is replaced with a new unit that has a low-flow rate (<1.0 gallon/minute).

(3) Water Heater Blanket[14]*:* Water heater jackets are designed to wrap around an existing water heater tank to improve insulation, prevent heat loss, and save energy. Installing an insulating blanket can reduce water heating energy use by 3-9%.

---

[9] LED Lighting. Toolbase Services. (www.toolbase.org/Technology-Inventory/Electrical-Electronics/white-LED-lighting)

[10] SF: designates measures that were applied only to single-family homes due to measure applicability. For example, solar water heating possesses additional market barriers for manufactured home units.

[11] Global Green USA website (www.globalgreen.org/pha-energytoolbox/tech_dhw.htm)

[12] Residential Deemed Savings, Installation, and Efficiency Standards. Frontier Associates. January 2008. Pg. 35

[13] Residential Deemed Savings, Installation, and Efficiency Standards. Frontier Associates. January 2008. Pg. 36

(4) Pipe Wrap[15]*:* Insulating hot water pipes will reduce losses as the hot water is flowing to the faucet and, more importantly, it will reduce standby losses when the tap is turned off and then back on within an hour or so. Pipe wrap will conserve energy and water that would normally be lost waiting for the hot water to reach the tap. Energy loss still occurs after pipe wrap has been installed, though to a smaller degree than the losses observed in non-insulated pipes.

(5) Efficient Electric Water Heater (stand-alone)[16,17]*:* In this measure, baseline replacement stand alone electric water heaters are replaced with high efficiency stand alone storage tank water heaters. Storage water heaters work by heating up water in an insulated tank. However, because heat is lost through the walls of the storage tank, energy is consumed even when no hot water is being used. New high-efficiency storage water heaters contain higher levels of insulation around the tank, reducing standby losses. In this analysis a baseline replacement model (EF=.90) is replaced with a high efficiency model (EF=.95). This measure applies to homes operating primarily electric heating systems and electric water heaters.

(6) Heat Pump Water Heater (SF)[18,19]*:* Heat pump water heaters are more efficient than electric storage water heaters because the electricity is used for moving heat from one place to another in lieu of generating the heat directly. For heat pump water heaters, the heat source is typically the outside air or air in the basement where units are typically located. A heat pump water heater uses anywhere from 33%-50% of the electricity required by a conventional storage tank water heater and are available with built-in water tanks or as add-ons to existing water tanks. In this analysis a baseline electric storage tank model (EF=.90) is replaced with a heat pump water heater model (EF=2.0). This measure applies to homes operating primarily electric heating systems and electric water heaters.

(7) Solar WH w/ Electric Back-up (SF)[20]*:* Solar water heaters are designed to serve as pre-heaters for conventional storage or demand water heaters. As the solar system preheats the water, the extra temperature boost required by the storage or demand water heater is relatively low, and high flow rate can be achieved. Solar water heaters can be particularly effective if they are designed for three-season use, with a home's heating system providing hot water during the winter months. Although less common in today's market, solar water heating units are considerably less expensive and more reliable than they were two to three decades ago.

In this analysis, 30% of homes were estimated to be available for solar water heating systems. This technical potential is based on factors including: roof orientation, roof size, shading, load-bearing capability, and local building codes and ordinances.

(8) Energy Star® Dishwasher[21]*:* Dishwashers exceeding minimum qualifying efficiency standards established under Energy Star® Program with an Energy Factor (EF) >= .75 (versus the current federal standard energy factor <=.60). Energy Star® labeled dishwashers save energy by using

---

[14] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[15] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[16] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003. Table 6.6.
[17] Energy Star Residential Water Heating: Draft Criteria Analysis. (www.energystar.gov)
[18] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[19] Energy Star Residential Water Heating: Final Criteria Analysis. (www.energystar.gov)
[20] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[21] Dishwashers: Key Product Criteria (www.energystar.gov)

both improved technology for the primary wash cycle, and by using less hot water to clean. Construction includes more effective washing action, energy efficient motors and other advanced technology such as sensors that determine the length of the wash cycle and the temperature of the water necessary to clean the dishes. In addition, a high efficiency dishwasher can save approximately 430 gallons of water a year if used to run an average of 4 loads per week.

(9) Energy Star® Clothes Washer[22]*:* Clothes washers exceeding minimum qualifying efficiency standards established under Energy Star® Program with a Modified Energy Factor (MEF) >= 1.8 and a Water Factor (WF) <=7.5. The MEF measures the energy used during the washing process, including machine energy, water heating energy, and dryer energy. The higher the MEF, the more efficient the clothes washer is. Energy Star® qualified washers extract more water from clothes during the spin cycle. This reduces the drying time and saves energy and wear and tear on your clothes. In addition, substantial savings on water and sewer bills contribute to the economic benefits of high-efficiency washers. A high efficiency clothes washer can save nearly 6,542 gallons of water a year based on an average of 7.5 cycles per week.

5. SPACE HEATING & COOLING (Building Envelope Measures)

The following section describes six energy efficiency building envelope measures that were included in this analysis for homes with electric space heating and/or cooling. The nine residential energy efficiency measures covered in this section include: Ceiling Insulation, Floor Insulation, Air Infiltration, Duct Sealing, Energy Star® Windows, and Radiant Barriers. Of these, the ceiling insulation upgrades and radiant barriers are considered only for single family homes, where adequate attic space is present, and not for manufactured homes. This study examines each measure for three heating and cooling scenarios: electric AC only, electric heat pumps and electric furnace heating. Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1) Ceiling Insulation (SF)[23]*:* Ceiling insulation levels vary greatly depending on the age of the home, type of insulation, and activity in the attic (i.e. using the attic for storage and HVAC equipment). For this analysis, measure savings are based on homes with little to no ceiling insulation improving to R-19 levels, and homes with a current ceiling insulation of R-19 increased to an efficient level of R-38.

(2) Floor Insulation[24]*:* In an otherwise well-insulated home, as much as 20% of the total heat loss can occur through uninsulated foundation walls or floors. For this analysis, measure savings are based on a home with no floor insulation increased to R-19. Manufactured homes were assumed to have a minimum of R-11 and upgraded to R-30.

(3) Air Infiltration[25]*:* Hidden air leaks cause some of the largest heating and cooling losses in older homes. Common air leakage sites include plumbing penetrations through insulated floors and ceilings, baseboard moldings, dropped ceilings above bathtubs and cabinets, attic access hatches, and doors. For this analysis, measure savings are based on a reducing a current home's air from 10 ACH_{50} to 7 ACH_{50}.

[22] Clothes Washers: Key Product Criteria. (www.energystar.gov)
[23] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[24] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.
[25] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.

(4) Duct Sealing[26]*:* This measure assumes that leaky and unsealed residential air ducts are properly repaired and sealed. Mastic (a special paste) is the preferred method for duct sealing. Properly sealing leaky ducts can save significant amounts of energy needed to heat a home.

(5) Energy Star® Windows[27]*:* In older homes, windows are often one of the largest sources of heat loss in winter due to their low insulating ability and high air leakage rates. Windows are also generally the major source of unwanted heat gain in the summer. As a result, windows are typically net energy losers, and can be responsible for much of the energy used to heat and cool homes. However, improved windows, combined with proper consideration of their placement and other details, can result in significant energy savings. Energy efficient windows help to reduce air leakage and heat transfer. High efficiency windows usually have double or triple glazing, have argon gas between the panes of glass, have excellent seals, and have a Low-Emissivity coating.

(6) Radiant Barriers (SF)[28]*:* Radiant heat from the sun is absorbed by roofing shingles and transferred to the roof decking below and into the attic space. Conventional insulation absorbs much of this heat and once its saturation point has been met, this heat is then transferred to the living spaces below. Radiant barriers, such as reinforced aluminum foil, reduce the flow of heat from a hot roof to the cooler ceiling insulation. By lowering the temperature in your attic, you can reduce the amount of heat transferred to your living spaces below by up to 50% giving you greater comfort in your home and lessening the strain your air conditioning unit.

6. SPACE HEATING & COOLING (HVAC Equipment)

The following section describes the energy-efficient HVAC equipment measures that were included in this analysis for homes with electric space heating and/or cooling. Seven residential energy efficiency measures are covered in this section: HVAC Tune-Up, Energy Star® Room Air Conditioners, High Efficiency Central Air Conditioners, High Efficiency Heat Pumps, Ground-Source Heat Pumps, Dual-Fuel Heat Pumps, and Electric Furnace Replacement (w/ Air Source Heat Pumps). Complete assumptions and sources for the measures can be found at the end of Appendix 2.

(1) HVAC Tune-Up[29]*:* HVAC tune-up and maintenance helps to keep heat pump and central air conditioning units running at top efficiency, prevent equipment failures, and extend the life of the equipment. A tune-up by a service professional can improve unit efficiency by as much as 20%. An annual HVAC tune up includes: checking the unit's refrigerant pressure and tubing, checking and adjusting belt tension, cleaning and lubricating the indoor blower unit, cleaning inside the "A" coil, and checking the thermostat, wiring, and other electric parts.

(2) Energy Star® Room Air Conditioners[30,31]*:* Room air conditioner units are typically mounted in a window so that part of the unit is outside and part is inside. An insulated divider to reduce heat transfer losses typically separates the two sides. The outdoor portion generally includes a compressor, condenser, condenser fan, fan motor, and capillary tube. The indoor portion

---

[26] Efficiency Vermont Technical Reference Usual Manual (TRM). No. 2006-41. Pg. 388.
[27] "Energy Efficiency in Remodeling: Windows" Tool Base Services website. (www.toolbase.org)
[28] Emerging Energy Saving Technologies & Practices for the Buildings Sector as of 2004. ACEEE Report# AO42. October 2004. Pg. 180.
[29] "Tuning Up for Summer" Kansas City Power & Light. (www.kcpl.com)
[30] Room Air Conditioners: Key Product Criterion. Energy Star website (www.energystar.gov)
[31] Technology Summary. CEE website. www.cee1.org

generally includes an evaporator and evaporator fan. The minimum federal standard used in this analysis (based on model type and capacity) is an Energy Efficiency Ratio (EER) of at least 9.8. Currently, units with an EER of 10.8 are eligible for the Energy Star® label. This analysis assumed a room air conditioner cooling capacity of 10,000 Btu/hr for primary units in single-family homes, and 8,000 Btu/hr for all secondary units or manufactured home units.

(3) High Efficiency Central Air Conditioners[32,33]*:* Central air conditioners circulate cool air through a system of supply and return ducts. Supply ducts and registers (i.e. openings in the walls, floors, or ceilings covered by grills) carry cooled air from the air conditioner to the home. This cooled air becomes warmer as it circulates though the home; then it flows back to the central air conditioner through return ducts and registers.

Central air conditioners are rated according to their seasonal energy efficiency ratio (SEER). SEER indicates the relative amount of energy need to provide a specific cooling output. New residential central air conditioner standards went into effect in January 2006. Central air conditioners manufactured after January 2006 must achieve a SEER of 13 or higher. For this analysis, the baseline replacement model has a SEER of 13 for all replace-on-burnout scenarios. The baseline for the early retirement analysis assumes existing homes currently have an average SEER 10 unit. The high efficiency central air conditioner has a SEER of 15. High efficiency central air conditioners were eligible for installation in all homes with central air conditioning.

(4) High Efficiency Electric Heat Pumps[34,35]*:* Electric heat pumps operate by transferring heat from one place to another. In the heating mode, a heat pump extracts heat from outside a residence and delivers it to the house. Like a furnace, most heat pumps work with forced warm-air delivery systems. Heat pumps can also be operated to cool a house during summer months. In the cooling mode, the cycle is reversed and heat is taken from the house and transferred to the outside air. Because heat pumps rely on the outside air as the heat source in the wintertime, they are much more common in warmer climates. Heat pumps are rated for both heating and cooling – both in terms of capacity and efficiency.

Heating efficiency is indicated by the heating season performance factor (HSPF). Cooling efficiency is indicated by the seasonal energy efficiency rating (SEER). Both indicate the relative amount of energy needed to provide a specific heating or cooling output. New residential heat pump standards went into effect in January 2006. Heat pumps manufactured after January 2006 must achieve a HSPF of 7.7 and a SEER of 13 or higher. For this analysis, the baseline replacement model has a HSPF of 7.7 and a SEER of 13 (replace-on-burnout) or a HSPF of 6.8 and a SEER of 10 (early retirement). The high efficiency heat pump has a HSPF of 8.5 and a SEER of 15.

(5) Ground Source Heat Pumps[36]*:* Ground Source heat pumps, or geothermal heat pumps, use the earth or groundwater as a heat source, instead of the outside air. Stable underground temperature allow geothermal systems to be rated for heating efficiency and cooling efficiency.

---

[32] Consumer Guide to Home Energy Savings' 8th ed. ACEEE. 2003.
[33] Central Air Conditioners and Heat Pumps Energy Conservation Standards. Federal Register. Volume 6:, No. 14. January 22, 2001. Pg. 31
[34] Consumer Guide to Home Energy Savings' 8th ed. ACEEE. 2003.
[35] Central Air Conditioners and Heat Pumps Energy Conservation Standards. Federal Register. Volume 6:, No. 14. January 22, 2001. Pg. 31
[36] "Consumer Guide to Home Energy Savings' 8th ed. ACEEE. 2003.

Geothermal heat pumps may be 25-45% more efficient than air-source heat pumps, but are more expensive and difficult to install. Most geothermal systems include "loops" that are buried in the ground in shallow trenches or in vertical boreholes. As an alternative, other systems may draw in groundwater and pass it through a heat exchanger instead of refrigerant before returning the water to the aquifer. Geothermal systems may also include 'desuperheaters' which recover discharged heat to provide domestic hot water at little to no cost.

Geothermal systems currently are eligible for a federal person tax credit up to 30% of the installation costs. These credits are available through December 2016.

(6) Dual-Fuel Heat Pump: A dual-fuel heat pump is an electric heat pump and a gas furnace all in one. When temperatures are above freezing, a heat pump is an efficient way to heat the home. In instances when the temperature drops below freezing, a gas furnace is able to provide heat more economically. When the outside temperature falls below 35 degrees, the heat pump automatically switches to supplemental gas heat for better efficiency. This analysis considered the benefits of installing a dual fuel heat pump in place of either a standard electric heat pump or a central AC/Electric Furnace unit.

(7) Electric Furnace Replacement with Air Source Heat Pumps (SF)[37]*:* Heat Pumps are considered to be more energy efficient than furnaces. As a result, this measure examines the possible energy savings derived from replacing an existing central AC/Electric Furnace or a central AC /Electric Furnace that has reached the end of its useful life with a new energy efficient air-source heat pump. The heat pump has a HSPF of 8.5 and a SEER of 15.

7. OTHER

Three residential energy efficiency measures are covered in this section: In Home Energy Displays, Pre-Pay Metering, and Pool pumps (single family only). Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1)In Home Energy Displays[38]*:* In-home energy displays provide real-time feedback to occupants on whole-house electricity consumption. Displays collect demand data from the meter and display instantaneous power usage and cumulative energy usage over selected time periods. Providing instantaneous feedback on household electrical demand has shown the promise to reduce energy consumption in households by 5-15% through behavioral changes. Although studies have shown reduced consumption, the persistence of these savings remains relatively unknown. For this analysis, savings were assumed to persist for a period of three years.

(2)Pre-Pay Metering[39]*:* Prepaid meters require consumers to purchase power in advance. In home display indicates how much money is on the account, how many kilowatts the household consumed in the last hour, day, and month, how much that power costs in dollar and cents, and when, approximately, the account will need to be replenished.

While pre-paid metering is not an applicable measure for all consumers, pre-paid metering has proven effective for credit-challenged consumers. The plan eliminates the need for a security deposit and late fees, and forces consumers to use only as much power as they afford. Utilities

---

[37] "Consumer Guide to Home Energy Savings' 8th ed. ACEEE. 2003.

[38] Pilot Evaluation of Energy Savings from Residential Energy Demand Feedback Devices. Florida Solar Energy Center. Janaury 2008.

[39] Prepaid Meters: Pay-as-you-use consumption. Consumer Reports.

currently offering pre-pay as an option to consumers has also shown the benefit of decreased consumption by users. One utility, Salt River Project, reports pre-pay consumers used an average of 12.8% less electricity annually than regular consumers.

Similar to in-home energy displays, reduced consumption is a result of behavior change and the persistence of savings is relative unknown. This analysis assumed savings for a period of 3 years.

(3)Pool Pumps (SF)[40]*:* Residential pool pumps are used to circulate and filter swimming pool water. While large, single speed pool pumps filter pools quickly, they use substantially more energy than a multi-speed pool pump. Two-speed operation saves energy while still filtering the same amount of pool water because the pumps operate more efficiently at lower water flow rates. High speed operation is only required intermittently.

8. MULTI-FAMILY ENERGY EFFICIENT RETROFIT PACKAGE

One residential energy efficiency measures are covered in this section: Multi-Family Energy Efficiency Kit (Tier 1). Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1)Multi-Family Energy Efficiency Kit (Tier 1): Multi-family homes make a relatively small part of the Big Rivers service territory, at approximately 2% of all residential units. In addition, the likelihood of shared walls and the possibility of inhabitants merely renting the property can create some additional obstacles for installing and investing in energy efficient measures. For this analysis, GDS considered installing a relatively inexpensive package of energy efficient retrofit measures for the multi-family population. This package consisted of: 5 CFL bulbs, a low flow showerhead, and basic air sealing measures (i.e. caulking). Total savings are estimated at a conservative 4% of total annual consumption.

9. NEW HOMES CONSTRUCTION

Two residential energy efficiency programs are covered in this section: Energy Efficient New Homes Construction (Tier 1: 15% more efficient) and Energy Efficient New Homes Construction (Tier 2: 35% more efficient). Tier 2 new construction homes are limited to single-family residences. Complete assumptions and sources for the measures can be found at the end of Appendix B.

(1) Energy Efficient New Homes Construction (15% more efficient)[41]*:* In this analysis, new homes are designed to be built to Energy Star® standards: at least 15 percent more energy efficient than those built to the 2006 International Residential Code (IRC).

Builders would receive an incentive for constructing new homes designed to Energy Star® standards: at least 15 percent more energy efficient than those built to the 2006 International Residential Code (IRC). Energy Star® Homes also incorporate other energy savings features that typically make them 20–30% more efficient than standard homes. The US Environmental Protection Agency reports that 165 home builders have partnered with EPA to construct more

---

[40] Leading the Way: Continued Opportunities for New State Appliance & Equipment Efficiency Standards. ACEEE Report # ASAP-6/ACEEE-AO62. March 2006.

[41] About Energy Star New Homes. (www.energystar.gov)

than 1,290 Energy Star® qualified homes in the state of Kentucky in 2010 to date. Nationwide, just over 1.1 million homes have earned the Energy Star® rating to date.

Energy savings are based on heating, cooling, and hot water energy use and are typically achieved through a combination of the following: high performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems, high efficiency water heating equipment, and high efficiency building envelope standards. Energy Star® Homes also encourage the use of energy-efficient lighting and appliances. These features contribute to improved home quality and homeowner comfort, and to lower energy demand and reduced air pollution.

Both single-family and manufactured homes can be built to Tier 1 (15% more efficient than code) standards.

(2) Energy Efficient New Homes Construction (35% more efficient): Similar to a Tier 1 home, homeowners would receive an incentive for purchasing new homes designed to exceed Energy Star® standards: at least 35 percent more energy efficient than those built to the 2006 International Residential Code. Tier 2 construction is limited to single family homes.

Electric Measure Assumptions (Initial Assumptions & Levelized Costs)

Discount Rate 6.33%

Measure	Measure Name	Home Type	Base Elec. Use (kWh)	% Savings	Elec. Savings (kWh)	Summer kW Savings	Winter kW Savings	Useful Life	Increm. Measure Cost	ROB vs. Retrofit	Measure/End Use Description	Base Saturation	EE Saturation	Annual Gas (MMBTU) Savings	Annual Water Savings (gal.)	Annual Amortized Cost Per Unit	Levelized Cost (-Admin)	TRC Test	Utility Test	Part. Test	RIM Test
	Electric Appliances - Single Family/Mobile Home																				
1	Energy Star® Compliant Top-Mount Refrigerator	SF	508.00	20.87%	106.00	0.007	0.006	12.00	$30.00	ROB	Homes w/ Refrigerators	65.00%	25.00%			$3.64	$0.034	1.86	1.00	1.00	1.00
2	Energy Star® Compliant Side-by-Side Refrigerator	SF	699.00	19.03%	133.00	0.007	0.006	12.00	$30.00	ROB	Homes w/ Refrigerators	35.00%	25.00%			$3.64	$0.027	2.29	1.00	1.00	1.00
3	Energy Star® Compliant Chest Freezer	SF	420.00	10.00%	42.00	0.004	0.003	11.00	$33.00	ROB	Homes w/ Freezers	36.40%	7.00%			$4.26	$0.101	0.64	1.00	1.00	1.00
4	Energy Star® Compliant Upright Freezer (Manual Def.)	SF	469.00	10.02%	47.00	0.004	0.003	11.00	$33.00	ROB	Homes w/ Freezers	15.60%	7.00%			$4.26	$0.091	0.70	1.00	1.00	1.00
5	Energy Star® Dehumidifer	SF	1,064.00	20.02%	213.00	0.131	0.131	12.00	$1.00	ROB	Homes w/ Dehumidifiers	7.00%	50.00%			$0.12	$0.001	207.42	1.00	1.00	1.00
6	Second Refrigerator Turn In	SF	978.00	100.00%	978.00	0.082	0.070	5.00	$142.20	Retrofit	Homes w/ more than one refrigerator	34.00%	10.00%			$34.06	$0.035	1.55	1.00	1.00	1.00
7	Second Freezer Turn In	SF	774.00	100.00%	774.00	0.065	0.055	5.00	$142.20	Retrofit	Homes w/ more than one freezer	4.00%	10.00%			$34.06	$0.044	1.23	1.00	1.00	1.00
8	Energy Star® Compliant Top-Mount Refrigerator	MH	508.00	20.87%	106.00	0.007	0.006	12.00	$30.00	ROB	Homes w/ Refrigerators	65.00%	25.00%			$3.64	$0.034	1.86	1.00	1.00	1.00
9	Energy Star® Compliant Side-by-Side Refrigerator	MH	699.00	19.03%	133.00	0.007	0.006	12.00	$30.00	ROB	Homes w/ Refrigerators	35.00%	25.00%			$3.64	$0.027	2.29	1.00	1.00	1.00
10	Energy Star® Compliant Chest Freezer	MH	420.00	10.00%	42.00	0.004	0.003	11.00	$33.00	ROB	Homes w/ Freezers	36.40%	7.00%			$4.26	$0.101	0.64	1.00	1.00	1.00
11	Energy Star® Compliant Upright Freezer (Manual Def.)	MH	469.00	10.02%	47.00	0.004	0.003	11.00	$33.00	ROB	Homes w/ Freezers	15.60%	7.00%			$4.26	$0.091	0.70	1.00	1.00	1.00
12	Energy Star® Dehumidifer	MH	1,064.00	20.02%	213.00	0.131	0.131	12.00	$1.00	ROB	Homes w/ Dehumidifiers	7.00%	50.00%			$0.12	$0.001	207.42	1.00	1.00	1.00
13	Second Refrigerator Turn In	MH	847.00	100.00%	847.00	0.071	0.060	5.00	$142.20	Retrofit	Homes w/ more than one refrigerator	34.00%	10.00%			$34.06	$0.040	1.34	1.00	1.00	1.00
14	Second Freezer Turn In	MH	774.00	100.00%	774.00	0.065	0.055	5.00	$142.20	Retrofit	Homes w/ more than one freezer	4.00%	10.00%			$34.06	$0.044	1.23	1.00	1.00	1.00
	Consumer Electronics - Single Family/Mobile Home																				
15	Home Electronics	SF	440.00	60.23%	265.00	0.030	0.030	7.00	$30.00	ROB	All Homes	100.00%	30.00%			$5.44	$0.021	2.98	1.00	1.00	1.00
16	Televisions	SF	310.00	15.81%	49.00	0.017	0.017	6.00	$1.00	ROB	Homes w/ a TV	245.00%	30.00%			$0.21	$0.004	18.82	1.00	1.00	1.00
17	Energy Star® Desktop Computer	SF	134.00	31.34%	42.00	0.005	0.005	4.00	$1.00	ROB	Homes w/ a Desktop	85.00%	30.00%			$0.29	$0.007	7.80	1.00	1.00	1.00
18	Energy Star® Computer Monitor	SF	97.00	21.65%	21.00	0.002	0.002	5.00	$1.00	ROB	Homes w/ a Desktop	85.00%	30.00%			$0.24	$0.011	4.98	1.00	1.00	1.00
19	Energy Star® Laptop Computer	SF	44.00	29.55%	13.00	0.001	0.001	4.00	$1.00	ROB	Homes w/ a Laptop	16.00%	30.00%			$0.29	$0.022	2.41	1.00	1.00	1.00
20	Home Electronics	MH	440.00	60.23%	265.00	0.030	0.030	7.00	$30.00	ROB	All Homes	100.00%	30.00%			$5.44	$0.021	2.98	1.00	1.00	1.00
21	Televisions	MH	310.00	15.81%	49.00	0.017	0.017	6.00	$1.00	ROB	Homes w/ a TV	150.00%	30.00%			$0.21	$0.004	18.82	1.00	1.00	1.00
22	Energy Star® Desktop Computer	MH	134.00	31.34%	42.00	0.005	0.005	4.00	$1.00	ROB	Homes w/ a Desktop	85.00%	30.00%			$0.29	$0.007	7.80	1.00	1.00	1.00
23	Energy Star® Computer Monitor	MH	97.00	21.65%	21.00	0.002	0.002	5.00	$1.00	ROB	Homes w/ a Desktop	85.00%	30.00%			$0.24	$0.011	4.98	1.00	1.00	1.00
24	Energy Star® Laptop Computer	MH	44.00	29.55%	13.00	0.001	0.001	4.00	$1.00	ROB	Homes w/ a Laptop	16.00%	30.00%			$0.29	$0.022	2.41	1.00	1.00	1.00
	Lighting - Single Family /Mobile Home																				
25	CFL (vs. Incandescent) - 5 hours/day	SF	76.65	-	51.10	0.003	0.007	4.00	$1.60	ROB	Sockets with Inc. bulbs (5hrs/day)	10.54%	22.48%			$0.47	$0.009	7.08	1.00	1.00	1.00
26	CFL (vs. Incandescent) - 3 hours/day	SF	45.99	-	30.66	0.003	0.007	7.00	$1.60	ROB	Sockets with Inc. bulbs (3hrs/day)	31.82%	19.27%			$0.29	$0.009	8.16	1.00	1.00	1.00
27	CFL (vs. Incandescent) - 1 hours/day	SF	15.33	-	10.22	0.003	0.007	20.00	$1.60	ROB	Sockets with Inc. bulbs (1hrs/day)	57.64%	9.03%			$0.14	$0.014	9.68	1.00	1.00	1.00
28	LED (vs. Incandescent)	SF	45.99	-	40.52	0.004	0.009	20.00	$29.75	ROB	Sockets with Inc. bulbs	100.00%	17.00%			$2.66	$0.066	1.41	1.00	1.00	1.00
29	LED (vs. CFL)	SF	15.33	-	9.86	0.001	0.002	20.00	$28.15	ROB	Sockets with CFL bulbs	17.00%	0.00%			$2.52	$0.256	0.44	1.00	1.00	1.00
30	CFL (vs. Incandescent) - 5 hours/day	MH	76.65	-	51.10	0.003	0.007	4.00	$1.60	ROB	Sockets with Inc. bulbs (5hrs/day)	3.48%	25.00%			$0.47	$0.009	7.08	1.00	1.00	1.00
31	CFL (vs. Incandescent) - 3 hours/day	MH	45.99	-	30.66	0.003	0.007	7.00	$1.60	ROB	Sockets with Inc. bulbs (3hrs/day)	14.53%	20.51%			$0.29	$0.009	8.16	1.00	1.00	1.00
32	CFL (vs. Incandescent) - 1 hours/day	MH	15.33	-	10.22	0.003	0.007	20.00	$1.60	ROB	Sockets with Inc. bulbs (1hrs/day)	81.99%	14.55%			$0.14	$0.014	9.68	1.00	1.00	1.00
33	LED (vs. Incandescent)	MH	45.99	-	40.52	0.004	0.009	20.00	$29.75	ROB	Sockets with Inc. bulbs	100.00%	12.00%			$2.66	$0.066	1.41	1.00	1.00	1.00
34	LED (vs. CFL)	MH	15.33	-	9.86	0.001	0.002	20.00	$28.15	ROB	Sockets with CFL bulbs	12.00%	0.00%			$2.52	$0.256	0.44	1.00	1.00	1.00
	Electric Water Heating - Single Family/Mobile Homes																				
35	Low Flow Faucets	SF	3,694.00	2.22%	82.00	0.014	0.022	10.00	$10.00	Retrofit	Homes w/ Electric WH	62.00%	60.00%		965	$1.38	$0.017	8.86	1.00	1.00	1.00
36	Low Flow Showerhead	SF	3,694.00	5.52%	204.00	0.014	0.022	10.00	$14.00	Retrofit	Homes w/ Electric WH	62.00%	60.00%		2738	$1.93	$0.009	15.29	1.00	1.00	1.00
37	Water Heater Blanket	SF	3,694.00	4.85%	179.16	0.010	0.014	13.00	$20.00	Retrofit	Homes w/ Electric WH	62.00%	15.00%			$2.30	$0.013	5.64	1.00	1.00	1.00
38	Pipe Wrap	SF	3,694.00	2.95%	109.00	0.010	0.014	13.00	$6.00	Retrofit	Homes w/ Electric WH	62.00%	15.00%			$0.69	$0.006	12.17	1.00	1.00	1.00
39	Efficient Water Heater	SF	3,694.00	5.25%	193.94	0.005	0.007	13.00	$50.00	ROB	Homes w/ Electric WH	62.00%	30.00%			$5.76	$0.030	2.31	1.00	1.00	1.00
40	Heat Pump Water Heater	SF	3,694.00	55.98%	2,067.90	0.187	0.281	10.00	$850.00	ROB	Homes w/ Electric WH	62.00%	30.00%			$117.30	$0.057	1.28	1.00	1.00	1.00
41	Solar Water Heating	SF	3,694.00	53.49%	1,975.92	0.288	0.000	14.00	$4,850.00	Retrofit	Homes w/ Electric WH	62.00%	30.00%			$372.75	$0.189	0.57	1.00	1.00	1.00
42	Energy Star® Dishwasher (Electric Water Heating)	SF	368.00	20.11%	74.00	0.003	0.001	10.00	$12.00	ROB	Homes w/ Dishwashers & Electric WH	35.3%	47.00%		430	$1.66	$0.022	3.97	1.00	1.00	1.00
43	Energy Star® Dishwasher (Non-Electric WH)	SF	167.00	19.76%	33.00	0.003	0.001	10.00	$12.00	ROB	Homes w/ Dishwashers & Non-Elec. WH	21.7%	47.00%	0.19	430	$1.66	$0.050	4.26	1.00	1.00	1.00
44	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	787.00	28.46%	224.00	0.026	0.007	11.00	$258.00	ROB	Homes w/ CW, Elec. WH and Elec. Dryer	55.2%	36.00%		6542	$33.27	$0.149	1.57	1.00	1.00	1.00
45	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	SF	487.00	19.92%	97.00	0.026	0.007	11.00	$258.00	ROB	Homes w/ CW, NG WH and Elec. Dryer	33.8%	36.00%	0.61	6542	$33.27	$0.343	1.59	1.00	1.00	1.00
46	Low Flow Faucets	MH	3,151.00	2.13%	67.00	0.010	0.014	10.00	$10.00	Retrofit	Homes w/ Electric WH	95.00%	60.00%		965	$1.38	$0.021	7.75	1.00	1.00	1.00
47	Low Flow Showerhead	MH	3,151.00	5.30%	167.00	0.010	0.014	10.00	$7.00	Retrofit	Homes w/ Electric WH	95.00%	60.00%		2190	$0.97	$0.006	24.45	1.00	1.00	1.00
48	Water Heater Blanket	MH	3,151.00	5.87%	184.96	0.010	0.014	13.00	$20.00	Retrofit	Homes w/ Electric WH	95.00%	15.00%			$2.30	$0.012	5.80	1.00	1.00	1.00
49	Pipe Wrap	MH	3,151.00	2.82%	89.00	0.010	0.014	13.00	$6.00	Retrofit	Homes w/ Electric WH	95.00%	15.00%			$0.69	$0.008	10.28	1.00	1.00	1.00
50	Efficient Water Heater	MH	3,151.00	6.35%	200.09	0.005	0.007	13.00	$50.00	ROB	Homes w/ Electric WH	95.00%	30.00%			$5.76	$0.029	2.38	1.00	1.00	1.00
51	Energy Star® Dishwasher (Electric Water Heating)	MH	368.00	20.11%	74.00	0.003	0.001	10.00	$12.00	ROB	Homes w/ Dishwashers & Electric WH	54.2%	47.00%		430	$1.66	$0.022	3.97	1.00	1.00	1.00
52	Energy Star® Dishwasher (Non-Electric WH)	MH	167.00	19.76%	33.00	0.003	0.001	10.00	$12.00	ROB	Homes w/ Dishwashers & Non-Elec. WH	2.9%	47.00%	0.19	430	$1.66	$0.050	4.26	1.00	1.00	1.00
53	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	787.00	28.46%	224.00	0.026	0.007	11.00	$258.00	ROB	Homes w/ CW, Elec. WH and Elec. Dryer	84.6%	36.00%		6542	$33.27	$0.149	1.57	1.00	1.00	1.00
54	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	MH	487.00	19.92%	97.00	0.026	0.007	11.00	$258.00	ROB	Homes w/ CW, NG WH and Elec. Dryer	4.5%	36.00%	0.61	6542	$33.27	$0.343	1.59	1.00	1.00	1.00
	Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric AC Only (& Gas Heat)																				
55	Insulation - Ceiling (R-0 to R-19)	SF	6,836.00	28.51%	1,949.00	1.241	0.000	20.00	$882.30	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	89.00%	29.40		$79.00	$0.041	8.23	1.00	1.00	1.00
56	Insulation - Floor (R-0 to R-19)	SF	4,887.00	2.28%	111.42	0.146	0.000	20.00	$1,366.70	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	50.00%	9.22		$122.37	$1.098	1.32	1.00	1.00	1.00
57	Energy Star® Windows	SF	4,887.00	8.41%	411.00	0.219	0.000	20.00	$3,610.88	ROB	Homes w/ Electric AC Only (& Gas Heat)	57.00%	41.00%	5.90		$323.30	$0.787	0.40	1.00	1.00	1.00
58	Insulation -Ceiling (R-19 to R-38)	SF	4,887.00	2.58%	126.08	0.073	0.000	20.00	$882.30	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	36.00%	2.16		$79.00	$0.627	0.58	1.00	1.00	1.00
59	Air infiltration	SF	4,887.00	2.08%	101.65	0.110	0.000	11.00	$529.00	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	27.00%	3.94		$68.21	$0.671	0.98	1.00	1.00	1.00
60	Duct Sealing	SF	4,887.00	11.99%	585.95	0.292	0.000	18.00	$500.00	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	10.00%	6.96		$47.33	$0.081	3.33	1.00	1.00	1.00
61	Radiant Barriers	SF	4,887.00	12.76%	623.58	0.292	0.000	15.00	$641.00	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	57.00%	5.00%	0.00		$67.43	$0.108	0.74	1.00	1.00	1.00
	Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Heat Pump																				
62	Insulation - Ceiling (R-0 to R-19)	SF	19,902.00	40.47%	8,054.00	1.241	5.548	20.00	$882.30	Retrofit	Homes w/ Electric Heat Pump	16.00%	89.00%			$79.00	$0.010	11.95	1.00	1.00	1.00
63	Insulation - Floor (R-0 to R-19)	SF	11,848.00	12.69%	1,502.93	0.146	1.460	20.00	$1,366.70	Retrofit	Homes w/ Electric Heat Pump	16.00%	50.00%			$122.37	$0.081	1.64	1.00	1.00	1.00
64	Energy Star® Windows	SF	11,848.00	11.39%	1,350.04	0.219	1.095	20.00	$3,610.88	ROB	Homes w/ Electric Heat Pump	16.00%	41.00%			$323.30	$0.239	0.53	1.00	1.00	1.00
65	Insulation -Ceiling (R-19 to R-38)	SF	11,848.00	4.04%	478.31	0.073	0.438	20.00	$882.30	Retrofit	Homes w/ Electric Heat Pump	16.00%	36.00%			$79.00	$0.165	0.80	1.00	1.00	1.00
66	Air Infiltration	SF	11,848.00	6.04%	715.61	0.110	0.657	11.00	$529.00	Retrofit	Homes w/ Electric Heat Pump	16.00%	27.00%			$68.21	$0.095	1.22	1.00	1.00	1.00
67	Duct Sealing	SF	11,848.00	14.38%	1,703.19	0.292	1.460	18.00	$500.00	Retrofit	Homes w/ Electric Heat Pump	16.00%	10.00%			$47.33	$0.028	4.54	1.00	1.00	1.00
68	Radiant Barriers	SF	11,848.00	5.26%	623.58	0.292	0.000	15.00	$641.00	Retrofit	Homes w/ Electric Heat Pump	16.00%	5.00%			$67.43	$0.108	0.74	1.00	1.00	1.00

Electric Measure Assumptions (Initial Assumptions & Levelized Costs)

Discount Rate 6.33%

Measure	Measure Name	Home Type	Base Elec. Use (kWh)	% Savings	Elec. Savings (kWh)	Summer kW Savings	Winter kW Savings	Useful Life	Increm. Measure Cost	ROB vs. Retrofit	Measure/End Use Description	Base Saturation	EE Saturation	Annual Gas (MMBTU) Savings	Annual Water Savings (gal.)	Annual Amortized Cost Per Unit	Levelized Cost (-Admin)	TRC Test	Utility Test	Part. Test	RIM Test
	Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Furnace																				
69	Insulation - Ceiling (R-0 to R-19)	SF	26,239.00	32.97%	8,650.00	1.241	5.548	20.00	$882.30	Retrofit	Homes w/ Electric Furnace & AC	12.00%	89.00%			$79.00	$0.009	12.43	1.00	1.00	1.00
70	Insulation - Floor (R-0 to R-19)	SF	17,589.00	12.51%	2,200.90	0.146	1.460	20.00	$1,366.70	Retrofit	Homes w/ Electric Furnace & AC	12.00%	50.00%			$122.37	$0.056	2.00	1.00	1.00	1.00
71	Energy Star® Windows	SF	17,589.00	9.96%	1,752.33	0.219	1.095	20.00	$3,610.88	ROB	Homes w/ Electric Furnace & AC	12.00%	41.00%			$323.30	$0.184	0.60	1.00	1.00	1.00
72	Insulation -Ceiling (R-19 to R-38)	SF	17,589.00	3.50%	615.11	0.073	0.365	20.00	$882.30	Retrofit	Homes w/ Electric Furnace & AC	12.00%	36.00%			$79.00	$0.128	0.85	1.00	1.00	1.00
73	Air Infiltration	SF	17,589.00	5.63%	990.79	0.110	0.621	11.00	$529.00	Retrofit	Homes w/ Electric Furnace & AC	12.00%	27.00%			$68.21	$0.069	1.41	1.00	1.00	1.00
74	Duct Sealing	SF	17,589.00	12.36%	2,173.70	0.292	1.460	18.00	$500.00	Retrofit	Homes w/ Electric Furnace & AC	12.00%	10.00%			$47.33	$0.022	5.16	1.00	1.00	1.00
75	Radiant Barriers	SF	17,589.00	3.55%	623.58	0.292	0.000	15.00	$641.00	Retrofit	Homes w/ Electric Furnace & AC	12.00%	5.00%			$67.43	$0.108	0.74	1.00	1.00	1.00
	Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric AC Only (& Gas Heat)																				
76	Air Infiltration	MH	4,114.00	2.51%	103.26	0.073	0.000	11.00	$326.00	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	24.00%	42.00%	4.31		$42.03	$0.407	1.68	1.00	1.00	1.00
77	Insulation - Floor (R-11 to R-30)	MH	4,114.00	0.65%	26.74	0.000	0.000	20.00	$821.60	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	24.00%	60.00%	4.17		$73.56	$2.751	0.93	1.00	1.00	1.00
78	Energy Star® Windows	MH	4,114.00	20.19%	830.62	0.365	0.000	20.00	$4,218.48	ROB	Homes w/ Electric AC Only (& Gas Heat)	24.00%	26.00%	12.45		$377.70	$0.455	0.71	1.00	1.00	1.00
79	Duct Sealing	MH	4,114.00	12.03%	494.91	0.219	0.000	18.00	$500.00	Retrofit	Homes w/ Electric AC Only (& Gas Heat)	24.00%	26.00%	6.96		$47.33	$0.096	3.14	1.00	1.00	1.00
	Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat Pump																				
80	Air Infiltration	MH	11,093.00	6.30%	739.05	0.073	0.511	11.00	$326.00	Retrofit	Homes w/ Electric Heat Pump	7.50%	42.00%			$42.03	$0.057	1.77	1.00	1.00	1.00
81	Insulation - Floor (R-11 to R-30)	MH	11,093.00	16.10%	647.87	0.000	0.511	20.00	$821.60	Retrofit	Homes w/ Electric Heat Pump	7.50%	60.00%			$73.56	$0.114	1.03	1.00	1.00	1.00
82	Energy Star® Windows	MH	11,093.00	4.90%	2,619.33	0.365	1.825	20.00	$4,218.48	ROB	Homes w/ Electric Heat Pump	7.50%	26.00%			$377.70	$0.144	0.81	1.00	1.00	1.00
83	Duct Sealing	MH	11,093.00	17.50%	1,546.65	0.219	1.095	18.00	$500.00	Retrofit	Homes w/ Electric Heat Pump	7.50%	26.00%			$47.33	$0.031	3.76	1.00	1.00	1.00
	Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat																				
84	Air Infiltration	MH	16,849.00	7.50%	1,080.04	0.073	0.511	11.00	$326.00	Retrofit	Homes w/ Electric Heat & Cool	53.00%	42.00%			$42.03	$0.039	2.22	1.00	1.00	1.00
85	Insulation - Floor (R-11 to R-30)	MH	16,849.00	20.70%	980.59	0.000	0.511	20.00	$821.60	Retrofit	Homes w/ Electric Heat & Cool	53.00%	60.00%			$73.56	$0.075	1.32	1.00	1.00	1.00
86	Energy Star® Windows	MH	16,849.00	3.30%	3,675.62	0.365	1.825	20.00	$4,218.48	ROB	Homes w/ Electric Heat & Cool	53.00%	26.00%			$377.70	$0.103	0.99	1.00	1.00	1.00
87	Duct Sealing	MH	16,849.00	17.50%	2,086.79	0.219	1.095	18.00	$500.00	Retrofit	Homes w/ Electric Heat & Cool	53.00%	26.00%			$47.33	$0.023	4.47	1.00	1.00	1.00
	Space Heating and Space Cooling Equipment - Single Family/Mobile Homes																				
88	HVAC Tune-Up	SF	4,887.00	13.01%	635.80	0.304	0.000	6.00	$160.00	Retrofit	Homes with Central AC or Heat Pump	85.00%	10.00%			$32.88	$0.052	1.26	1.00	1.00	1.00
89	Energy Star® Room A/C	SF	1,205.00	9.26%	111.58	0.069	0.000	9.00	$50.00	ROB	Homes w/ Electric Room AC	12.50%	25.00%			$7.46	$0.067	1.15	1.00	1.00	1.00
90	Second Energy Star® Room A/C	SF	964.00	9.26%	89.27	0.055	0.000	9.00	$50.00	ROB	Homes w/ more than one Room AC	6.50%	25.00%			$7.46	$0.084	0.92	1.00	1.00	1.00
91	High Efficiency Central AC	SF	3,379.00	11.29%	381.49	0.146	0.000	14.00	$555.71	ROB	Homes w/ Electric Central AC	68.00%	4.00%			$61.01	$0.160	0.47	1.00	1.00	1.00
92	High Efficiency Central AC/Early Retire	SF	4,887.00	38.66%	1,889.31	0.365	0.000	14.00	$3,413.00	Retrofit	Homes w/ Electric Central AC	68.00%	4.00%			$374.73	$0.198	0.31	1.00	1.00	1.00
93	High Efficiency Heat Pump (HP Upgrade)	SF	8,949.00	7.74%	692.29	0.146	0.000	12.00	$1,000.00	ROB	Homes with Electric Heat Pump (H&C)	16.00%	10.00%			$121.44	$0.175	0.38	1.00	1.00	1.00
94	High Efficiency Heat Pump/Early Retire (HP Upgrade)	SF	11,848.00	30.31%	3,591.28	0.365	0.000	12.00	$6,700.00	Retrofit	Homes with Electric Heat Pump (H&C)	16.00%	10.00%			$813.68	$0.227	0.26	1.00	1.00	1.00
95	Ground Source Heat Pump (HP Upgrade)	SF	12,643.00	28.93%	3,658.00	0.073	4.453	22.00	$8,300.00	ROB	Homes with Electric Heat Pump (H&C)	16.00%	10.00%			$350.32	$0.096	1.28	1.00	1.00	1.00
96	Ground Source Heat Pump/Early Retire (HP Upgrade)	SF	15,542.00	42.19%	6,557.00	0.288	4.453	22.00	$14,000.00	Retrofit	Homes with Electric Heat Pump (H&C)	16.00%	10.00%			$837.35	$0.128	0.91	1.00	1.00	1.00
97	Heat Pump (Replacing Electric Furnace)	SF	15,445.90	46.54%	7,189.19	0.146	0.000	12.00	$3,843.00	ROB	Homes with Electric Furnaces and CAC	12.00%	0.00%			$466.71	$0.065	0.89	1.00	1.00	1.00
98	Heat Pump/Early Retire (Replacing Electric Furnace)	SF	17,589.00	53.06%	9,332.29	0.365	0.000	12.00	$6,700.00	Retrofit	Homes with Electric Furnaces and CAC	12.00%	0.00%			$813.68	$0.087	0.72	1.00	1.00	1.00
99	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	8,949.00	38.53%	3,448.00	0.146	7.066	12.00	$2,000.00	ROB	Homes with Electric Heat Pump (H&C)	16.00%	10.00%	-19.22		$242.89	$0.070	1.43	1.00	1.00	1.00
100	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	15,445.90	64.39%	9,944.90	0.146	7.066	12.00	$4,843.00	ROB	Homes with Electric Furnaces and CAC	12.00%	0.00%	-19.22		$588.16	$0.059	1.22	1.00	1.00	1.00
101	HVAC Tune-Up	MH	4,114.00	13.00%	534.82	0.256	0.000	6.00	$160.00	Retrofit	Homes with Central AC or Heat Pump	72.50%	10.00%			$32.88	$0.061	1.06	1.00	1.00	1.00
102	Energy Star® Room A/C	MH	964.00	9.26%	89.27	0.055	0.000	9.00	$50.00	ROB	Homes w/ Electric Room AC	26.00%	25.00%			$7.46	$0.084	0.92	1.00	1.00	1.00
103	Second Energy Star® Room A/C	MH	964.00	9.26%	89.27	0.055	0.000	9.00	$50.00	ROB	Homes w/ more than one Room AC	14.00%	25.00%			$7.46	$0.084	0.92	1.00	1.00	1.00
104	High Efficiency Central AC	MH	2,845.00	11.31%	321.77	0.146	0.000	14.00	$555.71	ROB	Homes w/ Electric Central AC	65.00%	4.00%			$61.01	$0.190	0.41	1.00	1.00	1.00
105	High Efficiency Central AC/Early Retire	MH	4,114.00	38.66%	1,590.47	0.292	0.000	14.00	$3,252.00	Retrofit	Homes w/ Electric Central AC	65.00%	4.00%			$357.05	$0.224	0.27	1.00	1.00	1.00
106	High Efficiency Heat Pump (HP Upgrade)	MH	8,398.00	7.74%	650.00	0.146	0.000	12.00	$1,005.00	ROB	Homes with Electric Heat Pump (H&C)	7.50%	8.00%			$122.05	$0.188	0.35	1.00	1.00	1.00
107	High Efficiency Heat Pump/Early Retire (HP Upgrade)	MH	11,093.00	30.15%	3,344.71	0.292	0.000	12.00	$6,384.00	Retrofit	Homes with Electric Heat Pump (H&C)	7.50%	8.00%			$775.30	$0.232	0.25	1.00	1.00	1.00
108	Heat Pump (Replacing Electric Furnace)	MH	14,943.25	48.15%	7,195.25	0.146	0.000	12.00	$3,688.00	ROB	Homes with Electric Furnaces and CAC	53.00%	0.00%			$447.89	$0.062	0.93	1.00	1.00	1.00
109	Heat Pump/Early Retire (Replacing Electric Furnace)	MH	16,849.00	54.02%	9,101.00	0.292	0.000	12.00	$6,384.00	Retrofit	Homes with Electric Furnaces and CAC	53.00%	0.00%			$775.30	$0.085	0.75	1.00	1.00	1.00
110	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	8,398.00	40.03%	3,362.00	0.146	7.066	12.00	$2,000.00	ROB	Homes with Electric Heat Pump (H&C)	7.50%	8.00%	-19.26		$242.89	$0.072	1.41	1.00	1.00	1.00
111	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	14,943.25	66.30%	9,907.25	0.146	7.066	12.00	$4,688.00	ROB	Homes with Electric Furnaces and CAC	53.00%	0.00%	-19.26		$569.33	$0.057	1.25	1.00	1.00	1.00
	Other																				
112	In Home Energy Display Monitor	SF	18,090.00	5.00%	904.50	0.075	0.075	3.00	$240.00	Retrofit	All Homes	100.00%	0.00%			$90.34	$0.100	0.50	1.00	1.00	1.00
113	Pre-Pay Metering	SF	18,090.00	12.80%	2,315.52	0.193	0.193	3.00	$99.00	Retrofit	All Homes	100.00%	0.00%			$37.26	$0.016	3.09	1.00	1.00	1.00
114	Pool Pump and Motor	SF	-	-	1,260.00	0.315	0.000	10.00	$664.00	ROB	Homes with Pools	6.00%	30.00%			$91.63	$0.073	0.86	1.00	1.00	1.00
115	In Home Energy Display Monitor	MH	20,720.00	5.00%	1,036.00	0.086	0.086	3.00	$240.00	Retrofit	All Homes	100.00%	0.00%			$90.34	$0.087	0.57	1.00	1.00	1.00
116	Pre-Pay Metering	MH	20,720.00	12.80%	2,652.16	0.221	0.221	3.00	$99.00	Retrofit	All Homes	100.00%	0.00%			$37.26	$0.014	3.54	1.00	1.00	1.00
	Multi-Family Units																				
117	Multi-Family Homes Efficiency Kit	MF	8,626.73	4.14%	357.30	0.030	0.057	9.00	$60.00	Retrofit	All Multi-Family Homes	85.00%	50.00%			$8.95	$0.025	2.63	1.00	1.00	1.00
	New Construction Homes - Single Family																				
118	New Construction - 15% more efficient	SF	13,915.00	10.00%	1,391.50	0.584	0.073	20.00	$1,763.00	NEW	All Single Family New Homes w/ AC Only	35.00%	28.00%	13.08		$157.85	$0.113	2.09	1.00	1.00	1.00
119	New Construction - 15% more efficient	SF	19,686.00	20.00%	3,937.20	0.584	2.409	20.00	$1,763.00	NEW	All Single Family New Homes w/ Elec. HP	40.00%	28.00%	-		$157.85	$0.040	2.79	1.00	1.00	1.00
120	New Construction - 35% more efficient	SF	13,915.00	25.00%	3,478.75	0.876	0.438	20.00	$4,300.00	NEW	All Single Family New Homes w/ AC Only	35.00%	28.00%	15.26		$385.00	$0.111	1.39	1.00	1.00	1.00
121	New Construction - 35% more efficient	SF	19,686.00	30.00%	5,905.80	0.876	2.993	20.00	$4,300.00	NEW	All Single Family New Homes w/ Elec. HP	40.00%	28.00%	-		$385.00	$0.065	1.61	1.00	1.00	1.00
122	New Construction - 15% more efficient	MH	11,211.00	15.00%	1,681.65	0.584	0.073	20.00	$1,300.00	NEW	All Single Family New Homes w/ AC Only	15.00%	28.00%	6.56		$116.39	$0.069	2.10	1.00	1.00	1.00
123	New Construction - 15% more efficient	MH	16,992.00	15.00%	2,548.80	0.584	2.409	20.00	$1,300.00	NEW	All Single Family New Homes w/ Elec. HP	19.00%	28.00%			$116.39	$0.046	3.02	1.00	1.00	1.00

Note: In general, savings estimates for the thermal envelope were based on engineering calculations derived from the REMrate modeling software, but were adjusted down based on experience that suggests actual savings are much lower than pure engineering assumptions would suggest. This adjustment was completed by creating adjusted base consumptions and applying the savings % found in the modeling runs to this new base usage. Additional assumptions utilized for the calculation of indiviudal measure savings, costs, and measure saturation can be found noted in the "Residential Electric Measure Sources and Notes" table.

Residential Electric Measure Sources And Notes

Measure	Measure Name	Home Type	Base Elec. Use (kWh)	% Savings	Elec. Savings (kWh)	Peak kW Savings	Useful Life	Measure Cost	Base Saturation	EE Saturation	Notes
	Electric Appliances - Single Family/Multi Family										
1	Energy Star® Compliant Top-Mount Refrigerator	SF	ES-Calc RF	-	ES-Calc RF	DUKE/ACEEE	ES-Calc RF	ES-Calc RF	MEEA/EIA	MEEA	Avg. Total Volume= 20 cubic ft. ; Auto Defrost Baseline: 100% w/ Refrigerators (MEEA) ; 65% Top Mount (EIA)
2	Energy Star® Compliant Side-by-Side Refrigerator	SF	ES-Calc RF		ES-Calc RF	DUKE/ACEEE	ES-Calc RF	ES-Calc RF	MEEA/EIA	MEEA	Avg. Total Volume= 23.6 cubic ft. ; through the door ice dispenser Baseline: 100% w/ Refrigerators (MEEA) ; 35% SxS Mount (EIA)
3	Energy Star® Compliant Chest Freezer	SF	ES-Calc Freez	-	ES-Calc Freez	DUKE/ACEEE	ES-Calc Freez	ES-Calc Freez	MEEA/EIA	MEEA	Avg. Total Volume= 16.14 cubic ft. Baseline: 52% w/ Freezers (MEEA) ; 70% Chest (EIA)
4	Energy Star® Compliant Upright Freezer (Manual Def.)	SF	ES-Calc Freez		ES-Calc Freez	DUKE/ACEEE	ES-Calc Freez	ES-Calc Freez	MEEA/EIA	MEEA	Avg. Total Volume= 16.14 cubic ft. Baseline: 52% w/ Freezers (MEEA) ; 30% Upright (EIA)
5	Energy Star® Dehumidifer	SF	ES Calc-Dhum	-	ES Calc-Dhum	GDS LOAD-1	ES Calc-Dhum	ES Calc-Dhum	EIA RECS 2005	GDS Est.	40 pint capacity ; runs 1,620 hrs/yr. ; 1.20 L/kWh vs. 1.50 L/kWh EE Sat: Assumed 50% based on no cost difference and high 2008 Energy Star market penetration (75%) Incremental cost is $0. Set at $1 for benefit/cost purposes
6	Second Refrigerator Turn In	SF	ES Calc - RRS	-	ES Calc - RRS	DUKE/ACEEE	GDS-1	DEER-1	MEEA	GDS Est.	Assumed 2nd appliance had 5 years remaining useful life ; Age between 1993-2000 ; Size 19 - 24.4 cub. feet Cost: $92.20 for recycling and pick-up (DEER) ; $50 Incentive (GDS)
7	Second Freezer Turn In	SF	ES Calc - RRS	-	ES Calc - RRS	DUKE/ACEEE	GDS-1	DEER-1	MEEA	GDS Est.	Assume 2nd appliance had 5 years remaining useful life ; Age between 1993-2000 ; Size 16.5 - 18.9 cub. feet Cost: $92.20 for recycling and pick-up (DEER) ; $50 Incentive (GDS)
8	Energy Star® Compliant Top-Mount Refrigerator	MH	ES-Calc RF	-	ES-Calc RF	DUKE/ACEEE	ES-Calc RF	ES-Calc RF	MEEA/EIA	MEEA	Avg. Total Volume= 20 cubic ft. ; Auto Defrost
9	Energy Star® Compliant Side-by-Side Refrigerator	MH	ES-Calc RF		ES-Calc RF	DUKE/ACEEE	ES-Calc RF	ES-Calc RF	MEEA/EIA	MEEA	Avg. Total Volume= 23.6 cubic ft. ; through the door ice dispenser
10	Energy Star® Compliant Chest Freezer	MH	ES-Calc Freez	-	ES-Calc Freez	DUKE/ACEEE	ES-Calc Freez	ES-Calc Freez	MEEA/EIA	MEEA	Avg. Total Volume= 16.14 cubic ft.
11	Energy Star® Compliant Upright Freezer (Manual Def.)	MH	ES-Calc Freez		ES-Calc Freez	DUKE/ACEEE	ES-Calc Freez	ES-Calc Freez	MEEA/EIA	MEEA	Avg. Total Volume= 16.14 cubic ft.
12	Energy Star® Dehumidifer	MH	ES Calc-Dhum	-	ES Calc-Dhum	GDS LOAD-1	ES Calc-Dhum	ES Calc-Dhum	EIA RECS 2005	GDS Est.	40 pint capacity ; runs 1,620 hrs/yr. ; 1.20 L/kWh vs. 1.50 L/kWh EE Sat: Assumed 50% based on no cost difference and high 2008 Energy Star market penetration (75%) Incremental cost is $0. Set at $1 for benefit/cost purposes
13	Second Refrigerator Turn In	MH	ES Calc - RRS	-	ES Calc - RRS	DUKE/ACEEE	GDS-1	DEER-1	MEEA	GDS Est.	Assume 2nd appliance had 5 years remaining useful life ; Age between 1993-2000 ; Size 19 - 21.4 cub.feet Cost: $92.20 for recycling and pick-up (DEER) ; $50 Incentive (GDS)
14	Second Freezer Turn In	MH	ES Calc - RRS	-	ES Calc - RRS	DUKE/ACEEE	GDS-1	DEER-1	MEEA	GDS Est.	Assume 2nd appliance had 5 years remaining useful life ; Age between 1993-2000 ; Size 16.5 - 18.9 cub. feet Cost: $92.20 for recycling and pick-up (DEER) ; $50 Incentive (GDS)
	Consumer Electronics- Single Family/Multi Family										
15	Home Electronics	SF	ACEEE A042	-	ACEEE A042	ACEEE A042	ACEEE A042	ACEEE A042	GDS Est.	Amann	All homes have standby power appliances
16	Televisions	SF	ES-Calc TV	-	ES-Calc TV	ES-Calc TV	ES-Calc TV	ES-Calc TV	EIA RECS 2005	GDS Est.	TV w/ Screen 31"- 40" Baseline: Avg. of 2.45 TVs per home. (Based on EIA Data for East South Central Region)
17	Energy Star® Desktop Computer	SF	ES-Calc Office	-	ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	78% turned off a night ; 75% sleep mode activated. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
18	Energy Star® Computer Monitor	SF	ES-Calc Office	-	ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	75% Turned off at night ; 40% Power Saver Mode Enabled. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
19	Energy Star® Laptop Computer	SF	ES-Calc Office		ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	78% turned off a night ; 75% sleep mode activated. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
20	Home Electronics	MH	ACEEE A042	-	ACEEE A042	ACEEE A042	ACEEE A042	ACEEE A042	GDS Est.	Amann	All homes have standby power appliances
21	Televisions	MH	ES-Calc TV	-	ES-Calc TV	ES-Calc TV	ES-Calc TV	ES-Calc TV	GDS Est.	GDS Est.	TV w/ Screen 31"- 40" Baseline: Avg. of 1.5 TVs / home. (GDS Est based on fewer rooms & smaller house size from SF home)
22	Energy Star® Desktop Computer	MH	ES-Calc Office	-	ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	78% turned off a night ; 75% sleep mode activated. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
23	Energy Star® Computer Monitor	MH	ES-Calc Office	-	ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	75% Turned off at night ; 40% Power Saver Mode Enabled. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
24	Energy Star® Laptop Computer	MH	ES-Calc Office		ES-Calc Office	ES-Calc Office	ES-Calc Office	ES-Calc Office	EIA RECS 2005	GDS Est.	78% turned off a night ; 75% sleep mode activated. Incremental cost is $0. Set at $1 dollar for benefit/cost purposes.
	Lighting - Single Family /Multi Family										
25	CFL (vs. incandescent) - 5 hours/day	SF	GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	$1.85 Avg. CFL bulb cost - $.25 for replacement incandescent Assumed daily use: 5 hours Assumed incand. bulbs currently meet 2012 standard of 30% more efficient
26	CFL (vs. incandescent) - 3 hours/day		GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	Assumed daily use: 3 hours
27	CFL (vs. incandescent) - 1 hours/day		GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	Assumed daily use: 1 hour. Useful life capped at 20 years.
28	LED (vs. Incandescent)	SF	GDS-2	-	GDS-2	GDS-2	GDS-2	Eco-Story	GDS Est.	BR EU Survey	$30 LED bulb cost - $.25 for replacement incandescent Assumed daily use: 3 hours; Useful life capped at 20 years. Assumed incand. bulbs currently meet 2012 standard of 30% more efficient
29	LED (vs. CFL)	SF	GDS-2	-	GDS-2	GDS-2	GDS-2	Eco-Story	BR EU Survey	GDS Est.	Daily Use: 3 hours ; Useful life capped at 20 years.
30	CFL (vs. Incandescent) - 5 hours/day	MH	GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	$1.85 Avg. CFL bulb cost - $.25 for replacement incandescent Assumed daily use: 5 hours Assumed incand. bulbs currently meet 2012 standard of 30% more efficient
31	CFL (vs. Incandescent) - 3 hours/day		GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	Assumed daily use: 3 hours
32	CFL (vs. Incandescent) - 1 hours/day		GDS-2	-	GDS-2	GDS-2	GDS-2	Hoosier	Hoosier	Hoosier	Assumed daily use: 1 hour. Useful life capped at 20 years.
33	LED (vs. Incandescent)	MH	GDS-2	-	GDS-2	GDS-2	GDS-2	Eco-Story	GDS Est.	BR EU Survey	$30 LED bulb cost - $.25 for replacement incandescent Assumed daily use: 3 hours ; Useful life capped at 20 years Assumed incand. bulbs currently meet 2012 standard of 30% more efficient
34	LED (vs. CFL)	MH	GDS-2	-	GDS-2	GDS-2	GDS-2	Eco-Story	BR EU Survey	GDS Est.	Daily Use: 3 hours ; Useful life capped at 20 years.
	Electric Water Heating - Single Family/Multi Family										
35	Low Flow Faucets	SF	REM/Rate	-	MEEA/SB	DUKE/SB	DEER-2	MEEA/SB	BR EU Survey	MEEA	< 1.5 gallons/minute for bathrooms vs 2.5 gpm ; Cost assumes 2 per home Baseline: % of Single Story and Multi Story Gas Heat Homes. Table 8. (323+127 / 506+215)
36	Low Flow Showerhead	SF	REM/Rate	-	MEEA/SB	DUKE/SB	DEER-2	MEEA/SB	BR EU Survey	MEEA	< 2.0 gallons/minute vs 2.5 gpm ; Cost assumes 2 per home
37	Water Heater Blanket	SF	REM/Rate	REM/Rate	-	REM/GDS	GDS Est.	HD	BR EU Survey	MEEA	Baseline: R0 ; EE: Added R8 insulation to existing water heater ; Useful life estimated at 13 years (similar to pipe insulation)
38	Pipe Wrap	SF	REM/Rate	-	MEEA/SB	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	MEEA	All hot and cold pipe lengths insulated
39	Efficient Water Heater	SF	REM/Rate	REM/Rate	-	GDS Est.	EnergyStar	EnergyStar	BR EU Survey	MEEA	Base: Medium Size Tank (40 gal.) , EF=.88 , $650 ; EE: Medium Size Tank (40 gal.) , EF=.93 , $700
40	Heat Pump Water Heater	SF	REM/Rate	REM/Rate	-	ACEEE A042	EnergyStar	EnergyStar	BR EU Survey	MEEA	Base: Medium Size Tank (40 gal.) , EF=.90 , $650 ; EE: Medium Size Tank (40 gal.) , EF=2.0 , $1500
41	Solar Water Heating	SF	REM/Rate	ACEEE Solar	-	ACEEE Solar	ACEEE Solar	ACEEE Solar	BR EU Survey	MEEA	Base: Medium Size Tank (40 gal.) ; EF=.90 ; EE: Medium Size Tank (40 gal.) ; EF=1.8 .6 Peak kW savings in Summer. No Peak Savings in Winter. Levelized "cost" does include Federal Tax incentive (30% of cost) ; $4850 - $1455 = $3395
42	Energy Star® Dishwasher (Electric Water Heating)	SF	ES-Calc DW	-	ES-Calc DW	DUKE/ACEEE	ES-Calc DW	ES-Calc DW	BR EU Survey / MEEA	MEEA	Assumed 208 cycles per year. ES Dishwasher EF=.60 ; Standard EF=.75. Water Savings = 430 gallon Baseline: 62% w/ Electric WH (BR EU Survey) ; 57% Dishwashers (MEEA)

Residential Electric Measure Sources And Notes

Measure	Measure Name	Home Type	Base Elec. Use (kWh)	% Savings	Elec. Savings (kWh)	Peak kW Savings	Useful Life	Measure Cost	Base Saturation	EE Saturation	Notes
43	Energy Star® Dishwasher (Non-Electric WH)	SF	ES-Calc DW	-	ES-Calc DW	DUKE/ACEEE	ES-Calc DW	ES-Calc DW	BR EU Survey / MEEA	MEEA	Assumed 208 cycles per year. ES Dishwasher EF=.60 ; Standard EF=.75. Water Savings = 430 gallon Baseline: 38% w/ Non-Electric WH (BR EU Survey) ; 57% Dishwashers (MEEA)
44	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	ES-Calc CW	-	ES-Calc CW	DUKE/ACEEE	ES-Calc CW	ES-Calc CW	BR EU Survey / MEEA	MEEA	Assumed 392 per year. Water Savings = 6,542 gallons Baseline: 62% w/ Electric WH (BR EU Survey) ; 89% ClothesWashers (MEEA)
45	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	SF	ES-Calc CW	-	ES-Calc CW	DUKE/ACEEE	ES-Calc CW	ES-Calc CW	BR EU Survey / MEEA	MEEA	Assumed 392 per year. Water Savings = 6,542 gallons Baseline: 38% w/ Non-Electric WH (BR EU Survey) ; 89% ClothesWashers (MEEA)
46	Low Flow Faucets	MH	REM/Rate	-	MEEA/SB	DUKE/SB	DEER-2	MEEA/SB	BR EU Survey	MEEA	< 1.5 gallons/minute for bathrooms vs 2.5 gpm ; Cost assumed 2 per home Baseline: % of Manufactured Homes with Electric WH. Table 8.
47	Low Flow Showerhead	MH	REM/Rate	-	MEEA/SB	DUKE/SB	DEER-2	MEEA/SB	BR EU Survey	MEEA	< 2.0 gallons/minute vs 2.5 gpm ; Cost assumes 2 per home
48	Water Heater Blanket	MH	REM/Rate	REM/Rate	-	REM/GDS	GDS Est.	HD	BR EU Survey	MEEA	Baseline: R0 ; EE: Added R8 insulation to existing water heater Useful life estimated at 13 years (similar to pipe insulation)
49	Pipe Wrap	MH	REM/Rate	-	MEEA/SB	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	MEEA	All hot and cold pipe lengths insulated
50	Efficient Water Heater	MH	REM/Rate	REM/Rate	-	GDS Est.	EnergyStar	EnergyStar	BR EU Survey	MEEA	Base: Medium Size Tank (40 gal.) , EF=.88 , $650 ; EE: Medium Size Tank (40 gal.) , EF=.93 , $700
51	Energy Star® Dishwasher (Electric Water Heating)	MH	ES-Calc DW	-	ES-Calc DW	DUKE/ACEEE	ES-Calc DW	ES-Calc DW	BR EU Survey / MEEA	MEEA	Assumed 208 cycles per year. ES Dishwasher EF=.60 ; Standard EF=.75. Water Savings = 430 gallon Baseline: 95% w/ Electric WH (BR EU Survey) ; 57% Dishwashers (MEEA)
52	Energy Star® Dishwasher (Non-Electric WH)	MH	ES-Calc DW	-	ES-Calc DW	DUKE/ACEEE	ES-Calc DW	ES-Calc DW	BR EU Survey / MEEA	MEEA	Assumed 208 cycles per year. ES Dishwasher EF=.60 ; Standard EF=.75. Water Savings = 430 gallon Baseline: 5% w/ Non-Electric WH (BR EU Survey) ; 57% Dishwashers (MEEA)
53	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	ES-Calc CW	-	ES-Calc CW	DUKE/ACEEE	ES-Calc CW	ES-Calc CW	BR EU Survey / MEEA	MEEA	Assumed 392 per year. Water Savings = 6,542 gallons Baseline: 95% w/ Electric WH (BR EU Survey) ; 89% ClothesWashers (MEEA)
54	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	MH	ES-Calc CW	-	ES-Calc CW	DUKE/ACEEE	ES-Calc CW	ES-Calc CW	BR EU Survey / MEEA	MEEA	Assumed 392 per year. Water Savings = 6,542 gallons Baseline: 5% w/ Non-Electric WH (BR EU Survey) ; 89% ClothesWashers (MEEA)
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric AC Only (& Gas Heat)											
55	Insulation - Ceiling (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	MEEA	R-0 to R-19 ; 1730sq.ft. ; $0.51/sq.ft. for R-19 fiberglass install. Baseline: % of Single Story and Multi Story Gas Heat Homes. Table 6. (280+133 / 506+215)
56	Insulation - Floor (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	Little to no floor insulation ; upgrade to R-13; floor area: 1730sqft. ; $0.79 per sq.ft. 55.6 MMBTU for Gas Heating (Based on ESTAR Calc-Furnace)
57	Energy Star® Windows	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=166.4 sq.ft. Baseline: Uvalue-.72, SHGC-.55 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost. Materials and Install)
58	Insulation -Ceiling (R-19 to R-38)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	EIA RECS 2005	R-19 to R-38 ; 1730sq.ft. ; $0.51/sq.ft. for ~R-19. EE Sat: % of Homes well insulated (2.5/6.9). Tablehc13.5
59	Air Infiltration	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	BR EU Survey	From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals
60	Duct Sealing	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)
61	Radiant Barriers	SF	GDS Calc.	REM/Rate	-	REM/GDS	ICF	ICF	BR EU Survey	GDS Est.	Minimal to no winter savings
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Heat Pump											
62	Insulation - Ceiling (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	MEEA	R-0 to R-19 ; 1730sq.ft. ; $0.51/sq.ft. for R-19 fiberglass install. Baseline: % of Single Story and Multi Story Electric HP Homes. Table 6. (82+33 / 506+215)
63	Insulation - Floor (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	Little to no floor insulation ; upgrade to R-13; floor area: 1730sqft. ; $0.79 per sq.ft.
64	Energy Star® Windows	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=166.4 sq.ft. Baseline: Uvalue-.72, SHGC-.55 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost. Materials and Install)
65	Insulation -Ceiling (R-19 to R-38)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	EIA RECS 2005	R-19 to R-38 ; 1730sq.ft. ; $0.51/sq.ft. for ~R-19. EE Sat: % of Homes well insulated (2.5/6.9). Tablehc13.5
66	Air infiltration	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	BR EU Survey	From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals
67	Duct Sealing	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)
68	Radiant Barriers	SF	GDS Calc.	REM/Rate	-	REM/GDS	ICF	ICF	BR EU Survey	GDS Est.	Minimal to no winter savings
Space Heating and Space Cooling Shell Measures - Single Family Homes w/ Electric Furnace											
69	Insulation - Ceiling (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	MEEA	R-0 to R-19 ; 1730sq.ft. ; $0.51/sq.ft. for R-19 fiberglass install. Baseline: % of Single Story and Multi Story Electric Furnace Homes. Table 6. (66+21 / 506+215)
70	Insulation - Floor (R-0 to R-19)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	Little to no floor insulation ; upgrade to R-13; floor area: 1730sqft. ; $0.79 per sq.ft.
71	Energy Star® Windows	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=166.4 sq.ft. Baseline: Uvalue-.72, SHGC-.55 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost. Materials and Install)
72	Insulation -Ceiling (R-19 to R-38)	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	EIA RECS 2005	R-19 to R-38 ; 1730sq.ft. ; $0.51/sq.ft. for ~R-19. EE Sat: % of Homes well insulated (2.5/6.9). Tablehc13.5
73	Air Infiltration	*SF*	*GDS Calc.*	*REM/Rate*	-	*REM/GDS*	*DEER-2*	*MEEA/SB*	*BR EU Survey*	*BR EU Survey*	*From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals*
74	Duct Sealing	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)
75	Radiant Barriers	SF	GDS Calc.	REM/Rate	-	REM/GDS	ICF	ICF	BR EU Survey	GDS Est.	Minimal to no winter savings
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric AC Only (& Gas Heat)											
76	Air Infiltration	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	BR EU Survey	From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals
77	Insulation - Floor (R-11 to R-30)	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	R11 to R30 insulation under floor ; house w/ enclosed crawl space. Assumed install cost: $0.79/sqft. Baseline: % of mobile homes with Gas Heat and AC (24% of MH have Gas Heat ; 73% of MH have electric cooling. Assumed the 60.5% of MH with Electric Central Heat have Central AC. Remaining 12.5% are Gas Heat. Other Gas Heat Homes equipped with Room AC or Other)
78	Energy Star® Windows	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=194.4 sq.ft. Baseline: Uvalue-.87, SHGC-.73 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost. Materials and Install)
79	Duct Sealing	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat Pump											
80	Air Infiltration	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	BR EU Survey	From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals
81	Insulation - Floor (R-11 to R-30)	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	*R11 to R30 insulation under floor ; house w/ enclosed crawl space. Assumed install cost: $0.79/sqft.* Baseline: % of mobile homes with Electric HP
82	Energy Star® Windows	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=194.4 sq.ft. Baseline: Uvalue-.87, SHGC-.73 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost. Materials and Install)
83	Duct Sealing	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)
Space Heating and Space Cooling Shell Measures - Mobile Homes w/ Electric Heat											
84	Air Infiltration	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	MEEA/SB	BR EU Survey	BR EU Survey	From 12 ACH @ 50 Pascals to 7 ACH @ 50 Pascals

Residential Electric Measure Sources And Notes

Measure	Measure Name	Home Type	Base Elec Use (kWh)	% Savings	Elec Savings (kWh)	Peak kW Savings	Useful Life	Measure Cost	Base Saturation	EE Saturation	Notes
85	Insulation - Floor (R-11 to R-30)	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ORNL/GDS	BR EU Survey	GDS Est.	R11 to R30 insulation under floor ; house w/ enclosed crawl space. Assumed install cost: $0.79/sqft. Baseline: % of mobile homes with Electric Furnace and Central AC
86	Energy Star® Windows	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	DEER-1	BR EU Survey	BR EU Survey	Window Area=194.4 sq.ft. Baseline: Uvalue-.87, SHGC-.73 ; EE:Uvalue-.32, SHGC-.40 Incremental Cost = $21.70 sq. foot (Full retrofit cost, Materials and Install)
87	Duct Sealing	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	PSE/WI FOE	BR EU Survey	GDS Est.	Measure cost assumes duct sealing program does not require pre/post testing on most homes. *Reduce leakage from Qualitative (Leaky, Uninsulated) to Quantiative (6% of floor area =CFM@25)*
	Space Heating and Space Cooling Equipment - Single Family/Mobile Homes										
88	HVAC Tune-Up	SF	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ACEEE/DEER	BR EU Survey	GDS Est.	HVAC Maintence improves efficiency 13% in existing air conditioner (SEER 10) Baseline: % of Single Story and Multi Story CAC/HP Homes. Table 7. (340+141+88+41 / 506+215)
89	Energy Star® Room A/C	SF	ES Calc-RAC	-	ES Calc-RAC	GDS Calc.	ES Calc-RAC	ES Calc-RAC	BR EU Survey / EIA	MEEA	Base: EER - 9.8 / EE: EER - 10.8 (10000 btu/hr) Baseline: % of Single Story and Multi Story RAC Homes. Table 7. (65+26/ 506+215)
90	Second Energy Star® Room A/C	SF	ES Calc-RAC	-	ES Calc-RAC	GDS Calc.	ES Calc-RAC	ES Calc-RAC	BR EU Survey / EIA	MEEA	Base: EER - 9.8 / EE: EER - 10.8 (8000 btu/hr) Baseline: % of Single Story and Multi Story RAC Homes * % with more than one (EIA RECS) (.9/1.7)
91	High Efficiency Central AC	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-CAC	ES Calc-CAC	BR EU Survey	BR EU Survey	Replace on Burnout. Install SEER 15 in lieu of purchasing a new SEER 13. 3 Ton Unit Baseline: % of Single Story and Multi Story CAC Only Homes. Table 7. (340+141/ 506+215)
92	High Efficiency Central AC/Early Retire	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-CAC	ES Calc-CAC	BR EU Survey	BR EU Survey	SEER 10 (existing home) upgrade to a SEER 15 3 ton Central AC. Cost shown as full cost of new SEER 15 unit. 381 kWh annual savings is the incremental savings between SEER 13 vs. SEER 15. (4887*30.86%)=1508. 4887-1508=3379 (SEER 13 H&C Consumption). 3379*11.29% = 381 kWh
93	High Efficiency Heat Pump (HP Upgrade)	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	Replace on Burnout. Install SEER 15/HSPF 8.5 in lieu of purchasing a new SEER 13/HSPF 7.7.
94	High Efficiency Heat Pump/Early Retire (HP Upgrade)	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	SEER 10/HSPF 6.8 (existing home) upgrade to a SEER 15/HSPF 8.5 3 ton Heat Pump. *Cost shown as full cost of SEER 15 ASHP.* 692 kWh annual savings is the incremental savings between SEER 13 vs. SEER 15 (11848*24.47%)=2899. 10308-2899=8949(SEER 13 H&C Consumption). 8949*7.73% = 692 kWh
95	Ground Source Heat Pump (HP Upgrade)	SF	GDS Calc.	REM/Rate	-	ACEEE GSHP	ACEEE GSHP / DOE	Indiana	BR EU Survey	BR EU Survey	Incremental Cost assumes $14,000 full install cost (Indiana Heat Pump Review) - $5700 cost of std. hp. Levelized "cost" also includes federal tax credit (30%): $14000-$4200 = $9800 (-$5700)=$4100 Includes Water Heating Consumption and savings (GSHP:3.3 COP : 14 EER)
96	*Ground Source Heat Pump/Early Retire (HP Upgrade)*	*SF*	*GDS Calc.*	*REM/Rate*	-	*ACEEE GSHP*	*ACEEE GSHP / DOE*	*Indiana*	*BR EU Survey*	*BR EU Survey*	Full Cost assumes $14,000 full install cost (Indiana Heat Pump Review) Levelized "cost" also includes federal tax credit (30%): $14000-$4200 = $9800 *Includes Water Heating Consumption and savings (GSHP:3.3 COP : 14 EER)*
97	Heat Pump (Replacing Electric Furnace)	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP/CAC	BR EU Survey	GDS Calc.	Baseline: 17589(Base H&C of Strip Heat/AC Home) 12702*95% (Improve strip heat efficiency from 95% to 100% with new unit)+(4887 (Base AC Consumption) *30.86%(% savings to upgrade from SEER 10 to 13)) Cost = $6700 (Full Cost of ASHP) - $2857 (New SEER 13 CAC Unit)
98	Heat Pump/Early Retire (Replacing Electric Furnace)	SF	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP/CAC	BR EU Survey	GDS Calc.	Baseline: 17589(Base H&C of Strip Heat/AC HOME) Cost = $6700 (Full Cost of ASHP)
99	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	GDS Calc.	GDS Calc.	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	Heat Pump switches to back-up gas heat at 35 degrees and under. SEER 15 ; Gas Furnace 90% AFUE (Base Gas Usage from Estar Calc) Assumes dual fuel heat pump is approximately $1000 more than ASHP. (Added to $1000 incremental cost of SEER 13 vs SEER 15 HP)
100	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	GDS Calc.	GDS Calc.	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	GDS Calc.	Heat Pump switches to back-up gas heat at 35 degrees and under. SEER 15 ; Gas Furnace 90% AFUE Incremental cost reflects efficient dual fuel heat pump vs. standard efficiency CAC.
101	HVAC Tune-Up	MH	GDS Calc.	REM/Rate	-	REM/GDS	DEER-2	ACEEE/DEER	BR EU Survey	GDS Est.	HVAC Maintence improves efficiency 13% in existing air conditioner (SEER 10) Baseline: % of Manufactured Homes with CAC/HP. Table 7. (75+9 / 116)
102	Energy Star® Room A/C	MH	ES Calc-RAC	-	ES Calc-RAC	GDS Calc.	ES Calc-RAC	ES Calc-RAC	BR EU Survey / EIA	MEEA	Base: EER - 9.8 / EE: EER - 10.8 (8000 btu/hr) Baseline: % of Manufactured Home RAC Homes. Table 7.
103	Second Energy Star® Room A/C	MH	ES Calc-RAC	-	ES Calc-RAC	GDS Calc.	ES Calc-RAC	ES Calc-RAC	BR EU Survey / EIA	MEEA	Base: EER - 9.8 / EE: EER - 10.8 (8000 btu/hr) Baseline: % of Manufactured Home RAC Homes * % with more than one (EIA RECS) (.9/1.7)
104	High Efficiency Central AC	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-CAC	ES Calc-CAC	BR EU Survey	BR EU Survey	Replace on Burnout. Install SEER 15 in lieu of purchasing a new SEER 13. Baseline: % of Single Story and Multi Story CAC Only Homes. Table 7
105	High Efficiency Central AC/Early Retire	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-CAC	ES Calc-CAC	BR EU Survey	BR EU Survey	SEER 10 (existing home) upgrade to a SEER 15 2.5 ton Central AC. Cost shown as full cost of SEER 15. 322 kWh annual savings is the incremental savings between SEER 13 vs. SEER 15. (4114*30.84%)=1269. 4114-1269=2845(SEER 13 H&C Consumption). 2845*11.31% = 322 kWh
106	*High Efficiency Heat Pump (HP Upgrade)*	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	Replace on Burnout. Install SEER 15/HSPF 8.5 in lieu of purchasing a new SEER 13/HSPF 7.7.
107	High Efficiency Heat Pump/Early Retire (HP Upgrade)	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	SEER 10/HSPF 6.8 (existing home) upgrade to a SEER 15/HSPF 8.5 2.5 ton Heat Pump. Cost shown as full cost of SEER 15. 650 kWh annual savings is the incremental savings between SEER 13 vs. SEER 15 (11093*24.29%)=2694. 11093-2694=8399(SEER 13 H&C Consumption). 8399*7.74% = 650 kWh
108	Heat Pump (Replacing Electric Furnace)	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP/CAC	BR EU Survey	GDS Calc.	Baseline: 16849(Base H&C of Strip Heat/AC HOME): 12735*95% (Improve strip heat efficiency from 95% to 100% with new unit)+(4114 (Base AC Consumption) *30.84%(% savings to upgrade from SEER 10 to 13)) Cost = $6365 (Full Cost of ASHP) - $2696 (New SEER 13 CAC Unit)
109	Heat Pump/Early Retire (Replacing Electric Furnace)	MH	GDS Calc.	REM/Rate	-	REM/GDS	ES Calc-HP	ES Calc-HP/CAC	BR EU Survey	GDS Calc.	Baseline: 16849 (Base H&C of Strip Heat/AC HOME) Cost = $6365 (Full Cost of ASHP)
110	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	GDS Calc.	GDS Calc.	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	BR EU Survey	Heat Pump switches to back-up gas heat at 35 degrees and under. SEER 15 ; Gas Furnace 90% AFUE Assumes dual fuel heat pump is approximately $1000 more than ASHP. (Added to $1000 incremental cost of SEER 13 vs SEER 15 HP)
111	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	GDS Calc.	GDS Calc.	-	REM/GDS	ES Calc-HP	ES Calc-HP	BR EU Survey	GDS Calc.	Heat Pump switches to back-up gas heat at 35 degrees and under. SEER 15 ; Gas Furnace 90% AFUE Incremental cost reflects efficient dual fuel heat pump vs. standard efficiency CAC.
	Other										
112	*In Home Energy Display Monitor*	SF	GDS Calc.	ACEEE DISPLAY	-	GDS LOAD-2	GDS Est.	ACEEE Display	GDS Est.	GDS Est.	Assumed persistant savings of 3 years
113	Pre-Pay Metering	SF	GDS Calc.	CR-PREPAID	-	GDS LOAD-2	GDS Est.	CR-Prepaid	GDS Est.	GDS Est.	Savings % based on Salt River Project M-Power customer reported savings
114	Pool Pump and Motor	SF	-	-	ACEEE A062	GDS LOAD-3	ACEEE A062	ACEEE A062	EIA RECS 2005	GDS Est.	Baseline: Number of Homes with a Pool Filter / Number of Single Family Homes (.3 / 5.2) EE Saturation: GDS Assumption
115	In Home Energy Display Monitor	MH	GDS Calc.	ACEEE DISPLAY	-	GDS LOAD-2	GDS Est.	ACEEE Display	GDS Est.	GDS Est.	Assumed persistant savings of 3 years
116	Pre-Pay Metering	MH	GDS Calc.	CR-PREPAID	-	GDS LOAD-2	GDS Est.	CR-Prepaid	GDS Est.	GDS Est.	Savings % based on Salt River Project M-Power customer reported savings
	Multi Family Homes										

Residential Electric Measure Sources And Notes

Measure	Measure Name	Home Type	Base Elec Use (kWh)	% Savings	Elec. Savings (kWh)	Peak kW Savings	Useful Life	Measure Cost	Base Saturation	EE Saturation	Notes
117	Multi-Family Homes Efficiency Kit	MF	GDS Est.	-	GDS Est.	GDS Est.	GDS Est.	GDS Est.	BR EU Survey	GDS Est.	Consumption: Reduction of SF Consumption based on reduction in sq. footage from EIA RECS 2005 % savings - GDS estimate based on rougly 5 CFL bulbs, low flow showerhead, and basic air sealing measures (i.e. caulking) Cost: Based on cost of similar weatherization kit (AM Conservation).
New Construction Homes - Single Family/Multi Family											
118	New Construction - 15% more efficient	SF	GDS Calc.	GDS Calc.	-	REM/GDS	GDS Est.	EnergyStar2	BR EU Survey	EnergyStar 4	Energy Star Tier 1 is 15% efficient. Average savings ~ 20% REMRate modeling for package of efficient upgrades verifies 15% savings or greater Base Sat: % of Gas Homes Built in the last 4 years
119	New Construction - 15% more efficient	SF	GDS Calc.	GDS Calc.	-	REM/GDS	GDS Est.	EnergyStar2	BR EU Survey	EnergyStar 4	Energy Star Tier 1 is 15% efficient. Average savings ~ 20% REMRate modeling for package of efficient upgrades verifies 15% savings or greater Base Sat: % of Electric Heat Pump Homes Built in the last 4 years
120	New Construction - 35% more efficient	SF	GDS Calc.	GDS Calc.	-	REM/GDS	GDS Est.	EnergyStar3	BR EU Survey	EnergyStar 4	Savings approximately 30%. Savings may exceed 30% threshold. REMRate modeling verifies 30% savings Cost represents EnergyStar 2011 Estimate. Energy Star standards exceeding 2009 IECC Code. Base Sat: % of Gas Homes Built in the last 4 years
121	New Construction - 35% more efficient	SF	GDS Calc.	GDS Calc.	-	REM/GDS	GDS Est.	EnergyStar3	BR EU Survey	EnergyStar 4	Savings approximately 30%. Savings may exceed 30% threshold. REMRate modeling verifies 30% savings Cost represents EnergyStar 2011 Estimate. Energy Star standards exceeding 2009 IECC Code. Base Sat: % of Electric Heat Pump Homes Built in the last 4 years
122	New Construction - 50% more efficient	SF	GDS Calc.	GDS Est.	-	GDS Est.	GDS Est.	EnergyStar 5 /RTF	BR EU Survey / GDS Est.	EnergyStar 4	Base Consumption: Whole House Consumption Savings%: Current energy star standards (15%) Base Sat: Adjusted % of MH Gas Heat Homes based on shift found in SF Gas Old vs. New Homes
123	New Construction - 50% more efficient	SF	GDS Calc.	GDS Est.	-	GDS Est.	GDS Est.	EnergyStar 5 /RTF	BR EU Survey / GDS Est.	EnergyStar 4	Base Consumption: Whole House Consumption Savings%: Current energy star standards (15%) Base Sat: Adjusted % of MH ASHP Heat Homes based on shift found in SF Gas Old vs. New Homes

ACEEE A042: Emerging Energy Saving Technologies & Practices for the Buildings Sector as of 2004. ACEEE Report# A042. October 2004. Pg. 41.
ACEEE/DEER: Based on costs found in ACEEE Report E073 for HVAC Tune-UP and DEER Database (Refrigerant Charge, Coil Cleaning, etc.)
ACEEE Display: ACEEE Emerging Technologies Report. April 2007. In Home Energy Displays
ACEEE GSHP: ACEEE Emerging Technologies Report. April 2007. Ground Source Heat Pumps
ACEEE GSHP/DOE: Average useful life of several sources. ACEEEE GSHP estimates 18.4. DOE websites estimate lifetime of equipment at 25, and loop at 50+ years.
ACEEE Solar: ACEEE Emerging Technologies Report. April 2007. Solar Water Heaters
Amann: jennifer T. Amann (ACEEE), personal communication, Feb. 2006.
BR EU Survey: Big Rivers End-Use and Energy Efficiency Survey (December 2007). System-Wide Data.
BR EU Survey/EIA: Big Rivers End-Use and Energy Efficiency Survey (December 2007). System-Wide Data. Also used data from the Residential Energy Consumption Survey (RECS) 2005 Data reported by EIA . East South Central Region.
BR EU Survey/GDS Est.: Big Rivers End-Use and Energy Efficiency Survey (December 2007). System-Wide Data. Adjusted data based on GDS professional judgement.
BR EU Survey/MEEA: Big Rivers End-Use and Energy Efficiency Survey (December 2007). System-Wide Data. Midwest Residential Market Assessment and DSM Potential Study. March 2006. Baseline and EE Saturations are reported for the state of KY.
CR-Prepaid: Prepaid Meters: Pay As You Use Consumption. Consumer Reports.Org / Salt River Project M-Power Results
DEER-1: Database for Energy Efficient Resources (DEER). Revised DEER Measure Cost Summary (05/2008). Revised 06/2008. Window cost includes material and installation costs.
DEER-2: Database for Energy Efficient Resources (DEER). Effective/Remaining Useful Life Values. Updated Oct. 2008. (Air Sealing assumes similair useful life to LI Weatherization ; HVAC Tune-Up (6yrs) based on avg. between condensor coil cleaning (3yrs) and refrigerant charge (10yrs)
DUKE/ACEEE: DSM measure characterizations for Duke Indiana. Completed by Summit Blue. Peak Savings adjusted by coincidence factors in ACEEE Report #U072.
DUKE/SB: DSM measure characterizations for Duke Indiana. Completed by Summit Blue.
EIA RECS 2005: Residential Energy Consumption Survey (RECS) 2005 Data reported by EIA to refine baseline % of appliances. East South Central Region
Eco-Story: Vendor of LED bulbs, including a 5W Edison-based LED bulb replacement for bathrooms, lamps, and recessed cans.
EnergyStar: EnergyStar® Residential Water Heater FinalCriteria Analysis. Table 1. Page 10. (www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterFinalCriteriaAnalysis.pdf)
EnergyStar2: Energy Star® Homes information brochure. (www.energy.ky.gov/NR/rdonlyres/4C54401D-F058-4962-AFC2-F43BF5275776/0/ENERGYSTARHomes3.pdf)
EnergyStar3: Energy Star® Qualified Homes 2011 Fact Sheet. May 04, 2009. Pg.4 (www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/2011_Fact_Sheet.pdf)
EnergyStar4: Energy Star® Qualified New Homes Market Indices for States.
EnergyStar5 / RTF : $1100 incremental cost based on personal communication with two manufactured home Energy Star® qualified contractors that have completed manufactured new homes projects in 2009: Lexington Homes ($1100) and Clayton Homes ($950-$1245). April 13, 2010.
Also included ~$1400 value in $2006 from "Analysis of Cost and Savings Values for Energy Star® Manufactured Homes." powerpoint presentation from the Regional Technical Forum and Northwest Council (www.nwcouncil.org). Aug. 8, 2006
ES-Calc-ASHP: Calculation (www.energystar.gov) Energy Star® Calculator-AirSourceHeatPump (.xls)
ES-Calc-ASHP/CAC: Calculation using cost assumptions from both ASHP and CAC Energy Star® calculators
ES-Calc-CAC: Calculation (www.energystar.gov) Energy Star® Calculator-CentralAirConditioner (.xls)
ES Calc- CCW: Calculation (www.energystar.gov) Energy Star® Calculator - ConsumerClothesWasher (.xls)
ES Calc- DW: Calculation (www.energystar.gov) Energy Star® Calculator - ConsumerDishWasher (.xls)
ES Calc- Freez: Calculation (www.energystar.gov) Energy Star® Calculator - Freezers (.xls)
ES Calc- Office: Calculation (www.energystar.gov) Energy Star® Calculator - Home Office (.xls)
ES Calc-RAC: Calculation (www.energystar.gov) Energy Star® Calculator - Room Air Conditioner (.xls)
ES Calc- RF: Calculation (www.energystar.gov) Energy Star® Calculator - ResidentialRefrigerator (.xls)
ES Calc- RRS: Online calculator for Second Refrigerator Recycling (http://www.energystar.gov/index.cfm?fuseaction=refrig.calculator&which=1&rate=0.102&model=&screen=2)
ES Calc- TV: Calculation (www.energystar.gov) Energy Star® Calculator - Televisions (.xls)
GDS Calc.: GDS calculation. Baseline Consumption developed from regional data (ES Calculators) and engineering calculations to develop estimates for different home types. Weighted avg. whole house use = 18,779 kWh
GDS Est.: GDS estimate based on available regional data or professional judgement.
GDS-1: Assumed second appliance had 5 years remaining useful life
GDS-2: Calculated based on rated hours of 750 for incandescent, 7500 for CFL, and 40,000 for LEDs and an average daily use of 3 (or 5, or 1) hours per day. Rounded to the nearest whole year. Useful life's > 20 years capped at 20 years.
GDS Load-1: Assumes 1620 Annual Hrs of Operation (Based on Energy Star® calculator-Dehumidifier)
GDS Load-2: Assumed 8760 Annual Hrs of Operation (GDS Assumption)
GDS Load-3: Assumes 2920 Annual Hrs of Operation (Based on GDS Assumption that Pool Pump is only operational during 4 summer months)
HD: Home Depot Website. www.homedepot.com.
Hoosier: Socket and CFL Saturation Data from results of 384 on-site residential surveys in the Hoosier Energy service territory. Cost of CFL per bulb negotiated by Hoosier Energy for their buydown program ($1.85 - $0.25)
ICF: City of Gainesville Electricity Supply Needs. ICF Consulting. March 1, 2006.
indiana: Indiana Residential Geothermal Heat Pump Rebate: Program Review. indiana Office of Energy and Defense Development. Completed June 2008.
MEEA: Midwest Residential Market Assessment and DSM Potential Study. March 2006. Baseline and EE Saturations are reported for the state of KY.
MEEA/EIA: Midwest Residential Market Assessment and DSM Potential Study. March 2006. Also used data from the Residential Energy Consumption Survey (RECS) 2005 Data reported by EIA to refine baseline % of appliances. East South Central Region
MEEA/SB: Appendices from the MEEA Market Assessment Report (Appendices provided by Summit Blue)
ORNL/GDS: Oak Ridge National Laboratory and DOE Insulation Fact Sheet - Insulation Costs (www.ornl.gov/~roofs/Zip/tmp/cost3400.html)
PSE/WI FOE: Based on costs reported by Puget Sound Energy on average cost of duct sealing ($400) and Wisconsin Focus on Energy (Mobile Homes) $500-$600.
REM/Rate: Savings % based on results from REM/rate modeling software. Applied the % savings from a measure to the base annual consumption to calculate annual kWh savings.
REM/GDS: Applied best available coincidence factors to REM/Rate specified demand savings. Cooling Summer and Heating Winter CF assumed to be 73%.

APPENDIX 2-2

TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes based on Technical Potential (100% Penetration*), and Technical Potential Savings

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Technical Potential (kWH)	Annual Savings - Technical Potential (Summer kW)	Annual Savings - Technical Potential (Winter kW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	Technical Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Technical Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Technical Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
1	Energy Star® Compliant Top-Mount Refrigerator	SF	Homes w/ Refrigerators	ROB	106	0.007	0.006	54,135	40,601	4,303,701	296	253
2	Energy Star® Compliant Side-by-Side Refrigerator	SF	Homes w/ Refrigerators	ROB	133	0.007	0.006	29,149	21,862	2,907,653	160	136
3	Energy Star® Compliant Chest Freezer	SF	Homes w/ Freezers	ROB	42	0.004	0.003	30,315	28,193	1,184,119	103	88
4	Energy Star® Compliant Upright Freezer (Manual Def.)	SF	Homes w/ Freezers	ROB	47	0.004	0.003	12,992	12,083	567,894	44	38
5	Energy Star® Dehumidifer	SF	Homes w/ Dehumidifiers	ROB	213	0.131	0.131	5,830	2,915	620,882	383	383
6	Second Refrigerator Turn in	SF	Homes w/ more than one refrigerator	Retrofit	978	0.082	0.070	28,317	25,485	24,924,239	2,077	1,773
7	Second Freezer Turn in	SF	Homes w/ more than one freezer	Retrofit	774	0.065	0.055	3,331	2,998	2,320,626	193	165
8	Energy Star® Compliant Top-Mount Refrigerator	MH	Homes w/ Refrigerators	ROB	106	0.007	0.006	8,279	6,210	658,213	45	39
9	Energy Star® Compliant Side-by-Side Refrigerator	MH	Homes w/ Refrigerators	ROB	133	0.007	0.006	4,458	3,344	444,700	24	21
10	Energy Star® Compliant Chest Freezer	MH	Homes w/ Freezers	ROB	42	0.004	0.003	4,636	4,312	181,101	16	13
11	Energy Star® Compliant Upright Freezer (Manual Def.)	MH	Homes w/ Freezers	ROB	47	0.004	0.003	1,987	1,848	86,854	7	6
12	Energy Star® Dehumidifer	MH	Homes w/ Dehumidifiers	ROB	213	0.131	0.131	892	446	94,958	59	59
13	Second Refrigerator Turn In	MH	Homes w/ more than one refrigerator	Retrofit	847	0.071	0.060	4,331	3,898	3,301,345	275	235
14	Second Freezer Turn In	MH	Homes w/ more than one freezer	Retrofit	774	0.065	0.055	510	459	354,919	30	25
15	Home Electronics	SF	All Homes	ROB	265	0.030	0.030	83,284	58,299	15,449,184	1,749	1,749
16	Televisions	SF	Homes w/ a TV	ROB	49	0.017	0.017	204,046	142,832	6,998,772	2,398	2,398
17	Energy Star® Desktop Computer	SF	Homes w/ a Desktop	ROB	42	0.005	0.005	70,791	49,554	2,081,267	238	238
18	Energy Star® Computer Monitor	SF	Homes w/ a Desktop	ROB	21	0.002	0.002	70,791	49,554	1,040,634	119	119
19	Energy Star® Laptop Computer	SF	Homes w/ a Laptop	ROB	13	0.001	0.001	13,325	9,328	121,262	14	14
20	Home Electronics	MH	All Homes	ROB	265	0.030	0.030	12,738	8,916	2,362,816	267	267
21	Televisions	MH	Homes w/ a TV	ROB	49	0.017	0.017	19,106	13,374	655,347	225	225
22	Energy Star® Desktop Computer	MH	Homes w/ a Desktop	ROB	42	0.005	0.005	10,827	7,579	318,311	36	36
23	Energy Star® Computer Monitor	MH	Homes w/ a Desktop	ROB	21	0.002	0.002	10,827	7,579	159,156	18	18
24	Energy Star® Laptop Computer	MH	Homes w/ a Laptop	ROB	13	0.001	0.001	2,038	1,427	18,546	2	2
25	CFL (vs. Incandescent) - 5 hours/day	SF	Sockets with Inc. bulbs (5hrs/day)	ROB	51	0.003	0.007	337,080	261,305	13,352,670	819	1,866
26	CFL (vs. Incandescent) - 3 hours/day	SF	Sockets with Inc. bulbs (3hrs/day)	ROB	31	0.003	0.007	1,017,637	821,539	25,188,374	2,576	5,866
27	CFL (vs. Incandescent) - 1 hours/day	SF	Sockets with Inc. bulbs (1hrs/day)	ROB	10	0.003	0.007	1,843,388	1,676,930	17,138,228	5,259	11,973
28	LED (vs. Incandescent)	SF	Sockets with Inc. bulbs	ROB	41	0.004	0.009	799,527	663,607	26,889,355	2,750	6,261
29	LED (vs. CFL)	SF	Sockets with CFL bulbs	ROB	10	0.001	0.002	135,920	135,920	1,340,166	137	312
30	CFL (vs. Incandescent) - 5 hours/day	MH	Sockets with Inc. bulbs (5hrs/day)	ROB	51	0.003	0.007	8,511	6,383	326,174	20	46
31	CFL (vs. Incandescent) - 3 hours/day	MH	Sockets with Inc. bulbs (3hrs/day)	ROB	31	0.003	0.007	35,535	28,247	866,039	89	202
32	CFL (vs. Incandescent) - 1 hours/day	MH	Sockets with Inc. bulbs (1hrs/day)	ROB	10	0.003	0.007	200,516	171,341	1,751,101	537	1,223
33	LED (vs. Incandescent)	MH	Sockets with Inc. bulbs	ROB	41	0.004	0.009	61,140	53,803	2,180,115	223	508
34	LED (vs. CFL)	MH	Sockets with CFL bulbs	ROB	10	0.001	0.002	7,337	7,337	72,341	7	17
35	Low Flow Faucets	SF	Homes w/ Electric WH	Retrofit	82	0.014	0.022	51,636	20,654	1,693,664	297	446
36	Low Flow Showerhead	SF	Homes w/ Electric WH	Retrofit	202	0.014	0.021	51,636	20,654	4,176,092	295	442
37	Water Heater Blanket	SF	Homes w/ Electric WH	Retrofit	0	0.000	0.000	0	0	0	0	0
38	Pipe Wrap	SF	Homes w/ Electric WH	Retrofit	106	0.009	0.014	51,636	43,891	4,636,863	408	613
39	Efficient Water Heater	SF	Homes w/ Electric WH	ROB	183	0.005	0.007	10,327	7,229	1,324,743	33	49
40	Heat Pump Water Heater	SF	Homes w/ Electric WH	ROB	1,954	0.177	0.265	10,327	7,229	14,125,541	1,279	1,918
41	Solar Water Heating	SF	Homes w/ Electric WH	Retrofit	1,867	0.272	0.000	15,491	10,844	20,245,852	2,951	0
42	Energy Star® Dishwasher (Electric Water Heating)	SF	Homes w/ Dishwashers & Electric WH	ROB	74	0.003	0.001	29,433	15,599	1,154,345	45	12
43	Energy Star® Dishwasher (Non-Electric WH)	SF	Homes w/ Dishwashers & Non-Elec. WH	ROB	33	0.003	0.001	18,039	9,561	315,508	27	7
44	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	Homes w/ CW, Elec. WH and Elec. Dryer	ROB	224	0.026	0.007	45,956	29,412	6,588,269	760	204
45	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	SF	Homes w/ CW, NG WH and Elec. Dryer	ROB	97	0.026	0.007	28,167	18,027	1,748,586	466	125
46	Low Flow Faucets	MH	Homes w/ Electric WH	Retrofit	67	0.010	0.014	12,101	4,840	324,298	46	70
47	Low Flow Showerhead	MH	Homes w/ Electric WH	Retrofit	166	0.010	0.014	12,101	4,840	801,450	46	69
48	Water Heater Blanket	MH	Homes w/ Electric WH	Retrofit	0	0.000	0.000	0	0	0	0	0
49	Pipe Wrap	MH	Homes w/ Electric WH	Retrofit	86	0.009	0.014	12,101	10,286	888,389	96	144
50	Efficient Water Heater	MH	Homes w/ Electric WH	ROB	190	0.005	0.007	12,101	8,470	1,605,316	39	58
51	Energy Star® Dishwasher (Electric Water Heating)	MH	Homes w/ Dishwashers & Electric WH	ROB	74	0.003	0.001	6,897	3,656	270,515	10	3

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes based on Technical Potential (100% Penetration*), and Technical Potential Savings

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Technical Potential (kWH)	Annual Savings - Technical Potential (Summer kW)	Annual Savings - Technical Potential (Winter kW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	Technical Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Technical Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Technical Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
52	Energy Star® Dishwasher (Non-Electric WH)	MH	Homes w/ Dishwashers & Non-Elec. WH	ROB	33	0.003	0.001	363	192	6,349	1	0
53	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	Homes w/ CW, Elec. WH and Elec. Dryer	ROB	224	0.026	0.007	10,770	6,893	1,543,930	178	48
54	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	MH	Homes w/ CW, NG WH and Elec. Dryer	ROB	97	0.026	0.007	567	363	35,188	9	3
55	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	1,949	1.241	0.000	47,472	5,222	10,177,498	6,480	0
56	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	111	0.146	0.000	37,978	18,989	2,115,795	2,772	0
57	Energy Star® Windows	SF	Homes w/ Electric AC Only (& Gas Heat)	ROB	406	0.217	0.000	47,472	28,008	11,380,136	6,064	0
58	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	118	0.069	0.000	47,472	30,382	3,599,124	2,084	0
59	Air Infiltration	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	94	0.101	0.000	47,472	34,654	3,255,011	3,506	0
60	Duct Sealing	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	533	0.266	0.000	37,978	34,180	18,225,230	9,082	0
61	Radiant Barriers	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	506	0.237	0.000	33,230	31,569	15,980,940	7,483	0
62	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	Retrofit	8,054	1.241	5.548	13,325	1,466	11,805,542	1,819	8,132
63	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	Retrofit	1,503	0.146	1.460	10,660	5,330	8,010,869	778	7,782
64	Energy Star® Windows	SF	Homes w/ Electric Heat Pump	ROB	1,251	0.203	1.015	13,325	7,862	9,839,254	1,596	7,981
65	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Heat Pump	Retrofit	410	0.063	0.376	13,325	8,528	3,498,744	534	3,204
66	Air Infiltration	SF	Homes w/ Electric Heat Pump	Retrofit	586	0.090	0.538	13,325	9,728	5,701,038	872	5,234
67	Duct Sealing	SF	Homes w/ Electric Heat Pump	Retrofit	1,371	0.235	1.175	10,660	9,594	13,154,965	2,255	11,277
68	Radiant Barriers	SF	Homes w/ Electric Heat Pump	Retrofit	506	0.237	0.000	9,328	8,861	4,485,878	2,101	0
69	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	Retrofit	8,650	1.241	5.548	9,994	1,099	9,509,368	1,364	6,099
70	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	Retrofit	2,201	0.146	1.460	7,995	3,998	8,798,400	584	5,837
71	Energy Star® Windows	SF	Homes w/ Electric Furnace & AC	ROB	1,637	0.205	1.023	9,994	5,897	9,654,459	1,207	6,033
72	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Furnace & AC	Retrofit	539	0.064	0.320	9,994	6,396	3,449,506	409	2,047
73	Air Infiltration	SF	Homes w/ Electric Furnace & AC	Retrofit	840	0.093	0.526	9,994	7,296	6,130,133	677	3,839
74	Duct Sealing	SF	Homes w/ Electric Furnace & AC	Retrofit	1,798	0.242	1.208	7,995	7,196	12,936,638	1,738	8,689
75	Radiant Barriers	SF	Homes w/ Electric Furnace & AC	Retrofit	506	0.237	0.000	6,996	6,646	3,364,408	1,575	0
76	Air Infiltration	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	103	0.073	0.000	3,057	1,773	183,089	129	0
77	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	26	0.000	0.000	3,057	1,223	32,223	0	0
78	Energy Star® Windows	MH	Homes w/ Electric AC Only (& Gas Heat)	ROB	816	0.359	0.000	3,057	2,262	1,846,843	812	0
79	Duct Sealing	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	414	0.183	0.000	1,529	1,131	468,006	207	0
80	Air Infiltration	MH	Homes w/ Electric Heat Pump	Retrofit	739	0.073	0.511	955	554	409,495	40	283
81	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat Pump	Retrofit	615	0.000	0.485	955	382	234,879	0	185
82	Energy Star® Windows	MH	Homes w/ Electric Heat Pump	ROB	2,450	0.341	1.707	955	707	1,732,193	241	1,207
83	Duct Sealing	MH	Homes w/ Electric Heat Pump	Retrofit	1,192	0.169	0.844	955	707	842,847	119	597
84	Air Infiltration	MH	Homes w/ Electric Heat & Cool	Retrofit	1,080	0.073	0.511	6,751	3,916	4,228,907	286	2,001
85	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat & Cool	Retrofit	938	0.000	0.489	6,751	2,700	2,532,319	0	1,320
86	Energy Star® Windows	MH	Homes w/ Electric Heat & Cool	ROB	3,453	0.343	1.715	6,751	4,996	17,251,985	1,713	8,566
87	Duct Sealing	MH	Homes w/ Electric Heat & Cool	Retrofit	1,645	0.173	0.863	6,751	4,996	8,219,525	863	4,313
88	HVAC Tune-Up	SF	Homes with Central AC or Heat Pump	Retrofit	454	0.217	0.000	70,791	63,712	28,898,417	13,803	0
89	Energy Star® Room A/C	SF	Homes w/ Electric Room AC	ROB	80	0.049	0.000	10,411	7,808	621,514	384	0
90	Second Energy Star® Room A/C	SF	Homes w/ more than one Room AC	ROB	64	0.039	0.000	5,413	4,060	258,567	160	0
91	High Efficiency Central AC	SF	Homes w/ Electric Central AC	ROB	272	0.104	0.000	24,919	23,922	6,510,404	2,492	0
92	High Efficiency Central AC/Early Retire	SF	Homes w/ Electric Central AC	Retrofit	1,348	0.260	0.000	24,919	23,922	32,242,595	6,229	0
93	High Efficiency Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	ROB	473	0.100	0.000	2,665	2,399	1,134,119	239	0
94	High Efficiency Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	Retrofit	2,440	0.248	0.000	2,665	2,399	5,852,253	595	0
95	Ground Source Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	ROB	2,772	0.055	3.375	1,999	1,799	4,986,929	100	6,071
96	Ground Source Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	Retrofit	4,734	0.208	3.215	1,999	1,799	8,516,624	374	5,784
97	Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	ROB	5,095	0.103	0.000	1,499	1,499	7,637,777	155	0
98	Heat Pump/Early Retire (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	Retrofit	6,614	0.259	0.000	1,499	1,499	9,914,601	388	0
99	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	Homes with Electric Heat Pump (H&C)	ROB	2,314	0.098	4.743	3,998	3,598	8,327,025	353	17,066

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes based on Technical Potential (100% Penetration*), and Technical Potential Savings

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Technical Potential (kWH)	Annual Savings - Technical Potential (Summer kW)	Annual Savings - Technical Potential (Winter kW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	Technical Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Technical Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Technical Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
100	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	ROB	7,048	0.103	5.008	2,998	2,998	21,130,869	310	15,015
101	HVAC Tune-Up	MH	Homes with Central AC or Heat Pump	Retrofit	407	0.195	0.000	9,235	8,311	3,385,360	1,622	0
102	Energy Star® Room A/C	MH	Homes w/ Electric Room AC	ROB	68	0.042	0.000	3,312	2,484	168,872	104	0
103	Second Energy Star® Room A/C	MH	Homes w/ more than one Room AC	ROB	68	0.042	0.000	1,783	1,337	90,931	56	0
104	High Efficiency Central AC	MH	Homes w/ Electric Central AC	ROB	245	0.111	0.000	3,643	3,497	857,036	389	0
105	High Efficiency Central AC/Early Retire	MH	Homes w/ Electric Central AC	Retrofit	1,211	0.222	0.000	3,643	3,497	4,236,236	778	0
106	High Efficiency Heat Pump (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	ROB	463	0.104	0.000	334	308	142,285	32	0
107	High Efficiency Heat Pump/Early Retire (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	Retrofit	2,365	0.206	0.000	334	308	727,512	64	0
108	Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	ROB	5,156	0.105	0.000	1,013	1,013	5,221,451	106	0
109	Heat Pump/Early Retire (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	Retrofit	6,522	0.209	0.000	1,013	1,013	6,604,416	212	0
110	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	Homes with Electric Heat Pump (H&C)	ROB	2,341	0.102	4.920	287	264	617,151	27	1,297
111	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	ROB	7,100	0.105	5.064	2,025	2,025	14,378,992	212	10,256
112	In Home Energy Display Monitor	SF	All Homes	Retrofit	633	0.053	0.053	37,478	37,478	23,729,072	1,977	1,977
113	Pre-Pay Metering	SF	All Homes	Retrofit	1,621	0.135	0.135	37,478	37,478	60,746,425	5,062	5,062
114	Pool Pump and Motor	SF	Homes with Pools	ROB	1,260	0.315	0.000	4,997	3,498	4,407,390	1,102	0
115	In Home Energy Display Monitor	MH	All Homes	Retrofit	725	0.060	0.060	5,732	5,732	4,156,774	346	346
116	Pre-Pay Metering	MH	All Homes	Retrofit	1,857	0.155	0.155	5,732	5,732	10,641,340	887	887
117	Multi-Family Homes Efficiency Kit	MF	All Multi-Family Homes	Retrofit	357	0.030	0.057	1,666	833	297,574	25	48
118	New Construction - 15% more efficient	SF	All Single Family New Homes w/ AC Only	NEW	1,392	0.584	0.073	2,767	1,992	2,772,237	1,163	145
119	New Construction - 15% more efficient	SF	All Single Family New Homes w/ Elec. HP	NEW	3,937	0.584	2.409	3,162	2,277	8,964,511	1,330	5,485
120	New Construction - 35% more efficient	SF	All Single Family New Homes w/ AC Only	NEW	3,479	0.876	0.438	922	664	2,310,198	582	291
121	New Construction - 35% more efficient	SF	All Single Family New Homes w/ Elec. HP	NEW	5,906	0.876	2.993	1,054	759	4,482,256	665	2,272
122	New Construction - 15% more efficient	MH	All Single Family New Homes w/ AC Only	NEW	1,682	0.584	0.073	242	174	292,799	102	13
123	New Construction - 15% more efficient	MH	All Single Family New Homes w/ Elec. HP	NEW	2,549	0.584	2.409	306	221	562,123	129	531

***Note**: Solar Water Heating w/ Electric Back-Up and Geothermal systems only assumed a 30% technical potential penetration ; Radiant Barriers assumed a 70% technical potential penetration

	Energy	Summer Demand	Winter Demand
Total Residential Technical Potential:	730,625,837	130,127	207,951
Percent of 2020 Residential Forecast for Energy/Demand:	42.18%	31.90%	46.47%

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes (100% Penetration*), and Economic Potential Savings - *Based on the TRC Test*

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Economic Potential - TRC Test (kWH)	Annual Savings - Economic Potential (Summer kW)	Annual Savings - Economic Potential (Winter KW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	TRC Economic Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Economic Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Economic Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
1	Energy Star® Compliant Top-Mount Refrigerator	SF	Homes w/ Refrigerators	ROB	106	0.007	0.006	54,135	40,601	4,303,701	296	253
2	Energy Star® Compliant Side-by-Side Refrigerator	SF	Homes w/ Refrigerators	ROB	133	0.007	0.006	29,149	21,862	2,907,653	160	136
3	Energy Star® Compliant Chest Freezer	SF	Homes w/ Freezers	ROB	0	0.000	0.000	0	0	0	0	0
4	Energy Star® Compliant Upright Freezer (Manual Def.)	SF	Homes w/ Freezers	ROB	0	0.000	0.000	0	0	0	0	0
5	Energy Star® Dehumidifer	SF	Homes w/ Dehumidifiers	ROB	213	0.131	0.131	5,830	2,915	620,882	383	383
6	Second Refrigerator Turn In	SF	Homes w/ more than one refrigerator	Retrofit	978	0.082	0.070	28,317	25,485	24,924,239	2,077	1,773
7	Second Freezer Turn In	SF	Homes w/ more than one freezer	Retrofit	774	0.065	0.055	3,331	2,998	2,320,626	193	165
8	Energy Star® Compliant Top-Mount Refrigerator	MH	Homes w/ Refrigerators	ROB	106	0.007	0.006	8,279	6,210	658,213	45	39
9	Energy Star® Compliant Side-by-Side Refrigerator	MH	Homes w/ Refrigerators	ROB	133	0.007	0.006	4,458	3,344	444,700	24	21
10	Energy Star® Compliant Chest Freezer	MH	Homes w/ Freezers	ROB	0	0.000	0.000	0	0	0	0	0
11	Energy Star® Compliant Upright Freezer (Manual Def.)	MH	Homes w/ Freezers	ROB	0	0.000	0.000	0	0	0	0	0
12	Energy Star® Dehumidifer	MH	Homes w/ Dehumidifiers	ROB	213	0.131	0.131	892	446	94,958	59	59
13	Second Refrigerator Turn In	MH	Homes w/ more than one refrigerator	Retrofit	847	0.071	0.060	4,331	3,898	3,301,345	275	235
14	Second Freezer Turn In	MH	Homes w/ more than one freezer	Retrofit	774	0.065	0.055	510	459	354,919	30	25
15	Home Electronics	SF	All Homes	ROB	265	0.030	0.030	83,284	58,299	15,449,184	1,749	1,749
16	Televisions	SF	Homes w/ a TV	ROB	49	0.017	0.017	204,046	142,832	6,998,772	2,398	2,398
17	Energy Star® Desktop Computer	SF	Homes w/ a Desktop	ROB	42	0.005	0.005	70,791	49,554	2,081,267	238	238
18	Energy Star® Computer Monitor	SF	Homes w/ a Desktop	ROB	21	0.002	0.002	70,791	49,554	1,040,634	119	119
19	Energy Star® Laptop Computer	SF	Homes w/ a Laptop	ROB	13	0.001	0.001	13,325	9,328	121,262	14	14
20	Home Electronics	MH	All Homes	ROB	265	0.030	0.030	12,738	8,916	2,362,816	267	267
21	Televisions	MH	Homes w/ a TV	ROB	49	0.017	0.017	19,106	13,374	655,347	225	225
22	Energy Star® Desktop Computer	MH	Homes w/ a Desktop	ROB	42	0.005	0.005	10,827	7,579	318,311	36	36
23	Energy Star® Computer Monitor	MH	Homes w/ a Desktop	ROB	21	0.002	0.002	10,827	7,579	159,156	18	18
24	Energy Star® Laptop Computer	MH	Homes w/ a Laptop	ROB	13	0.001	0.001	2,038	1,427	18,546	2	2
25	CFL (vs. Incandescent) - 5 hours/day	SF	Sockets with Inc. bulbs (5hrs/day)	ROB	51	0.003	0.007	337,080	261,305	13,352,670	819	1,866
26	CFL (vs. Incandescent) - 3 hours/day	SF	Sockets with Inc. bulbs (3hrs/day)	ROB	31	0.003	0.007	1,017,637	821,539	25,188,374	2,576	5,866
27	CFL (vs. Incandescent) - 1 hours/day	SF	Sockets with Inc. bulbs (1hrs/day)	ROB	10	0.003	0.007	1,843,388	1,676,930	17,138,228	5,259	11,973
28	LED (vs. Incandescent)	SF	Sockets with Inc. bulbs	ROB	41	0.004	0.009	799,527	663,607	26,889,355	2,750	6,261
29	LED (vs. CFL)	SF	Sockets with CFL bulbs	ROB	0	0.000	0.000	0	0	0	0	0
30	CFL (vs. Incandescent) - 5 hours/day	MH	Sockets with Inc. bulbs (5hrs/day)	ROB	51	0.003	0.007	8,511	6,383	326,174	20	46
31	CFL (vs. Incandescent) - 3 hours/day	MH	Sockets with Inc. bulbs (3hrs/day)	ROB	31	0.003	0.007	35,535	28,247	866,039	89	202
32	CFL (vs. Incandescent) - 1 hours/day	MH	Sockets with Inc. bulbs (1hrs/day)	ROB	10	0.003	0.007	200,516	171,341	1,751,101	537	1,223
33	LED (vs. Incandescent)	MH	Sockets with Inc. bulbs	ROB	41	0.004	0.009	61,140	53,803	2,180,115	223	508
34	LED (vs. CFL)	MH	Sockets with CFL bulbs	ROB	0	0.000	0.000	0	0	0	0	0
35	Low Flow Faucets	SF	Homes w/ Electric WH	Retrofit	82	0.014	0.022	51,636	20,654	1,693,664	297	446
36	Low Flow Showerhead	SF	Homes w/ Electric WH	Retrofit	202	0.014	0.021	51,636	20,654	4,176,092	295	442
37	Water Heater Blanket	SF	Homes w/ Electric WH	Retrofit	0	0.000	0.000	0	0	0	0	0
38	Pipe Wrap	SF	Homes w/ Electric WH	Retrofit	106	0.009	0.014	51,636	43,891	4,636,863	408	613
39	Efficient Water Heater	SF	Homes w/ Electric WH	ROB	183	0.005	0.007	18,073	12,651	2,318,300	57	86
40	Heat Pump Water Heater	SF	Homes w/ Electric WH	ROB	1,954	0.177	0.265	18,073	12,651	24,719,696	2,238	3,357
41	Solar Water Heating	SF	Homes w/ Electric WH	Retrofit	0	0.000	0.000	0	0	0	0	0
42	Energy Star® Dishwasher (Electric Water Heating)	SF	Homes w/ Dishwashers & Electric WH	ROB	74	0.003	0.001	29,433	15,599	1,154,345	45	12
43	Energy Star® Dishwasher (Non-Electric WH)	SF	Homes w/ Dishwashers & Non-Elec. WH	ROB	33	0.003	0.001	18,039	9,561	315,508	27	7
44	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	Homes w/ CW, Elec. WH and Elec. Dryer	ROB	224	0.026	0.007	45,956	29,412	6,588,269	760	204
45	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	SF	Homes w/ CW, NG WH and Elec. Dryer	ROB	97	0.026	0.007	28,167	18,027	1,748,586	466	125
46	Low Flow Faucets	MH	Homes w/ Electric WH	Retrofit	67	0.010	0.014	12,101	4,840	324,298	46	70
47	Low Flow Showerhead	MH	Homes w/ Electric WH	Retrofit	166	0.010	0.014	12,101	4,840	801,450	46	69
48	Water Heater Blanket	MH	Homes w/ Electric WH	Retrofit	0	0.000	0.000	0	0	0	0	0
49	Pipe Wrap	MH	Homes w/ Electric WH	Retrofit	86	0.009	0.014	12,101	10,286	888,389	96	144
50	Efficient Water Heater	MH	Homes w/ Electric WH	ROB	190	0.005	0.007	12,101	8,470	1,605,316	39	58
51	Energy Star® Dishwasher (Electric Water Heating)	MH	Homes w/ Dishwashers & Electric WH	ROB	74	0.003	0.001	6,897	3,656	270,515	10	3
52	Energy Star® Dishwasher (Non-Electric WH)	MH	Homes w/ Dishwashers & Non-Elec. WH	ROB	33	0.003	0.001	363	192	6,349	1	0

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes (100% Penetration*), and Economic Potential Savings - ***Based on the TRC Test***

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Economic Potential - TRC Test (kWH)	Annual Savings - Economic Potential (Summer kW)	Annual Savings - Economic Potential (Winter kW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	TRC Economic Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Economic Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Economic Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
53	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	Homes w/ CW, Elec. WH and Elec. Dryer	ROB	224	0.026	0.007	10,770	6,893	1,543,930	178	48
54	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	MH	Homes w/ CW, NG WH and Elec. Dryer	ROB	97	0.026	0.007	567	363	35,188	9	3
55	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	1,949	1.241	0.000	47,472	5,222	10,177,498	6,480	0
56	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	111	0.146	0.000	37,978	18,989	2,115,795	2,772	0
57	Energy Star® Windows	SF	Homes w/ Electric AC Only (& Gas Heat)	ROB	0	0.000	0.000	0	0	0	0	0
58	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	0	0.000	0.000	0	0	0	0	0
59	Air Infiltration	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	0	0.000	0.000	0	0	0	0	0
60	Duct Sealing	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	579	0.289	0.000	37,978	34,180	19,799,358	9,867	0
61	Radiant Barriers	SF	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	0	0.000	0.000	0	0	0	0	0
62	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	Retrofit	8,054	1.241	5.548	13,325	1,466	11,805,542	1,819	8,132
63	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	Retrofit	1,503	0.146	1.460	10,660	5,330	8,010,869	778	7,782
64	Energy Star® Windows	SF	Homes w/ Electric Heat Pump	ROB	0	0.000	0.000	0	0	0	0	0
65	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Heat Pump	Retrofit	0	0.000	0.000	0	0	0	0	0
66	Air Infiltration	SF	Homes w/ Electric Heat Pump	Retrofit	653	0.100	0.600	13,325	9,728	6,352,938	972	5,833
67	Duct Sealing	SF	Homes w/ Electric Heat Pump	Retrofit	1,511	0.259	1.296	10,660	9,594	14,499,925	2,486	12,430
68	Radiant Barriers	SF	Homes w/ Electric Heat Pump	Retrofit	0	0.000	0.000	0	0	0	0	0
69	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	Retrofit	8,650	1.241	5.548	9,994	1,099	9,509,368	1,364	6,099
70	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	Retrofit	2,201	0.146	1.460	7,995	3,998	8,798,400	584	5,837
71	Energy Star® Windows	SF	Homes w/ Electric Furnace & AC	ROB	0	0.000	0.000	0	0	0	0	0
72	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Furnace & AC	Retrofit	0	0.000	0.000	0	0	0	0	0
73	Air Infiltration	SF	Homes w/ Electric Furnace & AC	Retrofit	916	0.101	0.574	9,994	7,296	6,686,483	739	4,188
74	Duct Sealing	SF	Homes w/ Electric Furnace & AC	Retrofit	1,953	0.262	1.312	7,995	7,196	14,054,519	1,888	9,440
75	Radiant Barriers	SF	Homes w/ Electric Furnace & AC	Retrofit	0	0.000	0.000	0	0	0	0	0
76	Air Infiltration	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	103	0.073	0.000	3,057	1,773	183,089	129	0
77	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	0	0.000	0.000	0	0	0	0	0
78	Energy Star® Windows	MH	Homes w/ Electric AC Only (& Gas Heat)	ROB	0	0.000	0.000	0	0	0	0	0
79	Duct Sealing	MH	Homes w/ Electric AC Only (& Gas Heat)	Retrofit	488	0.216	0.000	1,529	1,131	551,645	244	0
80	Air infiltration	MH	Homes w/ Electric Heat Pump	Retrofit	739	0.073	0.511	955	554	409,495	40	283
81	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat Pump	Retrofit	615	0.000	0.485	955	382	234,879	0	185
82	Energy Star® Windows	MH	Homes w/ Electric Heat Pump	ROB	0	0.000	0.000	0	0	0	0	0
83	Duct Sealing	MH	Homes w/ Electric Heat Pump	Retrofit	1,447	0.205	1.025	955	707	1,023,034	145	724
84	Air infiltration	MH	Homes w/ Electric Heat & Cool	Retrofit	1,080	0.073	0.511	6,751	3,916	4,228,907	286	2,001
85	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat & Cool	Retrofit	938	0.000	0.489	6,751	2,700	2,532,319	0	1,320
86	Energy Star® Windows	MH	Homes w/ Electric Heat & Cool	ROB	0	0.000	0.000	0	0	0	0	0
87	Duct Sealing	MH	Homes w/ Electric Heat & Cool	Retrofit	1,962	0.206	1.029	6,751	4,996	9,801,148	1,029	5,143
88	HVAC Tune-Up	SF	Homes with Central AC or Heat Pump	Retrofit	561	0.268	0.000	70,791	63,712	35,724,979	17,064	0
89	Energy Star® Room A/C	SF	Homes w/ Electric Room AC	ROB	98	0.061	0.000	10,411	7,808	768,331	475	0
90	Second Energy Star® Room A/C	SF	Homes w/ more than one Room AC	ROB	0	0.000	0.000	0	0	0	0	0
91	High Efficiency Central AC	SF	Homes w/ Electric Central AC	ROB	0	0.000	0.000	0	0	0	0	0
92	High Efficiency Central AC/Early Retire	SF	Homes w/ Electric Central AC	Retrofit	0	0.000	0.000	0	0	0	0	0
93	High Efficiency Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	ROB	0	0.000	0.000	0	0	0	0	0
94	High Efficiency Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	Retrofit	0	0.000	0.000	0	0	0	0	0
95	Ground Source Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	ROB	3,041	0.061	3.702	3,998	3,598	10,940,329	218	13,318
96	Ground Source Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	Retrofit	0	0.000	0.000	0	0	0	0	0
97	Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	ROB	0	0.000	0.000	0	0	0	0	0
98	Heat Pump/Early Retire (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	Retrofit	0	0.000	0.000	0	0	0	0	0
99	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	Homes with Electric Heat Pump (H&C)	ROB	2,695	0.114	5.523	3,998	3,598	9,695,279	411	19,870
100	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	ROB	7,951	0.117	5.649	2,998	2,998	23,837,442	350	16,938
101	HVAC Tune-Up	MH	Homes with Central AC or Heat Pump	Retrofit	480	0.230	0.000	9,235	8,311	3,990,370	1,912	0

Measure Assumptions (Adjusted for Interactive Effects), Total # of Remaining Homes (100% Penetration*), and Economic Potential Savings - *Based on the TRC Test*

#	Measure Name	Home Type	Measure/End Use Description	Replace-on-Burnout or Retrofit	Annual Savings - Economic Potential - TRC Test (kWH)	Annual Savings - Economic Potential (Summer kW)	Annual Savings - Economic Potential (Winter kW)	# of applicable homes (total number of homes where the measure is applicable)	Total # of homes remaining that can still receive efficiency measure	TRC Economic Potential total energy (kWh) savings potential if 100% penetration attained 'overnight'	Economic Potential summer demand (kW) savings potential if 100% penetration attained 'overnight'	Economic Potential winter demand (kW) savings potential if 100% penetration attained 'overnight'
102	Energy Star® Room A/C	MH	Homes w/ Electric Room AC	ROB	0	0.000	0.000	0	0	0	0	0
103	Second Energy Star® Room A/C	MH	Homes w/ more than one Room AC	ROB	0	0.000	0.000	0	0	0	0	0
104	High Efficiency Central AC	MH	Homes w/ Electric Central AC	ROB	0	0.000	0.000	0	0	0	0	0
105	High Efficiency Central AC/Early Retire	MH	Homes w/ Electric Central AC	Retrofit	0	0.000	0.000	0	0	0	0	0
106	High Efficiency Heat Pump (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	ROB	0	0.000	0.000	0	0	0	0	0
107	High Efficiency Heat Pump/Early Retire (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	Retrofit	0	0.000	0.000	0	0	0	0	0
108	Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	ROB	0	0.000	0.000	0	0	0	0	0
109	Heat Pump/Early Retire (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	Retrofit	0	0.000	0.000	0	0	0	0	0
110	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	Homes with Electric Heat Pump (H&C)	ROB	2,833	0.123	5.955	287	264	746,974	32	1,570
111	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	ROB	8,465	0.125	6.037	2,025	2,025	17,143,254	253	12,228
112	In Home Energy Display Monitor	SF	All Homes	Retrofit	0	0.000	0.000	0	0	0	0	0
113	Pre-Pay Metering	SF	All Homes	Retrofit	1,621	0.135	0.135	37,478	37,478	60,746,425	5,062	5,062
114	Pool Pump and Motor	SF	Homes with Pools	ROB	1,260	0.315	0.000	4,997	3,498	4,407,390	1,102	0
115	In Home Energy Display Monitor	MH	All Homes	Retrofit	0	0.000	0.000	0	0	0	0	0
116	Pre-Pay Metering	MH	All Homes	Retrofit	1,857	0.155	0.155	5,732	5,732	10,641,340	887	887
117	Multi-Family Homes Efficiency Kit	MF	All Multi-Family Homes	Retrofit	357	0.030	0.057	1,666	833	297,574	25	48
118	New Construction - 15% more efficient	SF	All Single Family New Homes w/ AC Only	NEW	1,392	0.584	0.073	2,767	1,992	2,772,237	1,163	145
119	New Construction - 15% more efficient	SF	All Single Family New Homes w/ Elec. HP	NEW	3,937	0.584	2.409	3,162	2,277	8,964,511	1,330	5,485
120	New Construction - 35% more efficient	SF	All Single Family New Homes w/ AC Only	NEW	3,479	0.876	0.438	922	664	2,310,198	582	291
121	New Construction - 35% more efficient	SF	All Single Family New Homes w/ Elec. HP	NEW	5,906	0.876	2.993	1,054	759	4,482,256	665	2,272
122	New Construction - 15% more efficient	MH	All Single Family New Homes w/ AC Only	NEW	1,682	0.584	0.073	242	174	292,799	102	13
123	New Construction - 15% more efficient	MH	All Single Family New Homes w/ Elec. HP	NEW	2,549	0.584	2.409	306	221	562,123	129	531

*Note: Solar Water Heating w/ Electric Back-Up and Geothermal systems only assumed a 30% technical potential penetration ; Radiant Barriers assumed a 70% technical potential penetration

	Energy	Summer Demand	Winter Demand
Total Residential Economic Potential:	538,754,369	89,284	189,836
Percent of 2020 Residential Forecast for Energy/Demand:	31.10%	21.89%	42.42%

Annual # of Achievable Homes (30% Penetration*) and Achievable Potential in 2020 *(based on the TRC Test)*

#	Measure Name	Home Type	Measure/End Use Description	Annual Savings - Achievable Potential - Energy (kWh)	Annual Savings - Achievable Potential - Summer Demand (kW)	Annual Savings - Achievable Potential - Winter Demand (kW)	Achievable Program Participants per year (30% penetration limit)* 2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TRC Test Achievable kWh Savings by 2020 (30% penetration limit)	TRC Test Achievable Summer Peak kW Savings by 2020 (30% penetration limit)	TRC Test Achievable Winter Peak kW Savings by 2020 (30% penetration limit)
1	Energy Star® Compliant Top-Mount Refrigerator	SF	Homes w/ Refrigerators	106	0.007	0.006	355	609	1,066	1,421	1,624	1,624	1,421	1,066	609	355	1,075,900	74	63
2	Energy Star® Compliant Side-by-Side Refrigerator	SF	Homes w/ Refrigerators	133	0.007	0.006	191	328	574	766	875	875	766	574	328	191	727,244	40	34
3	Energy Star® Compliant Chest Freezer	SF	Homes w/ Freezers	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Energy Star® Compliant Upright Freezer (Manual Def.)	SF	Homes w/ Freezers	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
5	Energy Star® Dehumidifer	SF	Homes w/ Dehumidifiers	213	0.131	0.131	40	73	113	117	106	88	73	55	37	29	155,703	96	96
6	Second Refrigerator Turn In	SF	Homes w/ more than one refrigerator	978	0.082	0.070	421	765	1,186	1,224	1,109	918	765	574	383	306	2,881,188	240	205
7	Second Freezer Turn In	SF	Homes w/ more than one freezer	774	0.065	0.055	50	90	140	144	131	108	90	68	45	36	268,578	22	19
8	Energy Star® Compliant Top-Mount Refrigerator	MH	Homes w/ Refrigerators	106	0.007	0.006	54	93	163	217	248	248	217	163	93	54	164,300	11	10
9	Energy Star® Compliant Side-by-Side Refrigerator	MH	Homes w/ Refrigerators	133	0.007	0.006	29	50	88	118	134	134	118	88	50	29	111,454	6	5
10	Energy Star® Compliant Chest Freezer	MH	Homes w/ Freezers	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
11	Energy Star® Compliant Upright Freezer (Manual Def.)	MH	Homes w/ Freezers	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
12	Energy Star® Dehumidifer	MH	Homes w/ Dehumidifiers	213	0.131	0.131	6	11	17	18	16	13	11	8	6	4	23,430	14	14
13	Second Refrigerator Turn In	MH	Homes w/ more than one refrigerator	847	0.071	0.060	64	117	181	187	170	140	117	88	59	47	381,997	32	27
14	Second Freezer Turn In	MH	Homes w/ more than one freezer	774	0.065	0.055	8	14	22	22	20	17	14	11	7	6	42,570	4	3
15	Home Electronics	SF	All Homes	265	0.030	0.030	612	1,049	1,836	2,449	2,798	2,798	2,449	2,448	2,098	2,448	4,634,320	525	525
16	Televisions	SF	Homes w/ a TV	49	0.017	0.017	2,357	4,285	6,642	6,856	6,213	5,142	6,642	7,499	8,785	8,570	2,099,699	719	719
17	Energy Star® Desktop Computer	SF	Homes w/ a Desktop	42	0.005	0.005	818	1,487	2,305	2,379	2,974	3,271	3,792	3,494	3,718	3,866	624,540	71	71
18	Energy Star® Computer Monitor	SF	Homes w/ a Desktop	21	0.002	0.002	818	1,487	2,305	2,379	2,156	2,602	2,974	3,420	3,123	2,751	312,270	36	36
19	Energy Star® Laptop Computer	SF	Homes w/ a Laptop	13	0.001	0.001	154	280	434	448	560	616	714	658	700	728	36,400	4	4
20	Home Electronics	MH	All Homes	265	0.030	0.030	93	160	280	374	427	427	374	373	320	373	707,020	80	80
21	Televisions	MH	Homes w/ a TV	49	0.017	0.017	221	401	622	642	581	481	622	702	823	802	196,539	67	67
22	Energy Star® Desktop Computer	MH	Homes w/ a Desktop	42	0.005	0.005	125	227	352	363	454	499	579	533	568	590	95,340	11	11
23	Energy Star® Computer Monitor	MH	Homes w/ a Desktop	21	0.002	0.002	125	227	352	363	329	397	454	522	477	420	47,670	5	5
24	Energy Star® Laptop Computer	MH	Homes w/ a Laptop	13	0.001	0.001	24	43	67	69	86	95	110	101	108	112	5,603	1	1
25	CFL (vs. incandescent) - 5 hours/day	SF	Sockets with inc. bulbs (5hrs/day)	51	0.003	0.007	4,311	7,839	12,150	12,542	15,678	17,246	19,989	18,421	19,598	20,382	4,005,729	246	560
26	CFL (vs. incandescent) - 3 hours/day	SF	Sockets with inc. bulbs (3hrs/day)	31	0.003	0.007	13,555	24,646	38,201	39,434	35,737	29,575	24,646	32,040	36,969	48,059	7,556,464	773	1,760
27	CFL (vs. incandescent) - 1 hours/day	SF	Sockets with inc. bulbs (1hrs/day)	10	0.003	0.007	17,608	30,185	52,823	70,431	80,493	80,493	70,431	52,823	30,185	17,608	5,141,478	1,578	3,592
28	LED (vs. incandescent)	SF	Sockets with inc. bulbs	41	0.004	0.009	6,968	11,945	20,903	27,871	31,853	31,853	27,871	20,903	11,945	6,968	8,066,722	825	1,878
29	LED (vs. CFL)	SF	Sockets with CFL bulbs	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
30	CFL (vs. incandescent) - 5 hours/day	MH	Sockets with inc. bulbs (5hrs/day)	51	0.003	0.007	105	191	296	306	382	420	487	449	478	496	97,601	6	14
31	CFL (vs. incandescent) - 3 hours/day	MH	Sockets with inc. bulbs (3hrs/day)	31	0.003	0.007	466	847	1,313	1,355	1,228	1,016	847	1,101	1,271	1,652	259,690	27	60
32	CFL (vs. incandescent) - 1 hours/day	MH	Sockets with inc. bulbs (1hrs/day)	10	0.003	0.007	2,827	5,140	7,967	8,224	7,453	6,168	5,140	3,855	2,570	2,056	525,308	161	367
33	LED (vs. incandescent)	MH	Sockets with inc. bulbs	41	0.004	0.009	565	968	1,695	2,260	2,582	2,582	2,260	1,695	968	565	653,993	67	152
34	LED (vs. CFL)	MH	Sockets with CFL bulbs	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
35	Low Flow Faucets	SF	Homes w/ Electric WH	82	0.014	0.022	341	620	961	992	899	744	620	465	310	248	508,400	89	134
36	Low Flow Showerhead	SF	Homes w/ Electric WH	203	0.014	0.022	341	620	961	992	899	744	620	465	310	248	1,261,431	89	134
37	Water Heater Blanket	SF	Homes w/ Electric WH	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
38	Pipe Wrap	SF	Homes w/ Electric WH	108	0.010	0.014	724	1,317	2,041	2,107	1,910	1,580	1,317	988	659	527	1,422,218	125	188
39	Efficient Water Heater	SF	Homes w/ Electric WH	191	0.005	0.007	102	175	307	409	467	467	409	307	175	102	556,817	14	21
40	Heat Pump Water Heater	SF	Homes w/ Electric WH	2,033	0.184	0.276	102	131	175	219	263	321	365	438	467	438	5,935,232	537	806
41	Solar Water Heating	SF	Homes w/ Electric WH	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
42	Energy Star® Dishwasher (Electric Water Heating)	SF	Homes w/ Dishwashers & Electric WH	74	0.003	0.001	257	468	725	749	679	562	468	351	234	187	346,320	13	4
43	Energy Star® Dishwasher (Non-Electric WH)	SF	Homes w/ Dishwashers & Non-Elec. WH	33	0.003	0.001	158	287	445	459	416	344	287	215	144	115	94,710	8	2
44	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	SF	Homes w/ CW, Elec. WH and Elec. Dryer	224	0.026	0.007	281	361	481	602	722	882	1,003	1,203	1,283	1,203	1,796,704	207	56
45	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	SF	Homes w/ CW, NG WH and Elec. Dryer	97	0.026	0.007	172	221	295	369	443	541	615	738	787	738	477,143	127	34
46	Low Flow Faucets	MH	Homes w/ Electric WH	67	0.010	0.014	80	145	225	232	210	174	145	109	73	58	97,217	14	21
47	Low Flow Showerhead	MH	Homes w/ Electric WH	167	0.010	0.014	80	145	225	232	210	174	145	109	73	58	241,699	14	21
48	Water Heater Blanket	MH	Homes w/ Electric WH	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
49	Pipe Wrap	MH	Homes w/ Electric WH	88	0.010	0.014	170	309	479	494	448	371	309	232	155	124	272,652	29	44
50	Efficient Water Heater	MH	Homes w/ Electric WH	197	0.005	0.007	68	117	205	273	312	312	273	205	117	68	383,917	9	14
51	Energy Star® Dishwasher (Electric Water Heating)	MH	Homes w/ Dishwashers & Electric WH	74	0.003	0.001	61	110	171	176	160	132	110	83	55	44	81,548	3	1
52	Energy Star® Dishwasher (Non-Electric WH)	MH	Homes w/ Dishwashers & Non-Elec. WH	33	0.003	0.001	3	6	9	10	9	7	6	5	3	2	1,980	0	0
53	Energy Star® Clothes Washer (w/ Elec. WH & Elec. Dryer)	MH	Homes w/ CW, Elec. WH and Elec. Dryer	224	0.026	0.007	66	85	113	141	169	207	235	282	301	282	421,344	49	13
54	Energy Star® Clothes Washer (w/ NG WH & Elec. Dryer)	MH	Homes w/ CW, NG WH and Elec. Dryer	97	0.026	0.007	4	5	6	8	9	11	13	15	16	15	9,894	3	1
55	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	1,949	1.241	0.000	55	94	165	220	251	251	220	165	94	55	3,059,930	1,948	0
56	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric AC Only (& Gas Heat)	111	0.146	0.000	200	342	599	798	912	912	798	599	342	200	635,337	832	0
57	Energy Star® Windows	SF	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
58	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
59	Air Infiltration	SF	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
60	Duct Sealing	SF	Homes w/ Electric AC Only (& Gas Heat)	584	0.291	0.000	359	461	615	769	923	1,128	1,281	1,538	1,640	1,538	5,986,628	2,983	0
61	Radiant Barriers	SF	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
62	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	8,054	1.241	5.548	15	26	46	62	70	70	62	46	26	15	3,527,652	544	2,430
63	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Heat Pump	1,503	0.146	1.460	56	96	168	224	256	256	224	168	96	56	2,404,684	234	2,336
64	Energy Star® Windows	SF	Homes w/ Electric Heat Pump	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
65	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Heat Pump	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0

Annual # of Achievable Homes (30% Penetration*) and Achievable Potential in 2020 *(based on the TRC Test)*

#	Measure Name	Home Type	Measure/End Use Description	Annual Savings - Achievable Potential - Energy (kWh)	Annual Savings - Achievable Potential - Summer Demand (kW)	Annual Savings - Achievable Potential - Winter Demand (kW)	Achievable Program Participants per year (30% penetration limit)*										TRC Test Achievable kWh Savings by 2020 (30% penetration limit)	TRC Test Achievable Summer Peak kW Savings by 2020 (30% penetration limit)	TRC Test Achievable Winter Peak kW Savings by 2020 (30% penetration limit)
							2011	2012	2013	2014	2015	2016	2017	2018	2019	2020			
66	Air Infiltration	SF	Homes w/ Electric Heat Pump	697	0.107	0.640	102	131	175	219	263	321	365	438	467	438	2,034,113	311	1,868
67	Duct Sealing	SF	Homes w/ Electric Heat Pump	1,644	0.282	1.409	101	130	173	216	259	317	360	432	461	432	4,736,635	812	4,060
68	Radiant Barriers	SF	Homes w/ Electric Heat Pump	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
69	Insulation - Ceiling (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	8,650	1.241	5.548	12	20	35	46	53	53	46	35	20	12	2,871,800	412	1,842
70	Insulation - Floor (R-0 to R-19)	SF	Homes w/ Electric Furnace & AC	2,201	0.146	1.460	42	72	126	168	192	192	168	126	72	42	2,641,083	175	1,752
71	Energy Star® Windows	SF	Homes w/ Electric Furnace & AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
72	Insulation -Ceiling (R-19 to R-38)	SF	Homes w/ Electric Furnace & AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
73	Air Infiltration	SF	Homes w/ Electric Furnace & AC	969	0.107	0.607	77	99	131	164	197	241	274	329	350	329	2,121,989	235	1,329
74	Duct Sealing	SF	Homes w/ Electric Furnace & AC	2,106	0.283	1.415	76	97	130	162	194	238	270	324	346	324	4,551,325	611	3,057
75	Radiant Barriers	SF	Homes w/ Electric Furnace & AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
76	Air infiltration	MH	Homes w/ Electric AC Only (& Gas Heat)	103	0.073	0.000	19	24	32	40	48	58	66	80	85	80	54,935	39	0
77	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
78	Energy Star® Windows	MH	Homes w/ Electric AC Only (& Gas Heat)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
79	Duct Sealing	MH	Homes w/ Electric AC Only (& Gas Heat)	493	0.218	0.000	12	15	20	26	31	37	43	51	54	51	167,536	74	0
80	Air Infiltration	MH	Homes w/ Electric Heat Pump	739	0.073	0.511	6	8	10	13	15	19	21	26	27	26	126,377	12	87
81	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat Pump	638	0.000	0.503	4	7	12	15	18	18	15	12	7	4	71,446	0	56
82	Energy Star® Windows	MH	Homes w/ Electric Heat Pump	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
83	Duct Sealing	MH	Homes w/ Electric Heat Pump	1,516	0.215	1.074	7	9	13	16	19	23	26	32	34	32	319,956	45	227
84	Air Infiltration	MH	Homes w/ Electric Heat & Cool	1,080	0.073	0.511	41	53	70	88	105	129	146	176	187	176	1,264,722	85	598
85	Insulation - Floor (R-11 to R-30)	MH	Homes w/ Electric Heat & Cool	968	0.000	0.504	28	49	85	113	130	130	113	85	49	28	783,874	0	408
86	Energy Star® Windows	MH	Homes w/ Electric Heat & Cool	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
87	Duct Sealing	MH	Homes w/ Electric Heat & Cool	2,049	0.215	1.075	53	68	90	113	135	165	188	225	240	225	3,077,420	323	1,615
88	HVAC Tune-Up	SF	Homes with Central AC or Heat Pump	613	0.293	0.000	669	860	1,147	1,433	1,720	2,102	3,058	3,727	4,205	4,300	11,717,796	5,597	0
89	Energy Star® Room A/C	SF	Homes w/ Electric Room AC	108	0.067	0.000	82	140	246	328	374	374	328	246	140	164	251,781	156	0
90	Second Energy Star® Room A/C	SF	Homes w/ more than one Room AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
91	High Efficiency Central AC	SF	Homes w/ Electric Central AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
92	High Efficiency Central AC/Early Retire	SF	Homes w/ Electric Central AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
93	High Efficiency Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
94	High Efficiency Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
95	Ground Source Heat Pump (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	3,462	0.069	4.214	32	41	54	68	81	99	113	135	144	135	3,122,713	62	3,801
96	Ground Source Heat Pump/Early Retire (HP Upgrade)	SF	Homes with Electric Heat Pump (H&C)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
97	Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
98	Heat Pump/Early Retire (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
99	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	SF	Homes with Electric Heat Pump (H&C)	3,209	0.136	6.576	32	41	54	68	81	99	113	135	144	135	2,894,333	123	5,932
100	Dual Fuel Heat Pump (Replacing Electric Furnace)	SF	Homes with Electric Furnaces and CAC	9,317	0.137	6.620	22	29	38	48	58	70	80	96	102	96	5,953,434	87	4,230
101	HVAC Tune-Up	MH	Homes with Central AC or Heat Pump	518	0.248	0.000	87	112	149	187	224	274	398	486	547	561	1,290,476	618	0
102	Energy Star® Room A/C	MH	Homes w/ Electric Room AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
103	Second Energy Star® Room A/C	MH	Homes w/ more than one Room AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
104	High Efficiency Central AC	MH	Homes w/ Electric Central AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
105	High Efficiency Central AC/Early Retire	MH	Homes w/ Electric Central AC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
106	High Efficiency Heat Pump (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
107	High Efficiency Heat Pump/Early Retire (HP Upgrade)	MH	Homes with Electric Heat Pump (H&C)	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
108	Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
109	Heat Pump/Early Retire (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
110	Dual Fuel Heat Pump Upgrade (Replacing New ASHP)	MH	Homes with Electric Heat Pump (H&C)	3,198	0.139	6.721	2	3	4	5	6	8	9	11	11	11	223,846	10	470
111	Dual Fuel Heat Pump (Replacing Electric Furnace)	MH	Homes with Electric Furnaces and CAC	9,461	0.139	6.748	15	19	26	32	39	47	54	65	69	65	4,077,696	60	2,908
112	In Home Energy Display Monitor	SF	All Homes	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
113	Pre-Pay Metering	SF	All Homes	1,621	0.135	0.135	393	674	1,180	1,574	1,798	1,798	1,574	1,180	674	393	3,642,081	304	304
114	Pool Pump and Motor	SF	Homes with Pools	1,260	0.315	0.000	37	47	63	79	95	116	131	158	168	158	1,325,520	331	0
115	In Home Energy Display Monitor	MH	All Homes	0	0.000	0.000	0	0	0	0	0	0	0	0	0	0	0	0	0
116	Pre-Pay Metering	MH	All Homes	1,857	0.155	0.155	60	103	181	241	275	275	241	181	103	60	638,640	53	53
117	Multi-Family Homes Efficiency Kit	MF	All Multi-Family Homes	357	0.030	0.057	9	15	26	35	40	40	35	26	15	9	86,109	7	14
118	New Construction - 15% more efficient	SF	All Single Family New Homes w/ AC Only	1,392	0.584	0.073	21	27	36	45	54	66	75	90	96	90	834,900	350	44
119	New Construction - 15% more efficient	SF	All Single Family New Homes w/ Elec. HP	3,937	0.584	2.409	24	31	41	51	61	75	85	102	109	102	2,681,233	398	1,641
120	New Construction - 35% more efficient	SF	All Single Family New Homes w/ AC Only	3,479	0.876	0.438	7	9	12	15	18	22	25	30	32	30	695,750	175	88
121	New Construction - 35% more efficient	SF	All Single Family New Homes w/ Elec. HP	5,906	0.876	2.993	8	10	14	17	21	25	29	35	37	35	1,364,240	202	691
122	New Construction - 15% more efficient	MH	All Single Family New Homes w/ AC Only	1,682	0.584	0.073	2	2	3	4	5	6	6	8	8	8	87,446	30	4
123	New Construction - 15% more efficient	MH	All Single Family New Homes w/ Elec. HP	2,549	0.584	2.409	2	3	4	5	6	8	9	11	11	11	178,416	41	169

	Energy	Summer Demand	Winter Demand
Total Residential TRC Achievable Potential:	136,311,827	25,355	53,886
Percent of 2020 Residential Forecast for Energy/Demand:	7.87%	6.22%	12.04%

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Appendix 3
Commercial/Industrial Sector Data
(Energy Efficiency)

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

APPENDIX 3

COMMERCIAL/INDUSTRIAL SECTOR DATA
(ENERGY EFFICIENCY)

APPENDIX 3-1

COMMERCIAL/INDUSTRIAL MEASURE DESCRIPTIONS,
ASSUMPTIONS AND SOURCES

DESCRIPTIONS OF COMMERCIAL/INDUSTRIAL ENERGY EFFICIENCY MEASURES

This technical appendix describes a broad range of commercial and industrial sector energy efficiency measures and programs where GDS has assessed the technical and achievable potential for electric energy savings for Big Rivers.

1. HEATING AND AIR CONDITIONING

The following sections describe the energy efficiency measures included in the commercial sector analysis that fall into the categories of, space heating and space cooling.

(1) High Efficiency Heat Pump[1]*:* Electric heat pumps operate by transferring heat from one place to another. In the heating mode, a heat pump extracts heat from outside a structure and delivers it to the building. Like a furnace, most heat pumps work with forced warm-air delivery systems. Heat pumps can also be operated to cool a building during summer months. In the cooling mode, the cycle is reversed and heat is taken from the building and transferred to the outside air. Because heat pumps rely on the outside air as the heat source in the wintertime, they are much more common in warmer climates. Heat pumps are rated for both heating and cooling – both in terms of capacity and efficiency.

This analysis assumes that a single or poly-phase packaged or split system unitary heat pump meeting CEE Tier II efficiency criteria replaces a heat pump meeting CEE Tier I efficiency criteria. High efficiency and baseline levels reflect weighted averages by size and type of units.

(2) Packaged Terminal Heat Pumps and Air Conditioning: The efficient design of the PSC motor and airflow pattern help to reduce the energy consumption of the fan. Packaged terminal heat pumps tend to be more efficient than electric heat only. In fact, operating savings may result in a payback of less than one year. During heating operation, refrigerant in the heat pump runs in the reverse direction of the cooling operation. The outside air is cooled, thereby giving up heat to the refrigerant in the heat pump. This heat is then pumped back inside, resulting in up to three Btu's of heat for every Btu of energy consumed. During cooling operation, heat is removed from the building as the air is cooled. This heat proceeds through the compression cycle and is ultimately rejected to the outside air.

(3) Centrifugal Chiller[2,3]*:* Water chillers come in many different types (centrifugal, rotary, screw, scroll, reciprocating, and gas absorption) and typically reject waste heat either through air-cooled or water-cooled condensers. Centrifugal chillers are used in building types which normally use water-based cooling systems and have cooling requirements greater than 200 tons. Centrifugal chillers reject heat through a water cooled condenser or cooling tower. In general, efficiency levels for centrifugal chillers start at 0.80 kW/ton (for older units) and may go as high as 0.4 kW/ton. This measure involves installation of a high-efficiency chiller (0.51 kW per ton) versus a standard unit (0.58 kW per ton).

---

[1] Nexant, 2005. NYSERDA Deemed Savings Measure Database. Prepared for NYSERDA

[2] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.

[3] Nexant, 2007. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures. For Frontier Associates, LLC, March, 2007.

When a water-cooled chiller is replacing an air-cooled chiller, the additional auxiliary electrical loads for the condenser water pump and the cooling tower fan has to be considered, therefore a penalty factor of 0.109 kW needs to be used as the adjustment downward to account for the peak demand and energy savings.

(4) DX Packaged System, EER=10.9, 10 tons; Tier 2, <20 Tons; Tier 2, >20 Tons[4]*:* A single-package DX A/C unit consists of a single package (or cabinet housing) containing a condensing unit, a compressor, and an indoor fan/coil.

An additional benefit of package units is that there is no need for field-installed refrigerant piping, thus minimizing labor costs and the possibility of contaminating the system with dirt, metal, oxides or non-condensing gases. This measure involves installation of a TIER 2 high efficiency unit (EER=10.9) versus a standard unit (EER=10.3).

2. WATER HEATING

Standard electric water heaters use resistance heating elements to transfer heat to a reservoir in a storage tank system or instantaneously as the water passes through the heater in a point-of-use or on-demand water heater system. Thermal efficiency is relatively constant for electric resistance water heaters, with slight efficiency improvements available through improved insulation to minimize standby losses. Significant efficiency savings may be achieved through the installation of heat pump water heaters that capture heat from the air and transfer it to the water in the tank.

(1) Pre-Rinse Sprayer, Low Flow, Commercial Applications[5]: Pre-rinse sprayers are an essential component of kitchen operations—they are used to get the leftover food and grease off dishes, pots and pans before they go into a dishwasher. While conventional sprayers use between 2.5 and 4 gallons of water per minute (gpm), the low-flow sprayers use from 1.6 to 2.65 gallons per minute, according to the Energy Ideas Clearinghouse of the Washington State University Extension Energy Program in Olympia, Wash. Hot water is used in the sprayers and so low-flow spray valves lead to reduced water heating bills.

(2) Water Heater Blanket[6]*:* Water heater jackets are designed to wrap around an existing water heater tank to improve insulation, prevent heat loss, and save energy. Installing an insulating blanket can reduce water heating energy use by 3-9%.

(3) On Demand[7]: Demand (tankless or instantaneous) water heaters provide hot water only as it is needed. Demand water heaters heat water directly without the use of a storage tank. Therefore, they avoid the standby heat losses associated with storage water heaters. Typically, demand water heaters provide hot water at a rate of 2–5 gallons (7.6–15.2 liters) per minute.

(4) High Efficiency Storage Tank[8]: In a high efficiency storage tank, Water is kept hot and ready for use at all times in insulated storage tanks with capacities ranging from 20 to 80 gallons. Many

---

[4] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.

[5] "PreRinseSprayers."http://www.focusonenergy.com/files/document_management_system/business_programs/prerinsesprayers_technicalsheet.pdf

[6] Consumer Guide to Home Energy Savings, 8th ed. ACEEE. Washington D.C. 2003.

[7] "Demand (tankless or instantaneous) Water Heaters." www.energysavers.gov/your_home/water_heating

[8] "High Efficiency Water Heaters." www.energystar.gov/ia/new_homes/features/WaterHtrs_062906.pdf

fuel options are available, including electricity, natural gas, oil, and propane. One drawback of these units is the energy used to keep the water hot at all times, otherwise known as "standby losses."

3. LIGHTING

Controls[9]***:*** There are several varieties of automatic lighting controls, including wall or ceiling mounted occupancy sensors, integral occupancy sensors (including bi-level controls), photocells, and time clocks. Demand and Energy savings were reviewed for lighting control measures to confirm the appropriateness of current values.

(1) Occupancy Sensors - wall; ceiling; HID; bi-level controls[10]*:* Occupancy sensors (infrared or ultrasonic motion detection devices) turn lights on upon entry of a person into a room, and then turn the lights off from ½ minute to 20 minutes after they have left. Occupancy sensors in commercial buildings require proper installation and calibration. Their savings depend on the mounting type, but typical energy savings for these controls are 20% over lights not equipped with occupancy sensors.

Fixtures[11]***:*** A variety of high efficiency fixtures, ballasts and lamps exist in the market today, producing the same amount of lumens, while consuming less electricity. Deemed lighting savings are mature components of utility sponsored DSM offerings around the country. The operating hours and demand factors for the different building types listed in this report are based on an in-depth research on a wide array of information available in the market.

(2) Super T8 Fixture - from 34W T12; from standard T8[12]*:* "High-Performance" or "Super" T8 lamp/ballast systems have higher lumens per watt than standard T8 systems. This results in lamp/ballast systems that produce equal or greater light than standard T8 systems, while using fewer watts. When used in a high-bay application, high-performance T8 fixtures can provide equal light to HID High-Bay fixtures, while using fewer watts.

(3) T5 Fluorescent High-Bay Fixtures; Troffer/Wrap; Industrial Strip; Indirect[13]*:* A T5 high-bay fixture has a fixture efficiency of over 91%, while a metal-halide fixture has a fixture efficiency of approximately 70%. By using a more efficient fixture, a space can be lit with fewer watts or fixtures. Typically, a 4-lamp F54T5HO system using 240 watts will provide as much light on a target surface as a standard 400 watt metal-halide fixture using 455 watts.

(4) CFL Fixture; CFL Screw-in[14]*:* An existing incandescent lamp is replaced with a lower wattage compact fluorescent lamp in either a hardwired fixture or screw-in fixture. CFLs have become an icon of energy efficiency and are commonly used as simple substitutes for incandescent lamps due to their significantly longer life and better energy efficiency. CFL's use approximately ¼ of the electricity as compared to a similar incandescent lamp and CFL's

---

[9] Nexant, 2007. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures. For Frontier Associates, LLC, March, 2007.
[10] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.
[11] Nexant, 2007. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures. For Frontier Associates, LLC, March, 2007.
[12] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41
[13] Ibid.
[14] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41

last between 8 and 10 times longer than a typical incandescent lamp. Dimmable CFL lamps are available. Much of the original concern over the performance of CFL's has been addressed through instant-start lamps (no flicker) and the use of electronic ballasts that function at much higher frequencies than their magnetic counterparts (no noticeable strobe effect)
(5) LED Exit Sign[15]*:* Exit sign illuminated with light emitting diodes (LED).

(6) Pulse Start Metal Halide[16]*:* Unlike incandescent lamps, which generate lighting by heating a filament, discharge lamps ionize a vapor to produce light. Metal halide high-intensity discharge ("HID")lamps that provide an intense cone of light are widely used because they are about three times as efficient as incandescent lamps. Traditional probe-start metal halide lamps do not use an igniter and require three electrical contacts to ignite the gas and remain lit. Recently developed pulse-start metal halide lamps use only two contacts and use an igniter located inside the ballast pod. Pulse-start lamps offer several benefits: higher light output per unit of electric power, higher light output as lamps age, longer lamp life, more stable color rendering as lamps age, and quicker startup – pulse-start lamps can reach full brightness in two to four minutes instead the five to ten minutes needed by probe-start lamps.

4. COOKING

The cooking end-use measures used in this study were taken from the Arkansas *Food Service Deemed Savings* manual.[17] Although the manual only refers to gas-fired food service equipment replacing existing gas equipment, the deemed savings include interactive electricity savings associated with each technology. All of the potential savings associated with cooking measures in this study result from the interactive electricity savings listed in the manual.

(1) Energy Star Ovens[18]*:* Commercial convection ovens are the most widely used appliances in the foodservice industry. These are the workhorses of the commercial kitchen, with a wide variety of uses from baking and roasting to warming and reheating. In addition to traditional uses, convection ovens are used for nearly all types of food preparation, including foods typically prepared using other types of appliances (e.g., griddles, fryers, etc.). Commercial ovens that have earned the ENERGY STAR are about 20 percent more energy efficient than standard models.

(2) Energy Star Griddles[19]*:* ENERGY STAR qualified griddles include thermostatically controlled, gas and electric, single- and double-sided models. It must also be 10 percent more energy efficient than standard models.

(3) Energy Star Steamers[20]: Steam cookers, also known as "compartment steamers", that have earned the ENERGY STAR are up to 50 percent more energy efficient than standard models. ENERGY STAR qualified steam cookers include both electric and gas models. Steam cookers that earn the ENERGY STAR must meet a minimum cooking efficiency* of 50 percent

---

[15] Ibid.
[16] Definition provided by Natural Resources Canada. www.nrcan.gc.ca
[17] Frontier Associates, LLC, 2007. Food Service Deemed Savings, Efficiency and Installation Standards for Arkansas Statewide Quick Start Programs. April 2007.
[18] www.energystar.gov
[19] Ibid.
[20] Ibid.

(electric) and 38 percent (gas) while also meeting maximum idle energy rates. Idle energy rates are given for 3-, 4-, 5-, and 6-pan sizes. Energy efficient steam cookers that have earned the ENERGY STAR offer shorter cook times, higher production rates, and reduced heat loss due to better insulation and more efficient steam delivery system.

(4) Energy Star Fryers[21]*:* Fryers that have earned the ENERGY STAR are up to 30 percent more energy efficient than standard models. ENERGY STAR qualified fryers include both gas and electric open deep-fat models. Fryers that earn the ENERGY STAR must meet a minimum cooking efficiency of 50 percent (gas) and 80 percent (electric) while also meeting a maximum idle energy rate of 9,000 Btu/hr (gas) and 1,000 watts (electric). Energy efficient fryers that have earned the ENERGY STAR offer shorter cook times and higher production rates through advanced burner and heat exchanger designs. Fry pot insulation reduces standby losses resulting in a lower idle energy rate.

(5) Energy Star Hot Food Holding Cabinets[22]*:* Hot food holding cabinets that have earned the ENERGY STAR are 65 percent more energy efficient than standard models. Hot food holding cabinet models that earn the ENERGY STAR must meet a maximum idle energy rate of 40 watts/ft^3. This means that ENERGY STAR qualified hot food holding cabinets are more efficient at maintaining food temperature while using less energy. Models that meet this requirement incorporate better insulation, reducing heat loss, and may also offer additional energy saving devices such as magnetic door gaskets, auto-door closures, or dutch doors. The insulation of the cabinet also offers better temperature uniformity within the cabinet from top to bottom.

5. REFRIGERATION

Commercial refrigerators and freezers are commonly found in restaurants and other food service industries. Reach in, solid door refrigerators and freezers are significantly more efficient than regular refrigerators and freezers due to better insulation and higher efficiency components. There are recognized high-efficiency designations, Tier 1 or Tier 2, for these types of refrigerators and freezers, which relate the volume of the appliance to its daily energy consumption. Tier 1 corresponds to Energy Star minimum efficiency levels while Tier 2 is the minimum efficiency level set by the Consortium for Energy Efficiency (CEE). Tier 2 refrigerators and freezers are 40% and 30% more efficient than Tier 1 refrigerators and freezers respectively. The three most common size refrigerators and freezers, one, two and three door, at both Tier 1 and Tier 2 levels, were analyzed for this report.[23]

(1) High Efficiency Refrigerators[24]*:* The measure described here is a high-efficiency packaged commercial reach-in refrigerator with solid doors, typically used by foodservice establishments. This includes one, two and three solid door reach-in, roll-in/through and pass-through commercial refrigerators. Beverage merchandisers – a special type of reach-in refrigerator with glass doors – are not included in this characterization. A high efficiency reach-in refrigerator can fall into one of two tiers: Tier 1 – those meeting the ENERGY STAR specifications, or Tier 2 – those meeting ENERGY STAR plus 40% more efficient.

---

[21] Ibid

[22] Ibid

[23] Nexant, 2007. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures. For Frontier Associates, LLC, March, 2007.

[24] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41

(2) High Efficiency Freezers[25]*:* The measure described here is a high-efficiency packaged commercial reach-in freezer with solid doors, typically used by foodservice establishments. This includes one, two and three solid door reach-in, roll-in/through and pass-through commercial freezers. A high efficiency reach-in freezer can fall into one of two tiers: Tier 1 – those meeting the ENERGY STAR specifications, or Tier 2 – those meeting ENERGY STAR plus 40% more efficient.

(3) Night Covers for Refrigerator and Freezer Display Cases[26]*:* Installing film or blanket type night covers on display cases can significantly reduce the infiltration of warm ambient air into the refrigerated space. This reduction in display case loads in turn reduces the electric use of the central plant, including compressors and condensers, thus saving energy. The target market for this measure is small, independently owned grocery stores and other stores that are typically closed at night and restock their shelves during the day. The target cases are vertical displays, with a single- or double-air curtain, and tub (coffin) type cases. [CA pg A-20].

(4) Vender Miser[27]*:* The Vending Miser is an energy control device for refrigerated vending machines. Using an occupancy sensor, during times of inactivity the Vending Miser turns off the machine's lights and duty cycles the compressor based on the ambient air temperature. The Vending Miser is applicable for conditioned indoor installations. The Baseline is a soft-drink vending machine without a Vending Miser device (typical usage of 3555 kWh).

(5) Demand Defrost Controls[28]*:* Defrost of evaporator coils in freezer displays is normally completed on a timed basis, but this is wasteful, as the time interval is designed to remove ice around the coil under worst case humidity levels. Demand defrost sensor and control systems are designed to optimize coil defrost. Demand defrost controls can work in conjunction with both electric heat defrost and hot gas defrost systems. Unfortunately, at the time, industry experts suggest that this technology is still in an early stage of design and not yet ready for the market. However, in the near future this technology should be viewed as a substantial opportunity for energy savings.

(6) Humidistat Controls[29]*:* A humidistat control is a control device to turn refrigeration display case anti-sweat heaters off when ambient relative humidity is low enough that sweating will not occur. Anti-sweat heaters evaporate moisture by heating the door rails, case frame and glass of display cases. Savings result from reducing the operating hours of the anti-sweat heaters, which without a humidistat control generally run continuously. There are various types of control strategies including cycling on a fixed schedule.

(7) High Efficiency Fan and Compressor Motors[30]*:* Packaged refrigeration equipment is estimated to account for more than half of the electricity used by refrigeration systems in the commercial sector. In the U.S., the ENERGY STAR-labeled commercial refrigerators and freezers are generally at least 25% more efficient than some products in the market. However, the existing

---

[25] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41

[26] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.

[27] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41

[28] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.

[29] Ibid.

[30] Efficient Fan Motor Options for Commercial Refrigeration, Emerging Technologies & Practices, ACEEE, 2004
http://www.aceee.org/pubs/a042_r3.pdf#search=%22fan%20motors%20measure%20description%22

stock of packaged refrigeration equipment is considered very inefficient due to the focus by most purchasers on first cost and the lack of effort from manufacturers to differentiate equipment on the basis of energy efficiency.

Fans and fan motors used in the condensers and evaporators account for 20% of the annual energy use and operate at overall efficiencies as low as 7 to 15%. These low efficiencies are due to both inefficient fans and low cost shaded pole (SP) motors with low efficiencies. New axial fan designs enable improved fan performance and advanced electric motors such as brushless DC or electronically commutated motors (ECM) offer motor performance solutions.

It appears that the majority of currently installed evaporator and condenser fan-motor sets can be replaced with advanced units that can achieve energy savings as high as 70% of the fan-motor energy. The input fan power of an evaporator and condenser in a typical 48 ft3 two-door reach-in commercial refrigerator can be reduced from 70W (35W per component) to 20W (10W per component) with use of the energy-efficient fans and motors. Incremental costs range from a low of approximately $20 for a better fan with a brushless DC motor to $50 for an ECM motor. The total incremental cost for a commercial fridge would be in the range of $40 to $100.

(8) Compressor VSD Retrofit[31]*:* A variable speed compressor is a screw or reciprocating compressor whose current is modulated by a frequency inverter. A controller senses the compressor suction pressure and modulates the current and therefore the motor speed in response to changes in this pressure. When low load conditions exist, the current to the compressor motor is decreased, decreasing the compressor work done on the refrigerant.

(9) Walk-in Cooler/Freezer Controls and Economizers[32]*:* Economizers save energy in walk-in coolers by bringing in outside air when it is sufficiently cool, rather than operating the compressor. High efficiency is a walk-in refrigeration system with an outside air economizer.

(10) Ice Machine, Energy Star, Self-Contained[33]: Ice makers are also classified as batch or continuous in operation. Batch models tend to produce ice that is purer than its source water, because the freezing process separates out the impurities. In continuous units, chemicals tend to remix in an ice/water combination. Controls for batch ice makers are more complicated—they must end the freezing process at the proper time to start a thawing cycle, and resume the freezing process after the ice has been harvested.

(11) Zero Energy Doors and Frames[34]: doors/frames are highly insulated, with either double- or triple-pane units and low-E glass coatings or low-conductivity filler gas (e.g., argon). They are also doors and frames that are completely free of electric resistance heating (i.e., no heaters in door frames).

(12) Commercial Refrigeration Tune Up: Operational maintenance of commercial refrigeration unit that includes cleaning of dirty coils, re-lubricating refrigeration lines, and making sure connections to the unit are not faulty. The tune up extends the elascity and the durability of the refrigeration unit.

---

[31] California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002.
[32] Efficiency Vermont Technical Reference User Manual (TRM) No. 2006-41
[33] "Ice Makers." http://www.mge.com/business/saving/BEA
[34] "2009 Rebate Application: Commercial Refrigeration Equipment.", Efficiency Vermont

(13) Advanced Refrigeration Technologies Fan Controller[35]: the Advanced Refrigeration Technologies (ART) Fan Controller can reduce the costs of using these refrigeration units up to 50%. The ART Evaporator Fan Controller is inexpensive and easy to install. It regulates the speed of the evaporator fan motors to meet the need of each phase of the refrigeration cycle. Just as energy is saved by turning off the lights in an unoccupied room, this controller saves energy by running the fans only as fast as the refrigerator needs at the time.

(14) LED Case Lighting[36]: Higher energy efficiency and better performance at low temperatures allows LED case lighting to use up to 50 percent less energy than fluorescent systems. Additionally, LED systems emit less heat, which means the refrigeration compressor does not have to work as hard to remove heat as with fluorescent systems. LED fixtures efficiently direct the light where it is truly needed, eliminating wasteful light that spills out onto the floor. LEDs are also able to illuminate shelves in a more uniform manner. LED lighting contains no mercury. Also, its reduced energy consumption will aid in preventing unnecessary green house gas emissions associated with energy production.

6. OFFICE EQUIPMENT

(1) Plug Sensors[37]*:* Plug load occupancy sensors are devices that control low wattage devices (<150 watts) using an occupancy sensor. Common applications are computer monitors, desk lamps, printers, and other desktop equipment. Two size tiers were analyzed based on available products in the market: 50 and 150 watt.

7. MOTORS (VENTILATION AND NON-VENTILATION)

(1) Motors - Variable Frequency Drives[38]*:* Installation of Variable Speed Drives (VSDs) will ensure that pumps are performing at maximum efficiency at partial-load conditions. The power required to operate a pump motor is proportional to the cube of the operating speed. For example, in a pump system with a VSD, a load reduction that results in a 10-percent reduction in motor speed reduces energy consumption by 27 percent [0.9 x 3 = 0.27].

(2) NEMA Premium Efficiency Motors[39]: NEMA motors (National Electrical Manufacturers Association) for the North American market distinguish themselves as a result of their new design – and especially as a result of their efficiency. NEMA motors are suitable in all types of industries, in sectors such as the automobile, textile, printing, chemical branches as well as in cross-industry applications – for example in conveyor technology. The HVAC sector (Heating, Ventilating & Air Conditioning), which requires extremely light motors are typical applications for our so-called General Purpose motors – either with gray cast iron or aluminum frames. Severe duty motors in a full gray cast iron design are suitable for use in tough ambient conditions – for instance in the pulp and paper industry. The Severe Duty SD100 IEEE 841 motor version even exceeds the stringent IEEE 841 Standards applicable in the crude oil and chemical industries.

---

[35] "Inventions and Innovation: EVAPORATOR FAN CONTROLLER FOR MEDIUM-TEMPERATURE WALK-IN REFRIGERATORS." http://www.e3energy.org/schrum.pdf
[36] "LED Refrigerated Case Lighting Display." http://www.pge.com/mybusiness
[37] Nexant, 2007. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures. For Frontier Associates, LLC, March, 2007.
[38] http://www.energystar.gov/ia/business/BUM_heat_cool.pdf
[39] "Motors acc. to NEMA." http://www.automation.siemens.com/mcms/large-drives/en/motors/low-voltage-motors/nema-motors/Pages/nema-motors.aspx

8. COMPRESSED AIR

(1) Compressed Air Leaks[40]: Leaks are a significant source of wasted energy in a compressed air system, often wasting as much as 20-30% of the compressor's output. Compressed air leaks can also contribute to problems with system operations, including fluctuating system pressure, which can cause air tools and other air-operated equipment to function less efficiently, possibly affecting production, excess compressor capacity, resulting in higher than necessary costs, and decreased service life and increased maintenance of supply equipment (including the compressor package) due to unnecessary cycling and increased run time.

(2) Engineered Nozzles[41]: Engineered Nozzles reduce air consumption and noise levels; ordinary nozzles cannot compete. Engineered Nozzles maintain safety features and can qualify for an energy savings rebate from a local utility; ordinary nozzles fall short. Open blow off or homemade blow off applications typically violate OSHA safety standards; Engineered Nozzles do not.

---

[40] "Energy Tips: Minimize Compressed Air Leaks." www.energystar.gov/ia/business/industry/compressed_air3.pdf

[41] "Engineered vs. Ordinary." http://www.docstoc.com/docs/42121280/Engineered-Vs-Ordinary-Air-Nozzles

Commercial and Industrial Measure Assumptions and B/C Test Results Discount Rate 6.33%

	Measure Name	Unit Notes	Annual kWh Saved	Percent Savings (kWh)	Winter KW Savings	Summer KW Savings	Incremental Cost	Measure Useful Life	Annual Amortized Cost Per Unit	Levelized Cost (- Admin)	TRC Test	Utility Test	Part. Test	RIM Test
1	***Lighting***													
1-1	Compact Fluorescent	bulb	202.00	74.00%	0.049	0.046	$3.00	2	$1.64	$0.01	6.97	19.93	9.53	0.73
1-2	LED Exit Sign	exit sign	201.00	87.00%	0.023	0.023	$25.00	15	$2.63	$0.01	5.74	16.39	6.86	0.84
1-3	Standard T8 (vs T12) 4ft	fixture	96.00	43.00%	0.024	0.011	$45.00	12	$5.46	$0.06	1.46	4.16	1.80	0.81
1-4	High Performance T8 (vs T12) 4ft	fixture	115.00	51.57%	0.113	0.113	$51.75	12	$6.28	$0.05	2.66	7.59	1.86	1.42
1-5	High Performance T8HO (vs T12) 8ft	fixture	138.00	43.00%	0.034	0.034	$69.00	12	$8.38	$0.06	1.36	3.89	1.71	0.79
1-6	Occupancy Sensor (under 500W)	sensor	397.00	41.00%	0.099	0.099	$100.00	10	$13.80	$0.03	2.28	6.52	2.69	0.85
1-7	Occupancy Sensor (over 500W)	sensor	994.00	41.00%	0.243	0.243	$200.00	10	$27.60	$0.03	2.84	8.12	3.27	0.87
1-8	Pulse Start Metal Halide 100W - 300W	fixture	220.50	9.00%	0.059	0.049	$23.00	15	$2.42	$0.01	8.07	23.06	8.11	1.00
1-9	Pulse Start Metal Halide > 300W	fixture	315.00	20.00%	0.084	0.070	$38.00	15	$4.00	$0.01	6.98	19.94	7.06	0.99
1-10	High performance T5 (replacing T8)	fixture	84.00	28.00%	0.000	0.000	$40.00	15	$4.21	$0.05	1.46	4.18	2.05	0.71
1-11	CFL Hard Wired Fixture	fixture	236.00	74.00%	0.043	0.036	$12.00	15	$1.26	$0.01	12.10	34.58	13.64	0.89
1-12	CFL High Wattage 31-115	bulb	572.50	68.00%	0.104	0.087	$35.00	15	$3.68	$0.01	10.75	30.71	11.40	0.94
1-13	CFL High Wattage 150-199	bulb	614.50	49.00%	0.112	0.094	$175.00	15	$18.41	$0.03	2.60	7.42	3.10	0.84
2	***Space Cooling***													
2-1	Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	5 ton	4,533.57	15.00%	0.000	0.089	$575.00	15	$60.49	$0.01	4.32	12.33	6.73	0.64
2-2	Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	5 ton	4,700.59	15.00%	0.000	0.091	$860.00	15	$90.47	$0.02	2.99	8.55	4.77	0.63
2-3	Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	5 ton	5,003.31	15.00%	0.000	0.096	$1,000.00	15	$105.19	$0.02	2.74	7.83	4.40	0.62
2-4	Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	8.3 ton	7,555.95	15.00%	0.000	0.125	$954.50	15	$100.41	$0.01	4.33	12.38	6.76	0.64
2-5	Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	8.3 ton	7,834.32	15.00%	0.000	0.128	$1,427.60	15	$150.18	$0.02	3.00	8.58	4.79	0.63
2-6	Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	8.3 ton	8,338.85	15.00%	0.000	0.132	$1,660.00	15	$174.62	$0.02	2.75	7.86	4.42	0.62
2-7	DX Packaged System (EER=10.9)	10 ton	4,439.00	17.43%	0.000	4.035	$607.00	15	$63.85	$0.01	4.00	11.44	6.27	0.64
2-8	DX Packaged System (CEE Tier 2)	< 20 ton	9,550.00	7.00%	0.000	8.682	$910.00	15	$95.73	$0.01	5.75	16.41	8.84	0.65
2-9	DX Packaged System (CEE Tier 2)	> 20 ton	12,733.00	18.00%	0.000	11.575	$1,813.00	15	$190.72	$0.01	3.84	10.99	6.03	0.64
2-10	Air Cooled Chiller	5 ton	4,720.06	15.00%	0.000	0.260	$575.00	23	$48.13	$0.01	6.30	18.00	9.20	0.68
2-11	Air Cooled Chiller	8 ton	7,313.31	15.00%	0.000	0.260	$920.00	23	$77.00	$0.01	6.10	17.43	8.92	0.68
2-12	PTAC	1/2 ton	201.20	31.91%	0.000	0.119	$50.00	15	$5.26	$0.03	2.20	6.29	3.61	0.61
2-13	PTAC	3/4 ton	178.23	21.13%	0.000	0.105	$75.00	15	$7.89	$0.04	1.30	3.72	2.27	0.57
2-14	PTAC	1 ton	352.85	31.76%	0.000	0.208	$100.00	15	$10.52	$0.03	1.93	5.52	3.21	0.60
2-15	PTAC	1 1/4 ton	469.25	28.90%	0.000	0.277	$150.00	15	$15.78	$0.03	1.71	4.89	2.88	0.59
3	***Space Heating***													
3-1	PTHP	1/2 ton	785.41	19.15%	0.071	0.000	$50.00	15	$5.26	$0.01	10.20	29.14	13.06	0.78
3-2	PTHP	3/4 ton	1,004.29	25.87%	0.131	0.000	$75.00	15	$7.89	$0.01	8.80	25.13	11.19	0.79
3-3	PTHP	1 ton	1,445.84	35.16%	0.241	0.000	$100.00	15	$10.52	$0.01	9.60	27.42	12.05	0.80
3-4	PTHP	1 1/4 ton	1,712.61	30.45%	0.285	0.000	$150.00	15	$15.78	$0.01	7.58	21.66	14.21	0.79
4	***Ventilation***													
4-1	Motors	1 to 5 HP	204.00	2.89%	0.056	0.062	$88.00	15	$9.26	$0.05	1.93	5.50	2.89	0.87
4-2	Motors	7.5 to 20 HP	737.92	9.68%	0.201	0.223	$227.00	15	$23.88	$0.03	2.70	7.72	4.05	0.91
4-3	Motors	25 to 100 HP	2,092.19	11.58%	0.569	0.631	$558.00	15	$58.70	$0.03	3.11	8.90	4.67	0.92
4-4	Motors	125 to 250 HP	6,276.56	12.32%	1.706	1.894	$1,079.00	15	$113.50	$0.02	4.83	13.80	7.24	0.96
4-5	Variable Frequency Drives	<2 HP	598.72	25.00%	0.154	0.170	$200.00	15	$21.04	$0.04	6.57	18.76	9.96	0.96
4-6	Variable Frequency Drives	3 to 10 HP	3,592.31	25.00%	0.921	1.022	$1,000.00	15	$105.19	$0.03	4.27	12.20	6.47	0.94
4-7	Variable Frequency Drives	11 to 50 HP	16,764.11	25.00%	4.298	4.771	$3,000.00	15	$315.58	$0.02	7.23	20.64	10.96	0.97
5	***Motors (Non-Ventilation)***													
5-1	Motors	1 to 5 HP	113.00	2.89%	0.031	0.031	$88.00	15	$9.26	$0.08	1.07	3.05	1.60	0.77
5-2	Motors	7.5 to 20 HP	408.00	9.68%	0.111	0.111	$227.00	15	$23.88	$0.06	1.49	4.27	2.24	0.83
5-3	Motors	25 to 100 HP	1,056.00	11.58%	0.287	0.287	$558.00	15	$58.70	$0.06	1.57	4.49	2.36	0.84
5-4	Motors	125 to 250 HP	2,435.00	12.32%	0.662	0.662	$1,079.00	15	$113.50	$0.05	1.87	5.36	2.81	0.86
5-5	Variable Frequency Drives	<2 HP	598.72	25.00%	0.154	0.154	$200.00	15	$21.04	$0.04	2.46	7.03	3.73	0.89
5-6	Variable Frequency Drives	3 to 10 HP	3,592.31	25.00%	0.921	0.921	$1,000.00	15	$105.19	$0.03	2.95	8.43	4.47	0.91

	Measure Name	Unit Notes	Annual kWh Saved	Percent Savings (kWh)	Winter KW Savings	Summer KW Savings	Incremental Cost	Measure Useful Life	Annual Amortized Cost Per Unit	Levelized Cost (- Admin)	TRC Test	Utility Test	Part. Test	RIM Test
5-7	Variable Frequency Drives	11 to 50 HP	16,764.11	25.00%	4.298	4.298	$3,000.00	15	$315.58	$0.02	4.59	13.11	6.96	0.94
6	***Water Heating***													
6-1	High Efficiency Storage (tank)		256.00	15.00%	0.054	0.045	$70.00	10	$9.66	$0.04	1.83	5.22	3.31	0.73
6-2	Pre-Rinse Sprayer, Low flow, Commercial Application		1,396.00	45.00%	0.233	0.196	$35.00	5	$8.38	$0.01	9.46	27.04	19.75	0.72
6-3	On Demand (tankless)		345.00	7.00%	0.072	0.061	$350.00	20	$31.34	$0.09	0.89	2.56	1.50	0.68
6-4	Tank Insulation		512.00	30.00%	0.108	0.091	$60.00	12	$7.29	$0.01	5.06	14.47	8.95	0.82
7	***Cooking***													
7-1	Electric Energy Star Fryers		983.00	6.50%	0.200	0.252	$4,252.00	15	$447.29	$0.46	0.18	0.51	0.29	0.33
7-2	Electric Energy Star Steamers,3-6 pan		13,162.00	51.00%	2.500	3.150	$4,150.00	15	$436.56	$0.03	2.41	6.88	3.95	0.83
7-3	Energy Star Hot Food Holding Cabinet		4,654.00	60.00%	0.638	0.803	$1,783.00	15	$187.56	$0.04	1.88	5.36	3.25	0.76
7-4	Energy Star Convection Ovens		1,879.00	15.40%	0.500	0.630	$2,928.50	10	$404.13	$0.22	0.36	1.04	0.58	0.50
7-5	Energy Star Griddles		651.00	11.00%	0.149	0.188	$4,089.50	15	$430.19	$0.66	0.13	0.36	0.20	0.26
8	***Refrigeration***													
8-1	Glass Door Freezer, <15-49 cu ft, Energy Star		2,759.00	24.17%	0.315	0.397	$100.00	9	$14.91	$0.01	11.42	32.63	22.87	0.75
8-2	Glass Door Freezer, 50+ cu ft, Energy Star		7,643.00	24.17%	0.873	1.099	$100.00	9	$14.91	$0.00	31.64	90.39	63.36	0.76
8-3	Solid Door Freezer, <15-49 cu ft, Energy Star		1,160.00	20.94%	0.132	0.167	$100.00	9	$14.91	$0.01	4.80	13.72	9.62	0.73
8-4	Solid Door Freezer, 50+ cu ft, Energy Star		4,181.00	20.94%	0.477	0.601	$100.00	9	$14.91	$0.00	17.31	49.45	34.66	0.76
8-5	Glass Door Refrigerator, <15 - 49 cu ft		724.33	25.07%	0.083	0.104	$100.00	9	$14.91	$0.02	3.00	8.57	6.00	0.70
8-6	Glass Door Refrigerator, 50+ cu ft, Energy Star		919.00	25.07%	0.105	0.132	$100.00	9	$14.91	$0.02	3.80	10.87	7.62	0.72
8-7	Solid Door Refrigerator, <15 cu ft, Energy Star		545.33	33.70%	0.062	0.078	$100.00	9	$14.91	$0.03	2.26	6.45	4.52	0.69
8-8	*Solid Door Refrigerator, 50+ cu ft, Energy Star*		*1,218.00*	33.72%	*0.139*	*0.175*	*$100.00*	9	$14.91	$0.01	5.04	14.40	10.10	0.73
8-9	Commercial Refrigeration Tune-Up, Medium Temp ,not self contained		537.00	7.00%	0.099	0.125	$75.00	1	$79.75	$0.15	0.33	0.93	0.77	0.39
8-10	Commercial Refrigeration Tune-Up, Low Temp, not self contained		1,388.00	7.00%	0.191	0.241	$75.00	1	$79.75	$0.06	0.82	2.33	1.98	0.50
8-11	Anti-sweat heater controls on freezers		1,745.50	16.46%	0.027	0.033	$170.00	12	$20.65	$0.01	4.95	14.15	10.77	0.67
8-12	Anti-sweat heater controls, on refrigerators		1,039.50	33.14%	0.028	0.035	$170.00	12	$20.65	$0.02	2.99	8.55	6.41	0.66
8-13	Vending Miser, Cold Beverage		1,694.00	48.50%	0.193	0.244	$160.00	15	$16.83	$0.01	6.97	19.93	13.18	0.78
8-14	Brushless DC Motors for freezers and coolers		1,050.00	8.79%	0.012	0.015	$25.00	5	$5.99	$0.01	8.46	24.18	20.80	0.61
8-15	Humidity Door Heater Controls for freezers and coolers		3,500.00	55.00%	0.094	0.118	$300.00	10	$41.40	$0.01	4.82	13.77	10.56	0.67
8-16	Refrigerated Case Covers		2,900.00	6.00%	0.331	0.417	$120.00	4	$34.89	$0.01	4.30	12.30	9.75	0.64
8-17	Zero Energy Doors for freezers and coolers		800.00	20.00%	0.165	0.208	$538.00	10	$74.24	$0.09	0.75	2.15	1.35	0.62
8-18	Evaporator Coil Defrost Control		600.00	43.60%	0.405	0.510	$500.00	10	$69.00	$0.12	0.90	2.58	1.09	0.85
8-19	Evaporator Fan Motor Control for freezers and coolers		2,600.00	35.77%	0.059	0.074	$2,254.00	13	$259.54	$0.10	0.60	1.72	1.29	0.51
8-20	Permanent Split Capacitor Motor		385.00	33.33%	0.044	0.055	$125.00	15	$13.15	$0.03	2.03	5.80	3.83	0.71
8-21	Ice Machine, Energy Star, Self-Contained		270.00	10.15%	0.029	0.037	$56.00	9	$8.35	$0.03	1.98	5.66	4.00	0.67
8-22	LED Case Lighting (5 door case)		398.00	61.00%	0.006	0.007	$190.00	8	$31.00	$0.08	0.45	1.28	0.87	0.49
9	***Office Equipment/Appliances***													
9-1	Watt Sensors on Office Electronics	50 Watt	129.00	59.00%	0.100	0.100	$75.00	10	$10.35	$0.08	0.91	2.59	1.56	0.67
9-2	Watt Sensors on Office Electronics	150 Watt	321.00	58.00%	0.200	0.200	$82.00	10	$11.32	$0.04	1.96	5.60	3.54	0.74
10	***Compressed Air***													
10-1	Fix Air Leaks	<5HP	262.50	15.00%	0.063	0.063	$75.00	1	$79.75	$0.30	0.18	0.50	0.37	0.30
10-2	Fix Air Leaks	10-50HP	2,009.67	15.00%	0.483	0.483	$75.00	1	$79.75	$0.04	1.35	3.86	2.86	0.61
10-3	Fix Air Leaks	50-100HP	6,134.50	15.00%	1.475	1.475	$75.00	1	$79.75	$0.01	4.12	11.78	8.74	0.68
10-4	Engineered Nozzles for blow-off		7,343.00	39.00%	3.680	3.680	$80.00	15	$8.42	$0.00	89.21	254.88	114.28	1.20

	Measure Name	Annual kWh Saved	Winter KW Savings	Summer KW Savings	Incremental Cost	Measure Useful Life
1	***Lighting***					
1-1	Compact Fluorescent	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-2	LED Exit Sign	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-3	Standard T8 (vs T12) 4ft	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-4	High Performance T8 (vs T12) 4ft	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-5	High Performance T8HO (vs T12) 8ft	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-6	Occupancy Sensor (under 500W)	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-7	Occupancy Sensor (over 500W)	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan	1 - Michigan
1-8	Pulse Start Metal Halide 100W - 300W	17 - Vermont	17 - Vermont	4 - GDS	17 - Vermont	17 - Vermont
1-9	Pulse Start Metal Halide > 300W	17 - Vermont	17 - Vermont	4 - GDS	17 - Vermont	17 - Vermont
1-10	High performance T5 (replacing T8)	17 - Vermont	17 - Vermont	4 - GDS	17 - Vermont	17 - Vermont
1-11	CFL Hard Wired Fixture	7 - Wisconsin	7 - Wisconsin	4 - GDS	14 - Maine	17 - Vermont
1-12	CFL High Wattage 31-115	7 - Wisconsin	7 - Wisconsin	4 - GDS	18 - Green Elec	17 - Vermont
1-13	CFL High Wattage 150-199	7 - Wisconsin	7 - Wisconsin	4 - GDS	18 - Green Elec	17 - Vermont
2	***Space Cooling (Unitary and Split AC)***					
2-1	Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-2	Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-3	Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-4	Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-5	Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-6	Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	15 - Measure Life
2-7	DX Packaged System (EER=10.9)	4 - GDS	4 - GDS	4 - GDS	19 - Connecticut	19 - Connecticut
2-8	DX Packaged System (CEE Tier 2)	4 - GDS	4 - GDS	4 - GDS	19 - Connecticut	19 - Connecticut
2-9	DX Packaged System (CEE Tier 2)	4 - GDS	4 - GDS	4 - GDS	19 - Connecticut	19 - Connecticut
2-10	Air Cooled Chiller	4 - GDS	4 - GDS	4 - GDS	14 - Maine	15 - Measure Life
2-11	Air Cooled Chiller	4 - GDS	4 - GDS	4 - GDS	14 - Maine	15 - Measure Life
2-12	PTAC	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
2-13	PTAC	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
2-14	PTAC	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	14 - Maine
2-15	PTAC	4 - GDS	4 - GDS	4 - GDS	13 - ActOnEnergy	14 - Maine
3	***Space Heating***					
3-1	PTHP	4- GDS	4- GDS	4- GDS	13 - ActOnEnergy	4- GDS
3-2	PTHP	4- GDS	4- GDS	4- GDS	13 - ActOnEnergy	4- GDS
3-3	PTHP	4- GDS	4- GDS	4- GDS	13 - ActOnEnergy	4- GDS
3-4	PTHP	4- GDS	4- GDS	4- GDS	13 - ActOnEnergy	4- GDS
4	***Ventilation***					
4-1	Motors 1 to 5 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
4-2	Motors 7.5 to 20 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
4-3	Motors 25 to 100 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
4-4	Motors 125 to 250 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
4-5	Variable Frequency Drives(<2HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
4-6	Variable Frequency Drives(3 to 10 HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
4-7	Variable Frequency Drives(11 to 50 HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
5	***Motors (Non-Ventilation)***					
5-1	Motors 1 to 5 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
5-2	Motors 7.5 to 20 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
5-3	Motors 25 to 100 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
5-4	Motors 125 to 250 HP	4 - GDS	4 - GDS	4 - GDS	14 - Maine	14 - Maine
5-5	Variable Frequency Drives(<2HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
5-6	Variable Frequency Drives(3 to 10 HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
5-7	Variable Frequency Drives(11 to 50 HP)	16 - Alliant	4 - GDS	4 - GDS	14 - Maine	17 - Vermont
6	***Water Heating***					
6-1	High Efficiency Storage (tank)	9 - MPRP	9 - MPRP	17 - Vermont/4 -GDS	9 - MPRP	10 - Construction
6-2	Pre-Rinse Sprayer, Low flow, Commercial Application	1 - Michigan	1 - Michigan	17 - Vermont/4 -GDS	1 - Michigan	1 - Michigan
6-3	On Demand (tankless)	11 - New York	11 - New York	17 - Vermont/4 -GDS	10 - Construction	10 - Construction
6-4	Tank Insulation	.2 - Energy Expert	12 - Energy Experts	17 - Vermont/4 -GDS	4 - GDS	12 - Energy Experts
7	***Cooking***					
7-1	Electric Energy Star Fryers	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	1 - Michigan	8 - Northwest
7-2	Electric Energy Star Steamers,3-6 pan	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	1 - Michigan	8 - Northwest
7-3	Energy Star Hot Food Holding Cabinet	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	1 - Michigan	8 - Northwest
7-4	Energy Star Convection Ovens	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	1 - Michigan	8 - Northwest
7-5	Energy Star Griddles	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	1 - Michigan	8 - Northwest
8	***Refrigeration***					
8-1	Glass Door Freezer, <15-49 cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-2	Glass Door Freezer, 50+ cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont

	Measure Name	Annual kWh Saved	Winter KW Savings	Summer KW Savings	Incremental Cost	Measure Useful Life
8-3	Solid Door Freezer, <15-49 cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-4	Solid Door Freezer, 50+ cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-5	Glass Door Refrigerator, <15 - 49 cu ft	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-6	Glass Door Refrigerator, 50+ cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-7	Solid Door Refrigerator, <15 cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-8	Solid Door Refrigerator, 50+ cu ft, Energy Star	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 -Vermont	17 -Vermont
8-9	Commercial Refrigeration Tune-Up, Medium Temp ,not self cor	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	19 - Refrig	19 - Refrig
8-10	Commercial Refrigeration Tune-Up, Low Temp, not self contair	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	19 - Refrig	19 - Refrig
8-11	Anti-sweat heater controls on freezers	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	20 - NW Council	20 - NW Council
8-12	Anti-sweat heater controls, on refrigerators	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	20 - NW Council	20 - NW Council
8-13	Vending Miser, Cold Beverage	17 - Vermont	4 - GDS	22 - Arkansas	17 - Vermont	17 - Vermont
8-14	Brushless DC Motors for freezers and coolers	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-15	Humidity Door Heater Controls for freezers and coolers	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-16	Refrigerated Case Covers	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-17	Zero Energy Doors for freezers and coolers	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-18	Evaporator Coil Defrost Control	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-19	Evaporator Fan Motor Control for freezers and coolers	17 - Vermont	17 - Vermont	22 - Arkansas	17 - Vermont	17 - Vermont
8-20	Permanent Split Capacitor Motor	17 - Vermont	7 - Wisconsin	22 - Arkansas	17 - Vermont	17 - Vermont
8-21	Ice Machine, Energy Star, Self-Contained	7 - Wisconsin	7 - Wisconsin	22 - Arkansas	17 - Vermont	17 - Vermont
8-22	LED Case Lighting (5 door case)	21 - PG&E	21 - PG&E	22 - Arkansas	13 - ActOnEnergy	4 -GDS
9	***Office Equipment/Appliances***					
9-1	Watt Sensors on Office Electronics (50W)	5 - Nexant	4 - GDS	4 - GDS	6 - DEER	6 - DEER
9-2	Watt Sensors on Office Electronics (150W)	5 - Nexant	4 - GDS	4 - GDS	6 - DEER	6 - DEER
10	***Compressed Air***					
10-1	Fix Air Leaks (<5HP)	2 - Alliant	4 - GDS	4 - GDS	23 - GA Tech	4 - GDS
10-2	Fix Air Leaks (10-50HP)	2 - Alliant	4 - GDS	4 - GDS	23 - GA Tech	4 - GDS
10-3	Fix Air Leaks (50-100HP)	2 - Alliant	4 - GDS	4 - GDS	23 - GA Tech	4 - GDS
10-4	Engineered Nozzles for blow-off	3 - Energy Star	3 - Energy Star	4 - GDS	1 - Michigan	3 - Energy Star

1 - Michigan Master Measure Savings Database, January 2009

2 - Alliant Energy Calculator for Variable Frequency Drives - http://www.alliantenergy.com/UtilityServices/ForYourBusiness/EnergyExpertise/EnergySafety/010794

3 - Energy Star

4 - GDS Calculation/Estimation

5 - Nexant, 2005. NYSERDA Deemed Savings Measure Database. Prepared for NYSERDA

6 - Database for Energy Efficient Resources - http://www.energy.ca.gov/deer/

7 - Wisconsin KEMA Technical Manual

8 - http://www.northwestern.edu/equipment-inventory/propertycodes.html

9 - MPRP Commercial Energy Efficiency and Demand Response Update Spreadsheet, June 2009.

10 - http://www.construction-today.com/cms1/content/view/1931/31/

11 - Energy Efficiency and Renewable Energy Resource Development Potential in NY State - Final Report, Volume 5 Energy Efficiency Technical Appendices, August 2003.

12 - http://energyexperts.org/EnergySolutionsDatabase/ResourceDetail.aspx?id=1243

13 - ActOnEnergy, Ameren Utilities Technical Resource Manual 2009

14 - Efficiency Maine, State of Maine Commercial Technical Resource Manual 2009

15 - Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates,Inc., June 2007

16 - http://www.alliantenergy.com/UtilityServices/ForYourBusiness/EnergyExpertise/EnergySafety/010794

17 - Efficiency Vermont Technical Reference User Manual - Measure Savinsg Algorithms and Cost assumptions - 2009

18 - http://www.greenelectricalsupply.com

19 - http://hvacrdistributionbusiness.com/hot_topics/refrigeration_new_commercial/

20 - NorthWest Council Industrial Conservation Data Catalogue

21 - Demonstration Assessment of Light-Emitting Diode (LED) Freezer Case Lighting - Oct 2009 Report by PG&E

22- Arkansas Deemed Savings Manual Coincidence factor calculation

23 - GA Tech, Energy and Environmental Management Center, PLANT-WIDE ASSESS for Shaw Industries (Plant #78) PREPARED BY: Michael Brown, P.E., C.E.M. April 2006

APPENDIX 3-2

TECHNICAL, ECONOMIC, AND ACHIEVABLE POTENTIAL

Total Potential by Measure

Measure Name	Technical Potential	Economic Potential	Achievable Potential
Lighting			
Compact Fluorescent	18,011,221	18,011,221	5,403,366
LED Exit Sign	1,750,371	1,750,371	525,111
Standard T8 (vs T12) 4ft	27,176,243	27,176,243	8,152,873
High Performance T8 (vs T12) 4ft	16,239,722	16,239,722	4,871,917
High Performance T8HO (vs T12) 8ft	13,541,104	13,541,104	4,062,331
Occupancy Sensor (under 500W)	149,077,520	149,077,520	44,723,256
Occupancy Sensor (over 500W)	5,140,604	5,140,604	1,542,181
Pulse Start Metal Halide 100W - 300W	4,000,005	4,000,005	1,200,002
Pulse Start Metal Halide > 300W	9,768,023	9,768,023	2,930,407
High performance T5 (replacing T8)	23,773,676	23,773,676	7,132,103
CFL Hard Wired Fixture	19,435,666	19,435,666	5,830,700
CFL High Wattage 31-115	21,898,050	21,898,050	6,569,415
CFL High Wattage 150-199	18,348,229	18,348,229	5,504,469
Space Cooling (Unitary and Split AC)			
Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
Split AC (10 SEER, 7.7 HSPF to 14.5 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
Split AC (10 SEER, 7.7 HSPF to 15 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
Split AC (10 SEER, 7.7 HSPF to 16 SEER, 8.5 HSPF)	1,001,794	1,001,794	300,538
DX Packaged System (EER=10.9)	11,367,726	11,367,726	3,410,318
DX Packaged System (CEE Tier 2)	5,148,940	5,148,940	1,544,682
DX Packaged System (CEE Tier 2)	13,240,131	13,240,131	3,972,039
Air Cooled Chiller	15,006,359	15,006,359	4,501,908
Air Cooled Chiller	15,006,359	15,006,359	4,501,908
PTAC	3,717,693	3,717,693	1,115,308
PTAC	2,461,854	2,461,854	738,556
PTAC	3,700,198	3,700,198	1,110,059
PTAC	3,365,918	3,365,918	1,009,775
Space Heating			
PTHP	698,039	698,039	209,412
PTHP	942,929	942,929	282,879
PTHP	1,281,485	1,281,485	384,445
PTHP	1,110,047	1,110,047	333,014
Ventilation			
Motors	699,473	699,473	209,842
Motors	2,259,232	2,259,232	677,770
Motors	12,152,652	12,152,652	3,645,796
Motors	10,779,048	10,779,048	3,233,714
Variable Frequency Drives	1,107,201	1,107,201	332,160
Variable Frequency Drives	7,957,877	7,957,877	2,387,363
Variable Frequency Drives	18,227,308	18,227,308	5,468,192
Motors (Non-Ventilation)	**26,810,421**	**26,810,421**	**8,043,126**
Motors	352,617	352,617	105,785
Motors	1,138,920	1,138,920	341,676
Motors	6,126,375	6,126,375	1,837,912
Motors	5,433,916	5,433,916	1,630,175

Measure Name	Technical Potential	Economic Potential	Achievable Potential
Variable Frequency Drives	558,160	558,160	167,448
Variable Frequency Drives	4,011,712	4,011,712	1,203,514
Variable Frequency Drives	9,188,721	9,188,721	2,756,616
Water Heating	**16,805,244**	**16,603,044**	**4,980,913**
High Efficiency Storage (tank)	4,585,779	4,585,779	1,375,734
Pre-Rinse Sprayer, Low flow, Commercial Application	5,482,897	5,482,897	1,644,869
On Demand (tankless)	202,200	0	0
Tank Insulation	6,534,367	6,534,367	1,960,310
Cooking	**1,985,921**	**1,373,989**	**412,197**
Electric Energy Star Fryers	108,974	0	0
Electric Energy Star Steamers,3-6 pan	505,244	505,244	151,573
Energy Star Hot Food Holding Cabinet	868,745	868,745	260,624
Energy Star Convection Ovens	410,749	0	0
Energy Star Griddles	92,209	0	0
Refrigeration	**86,885,716**	**65,143,035**	**19,542,911**
Glass Door Freezer, <15-49 cu ft, Energy Star	1,028,659	1,028,659	308,598
Glass Door Freezer, 50+ cu ft, Energy Star	1,028,659	1,028,659	308,598
Solid Door Freezer, <15-49 cu ft, Energy Star	1,179,352	1,179,352	353,806
Solid Door Freezer, 50+ cu ft, Energy Star	1,179,352	1,179,352	353,806
Glass Door Refrigerator, <15 - 49 cu ft	2,396,124	2,396,124	718,837
Glass Door Refrigerator, 50+ cu ft, Energy Star	2,396,124	2,396,124	718,837
Solid Door Refrigerator, <15 cu ft, Energy Star	3,565,675	3,565,675	1,069,703
Solid Door Refrigerator, 50+ cu ft, Energy Star	3,567,958	3,567,958	1,070,387
Commercial Refrigeration Tune-Up, Medium Temp ,not self cor	1,544,218	0	0
Commercial Refrigeration Tune-Up, Low Temp, not self contair	2,145,150	0	0
Anti-sweat heater controls on freezers	3,329,891	3,329,891	998,967
Anti-sweat heater controls, on refrigerators	10,683,041	10,683,041	3,204,912
Vending Miser, Cold Beverage	3,917,612	3,917,612	1,175,284
Brushless DC Motors for freezers and coolers	6,845,723	6,845,723	2,053,717
Humidity Door Heater Controls for freezers and coolers	8,807,905	8,807,905	2,642,371
Refrigerated Case Covers	837,336	837,336	251,201
Zero Energy Doors for freezers and coolers	1,459,315	0	0
Evaporator Coil Defrost Control	7,573,846	0	0
Evaporator Fan Motor Control for freezers and coolers	6,732,168	0	0
Permanent Split Capacitor Motor	13,975,831	13,975,831	4,192,749
Ice Machine, Energy Star, Self-Contained	403,796	403,796	121,139
LED Case Lighting (5 door case)	2,287,982	0	0
Office Equipment/Appliances	**17,833,669**	**8,840,622**	**2,652,187**
Watt Sensors on Office Electronics	8,993,047	0	0
Watt Sensors on Office Electronics	8,840,622	8,840,622	2,652,187
Compressed Air	**2,426,762**	**1,601,090**	**480,327**
Fix Air Leaks	825,672	0	0
Fix Air Leaks	800,902	800,902	240,270
Fix Air Leaks	454,119	454,119	136,236
Engineered Nozzles for blow-off	346,069	346,069	103,821
	Technical Potential	Economic Potential	Achievable Potential
	617,149,402	**584,773,871**	**175,432,161**

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Appendix 4
Demand Response Data

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

APPENDIX 4

DEMAND RESPONSE DATA

- "Analysis of a Renewable Portfolio Standard for the State of North Carolina." La Capra Associates. December 2006.

- Barrett, Larry. "Peak Load Management or Demand Response Programs: A Policy review." Association of Energy Services Professionals International Inc. Lakeworth, Fl. August 2001.

- "Consumers' Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment." Gas Appliance Manufacturers Association. 2000.

- "Demand Response Enabling Technologies for Small-Medium Businesses." Lockheed Martin Aspen. Rockville, Maryland. 12 April 2006.

- Ellington, Grant and Dewitt T. Gooden. "Mechanization and Curing."

- Elliott, Neal R. "Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to meet Texas' Growing Electricity Needs." American Council for an Energy-Efficient Economy. March 2007.

- Eppelheimer, Donald. "Let's Make Some Ice." The Trane Company. PowerPoint. 13 March 2003.

- Espey, James A. and Molly. "Turning on the Lights: A Meta-Analysis of Residential Electricity Demand Elasticities." Journal of Agricultural and Applied Economics. 2004.

- Faruqui, Ahmad, Ryan Hledik, and Sanem Sergici. "Rethinking Prices: The changing architecture of demand response in America." *Public Utilities Fortnightly*. January 2010. pp 31-39.

- Faruqui, Ahmad and Sanem Sergici. "Household Response to Dynamic Pricing of Electricity – A Survey of the Experimental Evidence." January 10, 2009.

- Freeman, Sullivan & Co. "2009 Load Impact Evaluation for Pacific Gas and Electric Company's Residential SmartRate™ – Peak Day Pricing and TOU Tariffs and SmartAC Program." April 1, 2010.

- "Florida Energy Efficiency and Conservation Act". Division of Economic Regulation and the Florida Public Service Commission. February 2007.

- Goldman, Charles. "A Methodology for Estimating Large-Customer Demand Response Market Potential". Ernest Orlando Lawrence Berkeley National Laboratory. August 2007.

- Herter, Karen. McAuliffe, Patrick. Rosenfeld, Arthur. "Observed Temperature Effects on Hourly Residential Electric Load Reduction in Response to an Experimental Critical Peak Pricing Tariff." Energy and Resources Group at Univ. of California at Berkeley. November 2005.

- Hope, Alan. "Energy Management Systems." PowerPoint. 27 April 2005.

- Kuchta, Robert J. "RSMeans Light Commercial Cost Data." 26th Annual Edition. Construction Publishers & Consultants, Kingston, MA. 2006.

- "Lighting Controls: How to Get the Right Amount of Light Where it's Needed, Only when it's Needed." Energy Design Resources.

- MacCraken, Mark M. "21st Century Cooling with Thermal Storage." CALMAC Mfg. Corp. 16 August 2005.

- Manczyk, Henry. "Economic Analysis for an Energy Management System in a Commercial Type of Office Building." Manczyk Energy Consulting. May 2003.

- "Means CostWorks 2007: Quick Start Guide". Kingston, MA. Data CD.

- Morante, Peter. "Making Lighting Responsive to Demand Response." Lighting Research Center and Rensselaer Polytechnic Institute. PowerPoint. 29 April 2005.

- Motagi, Naoya and David Watson. "Enterprise Energy Management System Installation Case Study at Food Process Plant." Lawrence Berkeley National Laboratory.

- "Product Data, Service Facts, Installers Guides, Submittals, Ratings and Use and Care". Trane Combination Data CD. American Standard. 2006.

- "Residential Load Management: Profile #54." Florida Power Corporation.

- "Residential Swimming Pool Efficiency." Building a Safer Florida. May 2006.

- Rutkowski, Hank. "Residential Equipment Selection: Manual S." Air Conditioning Contractors of America.

- Saenz, Steve. "Solving Peak Issues Through Demand Response." Utility Automation and Engineering T&D. PennWell Corporation. July 2007.

- "A Technical Introduction to Thermal Energy Storage Commercial Applications." CALMAC Mfg. Corp.. Englewood, NJ. 2002.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix B
Demand Side Management
Big Rivers Final Potential Study

Appendix 5
Supporting Documents for Recommended Programs

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

APPENDIX 5

SUPPORTING DOCUMENTS FOR
RECOMMENDED PROGRAMS

APPENDIX 5-1

RESIDENTIAL AND COMMERCIAL/INDUSTRIAL
ASSUMPTIONS BY MEASURE

Residential Program Measures and Assumptions

Lighting	Annual kWh	Winter kW	Summer kW	Cost	Incentive	Useful Life	Winter On	Winter Off	Summer On	Summer Off
CFL (vs. Incandescent)	30.66	0.01	0.00	$1.85	$1.85	7	31%	36%	15%	18%
LED (vs. Incandescent)	40.52	0.01	0.00	$30.00	$10.00	20	31%	36%	15%	18%
Residential Efficient Appliances										
Efficient Water Heater (SF)	193.94	0.01	0.00	$50.00	$35.00	13	50%	20%	21%	9%
Heat Pump Water Heater	2,067.90	0.28	0.19	$850.00	$350.00	10	50%	20%	21%	9%
Efficient Water Heater (MH)	200.09	0.01	0.00	$50.00	$35.00	13	50%	20%	21%	9%
Energy Star Compliant Top-Mount Refrigerator	106.00	0.01	0.01	$30.00	$25.00	12	35%	33%	16%	16%
Energy Star Compliant Side-by-Side Refrigerator	133.00	0.01	0.01	$30.00	$25.00	12	35%	33%	16%	16%
Energy Star Clothes Washer (Electric WH)	224.00	0.01	0.03	$258.00	$100.00	11	52%	17%	26%	6%
Energy Star Clothes Washer (Non-Electric WH)	97.00	0.01	0.03	$258.00	$100.00	11	52%	17%	26%	6%
Residential Advanced Technologies										
Heat Pump Water Heater	2,067.90	0.28	0.19	$850.00	$350.00	10	50%	20%	21%	9%
Geothermal Heat Pump Systems	3,658.00	4.45	0.07	$8,300.00	$1,500.00	22	34%	38%	15%	13%
Weatherization										
Ceiling Insualtion (R19-R38)	261.29	0.13	0.07	$882.30	$350.00	20	15%	16%	37%	33%
Ceiling Insualtion (R9-R38)	848.98	0.42	0.29	$1,159.10	$450.00	20	15%	16%	37%	33%
Floor Insualtion (R0-R19)	668.08	0.48	0.15	$1,366.70	$550.00	20	15%	16%	37%	33%
Floor Insualtion (R0-R19) - MH	680.29	0.37	0.00	$821.60	$350.00	20	26%	29%	24%	21%
Air Sealing	343.08	0.21	0.11	$529.00	$200.00	11	15%	16%	37%	33%
Air Sealing - MH	772.05	0.37	0.07	$326.00	$200.00	11	26%	29%	24%	21%
Duct Sealing	1,020.45	0.48	0.29	$500.00	$200.00	18	15%	16%	37%	33%
Duct Sealing - MH	1,586.67	0.79	0.22	$500.00	$200.00	18	26%	29%	24%	21%
Weatherization Care Pkg.	433.16	0.08	0.04	$60.00	$60.00	9	31%	36%	15%	18%
New Construction										
New Construction - 15% more efficient - Gas Heat	1,391.50	0.07	0.58	$2,563.00	$1,400.00	20	25%	24%	27%	25%
New Construction - 15% more efficient - ASHP	3,937.20	2.41	0.88	$2,563.00	$1,400.00	20	32%	34%	17%	16%
New Construction - 30% more efficient - Gas Heat	3,478.75	0.44	0.58	$5,100.00	$2,300.00	20	25%	24%	27%	25%
New Construction - 30% more efficient - ASHP	5,905.80	2.99	0.88	$5,100.00	$2,300.00	20	32%	34%	17%	16%

Commercial Program Measures and Assumptions

Commercial/Industrial Lighting Program	Annual kWh	Winter kW	Summer kW	Cost	Incentive	Useful Life	Winter On	Winter Off	Summer On	Summer Off
Lighting	23,400	5.72	5.35	7,000	2,450	10	28%	5%	42%	25%
Commercial/Industrial HVAC Program										
HVAC	16,400	1.24	6.62	7,800	2,800	15	34%	38%	15%	13%

APPENDIX 5-2

PROGRAM PARTICIPANTS BY MEASURE
(2011 – 2025)

Residential Cumulative Annual Participants

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
CFL (vs. Incandescent)	23,000	46,000	69,000	69,000	69,000	69,000	69,000	46,000	23,000	0	0	0	0	0	0
LED (vs. Incandescent)	0	0	0	4,000	8,100	12,300	16,600	21,000	25,500	30,125	34,875	39,725	44,700	49,800	55,025
Residential Efficient Appliances															
Efficient Water Heater (SF)	610	1,280	1,965	2,665	3,385	4,120	4,875	5,650	6,445	7,260	8,095	8,950	9,825	10,110	10,360
Heat Pump Water Heater	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Efficient Water Heater (MH)	90	190	290	395	500	610	725	840	960	1,080	1,205	1,335	1,465	1,510	1,545
Energy Star Compliant Top-Mount Refrigerator	635	1,335	2,050	2,785	3,535	4,305	5,095	5,905	6,735	7,585	8,455	9,350	9,630	9,870	10,115
Energy Star Compliant Side-by-Side Refrigerator	345	720	1,105	1,500	1,905	2,320	2,745	3,180	3,625	4,085	4,555	5,035	5,185	5,315	5,450
Energy Star Clothes Washer (Electric WH)	145	300	460	625	795	970	1,145	1,325	1,510	1,700	1,895	1,950	2,000	2,050	2,100
Energy Star Clothes Washer (Non-Electric WH)	65	140	215	290	370	450	535	620	710	800	890	920	940	965	990
Residential Advanced Technologies															
Heat Pump Water Heater	125	260	400	545	695	845	1,000	1,160	1,325	1,490	1,535	1,575	1,615	1,655	1,695
Geothermal Heat Pump Systems	30	60	95	130	165	200	235	270	310	350	390	430	470	515	560
Weatherization															
Ceiling Insualtion (R19-R38)	55	115	180	245	310	380	450	520	595	670	745	825	905	990	1,075
Ceiling Insualtion (R9-R38)	45	95	145	195	245	300	355	410	465	525	585	645	710	775	840
Floor Insualtion (R0-R19)	70	150	230	315	400	485	575	665	760	855	955	1,055	1,160	1,265	1,375
Floor Insualtion (R0-R19) - MH	15	35	55	75	95	115	135	155	175	200	225	250	275	300	325
Air Sealing	195	410	630	855	1,090	1,330	1,575	1,825	2,080	2,345	2,615	2,695	2,765	2,835	2,910
Air Sealing - MH	45	95	145	195	245	300	355	410	470	530	590	605	620	635	650
Duct Sealing	195	410	630	855	1,090	1,330	1,575	1,825	2,080	2,345	2,615	2,890	3,175	3,465	3,765
Duct Sealing - MH	45	95	145	195	245	300	355	410	470	530	590	650	715	780	845
Weatherization Care Pkg.	745	1,570	2,415	3,285	4,175	5,090	6,030	6,990	7,975	8,240	8,450	8,670	8,890	9,115	9,345
New Construction															
New Construction - 15% more efficient - Gas Heat	15	31	48	65	82	100	118	137	156	176	196	217	238	260	282
New Construction - 15% more efficient - ASHP	17	36	55	75	95	116	137	159	181	204	228	252	277	302	328
New Construction - 30% more efficient - Gas Heat	3	6	9	12	16	20	24	28	32	36	40	44	48	52	57
New Construction - 30% more efficient - ASHP	4	8	12	16	20	24	28	32	37	42	47	52	57	62	67

Commercial and Industrial Cumulative Annual Participants

Commercial/Industrial Lighting Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Lighting	30	64	100	140	180	222	264	308	354	400	418	432	446	458	470
Commercial/Industrial HVAC Program															
HVAC	26	56	86	120	156	192	230	268	308	348	390	432	476	520	566

APPENDIX 5-3

PROGRAM BUDGET BREAKDOWNS (ADMINISTRATIVE, INCENTIVES, PARTICIPANT COSTS)
(2011 – 2025)

1. Total Program Budget Breakdown

Recommended Program Budgets	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential	$670,000	$686,500	$703,500	$721,000	$739,000	$757,500	$776,500	$796,000	$816,000	$836,500	$857,500	$879,000	$901,000	$923,500	$946,500
Commercial/Industrial	$330,000	$338,000	$346,500	$355,000	$364,000	$373,000	$382,500	$392,000	$402,000	$412,000	$422,500	$433,000	$444,000	$455,000	$466,500
Total	***$1,000,000***	***$1,025,000***	***$1,050,500***	***$1,077,000***	***$1,104,000***	***$1,131,500***	***$1,160,000***	***$1,189,000***	***$1,218,500***	***$1,249,000***	***$1,280,000***	***$1,312,000***	***$1,345,000***	***$1,378,500***	***$1,413,000***

2. Residential Program Total Budget Breakdown

Recommended Residential Programs	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Lighting Program	$50,000	$50,000	$50,000	$50,000	$51,250	$52,500	$53,750	$55,000	$56,250	$57,750	$59,250	$60,750	$62,250	$63,750	$65,250
Residential Efficient Appliances	$100,000	$102,500	$105,000	$107,500	$110,250	$113,000	$115,750	$118,750	$121,750	$124,750	$127,750	$131,000	$134,250	$137,500	$141,000
Residential Advanced Technologies	$125,000	$128,000	$131,250	$134,500	$137,750	$141,250	$144,750	$148,250	$152,000	$155,750	$159,750	$163,750	$167,750	$172,000	$176,250
Residential Weatherization	$320,000	$329,000	$338,250	$348,000	$356,750	$365,750	$375,250	$384,750	$394,500	$404,500	$414,750	$425,000	$435,750	$446,750	$458,000
Residential New Construction	$75,000	$77,000	$79,000	$81,000	$83,000	$85,000	$87,000	$89,250	$91,500	$93,750	$96,000	$98,500	$101,000	$103,500	$106,000
	$670,000	$686,500	$703,500	$721,000	$739,000	$757,500	$776,500	$796,000	$816,000	$836,500	$857,500	$879,000	$901,000	$923,500	$946,500

3. Residential Program Incentive and Administration Breakdown

Incentives	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Lighting Program	$42,500	$42,500	$42,500	$40,000	$41,000	$42,000	$43,000	$44,000	$45,000	$46,200	$47,400	$48,600	$49,800	$51,000	$52,200
Residential Efficient Appliances	$70,000	$76,875	$78,750	$80,625	$82,688	$84,750	$86,813	$89,063	$91,313	$93,563	$95,813	$98,250	$100,688	$103,125	$105,750
Residential Advanced Technologies	$87,500	$96,000	$98,438	$100,875	$103,313	$105,938	$108,563	$111,188	$114,000	$116,813	$119,813	$122,813	$125,813	$129,000	$132,188
Residential Weatherization	$224,000	$246,750	$253,688	$261,000	$267,563	$274,313	$281,438	$288,563	$295,875	$303,375	$311,063	$318,750	$326,813	$335,063	$343,500
Residential New Construction	$60,000	$65,450	$67,150	$68,850	$70,550	$72,250	$73,950	$75,863	$77,775	$79,688	$81,600	$83,725	$85,850	$87,975	$90,100
Administration	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential Lighting Program	$7,500	$7,500	$7,500	$10,000	$10,250	$10,500	$10,750	$11,000	$11,250	$11,550	$11,850	$12,150	$12,450	$12,750	$13,050
Residential Efficient Appliances	$30,000	$25,625	$26,250	$26,875	$27,563	$28,250	$28,938	$29,688	$30,438	$31,188	$31,938	$32,750	$33,563	$34,375	$35,250
Residential Advanced Technologies	$37,500	$32,000	$32,813	$33,625	$34,438	$35,313	$36,188	$37,063	$38,000	$38,938	$39,938	$40,938	$41,938	$43,000	$44,063
Residential Weatherization	$96,000	$82,250	$84,563	$87,000	$89,188	$91,438	$93,813	$96,188	$98,625	$101,125	$103,688	$106,250	$108,938	$111,688	$114,500
Residential New Construction	$15,000	$11,550	$11,850	$12,150	$12,450	$12,750	$13,050	$13,388	$13,725	$14,063	$14,400	$14,775	$15,150	$15,525	$15,900

4. Residential Program Budget Breakdown

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$42,550	$42,550	$42,550	$40,000	$41,000	$42,000	$43,000	$44,000	$45,000	$46,250	$47,500	$48,500	$49,750	$51,000	$52,250
Administration	$7,500	$7,500	$7,500	$10,000	$10,250	$10,500	$10,750	$11,000	$11,250	$11,550	$11,850	$12,100	$12,450	$12,750	$13,050
Participant Costs	$0	$0	$0	$80,000	$82,000	$84,000	$86,000	$88,000	$90,000	$92,500	$95,000	$97,000	$99,500	$102,000	$104,500
Residential Efficient Appliances															
Incentives	$70,000	$76,825	$78,475	$80,425	$82,750	$84,700	$86,825	$88,775	$91,400	$93,475	$95,600	$98,350	$100,425	$103,175	$105,425
Administration	$30,000	$25,600	$26,150	$26,800	$27,600	$28,250	$28,950	$29,600	$30,450	$31,150	$31,850	$32,800	$33,500	$34,400	$35,150
Participant Costs	$48,580	$53,265	$54,405	$55,645	$57,650	$58,890	$60,205	$61,445	$63,550	$64,815	$66,130	$68,260	$69,525	$71,655	$72,995
Residential Advanced Technologies															
Incentives	$88,750	$92,250	$101,500	$103,250	$105,000	$105,000	$106,750	$108,500	$117,750	$117,750	$119,500	$121,250	$123,000	$132,250	$134,000
Administration	$38,050	$30,750	$33,850	$34,400	$35,000	$35,000	$35,600	$36,150	$39,250	$39,250	$39,850	$40,400	$41,000	$44,100	$44,650
Participant Costs	$266,500	$271,500	$308,000	$310,500	$313,000	$313,000	$315,500	$318,000	$354,500	$354,500	$357,000	$359,500	$362,000	$398,500	$401,000
Weatherization															
Incentives	$223,950	$250,000	$254,950	$261,200	$266,400	$275,900	$282,150	$285,350	$295,350	$304,850	$311,100	$316,650	$329,150	$334,400	$342,950
Administration	$96,000	$83,350	$85,000	$87,050	$88,800	$91,950	$94,050	$95,100	$98,450	$101,600	$103,700	$105,550	$109,700	$111,450	$114,300
Participant Costs	$267,254	$298,696	$304,503	$311,731	$318,021	$329,503	$336,732	$339,877	$351,897	$364,090	$371,319	$377,125	$393,174	$398,981	$409,354
New Construction															
Incentives	$60,900	$65,100	$66,500	$67,900	$70,200	$73,000	$73,000	$75,800	$78,100	$80,900	$82,300	$83,700	$85,100	$86,500	$90,200
Administration	$15,200	$11,500	$11,750	$12,000	$12,400	$12,900	$12,900	$13,400	$13,800	$14,300	$14,500	$14,750	$15,000	$15,250	$15,900
Participant Costs	$56,816	$60,305	$61,468	$62,631	$65,431	$67,757	$67,757	$70,083	$72,883	$75,209	$76,372	$77,535	$78,698	$79,861	$83,824

1. Total Program Budget Breakdown

Recommended Program Budgets	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Residential	$670,000	$686,500	$703,500	$721,000	$739,000	$757,500	$776,500	$796,000	$816,000	$836,500	$857,500	$879,000	$901,000	$923,500	$946,500
Commercial/Industrial	$330,000	$338,000	$346,500	$355,000	$364,000	$373,000	$382,500	$392,000	$402,000	$412,000	$422,500	$433,000	$444,000	$455,000	$466,500
Total	***$1,000,000***	***$1,025,000***	***$1,050,500***	***$1,077,000***	***$1,104,000***	***$1,131,500***	***$1,160,000***	***$1,189,000***	***$1,218,500***	***$1,249,000***	***$1,280,000***	***$1,312,000***	***$1,345,000***	***$1,378,500***	***$1,413,000***

2. Commercial/Industrial Program Budget Breakdown

Recommended Commercial/Industrial Programs	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Commercial/Industrial Lighting Program	$165,000	$169,000	$173,250	$177,500	$182,000	$186,500	$191,250	$196,000	$201,000	$206,000	$211,250	$216,500	$222,000	$227,500	$233,250
Commercial/Industrial HVAC Program	$165,000	$169,000	$173,250	$177,500	$182,000	$186,500	$191,250	$196,000	$201,000	$206,000	$211,250	$216,500	$222,000	$227,500	$233,250
	$330,000	$338,000	$346,500	$355,000	$364,000	$373,000	$382,500	$392,000	$402,000	$412,000	$422,500	$433,000	$444,000	$455,000	$466,500

3. Commercial Program Incentive and Administrative Breakdown

Incentives	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Commercial/Industrial Lighting Program	$74,250	$84,500	$86,625	$97,625	$100,100	$102,575	$105,188	$107,800	$110,550	$113,300	$116,188	$119,075	$122,100	$125,125	$128,288
Commercial/Industrial HVAC Program	$74,250	$84,500	$86,625	$97,625	$100,100	$102,575	$105,188	$107,800	$110,550	$113,300	$116,188	$119,075	$122,100	$125,125	$128,288
Administration	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Commercial/Industrial Lighting Program	$90,750	$84,500	$86,625	$79,875	$81,900	$83,925	$86,063	$88,200	$90,450	$92,700	$95,063	$97,425	$99,900	$102,375	$104,963
Commercial/Industrial HVAC Program	$90,750	$84,500	$86,625	$79,875	$81,900	$83,925	$86,063	$88,200	$90,450	$92,700	$95,063	$97,425	$99,900	$102,375	$104,963

4. C&I Program Budget Breakdown (Incremental Annual)

Commercial/Industrial Lighting Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$73,500	$83,300	$88,200	$98,000	$98,000	$102,900	$102,900	$107,800	$112,700	$112,700	$117,600	$117,600	$122,500	$127,400	$127,400
Administration	$89,850	$83,300	$88,200	$80,200	$80,200	$84,200	$84,200	$88,200	$92,200	$92,200	$96,200	$96,200	$100,250	$104,250	$104,250
Participant Costs	$136,500	$154,700	$163,800	$182,000	$182,000	$191,100	$191,100	$200,200	$209,300	$209,300	$218,400	$218,400	$227,500	$236,600	$236,600
Commercial/Industrial HVAC Program															
Incentives	$72,800	$84,000	$84,000	$95,200	$100,800	$100,800	$106,400	$106,400	$112,000	$112,000	$117,600	$117,600	$123,200	$123,200	$128,800
Administration	$89,000	$84,000	$84,000	$77,900	$82,450	$82,450	$87,050	$87,050	$91,650	$91,650	$96,200	$96,200	$100,800	$100,800	$105,400
Participant Costs	$130,000	$150,000	$150,000	$170,000	$180,000	$180,000	$190,000	$190,000	$200,000	$200,000	$210,000	$210,000	$220,000	$220,000	$230,000

APPENDIX 5-3

ENERGY AND DEMAND SAVINGS PER PROGRAM
(2011 – 2025)

Residential Program Annual kWh Breakdown (Cumulative Annual)

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter On Peak	215,926	431,852	647,778	697,401	748,264	800,368	853,713	692,372	532,271	373,722	432,649	492,816	554,534	617,804	682,623
Winter Off Peak	253,512	507,024	760,537	818,797	878,514	939,688	1,002,318	812,892	624,923	438,775	507,959	578,600	651,062	725,344	801,447
Summer On Peak	108,457	216,913	325,370	350,295	375,843	402,014	428,808	347,769	267,352	187,715	217,313	247,535	278,535	310,314	342,872
Summer Off Peak	127,285	254,570	381,855	411,107	441,090	471,804	503,250	408,142	313,765	220,303	255,039	290,507	326,889	364,185	402,395
Total Annual kWh	705,180	1,410,360	2,115,540	2,277,600	2,443,712	2,613,875	2,788,089	2,261,175	1,738,313	1,220,514	1,412,961	1,609,458	1,811,021	2,017,647	2,229,338
Residential Efficient Appliances															
Winter On Peak	128,242	268,813	412,447	559,834	711,024	865,968	1,024,825	1,187,420	1,354,508	1,525,564	1,700,863	1,860,807	1,983,647	2,038,003	2,088,339
Winter Off Peak	70,909	148,655	228,128	309,704	393,282	478,962	566,830	656,795	749,136	843,792	940,743	1,033,783	1,091,227	1,120,372	1,148,165
Summer On Peak	56,952	119,357	183,135	248,581	315,728	384,543	455,067	527,252	601,433	677,386	755,210	825,148	877,469	901,379	923,654
Summer Off Peak	32,185	67,480	103,559	140,593	178,526	217,414	257,306	298,151	340,065	383,038	427,051	469,895	495,765	508,985	521,617
Total Annual kWh	288,288	604,304	927,268	1,258,712	1,598,560	1,946,887	2,304,028	2,669,618	3,045,142	3,429,780	3,823,867	4,189,633	4,448,108	4,568,739	4,681,776
Residential Advanced Technologies															
Winter On Peak	167,577	345,591	535,010	729,648	929,503	1,129,359	1,334,433	1,544,725	1,766,422	1,988,119	2,084,576	2,175,814	2,267,052	2,364,477	2,461,902
Winter Off Peak	93,516	191,139	297,846	406,605	517,419	628,232	741,099	856,019	980,023	1,104,026	1,178,748	1,251,416	1,324,084	1,403,782	1,483,480
Summer On Peak	70,385	145,082	224,683	306,439	390,352	474,264	560,333	648,557	741,685	834,813	876,203	915,436	954,670	996,652	1,038,634
Summer Off Peak	36,749	75,322	117,132	159,854	203,488	247,121	291,667	337,125	385,820	434,514	461,322	487,218	513,114	541,336	569,557
Total Annual kWh	368,228	757,134	1,174,670	1,602,546	2,040,761	2,478,977	2,927,531	3,386,425	3,873,949	4,361,473	4,600,848	4,829,884	5,058,920	5,306,246	5,553,573
Weatherization															
Winter On Peak	182,936	386,254	593,430	805,428	1,022,100	1,246,960	1,476,641	1,709,987	1,951,386	2,100,816	2,244,458	2,371,762	2,503,238	2,636,329	2,772,345
Winter Off Peak	208,218	439,628	675,448	916,785	1,163,412	1,419,343	1,680,789	1,946,438	2,221,246	2,387,780	2,547,371	2,689,016	2,835,264	2,983,314	3,134,580
Summer On Peak	211,051	445,517	684,285	928,432	1,178,896	1,438,376	1,703,234	1,971,918	2,249,286	2,486,040	2,722,844	2,930,495	3,145,298	3,362,778	3,586,169
Summer Off Peak	202,075	426,512	655,165	889,089	1,129,028	1,377,453	1,631,149	1,888,634	2,154,309	2,370,247	2,585,201	2,774,404	2,969,972	3,168,023	3,371,446
Total Annual kWh	804,280	1,697,911	2,608,328	3,539,733	4,493,437	5,482,132	6,491,814	7,516,977	8,576,227	9,344,883	10,099,874	10,765,677	11,453,773	12,150,444	12,864,540
New Construction															
Winter On Peak	37,078	77,050	117,367	158,959	201,412	245,485	289,557	335,250	382,855	432,079	482,578	533,422	585,541	638,005	692,605
Winter Off Peak	38,578	80,196	122,142	165,444	209,568	255,376	301,184	348,676	398,203	449,413	501,980	554,875	609,126	663,706	720,463
Summer On Peak	24,149	50,041	76,306	103,256	131,139	160,080	189,021	219,021	250,047	282,131	314,901	348,043	381,870	416,071	451,890
Summer Off Peak	22,060	45,708	69,702	94,317	119,794	146,239	172,683	200,094	228,438	257,748	287,679	317,956	348,854	380,097	412,824
Total Annual kWh	121,864	252,995	385,516	521,975	661,913	807,179	952,446	1,103,041	1,259,542	1,421,371	1,587,138	1,754,297	1,925,392	2,097,879	2,277,782
	1,529,810	**1,549,351**	**1,566,383**	**1,585,820**	**1,608,140**	**1,629,692**	**1,657,057**	**1,683,558**	**1,710,391**	**1,732,071**	**1,759,572**	**1,784,980**	**1,809,956**	**1,837,134**	**1,864,311**

Residential Program Annual kW Breakdown (Cumulative Annual)

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter Peak kW	164	328	493	530	569	609	649	527	405	284	329	375	422	470	519
Summer Peak kW	72	144	216	233	250	267	285	231	178	125	145	165	185	206	228
Residential Efficient Appliances															
Winter Peak kW	13	26	41	55	70	85	101	117	133	150	167	184	194	199	204
Summer Peak kW	16	33	51	70	88	108	128	148	169	190	212	229	238	245	251
Residential Advanced Technologies															
Winter Peak kW	169	340	535	732	930	1,128	1,327	1,528	1,752	1,977	2,168	2,357	2,546	2,758	2,970
Summer Peak kW	26	53	82	112	142	173	204	237	271	304	316	326	337	347	358
Weatherization															
Winter Peak kW	312	659	1,011	1,372	1,741	2,124	2,515	2,910	3,321	3,684	4,049	4,361	4,685	5,011	5,347
Summer Peak kW	148	312	480	651	827	1,009	1,195	1,384	1,578	1,749	1,920	2,070	2,224	2,381	2,542
New Construction															
Winter Peak kW	55	116	176	239	302	367	433	501	572	646	722	798	876	955	1,036
Summer Peak kW	29	60	92	125	158	193	227	264	301	339	379	419	460	501	544

C&I Program Annual kWh Breakdown (Cumulative Annual)

Commercial/Industrial Lighting Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter On Peak	194,454	414,835	648,180	907,452	1,166,724	1,438,960	1,711,195	1,996,394	2,294,557	2,592,720	2,709,392	2,800,138	2,890,883	2,968,664	3,046,446
Winter Off Peak	37,908	80,870	126,360	176,904	227,448	280,519	333,590	389,189	447,314	505,440	528,185	545,875	563,566	578,729	593,892
Summer On Peak	295,542	630,490	985,140	1,379,196	1,773,252	2,187,011	2,600,770	3,034,231	3,487,396	3,940,560	4,117,885	4,255,805	4,393,724	4,511,941	4,630,158
Summer Off Peak	174,096	371,405	580,320	812,448	1,044,576	1,288,310	1,532,045	1,787,386	2,054,333	2,321,280	2,425,738	2,506,982	2,588,227	2,657,866	2,727,504
Total Annual kWh	702,000	1,497,600	2,340,000	3,276,000	4,212,000	5,194,800	6,177,600	7,207,200	8,283,600	9,360,000	9,781,200	10,108,800	10,436,400	10,717,200	10,998,000
Commercial/Industrial HVAC Program															
Winter On Peak	144,226	310,641	477,056	665,660	865,358	1,065,056	1,275,848	1,486,641	1,708,527	1,930,414	2,163,395	2,396,376	2,640,451	2,884,527	3,139,696
Winter Off Peak	163,894	353,003	542,112	756,435	983,365	1,210,296	1.449,833	1,689,371	1,941,516	2,193,661	2,458,413	2,723,165	3,000,525	3,277,884	3,567,851
Summer On Peak	64,074	138,007	211,939	295,728	384,447	473,165	566,813	660,460	759,036	857,612	961,117	1,064,622	1,173,056	1,281,490	1,394,852
Summer Off Peak	54,205	116,749	179,293	250,177	325,230	400,283	479,506	558,728	642,121	725,513	813,075	900,637	992,368	1,084,100	1,180,001
Total Annual kWh	426,400	918,400	1,410,400	1,968,000	2,558,400	3,148,800	3,772,000	4,395,200	5,051,200	5,707,200	6,396,000	7,084,800	7,806,400	8,528,000	9,282,400
	743,153	**755,211**	**766,768**	**780,131**	**794,941**	**810,225**	**825,595**	**841,103**	**856,804**	**872,627**	**888,554**	**904,551**	**920,575**	**934,398**	**948,221**

C&I Program Annual kW Breakdown (Cumulative Annual)

Commercial/Industrial Lighting Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter Peak kW	172	366	572	801	1,030	1,270	1,511	1,762	2,025	2,289	2,392	2,472	2,552	2,621	2,689
Summer Peak kW	160	342	535	748	962	1,187	1,411	1,646	1,892	2,138	2,234	2,309	2,384	2,448	2,512
Commercial/Industrial HVAC Program															
Winter Peak kW	32	70	107	149	194	238	286	333	383	432	484	537	591	646	703
Summer Peak kW	172	371	570	795	1,033	1,272	1,524	1,775	2,040	2,305	2,583	2,862	3,153	3,444	3,749

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix C
Detailed DSM Tables

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Residential Program Seasonal kWh Breakdown (Cumulative Annual)

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter	469,438	938,877	1,408,315	1,516,198	1,626,779	1,740,056	1,856,031	1,505,264	1,157,195	812,496	940,608	1,071,416	1,205,596	1,343,148	1,484,070
Summer	235,742	471,483	707,225	761,402	816,933	873,818	932,058	755,911	581,118	408,018	472,353	538,042	605,424	674,499	745,268
Efficient Appliances															
Winter	199,151	417,467	640,575	869,538	1,104,306	1,344,929	1,591,656	1,844,216	2,103,644	2,369,357	2,641,607	2,894,590	3,074,874	3,158,375	3,236,505
Summer	89,137	186,837	286,693	389,174	494,254	601,958	712,373	825,403	941,499	1,060,424	1,182,261	1,295,043	1,373,234	1,410,364	1,445,271
Advanced Technologies															
Winter	261,093	536,731	832,856	1,136,253	1,446,922	1,757,591	2,075,531	2,400,744	2,746,445	3,092,145	3,263,323	3,427,230	3,591,136	3,768,259	3,945,382
Summer	107,134	220,404	341,815	466,293	593,839	721,386	852,000	985,682	1,127,505	1,269,327	1,337,525	1,402,655	1,467,784	1,537,987	1,608,191
Weatherization															
Winter	391,154	825,882	1,268,878	1,722,212	2,185,512	2,666,303	3,157,431	3,656,425	4,172,631	4,488,596	4,791,829	5,060,778	5,338,503	5,619,643	5,906,925
Summer	413,126	872,029	1,339,450	1,817,521	2,307,924	2,815,829	3,334,383	3,860,552	4,403,595	4,856,287	5,308,045	5,704,900	6,115,271	6,530,801	6,957,615
New Construction															
Winter	75,655	157,246	239,509	324,403	410,980	500,860	590,741	683,926	781,057	881,492	984,558	1,088,298	1,194,668	1,301,711	1,413,068
Summer	46,209	95,749	146,008	197,572	250,933	306,319	361,705	419,115	478,485	539,879	602,580	665,999	730,724	796,168	864,714

Commercial Program Seasonal kWh Breakdown (Cumulative Annual)

Lighting	2011	2012	2013		2015					2020					2025
Winter	232,362	495,706	774,540	1,084,356	1,394,172	1,719,479	2,044,786	2,385,583	2,741,872	3,098,160	3,237,577	3,346,013	3,454,448	3,547,393	3,640,338
Summer	469,638	1,001,894	1,565,460	2,191,644	2,817,828	3,475,321	4,132,814	4,821,617	5,541,728	6,261,840	6,543,623	6,762,787	6,981,952	7,169,807	7,357,662
HVAC															
Winter	308,121	663,644	1,019,168	1,422,095	1,848,723	2,275,352	2,725,682	3,176,012	3,650,043	4,124,075	4,621,808	5,119,541	5,640,976	6,162,411	6,707,547
Summer	118,279	254,756	391,232	545,905	709,677	873,448	1,046,318	1,219,188	1,401,157	1,583,125	1,774,192	1,965,259	2,165,424	2,365,589	2,574,853

Combined Program Seasonal kWh Breakdown (Cumulative Annual)

Residential	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter	1,396,493	2,876,202	4,390,133	5,568,604	6,774,499	8,009,739	9,271,390	10,090,574	10,960,971	11,644,086	12,621,925	13,542,312	14,404,777	15,191,135	15,985,949
Summer	891,348	1,846,502	2,821,191	3,631,963	4,463,884	5,319,310	6,192,519	6,846,662	7,532,201	8,133,936	8,902,763	9,606,638	10,292,437	10,949,820	11,621,059
Total Annual kWh	2,287,840	4,722,703	7,211,324	9,200,567	11,238,382	13,329,049	15,463,908	16,937,236	18,493,172	19,778,022	21,524,688	23,148,950	24,697,214	26,140,955	27,607,008
Commercial															
Winter	540,483	1,159,350	1,793,708	2,506,451	3,242,895	3,994,830	4,770,467	5,561,595	6,391,915	7,222,235	7,859,385	8,465,554	9,095,424	9,709,804	10,347,885
Summer	587,917	1,256,650	1,956,692	2,737,549	3,527,505	4,348,770	5,179,133	6,040,805	6,942,885	7,844,965	8,317,815	8,728,046	9,147,376	9,535,396	9,932,515
Total Annual kWh	1,128,400	2,416,000	3,750,400	5,244,000	6,770,400	8,343,600	9,949,600	11,602,400	13,334,800	15,067,200	16,177,200	17,193,600	18,242,800	19,245,200	20,280,400
Residential & Commercial															
Winter	1,936,975	4,035,552	6,183,841	8,075,055	10,017,394	12,004,570	14,041,857	15,652,169	17,352,886	18,866,321	20,481,310	22,007,866	23,500,202	24,900,939	26,333,834
Summer	1,479,265	3,103,152	4,777,883	6,369,512	7,991,389	9,668,079	11,371,651	12,887,467	14,475,086	15,978,901	17,220,578	18,334,684	19,439,813	20,485,216	21,553,574
Total Annual kWh	3,416,240	7,138,703	10,961,724	14,444,567	18,008,782	21,672,649	25,413,508	28,539,636	31,827,972	34,845,222	37,701,888	40,342,550	42,940,014	45,386,155	47,887,408

Residential Program Seasonal Peak KW Breakdown (Cumulative Annual)

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter Peak kW	164	328	493	530	569	609	649	527	405	284	329	375	422	470	519
Summer Peak kW	72	144	216	233	250	267	285	231	178	125	145	165	185	206	228
Efficient Appliances															
Winter Peak kW	13	26	41	55	70	85	101	117	133	150	167	184	194	199	204
Summer Peak kW	16	33	51	70	88	108	128	148	169	190	212	229	238	245	251
Advanced Technologies															
Winter Peak kW	169	340	535	732	930	1,128	1,327	1,528	1,752	1,977	2,168	2,357	2,546	2,758	2,970
Summer Peak kW	26	53	82	112	142	173	204	237	271	304	316	326	337	347	358
Weatherization															
Winter Peak kW	312	659	1,011	1,372	1,741	2,124	2,515	2,910	3,321	3,684	4,049	4,361	4,685	5,011	5,347
Summer Peak kW	148	312	480	651	827	1,009	1,195	1,384	1,578	1,749	1,920	2,070	2,224	2,381	2,542
New Construction															
Winter Peak kW	55	116	176	239	302	367	433	501	572	646	722	798	876	955	1,036
Summer Peak kW	29	60	92	125	158	193	227	264	301	339	379	419	460	501	544

Commercial Program Seasonal Peak KW Breakdown (Cumulative Annual)

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter Peak kW	172	366	572	801	1,030	1,270	1,511	1,762	2,025	2,289	2,392	2,472	2,552	2,621	2,689
Summer Peak kW	160	342	535	748	962	1,187	1,411	1,646	1,892	2,138	2,234	2,309	2,384	2,448	2,512
HVAC															
Winter Peak kW	32	70	107	149	194	238	286	333	383	432	484	537	591	646	703
Summer Peak kW	172	371	570	795	1,033	1,272	1,524	1,775	2,040	2,305	2,583	2,862	3,153	3,444	3,749

Combined Program Seasonal Peak KW Breakdown (Cumulative Annual)

Residential	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Winter	712	1,469	2,256	2,928	3,611	4,313	5,025	5,583	6,183	6,741	7,435	8,074	8,723	9,393	10,076
Summer	291	603	921	1,190	1,465	1,750	2,039	2,263	2,496	2,707	2,971	3,208	3,444	3,681	3,923
Commercial															
Winter	204	436	679	950	1,224	1,509	1,796	2,095	2,408	2,721	2,876	3,008	3,143	3,266	3,392
Summer	333	713	1,104	1,543	1,996	2,459	2,935	3,422	3,933	4,443	4,818	5,171	5,537	5,893	6,262
Residential & Commercial															
Winter	916	1,905	2,935	3,878	4,835	5,821	6,821	7,678	8,591	9,462	10,311	11,083	11,866	12,660	13,468
Summer	623	1,316	2,025	2,733	3,461	4,208	4,974	5,685	6,428	7,151	7,789	8,379	8,981	9,573	10,185

All Combined Program Costs

All Residential Programs Combined	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$486,150	$526,725	$543,975	$552,775	$565,350	$580,600	$591,725	$602,425	$627,600	$643,225	$656,000	$668,450	$687,425	$707,325	$724,825
Administration	$186,750	$158,700	$164,250	$170,250	$174,050	$178,600	$182,250	$185,250	$193,200	$197,850	$201,750	$205,600	$211,650	$217,950	$223,050
Total Big Rivers Cost	$672,900	$685,425	$708,225	$723,025	$739,400	$759,200	$773,975	$787,675	$820,800	$841,075	$857,750	$874,050	$899,075	$925,275	$947,875
All C&I Programs Combined															
Incentives	$146,300	$167,300	$172,200	$193,200	$198,800	$203,700	$209,300	$214,200	$224,700	$224,700	$235,200	$235,200	$245,700	$250,600	$256,200
Administration	$178,850	$167,300	$172,200	$158,100	$162,650	$166,650	$171,250	$175,250	$183,850	$183,850	$192,400	$192,400	$201,050	$205,050	$209,650
Total Big Rivers Cost	$325,150	$334,600	$344,400	$351,300	$361,450	$370,350	$380,550	$389,450	$408,550	$408,550	$427,600	$427,600	$446,750	$455,650	$465,850
All Programs Combined															
Incentives	$632,450	$694,025	$716,175	$745,975	$764,150	$784,300	$801,025	$816,625	$852,300	$867,925	$891,200	$903,650	$933,125	$957,925	$981,025
Administration	$365,600	$326,000	$336,450	$328,350	$336,700	$345,250	$353,500	$360,500	$377,050	$381,700	$394,150	$398,000	$412,700	$423,000	$432,700
Total Big Rivers Cost	$998,050	$1,020,025	$1,052,625	$1,074,325	$1,100,850	$1,129,550	$1,154,525	$1,177,125	$1,229,350	$1,249,625	$1,285,350	$1,301,650	$1,345,825	$1,380,925	$1,413,725

Residential Program Costs

Lighting	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$42,550	$42,550	$42,550	$40,000	$41,000	$42,000	$43,000	$44,000	$45,000	$46,250	$47,500	$48,500	$49,750	$51,000	$52,250
Administration	$7,500	$7,500	$7,500	$10,000	$10,250	$10,500	$10,750	$11,000	$11,250	$11,550	$11,850	$12,100	$12,450	$12,750	$13,050
Total Big Rivers Cost	$50,050	$50,050	$50,050	$50,000	$51,250	$52,500	$53,750	$55,000	$56,250	$57,800	$59,350	$60,600	$62,200	$63,750	$65,300
Residential Efficient Appliances															
Incentives	$70,000	$76,825	$78,475	$80,425	$82,750	$84,700	$86,825	$88,775	$91,400	$93,475	$95,600	$98,350	$100,425	$103,175	$105,425
Administration	$30,000	$25,600	$26,150	$26,800	$27,600	$28,250	$28,950	$29,600	$30,450	$31,150	$31,850	$32,800	$33,500	$34,400	$35,150
Total Big Rivers Cost	$100,000	$102,425	$104,625	$107,225	$110,350	$112,950	$115,775	$118,375	$121,850	$124,625	$127,450	$131,150	$133,925	$137,575	$140,575
Residential Advanced Technologies															
Incentives	$88,750	$92,250	$101,500	$103,250	$105,000	$105,000	$106,750	$108,500	$117,750	$117,750	$119,500	$121,250	$123,000	$132,250	$134,000
Administration	$38,050	$30,750	$33,850	$34,400	$35,000	$35,000	$35,600	$36,150	$39,250	$39,250	$39,850	$40,400	$41,000	$44,100	$44,650
Total Big Rivers Cost	$126,800	$123,000	$135,350	$137,650	$140,000	$140,000	$142,350	$144,650	$157,000	$157,000	$159,350	$161,650	$164,000	$176,350	$178,650
Weatherization															
Incentives	$223,950	$250,000	$254,950	$261,200	$266,400	$275,900	$282,150	$285,350	$295,350	$304,850	$311,100	$316,650	$329,150	$334,400	$342,950
Administration	$96,000	$83,350	$85,000	$87,050	$88,800	$91,950	$94,050	$95,100	$98,450	$101,600	$103,700	$105,550	$109,700	$111,450	$114,300
Total Big Rivers Cost	$319,950	$333,350	$339,950	$348,250	$355,200	$367,850	$376,200	$380,450	$393,800	$406,450	$414,800	$422,200	$438,850	$445,850	$457,250
New Construction															
Incentives	$60,900	$65,100	$66,500	$67,900	$70,200	$73,000	$73,000	$75,800	$78,100	$80,900	$82,300	$83,700	$85,100	$86,500	$90,200
Administration	$15,200	$11,500	$11,750	$12,000	$12,400	$12,900	$12,900	$13,400	$13,800	$14,300	$14,500	$14,750	$15,000	$15,250	$15,900
Total Big Rivers Cost	$76,100	$76,600	$78,250	$79,900	$82,600	$85,900	$85,900	$89,200	$91,900	$95,200	$96,800	$98,450	$100,100	$101,750	$106,100

C&I Program Costs

Commercial/Industrial Lighting Program	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$73,500	$83,300	$88,200	$98,000	$98,000	$102,900	$102,900	$107,800	$112,700	$112,700	$117,600	$117,600	$122,500	$127,400	$127,400
Administration	$89,850	$83,300	$88,200	$80,200	$80,200	$84,200	$84,200	$88,200	$92,200	$92,200	$96,200	$96,200	$100,250	$104,250	$104,250
Total Big Rivers Cost	$163,350	$166,600	$176,400	$178,200	$178,200	$187,100	$187,100	$196,000	$204,900	$204,900	$213,800	$213,800	$222,750	$231,650	$231,650
Commercial/Industrial HVAC Program															
Incentives	$72,800	$84,000	$84,000	$95,200	$100,800	$100,800	$106,400	$106,400	$112,000	$112,000	$117,600	$117,600	$123,200	$123,200	$128,800
Administration	$89,000	$84,000	$84,000	$77,900	$82,450	$82,450	$87,050	$87,050	$91,650	$91,650	$96,200	$96,200	$100,800	$100,800	$105,400
Total Big Rivers Cost	$161,800	$168,000	$168,000	$173,100	$183,250	$183,250	$193,450	$193,450	$203,650	$203,650	$213,800	$213,800	$224,000	$224,000	$234,200

All Combined Program Costs

All Residential Programs Combined	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Incentives	$486,150	$526,725	$543,975	$552,775	$565,350	$580,600	$591,725	$602,425	$627,600	$643,225	$656,000	$668,450	$687,425	$707,325	$724,825
Administration	$186,750	$158,700	$164,250	$170,250	$174,050	$178,600	$182,250	$185,250	$193,200	$197,850	$201,750	$205,600	$211,650	$217,950	$223,050
Total Big Rivers Cost	$672,900	$685,425	$708,225	$723,025	$739,400	$759,200	$773,975	$787,675	$820,800	$841,075	$857,750	$874,050	$899,075	$925,275	$947,875
All C&I Programs Combined															
Incentives	$146,300	$167,300	$172,200	$193,200	$198,800	$203,700	$209,300	$214,200	$224,700	$224,700	$235,200	$235,200	$245,700	$250,600	$256,200
Administration	$178,850	$167,300	$172,200	$158,100	$162,650	$166,650	$171,250	$175,250	$183,850	$183,850	$192,400	$192,400	$201,050	$205,050	$209,650
Total Big Rivers Cost	$325,150	$334,600	$344,400	$351,300	$361,450	$370,350	$380,550	$389,450	$408,550	$408,550	$427,600	$427,600	$446,750	$455,650	$465,850
All Programs Combined															
Incentives	$632,450	$694,025	$716,175	$745,975	$764,150	$784,300	$801,025	$816,625	$852,300	$867,925	$891,200	$903,650	$933,125	$957,925	$981,025
Administration	$365,600	$326,000	$336,450	$328,350	$336,700	$345,250	$353,500	$360,500	$377,050	$381,700	$394,150	$398,000	$412,700	$423,000	$432,700
Total Big Rivers Cost	$998,050	$1,020,025	$1,052,625	$1,074,325	$1,100,850	$1,129,550	$1,154,525	$1,177,125	$1,229,350	$1,249,625	$1,285,350	$1,301,650	$1,345,825	$1,380,925	$1,413,725

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix D
Base Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix D – Base Case Appendix is a group of reports from a model run. All of Appendix D has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix E
High Fuel Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix E – High Fuel Case Appendix is a group of reports from a model run. All of Appendix E has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix F
High Load Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix F – High Load Case Appendix is a group of reports from a model run. All of Appendix F has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix G
Renewable Portfolio Standards
Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix G – Renewable Portfolio Standard ("RPS") Case Appendix is a group of reports from a model run. All of Appendix G has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix H
Environmental Compliance
Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix H – Environmental Compliance Case Appendix is a group of reports from a model run. All of Appendix H has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix I
MISO Case Output Reports

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix I – MISO Case Appendix is a group of reports from a model run. All of Appendix I has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix J
Carbon Allowance Cost

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix J – Carbon Allowance Cost is a projection of carbon allowance prices. All of Appendix J has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix K
Unit Operating Cost

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix K – Unit Operating Cost is a projection of unit operating costs. All of Appendix K has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix L
Market Prices

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix L – Market Price Appendix is a projection of electricity prices. All of Appendix L has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix M
Transmission Map

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Appendix M – Transmission Map is a map of the Big Rivers Transmission System. All of Appendix M has been redacted and filed under a Petition for Confidential Treatment.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix N
Environmental Equipment

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

Big Rivers Units' Environmental Equipment

Unit	Firing System	NOx Reduction	SO2 Reduction	Particulate Reduction
Coleman 1	Front Wall Fired	low-Nox burners & advanced over-fire air	wet limestone FGD, forced oxidation	ESP
Coleman 2	Front Wall Fired	low-Nox burners & advanced over-fire air	wet limestone FGD, forced oxidation	ESP
Coleman 3	Rear Wall Fired	low-Nox burners & advanced over-fire air	wet limestone FGD, forced oxidation	ESP
Henderson 1	Rear Wall Fired	low-Nox burners & selective catalytic reduction	wet mag-lime FGD, natural oxidation	ESP
Henderson 2	Rear Wall Fired	low-Nox burners & selective catalytic reduction	wet mag-lime FGD, natural oxidation	ESP
Green 1	Opposed Wall Fired	low-Nox burners & coal Re-burn	wet mag-lime FGD, natural oxidation	ESP
Green 2	Opposed Wall Fired	low-Nox burners & coal Re-burn	wet mag-lime FGD, natural oxidation	ESP
Wilson 1	Opposed Wall Fired	low-Nox burners & selective catalytic reduction	wet limestone FGD, inhibited oxidation	ESP
Reid 1	Front Wall Fired	over-fire air		ESP
Reid CT	Oil/Natural Gas Fired	convert to natural gas or fuel oil		

Over time considerable investment has been made in these units to control emissions. All of the coal-fired-only units listed above are equipped with low-NOx burners and either Selective Catalytic Reduction (SCR) equipment, coal re-burn, or advanced over-fire air combustion technology for NOx control; and scrubbers to control SO2. All of the units, except for the Reid combustion turbine, have precipitators to control particulate. The Reid #1 unit has been retro-fitted to burn natural gas as well as coal to better control NOx and SO2 emissions. The Reid combustion turbine (CT) has been retro-fitted to burn natural gas as well as fuel oil, also to better control emissions. Continuous emissions monitors are in place on each of the respective units' stacks, except for the Reid CT. Big Rivers reports emissions on this unit by measuring the gas (or oil) flow and applying associated default emission values to the hourly data. Big Rivers is able to do this as the unit qualifies as a "Low Mass Emission" unit.

Big Rivers Electric Corporation

2010 Integrated Resource Plan

Appendix O
Abbreviation Summary

Big Rivers
ELECTRIC CORPORATION

Your Touchstone Energy® Cooperative

List of Abbreviations and Acronyms

AMI	Automated Metering Infrastructure
Big Rivers	Big Rivers Electric Corporation
C&I	Commercial and Industrial
CAA	Clean Air Act
CAER	Center for Applied Energy Research
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
CATR	Clean Air Transport Rule
CC	Combined Cycle
CFL	Compact Fluorescent Light
CHP	Combined Heat and Power
CMRG	Carbon Management Research Group
CO_2	Carbon Dioxide
CP	Coincident Peak
CSRs	Customer Service Representatives
CT	Combustion Turbine
DOE	U.S. Department of Energy
DR	Demand Response
DSM	Demand Side Management
EE	Energy Efficiency
EFOR	Equivalent Forced Outage Rate
EHV	Extra High Voltage
EIA	Energy Information Administration
EISA 2007	Energy Independence and Security Act of 2007
EPA	U.S. Environmental Protection Agency
FGD	Flue Gas Desulphurization System
GAF	Generation and Fuel
GDS	GDS Associates, Inc.
GHG	Green House Gases
GWH	Gigawatt-hours
HERS	Home Energy Rating System
HMP&L	Henderson Municipal Power & Light
HPWH	Heat Pump Water Heater
HVAC	Heating, Ventilation, and Air Conditioning
ICR	Information Collection Request
IRP	Integrated Resource Plan
JPEC	Jackson Purchase Energy Corporation
KAR	Kentucky Administrative Regulations
Kenergy	Kenergy Corp.
KPSC	Kentucky Public Service Commission
KRS	Kentucky Revised Statutes
KU	Kentucky Utilities
kW	Kilowatt

List of Abbreviations and Acronyms

kWH	**Kilowatt-hours**
LED	**Light Emitting Diode**
LEM	**LG&E Energy Marketing, Inc.**
LFA	**Load Forecast Adjustment**
MACT	**Maximum Achievable Control Technology**
MCRECC	**Meade County Rural Electric Cooperative Corporation**
MISO	**Midwest Independent System Operator**
MMBtu	**Millions of British Thermal Units**
MW	**Megawatt**
MWH	**Megawatt-hours**
NCP	**Non-coincident Peak**
NERC	**North American Electric Reliability Corporation**
NOx	**Nitrogen Oxides**
O&M	**Operations and Maintenance**
O_2	**Oxygen**
PSD	**Prevention of Significant Deterioration**
RUS	**Rural Utilities Services**
SAE Model	**Statistically Adjusted End-Use Model**
SCR	**Selective Catalytic Reduction**
SEPA	**Southeastern Power Administration**
SO_2	**Sulfur Dioxide**
TIER	**Times-Interest Earned Ratio**
TRC Test	**Total Resource Cost Test**
TVA	**Tennessee Valley Authority**