The Maximum Achievable Cost Effective Potential for Electric Energy Efficiency In the Service Territory of the Big Rivers Electric Corporation

Final Report

Prepared for

Big Rivers Electric Corporation (BREC)

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MAXIMUM ACHIEVABLE COST EFFECTIVE POTENTIAL FOR ELECTRIC EFFICIENCY IN THE BREC TERRITORY
FINAL REPORT – NOVEMBER 10, 2005

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This technical report was prepared for the Big Rivers Electric Corporation by GDS Associates, Inc. GDS would like to acknowledge the many helpful data sources provided by BREC staff.

This report provides valuable and up-to-date estimates of electric energy efficiency potential savings information for decision-makers at BREC and for interested stakeholders. This report includes a thorough and up-to-date assessment of the impacts that electric energy efficiency measures and programs can have on electricity use in the service territory of BREC, the economic costs and benefits of such energy efficiency programs, and the environmental benefits of the maximum achievable cost effective programs identified by this study.

Richard F. Spellman, Vice President
GDS Associates, Inc.
November 10, 2005

1.0 EXECUTIVE SUMMARY – NATURAL GAS ENERGY EFFICIENCY POTENTIAL

This study estimates the maximum achievable cost effective potential for electric energy and peak demand savings from energy-efficiency measures in the geographic region of Kentucky served by the Big Rivers Electric Corporation. BREC). Energy-efficiency opportunities typically are physical, long-lasting changes to buildings and equipment that result in decreased energy use while maintaining the same or improved levels of energy service. The study shows that there is significant savings potential in the BREC service area for cost effective energy-efficiency measures that save electricity. Capturing the maximum achievable cost effective potential for energy efficiency in the BREC service area would reduce electric energy use by 12.2% (463 GWh annually) by 2015. The magnitude of the potential savings is very comparable to results reported for recent studies in other States (see Table 1-4 for the results of other recent studies). Load reductions from load management and demand response measures, which were not analyzed in this study, would be in addition to these energy efficiency savings. Table 1-1 below provides a summary of the maximum achievable cost effective energy efficiency potential savings for the BREC service area by the year 2015.

Table 1-1: Maximum Achievable Cost Effective Electric Energy Efficiency Potential By 2015 in the Service Area of the Big Rivers Electric Corporation

Sector	Maximum Achievable Cost Effective kWh Savings by 2015 from Electric Energy Efficiency Measures/Programs for the BREC Service Area	2015 kWh Sales Forecast for This Sector	Percent of Sector 2015 kWh Sales Forecast
Residential Sector	277,744,782	1,780,266,000	15.6%
Commercial and Small Industrial	85,475,300	854,753,000	10.0%
Large Industrial	99,758,000	1,159,630,000	8.6%
Total	462,978,082	3,794,649,000	12.2%

The net present savings to BREC for long-term implementation of energy efficiency programs throughout the BREC service area over the next decade are **$39 million.** The Total Resource Cost benefit/cost ratio for the maximum achievable cost effective potential scenario is 1.35. Because the overall TRC benefit/cost ratio is relatively low due to BREC's forecast of very low avoided costs for electricity, BREC's preferred strategy for energy efficiency is to provide an array of information and education to customers about the benefits of purchasing and installing energy efficiency measures in homes and businesses.

1.1 Study Scope

The objective of the study was to estimate the maximum achievable cost effective potential for energy conservation and energy efficiency resources over the ten-year period from 2006 through 2015 in the BREC service area. The definitions used in this study for energy efficiency potential estimates are the following:

- **Technical potential** is defined in this study as the complete penetration of all measures analyzed in applications where they were deemed technically feasible from an engineering perspective.

- **Maximum achievable potential** is defined as the maximum penetration of an efficient measure that would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market intervention. BREC would need to undertake an extraordinary effort to achieve this level of savings. The term "maximum" refers to efficiency measure penetration, and means that the GDS Team has based our estimates of efficiency potential on the maximum realistic penetration that can be achieved by 2015. The term "maximum" does not apply to other factors used in developing these estimates, such as measures energy savings or measure lives.

- **Maximum achievable cost effective potential** is defined as the potential for maximum penetration of energy efficient measures that are cost effective according to the Total Resource Cost test, and would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions. As demonstrated later tin this report, BREC would need to undertake an extraordinary effort to achieve this level of savings.

The main outputs of this study are summary data tables and graphs reporting the total cumulative maximum achievable cost effective potential for energy efficiency over the ten-year period, and the annual incremental achievable potential and cumulative potential, by year, for 2006 through 2015.

This study makes use of over 200 existing studies conducted throughout the US on the potential energy savings and penetration of energy efficiency measures. These other existing studies provided an extensive foundation for estimates of electric energy savings potential in existing residential, commercial and industrial facilities.

BREC has substantially expanded the assessment of electric energy efficiency potential savings in this new 2005 IRP to include additional energy efficiency equipment and building practices, and to include a detailed assessment of the maximum achievable cost effective electricity savings potential associated with aggressive energy efficiency measure/program implementation over the next decade in the BREC service area. While the prior IRP examined the cost effectiveness of many energy efficiency measures, this new energy efficiency potential assessment goes further to examine the magnitude of the potential savings that could be achieved throughout the BREC service area assuming aggressive implementation of programs over a ten-year period and assuming unlimited funding. The purpose of this analysis was to determine the maximum achievable kWh and dollar savings that could be achieved under such a scenario. This new energy efficiency analysis also provides a calculation of the net present value savings to BREC's members for the maximum achievable cost effective energy efficiency potential savings scenario.

1.2 Implementation Costs

Achieving the maximum achievable cost effective energy efficiency savings by 2015 would require programmatic support. Programmatic support includes financial incentives to customers, marketing, administration, planning, and program evaluation activities provided to ensure the delivery of energy efficiency products and services to consumers.

GDS estimates that costs for BREC (or its member distribution cooperatives) for program planning, administration, marketing, reporting and evaluation ("other program costs") would be 25% of efficiency measure incremental costs in the maximum achievable cost effective energy efficiency scenario.[1] Specifically, BREC would need to spend approximately $2.2 million a year for the next ten years for staffing, marketing, and administrative costs, plus approximately $4 to 5 million a year for financial incentives to electric consumers in order to achieve the maximum achievable cost effective potential savings. It is clear that to achieve all of the maximum achievable cost effective savings, BREC would have to undertake ***extraordinary*** steps to add staffing (either in-house staff or contractors), and BREC would have to spend close to **$8 million** a year to achieve such results.

1.3 Present Value of Savings and Costs (in $2006)

The results of this study demonstrate that energy-efficiency resources could play an expanded role in the BREC resource mix over the next decade. Table 1-2

[1] This estimate is based upon data collected by GDS for other electric utilities that have operated energy efficiency programs.

below shows the present value[2] of benefits and costs associated with implementing the maximum achievable potential energy savings in the BREC service area. The net present savings to BREC for long-term implementation of energy efficiency programs throughout the BREC service area are **$39 million.** The Total Resource Cost benefit/cost ratio for the maximum achievable cost effective potential scenario is 1.35. It is very important to note that the projected TRC benefit/cost ratio is lower than that found in for states with higher electricity costs. Because BREC's electric avoided costs are very, very low compared to other States, energy efficiency programs in the BREC service area typically have much lower TRC benefit/cost ratios than in high cost states in the Northeast, Midwest and the West coast.

Table 1-2: TOTAL RESOURCE COST TEST AND NET PRESENT VALUE SAVINGS FOR THE MAXIMUM ACHIEVABLE COST EFFECTIVE ELECTRICITY SAVINGS POTENTIAL SCENARIO FOR THE BREC SERVICE TERRITORY

Column #	1	2	3	4	5	6
	Present Value of Total Resource Benefits ($2006)	Present Value of Total Measure Incremental Costs ($2006)	Present Value of BREC Implementation Costs (Staffing, Marketing, Data Tracking & Reporting, etc., $2006)	Present Value Of Total Costs (Col 2 + Col 3)	Net Present Value savings ($2006)	Total Resource Cost (TRC) Benefit/Cost Ratio
Residential Sector	$114,046,771	$66,283,971	$16,570,993	$82,854,964	$31,191,807	1.38
Commercial Sector	$20,634,487	$13,270,543	$3,317,636	$16,588,179	$4,046,308	1.24
Industrial Sector	$16,012,307	$9,517,263	$2,379,316	$11,896,579	$4,115,728	1.35
Total	$150,693,565	$89,071,778	$22,267,944	$111,339,722	$39,353,843	1.35

Table 1-2 also provides the Total Resource Cost (TRC) Test benefit/cost ratio for the overall maximum achievable cost effective portfolio of energy efficiency measures, and the benefit/cost ratio by major market sector. The Total Resource Cost (TRC) Test is a standard benefit-cost test used by many of the public utilities commissions in the US and other organizations to compare the value of the avoided energy production and power plant construction to the costs of energy-efficiency measures and program activities necessary to deliver them. The value of both energy savings and peak demand reductions are incorporated into the TRC test.

1.4 Definitions of Benefit Cost Tests

A standard methodology for energy efficiency program cost effectiveness analysis was published in California in 1983 by the California Public Utilities Commission and updated in December 1987 and October 2001.[3] It was based

[2] The term "present value" refers to a mathematical technique used to convert a future stream of dollars into their equivalent value in today's dollars.

[3] California Public Utilities Commission and California Energy Commission, Standard Practice Manual, Economic Analysis of Demand-Side Programs and Projects, 1987 and 2001.

on experience with evaluating conservation and load management programs in the late 1970's and early 1980's. This methodology examines five perspectives:

- the Total Resource Cost Test
- the Participant Test
- the Utility Cost Test (or Program Administrator Test)
- the Rate Impact Measure (RIM) Test
- the Societal Cost Test

Table 1-3 below summarizes the major components of these five benefit/cost tests. Examining this table is useful when trying to understand the differences among the five benefit/cost tests.

Table 1-3
Components of Energy Efficiency Benefit/Cost Tests

	PARTICIPANT TEST	RATE IMPACT MEASURE TEST	TOTAL RESOURCE COST TEST	UTILITY COST TEST	SOCIETAL TEST
BENEFITS:					
Reduction in Customer's Utility Bill	X				
Incentive Paid By Utility	X				
Any Tax Credit Received	X		X		
Avoided Supply Costs		X	X	X	X
Avoided Participant Costs	X		X		X
Participant Payment to Utility (if any)		X		X	
External Benefits					X
COSTS:					
Utility Costs		X	X	X	X
Participant Costs	X		X		X
External Costs					X
Lost Revenues		X			

The five cost-benefit tests are defined by the California Standard Practice Manual as follows:

1.4.1 The Total Resource Cost Test

The Total Resource Cost (TRC) test measures the net costs of a demand-side management or energy efficiency program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.[4]

Benefits and Costs: The TRC test represents the combination of the effects of a program on both the customers participating and those not participating in a program. In a sense, it is the summation of the benefit and cost terms in the Participant and the Ratepayer Impact Measure tests, where the revenue (bill) change and the incentive terms intuitively cancel (except for the differences in net and gross savings).

The benefits calculated in the Total Resource Cost Test include the avoided natural gas supply costs for the periods when there is a gas load reduction, as well as savings of other resources such as electricity and water. The avoided supply costs are calculated using net program savings, which are the savings net of changes in energy use that would have happened in the absence of the program.

The costs in this test are the program costs paid by the utility and the participants plus any increase in supply costs for periods in which load is increased. Thus all equipment costs, installation, operation and maintenance, cost of removal (less salvage value), and administration costs, no matter who pays for them, are included in this test. Any tax credits are considered a reduction to costs in this test.

1.4.2 The Participant Test

The Participant Test is the measure of the quantifiable benefits and costs to program participants due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.[5] This test is designed to give an indication as to whether the program or measure is economically attractive to the customer. Benefits include the participant's retail bill savings over time, and costs include only the participant's costs.

[4]California Public Utilities Commission, California Standard Practice Manual, Economic Analysis of Demand-Side Management Programs and Projects, October 2001, page 18.
[5]Ibid., page 9.

1.4.3 The Rate Impact Measure Test

The Ratepayer Impact Measure (RIM) Test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by a program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementation are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer rate levels.[6] Thus, this test evaluates an energy efficiency program from the point of view of rate levels. The RIM test is a test of fairness or equity; it is not a measure of economic efficiency.

1.4.4 The Utility Cost Test

The Utility Cost Test measures the net costs of a demand-side management program as a resource option based on the costs incurred by the utility (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the Total Resource Cost Test benefits. Costs are defined more narrowly, and only include the utility's costs.[7] This test compares the utility's costs for an energy efficiency program to the utility's avoided costs for electricity and/or gas. It is important to remember that the Utility Cost Test ignores participant costs. This means that a measure could pass the Utility Cost Test but not be cost effective from a more comprehensive perspective.

1.4.5 The Societal Test

The Societal Cost Test is structurally similar to the Total Resource Cost Test. It goes beyond the TRC test in that it attempts to quantify the change in total resource costs to society as a whole rather than to only the service territory (the utility and its ratepayers). In taking society's perspective, the Societal Cost Test utilizes essentially the same input variables as the TRC test, but they are defined with a broader societal point of view.[8] An example of a societal benefit is reduced emissions of carbon, nitrous and sulfur dioxide from electric utility power plants. One example of a societal cost is the incremental cost to the health care system in the United States for dealing with increased respiratory ailments (asthma, etc.) due to the construction of new power plants that produce emissions and particulates. When calculating the Societal Cost Test benefit/cost ratio, future streams of benefits and costs are discounted to the present using a societal discount rate. The avoided costs of natural gas, electricity and water used for the benefit/cost analyses in this report are provided in Appendix E.

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[6] Ibid., page 17.
[7] Ibid., page 33.
[8] Ibid., page 27.

1.5 Definition of Electric Avoided Costs

The **avoided electric supply costs** for the BREC energy efficiency potential study consist of the electric supply costs avoided by BREC due to the implementation of electric energy efficiency programs. These avoided supply costs reflect the electric supply costs avoided by BREC when energy efficiency programs are implemented. These avoided electric system supply costs are those that would be avoided by BREC due to the implementation of a portfolio of energy efficiency programs The costs that are avoided depend on the amount electricity that is saved, and when it is saved (in peak heating season periods, seasonal or annual, etc.). The avoided costs of electricity, natural gas and water used in this study are provided in Appendix E.

Second, it is very important to note that the electricity avoided costs used in the Total Resource Cost (TRC) Test is not the retail rate for each customer class. While the actual retail rate is used in the calculation of the benefits for the Participant Test, the actual retail rate is not the avoided electric cost used in the calculation of the Total Resource Cost Test benefits.

1.6 Comparison of Results to Other Gas Savings Potential Studies

Table 1-4 presents a comparison of the results of this study to other recent electric potential studies. As shown in Table 1-6 below, the potential electricity savings available in the BREC service territory are very similar to the findings of these other recent studies.

Table 1-4: Comparison of Potential Electrcity Savings from Recent Studies in Other States

Percent of Total Electricity (GWh) Sales

Sector	Connecticut 2012	California 2011[2,3]	Vermont 2012[1,4]	Mass. 2007[1,4]	Southwest 2020(6)	Georgia 2015(7)	New York 2012(8)	Oregon 2013(9)
Technical Potential								
Residential	21%	28%			26%(6)	33%	43%	28%
Commercial	25%	18%			37%(6)	33%	42%	32%
Industrial	20%	15%			33%(6)	17%	22%	35%
Total	***24%***	***18%***			***33%(6)***	***29%***	***39%***	***31%***
Maximum Achievable Potential								
Residential	17%		30%			21%	32%	
Commercial	17%		32%			22%	39%	
Industrial	17%		32%			15%	20%	
Total	***17%***	***13%***	***31%***			***20%***	***34%***	
Maximum Achievable Cost Effective Potential								
Residential	13%	10%		31%		9%		
Commercial	14%	10%		21%		10%		
Industrial	13%	9%		21%		7%		
Total	***13%***	***10%***		***24%***		***9%***		

The footnotes to Table 1-4 are provided below.

1. Vermont and Massachusetts studies reported commercial and industrial sectors together.
2. "California's Secret Energy Surplus: The Potential For Energy Efficiency – Final Report", Prepared for The Energy Foundation and The Hewlett Foundation, prepared by XENERGY Inc., September 23, 2002. Page 3-3.
3. "CALIFORNIA STATEWIDE RESIDENTIAL SECTOR ENERGY EFFICIENCY POTENTIAL STUDY"; Study ID #SW063; FINAL REPORT VOLUME 1 OF 2; Prepared for Rafael Friedmann, Project Manager Pacific Gas & Electric Company San Francisco, California; Principal Investigator: F
4. "Electric and Economic Impacts of Maximum Achievable Statewide Efficiency Savings; 2003-2012 – Results and Analysis Summary"; Public Review Draft of May 29, 2002; prepared for the Vermont Department of Public Service by Optimal Energy, Inc.; Pages 32 &
5. The Remaining Electric Energy Efficiency Opportunities in Massachusetts; Final Report June 7, 2001; prepared for Program Administrators and Massachusetts Division of Energy Resources by RLW Analytics, Inc. and Shel Feldman Management Consulting; Page i
6. Southwest Energy Efficiency Project; "The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest"; Prepared for: Hewlett Foundation Energy Series; prepared by Southwest Energy Efficiency Project; November 2002; Page ES-5. It
7. Georgia Environmental Facilities Authority, "Assessment of Energy Efficiency Potential in Georgia - Final Report" prepared by ICF Consulting, May 5, 2005. Maximum Achievable shown corresponds to "Economic" in report and Maximum Achievable Cost Effecti
8. New York State Energy Research and Development Authority, "Energy Efficiency and Renewable Energy Resource Development Potential in New York State - Final Report" prepared by Optimal Energy, Inc., August, 2003. Maximum Achievable shown corresponds to
9. ENERGY EFFICIENCY AND CONSERVATION MEASURE RESOURCE ASSESSMENT FOR THE RESIDENTIAL, COMMERCIAL, NDUSTRIAL AND AGRICULTURAL SECTORS Prepared for the Energy Trust of Oregon, Inc. By Ecotope, Inc., ACEEE, Tellus Institute, Inc. January, 2003.

2.0 INTRODUCTION

The main objective of this energy efficiency potential assessment is to assess and evaluate the potential for achievable and cost-effective electric energy efficiency measures and electricity savings for residential, commercial and industrial customers in the BREC service territory. The main outputs of this study include the following deliverables:

- A concise, fully documented report on the work performed and the results of the analysis of opportunities for achievable, cost effective electric energy efficiency in BREC's service territory.
- An overview of the impacts that energy efficiency measures and programs can have on electric use in the BREC service territory.
- A summary of the economic costs and benefits of potential energy efficiency measures and programs.
- An assessment of the environmental and other non-energy benefits of the maximum achievable cost effective electric energy efficiency options examined in this study.

2.1 Summary of Approach

A comprehensive discussion of the study methodology is presented in Section 4. GDS first developed estimates of the technical potential and the maximum achievable potential for electric energy efficiency opportunities for the residential, commercial and industrial sectors in BREC's service territory. The GDS analysis utilized the following models and information:

(1) an existing electric energy efficiency potential spreadsheet model[9];
(2) detailed information relating to the current and potential saturation of electric energy efficiency measures in the BREC service area; and
(3) available data on electric energy efficiency measure costs, saturations, energy savings, and useful lives.

The technical potential for electric energy efficiency was based upon calculations that assume one hundred percent penetration of all energy efficiency measures analyzed in applications where they were deemed to be technically feasible from an engineering perspective.

The maximum achievable potential for electric energy efficiency was estimated by determining the maximum penetration of an efficient measure that would be

[9] This GDS developed Excel spreadsheet model is used to estimate the energy efficiency potential for natural gas energy efficiency measures in New Mexico. It operates on a PC platform using the Microsoft Windows operating system, is documented, and can be followed by a technician with expertise. GDS has provided this model to the study sponsors as a deliverable of this project.

adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market intervention.

The third level of energy efficiency examined is the maximum achievable cost effective potential. The calculation of the cost effective maximum achievable potential is based, as the term implies, on the assumption that energy efficiency measures/bundles will only be included in BREC electric efficiency programs when it is cost effective to do so.

All cost effectiveness calculations for electric energy efficiency measures and programs were done using a spreadsheet model that operates in Excel and that has been approved by regulators in several states.

2.2 Report Organization

The remainder of this report is organized as follows:

- Section 3 – Electric Usage – Overview of BREC Electric Sales and Peak Load Forecast
- Section 4 – Methodology for Determining Energy Savings Potential
- Section 5 – Electric Energy Efficiency Potential – Residential Sector
- Section 6 – Electric Energy Efficiency Potential – Commercial Sector
- Section 7 – Electric Energy Efficiency Potential – Industrial Sector
- Section 8 – Environmental and Other Non-Energy Benefits of Electric Energy Efficiency Programs
- Section 9 – Summary of Findings

3.0 CHARACTERIZATION OF CUSTOMER BASE, ELECTRIC USAGE, AND EXISTING ENERGY EFFICIENCY PROGRAMS IN THE BREC SERVICE TERRITORY

3.1 Overview of Big Rivers Service Area

The Big Rivers Electric Corporation is an electric generation and transmission cooperative supplying the wholesale power needs of its three member cooperatives and marketing power to non-member utilities and power markets. These members provide retail electric power and energy to industrial, residential and commercial customers in portions of 22 western Kentucky counties. For the purposes of this energy efficiency potential report, all references made to Big Rivers' service territory is to the 22 counties served by the three member cooperatives. Headquartered in Henderson, Kentucky, Big Rivers is dedicated to the following:

- Providing reliable wholesale energy to its three member cooperative owners who serve approximately 106,000 customers in the Commonwealth of Kentucky.
- Marketing reliable energy to surrounding utilities.
- Protecting the environment through detailed planning
- In-house design and construction of transmission and substation facilities
- Adding value to the customer through conservative measures

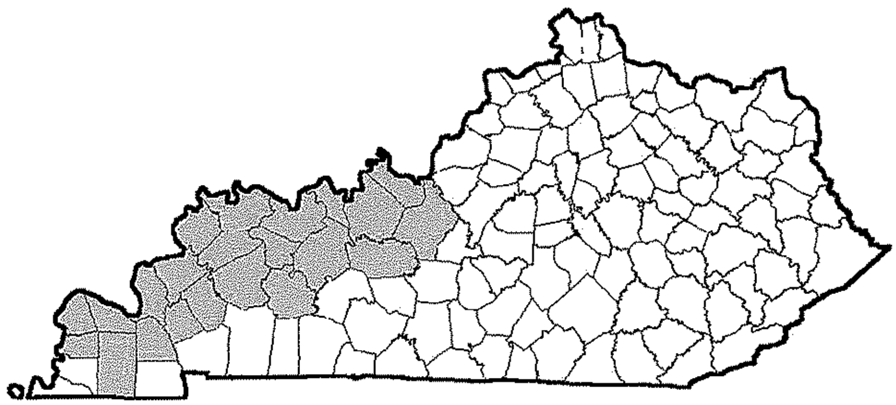
The distribution electric cooperatives that belong to Big Rivers are the following:

- Jackson Purchase Energy Corporation ("JPEC")
- Kenergy Corp. ("Kenergy")
- Meade County Rural Electric Cooperative Corporation ("MCRECC")

There are 22 counties included in the Big Rivers service area. Listed below are the counties in Kentucky served by each member distribution cooperative:

- JPEC - Ballard, Carlisle, Graves, Livingston, Marshall and McCracken
- Kenergy - Breckinridge, Daviess, Caldwell, Crittenden, Hancock, Henderson, Hopkins, Livingston, Lyon, McLean, Muhlenberg, Ohio, Union and Webster
- MCRECC - Breckinridge, Grayson, Hancock, Hardin, Meade and Ohio

3.2 BREC Service Area Map



3.3 Economic/Demographic Characteristics of the Service Area

The total population of the Big Rivers service area is 639,746[10] persons. Population in the past ten years has grown 0.5% per year in the region. The gender split is 51.2% female and 48.8% male. The summary below shows gender statistics for the counties that Big Rivers serves, Kentucky, and the United States.

Table 3-1: Gender Distribution

Gender	Big Rivers	Kentucky	US
Male	48.8%	49.0%	49.2%
Female	51.2%	51.0%	50.8%

The majority of the population in the BREC service area falls in the 20-44 years (33.7%) of age range. The median age for the region is 39.5 years.

Table 3-2: Age Distribution

Age	Big Rivers	Kentucky	US
Under 20	24.7%	25.2%	27.8%
20-44	33.7%	36.5%	35.8%
45-64	27.0%	25.8%	24.1%
65+	14.6%	12.5%	12.3%
Median Age	39.5	37.5	36.1

[10] This population estimate is higher than the total population value in the 2005 Load Forecast, which is weighted to reflect the population served by Big Rivers. The weighted population for Big Rivers in 2004 is 244,180.

The ethnicity of the population is predominantly white (93%). National, state, and local statistics are found below.

Table 3-3: Ethnicity Distribution

Ethnicity	Big Rivers	Kentucky	US
White	93.1%	89.4%	68.1%
Black	5.0%	7.6%	12.5%
Native American	0.2%	0.2%	0.8%
Asian and Pacific Islander	0.4%	1.0%	4.6%
Hispanic	1.3%	2%	14%

The Big Rivers service area:

- Covers approximately 8,000 square miles
- Contains 88-substations
- Utilizes just under 2,000 miles of transmission lines
- Has 7 surrounding utilities
- Serves 106,000 customers in 22 counties[11]

According to the estimates from the US Census[12], in 2003 the five largest cities (and their population counts) in the Big Rivers service territory are the following:

Table 3-4: Largest Cities

In the Service Area	
Owensboro, KY	54,312
Henderson, KY	27,468
Paducah, KY	25,565
Elizabethtown, KY	23,239
Radcliff, KY	21,894
Outside the Service Area	
Louisville, KY	248,762
Evansville, IN	121,582
Bowling Green, KY	50,663

The population density in the Big Rivers service area is approximately 80 persons per square mile[13]. This is less than the state population density, which is about 102.5 persons per square mile.

It is estimated that the proportion of single-family homes is 86.9% and the proportion of multi-family homes is 13.1% within the service area[14]. Average

[11] 2005 Big Rivers Load Forecast
[12] www.census.gov
[13] GDS estimate using 8,000 square miles and 640,000 for population.

household income for the counties served by Big Rivers is $58,986, which is lower than both the total state and national averages. The following table presents a distribution of household incomes for the area served by Big Rivers as well as for Kentucky and the entire U.S.

Table 3-5: Average Household Income

Income Range	Big Rivers	Kentucky	US
$9,999 or less	12.4%	13.0%	9.0%
$10,000 - $19,999	16.0%	15.2%	11.9%
$20,000 - $29,999	14.7%	14.4%	12.4%
$30,000 - $44,999	19.5%	18.4%	17.6%
$45,000 - $59,999	14.6%	13.9%	14.5%
$60,000 - $74,999	9.7%	9.4%	10.9%
$75,000 - $99,999	7.4%	8.1%	10.8%
$100,000 - $124,999	2.7%	3.4%	5.5%
$125,000 - $149,000	1.1%	1.5%	2.6%
$150,000 - $199,999	0.8%	1.3%	2.3%
$200,000 - or more	1.1%	1.5%	2.5%
Average Income	**$ 58,986**	**$ 66,591**	**$ 85,383**

The majority of the population in the Big Rivers service area is employed by careers in the services, retail trade and manufacturing industries. The following table presents a distribution of employment for the counties served by Big Rivers, the state of Kentucky, and the U.S.

Table 3-6: Area of Employment Distribution

Description	Big Rivers	Kentucky	US
Farm	6.5%	4.6%	1.8%
Other Agricultural	1.3%	1.3%	1.3%
Mining	1.4%	0.9%	0.0%
Construction	7.0%	5.9%	5.7%
Manufacturing	15.1%	13.6%	10.7%
Transport, Comm. and Public Utilities	4.8%	5.6%	5.0%
Wholesale Trade	3.6%	4.0%	4.4%
Retail Trade	17.5%	16.7%	16.1%
Finance, Insurance and Real Estate	4.5%	5.8%	8.0%
Services	25.1%	26.6%	32.7%
Federal Civilian Government	0.8%	1.5%	1.6%
Federal Military Government	0.6%	2.1%	1.2%
State and Local Government	11.8%	11.5%	11.0%

[14] ESRI

3.4 Latest Forecast of kWh Sales and Peak Demand

This latest BREC load forecast was completed in July 2005 and updates the prior load forecast that was completed in July 2003.[15] The forecast contains projections of energy and demand requirements for the 2005-2019 forecast horizon. High and low range forecast scenarios were developed to address uncertainties regarding the factors expected to influence energy consumption in the future.

The July 2005 forecast shows that total system native energy and peak demand requirements are projected to increase at average compound rates of 1.6% and 1.5%, respectively, from 2004 through 2019[16]. Growth in system requirements is projected to be conservative, as requirements for direct serve customers, which comprise approximately 32% of total system energy sales, have been held constant throughout the forecast period. Rural system energy and peak demand requirements, which are represented as total system requirements less those associated with direct-serve customers, are projected to increase at an average rate of 2.2% and 2.1%, respectively, over the same period.

The forecast is summarized in Tables 3-7 and 3-8 on the following page. The primary influences on long-term growth in BREC electric system requirements over the forecast period will continue to be growth in rural system requirements, which is primarily a function of growth in number of customers and changes in industrial activity. Industrial sales have declined in recent years due to economic conditions and the development of a cogeneration site by Weyerhauser. When combined with rural system sales, which have increased over the same period, total system sales growth has been low. Over the forecast horizon, industrial sales are projected to stay relatively level, and residential sales are expected to grow at 2.2% annually, resulting in overall system growth of 1.6% per year.

[15] Big Rivers Electric Corporation, 2005 Load Forecast, July 2005 (113 pages). Prepared by GDS Associates for BREC.
[16] Based on weather normalized values for 2005 and 2019.

Table 3-7
Load Forecast Summary

		Total System		Rural System	
Year	Consumers	Energy Requirements (MWH)	Peak Demand (CP kW)	Energy Requirements (MWH)	Peak Demand (CP kW)
1994	87,256	7,721,677	1,189,000	1,571,482	352,635
1999	98,168	3,532,841	663,890	1,921,792	475,416
2004	106,414	3,158,698	604,155	2,133,190	476,409
2009	114,383	3,519,951	675,440	2,485,739	536,630
2014	123,516	3,767,931	728,343	2,737,034	589,533
2019	133,462	4,054,080	789,356	3,027,093	650,546

Table 3-8
Load Forecast – Average Annual Growth Rates

Description	2004-2009	2004-2019
Total Native System Energy Requirements	1.8%	1.6%
Total Native System Peak Demand (CP)	1.3%	1.5%
Rural System Energy Requirements	2.6%	2.2%
Rural System Peak Demand (CP)	2.4%	2.1%
Residential Energy Sales	2.1%	2.2%
Residential Consumers	1.3%	1.4%
Small Commercial & Industrial Energy Sales	3.2%	2.1%
Small Commercial & Industrial Energy Consumers	2.4%	2.2%
Large Industrial – Direct Serve Energy Sales	0.3%	0.1%
Large Industrial – Direct Serve Consumers	0.0%	0.0%
Irrigation Sales	0.0%	0.0%
Public Street Lighting Sales	2.0%	1.8%

3.5 Existing Member Cooperative Demand-Side Programs

Kenergy

Kenergy offers educational and informative brochures, magazine articles, and television and radio commercials relating to energy efficiency topics. The ground source heat pump continues to be the central HVAC technology promoted.

Energy Resource Conservation Loans at 5 percent interest are available from Kenergy to qualifying customers installing a geothermal system in their existing homes. This offer is not available for new construction. The loans may finance up to 100 percent of the installation cost and may be amortized for up to 60 months. Kenergy publishes advertisements in newspapers and magazines that describe their 5% financing for installations in existing homes for geothermal energy systems. Informative pamphlets and magazine articles are used by Kenergy to educate customers on the energy savings gained by installing a geothermal system.

Following are annual operating cost estimates and efficiencies for different types of heating and cooling equipment in an average-size home (approximately 1,500 square feet). Resistance heat includes baseboards, ceiling cable and electric furnace. Propane based on $1.91 per gallon + $40 yearly tank rental. Natural gas based on $1.24 per CCF.

ANNUAL HEATING & COOLING OPERATING COSTS	
Resistance Heat	$816.05
Propane Heat 80% Efficient	$967.52
Natural Gas	$605.16
10 SEER Heat Pump	$594.58
12 SEER Heat Pump	$506.03
14 SEER Heat Pump	$440.62
Geothermal	$322.56

Kenergy is not currently conducting any load management programs.

Jackson Purchase Energy Corporation
JPEC provides similar informational articles and brochures for their members. One publication that they distribute is the Energy Savers Tips on Saving Energy & Money at Home, which is a brochure that compiles ideas and measures that will help reduce energy usage and save money for members. Magazine articles are also posted on the cooperative's web site with ideas on how to save energy (for example, by providing shade trees around a home to reduce peak air-conditioning loads). The JPEC web site provides the following additional links:

- a link to the electronic copy of the Energy Savers pamphlet.
- a link to the Department of Energy's Home Energy Saver Web Site. A cooperative member can go to that web site and obtain detailed information on energy use for their home and how to reduce their energy usage. A cooperative member can even customize the information for their specific type of home.

JPEC provides cash incentives for high efficiency heat pumps in new and existing residential homes. JPEC is not currently conducting any load management programs. JPEC provides free caulk to its member consumers in efforts to help consumers maintain adequate insulation of their homes.

Meade County Rural Electric Cooperative Corporation
MCRECC provides energy efficiency informational brochures on geothermal heating and cooling systems, and also publishes articles relating to energy efficiency tips in Kentucky Living magazine. The articles suggest ways to save on cooling costs during the summer and save on heating costs during the winter. Radio advertisements are also a way of educating their consumers about energy efficiency topics. Advertisements are also used to increase awareness of water and energy conservation issues such as leaking faucets and to increase awareness of energy efficiency measures that can be used to save money on heating and cooling bills while still making the home comfortable.

MCRECC offers the "All Seasons Comfort Home" program to a cooperative member that is building a new home. The program provides recommended, proven standards for insulation, energy-saving features, and assistance in the selection and installation of high efficiency heat pumps and geothermal heating and cooling systems. MCRECC provides information to members on the most efficient and economical heating and cooling system equipment. MCRECC is not currently conducting any load management programs.

The energy efficiency initiatives offered by Big Rivers' member system distribution cooperatives are summarized below in Table 3-10.

Table 3-10: Summary Of Existing Energy Efficiency Initiatives Offered By Big Rivers Electric Corporation And Its Distribution Cooperative Members

Kenergy

- Kentucky Living Magazine – Monthly magazine to all customers - focus articles on energy efficiency for the home and business and 4 page insert from local cooperative detailing programs, safety and customer service.
- DOE Pamphlet "Energy Savers - Tips on Saving Energy & Money at Home"
- Heat Pump Programs – Incentives Programs - 5% financing for Ground Source Heat Pumps for up to 5 years
- C/I News – Quarterly magazine to commercial and industrial customers – focus on energy related topics including conservation and efficiency improvements.
- Energy Efficiency Informational Brochures "Geothermal Heating and Cooling – The Answer to Comfortable and Affordable Living"
- Distribution of compact fluorescent bulbs to customers attending annual *meeting*

- Incentives Programs:
  - Touchstone Energy Home
  - Water Heater Replacement
  - Add-on Heat Pump
- Heat Loss / Gain analysis for HVAC contractors
- Web Site Information and Links
  - Geothermal Heat Pump Systems
  - USDOE – Energy Saving Tips for Consumers
  - USDOE – Home Energy Audit
  - Commercial Building Energy Checklist
- Energy Audits As Needed
  - Commercial / Industrial
  - Residential
- News Paper Advertising
  - Safety
  - Energy Efficiency

Jackson Purchase Energy

- DOE Pamphlet "Energy Savers - Tips on Saving Energy & Money at Home"
- Customer Newsletter – "Plugged In" Focus articles include energy efficiency, safety information and customer service
- C/I News – Quarterly magazine to commercial and industrial customers – focus on energy related topics including conservation and efficiency improvements.
- Pamphlet - "Keep An Eye On That Thermostat"
- Pamphlet - "How much will this light bulb save you?"
- Distribution of compact fluorescent bulbs to customers attending annual meeting
- Incentives Programs:
  - Touchstone Energy Home
  - Water Heater Replacement
  - Add-on Heat Pump
- Web Site Information and Links
  - USDOE – Energy Saving Tips for Consumers
  - USDOE – Home Energy Audit
- Energy Audits As Needed
  - Commercial / Industrial
  - Residential
- News Paper Advertising
  - Safety
  - Energy Efficiency
- Energy Efficiency Training for Employees
  - Basic – Employees with limited customer contact receive training in energy cost and efficiencies

  - Advanced – Employees with extensive customer contact receive in addition to the basic course. Training includes additional training in HVAC, water heating, lighting, building envelope and construction techniques who in turn will provide that guidance to customers.

Meade County RECC

- DOE Pamphlet "Energy Savers - Tips on Saving Energy & Money at Home"
- C/I News – Quarterly magazine to commercial and industrial customers – focus on energy related topics including conservation and efficiency improvements.
- Kentucky Living Magazine – Monthly magazine to all customers - focus articles on energy efficiency for the home and business and 4 page insert from local cooperative detailing programs, safety and customer service.
- Brochure – "Planting Trees to Save Money"
- Distribution of compact fluorescent bulbs to customers attending annual meeting
- Web Site Information and Links
  - Geothermal Heat Pump Systems
  - USDOE – Energy Saving Tips for Consumers
  - USDOE – Home Energy Audit
  - Commercial Building Energy Checklist
- Energy Audits As Needed
  - Commercial / Industrial
  - Residential
- News Paper Advertising
  - Safety
  - Energy Efficiency
- Energy Efficiency Training for Employees
- Basic – Employees with limited customer contact receive training in energy cost and efficiencies

4.0 Overall Approach To Assess Achievable Potential for Energy Efficiency Measures

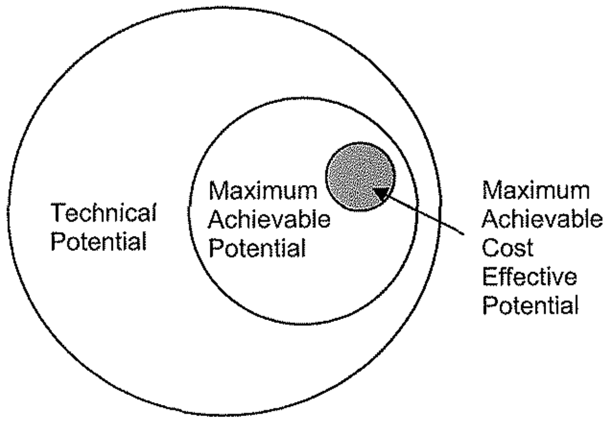
This section of the report presents an overview of the approach and methodology that was used to determine the maximum achievable cost-effective potential for electric energy efficiency measures in the service territory of BREC. The three key calculations that have been undertaken to complete this assessment are described below. Following the descriptions, the three stages of potential energy savings are shown graphically in a Venn diagram in Figure 4-1.

The first step was to estimate the technical potential for electric energy efficiency savings in the BREC service territory. **Technical potential** is defined as the complete penetration of all measures analyzed in applications where they are deemed to be technically feasible from an engineering perspective. The total technical potential for electric energy efficiency for each sector was developed from estimates of the technical potential of individual energy efficiency measures applicable to each sector (energy efficient space heating, energy efficient water heating, etc.). For each energy efficiency measure, GDS calculated the electricity 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).

The second step was to estimate the maximum achievable efficiency potential. **Maximum achievable potential** is defined as the maximum penetration of an efficient measure that would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market intervention over the next decade. The term "maximum" refers to efficiency measure penetration, and means that the GDS Team based its estimates of efficiency potential on the maximum realistic penetration that can be achieved. For similar studies recently completed by GDS in Connecticut, Florida, Utah, and New Mexico, GDS selected a long-term (over ten years) maximum achievable penetration rate of **80 percent** for all sectors. GDS has conducted additional secondary research on electric energy efficiency programs and determined that this long-term 80 percent penetration estimate is also applicable to this study.

The third step in this study was to estimate the maximum achievable cost effective potential. The **maximum achievable cost effective potential** is defined as the potential for maximum penetration of energy efficient measures that are cost effective according to the Total Resource Cost (TRC) test (TRC benefit/cost ratio of 1.0 or greater), and would be adopted given unlimited funding, and by determining the maximum market penetration that can be achieved with a concerted, sustained campaign involving highly aggressive programs and market interventions over the next decade. To develop the cost effective achievable potential, the GDS Team only retained those electric energy efficiency measures in the analysis that were found to be cost effective (according to the Total Resource Cost Test) based on the individual measure cost effective analyses conducted in this Study. Energy efficiency measures that are not cost effective were excluded from the estimate of cost effective achievable electric energy efficiency potential. Figure 4-1 below shows these three stages of the electric energy savings potential.

Figure 4-1 – Venn Diagram of the Stages of Energy Savings Potential



4.1 Overview of Methodology

Our analytical approach began with a careful assessment of the existing level of electric energy efficiency that has already been accomplished in the BREC service territory. For each electric energy efficiency measure, this analysis assessed how much energy efficiency has already been accomplished as well as the remaining potential for energy efficiency savings for a particular electric end use. For example, if 100 percent of the homes in the BREC service territory had electric lighting, and 30 percent of light bulbs were already high efficiency compact fluorescent bulbs (CFLs), then the remaining potential for energy efficiency savings is the 70 percent of light bulbs in the residential sector that are not already high efficiency bulbs.

The general methodology used for estimating the potential for electric energy efficiency in the residential, commercial and industrial sectors of the BREC service area included the following steps:

1. Identification of data sources for electric energy efficiency measures.
2. Identification of electric energy efficiency measures to be included in the assessment.
3. Determination of the characteristics of each energy efficiency measure including its incremental cost, energy savings, operations and maintenance savings, current saturation, and useful life.

4. Calculation of initial cost-effectiveness screening metrics (e.g., the total resource cost (TRC) benefit cost ratio) and sorting of measures from least-cost to highest cost.
5. Collection and analysis (where data was available) of the baseline and forecasted characteristics of the electric end use markets, including electric equipment saturation levels and consumption, by market segment and end use over the forecast period.
6. Integration of measure characteristics and baseline data to produce estimates of cumulative costs and savings across all measures (supply curves).
7. Determination of the cumulative technical and maximum achievable potentials using supply curves.
8. Determination of the annual maximum achievable cost effective potential for electricity savings over the forecast period.

A key element in this approach is the use of energy efficiency supply curves. The advantage of using an energy efficiency supply curve is that it provides a clear, easy-to-understand framework for summarizing a variety of complex information about energy efficiency technologies, their costs, and the potential for energy savings. Properly constructed, an energy-efficiency supply curve avoids the double counting of energy savings across measures by accounting for interactions between measures. The supply curve also provides a simplified framework to compare the costs of electric energy efficiency measures with the costs of electric energy supply resources.

The supply curve is typically built up across individual measures that are applied to specific base-case practices or technologies by market segment. 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. There are a number of other advantages and limitations of energy-efficiency supply curves (see, for example, Rufo 2003).[17]

4.2 General Methodological Approach

This section describes the calculations used to estimate the natural gas energy efficiency potential in the residential, commercial, and industrial sectors. There is a core equation, shown in Table 4-2, used to estimate the technical potential for each individual electric efficiency measure and it is essentially the same for each

[17] Rufo, Michael, 2003. *Attachment V – Developing Greenhouse Mitigation Supply Curves for In-State Sources, Climate Change Research Development and Demonstration Plan,* prepared for the California Energy Commission, Public Interest Energy Research Program, P500-03-025FAV, April. http://www.energy.ca.gov/pier/reports/500-03-025fs.html

sector. However, for the residential sector, the equation is applied to a "bottom-up" approach where the equation inputs are displayed in terms of the number of homes or the number of high efficiency units (e.g., compact fluorescent light bulbs, high efficiency air conditioning systems, programmable thermostats, etc.). For the commercial and industrial (C&I) sectors, a "top-down" approach was used for developing the technical potential estimates. In this case, the data is displayed in terms of energy rather than number of units or square feet of floor area.[18] Furthermore, due to the lack of readily available equipment saturation and electric end use data in the commercial sector, the energy savings potential estimates for the BREC commercial sector were based upon savings estimates from similar studies conducted recently in other States.

4.2.1 Core Equation for Estimating Technical Potential

The core equation used to calculate the electric energy efficiency technical potential for each individual efficiency measure for the residential and industrial sectors is shown below in Table 4-2.

Table 4-2 – Core Equation

Technical Potential of Efficient Measure	=	Total Number of Residential Households *[C&I : Total End Use Dth (by segment)]*	X	Base Case Equipment End Use Intensity (annual kWh use per home) *[C&I: NA]*	X	Base Case Factor	X	Remaining Factor	X	Convertible Factor	X	Savings Factor

where:

- **Number of Households** is the number of residential electric customers in the market segment. *(Residential only)*

- **Total end use decatherms (by segment)** is the forecasted level of electric gas sales for a given end-use (e.g., space heating) in a C&I market segment (e.g., office buildings). *(Industrial only)*

- **Base-case equipment end use intensity** is 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

[18] It is important to note that square-foot based saturation assumptions cannot be applied to energy use values without taking into account differences in energy intensity (e.g., an area covered by a unit heater may represent two percent of floor space but a larger percent of space heating energy in the building because it is likely to be less efficient than the main heating plant).

efficient measure were 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. *(Residential only)*

- **Base Case factor** is 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.

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

- **Convertible factor** is 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 they may not fit).

- **Savings factor** is the percentage reduction in electricity consumption resulting from application of the efficient technology.

Technical electric energy efficiency savings potential was 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 synergistic measures. By treating measures independently, their relative economics are analyzed without making assumptions about the order or combinations in which they might be implemented in customer buildings. However, the total technical potential across measures cannot be estimated by summing the individual measure potentials directly because some savings would be double-counted. For example, the savings from a weatherization measure, such as low-e ENERGY STAR® windows, are partially dependent on other measures that affect the efficiency of the system being used to cool or heat the building, such as high-efficiency gas furnaces or high efficiency air conditioning systems; the more efficient the gas furnace or electric air conditioner, the less energy saved from the low-e ENERGY STAR windows.

Due to the unique nature of industrial customers, the approach to develop savings potential for this sector is generally done on an industrial subsector (e.g. Food, Paper, Petroleum, Agriculture, etc.) basis. GDS used data provided by BREC on their largest eighteen industrial customers to develop the estimates of the industrial sector electricity savings potential.

For the residential and commercial sectors, the GDS Team addressed the new construction market separately. In the residential sector, detailed savings estimates for the ENERGY STAR Homes (Plus) program were used as a basis for determining electricity savings for this potential program in the BREC service territory.

4.2.2 Rates of Implementation for Energy Efficiency Measures

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 buildings, determining the annual rate of availability of savings is more complex. Energy efficiency potential in the existing stock of buildings can be captured over time through two principal processes:

1. as equipment replacements are made normally in the market when a piece of equipment is at the end of its useful life (we refer to this as the "market-driven" case); and,
2. at any time in the life of the equipment or building (which we refer to as the "retrofit" case).

Market-driven measures are generally characterized by *incremental* measure costs and savings (e.g., the incremental costs and savings of a high-efficiency versus a standard efficiency natural gas furnace); 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). A specialized retrofit case is often referred to as "early replacement". This refers to a piece of equipment whose replacement is accelerated by several years, as compared to the market-driven assumption, for the purpose of capturing energy savings earlier than they would otherwise occur.

For the market driven measures, we assumed that existing equipment will be replaced with high efficiency equipment at the time a consumer is shopping for a new appliance or other energy using equipment, or if the consumer is in the process of building or remodeling. Using this assumption, equipment that needs to be replaced (replaced on burnout) in a given year is eligible to be upgraded to high efficiency 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 efficiency programs.

4.2.3 Development of Maximum Achievable Cost Effective Potential Estimates for Energy Efficiency

To develop the **maximum achievable cost effective potential** for electric energy efficiency, energy efficiency measures that were found to be cost effective (according to the Total Resource Cost Test) were retained in the energy efficiency supply curves. Electric energy efficiency measures that were not cost effective were excluded from the estimate of maximum achievable cost effective energy efficiency potential.

4.2.4 Free-Ridership and Free-Driver Issues

Free-riders are defined as participants in an energy efficiency program who would have undertaken the energy-efficiency measure or improvement in the absence of a program or in the absence of a monetary incentive. Free-drivers are those who adopt an energy efficient product or service because of the intervention, but are difficult to identify either because they do not collect an incentive or they do not remember or are not aware of exposure to the intervention.[19] GDS has not included the impact of free-drivers in this study.

The issue of free-ridership is important. In summary, free-riders are accounted for through the electric energy and peak demand forecast provided by BREC. This electric kWh sales forecast already includes the impacts of naturally occurring energy efficiency (including impacts from vintaging of electric appliances, electric price impacts, and electric appliance efficiency standards). Because naturally occurring energy savings are already reflected in the electricity sales forecast used in this study, these electric savings will not be available to be saved again through the GDS energy efficiency supply curve analysis. GDS used this process to **ensure** that there is no "double-counting" of energy efficiency savings. This technical methodology for accounting for free-riders is consistent with the standard practice used in other recent technical potential studies, such as those conducted in California, Connecticut, Florida, Idaho, New Mexico and Utah.

4.3 Basis for Long Term Maximum Market Penetration Rate for High Efficiency Equipment and Building Practices

This section explains the basis used in this study for the maximum achievable penetration rate that cost effective electric energy efficiency programs can attain over the long-term (ten years) with well-designed programs and unlimited funding. GDS is using a maximum achievable penetration rate of **80 percent** by 2015 for BREC's residential, commercial and industrial sectors.

The maximum achievable natural gas energy efficiency potential for BREC's residential, commercial and industrial sectors is a subset of the technical potential estimates. The term "maximum" refers to efficiency measure penetration, and means that the GDS Team has based the estimates of

[19] Pacific Gas and Electric Company, "A Framework for Planning and Assessing Publicly Funded Energy Efficiency Programs", Study ID PG&E-SW040, March 1, 2001.

efficiency potential on the maximum realistic penetration that can be achieved by 2015 (ten years from now). The term "maximum" does not apply to other factors used in developing these estimates, such as measure costs, measure energy savings or measure lives.

The maximum achievable potential estimate for energy efficiency defines the upper limit of savings from market interventions. For each sector, the GDS Team developed the initial year (2006) and terminal year (2015) penetration rate that is likely to be achieved over the long term for groups of measures (space heating equipment, water heating equipment, etc.) by end use for the "naturally occurring scenario" and the "aggressive programs and unlimited funding" scenario. GDS reviewed maximum penetration forecasts from other recent energy efficiency technical potential studies, actual penetration experience for natural gas energy efficiency programs operated by energy efficiency organizations (Pacific Gas and Electric, KeySpan Energy Delivery, NEEP, NYSERDA, NEEA, BPA, Focus on Energy, other gas utilities, etc.), and penetration data from other sources (program evaluation reports, market progress reports, etc.) to estimate terminal penetration rates in 2015 for the maximum achievable scenario. In addition, the GDS Team conducted a survey of nationally recognized energy efficiency experts requesting their estimate of the maximum achievable penetration rate over the long-term for a state or region, assuming implementation of aggressive programs and assuming unlimited funding. The terminal year (2015) penetration estimates used by GDS for use in this study for BREC are based on the information gathered through this process. Based on a thorough review of all of this information, GDS used a maximum achievable penetration rate of **80 percent** by 2015 for BREC's residential, commercial and industrial sectors.

4.3.1 Examples of US Efficiency Programs with High Market Penetration

GDS collected information on energy efficiency programs conducted during the past three decades where high penetration has been achieved. Examples of seven such programs are listed below:

1. In the State of Wisconsin, a natural gas energy efficiency program to promote high efficiency gas furnaces attained a penetration rate of over 90 percent.[20]
2. KeySpan Energy Delivery's high efficiency residential furnace program has achieved a market share of approximately 70 percent over seven years (1997-2004).

[20] Hewitt, David. C., "The Elements of Sustainability", paper presented at the 2000 ACEEE Summer Study on Energy Efficiency in Buildings. Washington: American Council for an Energy Efficient Economy. Pages 6.179-6.190. The Wisconsin furnaces case study data can be found on pages 6.185-6.186.

3. The Residential Multifamily/Low-Income Program administered by Efficiency Vermont achieved a market share of over 90 percent for new construction and nearly 30 percent for existing housing.[21]
4. The Northwest Energy Efficiency Alliance reported that the market share of ENERGY STAR windows in the Northwest reached 75 percent by mid-2002 and is continuing to increase.[21]
5. Vermont Gas Systems' reported that 68 percent of new homes in their service territory were ENERGY STAR Homes in 2002.[21]
6. Gaz Metro in Quebec reported that the national market share of high efficiency furnaces in Canada has reached 40 percent due to years of energy efficiency programs.[21]
7. Residential weatherization and insulation programs implemented by electric and gas utilities in New England have achieved high participation rates.

GDS finds that the actual market penetration experience from electric and gas energy efficiency programs in other States is useful and pertinent information that should be used as a basis for developing long-term market penetration estimates for electric energy efficiency programs in the BREC service territory. In addition, recent natural gas technical potential studies in California, Connecticut, Florida, New Mexico, and Utah also used a maximum achievable penetration rate of 80 percent.

4.3.2 Lessons Learned from America's Leading Efficiency Programs

GDS also reviewed program participation and penetration data included in ACEEE's March 2003 report on America's leading energy efficiency programs.[22] The information presented in this ACEEE report clearly demonstrates the wide range of high-quality energy efficiency programs that are being offered in various areas of the United States today. A common characteristic of the programs profiled in this ACEEE report is their success in reaching customers with their messages and changing behavior, whether regarding purchasing of new appliances, designing new office buildings, or operating existing buildings.

[21] ACEEE - America's Best Natural Gas Energy Efficiency Programs, 2003.
[22] York, Dan; Kushler, Martin; "America's Best: Profiles of America's Leading Energy Efficiency Programs," published by the American Council for an Energy Efficient Economy, March 2003, Report Number U032.

5.0 RESIDENTIAL SECTOR ELECTRIC EFFICIENCY POTENTIAL

This section of the report presents the estimates of electric technical, maximum achievable and maximum achievable cost effective energy efficiency potential for the existing and new construction market segments of the residential sector in the BREC service territory. According to this analysis, there is still a large remaining potential for electric energy efficiency savings in this sector. Table 5-1 below summarizes the technical, maximum achievable, and maximum achievable cost effective savings potential by the year 2015.

Table 5-1: Summary of Residential Electric Energy Efficiency Savings Potential in BREC Service Territory

	Estimated Cumulative Annual Savings by 2015 (kWh)	Savings in 2015 as a Percent of Total 2015 Residential Sector Electricity Sales
Technical Potential	462,490,556	26.0%
Maximum Achievable Potential	312,355,072	17.5%
Maximum Achievable Cost Effective Potential	277,744,782	15.6%

The maximum achievable cost effective potential in the residential sector is 277,745 mWh, or 15.6 percent of the BREC residential kWh sales forecast in 2015.

5.1 Residential Sector Electric Energy Efficiency Programs

Twenty-four residential electric energy efficiency programs or measures were included in the analysis for the residential sector. The set of electric energy efficiency measures considered was pre-screened to only include those measures that are currently commercially available. Thus, emerging technologies were not included in the analysis. Tables 5-2, 5-3, and 5-4 below list the residential sector electric energy efficiency programs or measures included in the technical, maximum achievable, and maximum achievable cost effective potential analyses.

In this report we also present the technical achievable potential results in the form of electric supply curves. The supply curve for electric energy efficiency savings is shown in Figure 5-1 below. This analysis is based on BREC's most recent residential electric sales forecast for the years 2006 to 2015. Energy-efficiency measures were analyzed for the most important electric consuming end uses: space heating, water heating, refrigeration, and lighting.

Table 5-2: Total Cumulative Annual Maximum Technical Potential kWh Savings for Electric Energy Efficiency In the BREC Service Territory By 2015

Residential Sector - Market Driven and Retrofit Savings

1	2	3	4	5
Measure #	**Measure Description**	**Single-Family**	**Multi-Family**	**Total**
1	CFL Replacing Incandescent for 2.7 hrs/day	93,548,202	14,652,128	108,200,330
2	CFL Torchiere (Halogen)	3,208,961	502,608	3,711,570
3	CFL Torchiere (Incandescent)	967,782	151,580	1,119,362
4	ES Single Room AC	3,737,987	585,468	4,323,455
5	ES Freezer-Top Refrigerator	51,557,193	8,075,223	59,632,416
6	ES Side-by-Side Refrigerator	21,655,248	3,391,786	25,047,033
7	ES Upright Freezer	1,829,434	286,538	2,115,972
8	ES Chest Freezer	594,443	93,106	687,549
9	ES Built-In Dishwasher	5,160,892	808,333	5,969,225
10	ES Washing Machine with Electric Clothes Dryer and Electric Water Heater	7,348,325	1,150,942	8,499,267
11	ES Washing Machine with Electric Clothes Dryer and Gas Water Heater	4,447,670	696,623	5,144,293
12	ES Washing Machine with Gas Clothes Dryer and Gas Water Heater	0	0	0
13	Programmable Thermostat	1,621,979	254,045	1,876,024
14	Water Heater Blanket	11,773,179	1,843,992	13,617,171
15	Low Flow Shower Head	9,098,685	1,425,095	10,523,781
16	Pipe Wrap	5,532,001	866,458	6,398,459
17	Air Sealing (Low Income)	20,188,284	0	20,188,284
18	Reset Water Heater Thermostat (Low Income)	6,561,192	0	6,561,192
19	Water Heater Wrap (Low Income)	1,009,414	0	1,009,414
20	Attic Insulation (Low Income)	15,141,213	0	15,141,213
21	Air Sealing	23,590,443	3,691,706	27,282,149
22	Attic Insulation	69,323,323	2,768,779	72,092,102
23	Wall Insulation	13,876,731	4,346,928	18,223,659
24	Window Construction	39,015,737	6,110,899	45,126,636
	Total kilowatt hours (kWh)	410,788,320	51,702,236	462,490,556
	Forecast 2015 BREC Residential kWh Sales			1,780,266,000
	As a percent of forecasted residential sales 2015			26.0%

Note: Maximum Technical potential kWh savings were obtained from Appendix A column 28
The forecast of annual BREC residential kWh sales was obtained from the report titled "Big Rivers Electric Corporation, 2005 Long-Term Load Forecast - Base Case, Residential Classification" Appendix B, page 13 by GDS Associates in July, 2005

Table 5-3: Total Cummulative Annual Maximum Achievable Potential kWh Savings for Electric Energy Efficiency In BREC Service Territory By 2015

Residential Sector - Market Driven and Retrofit Savings

1	2	3	4	5
Measure # from GDS Electric DSM Data Base	***Measure Description***	***Single-Family***	***Multi-Family***	***Total***
1	CFL Replacing Incandescent for 2.7 hrs/day	70,161,152	10,989,096	81,150,248
2	CFL Torchiere (compared to Halogen Torchiere)	3,123,389	489,205	3,612,594
3	CFL Torchiere (compared to Incandescent Torchiere)	941,974	147,538	1,089,513
4	Energy Star Single Room Air Conditioner	2,236,402	350,280	2,586,682
5	Energy Star Compliant Freezer-Top Refrigerator	23,435,088	3,670,556	27,105,644
6	Energy Star Compliant Side-By-Side Refrigerator	9,843,294	1,541,721	11,385,015
7	Energy Star Compliant Upright Freezer	912,034	142,849	1,054,883
8	Energy Star Compliant Chest Freezer	296,350	46,416	342,766
9	Energy Star Built-In Dishwasher	3,087,713	483,618	3,571,331
10	Energy Star Washing Machine with Electric Water Heater and Electric Clothes Dryer	4,166,576	652,596	4,819,172
11	Energy Star Washing Machine with Gas Water Heater and Electric Clothes Dryer	2,521,875	394,992	2,916,867
12	Energy Star Washing Machine with Gas Water Heater and Gas Clothes Dryer	0	0	0
13	Programmable Thermostat	1,257,489	196,956	1,454,446
14	Water Heater Blanket	8,310,479	1,301,641	9,612,121
15	Low Flow Shower Head	6,499,061	1,017,925	7,516,986
16	Pipe Wrap	4,149,001	649,843	4,798,844
17	Air Sealing (Low Income)	15,477,999	0	15,477,999
18	Reset Water Heater Thermostat (Low Income)	5,030,350	0	5,030,350
19	Water Heater Wrap (Low Income)	773,900	0	773,900
20	Attic Insulation (Low Income)	4,643,400	0	4,643,400
21	Air Sealing	18,872,355	1,476,682	20,349,037
22	Attic Insulation	55,458,658	1,107,512	56,566,170
23	Wall Insulation	11,101,385	1,738,771	12,840,156
24	Window Construction	31,212,590	2,444,359	33,656,949

Maximum Achievable kWh Savings by 2015	283,512,514	28,842,558	312,355,072
Forecast 2015 BREC Residential kWh Sales			1,780,266,000
As a percent of forecasted residential sales 2015			17.5%

Table 5-4: Total Annual Maximum Achievable Cost-Effective Potential kWh Savings for Electric Energy Efficiency In BREC Service Territory By 2015

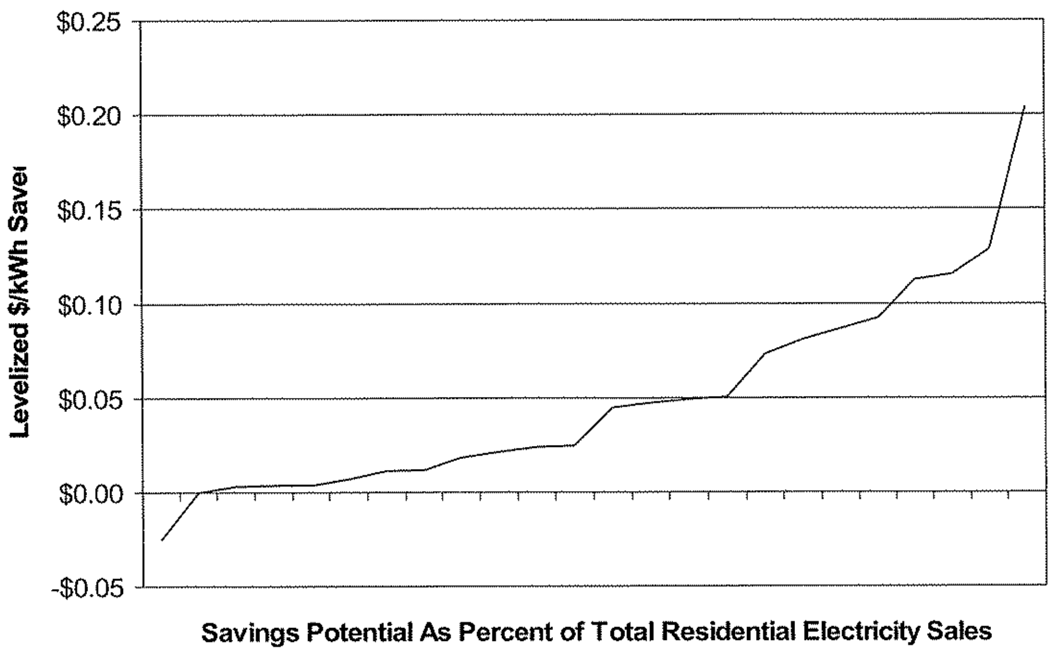
Residential Sector - Market Driven and Retrofit Savings

1	2	3	4	5	6	7
Measure #	Measure Description	Single-Family kWh Savings	Multi-Family kWh Savings	Measure Level TRC Benefit/Cost Ratio SF	Measure Level TRC Benefit/Cost Ratio MF	Total Cumulative Annual kWh Savings by 2015 (for cost effective measures)
1	CFL Replacing Incandescent Bulb for 2.7 hrs/day	70,161,152	10,989,096	1.47	1.47	81,150,248
2	CFL Torchiere (compared to Halogen Torchiere)	0	0	0.56	0.56	0
3	CFL Torchiere (compared to Incandescent Torchiere)	0	0	0.22	0.22	0
4	Energy Star Single Room Air Conditioner	0	0	0.29	0.29	0
5	Energy Star Compliant Freezer-Top Refrigerator	23,435,088	3,670,556	2.39	2.39	27,105,644
6	Energy Star Compliant Side-By-Side Refrigerator	9,843,294	1,541,721	1.16	1.16	11,385,015
7	Energy Star Compliant Upright Freezer	0	0	0.54	0.54	0
8	Energy Star Compliant Chest Freezer	0	0	0.21	0.21	0
9	Energy Star Built-In Dishwasher	3,087,713	483,618	>1	>1	3,571,331
10	Energy Star Washing Machine with Electric Water Heater and Electric Clothes Dryer	4,166,576	652,596	2.16	2.16	4,819,172
11	Energy Star Washing Machine with Gas Water Heater and Electric Clothes Dryer	2,521,875	394,992	3.07	3.07	2,916,867
12	Energy Star Washing Machine with Gas Water Heater and Gas Clothes Dryer	0	0	3.36	3.36	0
13	Programmable Thermostat	1,257,489	196,956	5.64	5.64	1,454,446
14	Water Heater Blanket	8,310,479	1,301,641	3.98	3.98	9,612,121
15	Low Flow Shower Head	6,499,061	1,017,925	60.70	60.70	7,516,986
16	Pipe Wrap	4,149,001	649,843	7.38	7.38	4,798,844
17	Air Sealing (Low Income)	0	0	0.55	NA	0
18	Reset Water Heater Thermostat (Low Income)	5,030,350	0	6.83	NA	5,030,350
19	Water Heater Wrap (Low Income)	0	0	0.30	NA	0
20	Attic Insulation (Low Income)	0	0	0.38	NA	0
21	Air Sealing	18,872,355		1.11	0.55	18,872,355
22	Attic Insulation	55,458,658		2.80	0.36	55,458,658
23	Wall Insulation	11,101,385	1,738,771	1.44	1.44	12,840,156
24	Window Construction	31,212,590		1.45	0.72	31,212,590

Maximum Achievable Cost Effective kWh Savings	255,107,065	22,637,717		277,744,782
Forecast 2015 BREC Residential kWh Sales				1,780,266,000
Savings as a percent of forecasted residential sales in 2015				15.6%

Note: The TRC Benefit/Cost Ratios were obtained from the GDS Benefit/Cost Screening Model, from the Program Cost Effectiveness Worksheet. The kWh savings shown above are from table 5-3, and kWh savings in the last column in the above table are counted only for those measures that have a TRC benefit/cost ratio greater than or equal to 1.0.

Figure 5-1 Residential Electric Energy Efficiency Supply Curve for BREC Service Territory



Figures 5-2 to 5-4 provide information on the potential electric savings in the residential sector. Thirty-six percent of the technical potential savings is in the residential lighting end use, and sixteen percent is in the refrigeration end use. Figure 5-5 presents the cost of conserved energy (CCE) for residential electric energy efficiency measures included in this study. Note that the CCE figures shown below only include electric savings, and do not include savings of other fuels (gas, oil, wood, etc.) or water. Note that Figure 5-5 is not a supply curve; rather, it simply provides a picture of the relative cost of conserved energy for the electric energy efficiency measures examined in this study. Note that there are **eight** energy efficiency measures having a cost of conserved energy less than $.02 per kWh saved.

Figure 5-2 Summary of Potential Savings

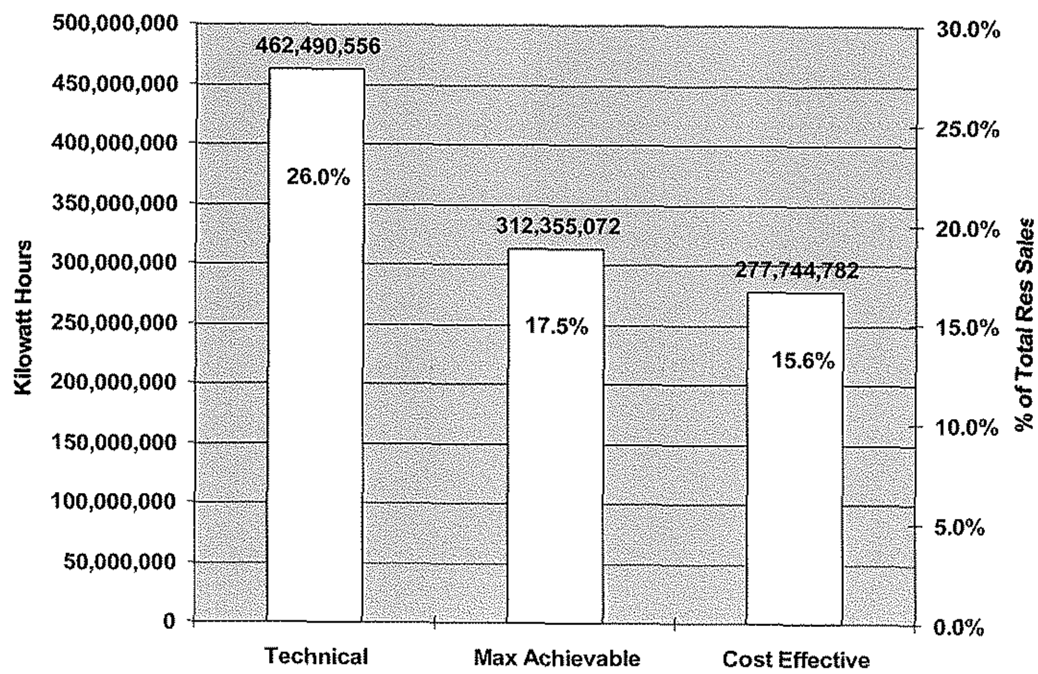


Figure 5-3 Residential Sector Technical Potential Savings By Measure Type - Kilowatt Hours

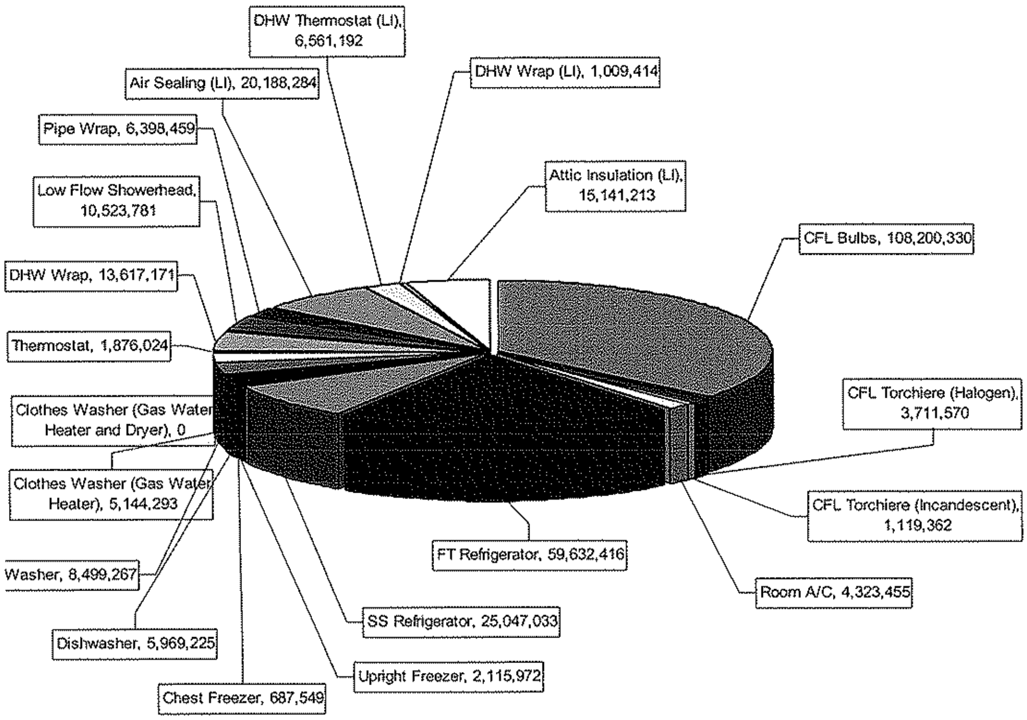


Figure 5-4 Residential Sector Technical Potential Savings By Measure Type - Percent of Total Savings

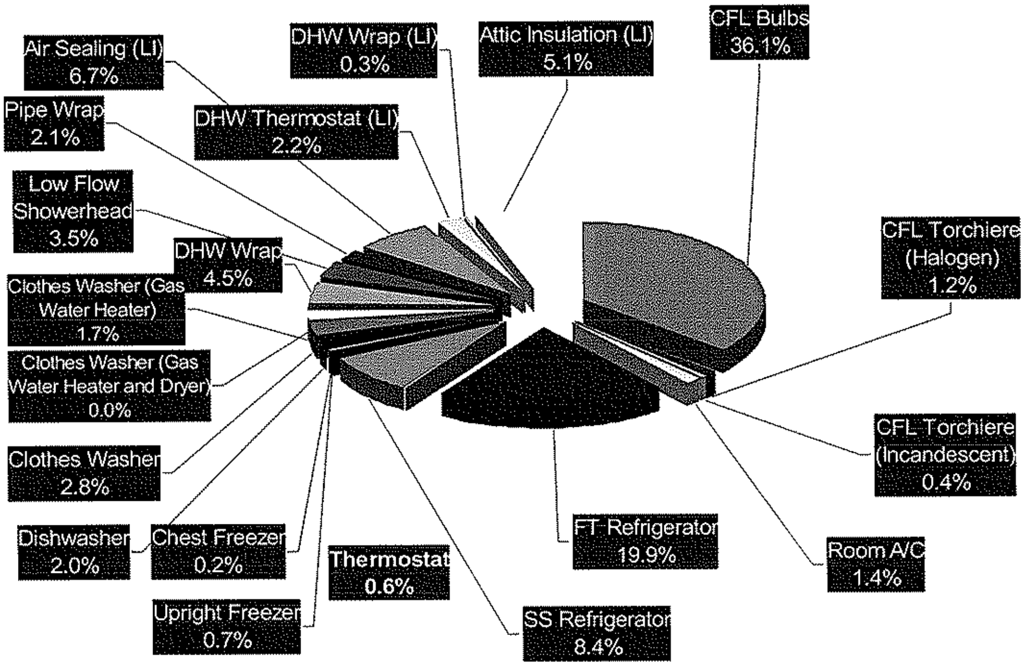
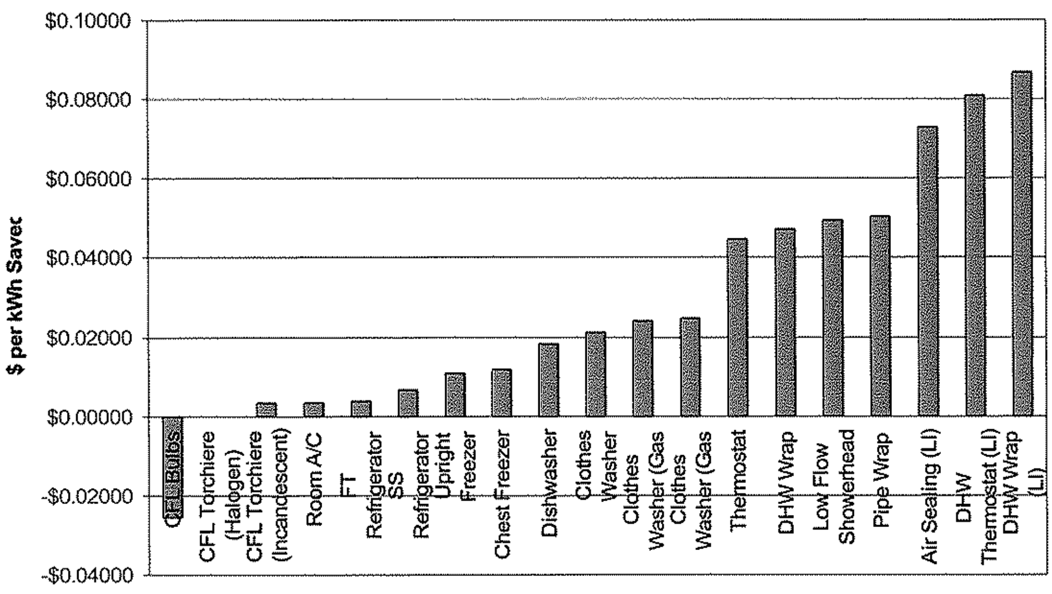


Figure 5-5 Cost of Conserved Energy - Residential Electric Energy Efficiency Measures ($ Per kWh Saved)



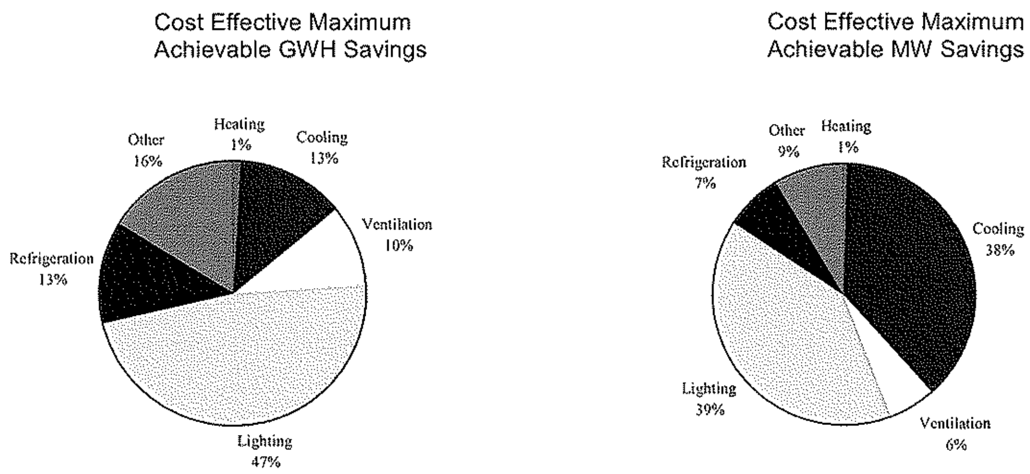
6.0 COMMERCIAL SECTOR GAS ENERGY EFFICIENCY POTENTIAL

Due to the lack of readily available equipment saturation and electric end use data for the BREC commercial sector, the energy savings potential estimates for the BREC commercial sector were based upon savings estimates from similar studies conducted recently in other States. Based on a thorough review of these other recent studies, GDS estimates that the maximum achievable cost effective potential for electric energy efficiency in the BREC service area the year 2015 is approximately 10% of 2015 commercial sector kWh sales. For the commercial sector, interior lighting still represents the largest end-use savings potential in absolute terms for both energy and peak demand, despite the significant adoption of high-efficiency lighting throughout the 1990's. The distribution of commercial sector potential savings of electricity by end use is shown in Figure 6-1.

As expected, the space cooling electric end use represents a significant portion of the total peak demand savings potential. Refrigeration energy savings potential is roughly equal to that of cooling but is significantly less important in terms of peak demand potential. In terms of energy savings, the Super T8 lamp/electronic ballast (SuperT8/EB) combination likely holds the largest potential, even though we estimate that current saturation levels of standard T-8's are well over 50 percent. Refrigeration compressor and motor upgrades, occupancy sensors for lighting, office equipment power management, and hard-wired CFL fixtures round out the measures that represent the largest opportunities for energy savings.

With respect to peak demand savings, such technologies as comparative enthalpy economizers represent a large peak demand savings opportunity, followed by the Super T8/EB combination. Cooling measures become more significant in terms of peak impacts with high-efficiency chillers and packaged units, as well as chiller tune-ups making up a large share of total potential demand savings. Occupancy sensors and Super T8/EB also represent a significant percent of total demand savings potential, as they did with respect to energy savings. These measures, when combined, represent approximately 45% of the electric peak demand reduction potential.

Figure 6-1 Distribution of Commercial Sector Maximum Achievable Potential Savings by End Use



The maximum achievable cost effective cumulative annual kWh savings by the year 2015 for the BREC commercial sector are shown in Table 6-1 below.

Table 6-1: Cumulative Annual Maximum Achievable Cost Effective kWh and kW Savings by 2015 – BREC Commercial Sector		
	Cumulative Annual kWh Savings by 2015	% of 2015 BREC System kWh Sales
Potential kWh Savings	85,475,300	10%

Appendix B of this report provides detailed information on the costs, savings and useful lives of commercial sector energy efficiency technologies.

7.0 LARGE INDUSTRIAL SECTOR ENERGY EFFICIENCY POTENTIAL IN THE BREC SERVICE AREA

The Large Industrial classification contains commercial and industrial customers that are directly served customers of Big Rivers. These customers are usually large industrial operations, and there are few customers in the class. These 20 large C&I customers in 2004 represented just under 32% of total system energy sales. The number of consumers for the class is expected to remain level at 20 from 2005 through 2019. Energy sales are projected to remain nearly constant throughout the forecast period.

7.1 Introduction

This section of the report provides the estimates of technical, maximum achievable, and maximum achievable cost effective energy-efficiency potential for electric energy efficiency measures for the industrial sector of the BREC service territory. There are still significant electric savings opportunities in this sector of the service area. Technical electric energy savings potential is estimated to be approximately 124,697 MWH by 2015, maximum achievable potential is estimated to be approximately 99,758 MWH and maximum achievable cost effective potential is estimated to be 99,758 MWH by 2015 (or between 8.6% and 10.8% of expected industrial electric consumption in the year 2015). The electric energy efficiency potential estimates are based on a detailed analysis of the electric usage and potential savings for eighteen large industrial customers represented in the BREC sales forecast.

Table 7-1 below summarizes the three types of electric energy efficiency savings potential for the industrial sector in the BREC service territory. It is important to note that the energy efficiency measures examined for the industrial sector proved to be cost effective according to the TRC test.

Table 7-1: Summary of Industrial Sector Electric Savings Potential in the BREC Service Area

	Estimated Cumulative Annual Savings in 2015 (MWH)	BREC Industrial Sector MWH Sales Foreacst for 2015	Savings in 2015 as a Percent of Total 2015 Industrial Sector Electric Sales
Technical Potential	124,697	1,159,630	10.8%
Maximum Achievable Potential	99,758	1,159,630	8.6%
Maximum Achievable Cost Effective Potential	99,758	1,159,630	8.6%

Overall Approach for the Industrial Sector

A literature review of several recent industrial electric potential studies indicates that due to the unique nature of industrial customers, the approach to develop savings potential generally is done on industrial sub-sectors (e.g. Food, Paper, Petroleum, Agriculture, etc.) basis. The specific data sources used by GDS for the development of the industrial sector electric savings potential estimates are listed in Appendix C of this report. Appendix C also provides detailed information on the costs, savings and useful lives of industrial sector energy efficiency technologies.

Steps to Develop Electric Energy Efficiency Potential for the Industrial Sector

The steps used by GDS to develop the estimates of energy efficiency potential for the industrial sector are listed below:

- Start with the Industrial annual electric use by customer information that was supplied.
- Classify the customers by Industrial sub-sector according to the ACEEE report.
- Apply the Percent of Sub-Sector Electricity Consumption by Sub-Sector found in Table 8 of 2003 ACEEE report.
- For 10-year Savings Potential use twice the "5-year Savings factors by End-use" found in Table 7, ACEEE, 2003 report. Rationale: The ACEEE numbers were based on an earlier XENERGY report[23] that estimated 10-year savings potential.
- Calculate the individual electric energy efficiency savings by end-use by customer.
- Sum information to determine maximum achievable electric energy efficiency savings potential.
- For estimating annual electric energy efficiency impact between 2006 and 2015 assume that an energy efficiency program achieved 10 percent of the total 2015 impact each year. Measure life is assumed to be a minimum of 10 years.

7.2 Efficiency Measures Examined

Four end-use categories (motors, process heating, HVAC, and lighting) were considered for the analysis. The analysis was kept at the aggregate end-use level since the level of detailed information that would be needed to provide a measure-by-measure analysis similar to that found in the residential and

[23] XENERGY, 2001, California Industrial Energy Efficiency Market Characterization Study, Oakland, CA.

commercial sector analyses was beyond the scope of the current study. However, examples of energy efficiency measures that can be included in an *industrial program for the four end-uses are listed in* Table *7-2.*

Table 7-2 Industrial Sector Energy Efficiency Measures

Motors
Process Pumps and Fans
Ventilation Fans
Heating Pumps
Compressor motors
Process Heating
Process Heat Recovery
Performance Optimization
HVAC
High Efficiency Cooling Systems
EMS install
EMS Optimization
Heat Recovery from Air to Air
Retrocommissioning
Lighting
High Efficiency Lighting Technologies
Daylighting
Occupancy Sensors and Photocells

As shown below in Table 7-3, estimates of the potential annual electric savings vary by end use. ACEEE and Xenergy used the following energy savings potential estimates for 5-year and 10-year estimates, respectively:

Table 7-3 – Potential Industrial Electric Savings by End Use

Industrial End-use	5-Year Savings Potential	10-Year Saving Potential
Motors	7%	14%
Process Heating	5%	10%
HVAC	12%	24%
Lighting	10%	20%

Emerging electric energy efficiency technologies were not considered in the analysis.

The end-use analysis was segmented into seven industrial types for the BREC service territory. The technical and economic potential results are presented in aggregate and by end use in the form of electric supply curves. We provide estimates of savings in both absolute MWH and percentage terms, and we express percent savings in two ways:

- percent of total industrial electric consumption; and
- percent of energy addressed, as discussed in more detail below.

We based the technical and maximum achievable cost effective potential energy savings analysis on BREC's industrial electric sales forecast data for the period 2006 to 2015.

Table 7-4 shows an estimated breakdown of 2004 industrial electric sales in the BREC service area by sector.

Table 7-4 2004 Industrial Electric Sales by Sector in BREC Service Territory

Industrial Sector	% of Industrial Sales in 2004
Food	7.8%
Paper	54.7%
Petroleum And Coal Products	9.0%
Chemicals	0%
Non-metallic Mineral products	0%
Primary metals	22.1%
All Other Manufacturing	6.5%

7.3 Technical and Maximum Achievable Economic Potential

This section presents technical and economic potential estimates for the industrial and agriculture sector for the year 2015.

Technical savings potential is estimated to be approximately 124,697 MWH by 2015, maximum achievable potential is estimated to be approximately 99,758 MWH and maximum achievable cost effective potential is estimated to be 99,758 MWH (or between 8.6 and 10.8 percent of expected industrial electric consumption in the year 2015). The savings level for the maximum achievable and the maximum achievable cost effective scenarios are identical for the industrial sector because all energy efficiency measures considered in the industrial sector analysis were cost effective (according to the TRC test). Figure 7-1 illustrates the three values along with the associated percent of electric sales in 2014.

Figure 7-1 Estimated Technical, Maximum Achievable and Maximum Achievable Cost Effective Potential for Electric Savings in the Industrial *Sector in the BREC Service Area*

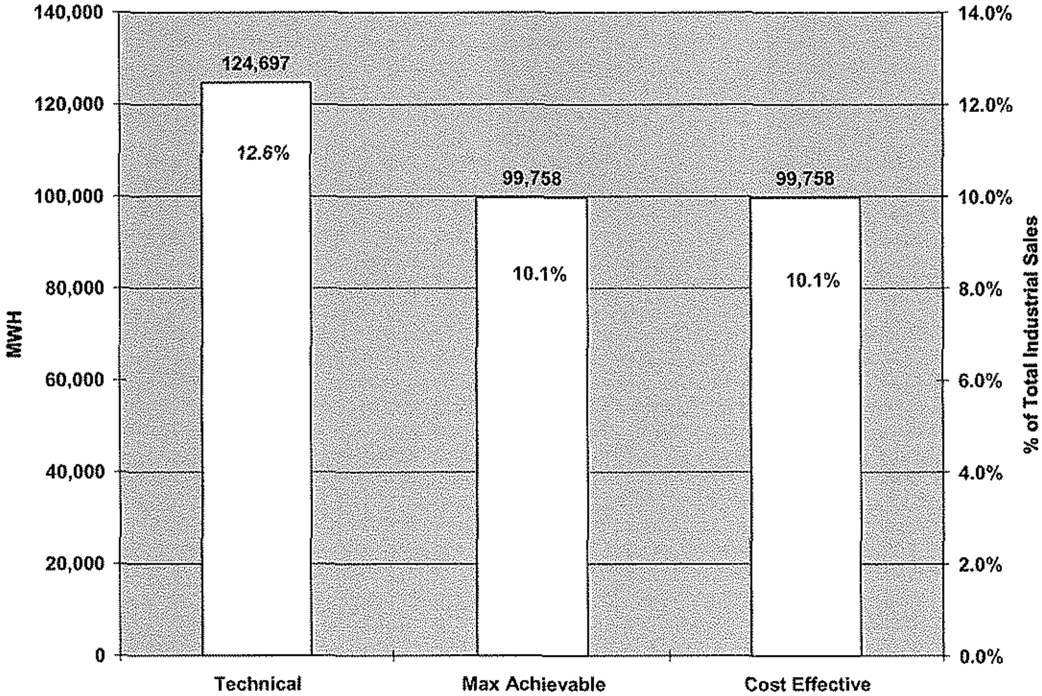
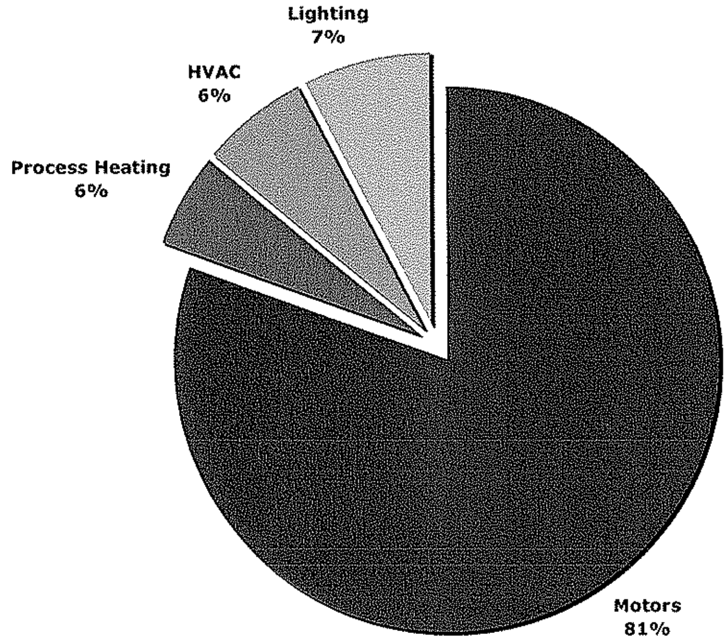


Figure 7-2 shows the percentage of total technical potential savings within each of the industrial end uses. Motors accounts for the largest percentage of technical potential at 81 percent, with lighting being the distant second at 7 percent. Process heating and HVAC both represent approximately 6 percent each. These percentages are identical for the maximum achievable cost effective potential savings estimates.

Figure 7-2 Industrial Sector Technical Potential Savings



In Table 7-5, we present estimates of the technical savings potential by end use in terms of energy saved in the year 2015 and in terms of percent of base end use energy consumption. The electric motors end use has the largest technical savings potential at approximately 100,573 MWH annually by 2015.

Table 7-5 2014 Industrial Electric Technical Potential by End Use		
End Use	**Savings Potential (MWH)**	**Savings Potential (% of Base Sales)**
Motors	100,573	10.2%
Process Heating	6,876	0.7%
HVAC	7,939	0.8%
Lighting	9,309	0.9%
Total	124,697	12.6%

In Table 7-6, we present estimates of maximum achievable cost effective savings potential by end use in terms of energy saved in the year 2015 and in terms of percent of base end use energy consumption[24]. Motors is the end use with the largest technical potential at 80,458 MWH.

Table 7-5 2014 Industrial Electric Maximum Achievable Cost Effective Savings by End Use		
End Use	**Savings Potential (MWH)**	**Savings Potential (% of Base Sales)**
Motors	80,458	8.2%
Process Heating	5,501	0.6%
HVAC	6,351	0.6%
Lighting	7,447	0.8%
Total	99,758	10.1%

Key Data Limitations Associated with Estimates of Industrial Electric Potential

- **End-use costs:** Estimates of aggregate measure costs for each end-use category were developed using several sources, including electric savings potential studies recently conducted in California, Connecticut and Iowa, as well as many other sources compiled for this study. While the sources used offer reasonable values for the end-use costs, GDS was unable (within the budget for this project) to gather end-use cost data specific to the BREC service area for every energy efficiency measure for the industrial sector.

- **End-use savings**. Estimates of aggregate measure savings for each end-use category were developed using several sources, including electric savings potential studies recently conducted in California, Connecticut and Iowa, as well as many other sources compiled for this study. While the sources used offer reasonable values for the end-use savings, GDS was unable (within the budget for this project) to gather energy savings data specific to BREC service area for every industrial energy efficiency measure.

[24] Maximum achievable savings breakdown is not shown because, as stated previously, the savings level for the maximum achievable and the maximum achievable cost effective scenarios are identical for the industrial sector because only cost effective measures were considered in this analysis.

7.4 Energy-Efficiency Supply Curves

Due to the aggregated measure approach used in the industrial sector, a supply curve was not developed.

8.0 NON-ENERGY BENEFITS OF ELECTRIC ENERGY EFFICIENCY PROGRAMS

In addition to saving energy, electric energy efficiency programs can provide a variety of non-energy benefits.[25] Implementing energy efficiency programs in the BREC service territory will save electricity gas and will provide several other benefits to the State's economy.

Listed below are examples of non-energy benefits that will result from implementation of the electric energy efficiency measures included in the portfolio of gas energy efficiency programs recommend by this study:

- Electric energy efficiency programs can help reduce emissions of air pollutants[26] and greenhouse gases
  - Saving one kwh saves 1.39 lbs. of C02.
  - Saving one kwh saves .002960 lbs. of NOX.
  - Saving one kwh saves .006040 lbs. of SO2.
- Electric energy efficiency programs can be more reliable than increasing the infrastructure of the electric generation supply system because electric energy efficiency measures are "distributed resources" and require no on-going fuel supply. As such, they are not subject to potential supply interruptions and/or fuel price increases.
- Electric energy efficiency can make homes and businesses more comfortable - less drafty, etc.
- Electric energy efficiency programs can make businesses in Kentucky more efficient, and thus more competitive with businesses in other states and other countries.
- Electric energy efficiency programs can help homes and businesses reduce operating costs. As a result, there are economic multiplier effects, such as increased productivity and increased jobs.

8.1 Residential Sector Non Energy Benefits

Electric energy efficiency measures installed in homes or businesses can be more reliable than investments in electric supply-side resources. Unlike transmission and distribution lines, for example, the location of electric energy efficiency projects may not be as vulnerable to severe storms (ice storms, snow

[25] The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest, Southwest Energy Efficiency Project (SWEEP), November 2002.

[26] GDS uses the following definitions of these emissions: CO2 is the major green house gas; NOx contributes to ground level ozone, particulate matter, acid rain, visibility impairment and nitrogen deposition; and SO2 contributes visibility impairment, acid rain, and particulate matter. GDS obtained the emissions rates shown here for SOX, NOX and CO2 from the US Environmental Protection Agency (see http://www.epa.gov/cleanenergy/egrid/samples.htm#highlights).

storms, wind storms, or spikes in the price of electricity. Contractors or homeowners, depending on the complexity of the measure, can easily install the electric energy efficiency measures. Energy efficiency measures are designed not only to save energy but also to improve the comfort of the occupant. Caulking, weather-stripping, insulation, ENERGY STAR windows, infiltration measures, CFLs and high efficiency air conditioners will reduce household and business operating costs and will decrease infiltration and heat loss.

The following benefits of energy efficiency programs have been noted in a recent evaluation report from the Wisconsin Focus on Energy Program[27]:

- Increased safety resulting from a reduction of gases emitted into the atmosphere, such as carbon monoxide.
- Fewer illnesses resulting from elimination of mold problems due to proper sealing, insulating and ventilation of a home
- Reduced repair and maintenance expense due to having newer, higher quality equipment
- Increased property values resulting from installation of new equipment

Non-energy benefits can play a key role for residential builders who promote energy efficiency in new home construction as seen in Wisconsin's Energy Star Home Program (WESH). Given that WESH homes are reported as selling at a higher price for 79 percent of homebuilders and the fact that 86 percent of homebuilders are more inclined to promote themselves as energy efficient builders, WESH homebuilders can view and market themselves as high-end homebuilders. WESH program implementers market the program by telling prospective homebuilders that they will be able to expand their business as a result of the WESH program. Also, given the frequency that comfort and safety improvements are cited as non-energy benefits associated with both WESH and Home Performance with Energy Star Program (HPWES), emphasizing these two non-energy benefits in program marketing efforts may help to increase program participation. In addition, increased durability and longevity of household equipment can be a selling point for the Wisconsin HPWES program, where 84 percent of contractors cite this as a non-energy benefit.[28]

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[27] State of Wisconsin Department of Administration Division of Energy, Focus on Energy Public Benefits Statewide Evaluation, Quarterly Summary Report: Contract Year 2, Second Quarter, March 31, 2003, Evaluation Contractor: PA Government Services Inc. Prepared by: Focus Evaluation Team.

[28] State of Wisconsin Department of Administration, Division of Energy, Focus on Energy Statewide Evaluation, Non-Energy Benefits Cross-Cutting Report, Year 1 Efforts, *Evaluation Contractor: PA Government Services Inc., Prepared by: Nick Hall, TecMarket Works, Oregon, Wisconsin Under Contract To PA Consulting,* January 20, 2003

8.2 Commercial Sector Non Energy Benefits

By utilizing electric energy efficiency programs, businesses in Kentucky can become more efficient and lower their monthly utility bills. The energy and monetary savings from electric energy efficiency programs can provide businesses with additional capital to invest in business infrastructure. Electric energy efficiency programs can help businesses in Kentucky become more competitive with other businesses in the United States and in other countries. Implementing electric energy efficiency measures may also increase productivity and afford the business with the opportunity to add new jobs, further bolstering the economy in the BREC service area.

Examples of Non Energy Benefits from The Wisconsin Focus on Energy Business Programs:[29]

- Increased productivity
- Improvement in morale
- Reduced repair and maintenance costs
- Reduced waste
- Reduced defect or error rates

8.3 Societal Related Benefits

Economic impact

The spending of dollars to provide electric energy efficiency programs creates jobs and increases the economic activity associated with local spending streams. As labor and material dollars are "turned-over" in the local economy, the people in that economy benefit.[30] In the Wisconsin Focus on Energy Program, for example, the Program Evaluation contractor reports that 46 new full-time jobs are created in the state for every $1 million invested in energy efficiency programs.

Environmental

Increased energy efficiency is in the public interest for environmental, economic and national security reasons. The production and use of energy causes a large portion of the nation's air pollution. Fossil fuel combustion and the resulting emissions can be harmful to public health in a variety of ways:

- by harming to ecological systems, especially by increasing the acidity of rainfall and water bodies, and

[29] Ibid.
[30] Beyond Energy Savings: A Review of the Non-Energy Benefits Estimated for Three Low-Income Programs, ACEEE Paper 326, *Nick Hall, TecMarket Works, Jeff Riggert, TecMarket Works,* From: 2002 ACEEE Summer Study Proceedings

- by being a major source of greenhouse gases causing climate change.

A reduction in energy consumption through greater efficiency of energy use is a means to reduce all emissions from burning fossil fuels, including NO_x, SO_2, and CO_2.[31]

Table 8-1 illustrates the level of pollutants and greenhouse gases that can be avoided if the maximum achievable cost effective savings from this report are realized. The estimates in Table 8-1 include only those emissions that are avoided from the avoidance of electric generation. Per the February 2005 Cantor Fitzgerald Market Price Index for SO_2 at $657.04 per ton and NO_x at $2,400 per ton, the values in Table 8-1 would result in a market value of over $1.6 million annually for avoided NO_x emissions and slightly more than $918,000 for avoided SO_2 emissions. In addition, a recent California Public Utilities Commission report[32] provides a value of avoided CO_2 emissions of $8 per ton in 2005. Using this $8 per ton value, the avoided CO_2 emissions are worth $2.6 million annually by 2015.

Table 8-1: Market Value of Avoided Emissions

		Tons of Pollutant Avoided by 2015		
	Cumulative Annual kWh Saved by Sector by 2015	SO2 Emissions Avoided (in lbs)	NOX Emissions Avoided (in lbs)	CO2 Emissions Avoided (in lbs)
Residential	277,744,782	1,677,578	822,125	386,756,831
Commercial	85,475,300	516,271	253,007	119,023,500
Industrial	99,758,000	602,538	295,284	138,912,017
Emissions rate (lbs. per kWh)	NA	0.006040	0.002960	1.392490
Total Avoided Emissions in Tons	NA	1398.2	685.2	322346.2
Value Per Ton	NA	$657.00	$2,400.00	$8.00
Total $ Value of Pollutants Avoided	NA	$918,613.33	$1,644,498.15	$2,578,769.40

Cost-effective energy efficiency actions are beneficial (1) to individual users of natural gas by reducing consumer costs and (2) to the economy by increasing discretionary income. The implementation of energy efficiency measures can help consumers save money.[33]

A recent American Council for An Energy Efficient Economy (ACEEE) analysis found that modestly reducing both natural gas and electricity consumption, and increasing the installation of renewable energy generation could dramatically affect natural gas price and availability. According to the ACEEE report, in just 12

[31] Energy Efficiency and Renewables Sources: A Primer, Prepared by the National Association of State Energy Officials Updated by Global Environment & Technology Foundation, October 2001.
[32] California Public Utilities Commission, Methodology and Forecasts of Long-Term Avoided Costs for the Evaluation of California Energy Efficiency Programs, E3 Research Report Submitted to the CPUC Energy Division, October 25, 2004.
[33] Ibid.

months, nationwide efforts to expand energy efficiency and renewable energy could reduce wholesale natural gas prices by 20 percent and save consumers $15 billion/year in retail gas and electric power costs.[34] [35]

8.4 Job Creation Benefits of Energy Efficiency Identified in SWEEP Report

The November 2002 Southwest Energy Efficiency Project "Mother Lode" report[36] determined that investing in electric energy efficiency measures can lower electricity and natural gas bills for residents and businesses in the Southwest. This report notes that these lower energy bills, in turn, promote overall economic efficiency and create additional jobs. The High Energy Efficiency Scenario included in the SWEEP report shows significant macroeconomic benefits for each of the states in the Southwest and the region as a whole. By 2020, SWEEP estimates that the efficiency investments and energy bill savings add more than $1.3 billion in new wage and salary income (in 2000 dollars) and support a net increase of 58,400 jobs for the Southwest region as a whole. These income and jobs gains reflect differences between a business-as-usual Base Scenario and a High Energy Efficiency Scenario. Although the job gains are distributed throughout much of the economy, several sectors, including services, retail trade, and government show the largest gains. Not surprisingly, the energy industries (electric and gas utilities, and coal mining) exhibit the largest losses.

The report found that a total job loss of 7,500 jobs is projected to occur in the region by 2020 in the High Energy Efficiency Scenario, compared to a total job gain of about 66,000 jobs and a net increase of **58,400** jobs in this scenario. Furthermore, the projected losses can be overcome if the energy industries recognize the new and expanding opportunities and transition to providing more efficiency-related products and services. In short, accelerating energy efficiency improvements can help to create a strong economic future in the southwest region.

8.5 Non Energy Benefits of Low Income Weatherization and Insulation Programs

GDS also conducted a literature search on the non-energy benefits of programs targeted at low-income households. One of the most comprehensive studies of low-income program non-energy benefits was recently completed for five

[34] The ACEEE study notes how natural gas energy efficiency programs can help reduce prices of natural gas.
[35] R. Neal Elliot, PH.D., P.E., et al., Natural Gas Price Effects of Energy Efficiency and Renewable Energy Practices and Policies, ACEEE, December 2003.
[36] Southwest Energy Efficiency Project, "The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest", November 2002, Section 4 of the report.

investor-owned utilities in California. The two documents listed below provide documentation of these non-energy benefits:

1. TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, Low-income Public Purpose Test, (The LIPPT), Final Report, Up-Dated for LIPPT Version 2.0, A Report Prepared for the RRM Working Group's Cost Effectiveness Committee, April 2001. This report provides a description of each non-energy benefit included in the KeySpan analysis of non-energy benefits, and provides the methodology for calculating the value of each category of non-energy benefits.

2. TecMRKT Works, Skumatz Economic Research Associates, and Megdal & Associates, User's Guide for California Utility's Low-Income Program Cost Effectiveness Model, The Low-Income Public Purpose Test, Version 2.0, A Microsoft Excel Based Model, Prepared for The RRM Cost Effectiveness Subcommittee, May 25, 2001.

Table 8-2 below provides examples of non-energy benefits that are applicable to weatherization and insulation programs that might be targeted at low income customers in the BREC service area.

Table 8-2
Summary of Potential Non-Energy Benefits for a Low Income Energy Efficiency Program

Benefit Number in LIPPT Model	Name of Non Energy Benefit	Non-Energy Benefit Description
	Utility Perspective	
7A	Carrying cost on arrearages	Energy Efficiency Programs reduce customer bills, improving the likelihood that customers will be able to keep up with payments.
7B	Lower bad debt write-offs	Makes energy bills more manageable for program participants, potentially reducing the bad debt for these customers.
7C	Fewer shut-offs	As a result of the customers ability to pay their bills, a similar reduction in the number of customers with service disconnects is expected.
7D	Fewer reconnects	As a result of the reduction in the number of shut-offs, the number of reconnects needed would also decline.
7E	Fewer notices	More affordable energy bills leads to more on-time payments and fewer notices from the utility.
7F	Fewer customer	More affordable energy bills leads to more on-time

	calls	payments and fewer customer calls.
7H	Reduction in emergency gas service calls.	
7J	Transmission and/or distribution savings (distribution only).	
	Societal Perspective	
8A	Economic impact	Estimate of economic impact to regional economy based upon using local labor for energy efficiency services instead of importing energy, and using bill savings being spent into local economy.
8B	Environmental benefits	Provides environmental benefits to the region and to society, particularly due to their role as a pollution abatement strategy. These include assisting in meeting Clean Air Act requirements, reduction in acid rain, and a variety of other benefits.
	Participant Perspective	
9B	Fewer shutoffs	Providing customers with services and education that reduces energy use also helps customers reduce bills and may help improve their payment record. As a result, participants experience fewer arrearages and are less likely to be disconnected.
9C	Fewer calls to the utility	Without payment problems the customer is less likely to make calls to the utility concerning payments.
9D	Fewer reconnects	Reconnections are reduced in response to the lower shutoff numbers.
9H	Moving costs/mobility	High energy costs can make it difficult for residential customers to keep up with all of their household bills, including rent or mortgage payments. By keeping their bills down, this will reduce non-payment on living expenses.
9I	Fewer Illnesses and lost days from work/school	Households with sufficient and continuous heating may experience changes in the number of colds and other illnesses per year.
9K	Net household benefits from more comfort, less noise, net of negatives	Weatherization of homes allows these homes to be kept warmer at lower costs, reduces drafts, and insulates them from noise and weather outside their homes.
9K	Net household benefits from additional hardship benefits	The additional hardship benefits are those associated non-dollar benefits from reduced disconnects, reconnects, and bill collection, such as reduced stress as perceived and valued by participant.

9.0 SUMMARY OF FINDINGS

In summary, the maximum achievable cost effective potential for electric energy efficiency in the BREC service territory by 2015 is significant. GDS estimates that the maximum achievable cost effective potential natural gas savings would amount to 463 million kWh a year (a 12.2 percent reduction in the BREC projected 2015 kWh sales forecast in the BREC service territory). Table 9-1 below summarizes the electricity savings potential in the BREC service territory by 2015.

Table 9-1: Maximum Achievable Cost Effective Electric Energy Efficiency Potential By 2015 in the Service Area of the Big Rivers Electric Corporation

Sector	Maximum Achievable Cost Effective kWh Savings by 2015 from Electric Energy Efficiency Measures/Programs for the BREC Service Area	2015 kWh Sales Forecast for This Sector	Percent of Sector 2015 kWh Sales Forecast
Residential Sector	277,744,782	1,780,266,000	15.6%
Commercial and Small Industrial	85,475,300	854,753,000	10.0%
Large Industrial	99,758,000	1,159,630,000	8.6%
Total	462,978,082	3,794,649,000	12.2%

The results of this study demonstrate that cost effective electric energy-efficiency resources can play a significantly expanded role in BREC's energy resource mix over the next decade. Table 1-2 in the Executive Summary shows the present value of benefits and costs associated with implementing the maximum achievable potential energy savings in the BREC service territory. The potential net present savings to BREC customers for implementation of electric energy efficiency programs over the next decade are approximately **$39 million** in 2005 dollars.

The Total Resource Cost benefit/cost ratio for the maximum achievable cost effective potential savings scenario is 1.35.

It is clear that electric energy efficiency programs could save BREC members a significant amount of electricity by 2015. The electric energy efficiency potential estimates and Total Resource savings provided in this report are based upon the most recent BREC electric energy and peak load forecast, appliance saturation data, economic forecasts, data on energy efficiency measure costs and savings, and energy efficiency measure lives available to GDS at the time of this study. All input assumptions and data have been reviewed by GDS and staff of BREC. GDS has conducted extra market research to ensure that data for residential energy efficiency weatherization and insulation measure costs and savings are applicable and up to date.

There are also significant environmental benefits with the maximum achievable cost effective scenario. If implemented, by 2015 this scenario would result in a market value of over $1.6 million annually for avoided NO_x emissions and slightly more than $918,000 for avoided SO_2 emissions. In addition, a recent California Public Utilities Commission report[37] provides a value of avoided CO_2 emissions of $8 per ton in 2005. Using this $8 per ton value, the avoided CO_2 emissions are worth $2.6 million annually by 2015.

[37] California Public Utilities Commission, Methodology and Forecasts of Long-Term Avoided Costs for the Evaluation of California Energy Efficiency Programs, E3 Research Report Submitted to the CPUC Energy Division, October 25, 2004.

APPENDIX A

APPENDIX A

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

APPENDIX - MEASURE SAVINGS, USEFUL LIVES, COSTS AND SATURATIONS OF RESIDENTIAL ENERGY EFFICIENCY MEASURES
[illegible]

HDD:

Discount Rate: 5.35%

Big Rivers Service Area in Kentucky

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19		
Measure #	Single- or Multi-family	Measure Description	Total Number of Residential Households ([illegible])	Market Driven or Retrofit	Savings Units	Cost Units	Equipment Cost	Labor Cost	Total Installed Cost	Cost Type: Incremental = 0 Full = 1	Measure Life (yrs)	Base Case Equipment End Use Intensity (Annual kWh per appliance)	Annual kWh Savings Per Unit Installed	Estimated Annual MMBtu (Natural Gas) Savings Per Unit Installed	Annual Amortized Cost Per Unit	Levelized Cost Per kWh Saved	Annual Gallons of Water saved	Electric End Use Affected	Implementation Type 1=Rebate 2=RB
1	Single-family	CFL replacing Incandescent bulb for 2 hrs/day	96,076	Market Driven	Per bulb	Per bulb	$5.97	$0.00	$5.97	0	10.1	65.17	48.88	0	$0.78	$0.0160	0	Lighting	2
2	Single-family	CFL Torchiere (compared to Halogen Torchiere)	96,076	Retrofit	Per lamp	Per lamp	$60.00	$0.00	$60.00	1	8.2	273.75	223.56	0	$9.21	$0.0412	0	Lighting	1
3	Single-family	CFL Torchiere (compared to Incandescent Torchiere)	96,076	Retrofit	Per lamp	Per lamp	$60.00	$0.00	$60.00	1	8.2	136.88	86.69	0	$9.21	$0.1063	0	Lighting	1
4	Single-family	Energy Star Single Room Air Conditioner	96,076	Market Driven	Per air conditioner	Per air conditioner	$89.00	$0.00	$89.00	0	13	706.00	118.75	0	$9.68	$0.0815	0	Room AC	2
5	Single-family	Energy Star Compliant Freezer Top Refrigerator	96,076	Market Driven	Per refrigerator	Per refrigerator	$115.00	$0.00	$115.00	0	17	1362.00	1029	0	$10.47	$0.0102	0	Refrigerator	2
6	Single-family	Energy Star Compliant Side-by-Side Refrigerator	96,076	Market Driven	Per refrigerator	Per refrigerator	$247.50	$0.00	$247.50	0	17	1679.00	1079	0	$22.53	$0.0209	0	Refrigerator	2
7	Single-family	Energy Star Compliant Upright Freezer	96,076	Market Driven	Per freezer	Per freezer	$50.00	$0.00	$50.00	0	15.5	692.00	110	0	$4.83	$0.0439	0	Freezer	2
8	Single-family	Energy Star Compliant Chest Freezer	96,076	Market Driven	Per freezer	Per freezer	$50.00	$0.00	$50.00	0	15.5	397.00	43	0	$4.83	$0.1123	0	Freezer	2
9	Single-family	Energy Star Built-in Dishwasher	96,076	Market Driven	Per dishwasher	Per dishwasher	($29.46)	$0.00	($29.46)	0	13	506.50	141	0	($3.20)	($0.0227)	0	Dishwasher	2
10	Single-family	Energy Star Washing Machine with Electric Water Heater and Electric Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		475	0	$20.66	$0.0435	5400	Clothes Washer	2
11	Single-family	Energy Star Washing Machine with Gas Water Heater and Electric Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		115	1.9	$20.66	$0.1796	5400	Clothes Washer	2
12	Single-family	Energy Star Washing Machine with Gas Water Heater and Gas Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		0	2.5	$20.66	N/A	5400	Clothes Washer	2
13	Single-family	Energy Star Compliant Programmable Thermostat	96,076	Market Driven	Per home	Per home	$49.00	$0.00	$49.00	0	10	778.00	87.9	2.5	$6.45	$0.0734	0	Central AC	2
14	Single-family	Water Heater Blanket	96,076	Retrofit	Per water heater	Per water heater	$15.00	$0.00	$15.00	1	10	3330.00	333	0	$1.98	$0.0059	0	Water Heating	1
15	Single-family	Low Flow Shower Head	96,076	Retrofit	Per shower head	Per shower head	$5.77	$0.00	$5.77	1	10	3330.00	250	0	$0.76	$0.0030	6789	Water Heating	1
16	Single-family	Pipe Wrap	96,076	Retrofit	Per home	Per home	$3.23	$0.00	$3.23	1	10	3330.00	133	0	$0.43	$0.0032	0	Water Heating	1
17	Single-family, Low Income	Air Sealing	96,076	Retrofit	Per home	Per home			$380.00	1	10		1171.99	0	$50.05	$0.0427	0	Space Heating	1
18	Single-family, Low Income	Reset Water Heater Thermostat (from medium to med-low)	96,076	Retrofit	Per home	Per water heater	$0.00	$10.00	$10.00	1	10		380.90	0	$1.32	$0.0035	0	Water Heating	1
19	Single-family, Low Income	Water Heater Wrap (from [illegible])	96,076	Retrofit	Per home	Per water heater			$35.00	1	10		58.60	0	$4.61	$0.0787	0	Water Heating	1

AENDIXA- MEASURE SAING,USEBL LIES,C65 A
Ctobr 09

Big Rivers Service Area in Kentucky

1	2	3	9	1	2	2 8		8 8	2	8	9	0 1	2	3	8	5		
Measure #	Single- or Multi-family	Measure Description	End Use Saturation Prcentage of total homes that contain the electric end use or the measure)	Base Case Ector (raction of the end use energy that is already energy efficient)	Remaining Ector (n howmany homes can this b installed)	Convertibility Ector	Single-Multi-Emily Fraction	Type of home here applicable	Numbr of applicable homes in B Before applying remaining factor and convertibility factor)[1]	Total Homes Remaining Without measure after applying remaining factor and convertibility factor)	Technical Potential- Total annual kWh savings potential in ## % penetration attained Overnight"	Maximum Achievable Program Participants per year (% penetration limit,and before application of convertibility factor)[2]	Maximum Achievable Program Participants per year (% penetration limit,and after application of convertibility factor)[2]	Maximum Achievable kWh Savings (## penetration limit,and after application of convertibility factor)[2]	Savings Ector Percentage reduction in electric energy consumption)	Total annual gallons of ater savings potential in #	Annual Maximum Achievable Term Savings Potential in #	On-going annual ## cost for savings ()
1	Single-family	CE replacing incandescent blifor 2 hrsday	100.0%	20.00%	60.0%	100%	83%	Homes in BREC service territory (for CFLs, the numbers reported here represent light bulb sockets)	2,392,292	1,913,834	93,548,202	143,538	143,538	70,161,152	75.00%	0	0	-$0.42
2	Single-family	CE Torchiere (compared to Hlogen Torchiere)	18.0%	0.00%	100%	100%	83%	Homes in BREC service area with halogen torchieres	14,354	14,354	3,208,961	1,397	1,397	3,123,389	81.67%	0	0	$0.00
3	Single-family	CE Torchiere (compared to Incandescent Torchiere)	14.0%	0.00%	100%	100%	83%	Homes in BREC service area with incandescent torchieres	11,164	11,164	957,782	1,087	1,087	941,974	63.33%	0	0	$0.00
4	Single-family	Energy Star Single Room Air Conditioner	25.8%	10.00%	90%	100%	83%	Homes in BREC service area with one or more window A/C units	34,975	31,478	3,737,987	1,883	1,883	2,236,402	16.82%	0	0	$0.00
5	Single-family	Energy Star Compliant Feezer Top Refrigerator	71.4%	12.00%	88%	100%	83%	Homes in BREC service area	56,937	50,104	51,557,193	2,277	2,277	23,435,088	75.55%	0	0	$0.00
6	Single-family	Energy Star Compliant Side-by-Side Refrigerator	28.6%	12.00%	88%	100%	83%	Homes in BREC service area	22,807	20,070	21,655,248	912	912	9,843,294	64.26%	0	0	$0.00
7	Single-family	Energy Star Compliant Upright Feezer	23.7%	12.00%	88%	100%	83%	Homes in BREC service area which contain a freezer	18,899	16,631	1,829,434	829	829	912,034	15.90%	0	0	$0.00
8	Single-family	Energy Star Compliant Chest Feezer	19.7%	12.00%	88%	100%	83%	Homes in BREC service area which have a freezer	15,709	13,824	594,443	689	689	298,350	10.83%	0	0	$0.00
9	Single-family	Energy Star Built-In Dishwasher	51.0%	10.00%	90%	100%	83%	Homes in Kentucky with a dishwasher	40,669	36,602	5,160,892	2,190	2,190	3,087,713	27.84%	0	0	$0.00
10	Single-family	Energy Star Washing Machine ith Electric Water Hater and Electric Clothes Dryer	20.0%	3.00%	97%	100%	83%	Homes in BREC service area with an electric water heater and an electric clothes dryer	15,949	15,470	7,348,325	877	877	4,166,576		4,736,739	0	$0.00
11	Single-family	Energy Star Washing Machine ith Gs Water Hater and Electric Clothes Dryer	50.0%	3.00%	97%	100%	83%	Homes in BREC service area with a gas water heater and an electric clothes dryer	39,872	38,675	4,447,670	2,193	2,193	2,521,875		11,841,847	41,666	$0.00
12	Single-family	Energy Star Washing Machine ith Gs Water Hater and Gs Clothes Dryer	20.0%	3.00%	97%	100%	83%	Homes in BREC service area with a gas water heater and a gas clothes dryer	15,949	15,470	0	877	877	0		4,736,739	21,929	$0.00
13	Single-family	Energy Star Compliant Programmable Termostat	26.0%	11.00%	89%	100%	83%	Homes in BREC service area with central air conditioning and or electric space heat	20,733	18,453	1,621,979	1,431	1,431	1,257,469	11.30%	0	35,765	$0.00
14	Single-family	Water Hater Blanket	65.2%	32.00%	68%	100%	83%	Homes in BREC service territory with an electric water heater	51,992	35,355	11,773,179	2,496	2,496	8,310,479	10.00%	0	0	$0.00
15	Single-family	Low Show Had	65.2%	30.00%	70%	100%	83%	Homes in BREC service territory with an electric water heater	51,992	36,395	9,098,685	2,600	2,600	6,499,061	7.51%	17,648,850	0	$0.00
16	Single-family	Ppe Wrap	65.2%	20.00%	80%	100%	83%	Homes in BREC service territory with an electric water heater	51,992	41,594	5,532,001	3,120	3,120	4,149,001	3.89%	0	0	$0.00
17	Single-family, Low Income	Air Sealing	25.2%	14.28%	86%	100%	83%	BREC Homes that are at or below 125% of poverty level	20,095	17,226	20,188,284	1,321	1,321	15,477,999		0	0	$0.00
18	Single-family, Low Income	Reset Water Hater Termostat (from medium to med-low)	25.2%	14.28%	86%	100%	83%	BREC Homes that are at or below 125% of poverty level	20,095	17,226	6,561,192	1,321	1,321	5,030,350		0	0	$0.00
19	Single-family, Low Income	Water Hater Wrap (from Ecto EB	25.2%	14.28%	86%	100%	83%	BREC Homes that are at or below 125% of poverty level	20,095	17,226	1,009,414	1,321	1,321	773,900		0	0	$0.00

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

AENDIXA- MEASURE SAVNG,USEBL LIES,COS AND SATRAIS O RESIDENTAL ENERGEFICIENCYMEASURES
Clobr 9

HDD:

Discount Rate: 5.35%

Big Rivers Service Area in Kentucky

1	2	3	4	5	6	7	8	9	0	1 2	2	3	4	5	6 7	8	9		
Measure #	Single- or Multi-family	Measure Description	Ttal Numbr of Residential Husehoids (Sand Mhmes)	Market Driven or Retrofit	Savings Units	Cost Units	Eqipment Cost	Labr Cost	Ttal Installed Cost	Cost Type: Incremental = 0 Ell =1	Measure Life (yrs)	Base Case Eqipment End Use Intensity (Annual kWh per appliance)	Annual kWh Savings Pr Unit Installed	Estimated Annual MMBTU (Natural Gs) Savings Pr Unit Installed	Annual Amortized Cost Pr Unit	Levelized Cost Pr kWh Saved	Annual Gllons of ater saved	Electric End Use Affected	Implementation Type 1=One 2RB
20	Single-family, Low Income	Attic Insulation (from R9o R3	96,076	Retrofit	Per home	Per home			$720.00	1	25		678.99	0	$52.89	$0.0602	0	Space Heating	1
21	Single-family - Non Low Income	Air Sealing Retrofit	96,076	Retrofit	Per home	Per home			$380.00	1	10		2346.00	0	$50.05	$0.0213		Space Heating	1
22	Single-family - Non Low Income	Attic Insulation Retrofit	96,076	Retrofit	Per home	Per home			$847.80	1	25		6894.00	0	$62.28	$0.0090		Space Heating	1
23	Single-family - Non Low Income	Wall Insulation Retrofit	96,076	Retrofit	Per home	Per home			$330.00	1	25		1380.00	0	$24.24	$0.0176		Space Heating	1
24	Single-family - Non Low Income	WindowConstruction from single-pane Uto doub pane,low U3	96,076	Retrofit	Per home	Per home			$1,223.00	1	40		3880.00	0	$74.72	$0.0193		Space Heating	1

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

AENDIX- MEASURE SAING,USEBL LIES,CGS A
Gobr ##

Big Rivers Service Area in Kentucky

1	2	3	9	2	2	2 3		9 9	2	9	9	0 3	2	3	8	5		
Measure #	Single- or Multi-family	Measure Description	End Use Saturation Prcentage of total homes that contain the electric end use or the measure)	Base Case Actor (fraction of the end use energy that is already energy efficient)	Remaining Actor (n howany homes can this b installed)	Convertibility Actor	Single-Multi-Emily Faction	Tpe of home bere applicab	Numbr of applicab homes in # bfore applying remaining factor and convertibility factor)[1]	Ital times Remaining ithout measure after applying remaining factor and convertility factor)	Echnical Btential- Ital annual kWh savings potential in #f % penetration attained Overnight"	Maximum Achievab Pogram Brticipants per year (% penetration limit,and bfore application of convertibility factor)[2]	Maximum Achievab Pogram Brticipants per year (% penetration limit,and after application of convertibility factor)[2]	Maximum Achievab kWh Savings b #% penetration limit,and after application of convertibility factor)[2]	Savings Actor Prcentage reduction in electric energy consumption)	Ital annual gallons of ater savings potential in #	Annual Maximum Achievab Eerm Savings Btential in #	O-going annual # cost for savings ()
20	Single-family, Low Income	Attic Insulation (rom R3o R)	25.2%	14.28%	86%	100%	83%	BREC Homes with electric space heat that are at or below 125% of poverty level	20,095	17,226	15,141,213	528	528	4,643,400		0	0	$0.00
21	Single-family - Non Low Income	Air Sealing Retrofit	38.8%	35.00%	65%	50%	83%	SF, non-low income homes in the BREC service area with electric space heat	30,940	10,056	23,590,443	1,609	804	18,872,355		0	0	$0.00
22	Single-family - Non Low Income	Attic Insulation Retrofit	38.8%	35.00%	65%	50%	83%	SF, non-low income homes in the BREC service area with electric space heat	30,940	10,056	69,323,323	1,609	804	55,458,658		0	0	$0.00
23	Single-family - Non Low Income	Wall Insulation Retrofit	38.8%	35.00%	65%	50%	83%	SF, non-low income homes in the BREC service area with electric space heat	30,940	10,056	13,876,731	1,609	804	11,101,385		0	0	$0.00
24	Single-family - Non Low Income	WindowConstruction (from single-pane Uto doub pane,low U)	38.8%	35.00%	65%	50%	83%	SF, non-low income homes in the BREC service area with electric space heat	30,940	10,056	39,015,737	1,609	804	31,212,590		0	0	$0.00

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

ABNDIXA- MEASURE SAVNG,USEBL LIES,COS AND SATURANS B RESIDENTAL ENERGEFICIENCYMEASURES
Ctobr

HDD:

Big Rivers Service Area in Kentucky

Discount Rate: 5.35%

1	2	3	4	5	6	7	8	9	9	1 2	2	3	4	5	6 7	8	9		
Measure #	Single- or Multi-family	Measure Description	Total Number of Residential Households (Band Mltimes)	Market Driven or Retrofit	Savings Units	Cost Units	Eqipment Cost	Labr Cost	Total Installed Cost	Cost Type: Incremental = 0 Full =1	Measure Life (yrs)	Base Case Eqipment End Use Intensity (Annual kWh per appliance)	Annual kWh Savings Per Unit Installed	Estimated Annual MMBTU (Natural Gas) Savings Per Unit Installed	Annual Amortized Cost Per Unit	Levelized Cost Per kWh Saved	Annual Gallons of Water saved	Electric End Use Affected	Implementation Type 1=Line 2=RD
1	Multi-family	CE replacing Incandescent for 2hrsDay	96,076	Market Driven	Per bulb	Per bulb	$5.97	$0.00	$5.97	0	10.1	65.17	48.88	0	$0.78	$0.0160	0	Lighting	2
2	Multi-family	CE Torchiere (compared to Halogen Torchiere)	96,076	Retrofit	Per lamp	Per lamp	$60.00	$0.00	$60.00	0	8.2	273.75	223.56	0	$9.21	$0.0412	0	Lighting	1
3	Multi-family	CE Torchiere (compared to Incandescent Torchiere)	96,076	Retrofit	Per lamp	Per lamp	$60.00	$0.00	$60.00	0	8.2	136.88	86.69	0	$9.21	$0.1063	0	Lighting	1
4	Multi-family	Energy Star Single Room Air Conditioner	96,076	Market Driven	Per air conditioner	Per air conditioner	$89.00	$0.00	$89.00	0	13	1020.00	118.75	0	$9.68	$0.0815	0	Room AC	2
5	Multi-family	Energy Star Compliant Freezer Top Refrigerator	96,076	Market Driven	Per refrigerator	Per refrigerator	$115.00	$0.00	$115.00	0	17	1362.00	1029	0	$10.47	$0.0102	0	Refrigerator	2
6	Multi-family	Energy Star Compliant Side-by-Side Refrigerator	96,076	Market Driven	Per refrigerator	Per refrigerator	$247.50	$0.00	$247.50	0	17	1679.00	1079	0	$22.53	$0.0209	0	Refrigerator	2
7	Multi-family	Energy Star Compliant Upright Freezer	96,076	Market Driven	Per freezer	Per freezer	$50.00	$0.00	$50.00	0	15.5	692.00	110	0	$4.83	$0.0439	0	Freezer	2
8	Multi-family	Energy Star Compliant Chest Freezer	96,076	Market Driven	Per freezer	Per freezer	$50.00	$0.00	$50.00	0	15.5	397.00	43	0	$4.83	$0.1123	0	Freezer	2
9	Multi-family	Energy Star Built-In Dishwasher	96,076	Market Driven	Per dishwasher	Per dishwasher	($29.46)	$0.00	($29.46)	0	13	506.50	141	0	($3.20)	($0.0227)	0	Dishwasher	2
10	Multi-family	Energy Star Washing Machine with Electric Water Heater and Electric Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		475	0	$20.66	$0.0435	5400	Clothes Washer	2
11	Multi-family	Energy Star Washing Machine with Gas Water Heater and Electric Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		115	1.9	$20.66	$0.1796	5400	Clothes Washer	2
12	Multi-family	Energy Star Washing Machine with Gas Water Heater and Gas Clothes Dryer	96,076	Market Driven	Per clothes washer	Per clothes washer	$200.00	$0.00	$200.00	0	14		0	2.5	$20.66	#DIV/0!	5400	Clothes Washer	2
13	Multi-family	Energy Star Compliant Programmable Thermostat	96,076	Market Driven	Per Home	Per home	$49.00	$0.00	$49.00	0	10	778.00	87.9	2.5	$6.45	$0.0734	0	Central AC	2
14	Multi-family	Water Heater Blanket	96,076	Retrofit	Per water heater	Per water heater	$15.00	$0.00	$15.00	1	10	3330.00	333	0	$1.98	$0.0059	0	Water Heating	1
15	Multi-family	Low Flow Shower Head	96,076	Retrofit	Per water heater	Per shower head	$5.77	$0.00	$5.77	1	10	3330.00	250	0	$0.76	$0.0030	6789	Water Heating	1
16	Multi-family	Pipe Wrap	96,076	Retrofit	Per home	Per home	$3.23	$0.00	$3.23	1	10	3330.00	133	0	$0.43	$0.0032	0	Water Heating	1
17	Multi-family	Reset Water Heater Thermostat (from medium to med-low)	96,076	Retrofit	Per home	Per home			$10.00	1	10		380.90	0	$1.32	$0.0035	0	Water Heating	1
18	Multi-family	Water Heater Wrap (from EEo EF	96,076	Retrofit	Per home	Per home			$35.00	1	10		58.60	0	$4.61	$0.0787	0	Water Heating	1
19	Multi-family	Air Sealing	96,076	Retrofit	Per home	Per home			$380.00	1	10		1171.99	0	$50.05	$0.0427	0	Space Heating	1

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

AENDIX A- MEASURE SAING,USEBL LIES,CSS A
Ctobr

Big Rivers Service Area in Kentucky

Measure #	Single- or Multi-family	Measure Description	End Use Saturation (Prcentage of total homes that contain the *electric end use* or the measure)	Base Case ctor (fraction of the end use energy that is *already energy* efficient)	Remaining ctor (how many homes can *this b* installed)	*Convertibily* ctor	Single-Multi-mily Faction	Type of home here applicable	Numbr of applicable homes in before applying remaining factor and convertibility factor)[1]	Tal times Remaining ithout measure after applying remaining factor and convertibility factor)	Technical Potential- Tal annual kWh savings potential in % penetration attained Overnight"	Maximum Achievable Pogram Prticipants per year (% penetration limit,and before application of convertibility factor)[2]	Maximum Achievable Pogram Prticipants per year (% penetration limit,and after application of convertibility factor)[2]	Maximum Achievable kWh Savings (% penetration limit,and after application of convertibility factor)[2]	Savings ctor Prcentage reduction in electric energy *consumption)*	Tal annual gallons of ter savings potential in	Annual Maximum Achievable Term Savings Ptential in	O-going annual cost for *savings ()*
1	2	3	8	1	2	3 4		5 9	7	8	9	6 1	2	3	4	5		
1	Multi-family	CE replacing Incandescent for 2rsday	100.0%	20.00%	80.0%	100%	13%	Homes in BREC service territory (for CFLs, the numbers reported here represent light bulb sockets)	374,696	299,757	14,652,128	22,482	22,482	10,989,096	75.00%	0	0	$0.00
2	Multi-family	CE Trchiere compared to Hogen Trchiere)	18.0%	0.00%	100.0%	100%	13%	Homes in BREC service area with halogen torchieres	2,248	2,248	502,608	219	219	489,205	81.67%	0	0	$0.00
3	Multi-family	CE Trchiere compared to Incandescent Trchiere)	14.0%	0.00%	100.0%	100%	13%	Homes in BREC service area with Incandescent torchieres	1,749	1,749	151,580	170	170	147,538	63.33%	0	0	$0.00
4	Multi-family	Energy Star Single Room Air Conditioner	25.8%	10.00%	90%	100%	13%	Homes in Kentucky with one or more A/C units	5,478	4,930	585,468	295	295	350,280	11.64%	0	0	$0.00
5	Multi-family	Energy Star Compliant Feezer Tp Refrigerator	71.4%	12.00%	88%	100%	13%	Homes in BREC service area	8,918	7,848	8,075,223	357	357	3,670,556	75.55%	0	0	$0.00
6	Multi-family	Energy Star Compliant Side-b-Side *Refrigerator*	28.6%	12.00%	88%	100%	13%	Homes in BREC service area	3,572	3,143	3,391,786	143	143	1,541,721	64.26%	0	0	$0.00
7	Multi-family	Energy Star Compliant Upright Feezer	23.7%	12.00%	88%	100%	13%	Homes in BREC service area which contain a freezer	2,960	2,605	286,538	130	130	142,849	15.90%	0	0	$0.00
8	Multi-family	Energy Star Compliant Chest Feezer	19.7%	12.00%	88%	100%	13%	Homes in BREC service area which contain a freezer	2,461	2,165	93,106	108	108	46,416	10.83%	0	0	$0.00
9	Multi-family	Energy Star Built-In Dishwasher	51.0%	10.00%	90%	100%	13%	Homes in Kentucky with a dishwasher	6,370	5,733	808,333	343	343	483,618	27.84%	0	0	$0.00
10	Multi-family	Energy Star Washing Machine ith Electric Water Hater and Electric Clothes Dryer	20.0%	3.00%	97%	100%	13%	Homes in BREC service area with an electric water heater and an electric clothes dryer	2,498	2,423	1,150,942	137	137	652,596		741,899	0	$0.00
11	Multi-family	Energy Star Washing Machine ith Gs Water Hater and Electric Clothes Dryer	50.0%	3.00%	97%	100%	13%	Homes in BREC service area with a gas water heater and an electric clothes dryer	6,245	6,058	696,623	343	343	394,992		1,854,747	6,526	$0.00
12	Multi-family	Energy Star Washing Machine ith Gs Water Hater and Gs Clothes Dryer	20.0%	3.00%	97%	100%	13%	Homes in BREC service area with a gas water heater and a gas clothes dryer	2,498	2,423	0	137	137	0		741,899	3,435	$0.00
13	Multi-family	Energy Star Compliant Pogrammable Termostat	26.0%	11.00%	89%	100%	13%	Homes in BREC service area with central air conditioning	3,247	2,890	254,045	224	224	196,956	11.30%	0	5,602	$0.00
14	Multi-family	Water Hater Blanket	65.2%	32.00%	68%	100%	13%	Homes in BREC service territory with an electric water heater	8,143	5,538	1,843,992	391	391	1,301,641	10.00%	0	0	$0.00
15	Multi-family	Low-Shower Had	65.2%	30.00%	70%	100%	13%	Homes in BREC service territory with an electric water heater	8,143	5,700	1,425,095	407	407	1,017,925	7.51%	*2,764,276*	*0*	*$0.00*
16	Multi-family	Ppe Wrap	65.2%	20.00%	80%	100%	13%	Homes in BREC service territory with an electric water heater	8,143	6,515	866,458	469	469	649,843	3.99%	0	0	$0.00
17	Multi-family	*Reset Water Hater Termostat (from medium to med-low*	65.2%		100%	100%	13%	BREC homes at or below 125% of poverty level	8,143	8,143	3,101,794	651	651	2,481,435		0	0	$0.00
18	Multi-family	Water Hater Wrap (from Edo E)	65.2%		100%	100%	13%	BREC homes at or below 125% of poverty level	8,143	8,143	477,199	651	651	381,759		0	0	$0.00
19	Multi-family	Air Sealing	38.8%	35.00%	65%	100%	13%	MF, non-low income homes in the BREC service area with electric space heat	4,846	3,150	3,691,706	252	126	1,476,682		0	0	$0.00

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

AENDIX- MEASURE SAING,USEBL LIES,CGS AND SAURAIS B RESIDENIAL ENERIEICIENCYMEASURES
Clobr

HDD:

Big Rivers Service Area in Kentucky

Discount Rate: 5.35%

1	2	3	4	5	6	7	8	9	0	1 2	2	3	4	5	6 7	8	9		
Measure #	Single- or Multi-family	Measure Description	Total Number of Residential Households (Blend MRknes)	Market Driven or Retrofit	Savings Units	Cost Units	Eqipment Cost	Labr Cost	Total Installed Cost	Cost Type: Incremental = 0 Full = 1	Measure Life (yrs)	Base Case Eqipment End Use Intensity (Annual kWh per appliance)	Annual kWh Savings Per Unit Installed	Estimated Annual MMBtu (Natural Gas) Savings Per Unit Installed	Annual Amortized Cost Per Unit	Levelized Cost Per kWh Saved	Annual Gallons of Water saved	Electric End Use Affected	Implementation Type 1 = Line 2 = RD
20	Multi-family	Attic Insulation	96,076	Retrofit	Per home	Per home			$720.00	1	25		878.99	0	$52.69	$0.0602	0	Space Heating	1
21	Multi-family	Wall Insulation (from R-0 to R-)	96,076	Retrofit	Per home	Per home			$330.00	1	25		1380.00	0	$24.24	$0.0176		Space Heating	1
22	Multi-family	Window Construction (from single-pane U to double pane, low U)	96,076	Retrofit	Per home	Per home			$611.50	1	40		1940.00	0	$37.36	$0.0193		Space Heating	1

Appendix A: Input Assumptions - Residential Energy Efficiency Measures

AENDIXA- MEASURE SAVNG,USEBL LIES,CGS A
Ctobr

Big Rivers Service Area in Kentucky

1	2	3	9	2	2	3	8	8	7	8	2	0 1	2	3	4	5		
Measure #	Single- or Multi-family	Measure Description	End Use Saturation (ercentage of total homes that contain the electric end use or the measure)	Base Case ector (raction of the end use energy that is already energy efficient)	Remaining ector (n howmany homes can this b installed)	Convertibility ector	Single-Multi-mily Faction	ype of home here applicab	Numbr of applicab homes in bfore applying remaining factor and convertibility factor)[1]	tal times Remaining ithout measure after applying remaining factor and convertibility factor)	echnical otential-tal annual kWh savings potential in if penetration attained overnight"	Maximum Achievab ogram articipants per year (penetration limit,and bfore application of convertibility factor)[2]	Maximum Achievab ogram articipants per year (penetration limit,and after application of convertibility factor)[2]	Maximum Achievab kWh Savings penetration limit,and after application of convertibility factor)[2]	Savings ector ercentage reduction in electric energy consumption)	tal annual gallons of ater savings potential in	Annual Maximum Achievab erm Savings otential in	O-going annual cost for savings ()
20	Multi-family	Attic Insulation	38.8%	35.00%	65%	100%	13%	MF, non-low income homes in the BREC service area with electric space heat	4,846	3,150	2,768,779	252	126	1,107,512		0	0	$0.00
21	Multi-family	Wall Insulation (from Rto R)	38.8%	35.00%	65%	100%	13%	MF, non-low income homes in the BREC service area with electric space heat	4,846	3,150	4,346,928	252	126	1,738,771		0	0	$0.00
22	Multi-family	WindowConstruction (from single-pane Uto doub pane,low U)	38.8%	35.00%	65%	100%	13%	MF, non-low income homes in the BREC service area with electric space heat	4,846	3,150	6,110,899	252	126	2,444,359		0	0	$0.00

APPENDIX A- SOURCES AND REFERENCES FOR RESIDENTIAL NATURAL GAS ENERGY EFFICIENCY INPUT ASSUMPTIONS - OCTOBER 20, 2005

1	2	3	4	5	6	7	8
Measure # from GDS Natural Gas Energy Efficiency Data Base	Measure Description	Source for MMBTU, Therm, kWh and Water savings	How savings numbers were calculated	Source for Useful Life	Source for Incremental Cost	Source for End Use Saturation	Source for Saturation of Energy Efficient Measure (Base Case factor)
1	Compact Fluorescent Lighting	Table 1-8 (Average Wattage Reduction Results) and 1-9 (Average Daily Hours of Use Results) in "Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs," July 29, 2004, by Nexus Market Research, Inc. and RLW Analytics, Inc.	The average hours of daily use and the average wattage reduction values were taken from the chart and multiplied together to arrive at Wh/day. That value was then multiplied by the number of days in the year and divided by 1000 to calculate the average number of kWh saved in a year.	Useful life of 10000 hours were taken from manufacturer data on product package and used to calculate useful life in years. Hour use of 2.7 hours/day came from the Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs on July 29, 2004.	Data collected by Courtney Denman at Home Depot store on June 7, 2005. Presented is the average incremental cost of available CFL bulbs.	End-Use Consumption of Electricity 2001	PowerPoint Presentation by Brad Kates and Steve Bonano on the results of the "Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs" on July 29, 2004.
2	CFL Torchieres	"Residential Torchiere Assumptions" from Energy Star's "Torchiere Savings Calculator," EnergyStar.gov, March, 2000. Base case incandescent torchiere energy use came from "Alternatives to Halogen Torchieres" on the Lighting Research Center's website (www.lrc.rpi.edu).	Average energy use per fixture (for a halogen torchiere and for a CFL torchiere) were compared and subtracted. Then the wattage difference was multiplied by 2.5 hours per day and 365 days per year.	Useful life hours were calculated based on an advertised life of 7500 hours and usage of 2.5 hours per day, 365 days per year, according to Table 1-9 (Average Daily Hours of Use Results) from Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs by Nexus Market Research, Inc. in July, 2004.	"Residential Torchiere Assumptions" from Energy Star's "Torchiere Savings Calculator," EnergyStar.gov, March, 2000.	Email from Jean Shelton at Itron on Wednesday, August 3, 2005.	Email from Jean Shelton at Itron on Wednesday, August 3, 2005.
3	Energy Star Single-Room, Window-Mounted Air Conditioner	kWh data came from energy labels for each model as advertised on Sears' website (Sears.com)	Savings were calculated by averaging kWh for each capacity air-conditioning unit (in BTUs/hr) and finding the difference between corresponding Energy Star and non-Energy Star model energy use. Then the differences were averaged to find a mean value for energy savings.	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Incremental cost was computed by comparing model prices as advertised on Sears' website (Sears.com)	Results from the final report of "Home Appliance Saturation and Length of First Ownership Study," May, 2001, by NFO WorldGroup	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
4-5	Energy Star Freezer-Top Refrigerator Models and Side-by-Side Refrigerator Models	Table 1 (Annual Refrigerator Usage--Averages and Comparisons to Rated) in "Statewide Refrigerator Monitoring and Verification Study & Results," by Dana Teague and Michael Blasnik	Savings were calculated by GDS by comparing the annual kWh usage for existing vs. energy efficient refrigerators as reported in Table 1.	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Data collected by Courtney Denman at Sears Department store on June 9, 2005	Table D6 (Appliances in East South Central Households).in "Regional Energy Profile: East South Central Appliance Report 2001," by the Energy Information Administration, and results from the final report of "Home Appliance Saturation and Length of First Ownership Study," May, 2001, by NFO WorldGroup	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
6	Energy Star Upright Freezer Models	kWh data came from energy labels for each model as advertised on Lowe's website (Lowes.com)	Savings were calculated by averaging kWh for each size freezer (in cu. Ft.) and finding the difference between corresponding Energy Star and non-Energy Star model energy use. Then the differences were averaged to find a mean value for energy savings.	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Incremental cost was computed by comparing model prices as advertised on Lowe's website (Lowes.com)	Results from the final report of "Home Appliance Saturation and Length of First Ownership Study," May, 2001, by NFO WorldGroup	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
7	Energy Star Chest Freezer Models	kWh data came from energy labels for each model as advertised on Home Depot's website (homedepot.com)	Savings were calculated by averaging kWh for each size freezer (in cu. Ft.) and finding the difference between corresponding Energy Star and non-Energy Star model energy use. Then the differences were averaged to find a mean value for energy savings.	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Incremental cost was computed by comparing model prices as advertised on Home Depot's website (homedepot.com)	Results from the final report of "Home Appliance Saturation and Length of First Ownership Study," May, 2001, by NFO WorldGroup	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
8	Energy Star Dishwasher	kWh data came from energy labels for each model as advertised on Sears' website (Sears.com)	Energy usage data was collected from website and then averaged for Energy Star-compliant models and non-Energy Star-compliant models. The averages were subtracted to find the difference.	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Incremental cost was computed by comparing model prices as advertised on Sears' website (Sears.com)	Table D6 (Appliances in East South Central Households).in "Regional Energy Profile: East South Central Appliance Report 2001," by the Energy Information Administration	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
9-11	Energy Star Clothes Washers	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah" Southwest Energy Efficiency Project. October 17, 2002
12	Energy Star Compliant Programmable Thermostat	Appendix A (Input Assumptions) in the 2005 report "The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM"	Appendix A (Input Assumptions) in the 2005 report "The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM"	Table B-5 (Supply Curve Development) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Appendix A (Input Assumptions) in the May, 2005 report "The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM" by GDS Associates, Inc.	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
13	Water Heater Blanket - Non Low Income Market Segment	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Costs were recorded from advertisements on Lowes' (Lowes.com) and Home Depot's (homedepot.com) websites	PowerPoint Presentation by E. A. Torrero and R. H. McClelland, "State of the Art of Residential Fuel Cells, Market, and Implementation Issues" in June, 2001	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
14	Low Flow Shower Head	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Appendix A (Input Assumptions) in the May, 2005 report "The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM" by GDS Associates, Inc.	PowerPoint Presentation by E. A. Torrero and R. H. McClelland, "State of the Art of Residential Fuel Cells, Market, and Implementation Issues" in June, 2002	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
15	Pipe Wrap	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Appendix A (Input Assumptions) in the May, 2005 report "The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM" by GDS Associates, Inc.	PowerPoint Presentation by E. A. Torrero and R. H. McClelland, "State of the Art of Residential Fuel Cells, Market, and Implementation Issues" in June, 2003	Table B-7 (Database of Energy Efficiency Measures) in Appendix B of "Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates
16	Air Sealing	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	"2004 Poverty Income Guidelines, Contiguous U.S. Grantees, Effective February 13, 2004," from http://chfs.ky.gov/dcbs/dfs/Weatherization.htm and "Detailed Demographic Update: 2004/2009" by ScanUS, Inc.	Email from Gary Brown, Program Specialist of the Kentucky Weatherization Assistance Program, on July 27, 2005
17	Reset Water Heater Thermostat	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	"2004 Poverty Income Guidelines, Contiguous U.S. Grantees, Effective February 13, 2004," from http://chfs.ky.gov/dcbs/dfs/Weatherization.htm and "Detailed Demographic Update: 2004/2009" by ScanUS, Inc.	Email from Gary Brown, Program Specialist of the Kentucky Weatherization Assistance Program, on July 27, 2005

APPENDIX A- SOURCES AND REFERENCES FOR RESIDENTIAL NATURAL GAS ENERGY EFFICIENCY INPUT ASSUMPTIONS - OCTOBER 20, 2005

1	2	3	4	5	6	7	8
Measure # from GDS Natural Gas Energy Efficiency Data Base	Measure Description	Source for MMBTU, Therm, kWh and Water savings	How savings numbers were calculated	Source for Useful Life	Source for Incremental Cost	Source for End Use Saturation	Source for Saturation of Energy Efficient Measure (Base Case factor)
18	Water Heater Wrap - Low Income Market Segment	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	"2004 Poverty Income Guidelines, Contiguous U.S. Grantees, Effective February 13, 2004," from http://chfs.ky.gov/dcbs/dfs/Watherization.htm and "Detailed Demographic Update: 2004/2009" by Scan/US, Inc.	Email from Gary Brown, Program Specialist of the Kentucky Weatherization Assistance Program, on July 27, 2005
19	Attic Insulation - Low Income Market Segment	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Table 8 (Weatherization Measures, Costs, and Savings for Typical House in South) in "Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program" by Mark Schweitzer and Joel F. Eisenberg of Oak Ridge National Laboratory, May 2002	"2004 Poverty Income Guidelines, Contiguous U.S. Grantees, Effective February 13, 2004," from http://chfs.ky.gov/dcbs/dfs/Watherization.htm and "Detailed Demographic Update: 2004/2009" by Scan/US, Inc.	Email from Gary Brown, Program Specialist of the Kentucky Weatherization Assistance Program, on July 27, 2005
20	Air Sealing	Energy 10 Simulations	Energy 10 Simulations	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Energy 10 Simulations	The source for the electric space heating saturation of 38.8% for Kentucky is from the US Bureau of the Census, 2000 Housing Census, Table DP-4, Profile of Selected Housing Characteristics for Kentucky for the Year 2000.	September 2005 Big Rivers Electric Corporation Market Research Study with Weatherization and Insulation Service Providers in the BREC Service Area, prepared by GDS Associates, September 9, 2005.
21	Attic Insulation - Non Low Income Market Segment	Energy 10 Simulations	Energy 10 Simulations	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Energy 10 Simulations	The source for the electric space heating saturation of 38.8% for Kentucky is from the US Bureau of the Census, 2000 Housing Census, Table DP-4, Profile of Selected Housing Characteristics for Kentucky for the Year 2000.	September 2005 Big Rivers Electric Corporation Market Research Study with Weatherization and Insulation Service Providers in the BREC Service Area, prepared by GDS Associates, September 9, 2005.
22	Wall Insulation	Energy 10 Simulations	Energy 10 Simulations	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Energy 10 Simulations	The source for the electric space heating saturation of 38.8% for Kentucky is from the US Bureau of the Census, 2000 Housing Census, Table DP-4, Profile of Selected Housing Characteristics for Kentucky for the Year 2000.	September 2005 Big Rivers Electric Corporation Market Research Study with Weatherization and Insulation Service Providers in the BREC Service Area, prepared by GDS Associates, September 9, 2005.
23	Window Construction	Energy 10 Simulations	Energy 10 Simulations	Table B-4 (Supply Curve Development...) in Appendix B of "Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region," June, 2004, by GDS Associates	Energy 10 Simulations	The source for the electric space heating saturation of 38.8% for Kentucky is from the US Bureau of the Census, 2000 Housing Census, Table DP-4, Profile of Selected Housing Characteristics for Kentucky for the Year 2000.	September 2005 Big Rivers Electric Corporation Market Research Study with Weatherization and Insulation Service Providers in the BREC Service Area, prepared by GDS Associates, September 9, 2005.

APPENDIX A - ELECTRIC END USE LOAD SHAPES FOR RESIDENTIAL ENERGY EFFICIENCY MEASURES

Loadshape Name	Winter Peak Energy	Winter Off-Peak Energy	Summer Peak Energy	Summer Off-Peak Energy	kWh check	Summer Gener. Capacity	Winter Gener. Capacity	Transm. Capacity	Distribution Capacity
Indoor Lighting	0.2870	0.0760	0.3600	0.2770	1.00	0.1230	0.2320	0.1230	0.1230
Refrigerator	0.2250	0.1080	0.3370	0.3300	1.00	0.6000	0.6230	0.6000	0.6000
Space Heat	0.6220	0.3780	0.0000	0.0000	1.00	0.0000	1.0000	0.0000	0.0000
AC	0.0000	0.0000	0.5000	0.5000	1.00	0.8000	0.0000	0.8000	0.8000
DHW Insulation	0.2230	0.1110	0.3330	0.3330	1.00	1.0000	1.0000	1.0000	1.0000
DHW Conserve	0.2840	0.0310	0.4650	0.2200	1.00	0.4810	0.7750	0.4810	0.4810
Clothes Washer	0.3420	0.0370	0.4200	0.2010	1.00	0.5000	0.5000	0.5000	0.5000

Source:	"Loadshape Table of Contents," page 9 in Technical Reference User Manual (TRM) No. 2004-31: Measure Savings Algorithms and Cost Assumptions Through Portfolio 31, by Efficiency Vermont, December, 2004.

Note:	Select numbers have been edited by GDS: Space Heat peak load (on the assumption that heat is not used in the summer months), Space Heat Summer and Winter Generation Capacity, AC Summer Generation Capacity, Clothes Washer Summer and Winter Generation Capacity

APPENDIX B

Appendix B: Input Assumptions - Commercial Energy Efficiency Measures

Discount Ra 5.35%

#	Commercial Market Segment	Retrofit or Market Driven	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	Incremental Cost	Cost Source	Measure Life	Measure Life Source	Annualized cost	Levelized cost per kWh saved
				Interior Lighting								
1	Existing	Retrofit	Interior	CFL - screw-in	90	GDS calculation: (75-15)W * 1500hr/yr	$6	Home Depot website	8		$0.94	$0.0105
2	Existing	Market	Interior	CFL - Hard Wired	228	National Grid, 2000 Energy Initiative Program (Large C&I) Data, 2000 DSM Performance	$27	Mike Rufo, 2003.	8	National	$4.24	$0.0186
3	Existing	Market	Interior	Biax Fluorescents	460	CL&P Program Data, 2003. 6 lamp 300 W Biax replacing 460 W HID. 3,000 hrs	$400	Environmental Building News, Volume 9, Aug. 2000	7	Northeast	$70.01	$0.1458
4	Existing	Market	Interior	Energy-efficient Torchiere	296	Lawrence Berkley Lab, "An Energy-Efficient, Safer Torchiere".	$20	ACEEE Selecting Targets for Market Transformation Program:	7	GDS	$3.50	$0.0118
5	Existing	Market	Interior	Halogen PAR Flood, 90W	180	GDS calculation. 3,000 hrs vs. 150 w halogen.	$12	California Statewide Commercial Sector Energy Efficiency	1	California	$12.64	$0.0702
6	Existing	Market	Interior	Ret 1L4'T5, 1EB	39	Lighting Research Center energy use data compared to 34W T12 fixtures. 3000 hrs.	$64	Lighting Research Center, 2003.	9	Northeast	$9.15	$0.2345
7	Existing	Market Driven	Interior Lighting	Ret 4L4' HO T5, 1EB (repl 400 w Metal halide)	648	GDS Calculation based on 3000 hrs assumed annual use. (234 W fixture replacing 450 W metal halide). Reference: Sacramento Municipal Utility District Technology Evaluation Report, T5 High Bay Lighting Systems, May 2002.	$400	Environmental Building News, Volume 9, Aug. 2000	9	Northeast Utilities, Action	$57.16	$0.0882
8	Existing	Market	Interior	Ret 1L4'T5, 1EB, Reflector	63	Lighting Research Center energy use data compared to 34W T12 fixtures. 3000 hrs. E-source	$98	Lighting Research Center, 2003. and California Statewide	9	Northeast	$14.00	$0.2223
9	Existing	Market Driven	Interior Lighting	RET T8, EB, Reflector	54	National Grid, 2000 Small C&I Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$72	California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002, C.1-1.	9	Northeast Utilities,	$10.29	$0.1905
10	Existing	Market	Interior	RET 2L4'T8, 1EB	72	GDS Calculation based on 34WT12.	$27	Maine Cost Effectiveness Model, March 2003.	9	Northeast	$3.86	$0.0536
11	Existing	Market Driven	Interior Lighting	RET 2L4' Super T8, 1EB	36	Lighting Research Center energy use data compared to Standard T8 fixtures. 3000 hrs.	$10	Lighting Research Center cost data (1.75 standard bulb and ballast cost) compared to standard T8 fixtures. Standard amp and ballast cost of $27 from California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002, C.1-1.	9	Northeast Utilities, Action Program C&I Persistenc	$1.43	$0.0397
12	Existing	Market Driven	Interior Lighting	RET 2L4' Super T8, 1EB, Reflector	84	Lighting Research Center energy use data compared to Standard T8 fixtures. 3000 hrs. E-source Technology Atlas Series 2001, 7.3.1. 33% delamping in addition to T8 to super T8 savings.	$45	California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002, C.1-1. ($72 - $27)	9	Northeast Utilities,	$6.43	$0.0765
13	Existing	Market	Interior	RET 2L4'T5, 1EB	84	Lighting Research Center energy use data compared to 34W T12 fixtures. 3000 hrs.	$64	Lighting Research Center, 2003.	9	Northeast	$9.15	$0.1089
14	Existing	Market Driven	Interior Lighting	RET 2L4'T5, 1EB, Reflector	132	Lighting Research Center energy use data compared to 34W T12 fixtures. 3000 hrs. E-source Technology Atlas Series 2001, 7.3.1. 33% delamping in addition to T12 to T5 savings.	$72	California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002, C.1-1.	9	Northeast Utilities,	$10.29	$0.0779
15	Existing	Market	Interior	RET 2L8'T8, 1EB	144	GDS calculation. Assumes 3,000 hrs. replacing 34 w T12	$27	Maine Cost Effectiveness Model, March 2003.	9	Northeast	$3.86	$0.0268
16	Existing	Market	Interior	RET 4L4' Super T8, 1EB	72	Lighting Research Center energy use data compared to standard T8 fixtures. 3000 hrs.	$12	Lighting Research Center cost data (1.75 standard bulb and	9	Northeast	$1.71	$0.0238
17	Existing	Market	Interior	250 Watt Metal Halide Lighting	513	Maine Cost Effectiveness Model, March 2003.	$65	Maine Cost Effectiveness Model, March 2003.	12	Northeast	$7.48	$0.0146
18	Existing	Market	Interior	High Intensity Discharge Systems, 250 W	510	National Grid, 2000 Energy Initiative Program (Large C&I) Data, 2000 DSM Performance	$65	Maine Cost Effectiveness Model, March 2003.	15	National	$6.41	$0.0126
19	New	Market	Interior	High Intensity Discharge Systems, 50 W	291	National Grid, 2000 Design 2000plus Program (Large C&I) Data, 2000 DSM Performance	$65	Maine Cost Effectiveness Model, March 2003.	15	National	$6.41	$0.0220
20	Existing	Market Driven	Interior Lighting	Pulse Start HID	330	GDS Calculation based on 3000 hrs assumed annual use. (350 W fixture replacing 450 W metal halide). Reference Energy Center of Wisconsin fact sheet "Pulse Start Metal Halide Lamps".	$200	Federal Energy Management Program, Technology Profile, "Metal Halide Lighting"	12	Northeast Utilities,	$23.01	$0.0697
21	Existing	Market	Exterior	High Pressure Sodium 250W Lamp	513	Maine Cost Effectiveness Model, March 2003.	$65	Maine Cost Effectiveness Model, March 2003.	12	Northeast	$7.48	$0.0146
22	Existing	Market	Interior	LED Exit Signs	184	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	$30	Northeast Energy Efficiency Partnership, Energy Efficiency	30	Northeast	$2.03	$0.0110
23	Existing	Market	Interior	Solid State Exit Signs	348	Maine Cost Effectiveness Model, March 2003.	$38	Maine Cost Effectiveness Model, March 2003.	30	Maine Cost	$2.57	$0.0074
24	Existing	Market	Interior	LED Signage	690	WI Focus on Energy Program. Assumes 3,000 hrs. 20 w LED vs. 250 w neon.	$100	WI Focus on Energy Program	20	Northeast	$8.26	$0.0120
25	Existing	Market	Exterior	LED Traffic Lights	430	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	$125	Northeast Energy Efficiency Partnership, Energy Efficiency	15	Northeast	$12.33	$0.0287
26	Existing	Market	Exterior	LED Traffic Lights (Yellow signals only)	22	assumes 5% of total savings per discussion with CL&P	$42	assumes 1/3 of total cost	15	Northeast	$4.11	$0.1912
27	Existing	Market	Interior	Occupancy Sensor	302	Northeast Utilities C&I Persistence Study Final Report, Oct 2001, Table 8.	$120	Maine Cost Effectiveness Model, March 2003.	15	Northeast	$11.84	$0.0392
28	Existing	Market	Interior	Daylight Dimming	353	National Grid, 2000 Energy Initiative Program Data, 2000 DSM Performance Measurement Report,	$181	California Statewide Commercial Sector Energy Efficiency	20	National	$14.96	$0.0424
29	New	Market	Interior	Daylight Dimming	252	National Grid, 2000 Design 2000plus Program (Large C&I) Data, 2000 DSM Performance	$181	California Statewide Commercial Sector Energy Efficiency	20	National	$14.96	$0.0594
30	Existing	Market Driven	Interior Lighting	Continuous Dimming, 10L4' Fluorescent Fixtures	945	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-1 and GDS calculation of 1,260 KWh baseline of 10 lamp, 34-W fixture (420 W) and 3,000 hours of use.	$288	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-1.	20	National Grid, 2000 Energy	$23.80	$0.0252
31	Existing	Market Driven	Interior Lighting	Continuous Dimming, 5L4' Fluorescent Fixtures	472	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-1 and GDS calculation of 1,260 KWh baseline of 10 lamp, 34-W fixture (210 W) and 3,000 hours of use.	$288	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-1.	20	National Grid, 2000 Design	$23.80	$0.0504
32	Existing	Market Driven	Interior Lighting	Continuous Dimming, 5L8' Fluorescent Fixtures	945	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-1 and GDS calculation of 1,260 KWh baseline of 10 lamp, 34-W fixture (420 W) and 3,000 hours of use.	$288	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-1.	20	National Grid, 2000 Design	$23.80	$0.0252
33	New	Market	Interior	15 % More Efficient Design (Lighting)	27,000	GDS Calculation based on 1,000, 2 lamp T8 and 3,000 hrs	$4,000	Assumes 40 hrs of Archit design work at $100/hr	20	Assumed	$330.56	$0.0122
34	New	Market	Interior	30 % More Efficient Design (Lighting)	54,000	GDS Calculation based on 1,000, 2 lamp T8 and 3,000 hrs	$8,000	Assumes 80 hrs of Archit design work at $100/hr	20	Assumed	$661.13	$0.0122
35	New	Market	Interior	5 % More Efficient Design (Lighting)	9,000	GDS Calculation based on 1,000, 2 lamp T8 and 3,000 hrs	$4,000	Assumes 40 hrs of Archit design work at $100/hr	20	Assumed	$330.56	$0.0367
36	New	Market	Interior	10 % More Efficient Design (Lighting)	18,000	GDS Calculation based on 1,000, 2 lamp T8 and 3,000 hrs	$8,000	Assumes 40 hrs of Archit design work at $100/hr	20	Assumed	$661.13	$0.0367
				Refrigeration								
37	Existing	Market	Refrigeration	Vender Miser	1,551	Northeast Utilities Vending Miser Monitoring Project Final Report, April 2001, p. 8	$179	USA Technologies, formerly Bayview Technology Group,	5	USA	$41.75	$0.0269
38	Existing	Market	Refrigeration	ENERGY STAR Beverage Vending Machines	330	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	$25	Northeast Energy Efficiency Partnership, Energy Efficiency	8.5	Northeast	$3.74	$0.0113
39	Existing	Market Driven	Refrigeration	Refrigeration Commissioning	190	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$113	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per ton)	3	California Statewide Commercia	$41.77	$0.2198
40	Existing	Market Driven	Refrigeration	Refrigeration Commissioning	375	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$113	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per ton)	3	California Statewide Commercia	$41.77	$0.1114
41	Existing	Market Driven	Refrigeration	Efficient compressor motor retrofit	266	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$62	Motorup Evaluation and Market Assessment, Xenergy, Inc, Nov. 2001. AND base efficiency motor costs from Grainger Industrial Supply 2001-2002 Catalog, pp. 41-44.	10	California Statewide Commercia	$8.17	$0.0307
42	Existing	Market Driven	Refrigeration	Efficient compressor motor retrofit	525	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$62	Motorup Evaluation and Market Assessment, Xenergy, Inc, Nov. 2001. AND base efficiency motor costs from Grainger Industrial Supply 2001-2002 Catalog, pp. 41-44.	10	California Statewide Commercia	$8.17	$0.0156

Appendix B: Input Assumptions - Commercial Energy Efficiency Measures

#	Commercial Market Segment	Retrofit or Market Driven	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	Incremental Cost	Cost Source	Measure Life	Measure Life Source	Annualized cost	Levelized cost per kWh saved
43	Existing	Market Driven	Refrigeration	Compressor VSD retrofit - refrig	228	CEE website (average usage for reach in refrigerators 3,800 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (6% savings), July, 2002, C.2-4. Per unit savings.	$2,000	Wisconsin Focus on Energy Program, VFD analysis spreadsheet.	20	Northeast Utilities, Action	$165.28	$0.7249
44	Existing	Market Driven	Refrigeration	Compressor VSD retrofit - freezer	450	CEE website (average usage for reach in refrigerators 7,500 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (6% savings), July, 2002, C.2-4. Per Unit Savings.	$2,000	Wisconsin Focus on Energy Program, VFD analysis spreadsheet.	20	Northeast Utilities, Action	$165.28	$0.3673
45	Existing	Market Driven	Refrigeration	Demand Defrost Electric - Refrig	304	CEE website (average usage for reach in refrigerators 3,800 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (8% savings), July, 2002, C.2-4.	$25	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. $25/hp	10	California Statewide Commercia	$3.29	$0.0108
46	Existing	Market Driven	Refrigeration	Demand Defrost Electric - Freezers	600	CEE website (average usage for reach in refrigerators 7,500 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (8% savings), July, 2002, C.2-4.	$25	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. $25/hp	10	California Statewide Commercia	$3.29	$0.0055
47	Existing	Market Driven	Refrigeration	Floating head pressure controls-Refrig	266	CEE website (average usage for reach in refrigerators 3,800 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (7% savings), July, 2002, C.2-4. Per unit savings.	$4,995	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4.	14	California Statewide Commercia	$515.97	$1.9397
48	Existing	Market Driven	Refrigeration	Floating head pressure controls-Freezers	525	CEE website (average usage for reach in refrigerators 7,500 KWh) and California Statewide Commercial Sector Energy Efficiency Potential Study (7% savings), July, 2002, C.2-4. Per Unit Savings.	$4,995	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4.	14	California Statewide Commercia	$515.97	$0.9828
49	Existing	Market	Refrigeration	High Efficiency Ice Maker	2,365	Federal Energy Management Program, Fact Sheet, "How to Buy an Energy Efficient Commercial Ice	$300	Maine Cost Effectiveness Model, March 2003.	7	Federal	$52.51	$0.0222
50	Existing	Market	Refrigeration	Beverage Merchandisers	1,730	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	$166	Northeast Energy Efficiency Partnership, Energy Efficiency	8.5	Northeast	$24.81	$0.0143
51	Existing	Market	Refrigeration	High Efficiency Reach in Refrigerator	1,330	CEE website. Www.cee1.org/com/com-ref/com-ref-main.php3	$400	Select Appliances website. Www.selectappliance.com	10	Federal	$52.69	$0.0396
52	Existing	Market	Refrigeration	High Efficiency Reach in Freezer	2,625	CEE website. Www.cee1.org/com/com-ref/com-ref-main.php3	$400	Select Appliances website. Www.selectappliance.com	10	Federal	$52.69	$0.0201
53	Existing	Market Driven	Refrigeration	High-efficiency fan motors - refrig	152	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from Technology Data Characterizing Refrigeration in Commercial Buildings: Application to End-use Forecasting wit	$62	Motorup Evaluation and Market Assessment, Xenergy, Inc, Nov. 2001. AND base efficiency motor costs from Grainger Industrial Supply 2001-2002 Catalog, pp. 41-44.	12	Northeast Utilities, Action	$7.13	$0.0469
54	Existing	Market Driven	Refrigeration	High-efficiency fan motors - freezer	300	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from Technology Data Characterizing Refrigeration in Commercial Buildings: Application to End-use Forecasting wit	$62	Motorup Evaluation and Market Assessment, Xenergy, Inc, Nov. 2001. AND base efficiency motor costs from Grainger Industrial Supply 2001-2002 Catalog, pp. 41-44.	12	Northeast Utilities, Action	$7.13	$0.0238
55	Existing	Market Driven	Refrigeration	Anti-sweat (humidistat) controls - refrig	190	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$6,500	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per HP)	12	California Statewide Commercia	$747.91	$3.9364
56	Existing	Market Driven	Refrigeration	Anti-sweat (humidistat) controls - freezer	375	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$6,500	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per HP)	12	California Statewide Commercia	$747.91	$1.9944
57	Existing	Market Driven	Refrigeration	Demand Hot Gas Defrost - refrig	114	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$25	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per HP)	10	California Statewide Commercia	$3.29	$0.0289
58	New	Market Driven	Refrigeration	Demand Hot Gas Defrost -freezer	225	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$25	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per HP)	10	California Statewide Commercia	$3.29	$0.0146
59	Existing	Market Driven	Refrigeration	Night covers for display cases - refrig	228	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 3,800 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$9	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per linear foot)	5	California Statewide Commercia	$2.10	$0.0092
60	New	Market Driven	Refrigeration	Night covers for display cases - freezers	450	GDS calculation from CEE website (www.cee1.org/com/com-ref/com-ref-main.php3) reach-in freezer base use of 7,500 KWh/yr and savings estimate from California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4	$9	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4. (per linear foot)	5	California Statewide Commercia	$2.10	$0.0047
61	Existing	Market	Refrigeration	Strip curtains for walk-ins - refrig	368	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4. and	$200	California Statewide Commercial Sector Energy Efficiency	4	California	$56.86	$0.1545
62	Existing	Market	Refrigeration	Strip curtains for walk-ins - freezer	613	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-4. and	$200	California Statewide Commercial Sector Energy Efficiency	4	California	$56.86	$0.0928
63	Existing	Market Driven	Refrigeration	Walk-In Cooler Economizers	1,149	National Grid, 2000 Small C&I Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$300	E-source Technology Atlas 2001, p. 6.3.1. $50-100/ton. 3-ton *capacity assumed*	15	National Grid, 1999 Small C&I	$29.59	$0.0258
64	Existing	Market Driven	Refrigeration	Walk-In Cooler Fan Control	1,487	National Grid, 2000 Small C&I Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$300	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-4.	16	National Grid, 2000 Small C&I	$28.37	$0.0191
65	Existing	Market Driven	Refrigeration	Walk-In Cooler Door Heater Control	4,202	National Grid, 2000 Small C&I Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$2,000		17	National Grid, 2000 Small C&I	$182.07	$0.0433
66	Existing	Market Driven	Refrigeration	Walk-In Freezer Door Heater Control	2,055	National Grid, 2000 Small C&I Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$2,000		18	National Grid, 2000 Small C&I	$175.80	$0.0856
				Space Cooling								
67	New	Market Driven	Space Cooling	Centrifugal Chiller, 0.51 kW/ton, 300 tons	55,968	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. Average efficiency (0.60 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$16,200	Trane Company, "Chilled Water Plant Costs Estimated", www.trane.com/commercial/issues/earthwise_systems AND LADWP Purchasing Advisor www.ladwp.com/energyadvisor/PA_14.html (Difference in first cost of efficient chiller vs 0.60 KW/ton system. Total first c	23	FEMP Fact Sheet, "How to Buy an Energy	$1,240.95	$0.0222

Appendix B: Input Assumptions - Commercial Energy Efficiency Measures

#	Commercial Market Segment	Retrofit or Market Driven	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	Incremental Cost	Cost Source	Measure Life	Measure Life Source	Annualized cost	Levelized cost per kWh saved
68	New	Retrofit	Space Cooling	Centrifugal Chiller, 0.51 kW/ton, 300 tons - Retrofit	118,155	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. 1990 Average efficiency (0.70 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$202,200	$674 per ton cost from tristate.apogee.net/cool/cmnch.asp	23	FEMP Fact Sheet, "How to Buy an Energy	$15,488.86	$0.1311
69	Existing	Market Driven	Space Cooling	Centrifugal Chiller, 0.51 kW/ton, 500 tons	93,281	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. Average efficiency (0.60 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$27,000	Trane Company, "Chilled Water Plant Costs Estimated", www.trane.com/commercial/issues/earthwise_systems AND LADWP Purchasing Advisor www.ladwp.com/energyadvisor/PA_14.html (Difference in first cost of efficient chiller vs 0.60 KW/ton system. Total first c	23	FEMP Fact Sheet, "How to Buy an Energy	$2,068.25	$0.0222
70	Existing	Retrofit	Space Cooling	Centrifugal Chiller, 0.51 kW/ton, 500 tons - Retrofit	196,926	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. 1990 Average efficiency (0.70 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$281,500	$563 per ton cost from tristate.apogee.net/cool/cmnch.asp	23	FEMP Fact Sheet, "How to Buy an Energy	$21,563.38	$0.1095
71	New	Market Driven	Space Cooling	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	207,290	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. Average efficiency (0.60 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$60,000	Trane Company, "Chilled Water Plant Costs Estimated", www.trane.com/commercial/issues/earthwise_systems AND LADWP Purchasing Advisor www.ladwp.com/energyadvisor/PA_14.html (Difference in first cost of efficient chiller vs 0.60 KW/ton system. Total first c	23	FEMP Fact Sheet, "How to Buy an Energy	$4,596.10	$0.0222
72	Existing	Retrofit	Space Cooling	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	310,935	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on EFLH average from Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report, June 1999, p. 3-12 (1,091 EFLH) and Base efficiency from FEMP Fact Sheet, "How to Buy an Energy Efficient Water Cooled Electric Chiller", Nov. 2000, p.2. Average efficiency (0.70 KW/ton) from www.trane.com/commercial/issues/environmental/ashrae_journal02.asp.	$314,500	$563 per ton cost from tristate.apogee.net/cool/cmnch.asp + $33K design and equipment premium.	23	FEMP Fact Sheet, "How to Buy an Energy	$24,091.24	$0.0775
73	Existing	Market Driven	Space Cooling	Chiller Tune Up/Diagnostics - 300 ton	25,207	CT estimate x ratio of CDD; CT estimate: GDS calculation of base use of 0.8 KW/ton chiller and 1,091 EFLH estimate for CT as used in chiller replacement. California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-3.	$5,100	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3. $17/ton	10	California Statewide Commercia	$671.75	$0.0266
74	Existing	Market Driven	Space Cooling	Chiller Tune Up/Diagnostics - 500 ton	25,207	CT estimate x ratio of CDD; CT estimate: GDS calculation of base use of 0.8 KW/ton chiller and 1,091 EFLH estimate for CT as used in chiller replacement. California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-3.	$8,500	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3. $17/ton	10	California Statewide Commercia	$1,119.58	$0.0444
75	New	Market Driven	Space Cooling	Cooling Circ. Pumps - VSD	3,486	GDS Calculation. 20 HP chilled water pumps per 500 tons chiller capacity (based on FEMP case study, Internal Revenue Service, Fresno, Aug 2001).	$6,280	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3.	20	Northeast Utilities, Action	$518.99	$0.1489
76	New	Market Driven	Space Cooling	DX Packaged System, EER=10.9, 10 tons	4,818	CT estimate x ratio of CDD; CT estimate: GDS Calculation. Maine Cost Effectiveness Model, March 2003 as reality check.	$607	Maine Cost Effectiveness Model, March 2003.	15	Maine Cost Effectiveness Model,	$59.87	$0.0124
77	Existing	Market Driven	Space Cooling	DX Packaged System, CEE Tier 2, <20 Tons	7,226	CT estimate x ratio of CDD; CT estimate: GDS Calculation. Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12 as reality check.	$910	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	15	Northeast Energy Efficiency	$89.76	$0.0124
78	Existing	Market Driven	Space Cooling	DX Packaged System, CEE Tier 2, >20 Tons	14,453	CT estimate x ratio of CDD; CT estimate: GDS Calculation. Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	$1,813	Northeast Energy Efficiency Partnership, Energy Efficiency Standards, Summer 2002, p. 12.	15	Northeast Energy Efficiency	$178.83	$0.0124
79	Existing	Market Driven	Space Cooling	DX Tune Up/ Advanced Diagnostics	3,110	CT estimate x ratio of CDD; CT estimate: 10 % savings per California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-3. Assumes 1.5 KW/ton, 1,091 EFLH, and 10 ton unit.	$340	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002. 20 ton chiller, C.1-3.	2		$183.76	$0.0591
80	Existing	Market Driven	Space Cooling	Packaged AC - 3 tons, Tier 1	918	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$138	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$13.61	$0.0148
81	Existing	Market Driven	Space Cooling	Packaged AC - 3 tons, Tier 2	1,273	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$207	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$20.42	$0.0160
82	Existing	Market Driven	Space Cooling	Packaged AC - 7.5 tons, Tier 1	2,056	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$405	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$39.95	$0.0194
83	Existing	Market Driven	Space Cooling	Packaged AC - 7.5 tons, Tier 2	2,890	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$607	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$59.87	$0.0207
84	Existing	Retrofit	Space Cooling	Packaged AC - 7.5 tons, Tier 1	6,202	CT estimate x ratio of CDD; CT estimate: Calculation of base use from 7.5 EER existing system (average efficiency of 1980's vintage unit, ARI, 1997). Per unit incremental Costs and Savings of High Efficiency Packaged Commercial A/C. ACEEE 2000.	$6,105	$760 per ton estimate for air cooled units from tristate.apogee.net/cool/cmnch.asp. With incremental cost from above added	15	National Grid, 2000 Design	$602.17	$0.0971
85	Existing	Retrofit	Space Cooling	Packaged AC - 7.5 tons, Tier 2	7,036	CT estimate x ratio of CDD; CT estimate: Calculation of base use from 7.5 EER existing system (average efficiency of 1980's vintage unit, ARI, 1997). Per unit incremental Costs and Savings of High Efficiency Packaged Commercial A/C. ACEEE 2000.	$6,307	$760 per ton estimate for air cooled units from tristate.apogee.net/cool/cmnch.asp. With incremental cost from above added	15	National Grid, 2000 Design	$622.09	$0.0884

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#	Commercial Market Segment	Retrofit or Market Driven	End Use	Measure Name	Annual kWh Savings	kWh Savings Source	Incremental Cost	Cost Source	Measure Life	Measure Life Source	Annualized cost	Levelized cost per kWh saved
86	Existing	Market Driven	Space Cooling	Packaged AC - 15 tons, Tier 1	3,827	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$791	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$78.02	$0.0204
87	Existing	Market Driven	Space Cooling	Packaged AC - 15 tons, Tier 2	6,606	CT estimate x ratio of CDD; CT estimate: "Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	$1,516	"Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C", ACEEE 2000	15	National Grid, 2000 Design	$149.53	$0.0226
88	Existing	Market Driven	Space Cooling	Economizer, Single Set Point Dry Bulb	5,970	CT estimate x ratio of CDD; CT estimate: Economizer Spreadsheet from CL&P. 30 ton cooling load. Hartford, CT	$1,500	E-source Technology Atlas 2001, p. 6.3.1. $50-100/ton	15	National Grid, 1999 Small C&I	$147.95	$0.0248
89	Existing	Market Driven	Space Cooling	Economizer, Single Set Point Entalpy	15,764	CT estimate x ratio of CDD; CT estimate: Economizer Spreadsheet from CL&P. 30 ton cooling load. Hartford, CT	$2,250	E-source Technology Atlas 2001, p. 6.3.1. $50-100/ton	15	National Grid, 1999 Small C&I	$221.93	$0.0141
90	Existing	Market Driven	Space Cooling	Economizer, Comparitive Enthalpy	28,916	CT estimate x ratio of CDD; CT estimate: Economizer Spreadsheet from CL&P. 30 ton cooling load. Hartford, CT	$3,000	E-source Technology Atlas 2001, p. 6.3.1. $50-100/ton	15	National Grid, 1999 Small C&I	$295.90	$0.0102
91	Existing	Market Driven	Space Cooling	EMS - Chiller 500 ton	82,916	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on TMY data for Hartford from University of Wisconsin Solar Energy Lab, cooling load diversity from"Implications of Measured Commercial Building Loads on Geothermal System Sizing", ASHRAE Annual Meeting, CDH Energy Corp., 1999 (691 E	$30,000	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002. 300 ton chiller, C.1-3.	10	California Statewide Commercial Sector Energy Efficiency	$3,951.45	$0.0477
92	Existing	Market Driven	Space Cooling	Prog. Thermostat	3,110	CT estimate x ratio of CDD; CT estimate: National Grid, 2000 Energy Initiative (Large C&I) Program Data, 2000 DSM Performance Measurement Report, Appendix 3, December 2001	$55	Maine Cost Effectiveness Model, March 2003.	5	National Grid, 2000 Energy	$12.83	$0.0041
				Ventilation								
93	Existing	Market	Ventilation	Fan Motor, 15hp, 1800rpm, 92.4%	1,053	GDS calculation, Maine Cost Effectiveness Model, March 2003 as reality check..	$46	Maine Cost Effectiveness Model, March 2003.	12	Northeast	$5.29	$0.0050
94	Existing	Market	Ventilation	Fan Motor, 40hp, 1800rpm, 94.1%	2,354	GDS calculation, Maine Cost Effectiveness Model, March 2003 as reality check..	$286	Maine Cost Effectiveness Model, March 2003.	12	Northeast	$32.91	$0.0140
95	Existing	Market	Ventilation	Fan Motor, 5hp, 1800rpm, 89.5%	393	GDS calculation, Maine Cost Effectiveness Model, March 2003 as reality check..	$34	Maine Cost Effectiveness Model, March 2003.	12	Northeast	$3.91	$0.0100
96	Existing	Market Driven	Ventilation	Variable Speed Drive Control, 15 HP	12,000	GDS base use Calculation based on 5,000 hrs, 90% motor efficiency, 65% load. 30% savings from California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002.	$3,465	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3.	20	Northeast Utilities, Action	$286.35	$0.0239
97	New	Market Driven	Ventilation	Variable Speed Drive Control, 40 HP	32,000	GDS base use Calculation based on 5,000 hrs, 90% motor efficiency, 65% load. 30% savings from California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002.	$6,280	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3.	20	Northeast Utilities, Action	$518.99	$0.0162
98	New	Market Driven	Ventilation	Variable Speed Drive Control, 5 HP	4,000	GDS base use Calculation based on 5,000 hrs, 90% motor efficiency, 65% load. 30% savings from California Statewide Commercial Sector Energy Efficiency Potential Study, July 2002.	$1,925	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-3.	20	Northeast Utilities, Action	$159.08	$0.0398
99	Existing	Market Driven	Ventilation	Heat Recovery	203,300	CT estimate x ratio of CDD; CT estimate: GDS Calculation based on Hartford TMY data and assuming 80% energy recovery (cooling only)	$400,000	WI Focus on Energy Cost Data (VA Hospital)	23		$30,640.68	$0.1507
100				Exterior Lighting								
101	Existing	Market	Exterior	Outdoor Lighting Controls (Photocell/Timeclock)	165	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-2. GDS	$108	California Statewide Commercial Sector Energy Efficiency	15	California	$10.65	$0.0646
102	Existing	Market	Exterior	ROB 2L4T8, 1EB	72	GDS calculation, 3,000 hrs vs. 34 w. T12.	$27	Maine Cost Effectiveness Model, March 2003.	9	Northeast	$3.86	$0.0536
103	Existing	Market	Heating	Hydronic Heating Pump VFD	10,875	National Grid, 2000 Energy Initiative Program Data, 2000 DSM Performance Measurement Report,	$3,465	California Statewide Commercial Sector Energy Efficiency	20	Northeast	$266.35	$0.0263
				Office equipment								
104	Existing	Market Driven	Office Equipment	External hardware control	146	Electricity Used by Office Equipment and Network Equipment in the U.S.: Detailed Report and Appendices, LBL, Feb. 2001, p. 7, and California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-5.	$173	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-5.	4	California Statewide Commercia	$49.19	$0.3369
105	Existing	Market Driven	Office Equipment	Nighttime shutdown - Laptop	13	Electricity Used by Office Equipment and Network Equipment in the U.S.: Detailed Report and Appendices, LBL, Feb. 2001, p. 7, and California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-5.	$0	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-5.	4	California Statewide Commercia	$0.00	$0.0000
106	Existing	Market Driven	Office Equipment	Nighttime shutdown - Desktop	115	Electricity Used by Office Equipment and Network Equipment in the U.S.: Detailed Report and Appendices, LBL, Feb. 2001, p. 7, and California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.2-5.	$0	California Statewide Commercial Sector Energy Efficiency Potential Study, July, 2002, C.1-5.	4	California Statewide Commercia	$0.00	$0.0000
107	Existing	Market Driven	Office Equipment	Power Management Enabling	201	Energy Star web site, savings calculator using default assumptions (55% already have power management enabled)	$4	Energy Star Power Management Program, assume range of IT staff time of 9-40 hours @ $100/hr. Average of 20 hours used for 500 computer project per discussion with Energy Star staff 4/11/03.	4	Energy Star Power Management	$1.14	$0.0056
108	New	Market Driven	Office Equipment	Purchase LCD monitor	77	ENERGY EFFICIENCY AND CONSERVATION MEASURE RESOURCE ASSESSMENT FOR THE RESIDENTIAL, COMMERCIAL, INDUSTRIAL AND AGRICULTURAL SECTORS. Prepared for the Energy Trust of Oregon, Inc. By Ecotope, Inc., ACEEE, and Tellus Institute, Inc.	$200	ENERGY EFFICIENCY AND CONSERVATION MEASURE RESOURCE ASSESSMENT FOR THE RESIDENTIAL, COMMERCIAL, INDUSTRIAL AND AGRICULTURAL SECTORS.	4	California Statewide Commercial Sector	$56.86	$0.7365
				Other								
109	Existing	Market Driven	Other	Dry Type Transformers	30	Thomas, Alison Department of Energy, Federal Energy Management Program, "Replacing Distribution Transformers - A Hidden Opportunity for Energy Savings" http://www.dc.lbl.gov/Replacing%20Distribution%20Transformers.pdf	$11	Thomas, Alison Department of Energy, Federal Energy Management Program, "Replacing Distribution Transformers A Hidden Opportunity for Energy Savings"	30	Northeast Energy Efficiency	$0.72	$0.0241

APPENDIX C

Appendix C - Industrial Energy Efficiency Measures

Count	Measure Name	2003-$ CCE	Measure Life
1	Near Net Shape Casting	($0.093)	15
2	Injection Moulding - Impulse Cooling	($0.060)	12
3	Intelligent extruder (DOE)	($0.028)	10
4	Clean rooms - Controls	($0.025)	10
5	Process Controls (batch + site)	($0.023)	10
6	Machinery	($0.019)	10
7	Machinery	($0.014)	10
8	*Machinery*	($0.014)	10
9	Machinery	($0.014)	10
10	Machinery	($0.014)	10
11	Compressed Air - System Optimization	($0.013)	10
12	O&M/scheduling spinning machines	($0.012)	10
13	Scheduling	($0.008)	10
14	Optimize drying process	($0.007)	10
15	O&M - Extruders/Injection Moulding	($0.006)	12
16	Compressed Air- Sizing	($0.005)	10
17	*Efficient practices printing press*	*($0.004)*	20
18	Efficient Machinery	($0.004)	10
19	Optimization (painting) process	($0.003)	10
20	Pumps - System Optimization	($0.002)	10
21	Pumps - Sizing	($0.001)	10
22	Fans- Improve components	($0.001)	10
23	Process control	($0.001)	10
24	Switch-off/O&M	$0.001	8
25	New transformers welding	$0.004	15
26	*New transformers welding*	$0.004	15
27	New transformers welding	$0.004	15
28	New transformers welding	$0.004	15
29	Pumps - O&M	$0.005	10
30	Fans - O&M	$0.005	10
31	Setback temperatures (wkd/off duty)	$0.005	10
32	Bakery - Process (Mixing) - O&M	$0.005	10
33	Replace V-belts	$0.005	5
34	Compressed Air-O&M	$0.005	10
35	*Efficient Refrigeration - Operations*	$0.005	10
36	Curing ovens	$0.006	15
37	ASD (6-100 hp)	$0.006	10
38	Heat Pumps - Drying	$0.007	15
39	Efficient Printing press (fewer cylinders)	$0.007	10
40	Bakery - Process	$0.007	15
41	Optimization (painting) process	$0.007	10
42	Optimization Process	$0.007	10
43	Optimization (painting) process	$0.007	10
44	*Air conveying systems*	$0.007	14
45	Efficient processes (welding, etc.)	$0.008	15
46	Scheduling	$0.008	10
47	Scheduling	$0.008	10
48	Scheduling	$0.008	10
49	Scheduling	$0.008	10
50	Pumps - Controls	$0.008	10
51	Curing ovens	$0.008	15
52	Curing ovens	$0.008	15
53	Curing ovens	$0.008	15
54	Curing ovens	$0.008	15
55	Replace V-Belts	$0.009	10

Appendix C - Industrial Energy Efficiency Measures

Count	Measure Name	2003-$ CCE	Measure Life
56	Compressed Air - Controls	$0.010	10
57	Optimization Refrigeration	$0.010	15
58	Energy Star Transformers	$0.010	25
59	Top-heating (glass)	$0.011	8
60	Process Control	$0.011	15
61	Motor practices-1 (100+ HP)	$0.013	6
62	High-efficiency motors	$0.014	10
63	Efficient drives	$0.014	10
64	Efficient drives - rolling	$0.014	10
65	Membranes for wastewater	$0.015	15
66	Motor practices-1 (6-100 HP)	$0.015	10
67	Drives - EE motor	$0.016	10
68	Fans - System Optimization	$0.017	10
69	Optimization control PM	$0.018	10
70	Scheduling	$0.018	10
71	High Consistency forming	$0.018	20
72	Process control	$0.018	15
73	Electronic Ballasts	$0.019	12
74	ASD (100+ hp)	$0.020	6
75	Metal Halides/Fluorescent	$0.021	12
76	Drying (UV/IR)	$0.022	8
77	High efficiency motors	$0.024	6
78	Gap Forming paper machine	$0.024	20
79	Replace by T8	$0.025	12
80	Controls/sensors	$0.027	12
81	Autoclave optimization	$0.027	10
82	Process Drives - ASD	$0.028	10
83	Process Heating	$0.028	15
84	Drives - ASD	$0.029	10
85	HVAC Management System	$0.030	10
86	Programmable Thermostat	$0.030	10
87	Clean Room - Controls	$0.030	10
88	Efficient electric melting	$0.031	20
89	Duct/Pipe Insulation/leakage	$0.033	10
90	Window film	$0.037	8
91	Motor practices-1 (1-5 HP)	$0.038	14.5
92	Injection Moulding - Direct drive	$0.039	12
93	Extruders/injection Moulding-multipump	$0.040	12
94	Fans - Controls	$0.042	10
95	Chiller O&M/tune-up	$0.042	10
96	Light cylinders	$0.053	10
97	Direct drive Extruders	$0.055	12
98	Replace 100+ HP motor	$0.057	6
99	Clean Room - New Designs	$0.060	10
100	Efficient grinding	$0.078	15

APPENDIX D

Appendix D - Database of Data Sources - Energy Efficiency Technical Potential Studies Recently Conducted

	STATE	Name of Technical Potential Study	Date Study Completed (Date on the final report)	Sponsoring Organization	Final Study Report Available to GDS in electronic or hard copy	Study Completed by Who (What Consultant)	Estimate of maximum technical potential for energy efficiency developed? (Yes or No)
1	Washington	Assessment of Long Term Electricity and Natural Gas Conservation Potential in Puget Sound Energy Service Area 2003-2024	August-03	Puget Sound Energy	Electronic	KEMA-Xenergy/Quantec	Yes
2	Connecticut	Independent Assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region	June-04	Connecticut Energy Conservation Management Board	Both	GDS Associates, Inc.	Yes
3	Wisconsin	Wisconsin Tech Potential	1994	Public Service Commission of Wisconsin	Electronic	Energy Center of WI	Yes
4	New York	Energy Efficiency and Renewable Energy Resource Develop Potential in New York State	2003	NYSERDA	Electronic	Optimal Energy	Yes
5	Minnesota	The Energy Conservation Potential for Retro-Commissioning in Xcel Energy's Minnesota Area	2003	Xcel Energy	Electronic	Summit Blue	Yes
6	California	California's Secret Energy Surplus: The Potential For Energy Efficiency - Final Report"	Sep-02	The Energy Foundation and The Hewlett Foundation	Electronic	Xenergy, Inc.	Yes
7	Arizona, Colorado, Nevada, New Mexico, Utah, Wyoming	The Mother Lode, The Potential for More Efficient Energy Use in the Southwest	Nov-02	Southwest Energy Efficiency Project (SWEEP)	Electronic	SWEEP along with the American Council for an Energy-Efficient Economy, Robert Mowris and Associates, the Etc Group, Inc., and MRG & Associates	Yes
8	California	California Statewide Residential Sector Energy Efficiency Potential Study	Apr-05	PG & E	Electronic	Xenergy, Inc.	Yes

Appendix D - Database of Data Sources - Energy Efficiency Technical Potential Studies Recently Conducted

	STATE	Name of Technical Potential Study	Date Study Completed (Date on the final report)	Sponsoring Organization	Final Study Report Available to GDS in electronic or hard copy	Study Completed by Who (What Consultant)	Estimate of maximum technical potential for energy efficiency developed? (Yes or No)
9	Vermont	Electric and Economic Impacts of Maximum Achievable Statewide Efficiency Savings; 2003-2012 - Results and Analysis Summary	May-02	Vermont Department of Public Service	Electronic	Optimal Energy	Yes
10	Massachusetts	The Remaining Electric Efficiency Opportunities in Massachusetts	Jun-01	Program Admins. & Mass. Division of Energy Resources	Electronic	RLW Analytics, Inc. & Shel FeldmanManagement Consulting.	No
11	Georgia	Assessment of Engery Efficiency Potential in Georgia-Final Report	May-05	Division of Energy Resources, GEFA	Electronic	Val Jensen and Eric Lounsbury of IFC Consulting	Yes
12	Oregon	Energy Efficiency and Conservation Measure Resource Assessment for the Residential, Commercial, Industrial, and Agricultural Sectors	Jan-03	Energy Trust of Oregon	Electronic	Ecotope	Not Available
13	Utah	The Maximum Achievable Cost Effective Potential for Gas DSM for Questar Gas	Jun-04	Utah Energy Office and Questar Gas Company	Both	GDS Associates, Inc.	Yes
14	New Mexico	The Maximum Achievable Cost Effective Potential for Natural Gas Energy Efficiency in the Service Terriroty of PNM	May-05	Public Service of New Mexico	Both	GDS Associates, Inc.	Yes
15	Service Area of Big Rivers Electric Corporation in Kentucky	2002 Big Rivers Electric Corporation DSM Report	Nov-02	Big Rivers Electric Corporation	Both	GDS Associates, Inc.	Yes
16	National Meta Analysis	The Technical, Economic and Achievable Potential for Energy Efficiency in the US - A Meta Analysis of Recent Studies	Aug-04	American Council for an Energy Efficient Economy - Summer Study on Building Energy Efficiency	Both	ACEEE	Yes

Appendix D - Database of Data Sources - Relevant Residential Sector Studies and Reports

Study #	Title of Document	Date of Publication	Number of Pages in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format (Yes/No)?
1	California Statewide Residential Sector Energy Efficiency Potential Study (ID #SW063) Final Report; Volume 1	April-03	165	Coito, Fred; Rufo, Mike KEMA-XENERGY Inc.	Pacific Gas & Electric Company	Residential	Efficiency Potential Study	California	Yes/PDF
2	California Statewide Residential Sector Energy Efficiency Potential Study (ID #SW063) Final Report; Volume 2 (Appendices)	April-03	232	Coito, Fred; Rufo, Mike KEMA-XENERGY Inc.	Pacific Gas & Electric Company	Residential	Efficiency Potential Study	California	Yes/PDF
3	NJ Appliance/Window	March-01	125	RLW	GPU Energy, PSE&G, Conectiv, NJ NG, Elizabethtown Gas, So Jersey Gas, and Rockland Electric	Residential	Baseline	New Jersey	Yes/PDF
4	NJ Res HVAC	November-01	152	Xenergy, Inc	Xenergy and NJ Res HVAC Working Group	Residential	Baseline	New Jersey	Yes/PDF
5	NJ Statewide EE Market Assessment	August-99	77	Xenergy, Inc	Xenergy and NJ Utilities Working Group	All	Market Assessment	New Jersey	Yes/PDF
6	So Cal Gas EE Program Report	May-03	64	Sempra Energy/SoCal Gas	Sempra Energy/SoCal Gas	Residential	Annual Report	So. Cal.	Yes/PDF
7	So Cal Gas LI Program Report	May-03	24	Sempra Energy/SoCal Gas	Sempra Energy/SoCal Gas	Residential	Annual Report	So. Cal.	Yes/PDF
8	Natural Gas Price and Availability Effects of Aggressive Energy Efficiency and Renewable Energy Policies: A Methodology White Paper	December-03	98	Elliot, R; Shipley, A; Nadel, S; Brown, E	ACEEE	All	Whitepaper	National	Yes/PDF
9	Recent Trends in WI Residential Gas Use	August-99	76	Scott Pigg, Rich Hasselman	Energy Center of WI	Residential	Baseline	Wisconsin	Yes/PDF
10	Appliance Sales Tracking: 1999 Residential Survey	March-02	190	ODC	Energy Center of WI	Residential	Sales Tracking	Wisconsin	Yes/PDF

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11	Selecting Targets for Market Transformation Programs, A National Analysis	August-98	174	Suozzo, M; Nadel, S	ACEEE	All	Market Research	National	No
12	Gas Appliance Manufacturers Association (GAMA)	October-05	14	n/a	GAMA	All	Water Heater Ratings	National	Yes/PDF
13	Technology Forecast Updates - Residential and Commercial Building Technologies	September-04	n/a	Navigant Consulting	U.S. DOE/EIA	All	Technology Forecast	National	Yes
14	Policies and Programs for Expanding the Use of High Efficiency Fenestration Products in Homes in the Southwest	September-04	18	Howard Geller	SWEEP	Residential	Whitepaper	Southwestern States	Yes/PDF
15	Increasing Energy Efficiency in the Southwest	August-03	115	Larry Kinney, Howard Geller, Mark Ruzzin	SWEEP	All	Whitepaper	Southwestern States	Yes/PDF
16	Utility Energy Efficiency Policies in the Southwest	September-04	12	Howard Geller	SWEEP	All	Whitepaper	Southwestern States	Yes/PDF
17	Energy Star Clothes Washer and Dishwasher Promotion and Incentives for Utah	Oct-02		Howard Geller	Utah Energy Office	Residential	Evaluation	Utah	Yes/PDF
18	Impact Evaluation of the Massachusetts, Rhode Island, and Vermont 2003 Residential Lighting Programs	Jun-05		Nexus Market Research and GDS Associates, Inc.	Joint Management Committee of the New England Energy Star Homes Program	Residential	Evaluation	Massachusetts, Rhode Island, and Vermont	Yes/PDF
19	Incemental Cost of Compact Flourescent Lighting	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	In store research at Home Depot	National	Not applicable
20	Residential Torchiere Assumptions" from Energy Star's "Torchiere Savings Calculator. www.EnergyStar.gov	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes
21	"Alternatives to Halogen Torchieres" on the Lighting Research Center's website (www.lrc.rpi.edu)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes

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22	kWh and Incremental Cost data for Energy Star Single-Room, Window-Mounted Air Conditioning Units on Sears website (www.sears.com)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes
23	Independent assessment of Conservation and Energy Efficiency Potential for Connecticut and the Southwest Connecticut Region	June-04	92	GDS Associates & Quantum Consulting	Conneticut ECMB	All	Efficiency Potential	Conneticut	Yes/PDF
24	Home Appliance Saturation and Length of First Ownership Study	May-01	61	NFO Worldgroup	Assoc. of Home Applianc Manufacturers (AHAM)	Residential	Appliance Saturation Report	National	No
25	Statewide Refrigerator Monitoring and Verification Study & Results (Conference Paper Presented at 2004 ACEEE Summer Study on Building Energy Efficiency)	January-04	n/a	Dana Teague (NSTAR Electric & Gas) and Michael Blasnik	ACEEE	Residential	Conference Paper	National	Yes
26	Incremental Cost of Energy Star Refridgerator Models. In-store research at Sears Company.	Summer 05	not applicable	GDS Associates Consultant	not applicable	Residential	In store research at Sears	National	Not applicable
27	Regional Energy Profile: East South Central Appliance Report 2001	/01	n/a	Energy Information Administration	Energy Information Administration, Dept. of Energy	Residential	Profile	Regional	Yes
28	kWh and Incremental Cost data for Energy Star Upright Freezer Models on Lowe's website (www.lowes.com)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes
29	kWh and Incremental Cost data for Energy Star Chest Freezer Models on the Home Depot website (www.homedepot.com)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes
30	kWh and Incremental Cost data for Energy Star Dishwasher Models on Sears website (www.sears.com)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes

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31	The Maximum Achievable Cost Effective Potential for Natural Gas Demand Side Management in the Service Territory of PNM	May-05	157	GDS Associates	PNM	All	Cost Effective Potential Study	New Mexico	Yes/PDF
32	Incremental Cost of Water Heater Blankets derived from listings at Home Depot (www.homedepot.com) and Lowe's (www.lowes.com)	Summer-05	not applicable	Research by GDS Consultant	not applicable	Residential	website	National	Yes
33	State of the Art of Residential Fuel Cells, Market, and Implementation Issues	June-01	3	E. A. Torrero and R. H. McClelland	EPA	Residential	Evaluation	National	Yes/PDF
34	Meeting the Challenge: The Prospect of Achieving 30 Percent Energy Savings Through the Weatherization Assistance Program	May-02	64	Mark Schweitzer and Joel F. Eisenberg (ORNL)	Dept. of Energy.	Residential	Evaluation	National	Yes/PDF
35	2004 Poverty Income Guidelines, Contiguous U.S. Grantees, Effective February 13, 2004 from http://aspe.hhs.gov/poverty/shtml	February-04	not applicable	Department of Health and Human Services	Department of Health and Human Services	Residential	website	National	Yes
36	Detailed Demographic Update: 2004/2009 (for the BREC Service Area) - Compiled in June 2005 by GDS, from Scan/US Inc website	June-05	6	Research by GDS Consultant	BREC	All	website	BREC Service Area	Yes
37	Energy 10 Model Simulations	Summer 2005	Numerous Model Runs	Research by GDS Consultant	BREC	Residential	Energy 10 Model	Residental	Yes

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1	NJ Electric & Gas Utilities: Comm EE Construction Baseline Study: Task 1 Final Report: On-Site Survey of New Construction & Renovation Projects	January-00	101	RLW	Atlantic, PSE&G, GPU	C/I	Baseline	NJ	Yes/PDF
2	NJ Electric & Gas Utilities: Comm EE Lighting and HVAC Baseline Study: Task II Report Decision-Maker Interviews	February-00	16	Roper Starch, RLW	Atlantic, PSE&G, GPU	C/I	Baseline	NJ	Yes/PDF
3	NJ Electric & Gas Utilities: Comm EE Lighting and HVAC Baseline Study Task III Report: Equipment Replacement and Remodeling Interviews	February-00	24	RLW	Atlantic, PSE&G, GPU	C/I	Baseline	NJ	Yes/PDF
4	R.S. Means Construction Cost Estimation Data	2004	CD-ROM	RS Means	--	All	Construction Costs	National (w/ city level detail)	Yes
5	Database for Energy Efficient Resources (DEER) 2001 Update	2001	NA	Xenergy and others	California Energy Commission	All	Efficiency Measure Database	California	Yes
6	EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case	September-04	69	Navigant Consulting	EIA	Commercial	Market Research	National	Yes
7	Methodology and Forecasts of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs	Oct-04	290	Energy and Environmental Economics, Inc.	California Public Utilities Comission	All	Forecast	California	Yes/PDF
8	2000 Energy Initiative Program (Large C&I) Data, 2000 DSM Performance Measurement Report	01/01/00		National Grid		C/I	Performance Measurement Report	Massachusetts	No
10	Alternatives to Energy Hogging Halogen Torchieres Invented here (http://www.lbl.gov/Science-Articles/Archive/fluorescent-torchiere.html) (Article on LBL website)	6/12/1997	not applicable	Chen, Allen	Lawrence Berkley Lab	Residential	website article	National	Yes

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11	Selecting Targets for Market Transformation Program: A National Analysis	Aug-98	200	ACEEE	Consortium for Energy Efficiency	All	Report	National	Yes/PDF
12	California Statewide Commercial Sector Energy Efficiency Potential Study	Jul-02		Xenergy, Inc.	California Energy Commission	Commercial	Efficiency Potential	California	Yes/PDF
14	Pulse Start Metal Halide Lamps	1999	1	Energy Center of Wisconsin	Energy Center of Wisconsin	All	Fact Sheet on Metal Halide Lamps	National	Yes/PDF
15	How to Buy Energy Efficient Commercial Downlight Luminaires	2004	2	Federal Emergency Management Program	Federal Energy Management Program	All	Fact Sheet	National	Yes/PDF
16	Energy Efficiency Standards, Summer 2002	2002			Northeast Energy Efficiency Partnership	All			
17	Northeast Utilities C&I Persistence Study Final Report	Oct-01	47	RLW Analytics	Northeast Utilities	C/I	Report	Northeast Utilities Service Area	No
18	Northeast Utilities Vending Miser Monitoring Project Final Report	Apr-01	22	The Nicholas Group P.C.	Northeast Utilities	Commercial	Report	Northeast Utilities Service Area	No
19	USA Technologies, formerly Bayview Technology Group, Miser Products Price List	2-Sep							
21	Motorup Evaluation and Market Assessment	Nov-01	93	Motorup Working Group	Xenergy Inc.	Commercial	Market Assessment	Vermont	Yes/PDF
22	Grainger Industrial Supply 2005 Catalog	2001	3818	Grainger Industrial Supply	Grainger Industrial Supply	Industrial	Catalog	National	No
23	How to Buy an Energy Efficient Commercial Ice Machine	2000	1	Federal Emergency Management Program	Federal Energy Management Program	Commercial	Fact Sheet	National	Yes/PDF

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24	E-source Technology Atlas	2001							
25	Northeast Utilities System 1999 Express Services Program Impact Evaluation Final Report	Jun-01	54	Sabo, C and Griffin, T.	Evans, Kate	C/I	Report	Conneticut and Massachusetts	No
26	Chilled Water Plant Costs Estimated (www.trane.com/commercial/issues/earthwise_systems)		not applicable		*Trane Company*	*Commercial*	*website*	*National*	Yes
27	LADWP Purchasing Advisor (www.ladwp.com/energyadvisor/PA_14.html)				Los Angeles Deprtment of Water and Power				
28	Per Unit Incremental Costs and Savings of High Efficiency Packaged Commercial A/C	2000	1	ACEEE	ACEEE	Commercial	Fact Sheet	National	Yes/PDF
29	Implications of Measured Commercial Building Loads on Geothermal System Sizing	1999	9	Henderson, Hugh	CDH Energy Corp (ASHRAE Annual Meeting)	Commercial	Report	National	
30	Electricity Used by Office Equipment and Network Equipment in the U.S.: Detailed Report and Appendices	Feb-01	50	Kawamoto, K et al.	LBNL	Commercial	Report	National	Yes/PDF
31	Energy Efficiency and Conservation Measure Resource Assessment for the Residential, Commercial, Industrial, and Agricultural Sectors	2003	115	Ecotope	Energy Trust of Oregon, Inc	All	Technical Potential	Oregon	Yes/PDF
32	Replacing Distribution Transformers - A Hidden Opportunity for Energy Savings	2002	9	Thomas, Alison et al.	Federal Emergency Management Program (Department of Energy)	Commercial	Online Brochure	*National*	Yes/PDF

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33	How to Buy an Energy Efficient Commercial Refrigerator and Freezer	4-Jan	3	Federal Emergency Management Program	Federal Emergency Management Program	Commercial	Online Brochure	National	Yes/PDF
34	How to Buy an Energy Efficient *Water Cooled Electric Chiller*	Nov-00	4	Federal Emergency Management Program	Federal Emergency Management Program	Commercial	Online Brochure	National	Yes/PDF
35	California Statewide Commercial Sector Natural Gas Energy Efficiency Potential Study Study ID #SW061	May-03	208	Mike Rufo and Fred Coito	KEMA-XENERGY Inc	Commercial	Technical Potential	California	Yes/PDF
38	How to Buy an Energy-Efficient Family-Sized Commercial Clothes Washer	Nov-00	2	Federal Emergency Management Program	Federal Emergency Management Program	Commercial	Online Brochure	National	Yes/PDF
39	Massachusetts Market Transformation Scoping Study	1997	198	Arthur D. Little	Mass Gas DSM/Market Transformation Collarborative		Report	Massachusetts	No (Hard Copy)
40	Assessment of Energy and Capacity Savings Potential in Iowa	Jul-02			Global Energy Partners and Quantec, LLC			Iowa	

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1	MN Master Tech Assumptions	2003	10	MN Dept of Commerce	MN Dept of Commerce	C/I	B/C Assumptions	MN LG C/I	Yes
2	California Industrial Energy Efficiency Market Characterization Study	2001		Xenergy	PG & E	Industrial	Market Research Study	California	
3	The Compressed Air Systems Market Assessment and Baseline Study for New England.	2003	71	Aspen Systems	Compressed Air Study Group	Industrial	Baseline	New England	No
4	Energy Management in Industry	1995	89	Caffel, C.	Centre for the Analysis and Dissemination of Demonstrated Energy Technologies (CADDET)	Industrial	Report	National	Yes/PDF
5	Saving Energy with Efficient Compressed Air Systems	1997		CADDET	CADDET		Brochure	National	
6	Saving Energy with Daylighting Systems	2001		CADDET	CADDET		Brochure	National	
7	Cooling, Heating and Power for Buildings (http://www.bchp.org/index.html - original broken link) (htt://www.chpcentermw.org/home.html - updated link)	2002	not applicable	Midwest CHP Application Center	DOE/ORNL		website	National	Yes
8	Guidelines for Selecting a Compressed Air System Service Provider and Levels of Analysis of Compressed Air Systems	2002	4	Compressed Air Challenge	Compressed Air Challenge			National	Yes/PDF
9	Energy Efficiency Opportunities in the Solid Wood Industries	1996	44	Carrol-Hatch Ltd.	Council of Forest Industries	Industrial	Report	National	Yes/PDF
10	ICARUS-3: The Potential of Energy Efficiency Improvement in the Netherlands up to 2000 and 2015	1994		De Beer, J.G., van Wees, M.T., Worrell, E., and Blok, K			Tech. Potential	Netherlands	
11	Industries of the Future Program for Metal Casting (http://www.eere.energy.gov/industry/metalcasting)	2003	not applicable	Office of Industrial Technologies, Energy Efficiency and Renewable Energy	DOE	Industrial	website	National	Yes
12	Electricity Consumption and the Potential for Electric Energy Savings in the Manufacturing Sector	1994	60	N.R. Elliot	ACEEE	Industrial	Tech. Potential	National	
13	Manufacturing Energy Consumption Survey 1994	1997	541	Energy Information Administration	Energy Information Administration (DOE)	Industrial	Survey	National	Yes/PDF
14	Energy Efficiency Improvement and Cost Saving Opportunities for the Vehicle Assembly Industry - A Guide for Energy and Plant Managers	Jan-03	78	Galitsky, C. and E. Worrell	LBNL	Industrial	Report	National	Yes/PDF
15	Energy Efficiency Opportunities for United States Breweries	2001	11	Galitsky, Christina, Nathan Martin, and Ernst Worrell	MBAA Technical Quarterly	Industrial	Article	National	Yes/PDF

Appendix D - Database of Data Sources - Relevant Industrial Sector Studies and Reports

Study #	Title of Document	Date of Publication	Number of Pages in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format (Yes/No)?
16	Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems	2001	19	Hydraulic Institute and Europump	Hydraulic Institute and Europump	Industrial		National	Yes/PDF
17	Efficiency Prediction Method for Centrifugal Pumps	1994		Hydraulic Institute	Hydraulic Institute	Industrial			
18	Pumps and Standards Since 1917- The Hydraulic Institute *(http://www.pumps.org/)*	2002	not applicable	Hydraulic Institute	Hydraulic Institute	Industrial	website	National	Yes
19	Industrial Assessment Center Database. (http://oipea-www.rutgers.edu/site_docs/dbase.html - original broken link) (http://iac.rutgers.edu/database - new link)		not applicable	Industrial Assessment Center	Industrial Assessment Center	Industrial	website	National	Yes
20	Information Plastic Processing Industry	1996			InfoMil	Industrial			
21	Information for Bread and Bread-and Pastry-Bakeries for energy use in the Environmental Permitting	1997			InfoMil	Industrial			
22	Group-Compressed Air Systems Energy Reduction Basics. (http://www.air.ingersoll-rand.com/NEW/pedwards.htm)	2001	not applicable	Ingersoll Rand	Air Solutions	Industrial	website	National	Yes
23	Scenarios for a Clean Energy Future	2000	371	Interlaboratory Working Group (ORNL & LBNL)	Office of Energy Efficiency and Renewable Energy	All		National	Yes/PDF
24	Industrial Electric Motor Drive Systems	1998	204	Jallouk, P., and C.D. Liles	CADDET	Industrial		National	Yes/PDF
25	Improving Compressed Air System Performance, a Sourcebook for Industry	1998	128	Lawrence Berkeley National Laboratory (LBNL) and Resource Dynamics Corporation	DOE Motor Callenge Program	Industrial		National	Yes/PDF
26	Improving Pumping System Performance: A Sourcebook for Industry	1999		Lawrence Berkeley National Laboratory (LBNL) and Resource Dynamics Corporation	DOE Motor Callenge Program	Industrial	Sourcebook	National	
27	Commercial and Industrial O&M Market Segment Baseline Study (Final Report)	Jul-99	158	Ledyard, T., L. Barbagallo and E. Lionberger	NE/NJ Utility Consortium	C/I	Baseline Study	NE/NJ	Yes/PDF
28	Opportunities to Improve Energy Efficiency and Reduce Greenhouse Gas Emissions in the U.S. Pulp and Paper Industry	Jul-00	58	Martin, N., N. Anglani, D. Einstein, M. Khrushch, E. Worrell, L.K. Price	Lawrence Berkeley National Laboratory	Industrial	Report	National	Yes/PDF
29	Emerging Energy-Efficient Industrial Technologies	2000	195	Martin, N., E. Worrell, M. Ruth, L. Price, R.N. Elliott, A.M. Shipley, J. Thorne	PG&E	Industrial	Report	National	Yes/PDF

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30	Learning from Experiences with Industrial Drying Technologies	1994		Mercer, A.C	CADDET	Industrial	Report		
31	Energy Efficiency in the Metals Fabrication Industries	1995	3	Michaelson, D. A. and F. T. Sparrow	ACCEEE	Industrial	Report		
32	Guide to Energy-Efficiency Opportunities in the Dairy Processing Industry	1997	36	Wardrop Engineering, Inc.	National Dairy Council of Canada	Industrial	Report		Yes/PDF
33	1999 O&M Services Program Impact and Process Evaluation - Final Report	2001	70	RLW Analytics, Inc.	Northeast Utilities System	C/I	Report		No
34	New Construction Program Report on 2000 Measure Installations	2002	33	RLW Analytics, Inc.	Northeast Utilities System	C/I	Report		No
35	Energy Cost Reduction in the Pulp and Paper Industry	1999	30	Francis, DW et al.	Paprican	Industrial	Report		Yes/PDF
36	Compressed Air Systems in the European Union, Energy, Emissions, Savings Potential and Policy Actions	2001	10	Radgen, P. and E. Blaustein (eds.)	European Commission	Industrial	Report		Yes/PDF
37	California's Secret Energy Surplus; The Potential for Energy Efficiency	2002	137	Rufo, Mike and Fred Coito	The Energy Foundation	All	Report	California	Yes/PDF
38	Evaluation of Advanced Technologies for Residential Appliances and Residential and Commercial Lighting	1995		Turiel, I., B. Atkinson, s. Boghosian, P. Chan, J. Jennings, J. Lutz, J. McMahon, and G. Rosenquist	LBNL	R/C	Report		
39	Energy Efficiency in Pumping Systems: Experience and Trends in the Pulp and Paper Industry	1999	11	Tutterow, V	ACEEE	Industrial	Report		
40	Profiting from your Pumping System	2000	8	Tutterow, V., D. Casada and A. McKane	Pump & Systems Magazine	Industrial	Report		Yes/PDF
41	Energy Use and Energy Intensity of the U.S. Chemical Industry	Apr-00	40	Worrell, E., Dian Phylipsen, Dan Einstein, Nathan Martin	LBNL	Industrial	Report		Yes/PDF
42	Opportunities to Improve Energy Efficiency in the U.S. Pulp and Paper Industry	Feb-01		Worrell, Ernst, Nathan Martin, Norma Anglani, Dan Einstein, Marta Khrushch, Lynn Price		Industrial	Report		
43	United States Industrial Electric Motor Systems Market Opportunities Assessment	Dec-98	93	Xenergy, Inc.	DOE: Office of Industrial Technology and ORNL	Industrial	Market Assessment	National	Yes/PDF
44	Motorup Evaluation and Market Assessment	2001	93	Xenergy, Inc.	Motorup Corp.	C/I	Market Assessment	National	Yes/PDF
45	Energy-Efficient Motor Systems: A Handbook on Technology, Program and Policy Opportunities (2nd Edition)	2002	520	Nadel, S., N. Elliott, M. Shepard, S. Greenberg, G. Katz and A.T. de Almeida	ACEEE	Industrial	Handbook	National	

Appendix D - Database of Data Sources - Documents Supplied by Big Rivers Electric Corporation

File #	Title of Document	Date of Publication	Number of Pages/Tabs in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format?
1	Big Rivers Electric Corporation Load Forecast	June-05	113 pgs	GDS Associates	BREC	All	Load Forecast	All Sectors	Yes
2	Big Rivers Electric Corporation web site	October-05	NA	BREC	BREC	All	Web site	All Sectors	Yes

Appendix D - Database of Data Sources - Other Documents Reviewed by GDS

File #	Title of Document	Date of Publication	Number of Pages/Tabs in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format?
1	2003 Gas Facts	2004	124	American Gas Association (AGA)	AGA	All	Reference Fact Book	All	No
2	NJ Clean Energy Annual Report	July-02	20	New Jersey Board of Public Utilities	NJ BPU	All	Annual Report	n/a	PDF
3	2001 DEER	August-01	309	Xenergy, Inc	Calif Energy Commission	All	Database of Energy Efficiency Measures	Varies	PDF
4	America's Best: Profiles of America's Leading Energy Efficiency Programs	December-03	47 (plus 63 Indiv Prog Descriptions)	Dan York and Marti Kushler	ACEEE	All	Program Descriptions	Varies	PDF
5	A Framework for Planning and Assessing Publicly Funded Energy Efficiency	March-01	220	Frederick Sebold and Alan Fields (RER); Lisa Skumatz; Shel Feldman; Miriam Goldberg; Ken Keating; Jane Peters	PG&E	All	Program Design, Theory and Policy	Varies	PDF
6	Increasing Energy Efficiency in New Buildings in the Southwest: Energy Codes and Best Practices	August-02	115	Kinney, Larry; Geller, Howard; Ruzzin, Mark	Southwest Energy Efficiency Project (SWEEP)	Res and Comm	Program Planning and Best Practices	Varies	PDF
7	Selecting Targets for Market Transformation Programs: A National Analysis	August-98	174	Suozzo, Margaret; Nadel, Steven	ACEEE	Res and Comm	Market Transformation Programs: Measures Analysis	Varies	PDF
8	Performance Guidelines for Instantaneous Water Heaters to Meet the Comfort Needs of the American Consumer	May-03	38 slides	Darrell, Paul, PhD	Battelle	Residential	Presentation	Water Heating	No

Appendix D - Database of Data Sources - Other Documents Reviewed by GDS									
File #	Title of Document	Date of Publication	Number of Pages/Tabs in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format?
9	California Standard Practice Manual	Oct-01	37	California Public Utilities Company	CA PUC	All	Economic Analysis of Demand-Side Management Programs and Projects		Yes/PDF
10	Attachment V-Developing Greenhouse Mitigation Supply Curves for In-State Sources, Climate Change Research Development and Demonstration Plan	Apr-03	85	Guido, Franco et al.	CA Energy Commission		Public Interest Energy Research Program		Yes/PDF
11	The Elements of Sustainability. Efficiency and Sustainability	2000		David C. Hewitt	ACEEE		Research Study	Buildings	
12	Demand-Side Management Market Penetration: Modeling and Resource Planning Perspectives from Central Maine Power Company	Apr-89	10	Richard F. Spellman	Electric Power Research Institute	All	Market Research	Maine	Yes/PDF
13	Market Transformation: Substantial Progress from a Decade of Work	Apr-03	60	Nadel, Thorne, Sachs, Prindle, Elliott	ACEEE		Market Research		Yes/PDF
14	Focus on Energy Public Benefits Statewide Evaluation, Quarterly Summary Report	Mar-03	24	Focus Evaluation Team	State of WI Department of Administration Division of Energy		Statewide Evaluation		Yes/PDF

Appendix D - Database of Data Sources - Other Documents Reviewed by GDS										
File #	Title of Document	Date of Publication	Number of Pages/Tabs in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format?
15	Focus on Energy Statewide Evaluation, Non-Energy Benefits Cross-Cutting Report	Jan-03	93	Nick Hall, TecMarket Works, PA Consulting	State of WI Department of Administration Division of Energy		Statewide Evaluation		
16	Beyond Energy Savings: A Review of the Non-Energy Benefits Estimated for Three Low-Income Programs	2002	14	Nick Hall & Jeff Riggert, TecMarket Works	ACEEE		Program Evaluation		
17	Energy Efficiency and Renewable Sources: A Primer	Oct-01	56	National Assoc. of State Energy Officials	Global Environment & Technology Foundation		Research Study		Yes/PDF
18	Natural Gas Price Effects of Energy Efficiency and Renewable Energy Practices and Policies	Dec-03	98	Elliott, R. Neal et al.	ACEEE		Report		Yes/PDF
19	Population Size of Various Cities in the Big Rivers Service Area	Summer 2005	not applicable	U.S Censu Bureau	U.S. Census Bureau	Residential	website		Yes
20	Annual Heating and Cooling Operating Costs for Various Equipment in a Average-Size Home http://www.kenergy.corp/Geothermal_Heating_and_Cooling.php)	Summer 2005	not applicable	Kenergy Corporation	Kenergy Corporation	Residental	website		Yes
21	America's Best Natural Gas Energy Efficiency Programs	3-Dec	50	Kushler, M, D. York, and P Witte	ACEEE		Report		Yes/PDF
22	Methodology and Forecasts of Long-Term Avoided Costs for the Evaluation of California Energy Efficiency Programs	Oct-04	290	Energy and Environmental Economics, Inc.	California Public Utilities Commission	All	Forecast	California	Yes/PDF
23	Proportion of Single-Family and Multi-Family Homes in the Big River Service Area			ESRI	ESRI	Residental			

Appendix D - Database of Data Sources - Other Documents Reviewed by GDS									
File #	Title of Document	Date of Publication	Number of Pages/Tabs in Main Body of Report	Author or Consulting Firm	Organization Publishing the Report	Sector (Residential, Commercial, Industrial)	Type (Program Evaluation, Load Forecast, Market Research Study, Appliance Saturation Survey, Energy Efficiency Plan, etc.)	Market Segment or End Use Targeted by the Report	Report or Study Available to GDS Team in Electronic Format?
24	Low-income Public Purpose Test, (The LIPPT), Final Report, Up-Dated for LIPPT Version 2.0	Apr-01	238	TecMarket Works, Inc, Skumatz Economic Research and Megdal & Assoc.	RRM Working Group		Report		Yes/PDF
25	User's Guide for California Utility's Low-Income Program Cost Effectiveness Model, The Low-Income Public Purpose Test, Version 2.0, A Microsoft Excel Based Model	May-01		TecMarket Works, Inc, Skumatz Economic Research and Megdal & Assoc.	RRM Working Group		Report		Yes/PDF

APPENDIX E

Appendix E.2 - Avoided Costs for Electricity, Natural Gas and Water ($2006)						
	General Rate of Inflation (2005-2025)	Avoided Cost for Electricity in Real $2006 Dollars[1] ($/kWh)	Avoided Cost for Transmission in Real $2006 Dollars[2] ($/kW)	Avoided Cost for Natural Gas - Residential Sector[3] - $2006 per mmbtu	Avoided Cost for Natural Gas - Commercial Sector[3] - $2006 per mmbtu	Avoided Cost for Water (Real $2006 per gallon)[4]
2006	0.031	[REDACTED]	$19.20	$10.05	$8.71	$0.00482
2007	0.031	[REDACTED]	$19.20	$9.42	$8.21	$0.00482
2008	0.031	[REDACTED]	$19.20	$8.89	$7.82	$0.00482
2009	0.031	[REDACTED]	$19.20	$8.77	$7.83	$0.00482
2010	0.031	[REDACTED]	$19.20	$8.57	$7.75	$0.00482
2011	0.031	[REDACTED]	$19.20	$8.52	$7.82	$0.00482
2012	0.031	[REDACTED]	$19.20	$8.64	$7.93	$0.00482
2013	0.031	[REDACTED]	$19.20	$8.78	$8.04	$0.00482
2014	0.031	[REDACTED]	$19.20	$8.99	$8.23	$0.00482
2015	0.031	[REDACTED]	$19.20	$9.15	$8.36	$0.00482
2016	0.031	[REDACTED]	$19.20	$9.13	$8.32	$0.00482
2017	0.031	[REDACTED]	$19.20	$9.24	$8.41	$0.00482
2018	0.031	[REDACTED]	$19.20	$9.44	$8.58	$0.00482
2019	0.031	[REDACTED]	$19.20	$9.63	$8.74	$0.00482
2020	0.031	[REDACTED]	$19.20	$9.77	$8.86	$0.00482
2021	0.031	[REDACTED]	$19.20	$9.88	$8.93	$0.00482
2022	0.031	[REDACTED]	$19.20	$9.90	$8.93	$0.00482
2023	0.031	[REDACTED]	$19.20	$9.90	$8.90	$0.00482
2024	0.031	[REDACTED]	$19.20	$9.95	$8.93	$0.00482

1. Power Purchase Agreement between Big Rivers Electric Corporation and LG&E Energy Marketing, Inc, dated 7/15/1998, pages 25-26.

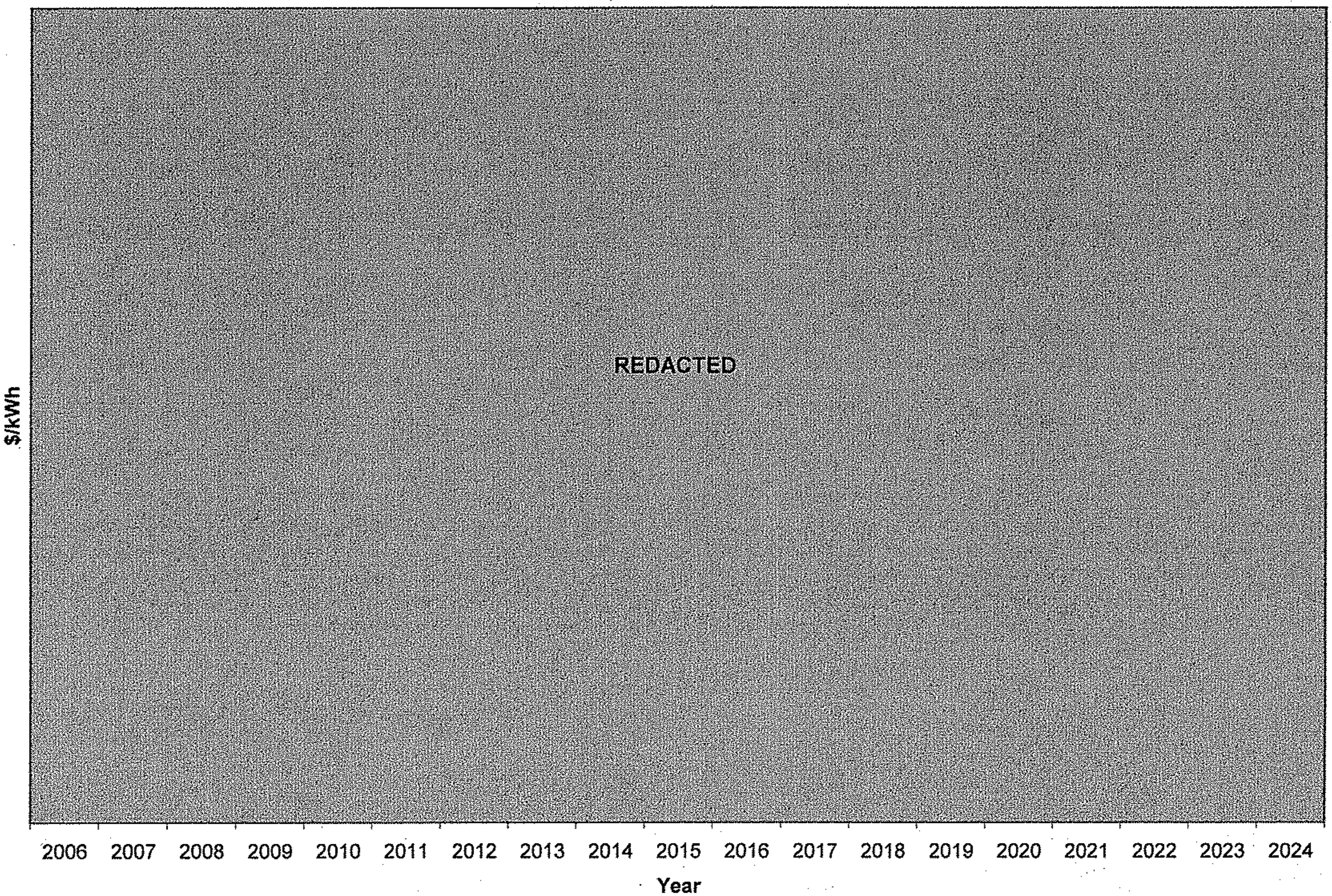
2. Annual Energy Outlook 2005. US Department of Energy, Energy Information Administration. February 2005, page 89, Table 27.

3. Annual Energy Outlook 2005. US Department of Energy, Energy Information Administration. February 2005. Supplemental data tables for energy prices, Table 106.

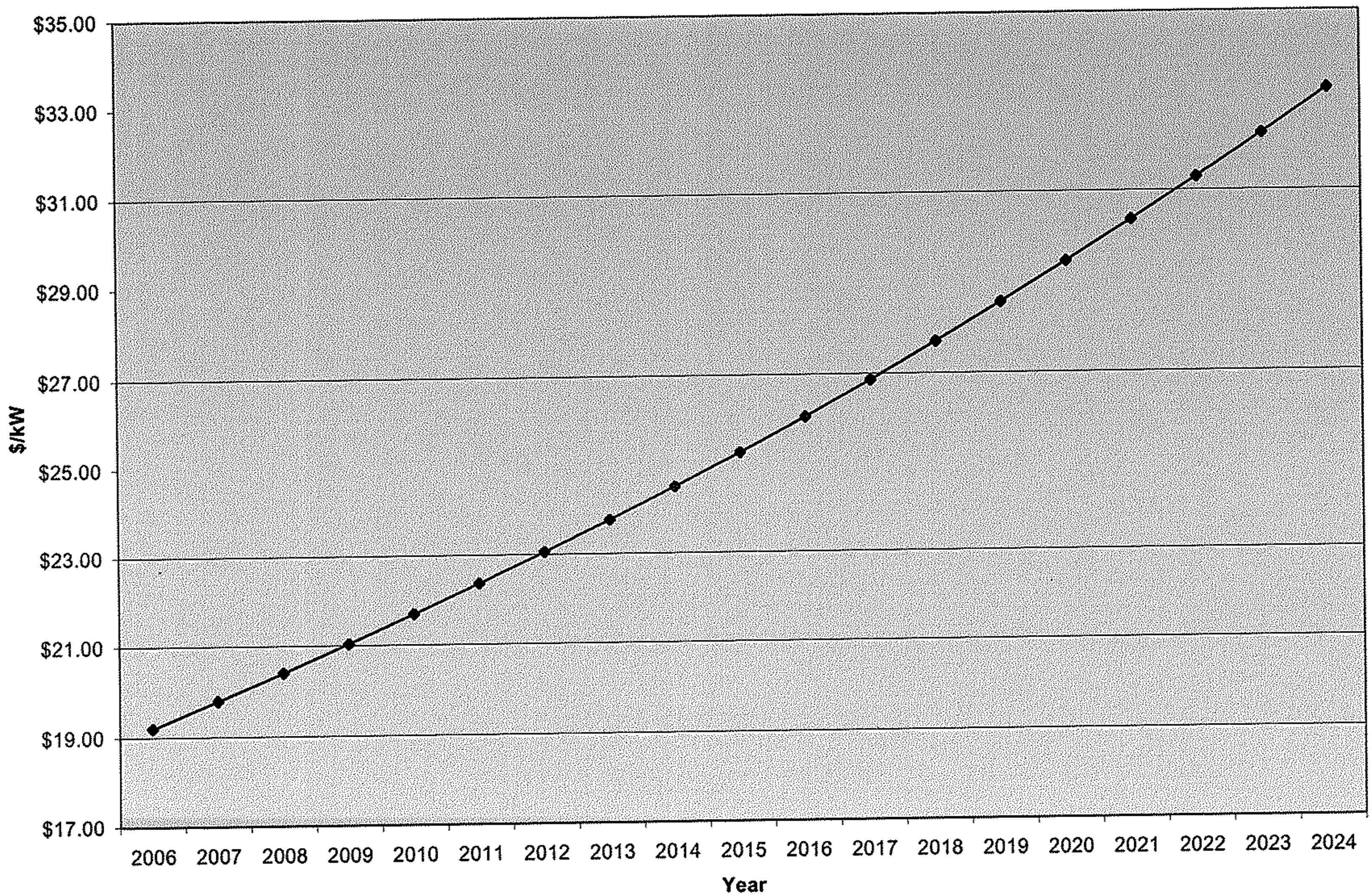
4. Public Service Commision. PSC Rules on Kentucky-American Water Rate Request. <http://www.environment.ky.gov/press/press2005/february2005/2-28kyamericanwater.htm> Accessed 06 Oct 2005.

Appendix E.2 - Avoided Costs for Electricity, Natural Gas and Water (in Nominal Dollars)						
	General Rate of Inflation (2005-2025)	Avoided Cost for Electricity in Nominal Dollars ($/kWh)	Avoided Cost for Transmission in Nominal Dollars ($/kW)	Avoided Cost for Natural Gas - Residential Sector ($/mmbtu)	Avoided Cost for Natural Gas - Commercial Sector ($/mmbtu)	Avoided Cost for Water ($/gal.)
2006	0.031	[REDACTED]	$19.20	$10.05	$8.71	$0.00482
2007	0.031	[REDACTED]	$19.80	$9.71	$8.46	$0.00497
2008	0.031	[REDACTED]	$20.41	$9.45	$8.31	$0.00512
2009	0.031	[REDACTED]	$21.04	$9.61	$8.58	$0.00528
2010	0.031	[REDACTED]	$21.69	$9.69	$8.76	$0.00545
2011	0.031	[REDACTED]	$22.37	$9.92	$9.11	$0.00561
2012	0.031	[REDACTED]	$23.06	$10.37	$9.52	$0.00579
2013	0.031	[REDACTED]	$23.77	$10.87	$9.95	$0.00597
2014	0.031	[REDACTED]	$24.51	$11.48	$10.50	$0.00615
2015	0.031	[REDACTED]	$25.27	$12.04	$11.00	$0.00634
2016	0.031	[REDACTED]	$26.05	$12.39	$11.29	$0.00654
2017	0.031	[REDACTED]	$26.86	$12.93	$11.76	$0.00674
2018	0.031	[REDACTED]	$27.70	$13.61	$12.38	$0.00695
2019	0.031	[REDACTED]	$28.55	$14.32	$13.00	$0.00717
2020	0.031	[REDACTED]	$29.44	$14.98	$13.59	$0.00739
2021	0.031	[REDACTED]	$30.35	$15.61	$14.12	$0.00762
2022	0.031	[REDACTED]	$31.29	$16.14	$14.56	$0.00786
2023	0.031	[REDACTED]	$32.26	$16.63	$14.95	$0.00810
2024	0.031	[REDACTED]	$33.26	$17.23	$15.47	$0.00835

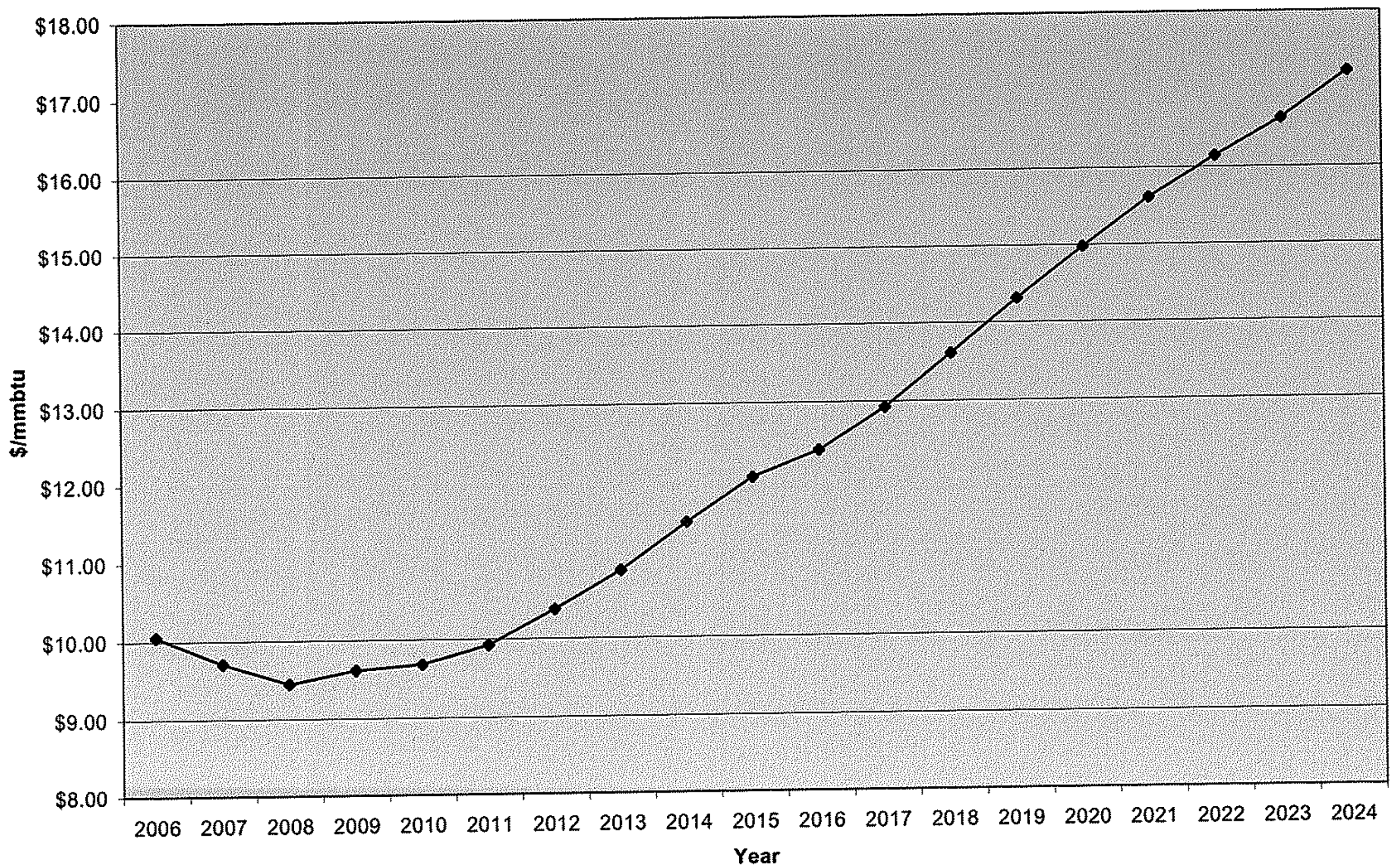
Avoided Cost for Electricity in Nominal Dollars



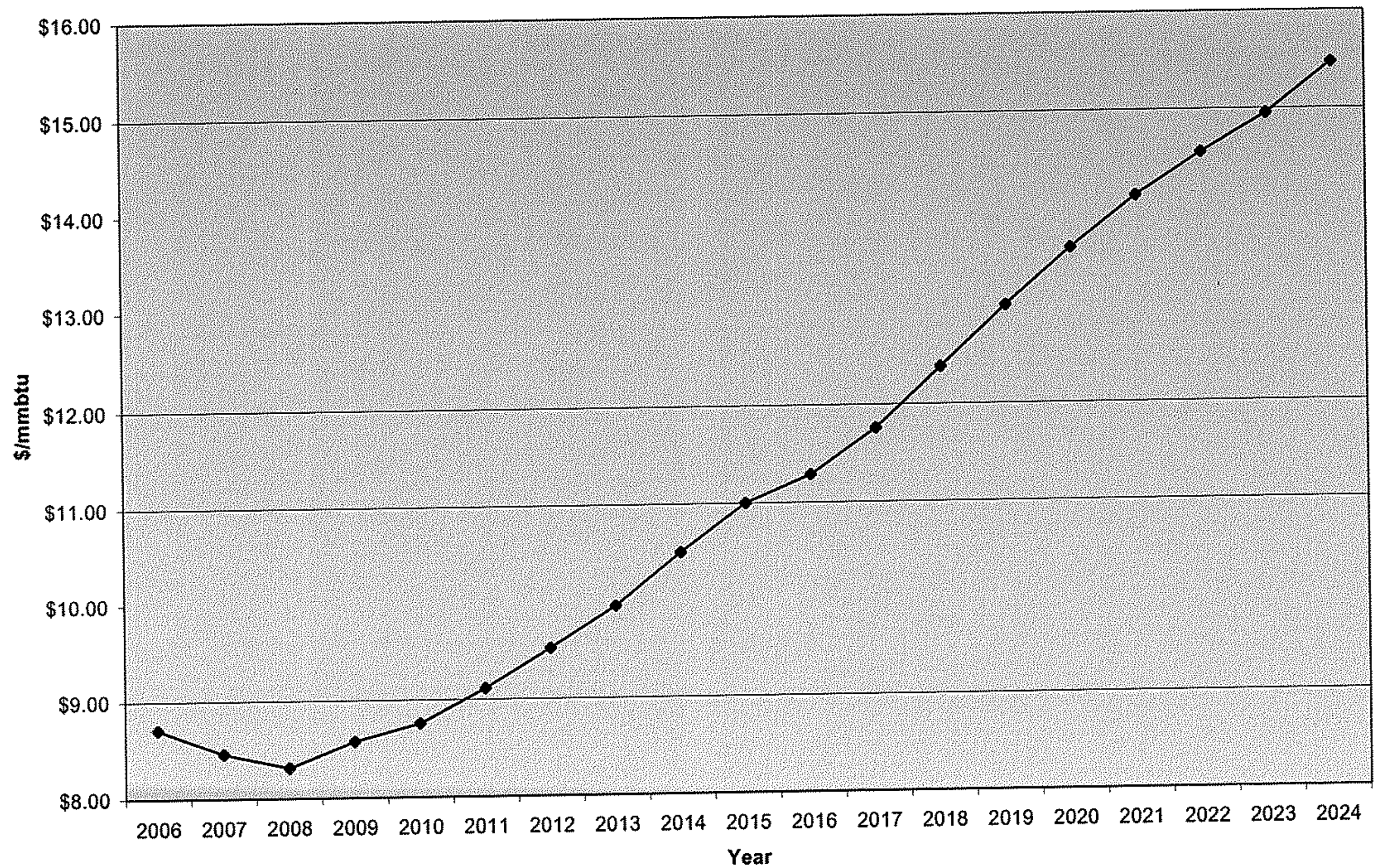
Page 4 - Avoided Cost for Transmission in Nominal Dollars



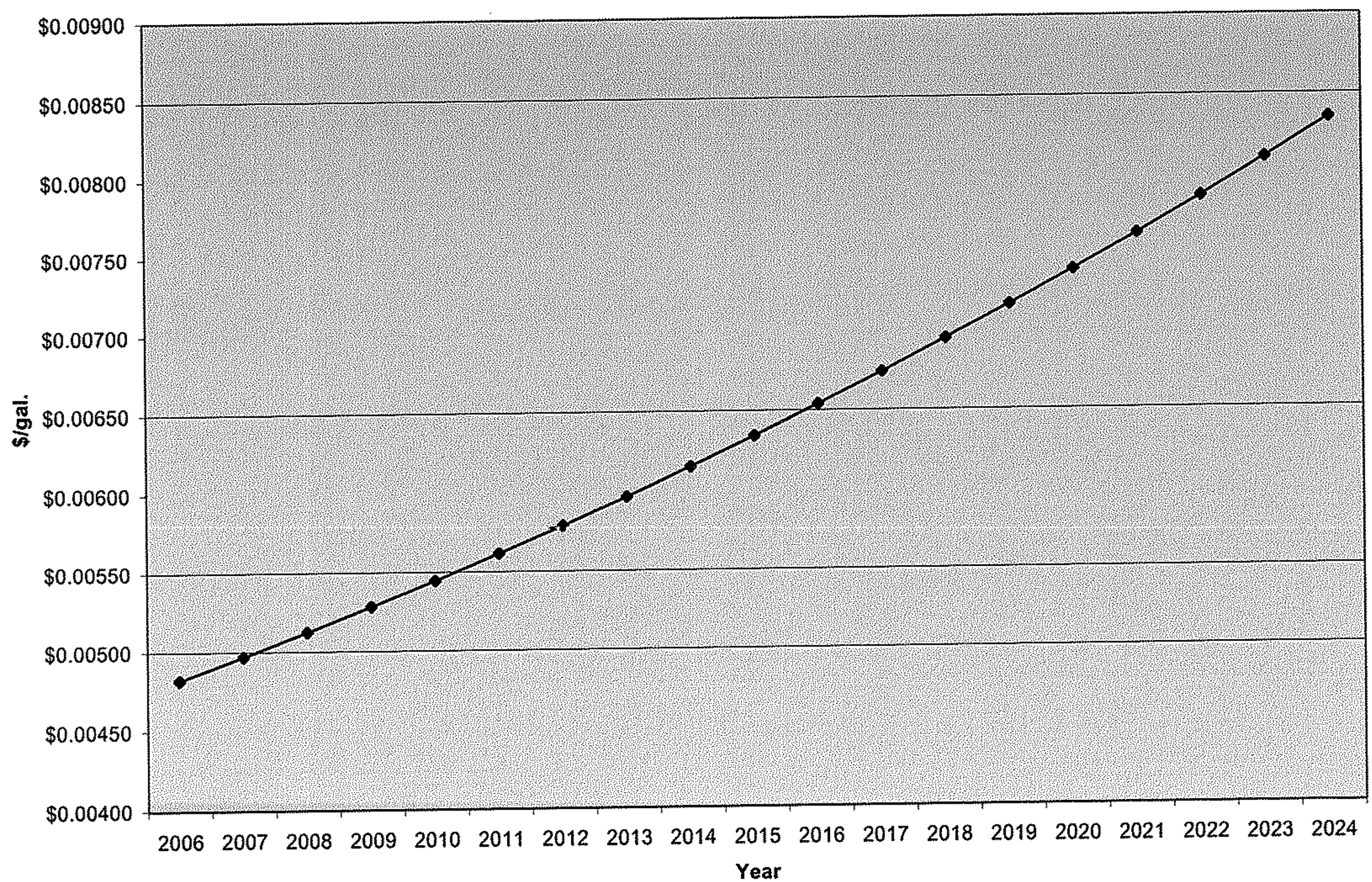
Page 5 - Avoided Costs for Natural (Residential Sector) in Nominal Dollars



Page 6 - Avoided Cost for Natural Gas (Commercial Sector) in Nominal Dollars



Page 7 - Avoided Cost for Water in Nominal Dollars



APPENDIX F

Final Report

Weatherization and Insulation Services Market Research with Energy Service Companies Serving the Big Rivers Electric Corporation Service Area

September 9, 2005

Prepared and Submitted by:

GDS Associates, Inc.
Engineers and Consultants

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

Results of Interviews with energy services contractors (insulation/weatherization/windows contractors) in the Kentucky service area of the Big Rivers Electric Corporation (BREC).

Questions

1. *During the year 2004, to how many homes did you provide weatherization and insulation services:*

Average: 160
Range: 4 to 750
Number of respondents: 10

Comments:

Mostly do new construction - insulation is part of the job
We mostly do new construction -- have a blower door - used to do energy audits
there is a coop program in our area - Kenergy -- not as good as it used to be with the "All-Seasons Comfort Home"
do more heating and air than insulation

2. *For your residential customers, what is the size of the typical single-family home?*

Average: 1850 sf
Range: 1300-3000 sf; 900-1600 sf renovations
Number of respondents: 9

Comments:

1800-2ksf existing; 2500-3ksf new construction
2300-2400 new const - actually they usually insulate the garages too -- 3000 including garages
average 900-1600 sf. Renovations
now they might average 2000 sf
at least 2000 sf - new construction

3. *What is the size of the typical Multi-family home?*

Average: 1060 sf
Range: 600-2250 sf;
Number of respondents: 7

Comments: none

Attic insulation

4. To how many homes did you add attic insulation in 2004?

Average: 95
Range: 2 to 250
Number of respondents: 9

Comments: none

5. On average, how much insulation do you add to homes needing such insulation? (of what material?)

Survey respondents report that existing homes have inadequate attic insulation. Often there is 4" to 6" of insulation existing and the contractors add 6" to 12" to bring the attic up to R-30, R-38, or R-40.

Average: 9"
Range: 6"to 12"
Number of respondents: 9

Fiberglass: 4 respondents, representing approximately 500 jobs per year
Cellulose: 5 respondents, representing approximately 300 jobs per year

Comments:

Usually find 4-6" existing; add 8-10"
Usually add r-30 on existing to bring total to R-40. Install R40 on new construction
Usually find R-19 and add another R-19 by putting in 6" of blown cellulose
Existing: had rolled fiberglass and we added 12"
They usually have 5-6 inches - we add 6-8 inches to reach R-38 I use Nu.wool; it's a cellulose with fire additives and doesn't support mold growth or insects www.nuwool.com. It comes from Michigan
Generally find 0 to 6" add 6" fiberglass
Finding older homes with R-19 or less - most of the calls are on heating or air conditioning - and attic insulation is the first thing I look at. Bring to R-38
More than anything most of the time I recommend adding R-30 whether they have anything or not

6. What is your best estimate of the installed cost for attic insulation per square foot?

Average: $0.48
Range: $0.26 to $0.60; most common answer was $.50 to $.60
Number of respondents: 7

Comments: none

7. To the best of your knowledge, what percent of existing single-and multi-family homes need additional attic insulation?

Average: 65%
Range: 35% to 85%
Number of respondents: 8

Comments:

It's a bunch - most built back in the late 60's. Even since then a lot of builders don't put enough in. And I'm not a fan of blown fiberglass - when it gets really cold, you use 40% of the R value - blown fiberglass should be capped with cellulose. You can tell by driving around on a cold day - if the frost has melted on the roof then they need more insulation.
if the house is 10 years old or more

Wall insulation

8. During 2004, in how many homes did you install wall insulation?

Average: 50
Range: 0 to 100
Number of respondents: 5 contractors active in this market and 3 who do this type of work but did zero or 1 such job in the past year.

Comments:

Do very few – it is a poor system [blown cellulose] - don't do it very often - can inject into wall - but it settles and doesn't do a good job
most that I've done had no insulation previously or just a little blown-in
A lot of walls don't have anything. Probably 2x4 would be the most common 3.5 inches Didn't do any last year - stay covered up with the new construction . Do that work when new construction slows down.
I do wet-blown on new construction. I have done it in the past - there is a lot of competition - it's hard for a big company to compete with guys who work out of their garage.

9. On average, how much insulation do you add to walls needing such insulation? What insulating material do you normally use in the walls?

Average: 3.5" is most common
Range: 3.5" R-13 for 2x4 construction; 5.5" R-19 for 2x6 construction
Number of respondents: 8

Fiberglass: Represents approximately 60 jobs per year
Cellulose: Represents approximately 250 jobs per year

Comments:
None

10. What is your best estimate of the installed cost for wall insulation per square foot?

Average: (weighted by number of jobs) $0.92/s.f.
Range: $0.55 to $1.30 one volume contractor quoted $0.55/s.f.; remaining volume contractors quoted $1 to $1.3 per square foot.
Number of respondents: 8; 5 who have done this work recently

Comments:
[By surveyor:] There does not seem to be a price difference between fiberglass and cellulose insulation.

11. To the best of your knowledge, what percent of existing single and multi-family homes need additional wall insulation?

Average: 50%
Range: 15% to 95%
Number of respondents: 5

Comments:

not a good application -- the question is moot
if the house is more than 10-15 years old then almost 100%

Floor insulation

12. During 2004, in how many homes did you install floor insulation?

Average: 66
Range: 2 to 150
Number of respondents: 6

Comments:

Don't do floor insulation -- there is duct work under the floor. Instead we insulate the perimeter foundation wall
I don't believe in insulating the floor – we insulate outside foundation walls - most heat/air systems are in the crawl typical 15% loss in that duct. The insulation is mostly used for sealing rather than for insulating – use about 1.5" cellulose -- used to use styrofoam but it is a fire hazard
only do perimeter foundation - put styrofoam on new construction
It's not really required - a lot of builders don't really do it. What I do is the perimeter - put a heavy 6 mil barrier for ground cover. Treat it like a half-basement. Insulate the band boards, seal the vent. Don't have to worry about the pipes freezing.
I do the perimeter
95% of the time the only place you can put it is underneath the house if you have a crawl space. That can get pretty expensive.

13. On average, how many inches of floor insulation do you add to homes needing such insulation? Of what material?

Average: 1.5 inches
Range: 1 to 1.5 inches; R-7 to R-19; fiberglass batts, cellulose, and styrofoam
Number of respondents: 7

Comments:

1 to 1.5" depends on the people's preference - a lot of people don't want it because they fear insects would get between the insulation and the foundation
R-8 on perimeter walls and band joists of the crawl space. Plus plastic vapor barrier.
We do a lot where they just want the crawl band insulated -- it's not required by code, so a lot of times it is not done.

14. What is your best estimate of the installed cost for floor insulation per square foot?

	Perimeter wall insulation	Floor insulation
Average:	$0.675	$0.723
Range:	$0.21 to $0.75	$0.52 to $0.85

$0.60 to $0.75 from contractors active in this type of work.

15. To the best of your knowledge, what percent of existing single and multi-family homes need additional floor insulation?

Average: 73%
Range: 40% to 100%
Number of respondents: 6

Comments:

Big Rivers used to recognize foundation perimeter cellulose as being superior and used to pay *incentives -- Contractor is familiar with programs and used to work for Kenergy*
There are a lot of existing homes on brick piers - would be hard to insulate, but perhaps as many as 85% would benefit
Need to insulate the crawl band: 95% of W Ky homes - not even doing new construction. In S. Indiana most counties require that you do at least the crawl band.

Air sealing, caulking or weather-stripping

16. During 2004, in how many homes did you provide air sealing, caulking or weather-stripping services?

Only one of the contractors surveyed provides this service as a retrofit.

Average: 26
Range: 1 to 100
Number of respondents: 6

Comments:

On the houses that we build, we have an insulation contractor put up a mesh on the wall then blow in fiberglass through the joints, etc.
Used to do that with the blower door - haven't been doing it lately
Do that just on new construction
Only do air-sealing in new construction. It is the most important part
Only in new construction.

17. What is your best estimate of the installed cost for air sealing per home?

Average: (weighted by number of jobs) $250/home
Range: $0.10 per square foot of wall area; $150 to $1400 per home.
Number of respondents: 6

Comments:

We used to charge $50 for blower door test then estimate. We used to think that the air losses were around windows and such, but now we know that the losses are up and down - like the chimney effect.

18. To the best of your knowledge, what percent of existing single and multi-family homes need additional air sealing, caulking or weather-stripping services?

Average: 67%
Range: 35% to 90%
Number of respondents: 4

Comments:
None

Windows

19. During 2004, in how many homes did you install vinyl replacement windows?

Average: 81
Range: 4 to 175
Number of respondents: 3

Comments:
None

20. Are the replacement windows Energy Star Rated?

Three respondents: two answered yes and one answered don't know.

21. On average, how many vinyl replacement windows do you install per home?

Average: 11
Range: 10 to 14
Number of respondents: 3

Comments:
None

22. What is the average cost per window for vinyl replacement windows?

Average: $433/window
Range: $375 to $500 per home.
Number of respondents: 3

Comments:
None

23. To the best of your knowledge, what percent of existing single and multi-family homes need vinyl replacement windows?

Average: 55%
Range: 30% to 75%
Number of respondents: 3

Comments:
None

APPENDIX G

Appendix G - Payback Data for Energy Efficiency Measures - Residential Sector

Residential Energy Efficiency Measure	Incremental Cost	Annual kWh Savings	Average Residential Retail Rate for Members (2004)	Annual Bill Savings	Payback (in years)
CFL replacing Incandescents for 2.7 hrs/day	5.97	48.88	$0.0616	$ 3.01	1.98
CFL Torchiere (compared to Halogen Torchiere)	60	223.56	$0.0616	$ 13.78	4.35
CFL Torchiere (compared to Incandescent Torchiere)	60	86.69	$0.0616	$ 5.34	11.23
Energy Star Single Room Air Conditioner	89	118.75	$0.0616	$ 7.32	12.16
Energy Star Compliant Freezer Top Refrigerator	115	1029.00	$0.0616	$ 63.43	1.81
Energy Star Compliant Side-by-Side Refrigerator	247.5	1079.00	$0.0616	$ 66.51	3.72
Energy Star Compliant Upright Freezer	50	110.00	$0.0616	$ 6.78	7.37
Energy Star Compliant Chest Freezer	50	43.00	$0.0616	$ 2.65	18.86
Energy Star Built-In Dishwasher	-29.46	141.00	$0.0616	$ 8.69	0.00
Energy Star Washing Machine with Electric Water Heater and Electric Clothes Dryer	200	475.00	$0.0616	$ 29.28	6.83
Energy Star Washing Machine with Gas Water Heater and Electric Clothes Dryer	200	115.00	$0.0616	$ 7.09	28.21
Energy Star Washing Machine with Gas Water Heater and Gas Clothes Dryer	200	0.00	$0.0616	$ -	0.00
Energy Star Compliant Programmable Thermostat	49	87.90	$0.0616	$ 5.42	9.04
Water Heater Blanket	15	333.00	$0.0616	$ 20.53	0.73
Low Flow Shower Head	5.77	250.00	$0.0616	$ 15.41	0.37
Pipe Wrap	3.23	133.00	$0.0616	$ 8.20	0.39
Air Sealing	380	1171.99	$0.0616	$ 72.24	5.26
Reset Water Heater Thermostat (from medium to med-low)	10	380.90	$0.0616	$ 23.48	0.43
Water Heater Wrap (from EF86 to EF88)	35	58.60	$0.0616	$ 3.61	9.69
Attic Insulation (from R9 to R38)	720	878.99	$0.0616	$ 54.18	13.29
Air Sealing Retrofit	380	2346.00	$0.0616	$ 144.61	2.63
Attic Insulation Retrofit	847.8	6894.00	$0.0616	$ 424.94	2.00
Wall Insulation Retrofit	330	1380.00	$0.0616	$ 85.06	3.88
Window Construction (from single-pane U=1.11 to double pane, low-e U=2.6)	1223	3880.00	$0.0616	$ 239.16	5.11

Note: The 2004 average residential retail rate of $.0616 was obtained by GDS from BREC, and it is the weighted average retail rate per kWh for residential members of BREC's three member distirbution cooperatives.

Appendix G - Payback Data for Energy Efficiency Measures - Commercial Sector						
Commercial Market Segment	Measure Name	Incremental Cost	Annual kWh Savings	Average Commercial Retail Rate (2004)	Annual Bill Savings	Payback (in years)
	Interior Lighting					
Existing	CFL - screw-in	$6	90	$ 0.0285	$ 2.57	2.34
Existing	CFL - Hard Wired	$27	228	$ 0.0285	$ 6.50	4.15
Existing	Biax Fluorescents	$400	480	$ 0.0285	$ 13.68	29.23
Existing	Energy-efficient Torchiere	$20	296	$ 0.0285	$ 8.44	2.37
Existing	Halogen PAR Flood, 90W	$12	180	$ 0.0285	$ 5.13	2.34
Existing	Ret 1L4'T5, 1EB	$64	39	$ 0.0285	$ 1.11	57.56
Existing	Ret 4L4' HO T5, 1EB (repl 400 w Metal halide)	$400	648	$ 0.0285	$ 18.47	21.65
Existing	Ret 1L4'T5, 1EB, Reflector	$98	63	$ 0.0285	$ 1.80	54.56
Existing	RET T8, EB, Reflector	$72	54	$ 0.0285	$ 1.54	46.77
Existing	RET 2L4'T8, 1EB	$27	72	$ 0.0285	$ 2.05	13.15
Existing	RET 2L4' Super T8, 1EB	$10	36	$ 0.0285	$ 1.03	9.74
Existing	RET 2L4' Super T8, 1EB, Reflector	$45	84	$ 0.0285	$ 2.39	18.79
Existing	RET 2L4'T5, 1EB	$64	84	$ 0.0285	$ 2.39	26.72
Existing	RET 2L4'T5, 1EB, Reflector	$72	132	$ 0.0285	$ 3.76	19.13
Existing	RET 2L8'T8, 1EB	$27	144	$ 0.0285	$ 4.11	6.58
Existing	RET 4L4' Super T8, 1EB	$12	72	$ 0.0285	$ 2.05	5.85
Existing	250 Watt Metal Halide Lighting	$65	513	$ 0.0285	$ 14.63	4.44
Existing	High Intensity Discharge Systems, 250 W	$65	510	$ 0.0285	$ 14.53	4.47
New	High Intensity Discharge Systems, 50 W	$65	291	$ 0.0285	$ 8.30	7.83
Existing	Pulse Start HID	$200	330	$ 0.0285	$ 9.41	21.26
Existing	High Pressure Sodium 250W Lamp	$65	513	$ 0.0285	$ 14.63	4.44
Existing	LED Exit Signs	$30	184	$ 0.0285	$ 5.25	5.72
Existing	Solid State Exit Signs	$38	348	$ 0.0285	$ 9.92	3.83
Existing	LED Signage	$100	690	$ 0.0285	$ 19.67	5.08
Existing	LED Traffic Lights	$125	430	$ 0.0285	$ 12.26	10.20
Existing	LED Traffic Lights (Yellow signals only)	$42	22	$ 0.0285	$ 0.61	67.98
Existing	Occupancy Sensor	$120	302	$ 0.0285	$ 8.61	13.94
Existing	Daylight Dimming	$181	353	$ 0.0285	$ 10.06	17.99
New	Daylight Dimming	$181	252	$ 0.0285	$ 7.18	25.19
Existing	Continuous Dimming, 10L4' Fluorescent Fixtures	$288	945	$ 0.0285	$ 26.94	10.69
Existing	Continuous Dimming, 5L4' Fluorescent Fixtures	$288	472	$ 0.0285	$ 13.46	21.40
Existing	Continuous Dimming, 5L8' Fluorescent Fixtures	$288	945	$ 0.0285	$ 26.94	10.69
New	15 % More Efficient Design (Lighting)	$4,000	27,000	$ 0.0285	$ 769.74	5.20
New	30 % More Efficient Design (Lighting)	$8,000	54,000	$ 0.0285	$ 1,539.49	5.20
New	5 % More Efficient Design (Lighting)	$4,000	9,000	$ 0.0285	$ 256.58	15.59
New	10 % More Efficient Design (Lighting)	$8,000	18,000	$ 0.0285	$ 513.16	15.59
	Refrigeration					
Existing	Vender Miser	$179	1,551	$ 0.0285	$ 44.22	4.05
Existing	ENERGY STAR Beverage Vending Machines	$25	330	$ 0.0285	$ 9.41	2.66
Existing	Refrigeration Commissioning	$113	190	$ 0.0285	$ 5.42	20.86
Existing	Refrigeration Commissioning	$113	375	$ 0.0285	$ 10.69	10.57
Existing	Efficient compressor motor retrofit	$62	266	$ 0.0285	$ 7.58	8.18
Existing	Efficient compressor motor retrofit	$62	525	$ 0.0285	$ 14.97	4.14
Existing	Compressor VSD retrofit - refrig	$2,000	228	$ 0.0285	$ 6.50	307.69
Existing	Compressor VSD retrofit - freezer	$2,000	450	$ 0.0285	$ 12.83	155.90
Existing	Demand Defrost Electric - Refrig	$25	304	$ 0.0285	$ 8.67	2.88
Existing	Demand Defrost Electric - Freezers	$25	600	$ 0.0285	$ 17.11	1.46
Existing	Floating head pressure controls-Refrig	$4,995	266	$ 0.0285	$ 7.58	658.67
Existing	Floating head pressure controls-Freezers	$4,995	525	$ 0.0285	$ 14.97	333.73
Existing	High Efficiency Ice Maker	$300	2,365	$ 0.0285	$ 67.42	4.45

Appendix G - Payback Data for Energy Efficiency Measures - Commercial Sector						
Commercial Market Segment	Measure Name	Incremental Cost	Annual kWh Savings	Average Commercial Retail Rate (2004)	Annual Bill Savings	Payback (in years)
Existing	Beverage Mechandisers	$166	1,730	$ 0.0285	$ 49.32	3.37
Existing	High Efficiency Reach in Refrigerator	$400	1,330	$ 0.0285	$ 37.92	10.55
Existing	High Efficiency Reach in Freezer	$400	2,625	$ 0.0285	$ 74.84	5.34
Existing	High-efficiency fan motors - refrig	$62	152	$ 0.0285	$ 4.33	14.31
Existing	High-efficiency fan motors - freezer	$62	300	$ 0.0285	$ 8.55	7.25
Existing	Anti-sweat (humidistat) controls - refrig	$6,500	190	$ 0.0285	$ 5.42	1199.99
Existing	Anti-sweat (humidistat) controls - freezer	$6,500	375	$ 0.0285	$ 10.69	607.99
Existing	Demand Hot Gas Defrost - refrig	$25	114	$ 0.0285	$ 3.25	7.69
New	Demand Hot Gas Defrost -freezer	$25	225	$ 0.0285	$ 6.41	3.90
Existing	Night covers for display cases - refrig	$9	228	$ 0.0285	$ 6.50	1.38
New	Night covers for display cases - freezers	$9	450	$ 0.0285	$ 12.83	0.70
Existing	Strip curtains for walk-ins - refrig	$200	368	$ 0.0285	$ 10.49	19.06
Existing	Strip curtains for walk-ins - freezer	$200	613	$ 0.0285	$ 17.48	11.44
Existing	Walk-In Cooler Economizers	$300	1,149	$ 0.0285	$ 32.75	9.16
Existing	Walk-In Cooler Fan Control	$300	1,487	$ 0.0285	$ 42.39	7.08
Existing	Walk-In Cooler Door Heater Control	$2,000	4,202	$ 0.0285	$ 119.79	16.70
Existing	Walk-In Freezer Door Heater Control	$2,000	2,055	$ 0.0285	$ 58.58	34.14
	Space Cooling					
New	Centrifugal Chiller, 0.51 kW/ton, 300 tons	$16,200	55,968	$ 0.0285	$ 1,595.60	10.15
New	Centrifugal Chiller, 0.51 kW/ton, 300 tons - Retrofit	$202,200	118,155	$ 0.0285	$ 3,368.50	60.03
Existing	Centrifugal Chiller, 0.51 kW/ton, 500 tons	$27,000	93,281	$ 0.0285	$ 2,659.34	10.15
Existing	Centrifugal Chiller, 0.51 kW/ton, 500 tons - Retrofit	$281,500	196,926	$ 0.0285	$ 5,614.16	50.14
New	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	$60,000	207,290	$ 0.0285	$ 5,909.64	10.15
Existing	Centrifugal Chiller, Optimal Design, 0.4 kW/ton, 500 tons	$314,500	310,935	$ 0.0285	$ 8,864.47	35.48
Existing	Chiller Tune Up/Diagnostics - 300 ton	$5,100	25,207	$ 0.0285	$ 718.64	7.10
Existing	Chiller Tune Up/Diagnostics - 500 ton	$8,500	25,207	$ 0.0285	$ 718.64	11.83
New	Cooling Circ. Pumps - VSD	$6,280	3,486	$ 0.0285	$ 99.38	63.19
New	DX Packaged System, EER=10.9, 10 tons	$607	4,818	$ 0.0285	$ 137.37	4.42
Existing	DX Packaged System, CEE Tier 2, <20 Tons	$910	7,226	$ 0.0285	$ 206.00	4.42
Existing	DX Packaged System, CEE Tier 2, >20 Tons	$1,813	14,453	$ 0.0285	$ 412.05	4.40
Existing	DX Tune Up/ Advanced Diagnostics	$340	3,110	$ 0.0285	$ 88.67	3.83
Existing	Packaged AC - 3 tons, Tier 1	$138	918	$ 0.0285	$ 26.16	5.27
Existing	Packaged AC - 3 tons, Tier 2	$207	1,273	$ 0.0285	$ 36.29	5.70
Existing	Packaged AC - 7.5 tons, Tier 1	$405	2,056	$ 0.0285	$ 58.61	6.91
Existing	Packaged AC - 7.5 tons, Tier 2	$607	2,890	$ 0.0285	$ 82.39	7.37
Existing	Packaged AC - 7.5 tons, Tier 1	$6,105	6,202	$ 0.0285	$ 176.80	34.53
Existing	Packaged AC - 7.5 tons, Tier 2	$6,307	7,036	$ 0.0285	$ 200.58	31.44
Existing	Packaged AC - 15 tons, Tier 1	$791	3,827	$ 0.0285	$ 109.09	7.25
Existing	Packaged AC - 15 tons, Tier 2	$1,516	6,606	$ 0.0285	$ 188.34	8.05
Existing	Economizer, Single Set Point Dry Bulb	$1,500	5,970	$ 0.0285	$ 170.19	8.81
Existing	Economizer, Single Set Point Entalpy	$2,250	15,764	$ 0.0285	$ 449.43	5.01
Existing	Economizer, Comparitive Enthalpy	$3,000	28,916	$ 0.0285	$ 824.37	3.64
Existing	EMS - Chiller 500 ton	$30,000	82,916	$ 0.0285	$ 2,363.86	12.69
Existing	Prog. Thermostat	$55	3,110	$ 0.0285	$ 88.67	0.62
	Ventilation					
Existing	Fan Motor, 15hp, 1800rpm, 92.4%	$46	1,053	$ 0.0285	$ 30.02	1.53
Existing	Fan Motor, 40hp, 1800rpm, 94.1%	$286	2,354	$ 0.0285	$ 67.11	4.26
Existing	Fan Motor, 5hp, 1800rpm, 89.5%	$34	393	$ 0.0285	$ 11.20	3.03
Existing	Variable Speed Drive Control, 15 HP	$3,465	12,000	$ 0.0285	$ 342.11	10.13
New	Variable Speed Drive Control, 40 HP	$6,280	32,000	$ 0.0285	$ 912.29	6.88

Appendix G - Payback Data for Energy Efficiency Measures - Commercial Sector						
Commercial Market Segment	Measure Name	Incremental Cost	Annual kWh Savings	Average Commercial Retail Rate (2004)	Annual Bill Savings	Payback (in years)
New	Variable Speed Drive Control, 5 HP	$1,925	4,000	$ 0.0285	$ 114.04	16.88
Existing	Heat Recovery	$400,000	203,300	$ 0.0285	$ 5,795.89	69.01
	Exterior Lighting					
Existing	Outdoor Lighting Controls (Photocell/Timeclock)	$108	165	$ 0.0285	$ 4.70	22.96
Existing	ROB 2L4'T8, 1EB	$27	72	$ 0.0285	$ 2.05	13.15
Existing	Hydronic Heating Pump VFD	$3,465	10,875	$ 0.0285	$ 310.04	11.18
	Office equipment					
Existing	External hardware control	$173	146	$ 0.0285	$ 4.16	41.56
Existing	Nighttime shutdown - Laptop	$0	13	$ 0.0285	$ 0.37	0.00
Existing	Nighttime shutdown - Desktop	$0	115	$ 0.0285	$ 3.28	0.00
Existing	Power Management Enabling	$4	201	$ 0.0285	$ 5.74	0.70
New	Purchase LCD monitor	$200	77	$ 0.0285	$ 2.20	91.11
	Other					
Existing	Dry Type Transformers	$11	30	$ 0.0285	$ 0.86	12.50

Note: The 2004 average residential retail rate of $.0616 was obtained by GDS from BREC, and it is the weighted average retail rate per kWh for residential members of BREC's three member distirbution cooperatives.

Appendix G - Payback Data for Energy Efficiency Measures - Industrial Sector

Count	Measure Name	2003-$ CCE	Measure Life	Payback (Years)
1	Near Net Shape Casting	($0.093)	15	< 1
2	Injection Moulding - Impulse Cooling	($0.060)	12	< 1
3	Intelligent extruder (DOE)	($0.028)	10	< 1
4	Clean rooms - Controls	($0.025)	10	< 1
5	Process Controls (batch + site)	($0.023)	10	< 1
6	Machinery	($0.019)	10	< 1
7	Machinery	($0.014)	10	< 1
8	Machinery	($0.014)	10	< 1
9	Machinery	($0.014)	10	< 1
10	Machinery	($0.014)	10	< 1
11	Compressed Air - System Optimization	($0.013)	10	< 1
12	O&M/scheduling spinning machines	($0.012)	10	< 1
13	Scheduling	($0.008)	10	< 1
14	Optimize drying process	($0.007)	10	< 1
15	O&M - Extruders/Injection Moulding	($0.006)	12	< 1
16	Compressed Air- Sizing	($0.005)	10	< 1
17	Efficient practices printing press	($0.004)	20	< 1
18	Efficient Machinery	($0.004)	10	< 1
19	Optimization (painting) process	($0.003)	10	< 1
20	Pumps - System Optimization	($0.002)	10	< 1
21	Pumps - Sizing	($0.001)	10	< 1
22	Fans- Improve components	($0.001)	10	< 1
23	Process control	($0.001)	10	< 1
24	Switch-off/O&M	$0.001	8	0.2
25	New transformers welding	$0.004	15	3.1
26	New transformers welding	$0.004	15	3.1
27	New transformers welding	$0.004	15	3.1
28	New transformers welding	$0.004	15	3.1
29	Pumps - O&M	$0.005	10	1.1
30	Fans - O&M	$0.005	10	1.1
31	Setback temperatures (wkd/off duty)	$0.005	10	1.1
32	Bakery - Process (Mixing) - O&M	$0.005	10	1.1
33	Replace V-belts	$0.005	5	1.6
34	Compressed Air-O&M	$0.005	10	1.3
35	Efficient Refrigeration - Operations	$0.005	10	1.3
36	Curing ovens	$0.006	15	6.2
37	ASD (6-100 hp)	$0.006	10	1.4
38	Heat Pumps - Drying	$0.007	15	6.1
39	Efficient Printing press (fewer cylinders)	$0.007	10	3.7
40	Bakery - Process	$0.007	15	2.1
41	Optimization (painting) process	$0.007	10	1.7
42	Optimization Process	$0.007	10	1.7
43	Optimization (painting) process	$0.007	10	1.7
44	Air conveying systems	$0.007	14	2.1
45	Efficient processes (welding, etc.)	$0.008	15	4.2
46	Scheduling	$0.008	10	3.1
47	Scheduling	$0.008	10	3.1
48	Scheduling	$0.008	10	3.1
49	Scheduling	$0.008	10	3.1
50	Pumps - Controls	$0.008	10	1.9
51	Curing ovens	$0.008	15	4.9
52	Curing ovens	$0.008	15	4.9
53	Curing ovens	$0.008	15	4.9
54	Curing ovens	$0.008	15	4.9
55	Replace V-Belts	$0.009	10	2.1

Appendix G - Payback Data for Energy Efficiency Measures - Industrial Sector				
Count	Measure Name	2003-$ CCE	Measure Life	Payback (Years)
56	Compressed Air - Controls	$0.010	10	3.4
57	Optimization Refrigeration	$0.010	15	5.2
58	Energy Star Transformers	$0.010	25	5.5
59	Top-heating (glass)	$0.011	8	2.1
60	Process Control	$0.011	15	4.7
61	Motor practices-1 (100+ HP)	$0.013	6	3.0
62	High-efficiency motors	$0.014	10	3.2
63	Efficient drives	$0.014	10	3.4
64	Efficient drives - rolling	$0.014	10	3.4
65	Membranes for wastewater	$0.015	15	5.5
66	Motor practices-1 (6-100 HP)	$0.015	10	4.6
67	Drives - EE motor	$0.016	10	3.8
68	Fans - System Optimization	$0.017	10	4.7
69	Optimization control PM	$0.018	10	4.5
70	Scheduling	$0.018	10	4.2
71	High Consistency forming	$0.018	20	3.6
72	Process control	$0.018	15	6.2
73	Electronic Ballasts	$0.019	12	4.9
74	ASD (100+ hp)	$0.020	6	3.2
75	Metal Halides/Fluorescent	$0.021	12	6.2
76	Drying (UV/IR)	$0.022	8	4.7
77	High efficiency motors	$0.024	6	3.8
78	Gap Forming paper machine	$0.024	20	5.7
79	Replace by T8	$0.025	12	6.6
80	Controls/sensors	$0.027	12	7.0
81	Autoclave optimization	$0.027	10	6.3
82	Process Drives - ASD	$0.028	10	6.5
83	Process Heating	$0.028	15	8.4
84	Drives - ASD	$0.029	10	6.7
85	HVAC Management System	$0.030	10	7.0
86	Programmable Thermostat	$0.030	10	7.0
87	Clean Room - Controls	$0.030	10	7.0
88	Efficient electric melting	$0.031	20	10.5
89	Duct/Pipe Insulation/leakage	$0.033	10	7.2
90	Window film	$0.037	8	7.0
91	Motor practices-1 (1-5 HP)	$0.038	14.5	10.4
92	Injection Moulding - Direct drive	$0.039	12	9.1
93	Extruders/injection Moulding-multipump	$0.040	12	10.5
94	Fans - Controls	$0.042	10	9.8
95	Chiller O&M/tune-up	$0.042	10	9.8
96	Light cylinders	$0.053	10	10.9
97	Direct drive Extruders	$0.055	12	11.5
98	Replace 100+ HP motor	$0.057	6	9.1
99	Clean Room - New Designs	$0.060	10	14.0
100	Efficient grinding	$0.078	15	23.2