**DATA REQUEST**

**KPSC 1_01** Refer to the IRP, pages ES-1 and 2. Provide the year and amount of Kentucky Power's highest annual energy requirement.

**RESPONSE**

Kentucky Power's peak amount of internal energy requirements occurred in 2005 with 8,071.9 GWh.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_02** Refer to the IRP, page ES-2.
a.Explain any changes in the forecasted load for the industrial classfrom the 2016 IRP to the current IRP.
b.Over the next 15 years, Kentucky Power's sales forecast is relatively flat. Explain whether this projection takes into account the cancellation of Enerblu, the uncertainty surrounding Brady Industries, and the recent economic events surrounding COVID-19. If not, explain how the sales projection would differ after accounting for these events.

**RESPONSE**

a. The forecasted industrial load in the 2019 IRP was a little weaker than forecast in the 2016 IRP. This is principally due to continued weakness in the mining industries and a plant closure.

b. Enerblu was not included in the 2019 IRP industrial load forecast. Braidy Industries was included at a discounted value to reflect risk. The economic events related to COVID-19 were not included as this event occurred well after the development of this forecast. See the response to Staff 1-10 for a discussion of COVID-19 impacts.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_03** Refer to the IRP, page ES-3, at which it states, in relevant part, the Plexos® modeling was performed through the year 2049, so as to properly consider various cost-based "end-effects" for the resource alternatives being considered.
a. Explain why Kentucky Power decided to use a 30-year term to perform its modeling, which contrasts with the 20-year term utilized in Case No. 2016-00413.[2]
b. Explain in further detail what is meant by "end-effects for resource alternatives being considered" that led Kentucky Power to choose to use a 30-year term to perform its modeling.

**RESPONSE**

a. The 30-year modeling period, plus the use of end-effects is used by the Company to account for long-lived resource alternatives impacts over the analysis horizon. This practice serves to mitigate any modeling bias against capital intensive resources that might be selected near the end of a shorter analysis horizon.

b. The term "end-effects" refers to a financial analysis method whereby an extrapolation is performed to extend the analysis time period in perpetuity in order to account for the value of long-lived assets.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_04** 4.Refer to the IRP, page ES-4. Explain whether the short-term market purchases (STMP) will conform to PJM requirements and whether they will be managed with additional hedging or insurance.

**RESPONSE**

For this IRP, it is assumed short term market purchases (STMPs) will conform to PJM capacity planning requirements. No specific hedging or insurance was included in the STMP resource assumptions.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_05** Refer to the IRP, pages ES-6 through E-7. Provide the impacts of the changes in generation resources from a reliance on coal-based generation to an increased reliance on demand-side and renewable resources on the reliability of Kentucky Power's system over the planning period.

**RESPONSE**

This IRP complies with PJM's capacity planning criteria as discussed in Section 3.2. The Preferred Plan (PP) shown on page ES-4, shows that the Company's PP has capacity reserves appropriately above the PJM reserve margin. The intermittent resources capacity values included in this calculation have been adjusted to reflect the PJM capacity planning value for these resources. Thus, the reliability of Kentucky Power's system based on this IRP's PP is not impacted.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_06** Refer to the IRP, page ES-7. Kentucky Power states that its exposure to energy, fuel, and potential carbon prices is reduced through the Preferred Plan's significant increase in renewable energy. Explain whether the decreased risk associated with energy, fuel and carbon prices outweighs the risk to reliability associated with renewables.

**RESPONSE**

The Company's risk to reliability associated with renewables is mitigated through the use of PJM guidance on Effective Load Carrying Capacity (ELCC) planning constraints for renewable resources. The Company's planning incorporates the ELCC for renewable resources to identify the appropriate amount of planning capacity required to meet its PJM Installed Reserve Margin obligations. See response to KPSC 1-05.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_07** Refer to the IPR, page ES-9 which lists Kentucky Power's three-year action plan.
a. Provide a list of green power tariff alternatives that Kentucky Power is evaluating.
b. Regarding Kentucky Power's proposed action to initiate Requests for Proposals (RFP):
(1) Explain whether these requests will be for power generated within Kentucky Power's service territory; and
(2) Explain whether these requests will be made by Kentucky Power alone or in conjunction with another utility (AEP affiliate or otherwise) as part of a larger request.
c. Regarding increasing the levels of energy efficiency (EE), explain whether Kentucky Power believes the level of adoption within their service territory will be at, below, or greater than the national level. Provide support for this assumption.

**RESPONSE**

a. Kentucky Power remains committed to providing its customers with safe and reliable electric service using conventional as well as renewable generation options. The Company had been working on a solar generation project since 2019 in an effort to provide customers with sustainability goals an option to purchase the output of such a facility as an alternative to its Renewable Power Option Rider. A final agreement with the developer was nearing completion when a problem with the planned site occurred. Unfortunately, this problem could not be satisfactorily resolved making the site, on reclaimed coal mining land, unusable for this project. Kentucky Power is currently working on its plan forward, which may include searching for another suitable site or pursuing another RFP for renewable generation.

b-1. Details related to a specific RFP have not been determined at this time. However, within this IRP, all resource options are estimated/forecasted to be either within the Company's service territory or to have the ability to deliver the products to the Company and, all generating resources are assumed to be PJM-interconnected resources.

b-2. Details related to a specific RFP have not been determined at this time.

c. At this time the Company does not have a source for a national level of EE adoption, but believes based on the levels of EE selected in the PP and as shown in Figure 40 are reasonable based on the assumptions in this IRP. However, as stated on page ES-9, the Company needs to further investigate this opportunity.

Witness: Brian K. West

**DATA REQUEST**

**KPSC 1_08** Refer to the IRP, Volume A, page 4, Table 1.
a. Provide an explanation for the decrease of on-peak energy prices between the 2016 and 2019 IPRs.
b. Provide an explanation for the increase in off-peak energy prices between the 2016 and 2019 IRPs.
c. Provide an explanation why, through 2028, the capacity prices are higher in the 2019 IRP than in the 2016 IRP and then are lower 2029 through 2034.

**RESPONSE**

a. The primary reason for the decrease in on- and off-peak electric energy prices between the 2016 and 2019 IRPs is the reduction in projected natural gas prices. The projected value of delivered coal prices have also decreased. Natural gas and coal prices are a key component in determining the supply stack, or merit order, for the dispatch of generating units. Generating units with the lowest variable operating cost are the first to dispatch and plants with incrementally higher variable operating cost are called upon sequentially as electricity demand increases. Although the latest vintage of natural gas electric generators are more efficient, volatile gas prices can quickly advantage or disadvantage them relative to other generation options, including coal.

b. The Company believes the question was intended to be worded; "Provide an explanation for the *decrease* of off-peak energy prices between the 2016 and 2019 IRP's." Please see the Company's response to (a.) above.

c. The 2016 Fundamentals Forecast employed a $CO_2$ dispatch burden (allowance price) on all existing fossil fuel-fired generating units that escalates from $2.92 per ton in 2024 to $26.31 per ton in 2032 in order to achieve national mass-based emission targets similar to those proposed in the Clean Power Plan (CPP). The 2019 Fundamentals Forecast employed a $CO_2$ dispatch burden on all existing fossil fuel-fired generating units that escalates 3.5% per annum from $15 per ton commencing in 2028. This difference in projected $CO_2$ mitigation policy affects the economic dispatch and retirement of fossil fuel-fired electric generating units. Capacity prices are a discrete output of the Aurora model used to project fundamentals power prices. Capacity prices represent the non-energy revenue necessary for the least-dispatched units to remain economically viable and for the entire fleet to meet required reserve margins. It would be reasonable to infer that low capacity prices mean that the model is long in generation and that new generation is not required to maintain reserve margins. Similarly, an increase in capacity prices would indicate that new generation is required to meet reserve margins.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_09** Refer to the IRP, page 5.
a. Provide a comparison of the 2019 and 2016 cost assumptions for solar and wind energy, including transmission costs.
b. Provide a comparison of Kentucky Power and the Energy Information Administration's cost for solar and wind energy using the same criteria and over the same period.
c. Explain the factors that led to the increased reliance on solar energy over wind energy in the 2019 IRP versus the 2016 IRP.
d. Explain why Kentucky Power decided not to extend the UPA from Rockport.
e. Refer to the IRP, page 5. Given Kentucky Power's significant increase in renewable energy over the planning period, explain why battery storage was excluded from the plan.

**RESPONSE**

a. The major cost assumptions for wind and solar resources are included in each IRP. In the 2016 IRP, solar resources are described in Section 4.6.5.1.1 and wind resources are described in Section 4.6.5.2 and in the 2019 IRP, solar resources are described in Section 4.5.6.1.1 and wind resources are described in Section 4.5.6.2. Some key differences between the assumptions for solar and wind resources in each IRP are: The changes in the capacity planning values for wind and solar are based on guidance from PJM. See KPCO_R_KPSC_01_09 Attachment 1 for the referenced PJM document, page 10, for the capacity planning values the Company assumed. In the 2019 IRP, solar resources have an assumed a capacity planning value of 51.1% of nameplate capacity versus in 2016 the assumed capacity planning value was 38%. Wind resources assumed a capacity planning value of 5% of nameplate capacity in 2016 versus 12.3% capacity planning value in the 2019 IRP. Both IRPs, modeled single-axis tracking solar resource and assumed similar capacity factors.

The installed cost for solar resources in the 2016 IRP are shown in Figure 26 and in the 2019 IRP in Figure 29, wind resource costs are shown in Figure 28 in the 2016 IRP and Figure 31 in the 2019 IRP. The table below shows the assumed installed cost in 2022 for both the 2016 and 2019 IRPs for wind and solar resources, these are inclusive of transmissions interconnection costs.

| Installed Cost ($/kW) | 2016 IRP | 2019 IRP |
|---|---|---|
| 2022 Solar - Tier 1 | 1,435 | 1,323 |
| 2022 Solar - Tier 2 | 1,594 | 1,393 |
| 2022 Wind - Tranche A | 1,950 | 1,455 |
| 2022 Wind - Tranche B | Not Applicable | 1,455 |

Other significant changes include: solar fixed O&M in 2016 was assumed to be $19.7/kW-year in 2022 and in the 2019 IRP solar fixed O&M in 2022 is assumed to be $15/kW-year; solar resource life is assumed to be 30 years in 2019 IRP and 25 years in the 2016 IRP; wind fixed O&M in the 2016 IRP was assumed to be $50/kW-year in 2016 and in the 2019 IRP fixed O&M was assumed to be $50/kW-year in 2022; the 2016 IRP modeled wind resources as a 20 year power purchase agreement and the 2019 IRP modeled wind resources as an owned resource with a 30 year life.

b. The same criteria from EIA does not exist; however, EIA provides the following: 2016 EIA Table 8.2 provides the following solar resource cost $2,480 and fixed O&M of $21.33/kW-year and wind resource cost $1,644/kW and fixed O&M of $45.98/kW-year, see KYPCO_R_KPSC_01_09_Attachment 2 for a complete description of all the footnotes corresponding to these values. 2019 EIA Table 2 provides the following solar resource cost $1,969/kW and fixed O&M of $22.46/kW-year and wind resource cost $1,624/kW and fixed O&M of $48.42/kW-year for a complete description of all of the footnotes corresponding to these values see KYPCO_R_KPSC_01_09_ Attachment 3.

c. The main factor is the 2016 IRP included capacity from the Rockport UPA as a resource throughout the planning period; therefore, there was little need for new capacity, see Figure ES-1. In the 2019 IRP, the Rockport UPA is not extended; therefore, there is more value for new resources that provide capacity, see Figure ES-1. As discussed in the Company's response to (a) the modeled solar resource has more planning capacity value than the modeled wind resource. Furthermore, the total wind added in 2019 IRP is 100 MW less than the 2016 IRP and the difference can generally be explained by the capacity contribution discuss above and as shown in Table 1 the forecasted energy prices are much lower in the 2019 IRP than the 2016 IRP, thus, providing the wind resource less value in 2019 versus 2016.

d. Kentucky Power currently expects that it will not renew the Rockport Plant UPA beyond the UPA's December 2022 expiration. This expectation is based, in part, on the Company's assumption that AEP Generation Company's ("AEG") Rockport Unit 2 lease, which terminates on December 7, 2022, is not renewed. Rockport Unit 2 is owned by Wilmington Trust Co. as owner trustee under twelve separate trusts. Wilmington Trust Co. leases an undivided 50% share of Rockport Unit 2 to AEG. AEG in turn leases an undivided 30% of its interest in Unit 2 to Kentucky Power under the UPA. Should the Company's position regarding the UPA change, the Company will seek appropriate approval from the Commission for an extension of the UPA or the acquisition of replacement energy and capacity.

e. A Battery Storage resource was available in the model, however, it was not selected in the modeling results and thus, not in the Company's Preferred Plan for this IRP.

Witness: Brian K. West

Witness: John F. Torpey

# Effective Load Carrying Capability (ELCC) Analysis for Wind and Solar Resources

Tom Falin
Resource Adequacy Planning
Planning Committee
2/7/19

# Background

- PJM has presented information regarding using Effective Load Carrying Capability (ELCC) to calculate wind/solar capacity credits at multiple PC and Special PC meetings
- Stakeholders have not provided feedback regarding switching to ELCC as the new methodology to calculate wind/solar capacity credits
- PJM believes that using ELCC is a superior alternative to calculate wind/solar capacity credits
- The following slides detail the ELCC proposal PJM has developed alongside some preliminary capacity credit values

# ELCC Proposal – General Considerations

- ELCC will be calculated for existing and future wind/solar capacity resources scheduled to be in-service by the beginning of the Delivery Year for which a Base Residual Auction is next to be run
- The runs will use the 10 most recent load, wind and solar 8,760 hourly shapes
  - If 10 years worth of data are not available, all data available will be used
- The ELCC runs will use the capacity model from the most recent Reserve Requirement Study
- Future wind/solar capacity resources will be able to request project-specific capacity credits (provided they supply supporting data). Those requested project-specific capacity credits will be incorporated in the ELCC runs.

# ELCC Proposal – General Methodology

- Step 1: Calculate Composite ELCC of wind and solar capacity resources combined
- Step 2: Calculate ELCC of wind resources and solar resources separately
- Step 3: Allocate the Composite ELCC from Step 1 in a prorated manner based on the results from Step 2 to derive the Wind ELCC and Solar ELCC.

## ELCC Proposal – General Methodology

- Step 4: Allocate the Wind ELCC and Solar ELCC from Step 3 to existing individual wind and solar units based on the individual unit's output during the top 10 daily peak load hours in the 10 most recent DYs
- Step 5: Future units will get the class average capacity credit (if they do not request a project-specific capacity credit) or an adjusted version of the project-specific capacity credit (if they do request a project-specific capacity credit)

pjm

# ELCC Proposal – Preliminary Results

- Step 1: Composite ELCC (2018 RRS Capacity Model, Projected Wind and Solar Nameplate MW for 2022/23 = 19,910 MW)

| Delivery Year | Projected Nameplate Solar & Wind Capacity 2022 (MW) | ELCC (MW) | ELCC (% of Nameplate) |
|---|---|---|---|
| 2012/13 | 19,910 | 3,762 | 18.9% |
| 2013/14 | 19,910 | 3,784 | 19.0% |
| 2014/15 | 19,910 | 5,213 | 26.2% |
| 2015/16 | 19,910 | 3,761 | 18.9% |
| 2016/17 | 19,910 | 4,443 | 22.3% |
| 2017/18 | 19,910 | 4,090 | 20.5% |
| | | **Average** | **21.0%** |

**The ELCC result indicates that the Capacity Credit of 19,910 MW of wind and solar resources is 21% x 19,910 MW = 4,181 MW**

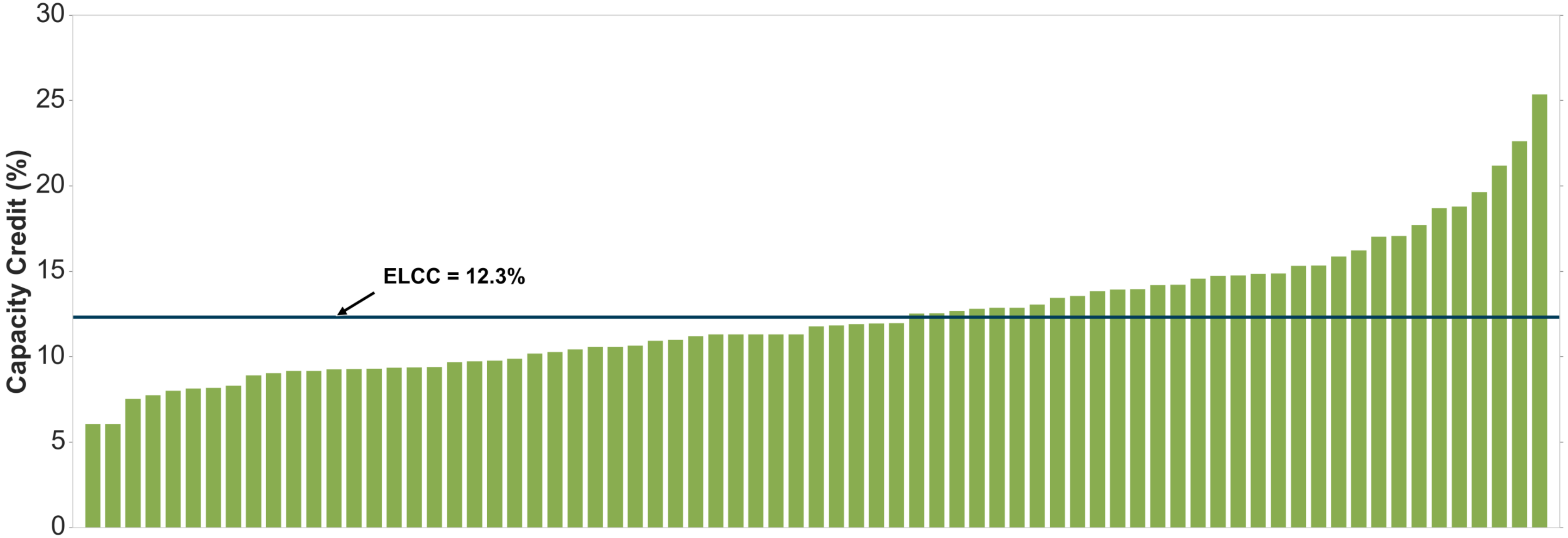
# ELCC Proposal – Preliminary Results

- Steps 2 and Step 3: In previous PC meetings, PJM showed that the average ELCC for wind and solar resources analyzed separately are
  - Wind: 11.5% or 11.5% x 14,620 = 1,681 MW
  - Solar: 42.3% or 42.3% x 5,290 = 2,238 MW
- The Composite ELCC is greater than the sum of the two values above: 4,181 MW vs 3,919. If the difference is allocated on a pro rata basis
  - Wind ELCC = 1,681 MW + 112 MW = 1,793 MW or **12.3%**
  - Solar ELCC = 2,238 MW + 150 MW = 2,388 MW or **45.1%**

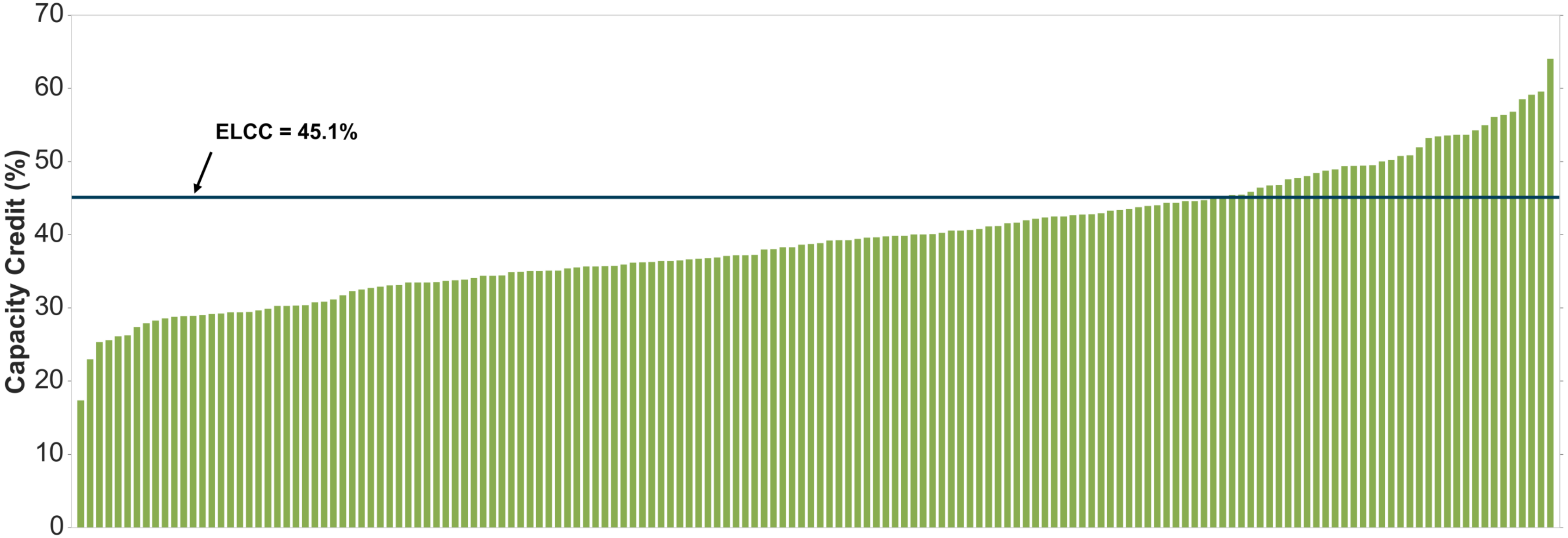
# ELCC Proposal – WIND Preliminary Results

- Step 4: Allocation to existing individual wind units based on the individual unit's output during the top 10 daily peak load hours in the 10 most recent DYs (or less if the unit has not been in service for 10 DYs)



# ELCC Proposal – SOLAR Preliminary Results

- Step 4: Allocation to existing individual **solar** units based on the individual unit's output during the top 10 daily peak load hours in the 10 most recent DYs (or less if the unit has not been in service for 10 DYs)



# ELCC Proposal – Preliminary Results

- Step 5: Class Average ELCC values are obtained by averaging the capacity credits (from Step 4) of the individual units within a category.

**Wind**

| Terrain | Class Average (%) |
|---|---|
| Mountainous | 12.6 |
| Open/Flat | 12.3 |

**Solar**

| Installation | Class Average (%) |
|---|---|
| Fixed Panel | 38.8 |
| Tracking Panel | 51.1 |

# ELCC Proposal – Preliminary Results

- Step 5: It is important to receive all project-specific capacity credit requests for future units prior to making the ELCC runs so that the system-wide ELCC reflects the characteristics of the future projects

## Timetable

- First read of all Manual 21 changes
  - March 7 PC
  - March 21 MRC
- Request for endorsement of all Manual 21 changes
  - April 11 PC
  - April 25 MRC
- UCAP values of wind and solar resources for the 2022/23 BRA would be posted on May 1, 2019.

**DATA REQUEST**

**KPSC 1_10** Refer to the IRP, Section 2.0, generally. If not addressed above, explain the effect of the COVID-19 virus on Kentucky Power's current sales by customer class and what longer-term effect, if any, Kentucky Power is projecting.

**RESPONSE**

The impacts of the COVID-19 pandemic and related government orders started near the end of March 2020. The sales statistics for April 2020 show a 6.6% decline in weather normalized retail sales for Kentucky Power compared to April 2019. By class, April results indicate a significant drop in Commercial (-5.2%) and Industrial (-17.5%) sales that was partially offset by an increase in Residential sales (+6.5%). It is not clear how long the pandemic will last or how fast the regional economy will recover. Based on Moody's Analytics recent projections, the Company is expecting the biggest decline from COVID-19 in Q2-20, followed by a slow, but steady recovery that will continue through 2021.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_11** Refer to the IRP, Section 2.2.1, page 7.
a. Provide the Moody's Analytics economic forecast report issued in December 2018.
b. Explain whether Kentucky Power believes that a 2.0 percent annual increase in gross domestic product is realistic for Kentucky Power's service territory.

**RESPONSE**

a. KPCO_R_KPSC_1_11_Attachment 1 provides documentation on Moody Analytics' December 2018 forecast.

b. The gross domestic product forecast rate of growth referenced on page 7 is for the United States. Moody's analytics projected gross regional product for the Company's service area to grow at approximately half the rate of the U.S. GDP growth, which was a reasonable assumption at the time the IRP was prepared. Please also see the Company's response to KPSC 1-10 for information on the current load forecast with respect to developments regarding the COVID-19 pandemic and related government orders.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_12** Refer to the IRP Section 2.4, pages 11–21, and Exhibits C-20 and H.
a. Provide the various model equations (including supporting models) in functional form, identifying each variable used to derive the sales and peak load forecasts for each of the customer classes.
b. For each of the models provide a listing of the sources of the data used in the equations. For variables developed by Kentucky Power internally, describe how the variables were derived.

**RESPONSE**

a. The long-term residential customer model with drivers labeled is presented on page 731 of Volume A of the Company's IRP. The long-term residential energy model is provided on page 929 of Volume A. The long-term commercial energy model is located on page 1122 of Volume A. The manufacturing model with labeled drivers can be found on page 1232 of Volume A. The mine power energy sales model can be found on page 1279 of Volume A. The other retail model with labeled drivers on page 1321 of Volume A. The wholesale models are located on pages 2182 and 2237 of Volume B.

b. See Exhibit C-20, Load Forecast Tables, provides the sources for the data used in load forecasting process. The coal forecast was derived using an internal forecast with Central Appalachian coal production and US coal exports being the drivers. The Central Appalachian coal production and US coal export forecasts are from EIA. The natural gas price forecasts are tied to EIA's forecast for the East North Central region. The electricity price forecasts are driven by the Company's corporate financial model and EIA's forecast for the East North Central Region.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_13** Refer to the IRP, Section 2.2.2, page 7. Provide a more robust description of how the price forecast was developed.

**RESPONSE**

There are two primary drivers in the development of Company's price forecast. For the short-term, the Company's corporate financial model determines the rate of growth of electric prices. The longer term prices were determined by forecasts by Energy Information Administration's 2019 Annual Outlook. The Company used nominal sectoral price growth rates for the East North Central region. Essentially, growth rates from the financial model and EIA are applied to historical prices to determine the price forecast by sector.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_14** Refer to the IRP, Section 2.2.3 at 7, Figure 4, page 21, and Exhibits C-1 and C-2A.
a. Provide a listing of individual customer additions, retentions, or expansions that were included in the load forecast including the dates and loads.
b. If not answered above, explain the reason for the ramping up of industrial sales in Figure 4 in the 2021–2024 timeframe.
c. If the increase in industrial sales does not materialize, explain how that would affect Kentucky Power's load forecast overall and how that would affect the Plexos model supply optimization results.

**RESPONSE**

a. See KPCO_R_KPSC_1-14_ConfidentialAttachment1 for the requested information. Further, on pages 1241 and 1288 of Volume A, aggregate load changes incorporated in the Company's forecast for manufacturing and mine power sectors are provided.

b. The information provided on pages 1241 and 1288 of Volume A includes the model results and aggregate amount for significant expected changes beyond the model projections.

c. The load would be reduced by the level of the post-model adjustments included on those pages. To the extent the load was reduced, fewer resources may be required in the Preferred Plan.

Witness: John F. Torpey

**Kentucky Power Company**
**Manufacturing and Mine Power**
**Post Model Adjustments (GWh)**

| Customer | Adjustment | Period |
|---|---|---|
| [redacted] | | |

**DATA REQUEST**

**KPSC 1_15** Refer to the IRP, Sections 2.2.4, page 8, 5.2.2, page 115, and 5.2.2.4, page 123.
a. Explain whether the normal weather assumptions used in the forecast is based on a 30-year, 20–year, or some other period.
b. Explain whether and how the optimization scenarios incorporate variations in weather.

**RESPONSE**

a. Both the Load Forecast and the Fundamentals forecast are based on a 30-year average of heating and cooling degree-days.

b. All optimization scenarios are based upon load resulting from a 30-year normal weather assumptions.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_16** Refer to the IRP, Section 2.2.5, page 8. Explain why the load forecast reflects no DSM activity after the Rockport UPA is terminated.

**RESPONSE**

The Company has a single, small DSM program for low income customers that continues to be implemented. Given its small size it is not explicitly shown but it is implicitly included in the load forecast. DSM resources included in this IRP are described in Section 4.4 of this IRP.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_17** Refer to the IRP, Section 2.3, page 9.
a. The long-term forecast models incorporate regional economic data. Please define what states and counties this regional economic data encompasses.
b. Describe the structural shift that Kentucky Power expects to occur in the underlying economy
c. Describe what and how professional judgement was used to blend the short-term model results with the long-term models, thus ensuring reasonable peak model results.

**RESPONSE**

a. The regional economic data for the Company's service area include the following counties in the Commonwealth of Kentucky: Boyd, Breathitt, Carter, Floyd, Greenup, Johnson, Knott, Lawrence, Leslie, Letcher, Lewis, Magoffin, Martin, Morgan, Perry, Pike and Rowan. No counties from other states are included in the Company's economic data.

b. The assumptions included in the Company's IRP did not assume a structural shift to occur in the underlying economy.

c. The short-term and long-term model results are integral parts of the forecasting process. The Economic Forecasting team evaluates both forecasts as well as the potential blend results to determine which of the alternatives provides the most reasonable forecast on both annual and monthly basis. The professional judgement includes knowledge about data patterns and expectations about future change including anticipated load additions or reductions.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_18** Refer to the IRP, Section 2.4.4, page 13. Provide the lag time used for the price of electricity and other fuels.

**RESPONSE**

The residential Statistically Adjusted End-Use (SAE) model used a ten-year (120 month) moving average for electricity and natural gas prices. The commercial SAE model used a 36-month moving average of electricity prices. The manufacturing and mine power econometric models both used a 36-month moving average of electricity prices.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_19** Refer to the IRP, Section 2.4.4.4, page 17. Given the decline in the mining industry, explain why Kentucky Power models mine power separately.

**RESPONSE**

While the mine power has been in decline, it still comprised nearly 15% of industrial load in 2018, the last year of historical data included in this forecast. Different economic drivers better reflect mine power change than those for the manufacturing activities. Having separate forecasts for mine power and manufacturing will result in a richer industrial forecast.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_20** Refer to the IRP, Section 2.6.2, page 25, and Exhibit C-6. Although no demand-side management (DSM) and EE was included in the forecast, explain whether any existing DSM/EE measures were modeled.

**RESPONSE**

See the Company's response to Staff 1-16.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_21** Refer to the IRP, Section 2.7, pages 27–30, Figure 10, and Exhibit C-10. For each of the load forecast scenarios, provide a comparison of the base case assumptions and how the assumptions were changed in each energy and demand forecast scenario.

**RESPONSE**

The energy efficiencies 2018 scenario shows the impacts of holding efficiencies at 2018 levels for the commercial and residential sectors. The base forecast had energy efficiencies improving over time in accordance with the EIA outlook.

The weather extreme scenario increases cooling degree-days and decreases the heating degree -days in line with a Purdue University study cited on page 30 of the IRP and available at:

https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1000&context=climatetr
The base forecast assumed that degree-days would be constant at the 30-year average over the forecast horizon.

The no-DSM forecast scenario is the same as the base forecast, as no new DSM programs were incorporated in the load forecast.

The extended energy efficiencies scenario estimates the impacts of EIA developing additional energy efficiency guidelines. The base forecast incorporates only EIA base assumptions regarding energy efficiencies.

The high and low economic forecast scenarios evaluate the impacts faster and slower than expected economic growth. The base forecast uses the base economic forecast rather than extremes.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_22** Refer to the IRP, Section 2.8, pages 31–32. Provide the short- and long-run elasticity utilized.

**RESPONSE**

KPCO_R_KPSC_1_22_Attachment1 provides the elasticities included in the Statistically Adjusted End-Use (SAE) residential model.

The commercial prices elasticity included in the commercial SAE was model was -0.15.

The long-term manufacturing and mine power models estimate price elasticities to be -0.173 and -0.215, respectively.

Witness: John F. Torpey

**Kentucky Power Company**
**Short- and Long-Term Direct and Cross Price Elasticities**
**Included in Residential Energy Model**

| Variable | Value | Definition |
|---|---|---|
| ST_SpHeatUsageOwn | -0.1000 | Short term Space Heating Usage Own Price Elasticity |
| ST_SpCoolUsageOwn | -0.0800 | Short term Space Cooling Usage Own Price Elasticity |
| ST_WHeatUsageOwn | -0.0800 | Short term Water heat Usage Own Price Elasticity |
| ST_CookUsageOwn | -0.0600 | Short term Cooking Usage Own Price Elasticity |
| ST_RefUsageOwn | 0.0000 | Short term Refrig/Freezer Usage Own Price Elasticity |
| ST_DishUsageOwn | -0.0600 | Short term Dishwasher Usage Own Price Elasticity |
| ST_CWashUsageOwn | -0.0600 | Short term Clothes Washer Usage Own Price Elasticity |
| ST_DryUsageOwn | -0.0600 | Short term Clothes Drying Usage Own Price Elasticity |
| ST_TVUsageOwn | -0.0700 | Short term TV Usage Own Price Elasticity |
| ST_FFUsageOwn | -0.1000 | Short term Furnace Fan Usage Own Price Elasticity |
| ST_LightUsageOwn | -0.0800 | Short term Lighting Usage Own Price Elasticity |
| ST_MiscUsageOwn | -0.0600 | Short term Misc Usage Own Price Elasticity |
| LT_SpHeatShrOwn | -0.1500 | Long term Space Heating Share/Efficiency Incremental Own Price Elastcity |
| LT_SpCollShrOwn | -0.1100 | Long term Space Cooling Share/Efficiency Incremental Own Price Elasticity |
| LT_WHeatShrOwn | -0.1600 | Long term Water heat Share/Efficiency Incremental Own Price Elasticity |
| LT_CookShrOwn | -0.0800 | Long term Cooking Share/Efficiency Own Incremental Price Elasticity |
| LT_RefShrOwn | -0.0300 | Long term Refrigeration/Freezer Share/Efficiency Own Incremental Price Elasticity |
| LT_DishShrOwn | -0.0800 | Long term Dishwasher Share/Efficiency Own Incremental Price Elasticity |
| LT_CWashShrOwn | -0.0800 | Long term Clothes Washer Share/Efficiency Own Incremental Price Elasticity |
| LT_DryShrOwn | -0.0800 | Long term Clothes Dryer Share/Efficiency Own Incremental Price Elasticity |
| LT_TVShrOwn | -0.0800 | Long term TV Share/Efficiency Own Incremental Price Elasticity |
| LT_FFShrOwn | -0.1500 | Long term Furnace Fan Share/Efficiency Incremental Own Price Elasticity |
| LT_LightShrOwn | -0.1000 | Long term Lighting Share/Efficiency Own Incremental Price Elasticity |
| LT_MiscShrOwn | -0.0800 | Long term Misc Share/Efficiency Own Incremental Price Elasticity |
| ST_SpHeatUsageCross | 0.0010 | Short term Space Heating Usage Cross Price Elasticity |
| ST_SpCoolUsageCross | 0.0000 | Short term Space Colling Usage Cross Price Elasticity |
| ST_WHeatUsageCross | 0.0000 | Short term Water heat Usage Cross Price Elasticity |
| ST_CookUsageCross | 0.0010 | Short term Cook Usage Cross Price Elasticity |
| ST_RefUsageCross | 0.0000 | Short term Refrigeration/Freezer Usage Cross Price Elasticity |

**Kentucky Power Company**
**Short- and Long-Term Direct and Cross Price Elasticities**
**Included in Residential Energy Model**

| Variable | Value | Definition |
|---|---|---|
| ST_DishUsageCross | 0.0000 | Short term Dishwasher Usage Cross Price Elasticity |
| ST_CWashUsageCross | 0.0000 | Short term Clothes Washer Usage Cross Price Elasticity |
| ST_DryUsageCross | 0.0000 | Short term Dryer Usage Cross Price Elasticity |
| ST_TVUsageCross | 0.0000 | Short term TV Usage Cross Price Elasticity |
| ST_FFUsageCross | 0.0000 | Short term Furnace Fan Usage Cross Price Elasticity |
| ST_LightUsageCross | 0.0000 | Short term Light Usage Cross Price Elasticity |
| ST_MiscUsageCross | 0.0000 | Short term Misc Usage Cross Price Elasticity |
| LT_SpHeatShrCross | 0.0100 | Long term Space Heating Share/Efficiency Incremental Cross Price Elasticity |
| LT_SpCoolShrCross | 0.0000 | Long term Space Cooling Share/Efficiency Incremental Cross Price Elasticity |
| LT_WHeatShrCross | 0.0100 | Long term Water heat Share/Efficiency Incremental Cross Price Elasticity |
| LT_CookShrCross | 0.0100 | Long term Cook Share/Efficiency Incremental Cross Price Elasticity |
| LT_RefShrCross | 0.0000 | Long term Refrigeration/Freezer Share/Efficiency Incremental Cross Price Elasticity |
| LT_DishShrCross | 0.0000 | Long term Dishwasher Share/Efficiency Incremental Cross Price Elasticity |
| LT_CWashShrCross | 0.0100 | Long term Clothes Washer Share/Efficiency Incremental Cross Price Elasticity |
| LT_DryShrCross | 0.0100 | Long term Dryer Share/Efficiency Incremental Cross Price Elasticity |
| LT_TVShrCross | 0.0000 | Long term TV Share/Efficiency Incremental Cross Price Elasticity |
| LT_FFShrCross | 0.0000 | Long term Furnace Fan Share/Efficiency Incremental Cross Price Elasticity |
| LT_LightShrCross | 0.0000 | Long term Light Share/Efficiency Incremental Cross Price Elasticity |
| LT_MiscShrCross | 0.0000 | Long term Misc Share/Efficiency Incremental Cross Price Elasticity |

**DATA REQUEST**

**KPSC 1_23** Refer to the IRP, Section 2.9.3, page 34. Provide the most recent residential customer survey and all reports on the results.

**RESPONSE**

KPCO_R_KPSC_1_23_Attachment_1 provides the most recent survey instrument. KPCO_R_KPSC_1_23_Attachment_2 provides the aggregate results from the survey,

Witness: John F. Torpey

FPO
LOGO

<Customer Name & Address Inserted Here >

<Mail Date Inserted Here>

Dear < Company Name Inserted Here > Customer:

< Company Name Inserted Here > is committed to providing you safe and reliable electric service. To do this, we need your help.

Occasionally, we ask a few of our customers to answer questions about their homes, energy use, appliances, and energy efficiency measures. Your responses are important to us because we use this information to help with our plans to meet the future energy needs of you and all of our customers. We ask that you take a few minutes to respond to these questions for the following service address.



<Service Address
Inserted Here>
**<Control Number Here>**

Please take advantage of three convenient ways to responding.

1) With Internet access logon to www. <web link here>.com and follow the directions on the screen. You will need the control number located below the service address.

2) Simply scan the QR code using your smartphone to access the survey.

3) Complete the enclosed questionnaire and return it in the enclosed postage paid envelope.

Your responses will be kept anonymous and in strictest confidence. Your responses will NOT be used for any sales or promotional purposes.

Thank you for your time and effort in completing this survey within the next few days. If you have any questions regarding this study, please call toll free 866-789-8898.

Sincerely,

<Signatory's Name Inserted Here>

<Signatory's Title Inserted Here>, <Company Name Inserted Here>

# 2018 RESIDENTIAL SURVEY

*Please answer each question by marking only the response or responses that apply to the home at the service address listed on the cover letter.*

• • •

*Answer each question by filling in the oval completely with dark color pen or pencil. Your responses will be kept in strict confidence.*



## YOUR HOME

**Do you own or rent your present home?**

- Own
- Rent

**What one type best describes your home?**

- Manufactured or Mobile Home
- Apartment, Condo or Townhouse (2-4 units)
- Single-Family Home
- Apartment, Condo, or Townhouse (> 4 units)

**Approximately how old is your home?**

- 2 years or newer
- 3-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- 21-30 years
- 31-40 years
- Over 40 years
- Don't Know

**What is the approximate square footage of your home's living area? Include basement, attic or garage only if it is regularly heated or cooled.**

- Under 600
- 601 – 1,200
- 1,201 – 1,600
- 1,601 – 2,000
- 2,001 – 2,500
- 2,501 – 3,000
- 3,001 or more
- Don't Know

## HOME HEATING & COOLING

**Which of the following is the MAIN heating type (energy source) for your home (choose only one)?**

- Electricity
- Propane or LPG
- Don't Heat Home
- Fuel Oil
- Other
- Natural Gas
- Don't Know

**Which best describes your MAIN heating system (choose only one)?**

- Central Forced Air Furnace
- Fireplace or Wood Stove
- Mini Split (ductless)
- Room or Space Heater
- Heat Pump
- Other
- None
- Don't Know

**What is your normal thermostat setting in the winter in degrees Fahrenheit?**

- 65 or lower
- 72-74
- None/Don't Use
- 66-68
- 75 or higher
- 69-71
- Don't Know

**What best describes your MAIN cooling system (choose only one)?**

- Heat Pump
- Room A/C (window unit)
- Mini Split (ductless)
- Central A/C
- Evaporative A/C
- Other
- None
- Don't Know

**What is your normal thermostat setting in the summer in degrees Fahrenheit?**

- 68 or below
- 75-77
- None/Don't Use
- 69-71
- 78-80
- Don't Know
- 72-74
- 81 or higher

## HOME HEATING & COOLING, continued

**Do you have a secondary system for heating/cooling (in addition to your primary heating/cooling system)?**

- Yes
- No

## WATER HEATING

**Which of the following is the MAIN water heating type (energy source) for your home (choose only one)?**

- Natural Gas
- Electricity
- Propane or LPG
- Don't Know
- None
- Other

**Is your water heater a tankless or on-demand model?**

- Yes
- No

## OTHER EQUIPMENT

**Please mark which of these devices you have in your home, and how many.**

| | 0 | 1 | 2 | 3 or more |
|---|---|---|---|---|
| Tube-type Television | ○ | ○ | ○ | ○ |
| High Definition Television | ○ | ○ | ○ | ○ |
| DVD, DVR or Cable Box | ○ | ○ | ○ | ○ |
| Gaming Console | ○ | ○ | ○ | ○ |
| Personal Computer | ○ | ○ | ○ | ○ |
| Tablet Computer | ○ | ○ | ○ | ○ |
| Printer or Fax | ○ | ○ | ○ | ○ |
| Cell or Smart Phone | ○ | ○ | ○ | ○ |
| Home Security System | ○ | ○ | ○ | ○ |
| Home Surge Protector | ○ | ○ | ○ | ○ |
| Electric (rechargeable) Lawn Equipment | ○ | ○ | ○ | ○ |
| Other Rechargeable Appliances | ○ | ○ | ○ | ○ |

**Do you connect to the internet at home (mark all that apply)?**

- Yes, with DSL or Cable (high speed)
- Yes, with Smart Phone (i.e. AT&T, Verizon, etc)
- Yes, with Dial-Up or Modem
- No

**Do you use a Voice Controlled Virtual Assistant (Amazon Echo, Google Home, etc.) in your home?**

- Yes
- No

**Which of the following is the MAIN cooking type (energy source) for your stove, range, or cooktop?**

- Electricity
- Combination Electric & Gas
- Gas or Propane
- Don't Know

**Do you have a pump or electric motor for any of the following?**

| | Yes | No |
|---|---|---|
| Swimming Pool | ○ | ○ |
| Hot Tub | ○ | ○ |
| Other Equipment | ○ | ○ |

**Do you have a backup generator for your home?**

- Yes
- No

PLEASE COMPLETE OTHER SIDE

## ENERGY MANAGEMENT & CONSERVATION

**Please indicate which of the following you have in your home (mark all that apply).**

- ○ Programmable Thermostat
- ○ Smart or Internet Connected Thermostat
- ○ Storm Windows
- ○ Additional Insulation
- ○ Window Treatments (thermal drapes, solar film, etc.)
- ○ Additional or Recent Window Caulking
- ○ Ceiling Fans
- ○ Solar Panels
- ○ Electric vehicle

**Do you plan to purchase the following in the next 2 years?**

| | Yes | No | Unsure |
|---|---|---|---|
| Solar Power (panels) | ○ | ○ | ○ |
| Electric Vehicles | ○ | ○ | ○ |
| LED lighting | ○ | ○ | ○ |
| Additional insulation | ○ | ○ | ○ |
| Smart (web enabled) appliances | ○ | ○ | ○ |
| New HVAC system | ○ | ○ | ○ |
| Battery Storage (Tesla Powerwall, etc.) | ○ | ○ | ○ |
| Plug-In Hybrid Vehicle | ○ | ○ | ○ |
| Voice Controlled Virtual Assistant | ○ | ○ | ○ |
| Electric (rechargeable) Lawn Equipment | ○ | ○ | ○ |

## APPLIANCES & EQUIPMENT

**Please indicate the AGE (in years) of the following appliances & equipment in your home.**

| | Don't Have | <=2 | 3 – 5 | 6 – 10 | 11 – 15 | >15 | Don't Know |
|---|---|---|---|---|---|---|---|
| Primary Refrigerator | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Second Refrigerator | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Stand Alone Freezer | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Automatic Dishwasher | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Clothes Washer | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Clothes Dryer (Gas) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Clothes Dryer (Electric) | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Stove, Range, or Cooktop | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Heating System Equipment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Cooling System Equipment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Water Heater | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| Electric (rechargeable) Lawn Equipment | ○ | ○ | ○ | ○ | ○ | ○ | ○ |



## LIGHTING

**Please indicate the MAIN source of lighting used in the following areas of your home.**

| MAIN source of lighting? | | | | | | How many light bulbs/fixtures in each room? | | | |
|---|---|---|---|---|---|---|---|---|---|
| Incandescent | CFL or Tubular Fluorescent | LED | Other | Don't Know | Area of the Home | 0 | 1 | 2 | 3 or more |
| ○ | ○ | ○ | ○ | ○ | Kitchen | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Living Room / Den | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Master Bedroom | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Other Bedroom(s) | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Bathroom | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Dining Room | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Family or Game Room | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Office or Study | ○ | ○ | ○ | ○ |
| ○ | ○ | ○ | ○ | ○ | Outdoor Areas | ○ | ○ | ○ | ○ |

**THANK YOU FOR YOUR TIMELY RESPONSE!**

DO NOT WRITE IN THIS AREA

SERIAL #

JURIS: Kentucky Power

## YOUR HOME

### Do you own or rent your present home?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Own | 90% | 90% | 91% |
| Rent | 10% | 10% | 9% |

### What one type best describes your home?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Mfd/Mobile Home | 28% | 26% | 25% |
| Apt./Condo/TH (2-4 units) | 2% | 4% | 2% |
| Apt./Condo/TH (> 4 units) | 2% | 2% | 2% |
| Single-Family Home | 67% | 68% | 71% |

### Approximately how old is your home?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| <= 2 | 2% | 3% | 1% |
| 3 - 5 | 5% | 4% | 2% |
| 6 - 10 | 8% | 5% | 4% |
| 11 - 15 | 10% | 13% | 7% |
| 16 - 20 | 8% | 8% | 9% |
| 21 - 30 | 17% | 15% | 17% |
| 31 - 40 | 14% | 16% | 18% |
| > 40 | 32% | 32% | 36% |
| Don't Know | 5% | 6% | 6% |

### What is the approximate square footage of your home's living area?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| < 600 | 4% | 6% | 3% |
| 601 - 1,200 | 17% | 17% | 16% |
| 1,201 - 1,600 | 20% | 18% | 20% |
| 1,601 - 2,000 | 18% | 16% | 14% |
| 2,001 - 2,500 | 10% | 10% | 14% |
| 2,501 - 3,000 | 7% | 6% | 8% |
| >= 3,001 | 5% | 7% | 5% |
| Don't Know | 19% | 21% | 20% |

## HOME HEATING & COOLING

### MAIN heating type (energy source)?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Electricity | 67% | 63% | 67% |
| Natural Gas | 26% | 29% | 23% |
| Propane / LPG | 3% | 5% | 5% |
| Fuel Oil | 1% | 1% | 1% |
| Other Source | 4% | 3% | 3% |
| Don't Heat | 0% | 0% | 0% |
| Don't Know | 0% | 0% | 0% |

### MAIN heating system?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Heat Pump | 45% | 43% | 37% |
| Central Forced Air | 38% | 40% | 47% |
| Room or Space Heater | 5% | 6% | 5% |
| Fireplace / Wood Stove | 5% | 5% | 4% |
| Mini Split (ductless) | 0% | 0% | 1% |
| Other System | 5% | 5% | 5% |
| None | 0% | 1% | 0% |
| Don't Know | 1% | 0% | 0% |

### Normal thermostat setting in the winter (degrees Fahrenheit)?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| <= 65 | 5% | 5% | 4% |
| 66 - 68 | 23% | 21% | 18% |
| 69 - 71 | 40% | 36% | 34% |
| 72 - 74 | 24% | 29% | 32% |
| >= 75 | 4% | 3% | 6% |
| None / Don't Use | 4% | 5% | 1% |
| Don't Know | 0% | 1% | 5% |

### Secondary system for heating/cooling?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | n/a | n/a | 35% |
| No | n/a | n/a | 65% |

### MAIN cooling system?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Heat Pump | 38% | 34% | 42% |
| Central A/C | 43% | 46% | 38% |
| Room A/C | 14% | 16% | 17% |
| Evaporative A/C | 0% | 0% | 0% |
| Mini Split (ductless) | 0% | 0% | 0% |
| Other System | 1% | 2% | 2% |
| None | 2% | 2% | 2% |
| Don't Know | 1% | 0% | 0% |

### Normal thermostat setting in the summer (degrees Fahrenheit)?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| <= 68 | 11% | 12% | 8% |
| 69 - 71 | 32% | 31% | 26% |
| 72 - 74 | 35% | 36% | 36% |
| 75 - 77 | 12% | 11% | 16% |
| 78 - 80 | 4% | 3% | 7% |
| >= 81 | 1% | 0% | 0% |
| None / Don't Use | 4% | 6% | 5% |
| Don't Know | 1% | 1% | 2% |

## WATER HEATING

### MAIN water heating type (energy source)?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Natural Gas | 19% | 20% | 15% |
| Electricity | 80% | 78% | 82% |
| Propane / LPG | 0% | 1% | 3% |
| Other | 0% | 0% | 0% |
| None | 0% | 0% | 0% |
| Don't Know | 0% | 1% | 1% |

### Is water heater a tankless or on-demand model?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 16% | 16% | 16% |
| No | 84% | 84% | 84% |

## OTHER EQUIPMENT

### Have a tube-type television?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 30% | 54% | 81% |
| Yes, 1 | 36% | 26% | 13% |
| Yes, >= 2 | 34% | 20% | 6% |

### Have a high definition television?

| | 2013 Survey 1/ | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 17% | 8% | 11% |
| Yes, 1 | 34% | 37% | 25% |
| Yes, >= 2 | 49% | 55% | 64% |

1/ LCD or LED

### Have a DVD, DVR, or Cable Box?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 6% | 19% | 18% |
| Yes, 1 | 43% | 43% | 42% |
| Yes, >= 2 | 50% | 38% | 40% |

### Have a gaming console?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | n/a | 61% | 64% |
| Yes, 1 | n/a | 25% | 23% |
| Yes, >= 2 | n/a | 14% | 13% |

### Have a personal computer?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 23% | 43% | 32% |
| Yes, 1 | 53% | 49% | 50% |
| Yes, >= 2 | 24% | 7% | 18% |

### Have a tablet computer?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 57% | 34% | 47% |
| Yes, 1 | 33% | 40% | 41% |
| Yes, >= 2 | 10% | 26% | 12% |

### Have a printer or fax?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 32% | 40% | 47% |
| Yes, 1 | 60% | 53% | 45% |
| Yes, >= 2 | 7% | 7% | 8% |

### Have a cell or smart phone?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 16% | 20% | 11% |
| Yes, 1 | 40% | 34% | 40% |
| Yes, >= 2 | 44% | 45% | 49% |

### Have a home security system?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | n/a | 76% | 73% |
| Yes, 1 | n/a | 23% | 24% |
| Yes, >= 2 | n/a | 0% | 3% |

### Have a surge protector?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | n/a | 7% | 47% |
| Yes, 1 | n/a | 91% | 19% |
| Yes, >= 2 | n/a | 2% | 34% |

### Have electric lawn equipment?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | n/a | n/a | 84% |
| Yes, 1 | n/a | n/a | 10% |
| Yes, >= 2 | n/a | n/a | 6% |

### Have other rechargeables?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| No | 42% | 55% | 74% |
| Yes, 1 | 21% | 19% | 7% |
| Yes, >= 2 | 37% | 26% | 19% |

**Do you connect to the internet at home?**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 65% | | |
| Yes, w/ DSL or Cable | | 43% | 49% |
| Yes, w/ Smart Phone | | 20% | 24% |
| Yes, w/ Satellite | | 8% | |
| Yes, with Dial-Up | | 5% | 7% |
| No | 35% | 24% | 20% |

**Heat source of stove, range, or cooktop?**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Electric | 86% | 83% | 86% |
| Combination | 3% | 3% | 3% |
| Gas / Propane | 11% | 14% | 11% |
| Don't Know | 0% | 0% | 0% |

**Pump/electric motor? Swimming Pool**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 15% | 12% | 10% |
| No | 85% | 88% | 90% |

**Pump/electric motor? Hot Tub**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 4% | 4% | 3% |
| No | 96% | 96% | 97% |

**Pump/electric motor? Other**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 9% | 7% | 11% |
| No | 91% | 93% | 89% |

**Have a backup generator for your home?**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | 17% | 18% | 15% |
| No | 83% | 82% | 85% |

**Do you use a Voice Controlled Virtual Assistant?**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Yes | n/a | n/a | 7% |
| No | n/a | n/a | 93% |

## ENERGY MANAGEMENT & CONSERVATION

**Have these in your home?**

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Additional Insulation | 41% | 46% | 32% |
| Additional or recent window caulking | 28% | 28% | 21% |
| Efficient light bulbs (eg CFLs) | 56% | 64% | n/a |
| Low-flow water fixtures | 22% | 22% | n/a |
| Ceiling Fans | 77% | 75% | 80% |
| Storm Windows | 44% | 34% | 50% |
| Window Treatments (thermal drapes) | 24% | 23% | 28% |
| Programmable Thermostat | 29% | 29% | 45% |
| Web Enabled Thermostat | | 2% | 4% |
| Solar Panels | 0% | 1% | 0% |
| Energy Star Appliances | | 36% | n/a |
| Electric Vehicle | | | 1% |

**Do you plan to Purchase in next 2 years?**

| | Solar Power (panels) | Electric Vehicles | LED Lighting | Additional Insulation | Smart (web enabled) appliances | New HVAC system | Energy Star Appliances | Battery Storage | Plug-in Hybrid Vehicle | Voice Controlled Virtual Assistant | Electric Lawn Equipment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 Survey | | | | | | | | | | | |
| Yes | 1% | 1% | 34% | 14% | 9% | 8% | 19% | n/a | n/a | n/a | n/a |
| No | 89% | 91% | 48% | 72% | 74% | 76% | 59% | n/a | n/a | n/a | n/a |
| Unsure | 11% | 8% | 17% | 14% | 16% | 16% | 22% | n/a | n/a | n/a | n/a |
| 2019 Survey | | | | | | | | | | | |
| Yes | 0% | 0% | 35% | 12% | 6% | 6% | n/a | 1% | 1% | 2% | 4% |
| No | 91% | 96% | 50% | 74% | 84% | 84% | n/a | 91% | 94% | 92% | 90% |
| Unsure | 9% | 3% | 15% | 14% | 9% | 11% | n/a | 7% | 5% | 6% | 6% |

## APPLIANCES

### Age of Primary Refrigerator?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 1% | 1% | 1% |
| <= 2 | 19% | 22% | 17% |
| 3 - 5 | 26% | 25% | 28% |
| 6 - 10 | 26% | 26% | 27% |
| 11 - 15 | 13% | 10% | 11% |
| > 15 | 10% | 9% | 8% |
| Don't Know | 6% | 6% | 7% |

### Age of 2nd refrigerator?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 71% | 65% | 65% |
| <= 2 | 3% | 6% | 4% |
| 3 - 5 | 4% | 10% | 6% |
| 6 - 10 | 8% | 4% | 8% |
| 11 - 15 | 5% | 7% | 6% |
| > 15 | 7% | 4% | 6% |
| Don't Know | 2% | 4% | 5% |

### Age of stand-alone freezer?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 52% | 50% | 48% |
| <= 2 | 5% | 14% | 8% |
| 3 - 5 | 8% | 10% | 13% |
| 6 - 10 | 13% | 8% | 13% |
| 11 - 15 | 7% | 6% | 8% |
| > 15 | 12% | 9% | 7% |
| Don't Know | 3% | 3% | 4% |

### Age of automatic dishwasher?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 47% | 36% | 40% |
| <= 2 | 8% | 16% | 12% |
| 3 - 5 | 13% | 17% | 13% |
| 6 - 10 | 17% | 14% | 15% |
| 11 - 15 | 9% | 7% | 8% |
| > 15 | 5% | 5% | 5% |
| Don't Know | 2% | 4% | 6% |

### Age of clothes washer?

| | 2013 Survey (Top Load) | 2016 Survey (Top Load | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 8% | 11% | 5% |
| <= 2 | 18% | 28% | 24% |
| 3 - 5 | 28% | 21% | 31% |
| 6 - 10 | 28% | 25% | 20% |
| 11 - 15 | 9% | 8% | 8% |
| > 15 | 5% | 5% | 7% |
| Don't Know | 4% | 2% | 6% |

### Age of clothes dryer (Gas)?

| | 2016 Survey | 2019 Survey |
|---|---|---|
| Don't Have/Use | 86% | 74% |
| <= 2 | 3% | 4% |
| 3 - 5 | 4% | 10% |
| 6 - 10 | 3% | 4% |
| 11 - 15 | 2% | 3% |
| > 15 | 0% | 2% |
| Don't Know | 3% | 3% |

### Age of clothes dryer (Electric)?

| | 2013 Survey (Tot) | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 8% | 7% | 5% |
| <= 2 | 18% | 21% | 20% |
| 3 - 5 | 27% | 28% | 29% |
| 6 - 10 | 26% | 25% | 22% |
| 11 - 15 | 11% | 9% | 12% |
| > 15 | 6% | 9% | 7% |
| Don't Know | 3% | 2% | 6% |

### Age of stove, range, or cooktop?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 1% | 3% | 2% |
| <= 2 | 16% | 23% | 21% |
| 3 - 5 | 21% | 20% | 23% |
| 6 - 10 | 33% | 28% | 23% |
| 11 - 15 | 14% | 10% | 12% |
| > 15 | 10% | 10% | 13% |
| Don't Know | 7% | 6% | 7% |

### Age of heating system equipment?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 0% | 6% | 8% |
| <= 2 | 15% | 17% | 15% |
| 3 - 5 | 20% | 18% | 17% |
| 6 - 10 | 23% | 21% | 20% |
| 11 - 15 | 17% | 13% | 15% |
| > 15 | 18% | 16% | 16% |
| Don't Know | 6% | 8% | 10% |

### Age of cooling system equipment?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 0% | 8% | 8% |
| <= 2 | 15% | 18% | 15% |
| 3 - 5 | 23% | 20% | 20% |
| 6 - 10 | 28% | 20% | 20% |
| 11 - 15 | 17% | 13% | 14% |
| > 15 | 11% | 13% | 14% |
| Don't Know | 6% | 8% | 10% |

### Age of water heater?

| | 2013 Survey | 2016 Survey | 2019 Survey |
|---|---|---|---|
| Don't Have/Use | 0% | 2% | 1% |
| <= 2 | 20% | 28% | 18% |
| 3 - 5 | 28% | 25% | 23% |
| 6 - 10 | 25% | 24% | 22% |
| 11 - 15 | 12% | 7% | 16% |
| > 15 | 8% | 8% | 11% |
| Don't Know | 8% | 6% | 9% |

### Age of electric lawn equipment?

| | 2019 Survey |
|---|---|
| Don't Have/Use | 81% |
| <= 2 | 9% |
| 3 - 5 | 4% |
| 6 - 10 | 1% |
| 11 - 15 | 0% |
| > 15 | 0% |
| Don't Know | 5% |

## LIGHTING

### Main Source of Lighting?

| | Kitchen | | | Living Room/Den | | | Master Bedroom | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey |
| Incandescent | 41% | 37% | 27% | 52% | 42% | 38% | 55% | 48% | 39% |
| CFL or Tubular Fluorescent | 48% | 33% | 16% | 33% | 24% | 12% | 31% | 22% | 11% |
| LED | n/a | 16% | 38% | n/a | 20% | 34% | n/a | 17% | 32% |
| Other | 8% | 7% | 8% | 12% | 9% | 6% | 11% | 8% | 8% |
| Don't Know | 4% | 7% | 10% | 3% | 5% | 10% | 4% | 5% | 10% |

| | Other Bedroom(s) | | | Bathroom | | | Dining Room | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey |
| Incandescent | 56% | 50% | 42% | 54% | 50% | 40% | 58% | 46% | 40% |
| CFL or Tubular Fluorescent | 31% | 21% | 9% | 34% | 21% | 13% | 30% | 25% | 11% |
| LED | n/a | 16% | 30% | n/a | 18% | 30% | n/a | 14% | 30% |
| Other | 9% | 6% | 9% | 9% | 6% | 8% | 8% | 8% | 9% |
| Don't Know | 4% | 6% | 9% | 3% | 6% | 9% | 4% | 7% | 11% |

| | Family or Game Room | | | Office or Study | | | Outdoor Areas | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey | 2013 Survey | 2016 Survey | 2019 Survey |
| Incandescent | 49% | 40% | 31% | 43% | 35% | 28% | 49% | 47% | 33% |
| CFL or Tubular Fluorescent | 35% | 28% | 14% | 35% | 33% | 17% | 32% | 23% | 12% |
| LED | n/a | 14% | 29% | n/a | 10% | 24% | n/a | 14% | 31% |
| Other | 11% | 7% | 9% | 13% | 5% | 10% | 14% | 9% | 10% |
| Don't Know | 6% | 10% | 17% | 9% | 17% | 21% | 6% | 7% | 14% |

### How Many Light Bulbs/Fixtures?

| | Kitchen | Living Room/Den | Master Bedroom |
|---|---|---|---|
| | 2019 Survey | 2019 Survey | 2019 Survey |
| 0 | 1% | 2% | 2% |
| 1 | 22% | 28% | 42% |
| 2 | 29% | 20% | 22% |
| 3 or more | 48% | 49% | 34% |

| | Other Bedroom(s) | Bathroom | Dining Room |
|---|---|---|---|
| | 2019 Survey | 2019 Survey | 2019 Survey |
| 0 | 4% | 1% | 15% |
| 1 | 47% | 44% | 41% |
| 2 | 25% | 23% | 13% |
| 3 or more | 24% | 33% | 31% |

| | Family or Game Room | Office or Study | Outdoor Areas |
|---|---|---|---|
| | 2019 Survey | 2019 Survey | 2019 Survey |
| 0 | 36% | 52% | 10% |
| 1 | 22% | 25% | 21% |
| 2 | 15% | 15% | 25% |
| 3 or more | 26% | 9% | 44% |

**DATA REQUEST**

**KPSC 1_24** Refer to the IRP, Section 3.2, page 41.
a. For the additional 20 MW of solar generation:
(1) Explain how Kentucky Power plans to procure the 20 MW.
(2) If Kentucky Power plans to build the 20 MW, provide the time line for the construction.
b. Provide by what other means Kentucky Power will arrange to meet its obligations.

**RESPONSE**

Kentucky Power remains committed to providing its customers with safe and reliable electric service using conventional as well as renewable generation options.
The Company had been working on a solar generation project since 2019 in an effort to provide customers with sustainability goals an option to purchase the output. A final agreement with the developer was nearing completion when a problem with the planned site occurred. Unfortunately, this problem could not be satisfactorily resolved making the site, on reclaimed coal mining land, unusable for this project. Kentucky Power is currently working on its plan forward, which may include searching for another suitable site or pursuing another Request for Proposals (RFP) for renewable generation.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_25** Refer to the IRP, Section 3.3. Provide any updates to environmental regulations that will impact Kentucky Power.

**RESPONSE**

Below please find all updates to Section 3.3 of the IRP that will impact Kentucky Power:

**Section 3.3.2 National Ambient Air Quality Standards (NAAQS)**
The Federal EPA issued new, more stringent NAAQS for PM in 2012 and ozone in 2015; both of these standards are currently under review.

In April 2020 Federal EPA proposed to retain the current PM standards without revision. The Federal EPA completed external review drafts of the integrated science assessment and policy assessment for the ozone standard in 2019, and work to complete the review of the 2015 ozone standard will continue in 2020.

**3.3.4 Mercury and Other Hazardous Air Pollutants (HAPs) Regulation**
In 2018, the Federal EPA released a revised finding that the costs of reducing HAP emissions to the level in the current rule exceed the benefits of those HAP emission reductions. The Federal EPA also determined that there are no significant changes in control technologies and the remaining risks associated with HAP emissions do not justify any more stringent standards. Therefore, the Federal EPA proposed to retain the current MATS standards without change. A final rule adopting the findings in the proposal was issued in April 2020.

**3.3.6 Coal Combustion Residual (CCR) Rule**
In 2015, Federal EPA published a final rule to regulate the disposal and beneficial re-use of coal combustion residuals (CCR), including fly ash and bottom ash generated at coal-fired electric generating units and FGD gypsum generated at some coal-fired plants. The final 2015 rule was challenged in the courts. In 2018, the U.S. Court of Appeals for the District of Columbia Circuit issued its decision vacating and remanding certain provisions of the 2015 rule. Remaining issues were dismissed. The provisions addressed by the court's decision, including changes to the provisions for unlined impoundments and legacy sites, will be the subject of further rulemaking consistent with the court's decision.

Prior to the court's decision, Federal EPA issued a final rule in July 2018 that modifies certain compliance deadlines and other requirements in the rule. In December 2018, challengers filed a motion for partial stay or vacatur of the July 2018 rule. On the same day, the Federal EPA filed a motion for partial remand of the July 2018 rule. The U.S. Court of Appeals for the District of Columbia Circuit granted Federal EPA's motion. During 2019 and 2020, Federal EPA proposed multiple rulemakings to address the court's decisions and stakeholder concerns. In August 2019, Federal EPA published a proposal to revise the beneficial use criteria and definition of CCR Piles. In December 2019, the Federal EPA published proposed revisions to implement the court's decision regarding timing for closure of unlined surface impoundments and impoundments not meeting the required distance from an aquifer. The Federal EPA also published a proposed Federal CCR permit program in February 2020, implementing the Water Infrastructure Improvements for the Nation (WIIN) Act, which will apply in states that do not have a federally approved state CCR program.

The Rockport Plant will stop using the east bottom ash pond by the date established in any final rule issued by the Federal EPA, and initiate closure to comply with the CCR Rule's requirements. The plant will continue operation of the generating units by making changes to its operating practices.

Other utilities and industrial sources have been engaged in litigation with environmental advocacy groups who claim that releases of contaminants from wells, CCR units, pipelines and other facilities to ground waters that have a hydrologic connection to a surface water body represent an "unpermitted discharge" under the Clean Water Act (CWA). Two cases have been accepted by the U.S. Supreme Court for further review of the scope of CWA jurisdiction. In April 2020, the Supreme Court issued an opinion remanding one of these cases to the Ninth Circuit Court of Appeals based on its determination that discharges from an injection well that make their way to the Pacific Ocean through groundwater may require a permit, if the distance traveled, the length of time to reach the ocean, and other factors make it "functionally equivalent" to a direct discharge from a point source. Prior to the Supreme Court's decision, the Federal EPA opened a rulemaking docket to solicit information to determine whether it should provide additional clarification of the scope of CWA permitting requirements for discharges to ground water.

The impact of these developments on CCR units will be determined by further agency guidance, additional permitting decisions, and future action from the courts.

**3.3.7 Clean Water Act Regulations**

In 2015, the Federal EPA issued a final rule revising effluent limitation guidelines for electricity generating facilities. The rule established limits on FGD wastewater, fly ash and bottom ash transport water and flue gas mercury control wastewater to be imposed as soon as possible after November 2018 and no later than December 2023. These requirements would be implemented through each facility's wastewater discharge permit. The rule was challenged in the U.S. Court of Appeals for the Fifth Circuit. In 2017, the Federal EPA announced its intent to reconsider and potentially revise the standards for FGD wastewater and bottom ash transport water. The Federal EPA postponed the compliance deadlines for those wastewater categories to be no earlier than 2020, to allow for reconsideration. A revised rule was proposed in November 2019.

The Federal EPA and the Corps of Engineers issued a final rule revising the regulatory definition of "waters of the United States" in April 2020 and the rule will become effective in June 2020. The final rule has been challenged in the courts.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_26** Refer to the IRP, Section 3.3.2, page 43. Provide a detailed explanation of the scientific risk and policy assessments for the proposed 2021 National Ambient Air Quality Standards rule.

**RESPONSE**

See the Federal Register's website for a copy of the Federal EPA's proposed rule on PM issued in April 2020 (https://www.federalregister.gov/documents/2020/04/30/2020-08143/review-of-the-national-ambient-air-quality-standards-for-particulate-matter), and the Federal EPA's website for the underlying assessments for the PM standard (https://www.epa.gov/naaqs/particulate-matter-pm-air-quality-standards) and ozone standard (https://www.epa.gov/naaqs/ozone-o3-air-quality-standards).

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_27** Refer to the IRP, Section 3.3.6, page 47. Provide an update to the Coal Combustion Residual Rule that was anticipated near the end of 2019 or early 2020.

**RESPONSE**

See the Company's response to KPSC 1-25 in this set of discovery for an update to the Coal Combustion Residual (CCR) Rule.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_28** Refer to the IRP, Section 3.4.2.1, page 55. For the two customers with demand-response (DR) capability, provide the type of DR.

**RESPONSE**

Kentucky Power's demand response customers are only available for interruption during PJM emergencies.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_29** Refer to the IRP, Section 3.4.3, page 56. Explain the type of EE resources that will be added in 2022.

**RESPONSE**

The EE resources selected in the IRP are not a commitment to add any particular type of EE resource. The IRP merely includes proxies for EE resources that were selected by the model to support a solution for meeting the Company's load obligation to PJM. As shown in Table ES-1, the Preferred Plan includes EE resources and as further described in the Company's three-year action plan on page ES-9, the Company plans to examine opportunities to increase cost effective levels of energy efficiency.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_30** Refer to the IRP, Section 3.4.4, pages 57–59.
a. Explain whether the discussion is predicated on Kentucky Power's current tariff and the net metering limitations in Kentucky.
b. Explain how the economics of net metering would change if Kentucky Power disaggregated its current Tariff R.S. Residential Service to remove a portion of the fixed costs that are now collected through the service and energy charges.
c. For the forecast of residential solar installations, explain how the forecast was developed and provide the annual growth rates.

**RESPONSE**

a. The discussion in Section 3.4.4 provides two examples of the relative value of rooftop solar. One example is based on the Company's average residential retail rate and the other is based on the wholesale rate. Both assume full net metering, under which customers exports are compensated at the applicable rate.

b. The Company has not completed this analysis and can not estimate this impact at this time.

c. Section 4.4.3.4 in the IRP discusses DG resources in the IRP. Please refer to the footnotes in this section for forecasts used in this IRP. For the period 2019-2034, the CAGR is 19.8%.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_31** Refer to the IRP, Section 3.4.4, page 58. Explain why a discount rate of 10 percent was chosen.

**RESPONSE**

As discussed on page 58, the 10% discount rate was assumed as a customer's average cost of capital because it is a reasonable value that falls within the range illustrated in Figure 18, which shows how the customer's assumed value may change with a higher and lower discount rate. As stated these are examples of the value of a rooftop solar system with full net metering.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_32** Refer to the IRP, Section 3.4.5, page 60.
a. Provide the current amount of Volt VAR Optimization (VVO) on Kentucky Power's system.
b. Provide the technological improvements in VVO since the 2016 IRP.
c. Regarding the limited VVO rollouts:
(1) Provide the number of installations; and
(2) Provide the reports supporting this energy demand reduction.

**RESPONSE**

a. VVO has been installed on 27 circuits in Kentucky Power's system.

b. There have been some minor upgrades to the VVO control system. There have not been any significant technological improvements.

c. (1) The number of installations is 27 circuits.
(2) Testing on 10 of the circuits was performed in March 2014 and February 2015. The Summary Report is included as KPCO_R_KPSC_1-32_Attachment1.

Witness: John F. Torpey

June 23, 2015

# American Electric Power – Kentucky Power: Measurement and Verification (M&V) Analysis for Belhaven, Highland, Russell and Wurtland Substations

## March 2014 – February 2015

Revision: 00

Utilidata, Inc. 245 Chapman Street, Providence RI 02905

Utilidata



**Purpose**

This report is intended to provide comparative information on the energy saving benefits of Voltage Optimization as deployed at American Electric Power's Belhaven, Highland, Russell and Wurtland substations in their Kentucky Power service territory.

## Table of Contents

## 1.0 Executive Summary

A one-year measurement and verification experiment was conducted on Kentucky Power's Belhaven, Russell, Wurtland and Highland substations, in accordance with the estimation methodology outlined in Automated CVR Protocol #1 (the "Protocol") from March 2014 through February 2015. While the demand records do not conform to the specifications outlined by the Protocol (as discussed herein), analysis indicates **yearly energy savings in the range of 1.02-5.39%.**

Detailed results for each individual circuit are provided as attachments to this report, and are outlined in Section 8 of this report. Graphical results are also contained in these attachments.

The data sets used for analysis suffered from severe defects. Probable causes for data set defects include (but are not limited to) circuit topology switching (impacting demand records) and field communications outages (causing data loss). The analyst implemented several methods to overcome these deficiencies, such as combining spring and autumn seasonal data sets into a larger "shoulder" period data set. These methods are outlined in Section 6 of this document.

## 2.0 Energy Savings Results

The following table outlines seasonal and yearly energy savings results (in percentages) for all of the circuits served by the Belhaven, Highland, Russell and Wurtland substations.

| Substation | Feeder | Shoulder | Summer | Winter | Yearly |
|---|---|---|---|---|---|
| | | % ΔkWh | % ΔkWh | % ΔkWh | % ΔkWh |
| Belhaven | 6701 | 1.60% | 3.16% | ** | 2.59% |
| | 6702 | 2.45% | 3.03% | ** | 3.19% |
| | 6703 | 2.62% | 2.42% | ** | 2.87% |
| Russell | 2601 | 1.33% | 0.53% | ** | 1.02% |
| | 2602 | 1.75% | 1.28% | ** | 1.38% |
| Wurtland | 1902 | 2.32% | 5.55% | ** | 4.67% |
| | 1903 | 2.02% | 5.74% | ** | 5.39% |
| Highland | 2901 | 1.44% | 2.00% | ** | 1.14% |
| | 2902 | 0.75% | 3.81% | ** | 1.43% |
| | 2903 | ** | ** | ** | ** |

## 3.0 Median Circuit Voltage Reduction Results

The table below outlines the voltage reductions achieved by the AdaptiVolt system for the circuits served by the Belhaven, Highland, Russell and Wurtland substations. Results are reported seasonally and yearly.

| Substation | Feeder | Shoulder | Summer | Winter | Yearly |
|---|---|---|---|---|---|
| | | ΔVBasis | ΔVBasis | ΔVBasis | ΔVBasis |
| Belhaven | 6701 | 4.21 V | 3.79 V | ** | 4.03 V |
| | 6702 | 4.15 V | 3.66 V | ** | 3.93 V |
| | 6703 | 4.23 V | 3.75 V | ** | 3.98 V |
| Russell | 2601 | 2.34 V | 2.00 V | ** | 2.19 V |
| | 2602 | 2.37 V | 2.00 V | ** | 2.21 V |
| Wurtland | 1902 | 3.39 V | *3.26 | ** | *3.53 V |
| | 1903 | *3.68 V | *3.25 V | ** | *3.51 V |
| Highland | 2901 | 2.14 V | *1.76 V | ** | *2.00 V |
| | 2902 | 2.14 V | *1.76 V | ** | 1.95 V |
| | 2903 | ** | ** | ** | ** |

## 4.0 Voltage Tap Change Results

The following table summarizes the AdaptiVolt's system impact on tap change operation performance while achieving the voltage reductions outlined in Section 3 of this report. Seasonal and yearly results are provided.

| Substation | Feeder | Phase | Shoulder | Summer | Winter | Yearly |
|---|---|---|---|---|---|---|
| | | | % ΔTaps | % ΔTaps | % ΔTaps | % ΔTaps |
| Belhaven | 6701 | AØ | ** | ** | ** | ** |
| | | BØ | 26.56% | 14.2% | ** | 21.7% |
| | | CØ | ** | ** | ** | ** |
| | 6702 | AØ | ** | ** | ** | ** |
| | | BØ | 27.4% | 15.5% | ** | 20.5% |
| | | CØ | ** | ** | ** | ** |
| | 6703 | AØ | ** | ** | ** | ** |
| | | BØ | 26.4% | 11.3% | ** | 20.0% |
| | | CØ | ** | ** | ** | ** |
| Russell | 2601 | LTC | 21.3% | 8.10% | ** | 15.3% |
| | 2602 | LTC | 22.4% | 9.70% | ** | 18.6% |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wurtland | 1902 | LTC | 4.60% | (13.5%) | ** | (3.50%) |
| | 1903 | LTC | (1.07%) | (1.70%) | ** | (8.85%) |
| Highland | 2901 | AØ | 26.8% | 15.3% | ** | 22.7% |
| | | BØ | ** | ** | ** | ** |
| | | CØ | 22.7% | 7.46% | ** | 15.8% |
| | 2902 | AØ | 23.3% | 18.0% | ** | 20.6% |
| | | BØ | ** | ** | ** | ** |
| | | CØ | 20.7% | 8.82% | ** | 14.5% |
| | 2903 | | ** | ** | ** | ** |

# 5.0 Notes on Missing Data

### Winter Period Results

Please see analyst's notes in Section 6.0, Data Set Quality, below.

### Tap Changer Results

Tap position feedback sensors for voltage regulators on Phase A and Phase C in the Belhaven substation, and on Phase B in the Highland substation occasionally reported erroneous data, skewing calculated results, and are not presented in these reports.

### Median Circuit Voltage Reductions

A regression code defect prevented generation of the median three-phase circuit voltage reductions for several analysis periods on multiple circuits (marked with "*"), particularly on those circuits with multiple banks of mid-line voltage regulators. The analyst has substituted the substation voltage reduction estimate for the executive results in the table above.

### Circuit 2903

Small data sets and the extensive presence of plural demand process (as discussed in Section 6.0, Effect of Plural Demand Process, of this report) prevented meaningful analysis of the subject circuit; and, the results are therefore excluded from this report.

# 6.0 Analyst's Notes

## Methodology

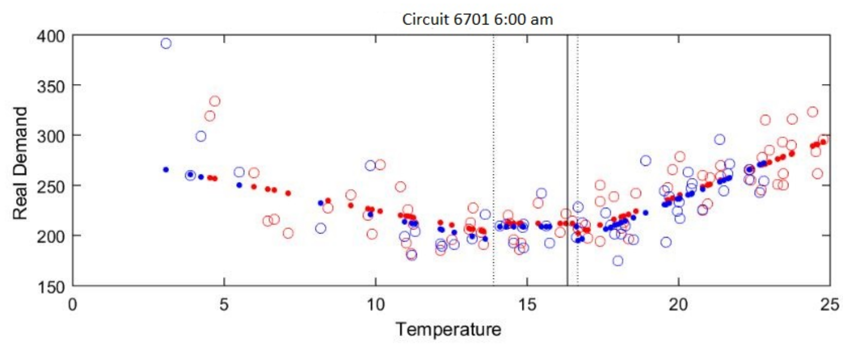
The results presented in this report were obtained using minimum covariance determinant linear regression of time series ensembles of real demand against ambient temperature, as outlined in reference [2]. A demand interval of 15 minutes was employed for all analyses.

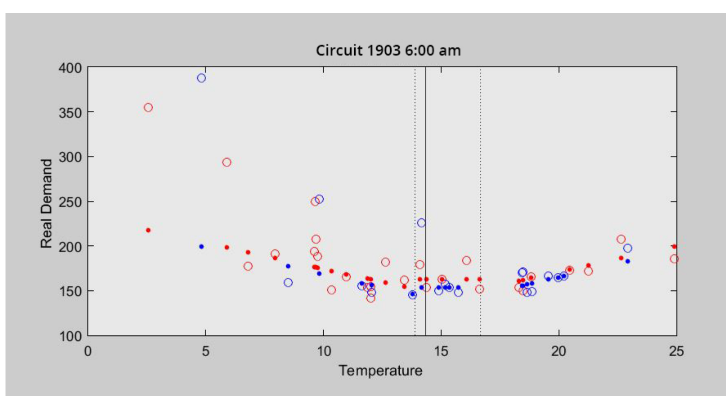
## Data Set Quality

The analysis procedures prescribed by the Protocol require a sufficient number of interleaved measurable days. No circuit had these data for the winter period so no analysis could be performed. To increase ensemble sizes the spring and autumn seasons were combined into "shoulder" period and an analysis was done for the entire year.

## Effect of Plural Demand Processes

The analysis is based on a linear regression of demand to temperature in three temperature regions. The impact of plural demand processes (i.e. variations in demand caused by circuit switching, seasonal factors, etc.) has caused the data to tend to fall along different lines as shown in the two graphs below.

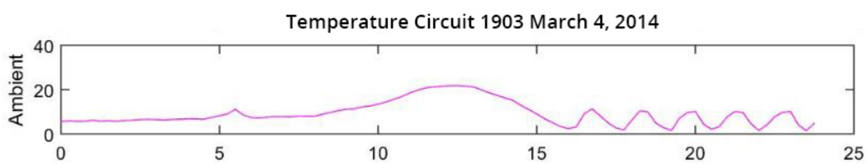


The images above show the raw data as open circles, red for days the system is off and blue for days the system is on. The analysis requires the fitting of lines for on and off days in the heating region below the vertical dashed line at 13.89 degrees C (Similar lines are formed in the cooling and neutral regions). Both the on and off data seem to cluster around an upper line and lower line but neither tend to form good linear fits. The solid red and blue dots show the fit the MCD algorithm puts to the data. A coefficient of determination is calculated for each line representing the quality of a fit. These coefficients are uncharacteristically low, therefore eroding confidence in the results.

### Temperature Records

Another cause of concern is the temperature data. Nearly all circuits show erratic temperature behavior in many days during winter months, as shown in the graph below.




It is not certain that smaller artificial disturbances did not occur earlier in the year and were not detected. The closest National Oceanographic and Atmospheric Administration (NOAA) weather station is in Huntington, West Virginia. It was determined that the error from using a distant temperature source outweighed the possible error in the measured data.

## 7.0 References

- Utilidata. *Automated CVR Protocol No. 1.* Spokane, WA: Utilidata, 2004.
- Bell, David G., *Estimation of Utilidata AdaptiVolt™ System Performance using Observed Energy Demand Profiles,* Spokane, WA: Utilidata, 2004.

## 8.0 Report Contents

In order to aid the review of detailed M&V analyses for each circuit, individual results are contained in separate attachments, as outlined below. Each attachment contains summary and graphical results for energy savings and other operational parameters for the subject M&V experiment.

**Attachment #1: Belhaven Substation, Circuit 6701, "Diedrich"**

**Attachment #2: Belhaven Substation, Circuit 6702, "Indiana Run"**

**Attachment #3: Belhaven Substation, Circuit 6703, "Argrillite"**

**Attachment #4: Russell Substation, Circuit 2601, "Kenwood"**

**Attachment #5: Russell Substation, Circuit 2602, "Bear Run"**

**Attachment #6: Wurtland Substation, Circuit 1902, "Greenup"**

**Attachment #7: Wurtland Substation, Circuit 1903, "Route 503"**

**Attachment #8: Highland Substation, Circuit 2901, "Russell"**

**Attachment #9: Highland Substation, Circuit 2902, "Flatwoods"**

**Attachment #10: Highland Substation, Circuit 2903, "Wurtland"**

# Appendix A – Acronyms & Terms

This document, and related technology use the following acronyms and terms:

| Acronym | Description |
|---|---|
| M&V | Measurement and Verification |
| % ΔkWh | Percent change in energy consumption. Positive numbers represent a reduction in energy consumption, while negative numbers (n) represent an increase in consumption. |
| ΔVBasis | Change in basis voltage. Positive numbers represent a reduction in voltage, while negative numbers (n) represent an increase in voltage. |
| % ΔTaps | Percent change in voltage tap change operations. Positive numbers represent a reduction in tap change operations, while negative numbers (n) represent an increase in tap change operations. |

# Appendix B – Revision History

This section provides a revision history for this document.

| Revision | Date | Description |
|---|---|---|
| 00 | 6/23/2015 | This is the initial release of this document. |

**DATA REQUEST**

**KPSC 1_33** Refer to the IRP, Section 3.5, page 62. Regarding transmission:
a. Confirm that a CPCN was applied for on each transmission project listed in Section 3.5.8, and provide their corresponding Case No.;
b. Provide an update to the transmission projects listed in Section 3.5.8 and any additional transmission projects since the filing of the 2019 IRP;
c. Provide a list of PJM transmission projects and the annual costs for Kentucky Power for the past five years and estimated cost for the next five years;
d. Explain the process Kentucky Power uses to prioritize transmission projects;
e. Explain the process PJM uses to prioritize transmission projects;
f. Provide Kentucky Power's assessment of the transmission system and its ability to continue to meet load obligations; and
g. Explain whether Kentucky Power applies for a CPCN for each transmission project, and if not, provide a description of transmission projects undertaken in the last five years and anticipated in the next five years for which a CPCN is not or was not needed.

**RESPONSE**

a. Kentucky Power applied for, or will apply for, any required certificate of public convenience and necessity in conformity with Kentucky law. KRS 278.020 and 807 KAR 5:001, Section 15(3) exempt certain projects from the certificate of public convenience and necessity process. Please see Attachment KPSC_1_33_Attachment_1, which provides a list of the projects contained in Section 3.5.8 of the IRP, an indication whether each requires a CPCN under Kentucky law, and a description of the status of and, if available, case number applicable to each required CPCN filing.

b. Since the Company filed its IRP in December 2019, the following two additional transmission projects have completed the PJM stakeholder process: Garrett Area Improvements (S2188) and the Middle Creek Project (S2200).

c. Please see the PJM website at the following link for a description of Kentucky Power's projects and the associated estimates for each project: https://www.pjm.com/planning/project-construction.

d. Kentucky Power, in coordination with AEP Transmission, implements a process that incorporates multiple factors when determining which transmission projects are carried forward. This process includes the following: 1) the needs identification, which assess an asset's condition, historical performance, and risk; 2)the solution development, which identifies how the needs would be addressed; and 3) how the solution will be implemented based on outage availability, resource availability, system impacts, and siting requirements.

e. Please see PJM's Manual 14B for discussion on the PJM RTEP Process. The manual can be found at the following link: https://www.pjm.com/-/media/documents/manuals/m14b.ashx.

f. The transmission facilities located in, and interconnected with, Kentucky Power's electric utility system are maintained and planned in a manner consistent with NERC and PJM requirements and good utility practice. These facilities are in constant need for maintenance and upgrades, are planned on a long-term planning horizon basis and are indispensable for Kentucky Power to provide electric service to its customers in a safe, reliable, and cost-effective manner.

g. Kentucky Power seeks a certificate of public convenience and necessity in accordance with KRS 278.020 and 807 KAR 5:001, Section 15(3) where one is required. Kentucky Power does not seek a CPCN for those projects for which one is not required. Please see PJM's website at https://www.pjm.com/planning/project-construction for a list of projects completed and currently planned by the Company.

Witness: John F. Torpey

| Project | Case Number | Additional Information |
|---|---|---|
| Hazard Wooton (161kV transmission line & Hazard transformer 161/138kV) | 2017-00328 | CPCN issued March 16, 2018 |
| Hazard Wooton- 138/69kV transformer #1 | 2019-00154 | CPCN application pending |
| | | |
| Cannonsburg- South Neal 69kV rebuild | | No CPCN required |
| | | |
| East Park | 2018-00072 | CPCN issued October 5, 2018 |
| | | |
| Boyd County | | A CPCN application is anticipated to be filed in the future. |
| | | |
| Chadwick Station | | No CPCN required |
| | | |
| Johns Creek and Stone Station Upgrades | | No CPCN required. |
| | | |
| Enterprise Park | 2018-00209<br>2020-00062 | A conditional CPCN was issued on December 6, 2018 and was subsequently cancelled because the condition related to Enerblu's financing could not be satisfied due to Enerblu's cancellation of its plan to locate in the Kentucky Enterprise Industrial Park. due to the cancellation by the customer at Enterprise. The Company plans to file a CPCN application for the Project, which is necessary to meet other system requirements, in Case No. 2020-00062 on or before September 8, 2020. |

**DATA REQUEST**

**KPSC 1_34** Refer to the IRP, Sections 4.3, pages 76–77, and 5.2.1, pages 113–114.
a. Explain whether the Fundamentals Forecast is significantly different if 20-year average heating and cooling degree days are assumed, as opposed to using 30-year averages.
b. Explain the relationship, if any, between forecasted data provided by the U.S. Energy Information Agency and the Fundamentals Forecast.
c. If not provided above, explain the sources of data that serve as the basis for the Base, Lower, and Upper Band forecasts.
d. Explain the differences in assumptions between the commodity pricing scenarios for the base, low and high band forecasts.

**RESPONSE**

a. The Fundamentals Forecast could be different; however, the significance of the difference would depend upon the periods compared. The National Oceanic and Atmospheric Administration ("NOAA") 30-year average heating and cooling degree day values are rolling averages meaning, as time progresses, prior yearly values are removed as new yearly values are added. This serves to dampen periods of abnormal weather over the 30-year period. It would be reasonable to conclude that a shorter period of rolling averages (20 years versus 30 years) would result in values that are more affected by abnormal weather (both lesser and greater degree days). Deviation from 30-year average heating and cooling degree days affects electric generation load. Differences in electric generation load are priced by the merit order of dispatch ("supply stack").

b. The Fundamentals Forecast and the U.S. Energy Information Administration (EIA) both reference the same historical data set for application in forecasts including energy prices, demand, supply and existing electric generation unit operating characteristics. Both forecasts are model driven and acknowledge that they are not predictions of what will happen in the future, but are projections of what may happen given the best available data at the time the forecast is modeled. The EIA states that "many of the events that shape energy markets and future developments and technologies, demographics, and resources cannot be seen with certainty." To bound this uncertainty, the EIA presents six plausible Side Cases in addition to their Reference Case.

c.- d. The sources of data that served as the basis for the Base, Lower, and Upper Band forecasts were internal statistical analysis of fuels prices from Energy Information Administration historical data and North American electric generation load data. To complement the Base Case Fundamentals Forecast, four associated cases were also created; the Lower Band, Upper Band, Base No Carbon and Lower Band No Carbon cases. The associated cases were designed and generated to define a plausible range of outcomes surrounding the Base Case Fundamentals Forecast. The Lower and Upper Band forecasts consider lower and higher North American demand for electric generation and fuels and, consequently, lower and higher fuels prices, respectively. Nominally, Lower and Upper bound fossil fuel price forecasts vary one standard deviation above and below Base Case values. The Base No Carbon and Lower Band No Carbon cases assume there will be no regulations limiting CO2 emissions throughout the entire forecast period.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_35** Refer to the IRP, Section 3.6, page 72. Provide any studies Kentucky Power has reviewed when evaluating Distributed Energy Resources as an alternative for capacity and reliably upgrades.

**RESPONSE**

The Company objects to this question as overly broad and unduly burdensome to the extent it requests "any studies" the Company has reviewed. Notwithstanding and without waiving this objection, the Company states as follows:

The Company's approach to evaluating Distributed Energy Resources (DER) as an alternative for capacity and reliability upgrades has been informed by:

- Participation in EPRI, EEI, and other industry forums
- Participation in industry conferences including third party developers with their perspectives
- AEP's experience with Energy Storage Systems
- Work with Energy Storage vendors to understand high level cost models.

Four examples of high level cost evaluations of analysis related to DERS as an option to defer distribution investment are included as KPCO_R_KPSC_1-35_Attachment1 through 4 - analyses for solar and storage options for the Ramey station, Marion Branch, Grays Branch, and Daisy stations, respectively.

The evaluations were done at a very high level to see if the savings by deferring the traditional projects were enough to offset the costs of the DER solution. The simple evaluation of the NPV value of the savings compared to the cost of the DER was utilized to determine if a more exhaustive analysis including additional benefit streams was warranted. None of the cases studied warranted further study because they were determined not do represent a good economic choice.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff’s First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_36** Refer to the IRP, Section 4.3, page 76. Kentucky Power and AEP operate within PJM. It is reasonable to assume that changing economic conditions occurring within PJM, surrounding RTO territories, and along fuel supply chains could affect the Fundamentals Forecast. Explain how operating conditions across North America affect zonal energy market prices.

**RESPONSE**

The Company confirms the statement; "It is reasonable to assume that changing economic conditions occurring within PJM, surrounding RTO territories, and along fuel supply chains could affect the Fundamentals Forecast." Operating conditions most influential to Kentucky Power occur within the AEP Gen Hub zone of PJM, adjacent zones, the entirety of PJM, and the remainder of the Eastern Interconnection. Influential operating conditions include; 1) the marginal cost of power supply; 2) the value of undispatched generation resources, and; 3) the ability of transmission to supply electric energy and capacity to, or from, the AEP Gen Hub and Kentucky Power. The Company's rigorous modeling, utilizing the Aurora energy market simulation model, captures the effects of operating conditions outside of the AEP Gen Hub and Kentucky Power.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_37** Refer to the IRP, Section 4.3.1, page 78.
a. Provide support of the 3.5 percent escalation for the CO2 dispatch burden.
b. Explain why Kentucky Power believes such an escalation is reasonable.

**RESPONSE**

a. The 3.5% annual escalation rate was intended to assure that overall CO2 emissions decline over time which necessitated a price that exceeds the projected average annual inflation rate of 1.7% from 2028 to 2053.

b. The Company's Base Case carbon price proxy ($15/metric ton escalating at 3.5% per annum) is intended to reflect the risks and costs associated with the regulation of carbon dioxide emissions from fossil fuel-fired power plants. The United States Environmental Protection Agency has determined carbon dioxide to be a pollutant under the Clean Air Act which makes CO2 emissions subject to further limitation. The yearly annual escalation rate of 3.5% takes into consideration the potential for change regarding carbon emission regulations in the future.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
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Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_38** Refer to the IRP, Section 4.4.1, page 83. Kentucky Power states that incremental DSM program impacts are modeled on the supply side; however, on page 8, Section 2.2.5, it states that no DSM programs are forecasted on the demand side. Reconcile these two statements.

**RESPONSE**

Incremental DSM programs impacts are described in Section 4.4.1 and are modeled in the IRP as an equivalent supply-side resources. This permits them to be selected by the IRP model if they are cost effective.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_39** Refer to the IRP, Sections 4.4.2 and 4.4.3, pages 83–89. Aside from Volt VAR Optimization, provide a discussion of any other initiatives to enhance the efficiency of the distribution and transmission systems, including substations.

**RESPONSE**

As noted in Section 4.4.3 of the IRP, the Plexos model allows the user to input incremental Combined Heat and Power (CHP), Energy Efficiency (EE), Demand Response (DR), and Volt-Var Optimization (VVO) as resources on equal footing with supply side resources. As discussed in Section 4.4.3.1 incremental EE was modeled in the IRP, with Tables 6 and 7 identifying EE Measure Categories that were considered. These are all ways in which more efficient options were included in the modeling parameters within this proceeding. The Company also continues to implement Distribution Supervisory Control and Data Acquisition (SCADA), add more Distribution Automated Circuit Reconfiguration (DACR) and install more advanced sensors to improve efficient operation of the distribution grid including substations, although these types of programs are not modeled in the IRP as resources. See section 3.6 of the IRP for discussion of other Distribution system initiatives.

As discussed in various subsections of Section 3.5 of the IRP, Kentucky Power and AEP participate in the PJM planning process for transmission expansion, which includes addressing the efficiency of the grid as appropriate. Projects that have been presented to PJM are included in Section 3.5.8 of the Company's IRP. Projects such as these, consistent with PJM's planning criteria, are performed to increase the reliability, efficiency and resiliency of the grid. To the extent these projects address thermal or voltage violations, operational flexibility, or provide voltage support, the efficiency of the transmission system (which includes substations) would be improved as a result. As also discussed in Sections 3.5 and 3.6, the Company is continually analyzing opportunities to improve both the transmission and distribution delivery system.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_40** Refer to the IRP, Section 4.4.3.1. Explain how the EE measures impact the supply-side forecast, but not the demand-side forecast.

**RESPONSE**

For this IRP, Kentucky Power Company modeled DSM programs as a supply side resource, competitive with other supply side resources available in the model. An optimized amount of EE is included to permit the Company to meet it's load obligation to PJM.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_41** Refer to the IRP, Section 4, Figure 26, page 91. Regarding distributed generation, specifically rooftop solar, provide an update of the annual installation cost, number of installations, payments to customers, and MW installed disaggregated for residential and commercial customers over the forecast period.

**RESPONSE**

Figure 13 on page 57 of the IRP provides the assumed annual installation costs. The assumed number of installations is calculated based on a 5kW system and shown in KPCO_R_KPSC_01_41 Attachment 1 along with the corresponding net payments to customers.

As described in Section 4.4.3.4 of the IRP, the Company used an aggregated forecast developed by PJM.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_42** Refer to the IRP, Section 4.4.3.3, page 89.
a. Explain why DR was modeled as a possible supply-side input when it was not included in the demand-side forecast.
b. Explain why industrial loads were not included as potential new DR program participants.

**RESPONSE**

a. As explained in section 4.4.3, the incremental DR resources (defined in section 4.4.1) were modeled similar to other incremental Demand-Side resources such as EE, VVO and CHP to analyze their impact in the model on equal-footing with more traditional "supply-side" generation resource options.

b. Industrial customers were not included due to the unique nature of those customers. Industrial offerings are tailored to the needs of specific and individual customers, and cannot be modeled accurately as a generic offering. However, our customer service engineers are in regular contact with industrial customers to discuss options available to manage customer demand and its value.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
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Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_43** Refer to the IRP, Section 4.4.3.6, pages 91–92.
a. Provide a list of the commercial and industrial customers in Kentucky Power's service territory that, as a practical matter, have the potential to cogenerate power and the estimated MW that could be produced as assumed in Kentucky Power's modeling.
b. For the generic combined heat and power option, explain whether Kentucky Power or the host owns the facility and whether any part of the facility is already present or whether it must be built from the ground up.
c. Cogeneration does not have to be limited to just customers utilizing waste heat to make steam. Explain whether any of Kentucky Power's industrial or commercial customers have approached Kentucky Power with the prospect of generating its own energy behind the meter regardless of technology.
d. Explain whether any of Kentucky Power's industrial or commercial customers have approached Kentucky Power with the prospect of generating its own energy behind the meter in pursuit of its own corporate green energy goals. If so, explain where those discussions stand.

**RESPONSE**

a. The IRP did not assume any customers had the potential to cogenerate power. The IRP included a generic Combined Heat and Power (CHP) resource, however this resource was not selected as part of the optimization modeling. Kentucky Power does have one customer, Inez Power LLC, that has applied for the Interconnection of a distributed generator with a maximum physical export capability of 6.8 MW. This resource is not yet in service and was not reflected in the IRP modeling.

b. For this IRP, the CHP assumption is that the resources is built from the ground up and the Company owns the resource.

c. Yes. Also see the Company's response to part (a) above.

d. Yes. Kentucky Power customers have approached Kentucky Power regarding behind the meter generation. Those discussions are preliminary and ongoing.

Witness: Brian K. West

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_44** Refer to the IRP, Section 3.3.4.3, page 90, at which Kentucky Power discusses the determination of the level of Distributed Generation (DG) penetration, Kentucky Power created a forecast using existing levels of DG and the incremental additions from PJM's forecast. Provide the calculations used to create the forecast, and detail any assumptions made to generate the forecast.

**RESPONSE**

No specific calculations were used to modify the PJM forecast referenced. Figure 26 charts the existing installed DG through 2018 and then adds the incremental PJM forecasted DG for future years as referenced in footnote 15 on page 90.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_45** Refer to the IRP, section 4.5.4.2, page 96.
a. State whether aeroderivatives have black start capability.
b. Identify the Kentucky Power units that have black start capability and would be utilized by PJM as such.

**RESPONSE**

a. The Aeroderivative units were not assumed to have black start capability.

b. Kentucky Power's generating units do not have black start capability.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_46** Refer to the IRP, Section 4.5.5, page 98. Explain the impacts the proposed Minimum Offer Pricing Rule (MOPR) currently under consideration by the Federal Energy Regulatory Commission will have on Kentucky Power's short-term market purchase program.

**RESPONSE**

It is not yet known what the final impact of the MOPR will be, as the rule is not yet final and no auctions have been held with such rules in effect. Any future short-term market purchase program will be executed in such a fashion as to allow the Company to continue to be a fixed resource requirement (FRR) entity within PJM. The Company operates today by supplying capacity sufficient to serve its own load and not participating in the Reliability Pricing Model (RPM) capacity market.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_47** Refer to the IRP, Sections 1.5 Table 1 at 4, 4.5.1, page 92, and 5.3 Table 17, page 128.

a. Explain whether Kentucky Power explored the option of only purchasing the capacity and any energy beyond 2023 as opposed to new construction after the expiration of the Rockport unit power agreement (UPA). If so, explain how the option was explored and the pricing options available to Kentucky Power. If not, explain why not.

b. With the expiration of the Rockport UPA, explain whether Kentucky Power explored the option of changing its participation in PJM from FRR to RPM. If so, explain the results of that study. If not, explain why not.

c. Explain whether and how the MOPR will affect Kentucky Power.

d. Explain whether Kentucky Power's Preferred Plan, as reported in Table 17, means that Kentucky Power is going to add up to 253 MW of new solar nameplate and 129 MW of new solar firm by 2024.

e. Explain the difference between new solar nameplate and new solar firm as reported in Table ES-1.

**RESPONSE**

a. For this IRP, the company limited the availability of the STMP resources through 2024 due to the Company's understanding of the availability of third-party capacity purchases. Beyond 2024, the Company may discover this type of resource is available for longer-terms than assumed in this IRP and remains open to appropriate options that might become available at that time.

b. The IRP assumed the Company would remain an FRR entity over the planning horizon. Kentucky Power annually reviews whether to remain an FRR entity or to participate in the RPM market.

c. See the Company's response to Staff 1-46.

d. The IRP is a planning document and is not a commitment to specific resource additions. The Company has not entered into any commitments for the referenced solar resources at this time.

e. PJM provides guidance for the Effective Load Carrying Capability (ELCC) associated with renewable resources. This is used to identify the amount of capacity a resource can contribute during peak hours and which can be offered as unforced capacity

which the Company refers to as "Firm Capacity" in this IRP. Nameplate capacity is the maximum rated output the solar resource is capable of producing.
For this IRP, the ELCC for utility solar resources in PJM was 51.1% of nameplate.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_48** Refer to the IRP, Section 4.5.2, page 93, Table 13.
a. Provide an explanation of the differences between E and F class combustion turbines.
b. Provide an explanation of the differences between H and J class combined cycle combustion turbines.
c. The Table appears to have footnotes attached to select column and row headings. Provide a copy of the table with the attendant footnotes attached.

**RESPONSE**

a. – b. Turbine classes are generally defined by the evolution of turbine design, generally with a later letter designation indicative of a more advanced turbine. A more detailed explanation can be read in the Power Engineering article "The Fall of the F-Class Turbine" (https://www.power-eng.com/2015/08/21/the-fall-of-the-f-class-turbine/#gref).

In summary, D- and E- class engines are typically in the 75-110 MW range with combined cycle efficiencies in the 50% range

F-class turbines are typically in the 170-230 MW range with combined cycle efficiencies in the 55% range.

The advanced class turbines (G-,H- and J- frames) are typically in the 275-350 MW range. This class can recognize combined cycle efficiencies exceeding 60%.

c. See Exhibit D in the Appendix to the Company's IRP for the requested information.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_49** Refer to the IRP, Section 4.5.5, page 99. Explain Kentucky Power's understanding of the availability of third-party capacity purchases and how that limited Kentucky Power's consideration of purchases to no later than 2024.

**RESPONSE**

For this IRP, the Company assumed based on its experience that there is no availability of short term market purchases for more than three years into the future. Generally, third party sellers of bilateral PJM capacity are unwilling to contract further out due to market and regulatory uncertainty.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_50** Refer to the IRP, Section 4.5.6, page 100. Provide support for the assumption that the RTO and other key stakeholders will support a higher penetration and capacity planning value of wind and solar.

**RESPONSE**

The Company's assumption that groups, individuals, as well as, the Company will look to develop innovations that support increased levels of intermittent resources is based on the Company's view that the public/society is interested in incorporating increasing amounts of renewable resources, including intermittent wind and solar resources. Furthermore, the planning assumption to allow for 45% penetration of intermittent resources over the planning period did not constrain the modeling results. As shown in ES-6, the Preferred Plan includes 11% and 16% wind and solar energy resources in 2034, respectively, well below the 45% constraint.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_51** Refer to the IRP, Section 4.5.6.1, Figure 29, page 102.
a. Explain the difference between Tier 1 and Tier 2 and the reason for the cost difference.
b. Provide support for the 1 percent solar escalation cost.

**RESPONSE**

a. Tier 1 installed cost are 5% less than Tier 2 installed cost. This is based on an assumption that if the resource is bid the Company will expect a range of bid prices and Tier 1 reflects the lower bid prices, while Tier 2 reflects the average price. Ultimately, this provides the IRP model two solar resource options.

b. The 1% escalation costs applied to solar resources after the Bloomberg New Energy Finance (BNEF) forecast ends in 2030 reflects an assumption that installed cost increases will be minimized through improved technology performance and continued innovation in this space.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_52** Refer to the IRP, Sections 4.5.6.1, pages 100–103, and 5.2.1, pages 113–114. Also, refer to Figure 30, page 103.
a. Explain the difference between Residential and Commercial solar installation cost and why commercial solar is consistently more expensive to install.
b. Explain whether large scale solar was modeled on the same basis as for CTs and NGCCs (i.e., Kentucky Power owning a share of a larger facility). If not, explain why not.
c. Explain whether Kentucky Power modeled various limits to Kentucky Power's load obligation below or above 15 percent.

**RESPONSE**

a. The cost information was provided by BNEF. The verbal explanation provided by BNEF is that based on observations in Australia and Germany when subsidies are removed the competition for retail customers has initiated additional cost savings for residential customers versus commercial customers by providing a more standard product for residential customers than commercial customers.

b. With the modeled installed capacity of each tranche being only 50.6 MW, the large scale solar resources were modeled as a single owner resource.

c. For this IRP, the Company constrained the total solar resources to 15% of its total load obligation over the analysis period. The model may not select more than this, but can select less if the solar resource is not the lest cost alternative.

Witness: John F. Torpey

Kentucky Power Company
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**DATA REQUEST**

**KPSC 1_53** Refer to the IRP, Section 4.5.6.2, pages 103–105.
a. Explain whether the Wind option being modeled and the modeling cost was predicated on the facility to be constructed in the Company's service territory.
b. Explain whether the Wind option was included in the model as a stand-alone facility or on the same basis as the CTs and NGCCs were modeled (i.e., Kentucky Power owning a share of a larger facility).
c. Explain why the two tranches of wind resources have differing capacity factors.

**RESPONSE**

a. For this IRP, all resource options are estimated/forecasted to be either within the Company's service territory or to have the ability to deliver the products to the Company. Within the IRP, all generating resources are assumed to be PJM-interconnected resources.

b. With the modeled installed capacity of each tranche being only 100 MW, the wind resources were modeled as a single owner resource.

c. The capacity factors for the different tiers in the IRP represent a potential for varying performance of different wind resources. Modeling two different capacity factors of this resource provides the model flexibility to include optimized amounts of each wind resource.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_54** Refer to the IRP, Section 4.6, pages 106–107. Each supply-side and demand-side resource is offered into the Plexos model on an equivalent basis. Provide a table comparing the values for capacity, energy production (or savings), and cost for each resource offered into the model.

**RESPONSE**

See KPCO_R_KPSC_1_54_Attachment 1 for the requested information.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_55** Refer to the IRP, Sections 4.5.2, Table 13, page 93, and 5.2.1, pages 113–114. Table 13 illustrates modeling the CTs and NGCCs at the cost of an entire unit.

a. Explain why only a 50 percent share of two combustion turbine units was modeled rather than a 100 percent share of one combustion turbine.

b. Explain why a 25 percent share of a natural gas combined cycle facility was modeled rather than a larger percentage of a smaller unit.

c. For parts a. and b. above, explain whether there will be a need for additional power in the AEP East system and whether the same assumptions were made for other AEP East operating companies' IRPs. If so, explain whether the modeling results indicated that the larger units should be built, in which year, and the identity of the shared ownership companies.

d. Explain whether the modeled peaking capacity and intermediate baseload capacity modeled is within Kentucky Power's service territory.

e. Explain why the wind resources have differing levelized costs of energy.

f. Explain why the solar Tiers have differing costs/mWh.

g. Provide support for the compound annual growth rate of DG of 19.8 percent over the planning period.

**RESPONSE**

a. & b. The Company modeled a shared ownership of the Combustion Turbine (CT) and Combined Cycle (CC) units to help mitigate a size bias for these resources while maintaining reasonable economies of scale for these technologies.

c. The shared ownership assumptions were made in other AEP Operating Company plans.

The recently filed IRP for the Indiana Michigan Power Company showed a need for CC capacity beginning in 2028. This IRP did not inherently assume or constrain the shared ownership with an AEP affiliate in its modeling.

d. For this IRP, all resource options are estimated/forecasted to be either within the Company's service territory or to have the ability to deliver the products to the Company. Within the IRP, all generating resources are assumed to be PJM-interconnected resources.

e. & f.  The LCOE of the different wind and solar resource tiers is a function of their relative build and operating costs as well as their associated capacity factors for the wind resources.

g. See KPCO_R_KPSC_1_41_Attachment 1 for the requested information.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_56** Refer to the IRP, Sections 4.7, Item 4, page 108, and 5.3, Table 17, page 128. Item 4 states that Kentucky Power has included 20 MW of solar resources in its "Going In Position". Table 17 shows that Kentucky Power's capacity position in 2021 is 232 MW.
a. Explain whether Kentucky Power's capacity position as of the date of this Order is 236 MW.
b. Explain whether the 236 MW includes the 20 MW of solar capacity.
c. Explain when Kentucky Power intends to file a CPCN to construct the 20-MW facility.
d. Explain when Kentucky Power anticipates filing CPCNs for the new solar nameplate and firm solar capacity listed in Table 17.

**RESPONSE**

Negotiations associated with the 20 MW of solar generation referenced in IRP §3.2 have ceased due to project permitting issues. The 20 MW opportunity was the result of a competitive request for proposals (RFP) issued by the Company on October 17, 2018."www.kentuckypower.com/rfp).

a. Kentucky Power Company's net capacity position above the PJM Obligation is 236MW for the 2020/2021 planning year.

b. The 236 MW net capacity position for the 2020/2021 planning year does not include the 20 MW of solar capacity.

c. See the Company's response to 1-24 in this set of discovery.

d. The solar resources identified in Table 17 were identified as solutions for capacity and/or energy needs at the time the current IRP was created. As the Company nears the years those resources are projected to be required, the Company will assess its needs and determine the best resource additions for the Company. Once resources are secured and under contract, the Company will make any regulatory filings necessary in a time frame such that the projects can enter service by the date they are projected to be needed by the Company.

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_57** Refer to the IRP, Section 5.1, page 110. Provide Kentucky Power's capital structure and associated weighted average cost of capital.

**RESPONSE**

Kentucky Power Capital Structure and WACC, as of December 31, 2018, used as an assumption for this IRP is the following:

| **Description** | **Capital Ratio** | **WACC** |
|---|---|---|
| Debt | 54.3% | 2.44% |
| Equity | 45.7% | 4.69% |
| **TOTAL** | **100%** | **7.13%** |

Witness: Brian K. West

Witness: John F. Torpey

Kentucky Power Company
KPSC Case No. 2019-00443
Commission Staff's First Set of Data Requests
Order Dated April 28, 2020

**DATA REQUEST**

**KPSC 1_58** Refer to the IRP, Section 5.2.2.4, page 123. Explain the participants in the key Stakeholder technical conference and what the key stakeholders were asked to evaluate. Include in the answer any conference materials provided to participants and participant responses.

**RESPONSE**

The IRP technical conference was offered by Kentucky Power to allow key stakeholders an opportunity to actively engage in the IRP process, provide insights to preliminary modeling results and solicit input and feedback to consider for further analysis in identifying a Preferred Plan. The participants included representation from the Commission Staff, the Attorney General's Office, the Office of Energy Policy, the KIUC and Marathon. Please see KPCO_R_KPSC_1_58_Attachment1 for a copy of the presentation from the technical conference. Please also see KPCO_R_KPSC_1_58_Attachment2 for a copy of a request submitted by one of the technical conference participants after the conference ended.

Witness: Brian K. West

Witness: John F. Torpey

# Kentucky Power Company

2019 Integrated Resource Plan

Technical Conference

October 3, 2019

10:00am – 1:30pm

Location:

Kentucky Chamber

464 Chenault Road

Frankfort, KY 40601

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# Technical Conference Agenda

| Time | Topic | Speaker |
|---|---|---|
| 10:00 | Welcome & Safety Message | Brett Mattison, President & COO KPCo |
| 10:10 | Meeting Overview | Ranie Wohnhas, KPCo VP Regulatory & Finance |
| 10:20 | IRP Overview | John Torpey, AEP Managing Director Resource Planning |
| 10:30 | IRP Planning Process | Greg Soller, Resource Planning Analyst |
| 10:45 | Preliminary IRP Inputs/Assumptions<br>• Fundamental Commodity Forecast<br>• Load Forecast<br>• Going-In Position<br>• Resource Options | Karl Bletzacker – Director, Fundamental Analysis<br>Chad Burnett – Director, Economic Forecasting<br>Scott Fisher – Manager, Resource Planning |
| 11:45 | BREAK/LUNCH | |
| 12:30 | Preliminary Modeling Results | Scott Fisher |
| 1:15 | Next Steps & Closing Remarks | Brian West, KPCo Director Regulatory Services |
| 1:30 | Adjourn | |

# Ground Rules

## Ground Rules

- Everyone will be heard and have the opportunity to contribute
- Please be respectful of all opinions and/or proposals

## Housekeeping

- Safety – emergency exits
- Restroom locations
- Lunch logistics
- Please silence phones and if you must take a call, please step outside the room to do so

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# Goals for Today

## ❑ Today's Goals:

- ✓ Discuss the IRP process, key priorities, initial assumptions and preliminary scenarios/portfolios
- ✓ Obtain Stakeholder Input on the IRP process, priorities, assumptions and scenarios/portfolios

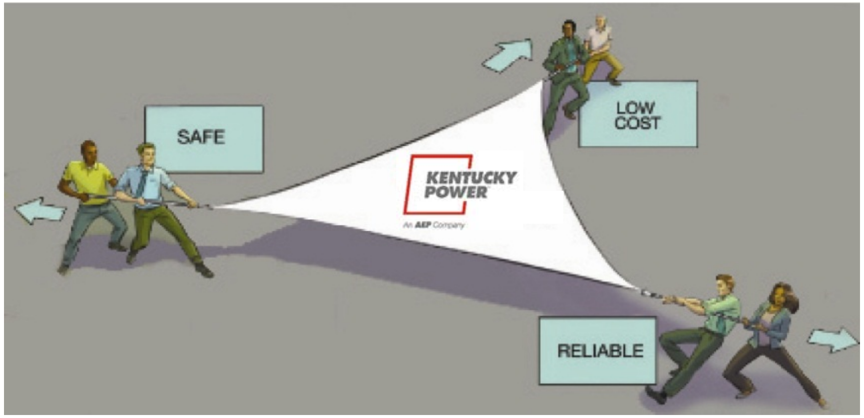
# IRP Schedule

| Date | Topic |
|---|---|
| Oct 3, 2019 | KPCo IRP Technical Conference |
| Dec 21, 2019 | KPCo files 2019 IRP |
| TBD | PSC Issues Procedural Schedule |
| TBD | Parties file requests and supplemental requests for information. |
| TBD | Parties file written comments. |
| TBD | Staff Report on KPCo's 2019 IRP |
| TBD | Commission Order closing case |

# IRP Planning Process

# The Integrated Resource Planning Process

- Resource planning is a complex effort that must balance the needs of a variety of stakeholders:
  - Customers
  - Regulators
  - Shareholders
- While ensuring that electricity is provided in a safe, reliable & efficient manner at just & reasonable rates.




*There are many priorities that compete for resources as KPCo works toward its objective is to provide safe, reliable, clean power at rates that are reasonable.*

- The process involves looking at "big-picture" trends that affect energy markets, developing & using forecasting & analysis models, & selecting approaches that will meet customer needs in the safest, most reliable & economical way given the uncertainties about the future.

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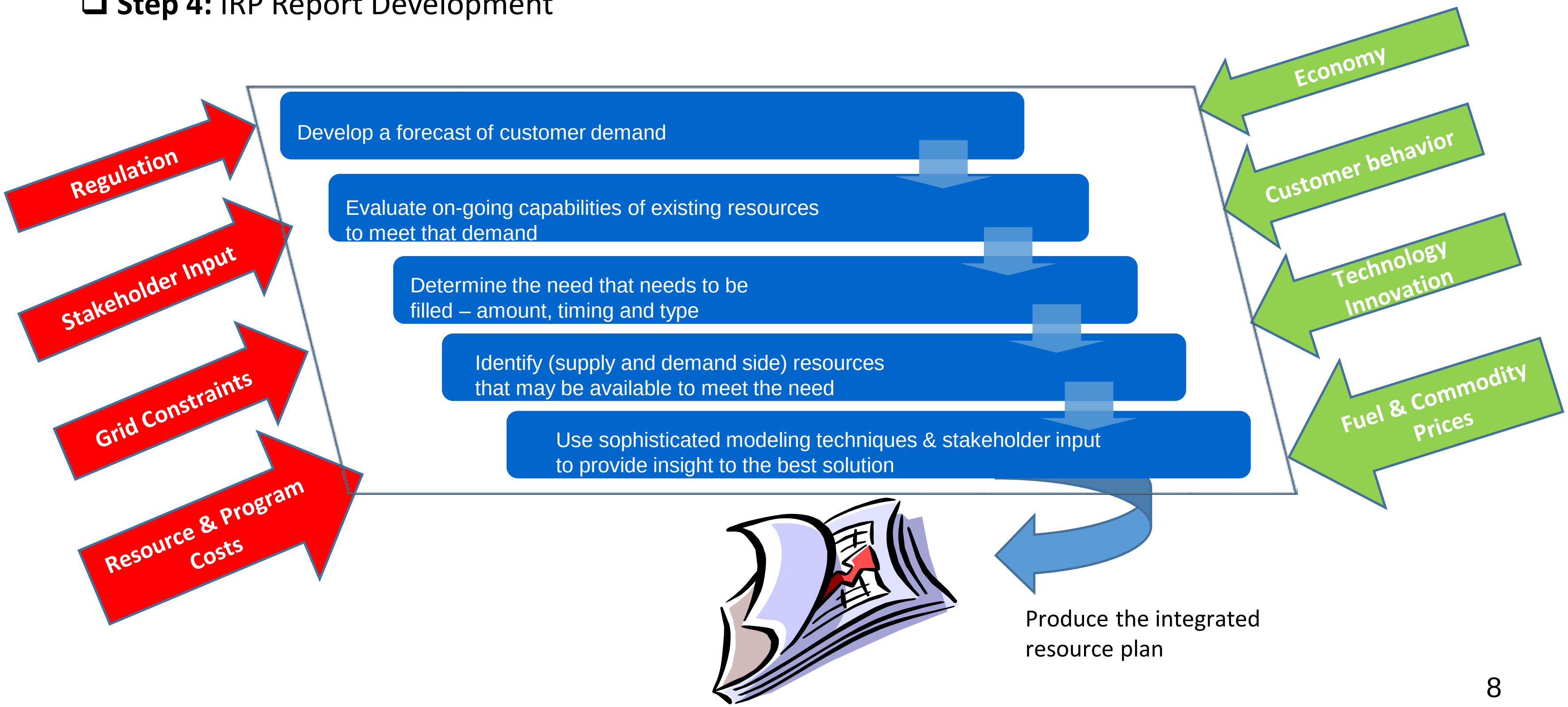
# The Integrated Resource Plan Development

Creating an Integrated Resource Plan (IRP) involves four basic & interconnected steps:

- ❑ **Step 1:** Gathering data, developing input assumptions & creating scenarios
- ❑ **Step 2:** Portfolio Development
- ❑ **Step 3**: Analyzing portfolios
- ❑ **Step 4:** IRP Report Development



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# IRP Report Development

### Step 1

**Data gathering, Input Assumptions, Scenario Creation**

- Forecasts – Commodities and Fuel Prices, Loads
- Cost Projections
- Supply-Side Resource Options
- Future state scenario definition

### Step 2

**Portfolio Development**

- Supply-Side Resource Screening
- Capacity addition resource portfolios created
- Sensitivity analysis to key assumptions in portfolios

### Step 3

**Portfolio Analysis**

- Optimization of portfolios using Plexos
- Comparison of optimized portfolios
- Selection of Preferred Plan

### Step 4

**IRP Report Development**

- KPCo refinement of optimized portfolios
- Preferred Plan and components shared with stakeholders
- Final IRP prepared and reviewed, edited & submitted

# Resource Planning Specific to KPCo

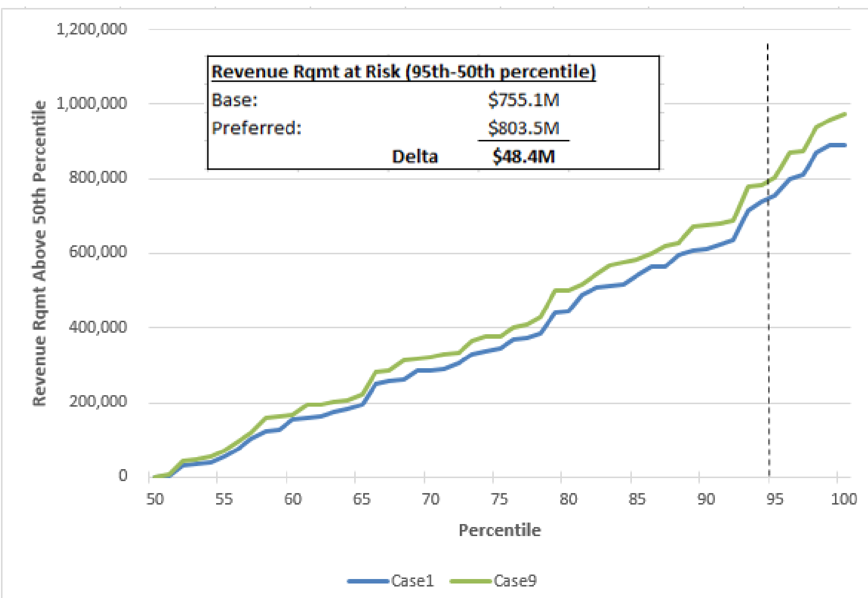
- KPCo is a member of the PJM Regional Transmission Organization (RTO) & is able to transact capacity & energy within PJM
- The discount rate used in all calculations is KPCo's weighted average cost of capital (WACC)
- The analysis period covers 30 years, and the IRP results and report will cover a 15-year period
- Sunk Costs are not included in the analysis
  - Example: unamortized costs of past investments
  - Assumes all sunk costs continue to be recovered regardless of resource disposition

# Output

- The optimized portfolio will be a resource portfolio that has the lowest present value of revenue requirements (PVRR), given the set of forecasts & assumptions.
- The model can calculate the PVRR for portfolios that are developed by KPCo or stakeholders (non-optimized portfolios).
- When performing a risk analysis on a portfolio, the output is a distribution of PVRRs.

# Risk Modeling

- "Risk" is the likelihood and magnitude of a bad outcome.
- The present value of IRP Portfolio's relative revenue requirements measured over 100+ simulations that vary key inputs
  - Power, natural gas, coal and $CO_2$




"Revenue Requirements at Risk" is defined as the difference in the 95% of results from the 50% (median) results.

# Risk Variables

- Determining Correlations between power, natural gas, coal and $CO_2$ is done with historical data

- Other variables can be modeled as well, but if there is no historical data then correlations must be hypothesized.

Before Carbon Pricing

| 2019 - 2027 | Natural GAS | COAL | $CO_2$ | Electricity |
|---|---|---|---|---|
| Natural GAS | 1.00 | -0.14 | 0.00 | 0.89 |
| COAL | | 1.00 | 0.00 | -0.15 |
| $CO_2$ | | | 0.00 | 0.00 |
| Electricity | | | | 1.00 |
| Avg Coeff of Variation | 10.2% | 9.2% | 0.0% | 7.0% |

After Carbon Pricing

| 2028 - 2038 | Natural GAS | COAL | $CO_2$ | Electricity |
|---|---|---|---|---|
| Natural GAS | 1.00 | -0.67 | 0.91 | 0.68 |
| COAL | | 1.00 | -0.72 | -0.48 |
| $CO_2$ | | | 1.00 | 0.67 |
| Electricity | | | | 1.00 |
| Avg Coeff of Variation | 9.2% | 9.3% | 70.7% | 12.4% |

Example

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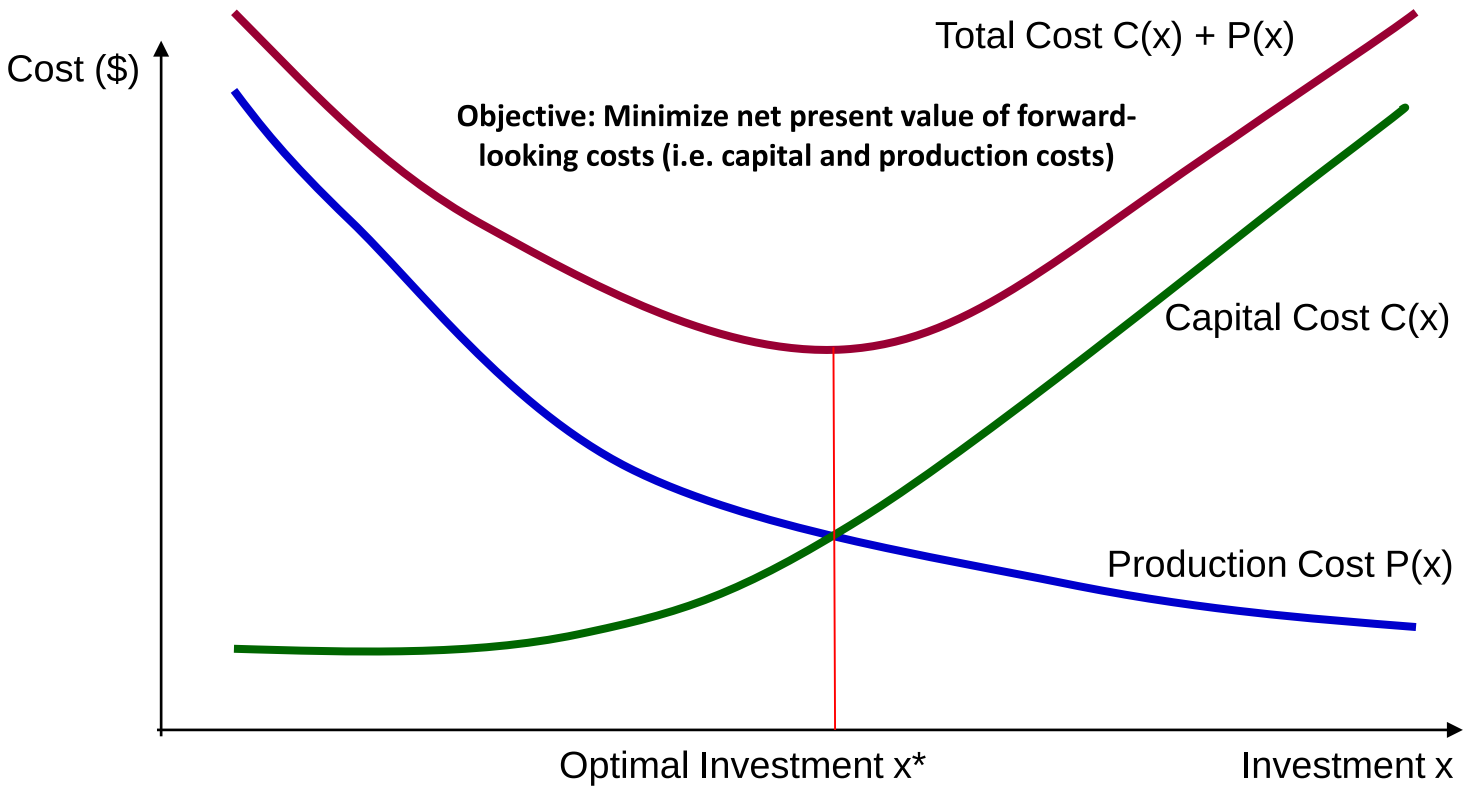
# PLEXOS

- *Plexos* is a model that incorporates all of the fundamental inputs and supply and demand options.
- *Plexos* can:
  - Given a set of fundamentals, "build" a portfolio that has the lowest (PV) revenue requirements
  - Given a supply and demand side portfolio, determine its (PV) revenue requirements
  - Given both, run multiple (Monte Carlo) iterations

*Resource Planning is currently using the* ***Plexos Long-term Planning Module*** *known as* ***Plexos LTPlan*** ®

# IRP Development – Modeling Tool

The PLEXOS LTPlan model selects the optimal (lowest total cost) plan based on resource characteristics (e.g. installed cost, heat rate, fuel costs, min run times, load shapes)



# Preliminary IRP Inputs/Assumptions

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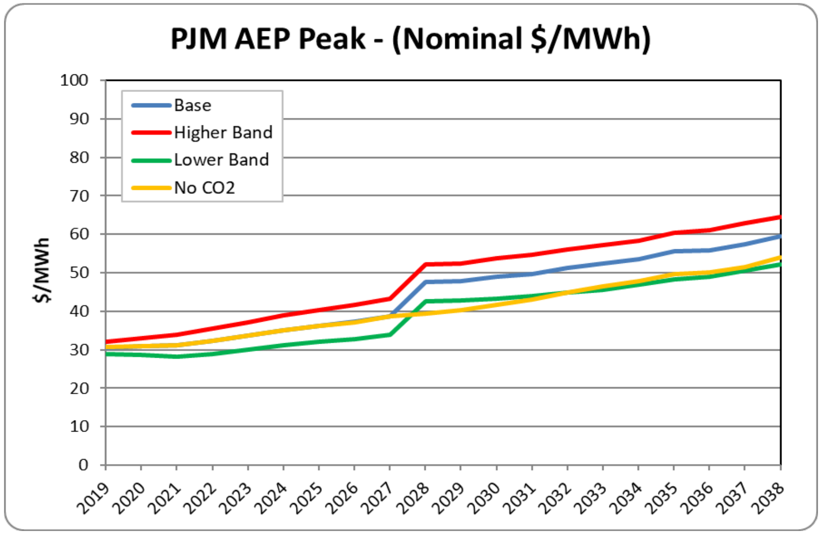
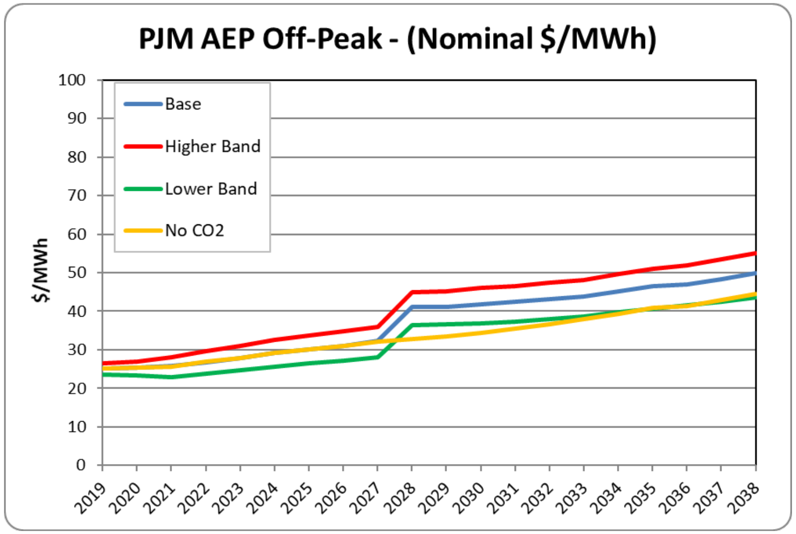
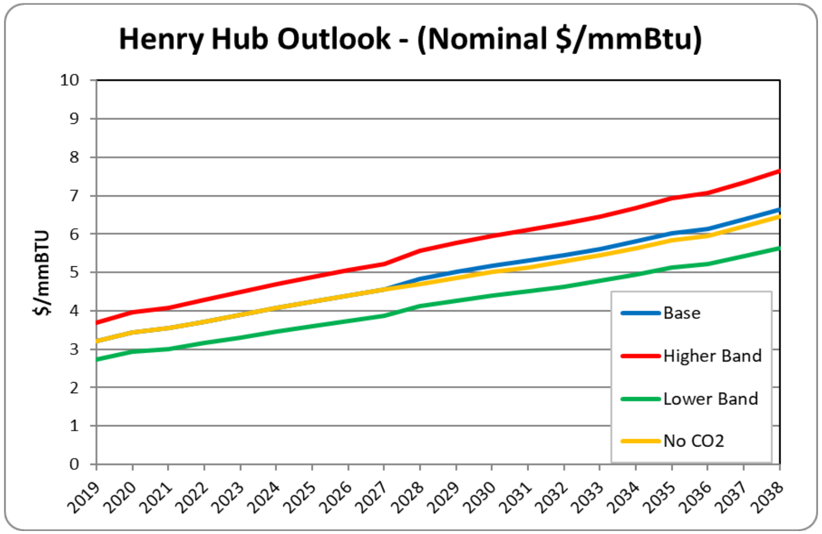
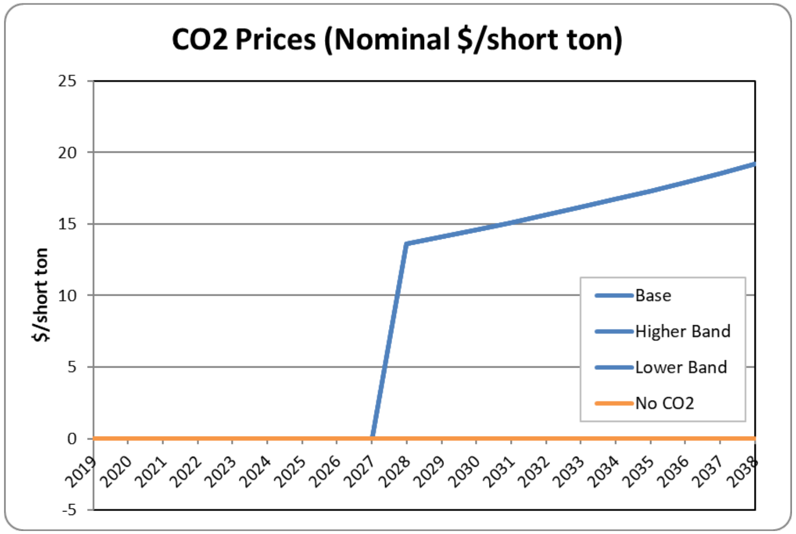
# Key Inputs – Fundamental Forecast (2019H1, 2019 Forecast)

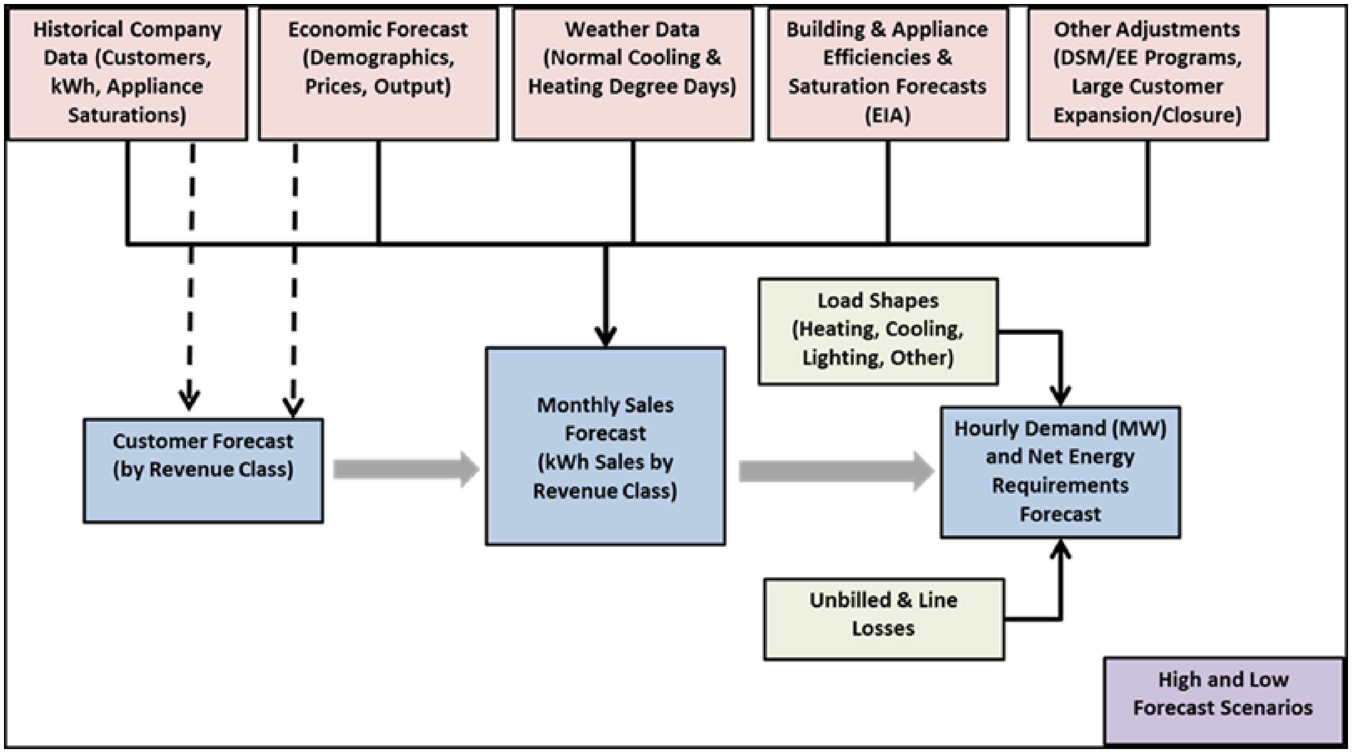


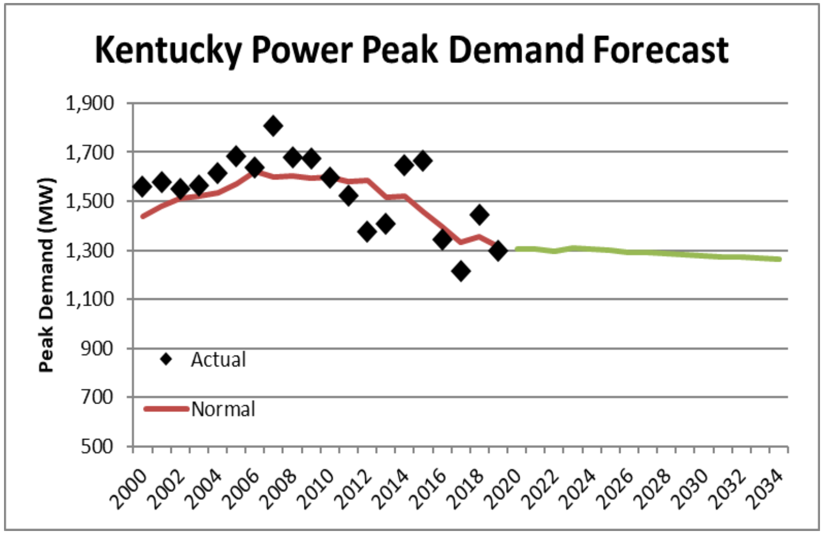



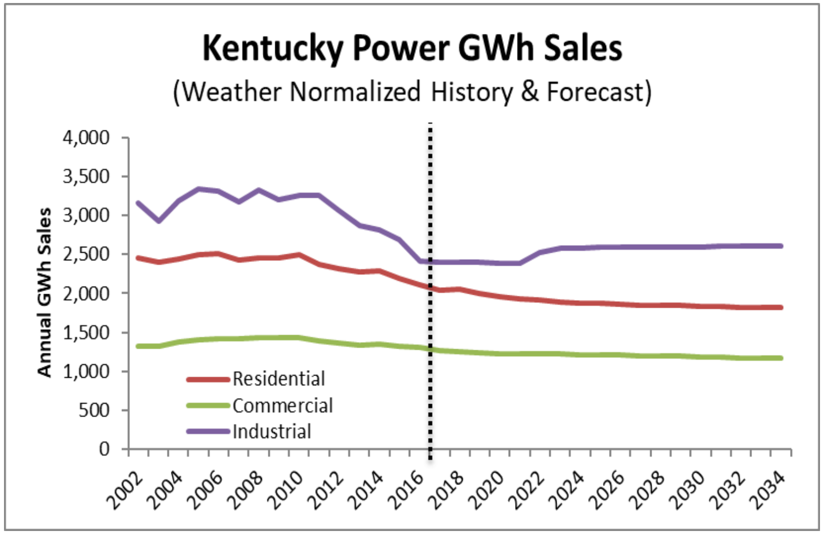



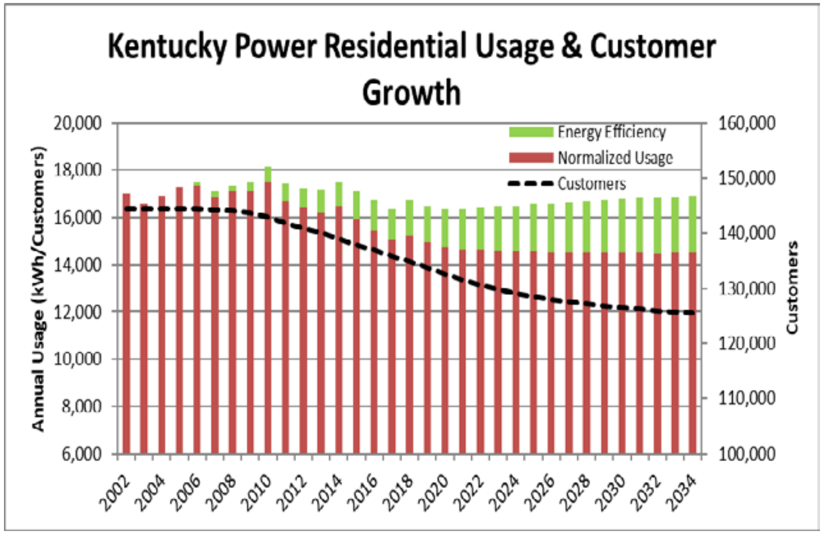
# Load Forecast Development Method

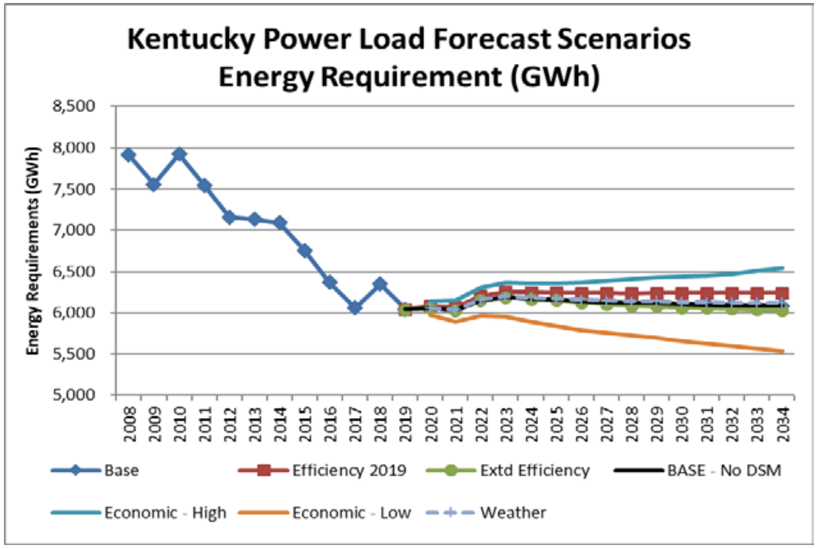


# Load Forecast Summary - June 2019 Forecast



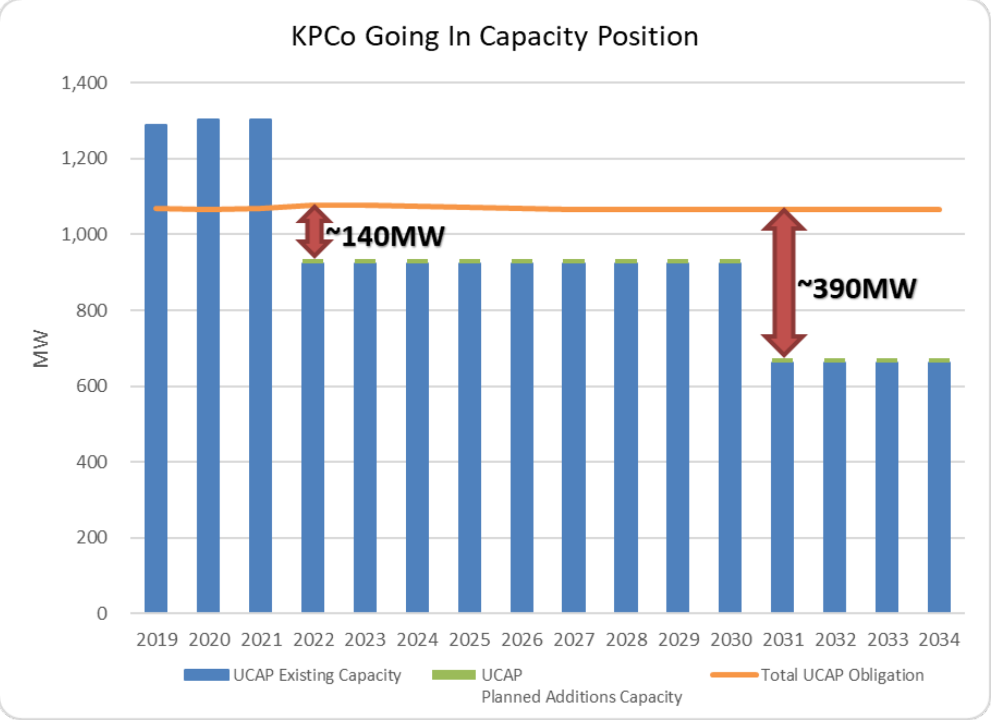
# Key Input - "Going-In" Capacity Position

Existing resources:

- Continue operation of the Mitchell Plant (KPCo share 780 MW)
- Continue operation through 2030 of Big Sandy Unit 1 (285 MW) which was converted to burn natural gas;
- Receive power under the Unit Power Agreement (UPA) from the Rockport Units (393 MW) through 2022.

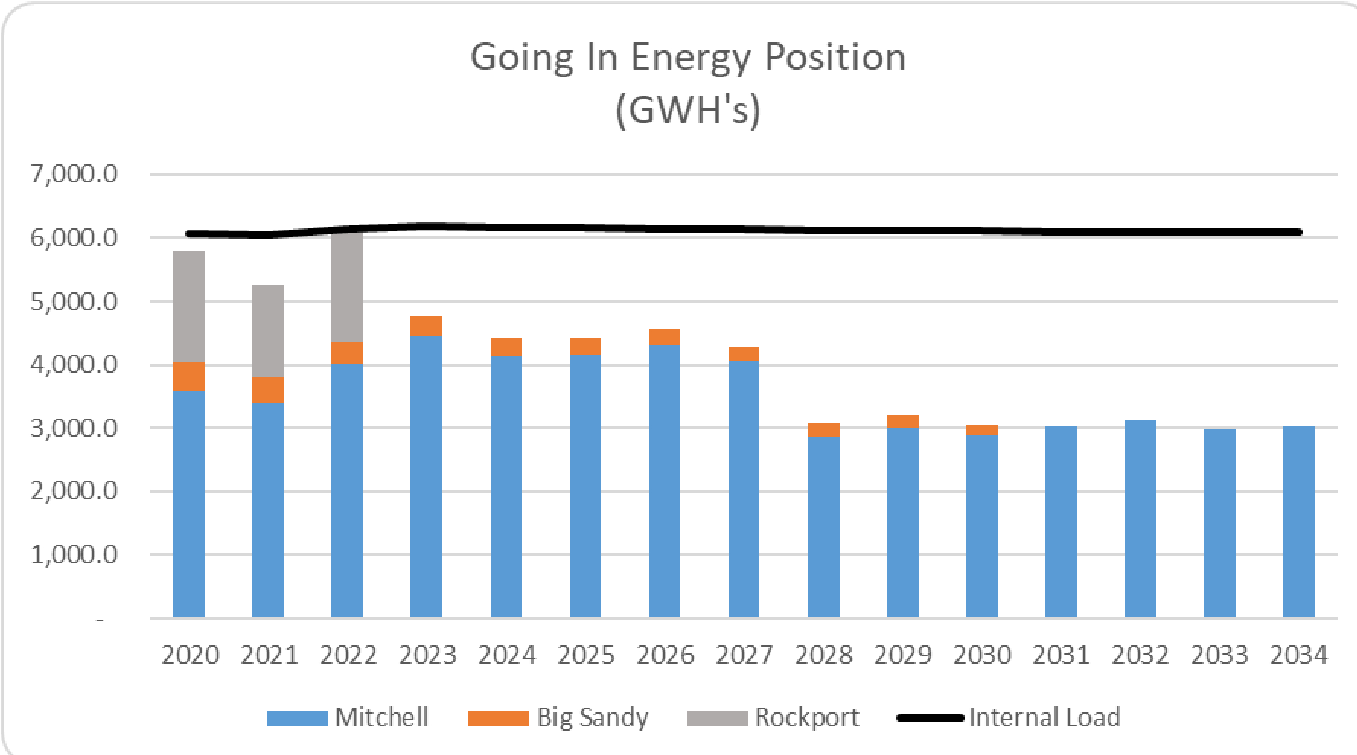
Planned resources:

- Includes a planned 20MWac (Nameplate) solar facility with an EOY '21 in-service date.




** Years are PJM Planning Year – 6/1/XX to 5/31/XX+1*

# Key Inputs – "Going-In" Energy Position




Load stays relatively flat throughout the planning period

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# Key Inputs – Future Resources Summary

Capacity and energy additions are selected from a diverse mix of Supply-Side and Demand-Side resources

❑ **Supply-Side Resources**
- Nuclear, Coal w/ CCS
- Natural Gas Combined Cycle
- Natural Gas Combustion Turbine & Reciprocating Engines
- Wind
- Solar
- Energy Storage

❑ **Demand-Side Resources**
- Energy Efficiency
- Demand Response
- Distributed Generation
- Grid Improvements

**Resource Screening Analysis Summary Table**

| Resource | Selected for Further IRP Analysis |
|---|---|
| Aeroderivative | Yes |
| Battery Storage | Yes |
| Biomass | No |
| Coal-Fired Generation | No |
| Combined Heat and Power | Yes |
| Demand Response | Yes |
| Distributed Generation | Yes |
| Energy Efficiency | Yes |
| Hydros | No |
| Natural Gas Combined Cycle | Yes |
| Nuclear Generation | No |
| Rate Design | No |
| Reciprocating Engines | Yes |
| Simple Cycle Combustion Turbine | Yes |
| Short-Term Market Purchase | Yes |
| Solar | Yes |
| Transmission Facilities | No |
| Volt Var Optimization (VVO) | Yes |
| Wind | Yes |

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# Key Inputs – Resources

**AEP System**
**New Generation Technologies**
**Key Supply-Side Resource Option Assumptions (a)(b)(c)**

| Type | Capability (MW) (d) Std. ISO | Summer | Winter | Installed Cost (c,e) ($/kW) | Capacity Factor (%) | LCOE (f) ($/MWh) |
|---|---|---|---|---|---|---|
| **Base Load** | | | | | | |
| Nuclear | 1,610 | 1,560 | 1,690 | 8,500 | 80 | 174.3 |
| Pulv. Coal with Carbon Capture (PRB) | 540 | 520 | 570 | 9,500 | 75 | 216.6 |
| Combined Cycle (1X1 "J" Class) | 610 | 800 | 820 | 900 | 75 | 60.2 |
| Combined Cycle (2X1 "J" Class) | 1,230 | 1,600 | 1,640 | 700 | 75 | 56.1 |
| Combined Cycle (2X1 "H" Class) | 1,150 | 1,490 | 1,530 | 700 | 75 | 56.9 |
| **Peaking** | | | | | | |
| Combustion Turbine (2 - "E" Class) (g) | 180 | 190 | 190 | 1,200 | 25 | 148.9 |
| Combustion Turbine (2 - "F" Class, w/evap coolers) (g) | 490 | 500 | 510 | 700 | 25 | 117.2 |
| Aero-Derivative (2 - Small Machines) (g) | 120 | 120 | 120 | 1,100 | 25 | 135.7 |
| Recip Engine Farm | 220 | 220 | 230 | 1,300 | 25 | 126.6 |
| Battery | 10 | 10 | 10 | 1,900 | 25 | 157.1 |

Resources included in Plexos/Model

Notes:
(a) Installed cost, capability and heat rate numbers have been rounded
(b) All costs in 2019 dollars, except as noted.
(c) $/kW costs are based on summer capability
(d) All Capabilities are at 1,000 feet above sea level
(e) Total Plant Investment Cost w/AFUDC (AEP-East rate of 5.5%,site rating $/kW)
(f) Levelized cost of energy based on capacity factors shown in table
(g) Includes SCR environmental installation

- Combined Heat and Power resource is assumed to be 15MW, with a full load net heat rate of ~4,800 Btu/kWh and an installed cost of ~$2,300/kW

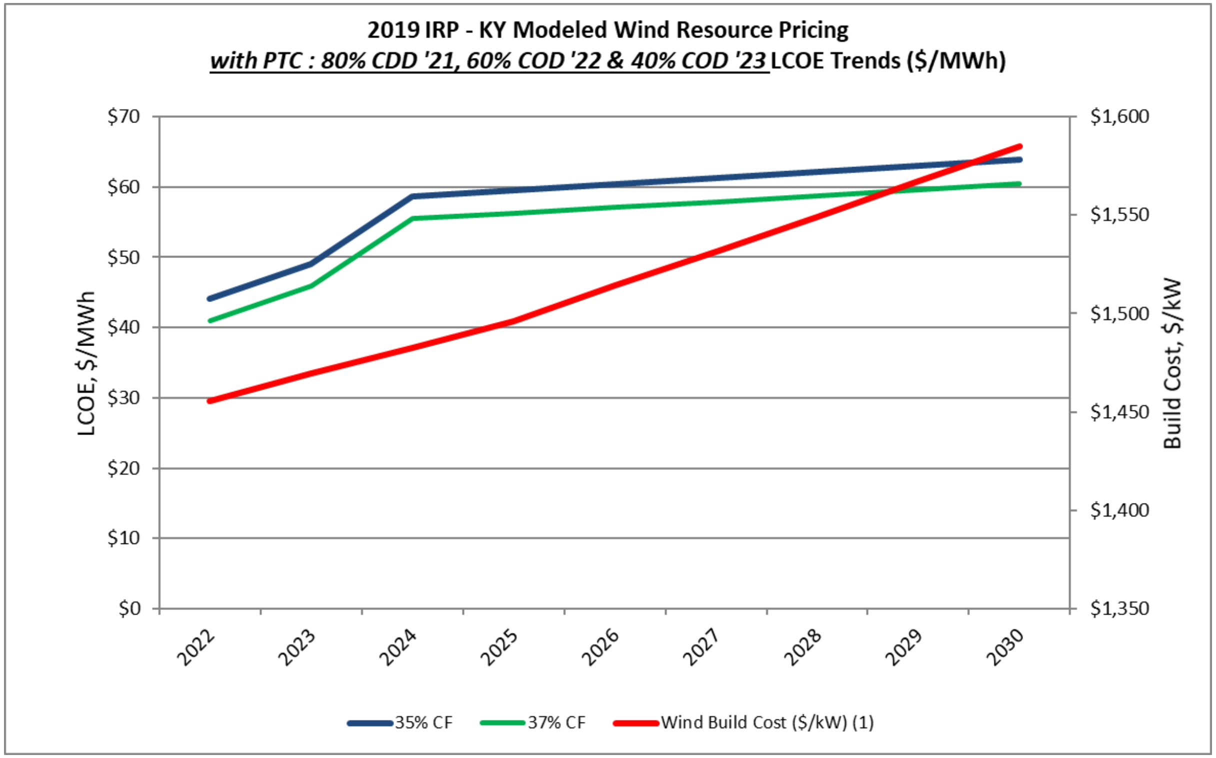
# Key Inputs – Big Sandy site development options

## Potential development options

- Combined Cycle
- Simple Cycle Gas Combustion Turbine
- Reciprocating Engines
- Solar
- Storage

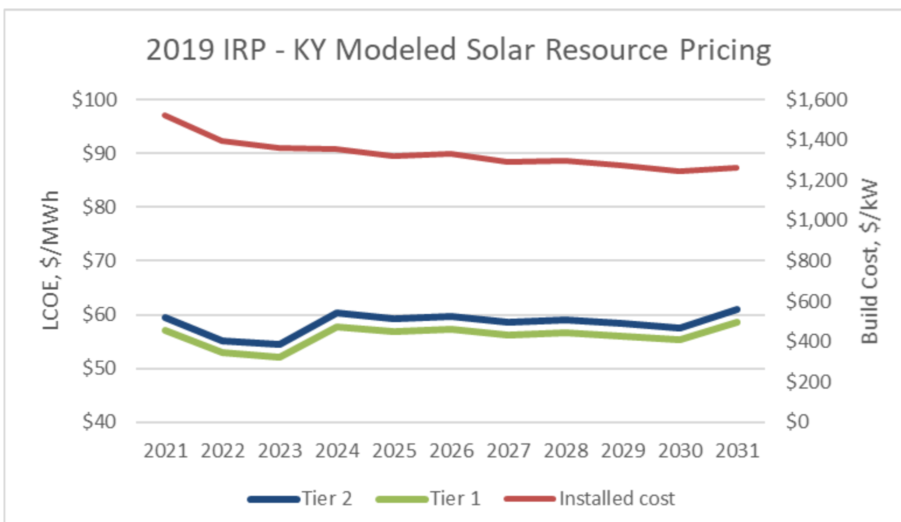
# Key Inputs – Resources - Wind

- Installed Cost based on Bloomberg New Energy Finance's H2 2018 Renewable Energy Market Outlook
- Wind capacity credit increased to 12.3% from 5% based on PJM proposal released in February
- 200MW of Wind Available per year; 100MW for each Tranche
  - Maximum build over the planning period of 600MW (30% penetration)
- Expected Capacity Factor: 37% for Tranche A & 35% for Tranche B



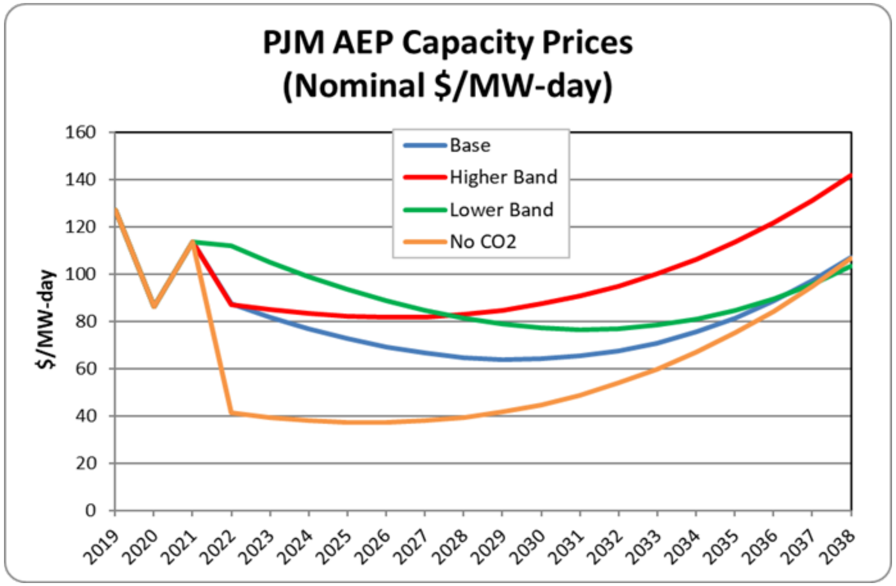
# Key Inputs – Resources - Solar

- Installed Cost based on Bloomberg New Energy Finance's H2 2018 Renewable Energy Market Outlook
- Two Tranches Available – Tier 1 and Tier 2 Pricing with Normalized ITC impact informed by KPCo solar RFP
- 300MW of Solar Available per year; 50MW Blocks in each Tier (1 & 2)
    - Maximum build over the planning period of 450MW (15% penetration)
- Expected Capacity Factor ~23.7%, from Single Axis Tracking system
- For a EOY 2021 Commercial Operation Date ~LCOE $57 to $60/MWh,
- Solar capacity credit increased to 51.1% from 38% based on PJM proposal released in February



# Key Inputs – Resources

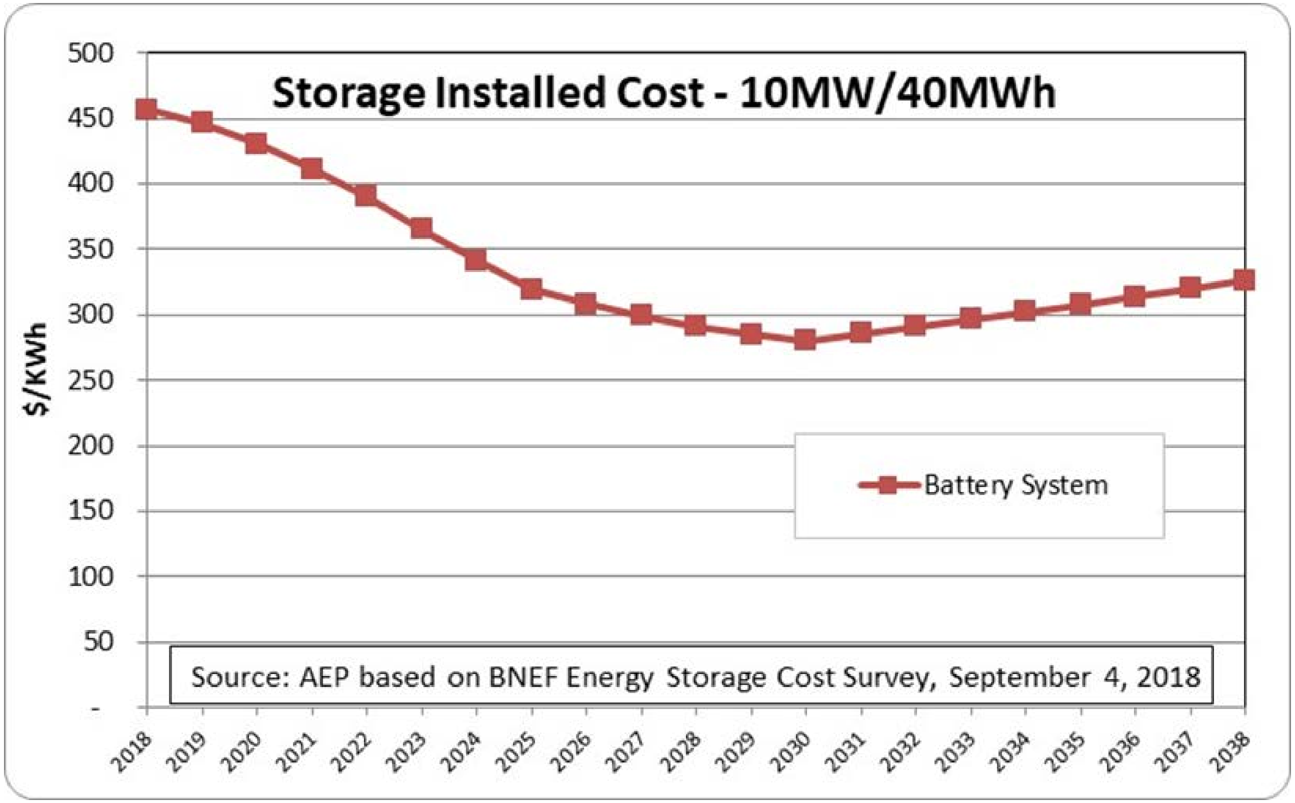
## Short-Term Market Capacity Purchases (STMP)




- This resource is "Capacity" only, with no "Energy" associated with it
- Contract term of one year and 1,000MW can be added annually.
- Pricing is based on the PJM Capacity Prices from the Fundamental Commodity Forecast
- STMP allows an option to include a short-term commitment vs. building a long-term resource.

# Key Inputs – Resources

## Energy Storage – 10MW/40MWh Resource




- Based on Lithium Ion technology, Energy Product
- Cost Estimates based on Internal Estimates and information from EPRI and Storage Suppliers

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# Key Inputs – Energy Efficiency (EE) Resources

Include blocks of EE in the modeling beginning in the 2022 timeframe to align with change from "long to short" capacity position.

## Residential

| Bundle | Installed Cost ($/kWh) | Yearly Potential Savings (MWh) 2022-2024 | Yearly Potential Savings (MWh) 2025-2029 | Yearly Potential Savings (MWh) 2030-2040 | Bundle Life | PCT Ratio | RIM Ratio | TRC Ratio | UCT ratio | Measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Thermal Shell - AP | $0.18 | 1,540 | 514 | 680 | 10 | 3.87 | 0.22 | 0.79 | 1.36 | Duct Repair,Duct Insulation |
| Thermal Shell - HAP | $0.27 | 7,127 | 3,590 | 1,697 | 10 | 4.12 | 0.21 | 0.79 | 1.00 | |
| Heating/Cooling - AP | $0.36 | 16,726 | 2,849 | 0 | 18 | 2.84 | 0.22 | 0.61 | 1.05 | SEER 16 Heat Pump |
| Heating/Cooling - HAP | $0.53 | 19,678 | 330 | 0 | 18 | 3.09 | 0.20 | 0.61 | 0.77 | |
| Water Heating - AP | $0.26 | 7,732 | 1,799 | 1,759 | 14 | 3.33 | 0.22 | 0.71 | 1.21 | FEF=2 - Water Heating, Faucet Aerators , Pipe Insulation , Low Flow |
| Water Heating - HAP | $0.37 | 27,566 | 13,756 | 7,174 | 14 | 3.71 | 0.20 | 0.73 | 0.92 | Showerheads |
| Appliances - AP | $0.12 | 2,294 | 366 | 0 | 12 | 5.95 | 0.21 | 1.19 | 2.05 | Efficient Dishwasher, Reduce Standby Wattage Television |
| Appliances - HAP | $0.19 | 3,704 | 509 | 0 | 12 | 5.97 | 0.20 | 1.14 | 1.44 | |
| Lighting - AP | $0.06 | 4,937 | 0 | 0 | 28 | 16.32 | 0.26 | 4.35 | 7.46 | Screw-In Lighting to LED |
| Lighting - HAP | $0.07 | 8,252 | 716 | 0 | 28 | 20.77 | 0.26 | 13.19 | 17.78 | |

## Commercial

| Bundle | Installed Cost ($/kWh) | Yearly Potential Savings (MWh) 2022-2024 | Yearly Potential Savings (MWh) 2025-2029 | Yearly Potential Savings (MWh) 2030-2040 | Bundle Life | PCT Ratio | RIM Ratio | TRC Ratio | UCT Ratio | Measures |
|---|---|---|---|---|---|---|---|---|---|---|
| Heat Pump - AP | $4.19 | 5,123 | 511 | 0 | 15 | 0.63 | 0.05 | 0.04 | 0.07 | Heat Pump COP=4.0 |
| Heat Pump - HAP | $6.29 | 6,027 | 0 | 0 | 15 | 0.88 | 0.04 | 0.04 | 0.05 | |
| HVAC Equipment - AP | $0.10 | 1,337 | 0 | 0 | 15 | 5.95 | 0.29 | 1.67 | 2.86 | Variable Speed Fan Control, Energy Efficient Motors |
| HVAC Equipment - HAP | $0.16 | 2,370 | 0 | 0 | 15 | 6.20 | 0.28 | 1.67 | 2.11 | |
| Indoor Screw-In Lighting - AP | $0.01 | 1,042 | 0 | 0 | 6 | 24.20 | 0.81 | 17.20 | 29.49 | Screw-In Lighting to LED |
| Indoor Screw-In Lighting - HAP | $0.02 | 1,536 | 0 | 0 | 6 | 24.45 | 0.80 | 17.20 | 21.73 | |
| Indoor HID/Fluor. Lighting - AP | $0.11 | 7,689 | 901 | 0 | 14 | 5.47 | 0.31 | 1.63 | 2.79 | Indoor Linear Fluorescent Lighting to LED |
| Indoor HID/Fluor. Lighting - HAP | $0.16 | 9,045 | 0 | 0 | 14 | 5.72 | 0.30 | 1.63 | 2.05 | |
| Outdoor Lighting - AP | $0.42 | 1,287 | 0 | 0 | 15 | 1.85 | 0.25 | 0.46 | 0.79 | LED Street Lighting |
| Outdoor Lighting - HAP | $0.63 | 1,514 | 0 | 0 | 15 | 2.10 | 0.22 | 0.46 | 0.58 | |

KENTUCKY POWER
An AEP Company

# Key Inputs – Demand Response (DR) Resources

## Residential – Bring-Your-Own Thermostat program

| Sector | Participants | Demand Savings (kW) | Energy Savings (kWh) | Enrollment/ Installation Cost | Total First Year Cost | Ongoing Annual Cost | Service Life (Years) |
|---|---|---|---|---|---|---|---|
| Residential | 1,000 | 887 | 0 | $336,000 | $350,280 | $264,280 | 15 |

## Commercial - Thermostat set back DR approach

| Sector | Participants | Demand Savings (kW) | Energy Savings (kWh) | Enrollment/ Installation Cost | Total First Year Cost | Ongoing Annual Cost | Service Life (Years) |
|---|---|---|---|---|---|---|---|
| Commercial | 10 | 213 | 0 | 226,546 | 235,075 | 116,630 | 15 |

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An AEP Company

# Key Inputs – VVO Resources

## Volt VAR Optimization – Potential future VVO circuits considered for modeling for cost and energy reduction

| Tranche | No. of Circuits | Capital Investment | Annual O&M | Demand Reduction (kW) | Peak Reduction (kW) | Energy Reduction (MWh) |
|---|---|---|---|---|---|---|
| 1 | 14 | $4,962,209 | $148,866 | 3,922 | 130,730 | 16,147 |
| 2 | 14 | $4,962,209 | $148,866 | 3,017 | 100,550 | 12,420 |
| 3 | 15 | $5,316,652 | $159,500 | 2,553 | 85,110 | 10,512 |
| 4 | 15 | $5,316,652 | $159,500 | 2,254 | 75,130 | 9,280 |
| 5 | 14 | $4,962,209 | $148,866 | 1,916 | 63,880 | 7,890 |
| 6 | 15 | $5,316,652 | $159,500 | 1,802 | 60,060 | 7,418 |
| 7 | 10 | $3,544,435 | $106,333 | 1,082 | 36,060 | 4,454 |
| 8 | 8 | $2,835,548 | $85,066 | 647 | 21,560 | 2,663 |

# Preliminary Modeling Results

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An AEP Company

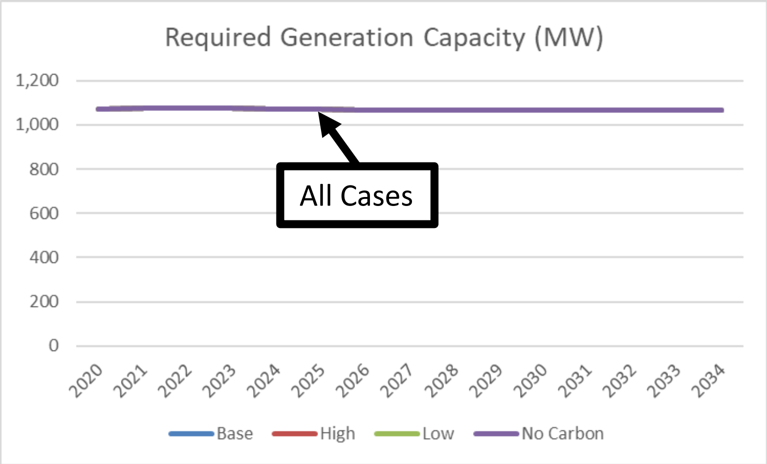
# Modeling Scenarios - *Preliminary*

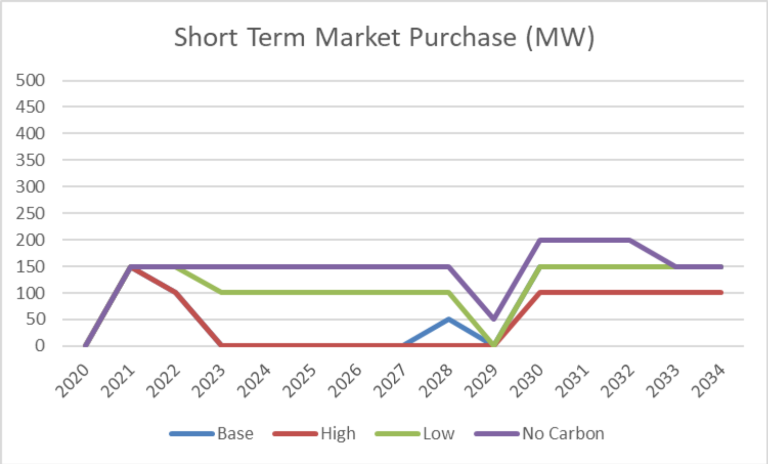
- Scenarios intended to evaluate wide-range of future potential outcomes
- Price scenarios assume a $CO_2$ dispatch burden commencing in 2028 (except for No Carbon Pricing Condition)

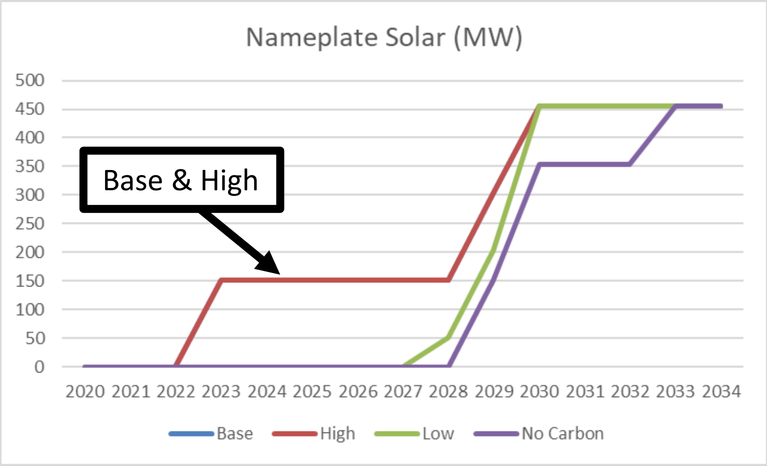
| Case | Scenarios | Commodity Pricing conditions | Load Forecast Assumptions |
|---|---|---|---|
| 1 | Base Case | Base with Carbon | Base |
| 2 | High Commodity Price Case | High with Carbon | Base |
| 3 | Low commodity Price Case | Low with Carbon | Base |
| 4 | No Carbon | No Carbon | Base |
| 5 | Low Load Case | Base with Carbon | Low |
| 6 | High Load case | Base with Carbon | High |
| 7 | Short-Term Market Purchase (STMP) + Renewables Case | Base with Carbon | Base |
| 8 | STMP until BS1 Retires (same as case 7 but w/o renewable) | Base with Carbon | Base |
| 9 | BS1 Repower in mid 20s Case | Base with Carbon | Base |
| 10 | Simple-Cycle CT with solar and storage | Base with Carbon | Base |
| 11 | Combined-Cycle CT with solar and storage | Base with Carbon | Base |
| 12 | Preferred Plan | Base with Carbon | Base |

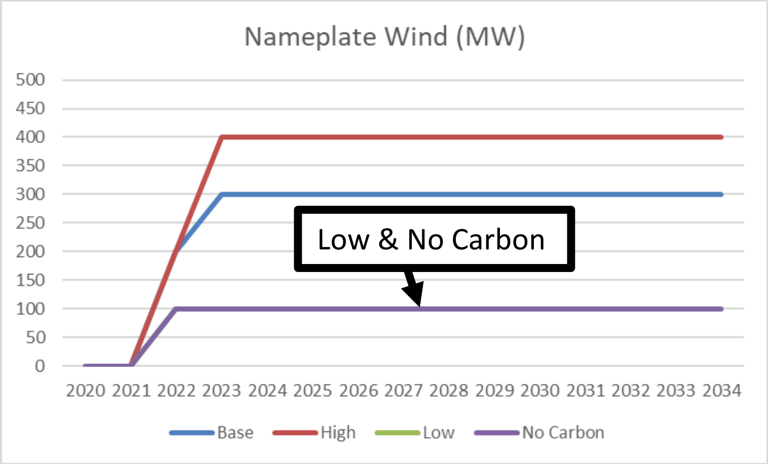
- Cases 1-6 provide insight to resource plans over varying commodity pricing and customer load conditions
  - Today - Review Cases 1-4 initial results
- Next Steps further define:
  - Cases 7-12 provide insight to specific constraints and impact on resource optimization/selection

# Modeling Results - Preliminary

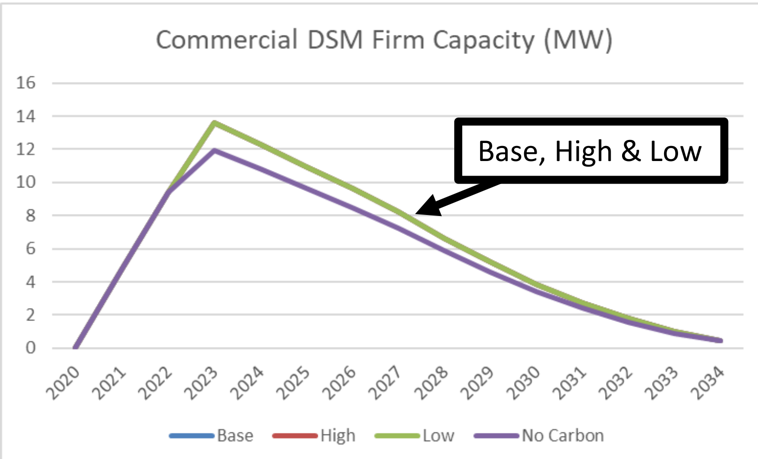


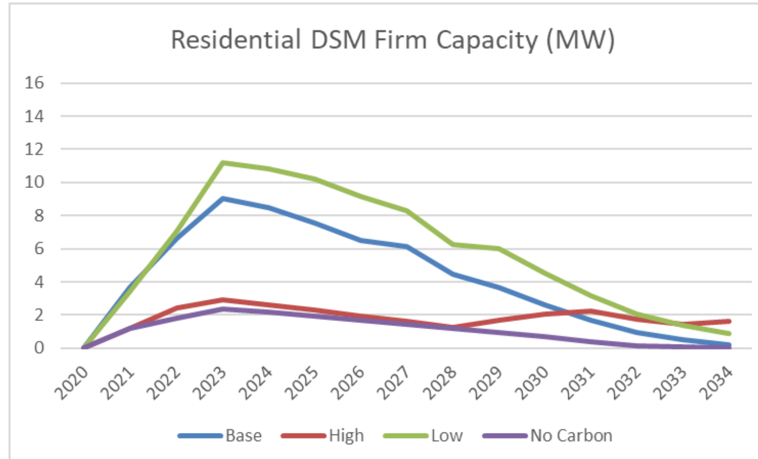



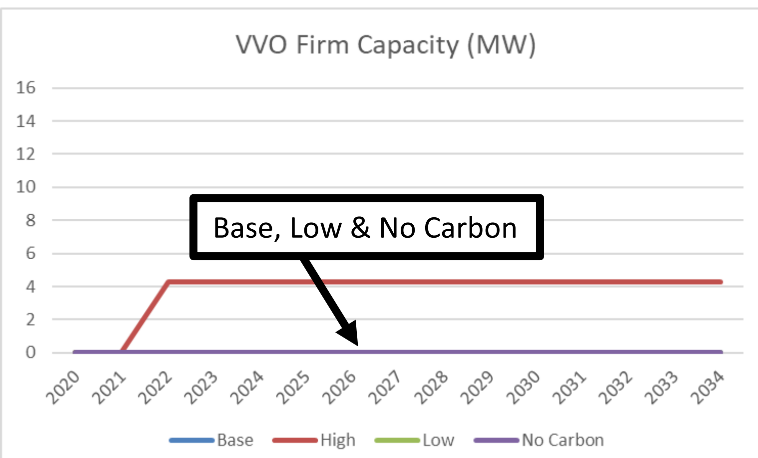



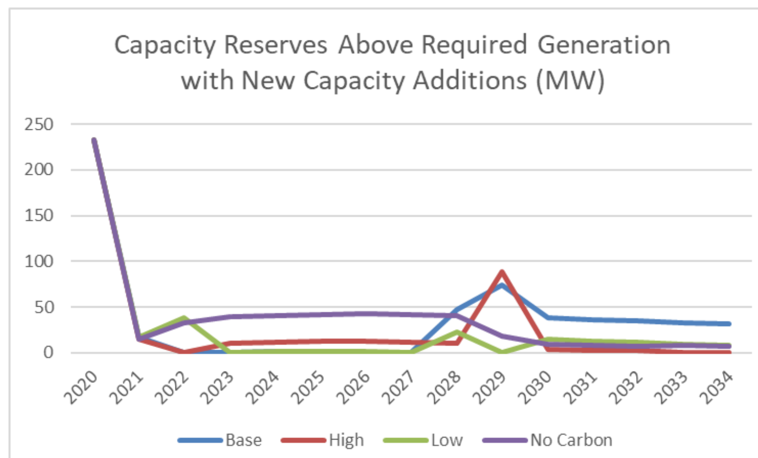



# Modeling Results - continued



# Next Steps

- KPCo will consider input/feedback from today's meeting
- KPCo begin analysis towards a Preferred Plan
- Submit IRP – December 2019

# Thank You for Your Participation and Safe Travels

1. For each year of the eight year period 2023 (after the end of the Rockport UPA) through 2030 (the planned retirement of Big Sandy 1) please provide the nominal annual revenue requirement for meeting the approximate 140 MW capacity shortfall and the associated energy shortfall for each of the base, higher band, lower band and no CO2 forecasts under the following compliance scenarios.
   a. The energy and capacity shortfalls are met by market purchases.
   b. The energy and capacity shortfalls are met by wind resources.
   c. The energy and capacity shortfalls are met by solar resources.
   d. The energy and capacity shortfalls are met by Kentucky Power's share of a combined cycle (2x1 "J" class).
   e. The energy and capacity shortfalls are met by Kentucky Power's share of a combustion turbine (2-"F" class, w/evap collers).

2. Using Kentucky Power's weighted average cost of capital as the discount rate, please provide the net present value revenue requirements for each of the above 20 scenarios.

**DATA REQUEST**

**KPSC 1_59** Refer to the IRP, Exhibits E1 and E2, and Sections 5.2 and 5.3. Throughout the discussion, Kentucky Power compares and contrasts the various modeling scenarios. Even though it is clear that the Preferred Plan is comparably cost effective over the 15-year time horizon and contains elements common to many of the comparison scenarios, it is not clear exactly how Kentucky Power arrived at its Preferred Plan. Explain how Kentucky Power arrived at the precise resource mix and the timing of the resource implementation as outlined in the Preferred Plan.

**RESPONSE**

The Company started with the modeling and analysis of the Base Optimal Plan. This plan minimized constraints and showed that from 2022 through 2028, the reserve margin was just being met with the addition of Wind, Solar, Energy Efficiency (EE) and Short Term Market Purchases (STMP, as a 2022 and 2023 resource). Additional insights gained from this model were that while wind resources were selected early in plan, the net profitability was not realized until much later in the 30-year analysis period. The Company also recognized that while EE was selected, most of the selections by the model were not actually profitable during the period 2022-2024. This summary is shown in the Base Optimization Capacity Position file. The result, however, provided a least cost plan over the full 30-year planning horizon.

Case 7 analyzed the scenario where a combustion turbine (CT) was introduced in 2023. In this scenario, the Company recognized that while the capacity position above the PJM reserve margin obligation was robust, the net profitability of the CT unit over all slices of the 30-year planning horizon was negative to the overall plan.

Case 8 analyzed a scenario where a combined cycle (CC) unit was introduced in 2024. Similar to Case 7, the Company recognized again, that the capacity position above the PJM reserve margin obligation was robust but the net profitability of the CC unit over all slices of the 30-year planning horizon was negative to the overall plan, although not as much as the CT unit.

Figure 36 in the IRP illustrated the net cost of Cases 7 & 8 compared to the Base Optimization plan. A primary takeaway from this figure is that the cumulative costs in 5 year increments was consistently higher than the base optimization plan. This informed the process that alternative resources to the CT and CC units were beneficial.

The Company then analyzed several Stakeholder scenarios primarily to evaluate the impact of a single resource to meet obligations through 2030 before including other resources for the remainder of the planning period. The results of these scenarios are described in section 5.2.2.4 but in summary, the Stakeholder scenarios informed the process where STMP resources were beneficial early in the analysis period while also suggesting a role for a smaller Aeroderivative unit to support the Company's obligations along with other renewable and DSM resources.

Figure 38 further illustrates the costs of these Stakeholder scenarios were generally higher than the base optimization scenario although there were some benefits toward relying on STMP within the first 5 years of the analysis period.

Given the insights the Company learned from the different scenarios, the Company recognized earlier cost benefits by leveraging some resources, such as solar resources earlier in the analysis period.

The Preferred Plan was informed by these various insights to minimize revenue requirements over the 15-year planning period while also providing a plan that is very close to the costs of an optimized plan over the full 30-year planning horizon as shown in Figure 41.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_60** Refer to the IRP, Section 4.4, Demand-Side Management (DSM) Program Screening & Evaluation Process.
a. Explain in detail, the potential incremental DSM programs that were developed for potential EE bundles as a resource option.
b. Explain the process in which the Volt VAR Optimization (VVO) tranches were modeled.

**RESPONSE**

a. Please refer to section 4.4.3.1. Specifically, tables 6 & 7 identify individual measure categories for both residential and commercial sectors that were the primary basis for the bundles modeled in Plexos.

b. Each tranche shown in Table 10 of the IRP was modeled as an individual resource available for the model to select. In this manner, they were able to compete with all other resources in a comparable manner to optimize their selection for a balanced portfolio of resources within this Preferred Plan based on the assumptions in the IRP.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_61** Refer to the IRP, Section 2.9.1, page 32, at which Kentucky Power states the economy in their service area continues to be sluggish.
a. Describe any ongoing plans or efforts to attract economic development to Kentucky Power's service area.
b. State whether Kentucky Power has had any successes or failures in attracting economic development to their service area.
c. Describe Kentucky Power's process for attracting economic development and commercial or industrial customers.
d. State whether any large commercial or industrial customer has expressed a desire to purchase renewable energy from Kentucky Power.

**RESPONSE**

a. Kentucky Power has a robust economic development program that includes an annual "plan of work." The Company's plan of work includes assisting with business recruitment meetings, supporting our local and regional economic development agencies, training for employees and helping with the preparedness and product development of our communities.

Kentucky Power's ongoing plans and efforts to attract businesses to its service territory rely heavily on its relationships with economic development organizations in the region, primarily One East Kentucky and Ashland Alliance. Kentucky Power representatives serve on the board of directors for both organizations.

Beginning in 2015, the Company developed the Kentucky Power Economic Growth Grant Program (K-PEGG). The K-PEGG program is funded through the Kentucky Economic Development Surcharge. Business customers contribute $12 a year through their monthly electric bills. Those dollars are matched dollar-for-dollar by shareholders to generate nearly $800,000 annually for investment at the local and regional levels. The K-PEGG committee consists of Kentucky Power employees as well as representatives from the Kentucky Association of Economic Development and the Kentucky Cabinet for Economic Development.

K-PEGG funds assist the communities in the Company's service territory with economic development investments, as well as due diligence studies, geotechnical and site preparedness. In recent years, Kentucky Power has strategically invested nearly $6 million in economic development efforts within its service territory through the K-PEGG program.

Kentucky Power also offers rate incentives as an attraction for business recruitment. Its Economic Development Rider encourages development through reduced electric rates for major expansions and new investment. The Company also offers a renewable pricing option and the potential for other discounted rates such as interruptible service as incentive to locate in Kentucky Power's service territory.

b. Kentucky Power has experienced some successes and some failures in attracting economic development to its service territory. Local and regional economic development partners, as well as the Kentucky Cabinet for Economic Development, receive and distribute numerous requests for information for potential projects. Kentucky Power's economic development partners have over 100 projects in their respective pipelines. Very few of those will become a reality. According to the International Economic Development Council, each year 15,000 localities compete for the 100-200 projects that actually make it to the site selection process.

Economic Development can often be a long process, taking years for a project to come to fruition. An example of a recent long-story success is Logan Corporation. In 2016, Logan Corp. moved to Magoffin County and K-PEGG funding assisted with this move. Without K-PEGG assisting Big Sandy Regional Industrial Development Authority (BSRIDA) with the purchase of the Logan Corporation building, the expansion would not have been possible. In recent months, Logan Corporation announced a $1.2 million investment to expand its business and increase employment. In addition to the success of Logan Corporation, Kentucky Power's assistance in the project allowed BSRIDA to maintain control of the property. It currently has a tenant and plans a $1.3 million project to create an international landing zone on site.

The following is a list of Economic Development projects announced in Kentucky Power's service territory since 2017:
2017

- Wright-Mix Materials Solutions, LLC, plans an $8.5 million block and precast production facility at the Wurtland Riverport. The project is anticipated to produce 130 jobs. K-PEGG assisted this project with close-the-deal funding.
- Braidy Industries plans to build an aluminum rolling mill in EastPark Industrial Park. The $1.3 billion mill is anticipated to create 550 jobs. Kentucky Power K-PEGG assisted Boyd and Greenup counties and Ashland Alliance with the due diligence for the project.
- Dueling Barrels, Brewing & Distilling Co. constructed and opened a $22 million facility in Pikeville and are producing bourbon, moonshine and beer. K-PEGG assisted with the Pikeville master plan update.
- Silver Liner, LLC, invested $570,000 in the Kentucky Enterprise Industrial Park for a tanker truck manufacturing facility. The company plans to employ up to 300. K-PEGG funds were provided for park updgrades.
- Thoroughbred Aviation Maintenance Incorporated provides aircraft maintenance, avionics, painting and structural repair along with overhauling and refurbishment.

The company opened a 15-employee operation at Big Sandy Regional Airport in Martin County.

2018

- SWVA Kentucky, LLC, a merchant bar rolling mill, purchased the idled Kentucky Electric Steel facility. The company invested $10 million and added 60 jobs.
- Veloxint Corporation, nanocrystalline alloy products manufacturer located a $60 million facility in EastPark. The company is affiliated with Braidy Industries and plans to employ 100. K-PEGG funded the McCallum Sweeney Site Certification as well as due diligence and marketing of the EastPark location.
- Global Wood Company, LLC, a biomass energy company, invested $1.7 million in Pike County and employs 34. K-PEGG assisted with Pike County marketing.
- Hunt Brothers Pizza constructed a $1 million distribution center in Letcher County with 4 employees. K-PEGG funding provided to Appalachian Regional Industrial Authority to assist with the project.
- Dajcor Aluminum Ltd., a Canadian manufacturer of extruded and fabricated aluminum products, plans to create up to 265 full-time jobs as it invests nearly $19.6 million to locate its first U.S. operation near Hazard. Dajcor has located in Perry County's Coalfields Industrial Park. Kentucky Power assisted in this project by providing K-PEGG funds provided to the Perry County Fiscal Court so it could retrofit an existing building for the project and extend a gas line to the building. Also, K-PEGG funding assisted One East Kentucky in its marketing efforts.

2019

- Intuit Inc. and Sykes Enterprises, Inc., announced a partnership to create 300 full-time customer success jobs at a customer service center in Perry County's Coal Fields Regional Industrial Park. The partnership includes the renovation of a facility in the Coal Fields Regional Industrial Park that has been home to Sykes since 2007. K-PEGG assisted One East Kentucky in its marketing efforts for the Coalfields Park.
- Boxvanna, a tiny modular home manufacturer located in the Honey Branch Industrial Park in Martin County. The company will employ 25. K-PEGG assisted One East Kentucky in marketing efforts of East Kentucky Business Park.

c. Prospective businesses often inquire through the state for help with site and infrastructure availability. Kentucky Power works closely with the Kentucky Cabinet for Economic Development, which often contacts the Company for assistance. Kentucky Power understands the importance of being involved early on when a new industry or business is thinking of coming to Kentucky. In almost every case, reliability and affordability of electricity are priority topics.

Kentucky Power's external affairs and customer service teams work closely with all potential commercial and industrial customers throughout all phases of their projects. The Company understands that attracting new customers helps the region in many ways. Residential customers have opportunities for employment and communities gain taxpayers. These efforts help control costs for everyone by spreading fixed costs among more customers.

Kentucky Power plays an important role in attracting economic development and commercial or industrial customers. The Company supports its communities in site preparedness, economic development education and marketing. Kentucky Power is a willing partner in recruitment trips with our local, regional and state economic development partners.

In addition, the Company has been instrumental in gap analysis of its communities' properties and the study of the regional workforce. Both of these activities assist Kentucky Power's communities in being ready when an economic development opportunity is presented.

d. Yes, certain commercial and industrial customers have expressed a desire to purchase renewable energy from Kentucky Power.

Witness: Brian K. West

**DATA REQUEST**

**KPSC 1_62** Refer to the IRP, Section 4.5.6, page 99.
a. State whether any RFPs have been planned or issued in search of renewable power options.
b. Describe Kentucky Power's process for planning and procuring renewable energy sources.

**RESPONSE**

a. As discussed in response to KPSC 1-24, following the cancellation of the anticipated 20 MW solar generation project, the Company is currently working on its plan forward, which may include searching for another suitable site or pursuing another RFP for renewable generation.

b. The Company's IRP process is used to plan for new energy resources, including renewables. The Company's process for procuring renewables may vary based o the type of resource identified and the timing of such needs. As an example of a competitive Request for Proposal process recently used by the Company, see the RFP on Kentucky Power's web site for a 20 MW solar facility: www.kentuckypower.com/rfp

Witness: Brian K. West

**DATA REQUEST**

**KPSC 1_63** Refer to the IRP, Volume A, Section 2.2.1, page 7.
a. Describe how regional economic data is applied to make projections for Kentucky Power's specific service area.
b. State whether other economic forecasts besides Moody's Analytics were evaluated for the purposes of this IRP. If not, explain why.

**RESPONSE**

a. Selected regional economic variables are used as drivers in the Company's long-term energy and customer models.

b. No. The Company has used Moody's Analytics as the source for regional economic and macro-economic forecasts for a number of years. It is widely accepted as a reliable source for economic information and is utilized by numerous electric utilities and other entities such as PJM.

Witness: John F. Torpey

**DATA REQUEST**

**KPSC 1_64** Refer to the IRP, Appendix C-8.
a. Explain whether this blending is an illustration or the actual blending used.
b. If it is an illustration, provide a similar table of the actual forecast, weights, and blended forecast.

**RESPONSE**

a. Appendix C-8 is an illustration of the blending process.

b. KPCO_R_KPSC_1_64_Attachment 1 provides the blending calculation for the Kentucky Power's commercial customers.

Witness: John F. Torpey

## Kentucky Power Commercial Customer Blending

| Year | Month | Short-term Forecast | Weight | Long-term Forecast | Weight | Blended Forecast |
|---|---|---|---|---|---|---|
| 2020 | 9 | 29,954 | 100% | 30,067 | 0% | 29,954 |
| 2020 | 10 | 29,887 | 100% | 30,052 | 0% | 29,887 |
| 2020 | 11 | 29,881 | 100% | 30,048 | 0% | 29,881 |
| 2020 | 12 | 29,798 | 100% | 30,059 | 0% | 29,798 |
| 2021 | 1 | 29,888 | 83% | 29,838 | 17% | 29,880 |
| 2021 | 2 | 29,767 | 67% | 29,791 | 33% | 29,775 |
| 2021 | 3 | 29,771 | 50% | 29,854 | 50% | 29,813 |
| 2021 | 4 | 29,747 | 33% | 29,824 | 67% | 29,798 |
| 2021 | 5 | 29,820 | 17% | 29,875 | 83% | 29,865 |
| 2021 | 6 | 29,816 | 0% | 29,927 | 100% | 29,927 |
| 2021 | 7 | | 0% | 29,917 | 100% | 29,917 |
| 2021 | 8 | | 0% | 30,005 | 100% | 30,005 |

**DATA REQUEST**

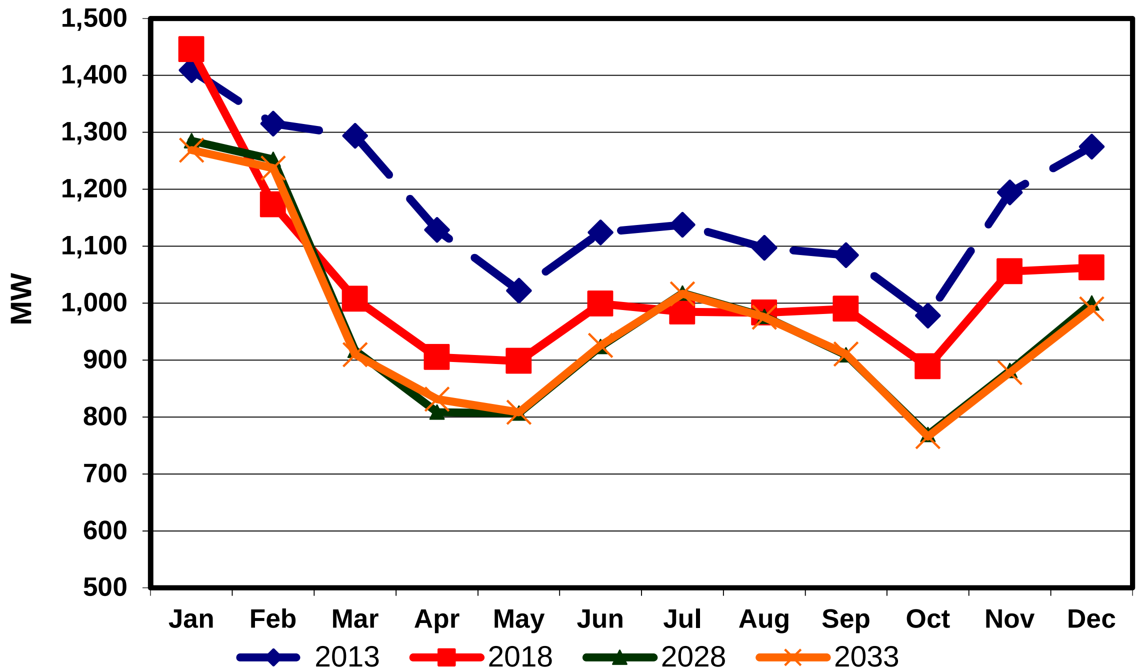
**KPSC 1_65** Refer to the IRP, Appendix C-19. Provide the labels for the graph.

**RESPONSE**

See KPCO_R_KPSC_1_65_Attachment 1 for the requested information.

Witness: John F. Torpey

**Kentucky Power Company**
**Profiles of Monthly Peak Internal Demands**
**2013 and 2018 (Actual)**
**2028 and 2033 (Forecast)**



**VERIFICATION**

The undersigned, John F. Torpey, being duly sworn, deposes and says he is the Managing Director of Resource Planning and Operation Analysis for the American Electric Power Service Corporation, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

John F Torpey
___________________________
John F. Torpey

| | | |
|---|---|---|
| State of Indiana | ) | |
| | ) | Case No. 2019-00443 |
| County of Allen | ) | |

Subscribed and sworn before me, a Notary Public, by John F. Torpey this ___19___ day of May, 2020.

Regiana M. Sistevaris Digitally signed by Regiana M. Sistevaris Date: 2020.05.19 15:14:19 -04'00'
___________________________
Notary Public, Regiana Maria Sistevaris

My Commission Expires ___January 7, 2023________

# VERIFICATION

The undersigned, Brian K. West, being duly sworn, deposes and says he is the Director of Regulatory Services for Kentucky Power, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Brian K. West

State of Indiana )
) Case No. 2019-00443
County of Allen )

Subscribed and sworn before me, a Notary Public, by Brian K. West this 19 day of May, 2020.

Regiana M. Sistevaris Digitally signed by Regiana M. Sistevaris
Date: 2020.05.19 15:45:10 -04'00'

Notary Public, Regiana Maria Sistevaris

My Commission Expires January 7, 2023