Kentucky Public Service Commission

Staff Report On the

2008 Integrated Resource Plan

of Duke Energy Kentucky, Inc.

Case No. 2008-00248

APRIL 2010

SECTION 1

INTRODUCTION

Administrative Regulation 807 KAR 5:058, promulgated in 1990 and amended in 1995 by the Kentucky Public Service Commission (“Commission”), established an integrated resource planning (“IRP”) process that provides for regular review by the Commission Staff (“Commission Staff” or “Staff”) of the long-range resource plans of the six major jurisdictional electric utilities. The goal of the Commission in establishing the IRP process was to ensure that all reasonable options for the future supply of electricity were being examined and pursued, and that ratepayers were being provided a reliable supply of electricity at the lowest possible cost.

Duke Energy Kentucky Inc. (“Duke Kentucky”) submitted its 2008 IRP to the Commission on July 1, 2008. The IRP includes Duke Kentucky’s plan for meeting its customers’ electricity requirements for the period 2008-2028.

Duke Kentucky is an investor-owned public utility that supplies electricity and natural gas to customers located in the Northern Kentucky area adjacent to the Southwestern Ohio area served by Duke Energy Ohio, Inc. Duke Kentucky serves approximately 134,000 electric customers throughout its 500 square mile service area.

Duke Kentucky’s total installed net summer generation capability is 1,077 MW. Coal-fired steam capacity is divided among two stations, East Bend and Miami Fort, and is comprised of two units that account for 577 MW of its total installed capacity. Duke Kentucky’s 500 MW of peaking capacity exists in the form of six natural gas-fired combustion turbines housed at one station, Woodsdale. Duke Kentucky’s peaking units have the option of burning propane as a back-up fuel. Duke Kentucky operates and owns 69% of the coal-fired East Bend Unit 2 unit. It shares ownership of this unit with Dayton Power & Light.

Duke Kentucky owns an electric transmission and distribution system and a gas distribution system both of which are located in Northern Kentucky. The combined transmission systems of Duke Kentucky, Duke Ohio, and Duke Indiana form the Duke Energy Midwest balancing authority (“Duke Midwest”). The Midwest Independent Transmission System Operator, Inc. (“Midwest ISO”) provides transmission service to deliver electricity from Duke Kentucky’s generation plants and from points outside Duke Midwest’s transmission system through that system to Duke Kentucky’s transmission and distribution systems, ultimately delivering to Duke Kentucky’s end users. The number of interconnections that Duke Midwest has with other large control areas provides increased reliability to the region.

The purpose of this report is to review and evaluate Duke Kentucky’s IRP in accordance with 807 KAR 5:058, Section 12(3), which requires the Commission Staff to issue a report summarizing its review of each IRP filing made with the Commission and make suggestions and recommendations to be considered in future IRP filings. The

Staff recognizes that resource planning is a dynamic ongoing process. Thus, this review is designed to offer suggestions and recommendations to Duke Kentucky on how to improve its resource plan in the future.

Specifically, the Staff's goals are to ensure that:

- All resource options are adequately and fairly evaluated;
- Critical data, assumptions and methodologies for all aspects of the plan are adequately documented and are reasonable; and
- The report also includes an incremental component, noting any significant changes from Duke Kentucky's most recent IRP filed in 2004.

Duke Kentucky states that the purpose of its IRP is to provide an overview of the strategy it uses to provide electric energy services in a reliable, efficient, and economic manner while taking into account current environmental considerations. Duke Kentucky's IRP is the result of a process designed to concentrate on short term needs while realizing that corrections may be needed to limit long term risks. This IRP covers a planning period from 2008 – 2028 as opposed to the fifteen year requirement set forth in the Commission's regulation, in order to incorporate a longer period of compliance with CO_2 restrictions.

Duke Kentucky used a long-term reliability criterion of a 15 percent minimum reserve margin. The Midwest Planning Reserve Sharing Group ("PRSG"), of which Duke Kentucky is a member, issued a preliminary report for the June 2008 through May 2009 planning year showing a reserve margin target of 14.3 percent for the zone in which Duke Kentucky is located. Duke Kentucky was concerned that the assumptions and methodologies used in the PRSG report tended to bias the results toward a lower than necessary reserve margin. Based on these concerns and a Midwest ISO long-term adequacy proposal filed with FERC in late 2007, Duke Kentucky believes that a reserve margin target of 15 percent should be maintained.

The Duke Kentucky resource planning process is comprised of the following:

- Development of planning assumptions;
- Preparation of a load forecast;
- Assessment of demand-side options;
- Assessment of supply-side options;
- Analysis of potential environmental compliance options;
- Integration of demand-side, supply-side, and environmental compliance options;
- Analysis of alternatives and recommendation of a plan; and
- Implementation of the recommended plan.

Duke Kentucky's peak load is expected to increase from 859 MW in 2008 to 1,007 MW in 2028, reflecting a growth rate of 0.8 percent once the impacts of its energy efficiency programs are acknowledged. Its winter peak load is expected to increase from 766 MW to 868 MW over the same period, reflecting a growth rate of 0.6 percent. These growth rates are lower than those reported in Duke Kentucky's 2004 IRP when the average annual growth rate was 1.8 percent and its peak growth rate was 1.5 percent. The lower expected rates of growth reflect higher energy prices, greater efficiency levels and lower than expected economic growth.

Duke Kentucky expects that it will require supply-side resource additions consisting of 2 combustion turbine ("CT") units, each 35 MW, in 2019 and 2023 and a 35 MW nuclear unit in 2027. The IRP also accounts for conservation and demand response on the part of residential and non-residential customers throughout the planning period. Environmental compliance measures are expected to be added in 2012 on Miami Fort Unit 6, a 168 MW coal-fired generating unit.

The remainder of this report is organized as follows:

- Section 2, Load Forecasting, reviews Duke Kentucky's projected load growth and load forecasting methodology.
- Section 3, Demand-Side Management ("DSM"), summarizes Duke Kentucky's evaluation of DSM opportunities.
- Section 4, Supply-Side Resource Assessment, focuses on supply resources available to meet Duke Kentucky's load requirements.
- Section 5, Integration and Plan Optimization, discusses Duke Kentucky's overall assessment of supply-side and demand-side options and their integration into an overall resource plan.

SECTION 2

LOAD FORECASTING

Introduction

This section reviews Duke Kentucky's projected load growth and load forecasting methodology. Duke Kentucky's energy and peak demand forecasts are prepared yearly as part of its planning process by a staff it shares with other Duke Energy utilities, using a common methodology. Duke Kentucky's service area is located in northern Kentucky just south of the Duke Energy Ohio service area. Being within the Cincinnati Primary Metropolitan Statistical Area, this area is an important part of the regional economy.

Forecasting Methodology

Forecasting energy and demand is an important aspect of Duke Kentucky's planning process. Its forecast of energy requirements is part of the overall forecast of energy requirements of the Greater Cincinnati and Northern Kentucky region. The Duke Kentucky component is derived through allocating percentages of the regional forecast by customer group. Its peak demand forecast is likewise developed through this allocation process. These allocations reflect both historical ratios and the judgment of planning and forecasting personnel. Duke Kentucky's forecasting methodology reflects general economic theory in that energy use is dependent on key economic factors such as income, production, energy prices and the weather.

Duke Kentucky determines its forecasted energy needs through econometric analyses, relying on models to represent economic behavior. Ordinary least squares is the principle regression analysis technique used to estimate behavior, or economic relationships, among relevant variables. Based on their relationship with dependent variables, a number of independent variables are tested in the regression models. Statistical strength and logical consistency form the bases for the final models chosen. This type of analysis allows national economic conditions and their impacts on regional and local economic and demographic conditions to be reflected in the forecast results. This approach quantifies cause and effect relationships between electric sales and the national, regional, and local factors that influence their growth.

Gathering national, state and local economic and demographic data to specify models that describe customers' usage characteristics is the first step in the forecasting process. National economic data are relied on due to the link between forecasts for national and regional economies and estimated energy use. The majority of data used to develop the forecasts is provided by Moody'sEconomy.com. This includes national and service area economic forecasts. Forecasts of employment and industrial production are provided by North American Industry Classification System ("NAICS"). Various financial data comes from Duke Kentucky financial reports and several published sources. Local weather data are obtained from the National Oceanic and Atmospheric Administration ("NOAA"). Development of energy and peak demand forecasts generally involves a national economic forecast, a service area economic forecast and the electric load forecast.

Energy Forecasts

Forecasts are prepared for the residential, commercial, industrial, governmental or other public authority and street lighting energy sectors plus three minor categories: interdepartmental use (gas department), company use and losses. Residential sector energy use is developed based on two components: number of customers and energy usage per customer. The number of customers is based on population and real per capita income. The process used by Duke Kentucky is modeled using a lag structure. Use per customer is developed based on per capita income, real electricity prices, and the combined impact of other factors, including saturation of air conditioning, electric space heating, other appliances, the efficiency of those appliances and weather.

The commercial sector energy forecast is developed based on the level of local commercial employment, real electricity prices and the impact of weather. The forecast for the industrial sector is developed based on the level of industrial production, the impact of real electricity prices, electric price relative to alternative fuels and the impacts of weather. Duke Kentucky's industrial sales forecast is developed by NAICS classifications.

Two categories make up the electricity sales to the governmental sector: water pumping customers and non-water pumping customers. The forecast to water pumping customers incorporates the number of residential electric customers, the real electricity demand price, precipitation levels, and heating and cooling degree days. Electric sales to non-water pumping customers are based on governmental employment, the real price of electricity, the real price of natural gas, and heating and cooling degree days.

Electricity usage varies in the street lighting sector based on the number of lights and the efficiency of lighting fixtures. The number of street lights is dependent on the population of a service area while the efficiency of fixtures is related to the saturation of mercury and sodium vapor lights.

After summing the results of the individual energy sales forecasts to derive the total energy sales forecast, Duke Kentucky prepares the forecast of its total system sendout. This involves combining the total sales forecast with the forecasts of company use and system losses. This is the final step prior to developing the peak load forecast.

Peak Load Forecasts

There are two peak load forecasts: one for summer peak demand and one for winter peak demand. The peak forecasting is intended to closely reflect the relationship of weather to peak loads. Only days with a temperature of 90 degrees or more are included in the summer model while only days with a temperature of 10 degrees or below are included in the winter peak model.

Peak summer load is influenced by economic activity, temperature and humidity. In addition, the morning low temperature and the high temperature from the previous day are variables important in capturing the effect of thermal buildup.

Peak winter load is also influenced by economic activity and weather conditions. If the peak occurs in the morning, the morning low temperature, wind speed and the previous night's low temperature are the primary weather factors. If the peak occurs at night, the primary factors are the evening low temperature, wind speed and the morning low temperature.

In order to develop the peak load forecasts, the impact of abnormal weather must be excluded. This requires weather normalizing the historical monthly sendout. Each of the energy sectors, residential, commercial, industrial, and governmental or other public authority, is individually adjusted for the difference between actual and normal weather (street lighting sales are not considered weather sensitive). Weather normalized sales from these weather sensitive sectors are then combined with sales of non-weather sensitive sectors to produce the weather-normalized sendout, which is a variable in the summer and winter peak equations.

Duke Kentucky's summer peak typically occurs in August in the afternoon while its winter peak typically occurs in January in the morning. The sendout forecast drives the peak forecasts. Values used in the forecasts, which are determined to be normal peak-producing conditions, are based on historical data on the worst weather conditions in each year for both summer and winter.

Assumptions

Duke Kentucky's forecasts generally assume that its service territory economy will resemble the national economy over the forecast period. The Cincinnati area economy, including Northern Kentucky, has an extremely diverse economy. In the manufacturing sector, its major industries are food products, printing, steel, machinery and automotive transportation equipment. Its major non-manufacturing industries are finance and life insurance.

The Energy Independence and Security Act of 2007 was signed into law in December 2007. Generally, this act was designed to increase energy efficiency and encourage the development and availability of renewable energy. For Duke Kentucky, the largest impact on sales will come from new energy efficient lighting. The Lighting Controls Association has stated that this legislation will essentially eliminate the manufacture of most common incandescent lamps. It has also stated its belief that compact fluorescent light bulbs ("CFLs") will capture the incandescent market. Duke Kentucky estimated the impact of this legislation on its lighting load and reduced its forecast beginning in 2012, the year the new standards for lighting begin.

At the local level, Duke Kentucky forecasts the majority of employment growth occurring in the non-manufacturing sector over the forecast period, which continues a trend that has existed for several years. While the rate of growth in employment on a national level is expected to be 1.2 percent over the forecast period, the local growth rate in employment is expected to be 1.6 percent.

Over the forecast period, Duke Kentucky's area population is expected to grow at an annual average rate of 0.5 percent while the national population's average annual growth rate is expected to be 0.8 percent. Local industrial production is forecast to grow at rate of 1.5 percent over the forecast period compared to a growth rate of 1.1 percent nationally.

Prices of natural gas and oil are expected to increase over the forecast period. There may be changes due to legislation or to supply or pricing policy changes by oil-producing countries. Such items cannot be accurately quantified within a forecast and Duke Kentucky made no attempt to do so.

Overall, the forecast includes a projection of increasing saturation for appliances, including heat pumps, air conditioners, water heaters, clothes dryers, and freezers. It also captures the general trend of increasing efficiencies of major appliances consistent with the most recent federal standards. To account for appliance saturations and the federal efficiency standards, Duke Kentucky develops an appliance stock variable. The appliances included in creating the variable are: electric range; refrigerator, freezer, dish washer, clothes washer, clothes dryer, water heater, microwave, color television, black and white television, room air conditioner, central air conditioner, electric resistant heat, and electric heat pump.

Information on historical appliance saturations in obtained from Duke Kentucky's appliance saturation surveys while data on historical appliance efficiency is obtained from the Association of Home Appliance Manufactures and the Air Conditioning and Refrigeration Institute. Information on average appliance life is obtained from Appliance Week. ITRON Inc., a forecast consulting firm, supplies forecasts of appliance saturation and efficiency.

Changes in Methodology

Duke Kentucky made a change in how it calculated heating degree days ("HDD") and cooling degree days ("CDD"). Historically, as many other utilities have done, it used a base temperature of 65ºF to make its degree day calculations. However, evidence indicated that its customers did not start to use energy for heating at that temperature. As a combination gas and electric utility, Duke Kentucky was especially interested in having consistent degree day calculations that were consistent for both electric and gas sales. Its analysis indicated that heating loads start around 59ºF rather than 65ºF. As a result, the base temperature for calculating HDD was changed to 59ºF.

Duke Kentucky also changed the historical time period on which it based its HDD and CDD calculations. Previously, it had relied on the 30-year normal degree day data provided by NOAA. That data, since 1971, indicated a downward trend in HDD and an upward trend in CDD. However, Duke Kentucky discerned that the NOAA data was not adequately reflecting the downward trend in HDD. It analyzed the data and reached a decision to develop its normal HDD and CDD levels based on a recent 10-year period, rather than a 30-year period.

Forecast Results

Based on implementing new energy efficiency/DSM programs and the incremental impacts of existing efficiency programs, residential energy sales are forecast to grow at an average annual rate of 0.2 percent, commercial sales at an average rate of 1.3 percent and industrial sales at an average rate of 1.1 percent. The summation of the forecasts of each sector, along with the recognition of energy losses, results in an increase in sales, from 4,186,423 MWh in 2008 to 4,844,532 MWh in 2028, for an annual average system-wide growth rate for energy sales of 0.7 percent.

Duke Kentucky's peak load is expected to increase from 859 MW in 2008 to 1,007 MW in 2028, an average annual rate of 0.8 percent, once the impacts of energy efficiency programs are acknowledged. Its winter peak load is expected to increase from 766 MW to 868 MW over this period, an average annual rate of 0.6 percent.

The growth rates in these forecasts are significantly lower than those in Duke Kentucky's most recent IRP filed in 2004. Its 2004 energy forecast reflected an average annual growth rate of 1.8 percent, compared to 0.7 percent in its current forecast, while its summer peak demand was projected to grow at a rate of 1.5 percent compared to the 0.8 percent rate it now projects. According to Duke Kentucky, the lower forecasts are due mainly to higher energy prices, higher efficiency levels, and reduced expectations concerning economic growth. It indicated that Duke Ohio and Duke Indiana, its Duke Energy Midwest affiliates, are experiencing similarly reduced forecasts.

In addition to the base case forecasts described above, Duke Kentucky also prepares high and low energy and peak demand forecasts. In developing these forecasts, it used the standard errors of the regression from the econometric models used to produce the base energy forecast. Generally, the high forecast reflects a scenario based on more optimistic assumptions regarding the future growth of energy sales while the low forecast reflects a scenario based on more pessimistic assumptions. The upper and lower bands are based on an 80 percent confidence interval around the based forecast, which equates to 1.28 standard deviations.

Duke Kentucky's high case energy forecast shows sales of 4,409,000 MWh in 2008 and 5,235,000 MWh in 2028, which are 5.3 and 8.1 percent, respectively, greater than its base case results. Its low case forecast shows sales of 3,964,000 MWh in 2008 and 4,495,000 MWh in 2028, which, respectively, are 5.3 and 7.2 percent less than the base case results. Duke Kentucky's high case load forecast of its summer peak demand is 5.6 percent greater than its base case results, both in 2008 and 2028, at levels of 907 MW and 1,063 MW, respectively. Compared to its base case results, its low case load forecast for its winter peak demand, 810 MW in 2008 and 950 MW in 2028, are both 5.7 percent lower.

Discussion of Reasonableness

In general, Commission Staff is satisfied with Duke Kentucky's forecasting. For the most part, Duke Kentucky's forecasting methodology is consistent with the methodology used in its previous IRPs. It has, however, changed the base temperature used in its HDD calculations and has reduced the time period upon which it bases "normal" HDD and CDD from 30 to 10 years. Staff is generally familiar with using a base temperature less than 65ºF, which has been the industry standard for decades, in HDD calculations, as this was proposed by Columbia Gas of Kentucky, Inc. in its forecasted test year rate cases in the early and mid 1990s. Commission Staff is not, however, familiar with using a period of only 10 years as the basis for normal HDD and CDD levels other than as proposed by Duke Kentucky in its most recent rate cases, and will be especially interested in how actual energy and demand levels compare to forecasted levels based on this approach.

For its next IRP, Staff makes the following recommendations concerning Duke Kentucky's energy and demand forecasts:

- Report on how the change in base temperature for its HDD calculations and its use of a 10-year period in developing HDD and CDD "normals" have impacted how its actual energy and demand levels compare to its forecasted levels.

- Examine and report on the potential impact of future environmental requirements (specifically carbon capture and sequestration and other green house gas mitigation requirements) and how these issues are incorporated into present forecasts and/or will be incorporated into future forecasts.

- Report on the need, if any, to incorporate impacts occurring due to the expanding role of the Midwest Independent System Operator into future forecasts.

SECTION 3

DEMAND-SIDE MANAGEMENT

Introduction

This section addresses the DSM portion of Duke Kentucky's 2008 IRP. At present, it has the following programs in place that were developed in conjunction with its DSM Collaborative groups:

1: Residential Conservation and Energy Education Program
2: Residential Home Energy House Call Program
3: Residential Comprehensive Energy Education Program ("NEED")
4: Program Administration, Development & Evaluation Funds
5: Payment Plus (formerly Home Energy Assistance Plus)
6: Power Manager
7: Energy Star® Products
8: Energy Efficiency Website
9: Personal Energy Report ("PER")
10: C&I High Efficiency Incentive (for Businesses and Schools)
11: Powershare®

There are two collaboratives: a Residential Collaborative and a Commercial and Industrial Collaborative. Both include local stakeholders plus other parties interested in the development and implementation of DSM or conservation programs.

The Commission has been regularly updated on these programs through Duke Kentucky's annual DSM filings. Pursuant to various Commission orders, at the time the IRP was filed, all programs except Power Manager and PER were scheduled to terminate at the end of 2009.[1] On November 16, 2009 Duke requested authorization to continue its existing DSM programs and DSM rates while its application for approval of cost recovery is pending before the Commission.[2] In an order dated December 11, 2009 the Commission granted this request.

Current Duke Kentucky DSM Programs

This section describes Duke Kentucky's 11 existing DSM programs. Subsequent to filing its IRP, Duke Kentucky filed an application seeking Commission approval of its save-a-watt proposal, which was docketed as Case No. 2008-00495. In its November 16, 2009 annual DSM filing, Duke Kentucky proposed to extend various existing DSM programs beyond their scheduled December 31, 2009 termination date. It also

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[1] Power Manager and PER had been approved to continue beyond 2009.

[2] Case No. 2009-00444, Annual Cost Recovery Filing for Demand-Side Management by Duke Energy Kentucky, Inc.

proposed adjustments to its DSM rates in addition to requesting that the Commission permit its existing programs remain in effect until it received Commission approval to implement new DSM programs under its save-a-watt model.[3]

Residential Conservation and Energy Education

This program is designed to help low income customers reduce their energy use and energy costs. It focuses on customers that meet the eligibility requirements of the federally-funded Low Income Home Energy Assistance Program ("LIHEAP"). The program provides direct installation of weatherization and energy-efficiency measures and educates customers about energy use and opportunities to reduce their energy consumption and energy costs.

There are two "tiers" of customers. Tier 1 customers use less natural gas and/or electricity than Tier 2 customers, based on usage per square foot per year. Tier 2 services are provided to customers that use at least 1 therm and/or 7 kWh per square foot per year based on their most recent year as a Duke Kentucky customer. Tier 2 services include Tier 1 services (low flow showerheads, weatherization, aerators, outlet gaskets, CFLs plus measures such as attic insulation, wall insulation, crawl space insulation, floor insulation and sill box insulation.[4]

Residential Home Energy House Call

This program provides an in-home audit performed to identify potential energy savings. The auditor analyzes total home energy use, checks the home for air infiltration, examines insulation levels, and checks appliances and heating/cooling systems. Within 10 business days from the inspection date the customer receives a home-specific energy use report, which focuses on building envelope improvements and low-cost and no-cost measures to save energy. During the home audit, the customer receives a free kit containing a low-flow showerhead, two aerators, outlet gaskets, two CFLs, and a motion sensor night-light.

Satisfaction ratings for the program are 4.8 on a 5-point scale. This score is the result of survey cards completed and returned to Duke Kentucky by customers who received an audit.

Residential Comprehensive Energy Education

The Residential Comprehensive Energy Education program, which is operated by Kentucky NEED, provides education information on all energy sources, emphasizing

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[3] On January 28, 2010, Duke Kentucky filed a motion requesting to withdraw its save-a-watt application and that Case No 2008-00495 be dismissed without prejudice. By Order dated January 29, 2010, the Commission granted Duke Kentucky's request and dismissed Case No. 2008-00495 without prejudice.

[4] In 2003, Duke Kentucky was authorized to expand this program to include refrigerator replacement as an approved DSM measure.

efficient energy use.[5] Teachers receive energy education materials. Leadership training workshops educate teachers and students to provide training and implement behavioral changes to reduce energy use. Educational materials and workshops have been provided for students and teachers in grades K through 12.

The program has been provided to more than 5,000 students. After attending workshops, students mentor other students to promote conservation. Middle and high school students serve as facilitators at workshops. Students make presentations to community groups on energy, energy conservation and to show that the actions of each person impact energy efficiency. It is intended that students will share this information with their families and reduce consumption in their homes.

The program addresses: (1) energy efficiency in buildings (new construction and retrofits); (2) school transportation practices; (3) educational programs; (4) procurement practices; and (5) links between school facilities and activities in the community.

An energy savings kit was added in 2004 to improve and better document energy savings related to the program. A new curriculum was developed to allow teachers to have DSM measures implemented and assessed, allowing the program to demonstrate that the kit contents (low-flow shower heads, faucet aerators, a water temperature gauge, outlet insulation pads, CFLs and a flow meter bag) were installed in the home.

<u>Program Administration, Development, & Evaluation Funds</u>

This program is responsible for designing, implementing and capturing costs related to administering, evaluating and supporting the DSM efforts of Duke Kentucky and its Collaboratives. Program development funds are used for redesigning programs and for developing new programs. Evaluation funds are used for cost-effectiveness analysis and evaluation, impact evaluation and process evaluation of program activities. Going forward, funds will be used to monitor, evaluate and analyze programs to improve cost effectiveness and program design.

<u>Payment Plus (formerly Home Energy Assistance Plus)</u>

This program is designed to impact customer behaviors (i.e..encourage customers to timely pay their bills and eliminate arrearages) and to promote energy conservation impacts. It is offered over 6 winter months per year starting in October to low-income customers.

The program has three parts:

1. Energy and budget counseling - to help customers understand how to control energy use and manage household bills. A combined education counseling approach is used.

2. Weatherization - participants must have their homes weatherized as part of the Residential Conservation and Energy Education program

[5] Kentucky's segment of the National Energy Education Development program.

unless the home has been weatherized in past program years.

3. Bill assistance - to provide an incentive to participate in education and weatherization and help customers get control of their bills, credits are provided to those who complete other aspects of the program. Credits amounts are: $200 for participating in energy efficiency counseling, $150 for participating in budgeting counseling, and $150 to participate in the Residential Conservation and Energy Education program. If all requirements are completed, a household can receive up to $500.

The program is evaluated to see if energy use declines and if bill paying habits change. The evaluation looks at energy savings, arrearages, and payment practices. It is the only long-term evaluation in the country of both energy savings and arrearages. Evidence to date shows it is effective at saving energy and reducing arrearages.

<u>Power Manager</u>

The purpose of this program, available to residential central air conditioning customers, is to reduce demand by controlling air conditioning use at peak hours. Duke Kentucky attaches a load control device (switch) to a customer's compressor, enabling it to cycle the air conditioner off and on when demand reaches peak levels. Customers receive financial incentives for participating based on the option selected. Under Option A, the air conditioner is cycled to achieve a 1 kW reduction. Under Option B, the air conditioner is cycled to achieve a 1.5 kW reduction. Incentives provided at the time of installation are: $25 for Option A and $35 for Option B. When a cycling event occurs, a Variable Daily Event lncentive based upon marginal costs is also provided.

Air conditioning cycling has resulted in minimal impact on customer comfort levels. The device has built-in safeguards to prevent short cycling, resulting in no negative impact on the system's long-term operations. Research from other programs has shown that indoor temperatures rise roughly one to two degrees for control Option A and approximately two to three degrees for control Option B. Additionally, the indoor fan continues to run and circulate air during the cycling event.

Power Manager combines direct load control with a form of real-time pricing via the Variable Daily Event Incentive structure. Through the Variable Daily Event Incentive structure, customers become better informed about the real-time cost of electricity.

By the end of 2006, 6,888 switches were installed. Installations slowed in 2007, as a quality management effort was implemented to ensure that switches and systems were operating as efficiently and effectively as possible. The result was an increase in load reductions to an average of 1.04 kW per home, which provides greater assurance that the program operates as intended at a cost effective load reduction level.

<u>Energy Star® Products</u>

This program provides market incentives and market support via retailers to build market share and sales of Energy Star® products. Incentives to buyers and in-store support stimulate demand for products. The program targets purchases of specific technologies through retail stores and special sales events. The first year, the program focused on CFLs and torchiere lamps.

To stimulate the market and encourage customers to buy and install the energy efficient lighting, the program provides incentives via special in-store events that occur at the time of purchase or at special promotional events in the community. Incentives start at $2 per bulb and $20 per torchiere. The program also provides training to retail sales staff on the sales aids provided. Duke Kentucky contracted with the Wisconsin Energy Conservation Corporation, which has been recognized as the national leader in this program, to provide this service.

In 2007, events were hosted by the cities of Alexandria and Ludlow as part of their Earth Day celebrations. Events were hosted in the fall in the cities of Bellevue, Ft. Mitchell, and Newport in coordination with the 2007 "Change a Light, Change the World" campaign. Total sales in 2007 consisted of 36,607 CFLs and 502 torchieres.

Energy website, on-line energy assessment, energy efficient starter kit

Duke Kentucky's website enables its customers to assess their energy use and receive recommendations for being more energy efficient. This program fits the Duke companies' multi-state program referred to as the Residential Energy Assessment Program. The Home Energy Calculator is an on-line tool, provided by Apogee, which allows customers to provide information about their home, number of occupants, and other energy-related home and family characteristics. The electronic calculator allows an unlimited number of potentially energy-saving scenarios to be run while charts and tables compare the scenarios to show energy savings. As an incentive to encourage customers to use the website, a free Energy Efficiency Starter Kit is offered. The kit is mailed directly to the customer's service address and provides the following measures:

Showerhead, 1.5 GPM
Kitchen Swivel Aerator, 1.5 GPM
Bathroom Aerator, 1.0 GPM
15 Watt CFL
20 Watt CFL
Shrink Fit Window Kit
Closed Cell Foam Weatherstrip
7' Roll Switch and outlet draft stopper gaskets

Personal Energy Report ("PER")

The PER provides customers a customized energy report aimed at helping them better manage their energy costs. It also includes the Energy Efficiency Starter Kit containing measures that demonstrate how easily energy efficiency can be improved. The report gives energy use information, providing tips and information on how energy is used and how simple, low cost measures can lower the customer's energy bill. This program is meant to educate customers and provide information, customized tips and simple-to-install measures which could lower their energy costs.

To get this information, a customer completes an energy survey which generates the PER. The process begins with a letter to customers, offering the PER if they return a 14-question survey about their home. The survey asks questions such as age of home, number of occupants, types of fuel used to cool, heat, and cook. The survey stimulates customers to think about how they use energy and then the PER provides tools and information on how to lower energy costs. It also provides instructions on installing the energy measures, demonstrating how easy it is to improve efficiency.

Commercial & Industrial (C&I) High Efficiency Incentive (with schools initiative)

This program provides incentives to small commercial and industrial customers to install high efficiency equipment in new construction, retrofit, and the replacement of failed equipment. First planned for joint implementation with a Duke Indiana program, to reduce administrative costs and leverage promotion, it was eventually implemented jointly with an expanded C&I program approved for Duke Ohio. With that approval, the program can now economically expand technologies in Kentucky to include all the technologies that were initially proposed.[6]

Full operations began in 2005 with results exceeding expectation. In the first nine months, 36 applications were processed totaling $313,350 in incentives. Duke Kentucky attributes this to high installation rates of T-8, T-5 High Output, and High Bay Lighting technologies plus pent-up demand in the marketplace.

The program ran out of funds in April of 2007. In anticipation of that event, Duke Kentucky filed a request for a 100% increase in funding plus $451,885 for a Kentucky schools program. In May 2007, the Commission approved Duke Kentucky's request. During the current DSM filing period, 12,742 light fixtures have been installed of which 30% were T8 High Bay six-lamp and T5 High Output High Bay four-lamp fixtures. Twenty HVAC units and four motors were also installed.

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[6] The technologies are: High-Efficiency Incentive Lighting, T-8 with Electric Ballasts replacing T-12, LED Exit Signs New/Electronic, CFL Fixture / CFL Screw in, T-5 with Elec. Ballast replacing T-12, T-5 High Output with Elec. Ballast replacing T-12, T-5 High Output High Bay. Tubular Skylight Hi Bay Fluorescent, 320 Metal Halide Pulse Start, LED Traffic Signals, Controls/Occupancy Sensors, High Efficiency Incentive HVAC, Packaged Terminal AC, Unitary AC & Heat Pump, Rooftop HP & AC, Ground Source High Efficiency Incentive Pumps - Closed Loop, Air Cooled Chillers, Water Cooled Chillers, Window AC, HP Water Heater, Thermostats Controls, High Efficiency Incentive Pumps, Motors & Drives, NEMA Premium Motors 1 to 250 HP with greater than 1500 hours per year, High Efficiency Pumps 1-20 HP, Variable Frequency Drives 1-50 HP, Refrigeration Energy Star® Refrigerators and Freezers, Energy efficiency Ice Machines, Head Pressure Controls, Night Covers for displays, Efficient Refrigeration Condensers, Anti-sweat Heater Controls, Vending Machine Controls Other Misc. Technologies, Injection Molder Barrel Wraps, Engineered Air Compressor Nozzles, Pellet Dryer Duct Insulation, and "Energy Star" Clothes Washers for Commercial Applications.

Powershare®

PowerShare® is the brand name of Duke Kentucky's Peak Load Management Program (Rider PLM, Peak Load Management Program). The program is voluntary and offers large volume customers an opportunity to reduce costs by managing their electric use during peak load periods. Customers enter into a service agreement specifying terms and conditions under which they agree to reduce usage. There are two options offered for Powershare®: 1) Call option and 2) Quote option.

A customer served under a Call option product agrees, upon notification by Duke Kentucky, to reduce its demand or provide generation for purchase by Duke Kentucky. Each time it exercises its option under the agreement, Duke Kentucky provides the customer a credit for energy reduced or generation provided. If available, the customer may elect to buy through the reduction at a market-based price. In addition to the energy credit, customers on the Call option receive an option premium credit. Only customers able to provide a minimum 100 kW load response qualify for Call option.

Under a Quote option product, a customer and Duke Kentucky agree that, when the average wholesale energy market price during a notification period exceeds a pre-set strike price, Duke Kentucky may notify the customer of a Quote option event and provide a price quote to the customer for each event hour. The customer will decide whether to reduce demand or provide generation. Based on its decision, the customer will notify and provide Duke Kentucky an estimate of its projected load reduction or generation. Each time Duke Kentucky exercises the option, the customer receives an energy credit. There is no option premium for a Quote option product since customer load reductions are voluntary. Only customers able to provide a minimum 100 kW load response qualify.

DSM Screening and Cost-Effectiveness

Duke Kentucky evaluates the cost-effectiveness of specific DSM measures when determining which DSM programs to implement. The net present value of costs vs. benefits is assessed, i.e., the costs to implement the measures are valued against the savings or avoided costs. The resultant benefit/cost ratios, or tests, provide a summary of the measure's cost-effectiveness relative to the benefits of its projected load impacts.

The main criteria Duke Kentucky uses to screen DSM measures are the Utility Cost Test ("UCT"), the Total Resource Cost ("TRC") Test, and the Ratepayer Impact Measure ("RIM") Test. The UCT compares utility benefits to utility costs by comparing the cost to the utility to implement the measure with the savings or avoided costs to the utility resulting from the change in magnitude and/or the pattern of electricity use caused by implementing the measure. Avoided costs are considered in the evaluation of cost-effectiveness based on the projected market price of power including environmental compliance costs. The cost-effectiveness analyses also include avoided transmission and distribution costs, line losses, and avoided ancillary services.

The TRC test compares total benefits to the utility and participants relative to the cost to implement the program and the cost to participate. The utility's benefits are the same as for the UCT. The RIM test, or non-participant test, indicates if market prices and rates increase or decrease over the long-run due to the program. The costs incurred from implementing measures in DSM programs include incentives offered to consumers plus vendor delivery and installation costs, if applicable.

Cost effectiveness test results for existing DSM programs are shown below.

	UCT	TRC	RIM
Residential Conservation and Energy Education Program	0.93	0.93	0.45
Refrigerator Replacement Component	1.03	1.03	0.46
Residential Home Energy House Call Program	3.38	3.38	1.02
Residential Comprehensive Energy Education Program (NEED)	1.57	1.57	0.64
Power Manager	3.32	3.98	3.32
Energy Star® Products	9.75	7.92	0.66
Energy Efficiency Website	1.95	2.49	0.57
Personal Energy Report (PER)	5.78	10.76	0.71
C&I High Efficiency Incentive (for Businesses and Schools)			
Lighting	4.73	2.69	0.84
HVAC	2.17	1.32	0.79
Motors	1.39	1.23	0.61
Powershare®	2.16	261.94	1.86

Discussion of Reasonableness

Commission Staff commends the efforts of Duke Kentucky and its Collaboratives have made in developing and expanding the existing DSM programs. Given the pendency of its 2009 DSM filing, and the likelihood that it will be addressed by the Commission well in advance of Duke Kentucky's next IRP, Commission Staff makes no specific recommendations regarding the existing DSM programs. However, Staff notes that the relatively broad, comprehensive scope of Duke Kentucky's programs, plus the specific attributes of those programs, appear to be meeting a need, both for its customers and for Duke Kentucky, in developing its least-cost supply plan.

SECTION 4

SUPPLY-SIDE RESOURCE ASSESSMENT

Introduction

This section summarizes and comments on Duke Kentucky's evaluation of supply-side resources and includes a discussion of environmental compliance planning.

Existing Capacity

Duke Kentucky's net summer generation capability is 1,077 MW which consists of 577 MW of coal-fired steam capacity and 500 MW of natural gas-fired peaking capacity. The steam capacity, located at two stations, is comprised of two coal-fired units. East bend Unit 2, the larger of the two coal-fired steam units, is jointly owned with Dayton Power & Light. Duke Kentucky operates East Bend Unit 2. It owns 69 percent of the unit. The peaking capacity consists of six gas-fired combustion turbines ("CTs") located at one station that have propane as a back-up fuel. Duke Kentucky's existing electric generating facilities are identified in Table 1, below.

TABLE 1

SUMMARY OF EXISTING ELECTRIC GENERATING FACILITIES

STATION NAME & LOCATION	FOOT NOTE	UNIT	TYPE OF UNIT	DATE INSTALLED YEAR	TENTATIVE RETIREMENT YEAR	MAXIMUM GENERATING CAPABILITY (net MW) SUMMER	WINTER	ENVIRONMENTAL PROTECTION MEASURES
East Bend Boone Co. Kentucky	A	2	CF-S	1981	Unknown	414	414	EP, LNB, TRO, Scrubber, SCR, CT & SO_2
Miami Fort North Bend Ohio		6	CF-S	1960	Unknown	163	163	EP, LNB, & OFA
Woodsdale	B	1	G/PF-GT	1993	Unknown	83.43	94.0	WI
Trenton	B	2	G/PF-GT	1992	Unknown	83.43	94.0	WI
Ohio	B	3	G/PF-GT	1992	Unknown	83.43	94.0	WI
	B	4	G/PF-GT	1992	Unknown	83.43	94.0	WI
	B	5	G/PF-GT	1992	Unknown	83.43	94.0	WI
	B	6	G/PF-GT	1992	Unknown	83.43	94.0	WI
					Station Total	500.6	564.0	
				TOTAL		1,077.6	1,141.0	

Legend

CF=Coal Fired	S=Steam	EP=Electrostatic Precipitator
G/PF= Gas / Propane Fired	GT=Simple Cycle CT	SCR=Selective Catalytic Reduction
WI=Water Injection, NO_X	LNB=Low NO_X Burners	TRO=Trona Injection System
OFA=Overfire Air	CT=Cooling Towers	

Footnotes

(A) Unit 2 is co-owned by Duke Energy Kentucky (69%-Operator) and The Dayton Power and Light Company (31%)

(B) Unit Ratings at Ambient Temperature: Summer – 90 deg F; Winter – 20 deg F and include inlet misting capability

The oldest units on Duke Kentucky's system are Miami Fort Unit 6, which is 48 years old, and East Bend Unit 2, which is 27 years old. Duke Kentucky does not have any current plans to retire either of these units within the 20-year time frame of this IRP.

Reliability Criteria

A reserve margin is required in order for a utility to have sufficient capacity available to allow for (1) unexpected loss of generation, (2) reduced generation capacity due to equipment problems, (3) unanticipated load growth, (4) variances in load due to extreme weather conditions, and (5) disruptions in contracted purchase power. A utility's required reserve capacity can be supplied via its own generation, purchased power, or a combination thereof. "Reserve Margin" is derived as follows:

Reserve Margin Percent = (Total Supply Capability – Peak Load)/ Peak Load

At the time the IRP was filed, Duke Kentucky was a member of the Midwest Planning Reserve Sharing Group ("PRSG"). On February 5, 2008, PRSG issued its preliminary report showing the required reserve margin targets for the June 2008 - May 2009 planning year. The reserve margin target for the zone in which Duke Kentucky is located is 14.3 percent. Since this was the first year the Midwest PRSG has performed this type of study, Duke Kentucky stated that it believed that many refinements to assumptions and methodologies will be incorporated in future studies. Duke Kentucky believes that some of the assumptions in the study tended to bias the results toward producing a lower reserve margin.

Duke Kentucky also explained that FERC has approved a Midwest ISO proposal for long-term resource adequacy. It stated that, once in place, the proposal would require load-serving entity ("LSE") market participants in the Midwest ISO region to have and maintain access to sufficient planning resources. The Midwest ISO would establish a Planning Reserve Margin based on a Loss of Load Expectation ("LOLE") study using the 1 day in 10 year standard. The initial planning year would be from June I, 2009, through May 31, 2010. Duke-Kentucky anticipates that the Midwest ISO LOLE study process will essentially replace the Midwest PRSG study process.

Under the LOLE process, the capacity toward reserves will be adjusted by the unit-specific Equivalent Forced Outage Rates exclusive of outside management control which may change the amount of reserves each LSE is required to carry. Units with better availability will be credited with higher capacity value compared to units with poorer availability. Duke Kentucky, therefore, plans to continue to use a reserve margin target of 15 percent until the LOLE process has matured.

Duke Kentucky is also required to meet NERC reliability standards related to Contingency Reserves. Duke Kentucky is required to maintain a Contingency Reserve requirement of 11 MW, 45 percent of which must be Spinning Reserve that is on-line. The remainder can be Non-Spinning Reserve that is capable of being supplied within ten minutes. Currently these needs are met through the Midwest Contingency Reserve Sharing Group Agreement.

In addition, on a day-ahead basis, Duke Kentucky stated that it plans to maintain regulating reserves generally based on one percent of the projected peak load for the next operating day to provide on-line generation for load and frequency regulation.

In Case No. 2003-00252,[7] as part of the acquisition of generating facilities, Duke Kentucky proposed that a back-up power supply plan was necessary in the event it experienced outages with its generating facilities. On January 23, 2007, Duke Kentucky, Inc. submitted its application seeking Commission approval of a three-year back-up power supply plan. Duke Kentucky's 2007-2009 back-up power supply plan, which was approved by the Commission's Order in Case No. 2007-00044,[8] expired December 31, 2009. Duke Kentucky's back-up power supply plan for the period 2010-2012 was authorized by the Commission on December 22, 2009.[9]

Duke Kentucky's current back-up power supply is basically unchanged from the previous plan and consists of capacity purchases through bilateral contracts and energy purchases through the Midwest Independent Transmission System Operator's daily energy markets, with forward contracts purchased through the Intercontinental Exchange for scheduled outages.

Supply-Side Evaluation

A diverse range of technology choices utilizing a variety of different fuels was considered by Duke Energy. The technology includes pulverized coal units, Integrated Gasification Coal Combustion ("IGCC") units, CTs, combined cycle units, and nuclear units. In addition, renewable technologies such as winds, biomass, hydro, animal waste, and solar were screened.

Cogeneration

According to Duke Kentucky, customers make cogeneration decisions based on their particular economic situations and, therefore, it does not attempt to forecast specific levels of cogeneration activity in its service area. Duke Kentucky stated that cogeneration facilities built to affect customer energy and demand served by the utility

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[7] Case No. 2003-00252, Application of The Union Light, Heat and Power Company for A Certificate of Public Convenience and Necessity to Acquire Certain Generation Resources and Related Property; For Approval of Certain Purchase Power Agreements; For Approval of Certain Accounting Treatment; and For Approval of Deviation From Requirements of KRS 278.2207 and 278.2213(6) (Ky PSC Dec. 5, 2003)

[8] Case No. 2007-00044, Back-up Power Supply Plan of Duke Energy Kentucky, Inc. (Ky. PSC Mar. 29, 2007).

[9] Case No. 2009-00429 Back-Up Power Supply Plan of Duke Energy Kentucky (Ky.PSC Dec. 22, 2009).

are captured in the load forecast. Duke Kentucky further stated that cogeneration built to supply the electric network represent additional regional supply capability. Finally, Duke Kentucky stated that as purchase contracts are signed, the resulting energy and capacity supply will be reflected in future plans.[10]

Based on the results of the screening curve analysis, the renewables that were included in the System Optimizer model were the Wind and Poultry Waste ("Animal Waste") technologies since these were the most economic of all of the renewables.[11] However, the availability of these kinds of resources for Duke Kentucky was not considered in this IRP analysis.[12]

Renewables

The IRP's Executive Summary identified several significant changes since Duke Kentucky's prior IRP. Among them was the increased potential for federal Renewable Portfolio Standard ("RPS") legislation. Duke Kentucky cited the fact that one version of the law passed in 2007 known as the Energy Independence and Security Act ("EISA 2007"), included a 15 percent RPS that allowed energy efficiency to provide up to 25 percent of the requirement. Duke Kentucky believes that because bills that would mandate RPS continue to be introduced in Congress, the eventual imposition of some kind of RPS appears more likely than in past years. Since the imposition of an RPS will impact the resource mix and costs to serve its customers, Duke Kentucky included in its IRP an analysis of a sensitivity concerning the impact of a potential RPS requirement.[13]

Duke Kentucky also discussed renewable or alternative fuels in the IRP. It cited Duke Energy's continued research of co-firing biomass in its existing generating units. Duke Energy has historically supported the Electric Power Research Institute ("EPRI") and other research organizations in developing new economically-competitive, environmentally-conscious sources of energy.

Duke Kentucky explained that it will continue to explore fuels that can compete with coal for the lowest cost production of electricity. Technologies being considered are Refuse-Derived Fuel ("RDF"), Tire-Derived Fuel ("TDF"), and advanced coal slurry. Duke Kentucky's Fuels Department monitors potential changes in mining methodologies and the availability of different fuels. To the extent that any of these potential changes has an influence on the IRP, they have been incorporated.

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[10] 1-18 to 1-19.

[11] System Optimizer is a computer model that analyzes the economics of resource utilization.

[12] 8-9.

[13] Application, 1-6.

The focus of Duke Kentucky's fuel-related R&D efforts is to develop leading edge technologies and provide information, assessments, and decision-making tools to support fossil power plants in reducing their costs for fuel utilization and managing environmental risk.[14]

Duke Kentucky stated that renewable technologies such as wind, biomass, hydro, animal waste, and solar received a greater focus in this IRP's screening analysis.[15] Due to recent interest in several states of adopting RPS, which has led to a deeper investigation into renewable technologies, it compiled data from over a dozen sources on eight broad categories of renewable technologies and six subcategories within thee eight. Data from five wind projects was also included in this compilation. The following renewable technologies were added to the screening analyses.

Poultry Waste,
Fluidized Bed Biomass,
Solar Photovoltaic,
Solar Thermal Gas Hybrid,
Hog Waste Digester, and
Wind.[16]

In its supply-side screening analysis, Duke Kentucky used a relative dollar per kilowatt-year versus capacity factor in a spreadsheet-based screening curve model developed by Duke Energy. This model calculates the fixed costs associated with owning and maintaining a technology type over its lifetime.[17]

Based on the analysis performed by Duke Kentucky, Wind appeared to be the least cost renewable alternative followed by Poultry Waste and Solar Thermal Gas Hybrid. Fluidized Bed Biomass is generally the next least costly alternative up to the 85 percent capacity factor range where the Hog Waste Digester appears to be the more economic of the two. Duke Kentucky noted that there was a gradual emergence of renewable and alternative resource technologies in the Duke Energy Midwest service territory and it briefly addressed each alternative technology.[18]

According to Duke Kentucky, commercial wind developers are currently investigating the wind resource regions in Northwestern Indiana. At heights, usually in the 80 to 100 meters above ground level, a phenomenon of the Midwest Low Level Jet stream known as "wind shear" provides a better wind resource which leads to improved

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[14] 5-9.

[15] 5-24.

[16] 5-28.

[17] 5-28 to 5-29.

[18] 5-32 to 5-33.

capacity-utilization factors for wind turbines. However, higher towers require additional capital costs for tower material and larger tower foundations. In addition to additional capital costs, the actual capacity that would be available from wind resources generally does not coincide with Duke Kentucky's power supply system requirements. As it explained, at the time of summer peak, when capacity is needed the most, the available wind resource is significantly less or not available at all. Considerably more capacity at a correspondingly higher capital cost would need to be installed for the wind capacity to be equivalent to the dispatchable capacity of a conventional technology resource, with no guarantee that the wind power resources will be available when needed.[19]

According to Duke Kentucky, solar energy continues to grow in popularity throughout the world with either government RPS mandates or good solar power density. Duke Energy Midwest is continuing to study solar power and use demonstration projects to promote and raise awareness of solar technology. Two types of solar power, Solar Photovoltaic and the Solar Thermal Gas Hybrid, were included in the analysis of renewable resources. However, when considering current costs, Duke Kentucky concluded that solar power is still not cost competitive for bulk power production in the Midwest even when only compared to other renewable resources.[20]

Landfill gas, a source of alternative energy that generally has high levels of contaminants and a low heat content resulting in a quality far below that required for pipeline-quality natural gas, was also considered. Duke Kentucky explained that it is preferred to collect and transport this low-Btu gas short distances where it can be used in a "landfill to boiler" activity. It is generally best suited for use in various manufacturing processes of private enterprise ventures and not for utility-scale projects. According to Duke Kentucky, only a small number of private companies currently utilize landfill gas within Duke Energy Midwest's service territory. Generally, landfill gas is consumed as boiler fuel, or to generate power on a small scale, which is introduced into the grid at the distribution voltage level.[21]

Another alternative resource considered was Biogas, a fuel generally associated with waste water treatment plants or anaerobic digesters at large livestock operations (large dairy or hog operations). This type of power generation is complimentary to the primary operation of waste treatment facilities. The environmental benefits of a reduction in the land application of manure are also ancillary benefits of this type of power generation. Duke Kentucky included a Hog Waste Digester in the renewables screening analysis but noted that Poultry Waste is a related technology.[22]

[19] 5-33 to 5-34.

[20] 5-34 to 5-35.

[21] 5-35.

[22] Id.

Municipal Solid Waste ("MSW') combustion was also considered in the economic screening analysis. Duke Kentucky explained that MSW combustion is rarely done solely to produce energy but to offset the need for landfilling. In most instances, the energy sales help to offset some of the costs associated with MSW combustion. There are some drawbacks to MSW combustion. Siting a MSW combustion facility may generate local opposition. In addition, most states and national green energy certifying organizations do not consider MSW combustion a renewable source of energy eligible to meet RPS.[23]

Dedicated biomass energy production, in this case, Fluidized Bed Biomass technology, was the last alternative technology included in the economic screening analysis. According to Duke Kentucky, such facilities are limited by the availability of fuel which, due to low heat content, can be cost-prohibitive if transported more than about 50 miles. In addition, use of the fuel in an existing pulverized coal power plant can result in material handling and storage problems. Additional expense can also be incurred at high blend ratios due to the need to upgrade fuel handling and feed systems designed for pulverized coal, in addition to unit derates due to low heat content. However, while the limitations negatively impact both the size and economics of biomass energy production in existing power plants, Duke Kentucky notes that in areas where biomass is available and in close proximity to existing power plants, co-firing biomass in existing coal-fired boilers in relatively low blend ratios may be one of the most economical ways for utilities to meet RPS requirements.[24]

Duke Kentucky stated that greater interest in renewable energy resources relating to climate change in recent years has caused many states to adopt RPS requirements or goals. Therefore, despite renewables generally not being economic in comparison to more traditional technologies, alternative technologies were included as part of the screening process to allow an economic comparison between the different technologies and to allow sensitivity analyses around base assumptions to be performed.[25]

Hydro Resources

Since any new hydro resources would be site-specific, Duke Kentucky normally evaluates both pumped storage capacity and run-of-river energy resources on a project-specific basis. No hydro resources of either type were included in the screening analysis for this IRP.[26]

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[23] 5-36.

[24] 5-36 to 5-37.

[25] 5-37.

[26] 5-37.

Nonutility

For the period from 2008 through 2028, Duke Kentucky shows no power purchases from other utilities or from any nonutility sources.[27] In addition, it did not identify any net-metering customers or distributed generation applications in its IRP.

Coordination with Other Utilities

Duke Kentucky stated that decisions related to coordinating the construction and operation of new units with other utilities or entities are dependent on a number of factors including the size of the unit, each utility's capacity requirement and the timing of the need for facilities. Duke Kentucky did not identify any plans to undertake such coordination in this IRP. However, it did state that it will consider co-ownership if it becomes economically viable. Duke Kentucky also noted that coordination with other utilities can also be achieved through purchases and sales in the bulk power market but, as previously stated, it did not identify any power purchases in this IRP.

Duke Kentucky indicates that for the IRP screening analyses, technology types were screened within their own general category of baseload, peaking/intermediate, and renewable. The best alternatives from each of these three categories will pass to the integration process. The cost and performance data for each technology being screened are based on information provided by the following: Duke Energy's New Generation Team, Duke Energy Analytical and investment Engineering group, the EPRI Technology Assessment Guide, studies performed by and/or information gathered from entities such as the DOE, LaCapara, Navigant, and Firbrowatt.

The following is a brief description of technologies eliminated and the logic for their exclusion:[28]

- Geothermal technologies were eliminated because there are no suitable geothermal resources in the region to develop into a generation project.

- Advanced battery storage technologies remain relatively expensive and are generally suitable for small scale emergency back-up and/or power quality applications with short-term cycles of three hours or less. In addition, the current energy storage capability is generally 100 MWh or less. Research, development, and demonstration continue, but this technology is generally not commercially available on a larger utility scale.

- Compressed Air Energy Storage ("CAES"), although demonstrated on a utility scale and generally commercially available, is not a widely applied technology. This is because suitable sites that possess the proper geological formations and conditions necessary for the compressed air storage reservoir are relatively scarce.

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[27] Table 8.(4)(b), Forecast Annual Energy (GWh), SA-18, Secondary Appendix.

[28] Duke Energy Kentucky 2008 INTEGRATED RESOURCE PLAN, July 1, 2008, pages 5-26 through 5-27, Technical Screening.

- Coal-fired Circulating Fluidized Bed combustion is a conventional commercially-proven technology. However, boiler size remains generally limited to 300-350 MW, typically reducing any advantages in lowering the installed capital cost per kilowatt for large scale baseload unit sizes. In addition, the U. S. EPA's new source performance standards ("NSPS") requirements generally dictate that post-boiler flue gas clean-up equipment must be installed to meet those standards when burning coal, which effectively eliminates one of the advantages of this technology. These issues cause it to be a relatively high-cost baseload alternative on a utility scale. Nevertheless, it is still a viable technology on a utility scale to burn low-grade or "waste" coals and may be economic if long-term supplies of relatively low cost fuels of this type can be secured.

- Fuel Cells, once envisioned as a competitor for combustion turbines and central power plants, are now targeted mainly to distributed power generation systems. The size of the systems ranges from a few kilowatts to tens of megawatts in the long-term. Cost and performance issues have generally limited their application to niche markets and/or subsidized installations. While a medium level of research & development continues, the technology is not commercially available for utility-scale application.

Duke Kentucky believes some kind of RPS will be imposed on electric utilities in the future. Therefore, it added the renewable technologies Poultry Waste, Fluidized Bed Biomass, Solar Photovoltaic, Solar Thermal Gas Hybrid, Hog Waste Digester, and Wind to the screening analysis.

The results of the screening within each category are:

1. For the baseload technologies category, nuclear becomes economic compared to pulverized coal at about a 70 percent capacity factor.

2. For the peak/intermediate technologies category, the simple-cycle CT is the more economical up to a 15 percent capacity factor and a combined cycle unit is the more economical over the rest of the capacity factor range.

3. For the renewable technologies category, wind appears to be the least cost alternative. Poultry waste and solar thermal gas hybrid are relatively close with poultry waste the more economic of the two in all cases but a small band of capacity factors from about 25 percent to about 30 percent.

All technologies in the final screening were passed to the System Optimizer integration portion of the analysis. The selected supply technologies screened were:

1. 100 MW wind (renewable)
2. 80 MW solar thermal gas hybrid (renewable)
3. 2 x 1,117 MW nuclear
4. 4 x 160 MW simple-cycle CT
5. 800 MW supercritical coal
6. 10 x 5 MW solar photovoltaic – fixed flat plate (renewable)

7. 75 MW fluidized bed biomass (renewable)
8. Hog waste digester (renewable)
9. 460 MW unfired + 120 MW duct fired + 40 MW inlet chilling CC: 620 MW total
10. Poultry waste (renewable)
11. 460 MW unfired + 4 MW inlet chilling CC: 500 MW total
12. 630 MW class IGCC coal

Once the screening processes were complete, demand-side and environmental compliance options were integrated into a set of resource plans. System Optimizer and Planning and Risk were the models used in the final integration process. The sensitivities addressed at the integration stage were higher gas and coal price forecasts, higher capital costs for unit alternatives, changes in the level of service area load, changes in regulatory requirements, and increased environmental regulations or rules, including a sensitivity with a higher CO_2 tax/allowance price and a RPS. Based on the results of the screening analyses and sensitivity analyses, Table 2, below, shows the type and the size of capacity Duke Kentucky will need in the future (2008-2028).

TABLE 2

DUKE ENERGY KENTUCKY INTEGRATED RESOURCE PLAN

2008-2028

YEAR	PURCHASES/UNIT ADDITIONS
2008	
2009	
2010	
2011	
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	Install New CT (35 MW)
2020	
2021	
2022	
2023	Install New CT (35 MW)
2024	
2025	
2026	
2027	Install New Nuclear (35 MW)
2028	

Since no additional capacity is needed until 2019, Duke Kentucky indicates that no decisions concerning additional supply-side resources are necessary over the next three years. It will continue to evaluate its resource requirements. Future capacity needs can be fulfilled by purchases from the market, cogeneration, or other capacity that may be economical at the time decisions to acquire new capacity are required. Tables 3 and 4 show Duke Kentucky's "Supply vs. Demand Balance" for summer and winter loads.

TABLE 3

SUPPLY VS. DEMAND BALANCE
(Summer Capacity and Loads)

YEAR	INITIAL CAPACITY	INCR CAPACITY ADDITIONS	INCR CAPACITY RETIRE/ DERATES	TOTAL CAPACITY	PEAK LOAD	EISA LIGHT IMPACT	INCR CONSERV	DEMAND REPONSE	NET LOAD	RES MAR (%)	PURCHASES NEEDED TO MEET 15% RM
2008	1077	0	0	1077	871	0	0	-11	859	25.3	(89)
2009	1077	0	0	1077	880	0	-1	-13	866	24.3	(81)
2010	1077	0	0	1077	889	0	-1	-14	874	23.3	(72)
2011	1077	0	0	1077	907	0	-2	-14	891	20.9	(53)
2012	1077	0	-1	1076	918	-8	-2	-14	893	20.5	(49)
2013	1076	0	0	1076	928	-15	-3	-14	896	20.1	(46)
2014	1076	0	0	1076	938	-23	-3	-14	898	19.9	(44)
2015	1076	0	0	1076	948	-25	-3	-14	905	18.8	(35)
2016	1076	0	0	1076	958	-23	-4	-14	917	17.3	(21)
2017	1076	0	0	1076	968	-28	-4	-14	922	16.7	(16)
2018	1076	0	0	1076	978	-29	-4	-14	931	15.6	(5)
2019	1076	35	0	1111	987	-30	-4	-14	939	18.3	(31)
2020	1111	0	0	1111	995	-32	-4	-14	945	17.6	(24)
2021	1111	0	0	1111	1004	-28	-4	-14	958	16.0	(9)
2022	1111	0	0	1111	1013	-28	-4	-14	967	14.9	1
2023	1111	35	0	1146	1021	-32	-4	-14	971	18.0	(29)
2024	1146	0	0	1146	1030	-32	-4	-14	980	16.9	(19)
2025	1146	0	0	1146	1038	-32	-4	-14	988	16.0	(10)
2026	1146	0	0	1146	1046	-32	-4	-14	996	15.1	(1)
2027	1146	35	0	1181	1053	-28	-4	-14	1007	17.3	(23)
2028	1181	0	0	1181	1061	-33	-4	-14	1010	16.9	(19)

TABLE 4
SUPPLY VS. DEMAND BALANCE
(Winter Capacity and Loads)

YEAR	INITIAL CAPACITY	INCR CAPACITY ADDITIONS	INCR CAPACITY RETIRE/ DERATES	TOTAL CAPACITY	PEAK LOAD	ENERGY SECURITY ACT LIGHTING IMPACTS	INCR CONSERV	DEMAND RESPONSE	NET LOAD	RES MAR (%)	PURCHASES NEEDED TO MEET 15% RM
2008 2009	1141	0	0	1141	767	0	-1	0	766	49.0	(260)
2009 2010	1141	0	0	1141	773	0	-2	0	771	48.0	(254)
2010 2011	1141	0	0	1141	787	0	-3	0	784	45.5	(239)
2011 2012	1141	0	0	1141	794	-6	-4	0	784	45.5	(239)
2012 2013	1141	0	-1	1140	802	-12	-5	0	785	45.1	(237)
2013 2014	1140	0	0	1140	809	-18	-5	0	786	45.1	(236)
2014 2015	1140	0	0	1140	816	-19	-6	0	791	44.1	(230)
2015 2016	1140	0	0	1140	824	-20	-6	0	798	42.9	(223)
2016 2017	1140	0	0	1140	831	-21	-7	0	803	42.0	(216)
2017 2018	1140	0	0	1140	838	-23	-7	0	808	41.1	(211)
2018 2019	1140	0	0	1140	845	-24	-7	0	814	40.0	(204)
2019 2020	1140	38	0	1178	851	-25	-7	0	819	43.8	(236)
2020 2021	1178	0	0	1178	857	-25	-7	0	825	42.7	(229)
2021 2022	1178	0	0	1178	863	-25	-7	0	831	41.7	(222)
2022 2023	1178	0	0	1178	869	-25	-7	0	837	40.7	(215)
2023 2024	1178	38	0	1215	875	-25	-7	0	843	44.1	(245)
2024 2025	1215	0	0	1215	881	-25	-7	0	849	43.1	(239)
2025 2026	1215	0	0	1215	886	-26	-7	0	853	42.4	(234)
2026 2027	1215	0	0	1215	892	-26	-7	0	859	41.4	(227)
2027 2028	1215	35	0	1250	897	-26	-7	0	864	44.7	(256)

Compliance Planning

In March 2005, the EPA issued the Clean Air Interstate Rule ("CAIR"). CAIR requires NO_x and SO_2 emissions to be cut by 65 percent and 70 percent respectively by 2015, with the first phase of reductions by 2009.

Upgrades to the original Flue Gas Desulfurization ("FGD") system at East Bend Unit 2, and installation of advanced low NO_x burners with over-fire air at Miami Fort Unit 6 were necessary to comply with CAIR rules. These projects have been completed and are in service. Duke Kentucky indicated that the Selective Catalytic Reduction ("SCR") equipment on East Bend Unit 2 would be required to operate annually beginning on January 1, 2009. It was also planning to operate the East Bend SCR in 2008 in order to earn CAIR annual NO_X Compliance Supplement Pool Allowances.

Duke Kentucky plans to manage emissions risk through purchasing allowances, installing equipment, and purchasing power. It indicates that the most economic decision will depend upon the current and forecasted market price of allowances, the cost and lead-time to install control equipment, and the current and forecasted market price of power. The most economic emission compliance strategy will be employed.

<u>Efficiency Improvements -Generation</u>

Potential equipment repairs, replacement of components, and efficiency changes at existing generating units are evaluated for cost-effectiveness during Duke Kentucky's annual budgeting process. It does not include smaller-scale changes in the context of the IRP integration process due to modeling limitations. However, the routine economic evaluation of these smaller-scale changes is consistent with that utilized in the overall IRP process. Duke Kentucky believes that the outcome and validity of the IRP have not been affected by its approach.[29] It assumed for this IRP that its generating units will continue to operate at present availability and efficiency (heat rate) levels.[30]

Duke Kentucky's intent is to maintain its generating units at their current levels of efficiency and reliability. Improvements to the FGD system at East Bend resulted in increased SO_2 removal. Duke Kentucky evaluates the cost effectiveness of maintenance options on various individual components of its existing generating units. If the potential maintenance options prove to be cost justified, they will be budgeted and undertaken during a scheduled unit maintenance outage.[31]

Duke Kentucky monitors the efficiency and availability of its generating units. Projects that are intended to maintain the long term performance of the units are planned, evaluated, selected, budgeted, and executed.

Projects cited include:

- combustion and steam turbine generator overhauls;
- condenser cleanings and condenser system repairs, such as cooling tower rebuilds and vacuum and circulating water pump rebuilds;
- burner replacement;
- coal pulverizer overhauls;
- combustion tuning;
- secondary air heater basket material replacements;
- boiler tube section replacements;
- pollution control equipment maintenance, such as SCR catalyst replacement and FGD slurry pump rebuilds.

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[29] Application, Volume I, Section 1, Executive Summary, at 1-18.

[30] Id., Section 5, Supply-Side Resources, at 5-2.

[31] Id., at 5-10.

Duke Kentucky stated that it looks for opportunities to improve the overall performance of its units, including targeted projects for generating unit efficiency improvements. It also stated that Duke Energy has initiated an internal, voluntary greenhouse gas reduction initiative that involves targeted efficiency improvement projects at various generating units across the Duke Energy system, including those in Kentucky and Ohio.

Examples of these projects include:

- circulating water pump and condenser;
- system improvements;
- improvements in steam cycle isolation;
- reductions in boiler system air in-leakage;
- combustion system advanced controls tuning.

Duke Kentucky cautions that plans to increase fossil fuel generation efficiency must be viewed in light of regulatory requirements, specifically EPA's new source review rules which have been subject to interpretation and change over the years. It stated that it plans routine maintenance, which may maintain or increase efficiency of its generation, in the context of such requirements. Therefore, plans are subject to change depending on the changing regulatory environment and rules related to new source review.[32]

Duke Kentucky stated that the technology available to meet environmental regulations adds constraints to the power plant fuel cycle and also requires energy to operate. The result is a reduction in load capability, lower overall efficiency and lost capacity that must be replaced. Another potential effect of meeting environmental regulations can be to degrade the reliability (i.e., the availability) of each generating unit by increasing the complexity of the overall system. This could translate into a cost to replace the unavailable capacity in terms of new resource acquisitions.[33]

Efficiency Improvements - Transmission and Distribution

Duke Kentucky owns electric transmission and distribution systems in portions of Kenton, Campbell, Boone, Grant, and Pendleton counties of Northern Kentucky. It also contracts with the Midwest ISO for bulk transmission service to transport electric power from Duke Kentucky's plants and from outside the Duke Energy Midwest system for delivery to Duke Kentucky's distribution system and end-use retail customers.[34]

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[32] Id., at 5-11 to 5-12.

[33] Id., at 5-12.

[34] Id., Section 1, Executive Summary, at 1-1 to 1-2.

Duke Kentucky has no current transmission system projects, planned or in-progress, intended to provide additional resources. It states that changes to its transmission system are based on meeting planning criteria, which are intended to provide reliable system performance in a cost-effective manner.[35]

Discussion of Reasonableness

Generally, Commission Staff finds that Duke Kentucky's supply-side resource assessment is balanced, thorough and well-reasoned. Duke Kentucky's consideration and analysis of various generation technologies covers a broad range of alternatives in a relatively in-depth manner. Staff expects to continue to see this type of assessment in Duke Kentucky's future IRPs.

For its next IRP, Staff makes the following recommendations concerning Duke Kentucky's supply-side resource assessment:

- In the next IRP, Duke Kentucky should specifically discuss the existence of any cogeneration within its service territories and the consideration given to cogeneration in the resource plan.

- Duke Kentucky should specifically identify and describe the net metering equipment and systems installed. A detailed discussion of the manner in which such resources are considered in its next IRP should also be provided.

- Duke Kentucky should provide a detailed discussion of the consideration given to distributed generation in its next IRP.

- Duke Kentucky should provide a specific discussion of the improvements to and more efficient utilization of transmission and distribution facilities as required by 807 KAR section 8 (2)(a). This information should be provided for the past three years and should address Duke Kentucky's plans for the next three years.

[35] Application, Volume II, Section 5. (4), Planned Resource Acquisition Summary, at II-1.

SECTION 5

INTEGRATION AND PLAN OPTIMIZATION

The final step in the IRP process is the integration of supply-side and demand-side options to achieve the optimal resource plan. This section will discuss the integration process and the resulting Duke Kentucky plan.

The Integration Process

Duke Kentucky developed its ultimate resource assessment and acquisition plan based on minimizing expected Present Value Revenue Requirements ("PVRR") over a 21-year planning horizon (2008-2028). Differences were evaluated by changing assumptions and calculating the total PVRR based on the changes with a smaller PVRR as the objective.

Duke Kentucky's planning analysis was performed using modules of the Ventyx System Optimizer model and the Ventyx Planning and Risk computer model. The plan includes analyses of reserve margin requirements, supply-side resources, demand-side resources and compliance options.

System Optimizer is a computer model that analyzes the economics of resource utilization. The model assesses the cost and benefits related to the use of conventional units, renewable resources, DSM resources, and compliance alternatives such as retrofits to existing units.

System Optimizer selects the most economic plan by assessing the cost and reliability effects of load modification by DSM or the addition of supply side resources. By also modeling emission related constraints, environmental compliance strategies can be integrated with DSM and supply side resources options. Emission rates are integrated using penalty cost adders. The adders are calculated using emission allowance prices and a unit's specific emissions rate.

Duke Kentucky also uses Planning and Risk, a production costing model to simulate a plant's production. Planning and Risk provides a facilities operating cost projection using inputs such as unit, fuel, load, DSM, emission levels and allowance cost data.

MARKETSYM is a proprietary system used by Duke Kentucky to forecast market power prices. Duke uses MARKETSYM to provide emissions allowance and fuel prices and long term price forecasts. This information assists in determining cost recovery projections.

Duke uses an engineering environmental compliance planning and screening model to determine the most economic compliance options to be considered by the System Optimizer. This model uses unit characteristics and market information to calculate dispatch costs.

Summary of Results

For the purposes of its integration process, Duke Kentucky included nuclear units as possible resources. This provides a broader look at potential resources, especially with potential impending carbon emissions regulation. Currently, the Commonwealth of Kentucky has a moratorium on nuclear power plants.

Changes in environmental regulatory requirements, service area load, and gas and coal prices are addressed through sensitivity studies. A high load forecast with higher load based upon load growth assumptions was studied. Growth rates for peak demand and energy are set at 0.8 percent and 0.9 percent, versus 0.8 percent and 0.8 percent respectively in the base forecast, for this scenario. In the low load/high level of renewables forecast growth rates are set at 0.8 percent and 0.7 percent for peak demand and energy. This sensitivity can also be used to determine the effects of high renewables as a reduction in load level may be due to lower net load served after renewables rather than a decreasing load rate. A sensitivity using higher gas prices was performed to illustrate the economics associated with fluctuations in gas prices. A sensitivity analysis with ten percent higher coal prices was also performed.

Duke Kentucky expects that cost control mechanisms will be incorporated into any climate change legislation designed to prevent high emission allowance prices and limit price volatility. Given the uncertainty of the price levels associated with such price control mechanisms, the analysis performed considered a range of possible prices.

A sensitivity analysis was performed with no carbon tax assumed. Analysis was performed to show the effects this might have on fuel and market prices and load levels.

Only in one case, the sensitivity with no carbon tax, were coal resources added. Supply side resources in the final plan consisted of gas-fired CTs, renewables, or nuclear units. While these are basically placeholders and economic factors at the time of the additions will drive the decision regarding what sources to use, this may be an issue in Kentucky which predominantly relies of coal as a fuel for electricity generation.

Another sensitivity performed using a 15 percent RPS included various levels of multiple renewable resources. Resources considered included biomass, hydro, solar, wind, and landfill gas. Sensitivity analyses were also conducted for the reinstatement of cap and trade for mercury regulation instead of MACT, and a determination of the resources needed if there were no efficiency or demand response programs.

Specifics of the Supply-Side Analyses

The portfolio analysis phase compared 1) the Gas / Nuclear / Energy Efficiency portfolio; 2) the Coal / Nuclear / Energy Efficiency portfolio; and 3) the High Renewables / EE portfolio. The Gas / Nuclear / Energy Efficiency portfolio, based upon the base case load forecast, consists of two CTs added in 2019 and 2023 (35 MW each) and a 35 MW nuclear unit in 2027. The Coal / Nuclear / Energy Efficiency portfolio has a 35 MW coal unit in 2019, a 35 MW CT unit in 2023 and a 35 MW nuclear unit in 2027. The

High Renewables / Energy Efficiency portfolio resources include two 50 MW wind plants in 2010 and 2013, and two 35 MW animal waste units in 2017 and 2020.

Several environmental regulatory requirements could affect Duke Kentucky's forecast. National ambient air quality standards, revised in 2008, require states to use pollution controls to reduce emissions that lead to ozone creation. Requirements will compel affected states to file implementation plans by 2013. Compliance will be required to comply with new emission reductions between 2015 and 2030.

Specifics of the DSM Analysis

The present value for each DSM alternative was calculated in this analysis based on the five California Tests which have been employed historically in the evaluation of DSM alternatives. These are the participant test, the utility cost test, the ratepayer impact measure, the total resource cost test, and the societal cost test. The results of this quantitative analysis indicated that Duke Kentucky's existing 11 programs: Residential Conservation and Energy Education; Residential Home Energy House Call; Residential Comprehensive Energy Education Program ("NEED"); Program Administration, Development & Evaluation Funds; Payment Plus; Power Manager; Energy Star Products; Energy Efficiency Website; Personal Energy Report; C&I High Efficiency Incentive; and PowerShare; should be considered in the integrated analysis, where DSM programs are evaluated together with supply-side alternatives.

Overall Plan Integration

After sensitivity analyses were conducted on the three portfolios it was apparent that the Gas / Nuclear / Energy Efficiency portfolio was the least cost option, with Coal / Nuclear / Energy Efficiency second and High Renewables / Energy Efficiency much higher in cost.

Iterations of the base case analysis show a need for Fabric Filter/Activated Carbon Injection ("ACI")[36] environmental compliance alternative for Miami Fort Unit 6, combined cycle units installed in 2019 and 2023 and a nuclear unit installed in 2027. The base case analysis shows that these supply additions, in conjunction with the DSM programs that passed the quantitative screening, produced the optimal resource plan.

Staff is generally satisfied with Duke Kentucky's responses and the information contained therein. It believes these responses adequately address the previous recommendations. All of Staff's recommendations for Duke Kentucky's next IRP filing are contained in Sections 2, 3 and 4 of this report.

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[36] Mercury control at Miami Fort Unit 6 would probably be provided by a fabric filter or "baghouse" with ACI. The fabric filter collects particulates from the flue gas stream. As solid particles accumulate they absorb vapor compounds. This occurs as the stream passes through the built up filter "cake". When an absorbing agent such as activated carbon is injected upstream of the filter and accumulates on the filter surface it becomes an effective means of removing mercury.