COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

ELECTRONIC 2021 JOINT INTEGRATED RESOURCE PLAN OF LOUISVILLE GAS AND ELECTRIC COMPANY AND KENTUCKY UTILITIES COMPANY	))))	**CASE NO. 2021-00393**

RESPONSE OF
LOUISVILLE GAS AND ELECTRIC COMPANY AND
KENTUCKY UTILITIES COMPANY TO
THE ATTORNEY GENERAL'S INITIAL DATA REQUESTS
DATED JANUARY 21, 2022

FILED: FEBRUARY 11, 2022

VERIFICATION

COMMONWEALTH OF KENTUCKY)

COUNTY OF JEFFERSON)

The undersigned, **Christopher D. Balmer**, being duly sworn, deposes and says that he is Director – Transmission Strategy and Planning for LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge, and belief.

Christopher D. Balmer

Christopher D. Balmer

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 9th day of February 2022.

Judy Schooler

Notary Public

Notary Public ID No. 603967

My Commission Expires:

July 11, 2022

VERIFICATION

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF JEFFERSON)

The undersigned, **John Bevington**, being duly sworn, deposes and says that he is Director – Business and Economic Development for LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge, and belief.

John E. Bevington
John Bevington

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 10th day of February 2022.

Judy Schooler
Notary Public

Notary Public ID No. 603967

My Commission Expires:

July 11, 2022

VERIFICATION

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF JEFFERSON)

The undersigned, **Robert M. Conroy**, being duly sworn, deposes and says that he is Vice President, State Regulation and Rates, for Kentucky Utilities Company and Louisville Gas and Electric Company and an employee of LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge, and belief.

Robert M. Conroy

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 9th day of February 2022.

Notary Public

Notary Public ID No. 603967

My Commission Expires:

July 11, 2022

VERIFICATION

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF JEFFERSON)

The undersigned, **David S. Sinclair**, being duly sworn, deposes and says that he is Vice President, Energy Supply and Analysis for Kentucky Utilities Company and Louisville Gas and Electric Company and an employee of LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge, and belief.

David S. Sinclair

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 10th day of February 2022.

Judy Schooler
Notary Public

Notary Public ID No. 603967

My Commission Expires:

July 11, 2022

VERIFICATION

COMMONWEALTH OF KENTUCKY)
)
COUNTY OF JEFFERSON)

The undersigned, **Stuart A. Wilson**, being duly sworn, deposes and says that he is Director, Energy Planning, Analysis & Forecasting for LG&E and KU Services Company, and that he has personal knowledge of the matters set forth in the responses for which he is identified as the witness, and the answers contained therein are true and correct to the best of his information, knowledge, and belief.

Stuart A. Wilson
Stuart A. Wilson

Subscribed and sworn to before me, a Notary Public in and before said County and State, this 10th day of February 2022.

Judy Schooler
Notary Public

Notary Public ID No. 603967

My Commission Expires:

July 11, 2022

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 1

Responding Witness: Christopher D. Balmer / David S. Sinclair

Q-1. Identify any material changes that may have occurred from the date the Companies' Integrated Resource Plan ("IRP") was filed, and please also address the following subparts:

a. Include in your explanation any changes in the generation and/or transmission planning provisions in the as-filed IRP that may result from the publicly-announced Ford Motor Company manufacturing project at the Glendale MegaSite in Hardin County.

b. Based on the article referenced in the footnote below,[1] confirm that the U.S. Environmental Protection Agency ("EPA") is proposing to deny extensions of time for compliance with the EPA's revisions to the coal combustion residuals rule ("CCR") to three utilities, among them, Ohio Valley Electric Corporation ("OVEC"). Confirm that according to the article, OVEC may have to cease operations at its Clifty Creek Station.

   (i) Explain how much advance notice the Companies would receive if Clifty Creek is required to close.

   (ii) Confirm that under the OVEC Inter-Company Power Agreement, the Companies receive approximately 152 MW of power from OVEC.

   (iii) Explain where the Companies' share of OVEC power falls within their order of economic dispatch.

   (iv) Explain whether the Companies would still receive power from OVEC's remaining power station if Clifty Creek closes.

[1] https://www.utilitydive.com/news/midwest-power-plants-face-shutdown-epa-deny-coal-ash/617036/ (Last accessed Jan. 21, 2022).

(v) Explain how the Companies would make up for this lost power source, and whether the potential retirement of Clifty Creek Station could delay or otherwise impact the retirement of Mill Creek Unit 2, and/or other coal-fired units in the Companies' fleet.

A-1. The only material change is the planned new load from Ford's battery plants as noted in footnote 47 on page 5-44 of Volume I of the IRP.

a. With the new load, the Companies do not anticipate needing additional generation capacity prior to 2028. Similarly, no changes in the as-filed IRP generation plans have been identified.

The as-filed IRP did not include any transmission system upgrades to serve the new load. The Companies must follow the Transmission Service Request (TSR) process administered by the Independent Transmission Organization (ITO) to identify any required network upgrades. The Companies have submitted a TSR for construction power and the ITO approved it without any network upgrades needed. The Companies will submit a TSR to the ITO for permanent power needed to operate the full capacity of the plant in the near future.

b. Based upon information provided by OVEC management, the EPA's January 11th action represents a proposed conditional denial of OVEC's application for an alternative (extended) date to cease placement of CCR wastes and non-CCR wastewater and initiate closure activities for two surface impoundments at the Clifty Creek Station. The alternative dates OVEC requested are December 5, 2022 for one surface impoundment and April 2023 for the second surface impoundment. The proposed denial is subject to a public comment period running thru late February, followed by an EPA final decision, which may occur during 2022. OVEC anticipates submitting information, potential design changes or both during the comment period to seek to address EPA concerns in the conditional denial, as well as considering legal strategies. In the event a final denial decision is issued without modification, that decision would not require the plant to shut down, it would only prohibit the continued placement of CCR and non-CCR wastewater into the surface impoundments through the alternative dates requested by OVEC. The conditional denial provides that Clifty Creek would be required to cease placing CCR in the impoundment 135 days after a final denial decision date. Clifty Creek would then be in a temporary outage until the new CCR treatment systems that are being installed to fulfill the requirements of the CCR rule are operational.

(i) See above.

(ii) The Companies collectively are entitled to receive 8.13% of OVEC's output, which equates to a summer rating of 172 MW. The Companies expect to receive 152 MW at the time of summer peak, on average, when accounting for potential outages. See footnote 49 on page 6-6 of Volume I of the IRP.

(iii) OVEC's position in dispatch order typically falls after Cane Run 7 and the coal units at Trimble County, Mill Creek, and Ghent, but before Brown 3 and the simple-cycle combustion turbines.

(iv) In accordance with the ICPA power contract, the Companies would continue to receive their share of power from OVEC's Kyger Creek station.

(v) Because OVEC is actively working to remedy this situation, the Companies assume that such a loss would be only temporary and short-lived and would therefore have no impact on the Companies' resource plan. The Companies would need to operate more expensive generating units during such a time, which would increase the cost of serving customers.

CONFIDENTIAL INFORMATION REDACTED

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Informatio
Dated January 21, 2022

Case No. 2021-00393

Question No. 2

Responding Witness: Christopher D. Balmer

Q-2. Reference the confidential document, "[redacted]."

a. Provide the most recent [redacted] for each [redacted]

b. For each [redacted] whose estimated [redacted] $3 million, provide a discussion of all alternatives that were considered, including any [redacted] analyses that were considered, and the results of each such analysis.

A-2.

a. See attached. The information requested is confidential and proprietary and is being provided under seal pursuant to a petition for confidential protection.

b. See the response to part (a).

The entire attachment is Confidential and provided separately under seal.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 3

Responding Witness: Christopher D. Balmer

Q-3. Reference IRP Vol. 3, "2021 IRP Reserve Margin Analysis," § 4.4, p. 16, "Available Transmission Capacity" ("ATC"). Explain to what extent the Companies' planned transmission projects over the next five (5) years will improve the Companies' ATC.

a. In the event the Companies join an RTO, discuss: (i) whether it is likely they will have to improve their ATC ratings, and include in your response any cost estimates the Companies may have prepared in this regard; and (ii) to what extent, if any, the Companies' 2021 RTO Membership Analysis analyzed this issue.

A-3. The Companies' planned transmission projects are determined based on meeting NERC Transmission Planning Reliability Standards and the Companies' Transmission Planning Guidelines and *may* result in improved ATC between the Companies and adjacent entities; however, improving ATC is not the purpose of the Planning Standards, nor is it something the Companies attempt to quantify on a forward-looking basis.

a. The concept of ATC is not particularly relevant to participation in an RTO. Transmission limitations in an RTO construct are manifested in the congestion pricing portion of the LMPs calculated for all load nodes. Therefore, no projects to reduce potential congestion that may exist if Companies were to join an RTO were estimated / prepared, nor was this analyzed in the Companies' 2021 RTO Membership Analysis.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 4

Responding Witness: Stuart A. Wilson

Q-4. Provide the Companies' most recent natural gas combined cycle ("NGCC") capacity costs per kW, both with and without carbon capture and sequestration ("CCS").

a. If known, provide also the most recent NGCC capacity cost per kW developed by the National Renewable Energy Laboratory ("NREL").

A-4. See the response to PSC 1-26, part (h).

a. The Companies used cost and operating inputs from NREL's 2021 ATB for the 2021 IRP. See the response to PSC 1-26, part (h).

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 5

Responding Witness: Robert M. Conroy / David S. Sinclair

Q-5. Reference IRP Vol. 1, § 5, pp. 5-1 and 5-8. Given that KU operates as Old Dominion Power Co. in Virginia, explain to what extent the fact that the Commonwealth of Virginia has a renewable energy portfolio mandate drives the Companies' resource determinations.

A-5. Old Dominion Power Company is not subject to a renewable energy portfolio mandate. Therefore, there is no extent to which current Virginia renewable energy law affects the Companies' resource decisions.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 6

Responding Witness: Robert M. Conroy

Q-6. Given the increasing popularity of the Companies' Green Tariff (Option # 3),[2] explain whether the decision-making processes for how to meet the renewable energy requests from Green Tariff Option # 3 participants could ever replace or outweigh the decision-making processes the Companies would ever utilize for the IRP and CPCN processes.

a. Explain whether the Companies will remain committed to providing least-cost supply side resources as mandated by Kentucky law.

A-6. The Companies are and will remain committed to complying with Kentucky law and providing all customers with safe and reliable service at the lowest reasonable cost. Green Tariff Option #3 is a component part of providing such service that allows qualifying customers to purchase renewable energy in a particular way. But Green Tariff Option #3 does not displace or replace the Companies' IRP obligations or the need to seek CPCNs for facilities that require them.

a. The Companies will remain committed to complying with Kentucky law and providing all customers with safe and reliable service at the lowest reasonable cost.

---

[2] See e.g., KU Tariff Sheet P.S.C. No. 20, First Revision of Original Sheet No. 69.1 – 69.3.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 7

Responding Witness: Stuart A. Wilson

Q-7. Reference IRP Vol. 1, p. 5-3, and Figures 5-3 and 5-4. Given the fact that the Companies continue to experience peaks in not only summer but also winter, discuss the Companies' plans to avoid an over-reliance on renewable resources which experience diminished capacity in cold and cloudy weather.

a. Confirm the following statement in IRP Vol. 1, p. 5-19: "Furthermore, because annual peak demands can occur during the winter months and because winter peaks typically occur during nighttime hours, solar generation has virtually no value in the Companies' service territories as a source of winter capacity."

b. Reference further IRP Vol. 1, p. 5-11. Confirm that rather than communicating the reserve margin analysis in terms of a summer peak, the Companies in the instant IRP are expressing this analysis in the context of a summer and winter peak reserve margin.

A-7. The Companies plan the generation system with the operational capabilities and attributes needed to reliably serve customers' year-round energy needs at a reasonable cost. The analysis presented in the IRP considers all hours, including both summer and winter, when evaluating potential new resources, including renewables. The Companies will work to ensure that the addition of non-dispatchable resources will not affect reliability.

a. Confirmed.

b. Confirmed.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 8

Responding Witness: Stuart A. Wilson

Q-8. Reference IRP Vol. 1, p. 5-6, Table 5-1. Confirm that today the Companies have 7,597 total net dispatchable capacity (summer rating), and 105 MW of non-dispatchable generation (hydro and solar).

a. Under the Companies' preferred plan, explain what the ratio of dispatchable to non-dispatchable resources will be in 2028, 2032, and 2036.

b. Confirm that as the amount of dispatchable resources dwindles in comparison to non-dispatchable resources, the Companies will likely have to either: (i) increase their reserve margin; and/or (ii) more frequently rely on more expensive back-up power resources, whether through Company-owned resources, market power, Purchase Power Agreements ("PPA"s) or bilateral agreements.

c. Confirm also that the total of non-dispatchable resources does not include solar generation procured under several Green Tariff Option # 3 PPAs, namely: (i) 100 MW of solar generation from Rhudes Creek; (ii) 125 MW of solar generation finalized in a PPA on Oct. 11, 2021; and (iii) another 160 MW of solar generation that is assumed to come online in 2025.

A-8. Confirmed. Non-dispatchable generation reflects the expected contribution at the time of summer peak and not the nameplate capacity.

a. The Companies do not have a “preferred” plan, but under the base load and base fuel case, the net dispatchable capacity (summer rating), the non-dispatchable capacity (summer rating), and ratio are shown in the table below.

Year	Net Dispatchable Capacity (MW)	Net Non-Dispatchable Capacity (MW)	Ratio of Dispatchable to Non-Dispatchable Resources
2028	6,981	702	9.9
2032	6,981	702	9.9
2036	6,617	1,960	3.4

b. Not confirmed. The ratio of dispatchable to non-dispatchable resources is not relevant. The Companies are planning to add non-dispatchable resources only as part of a least cost portfolio. The Companies’ analysis finds that it will be lower cost to continue to serve load reliably using a mix of dispatchable and non-dispatchable resources. The Companies do not necessarily expect the target reserve margin to increase, but summer reserve margin will become less meaningful as a reliability metric as more intermittent resources are added. As stated in the Reserve Margin Analysis in Vol. III of the IRP, as more solar generation is integrated into the Companies’ generation portfolio, the summer reserve margin will have less meaning as an indicator of the portfolio’s ability to reliably serve customers in all hours, and the 2021 IRP analysis places emphasis on meeting both summer and winter reserve margin needs. Also see the response to Question No. 35.

c. The ratings specified in Table 5-1 reflect resources as of September 2021, and do not include any of the solar generation procured under Green Tariff Option #3. The Companies do not have plans for the PPA referenced in (iii). The 125 MW PPA that was finalized on October 11, 2021 reflects a reduction in capacity of the originally-planned 160 MW PPA. See the response to PSC 1-55.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 9

Responding Witness: Stuart A. Wilson

Q-9. Reference IRP Vol. 1, Table 5-2, p. 5-7. Explain whether the Zorn unit has been retired.

A-9. The Zorn unit was retired on November 30, 2021.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 10

Responding Witness: Stuart A. Wilson

Q-10. Reference IRP Vol. 1, p. 5-11, "Reserve Margin Analysis – Models and Methods." Confirm the following statement: "In addition to the ability to serve load during the annual system peak hour, the generation fleet must have the ability to produce low-cost baseload energy, the ability to respond to unit outages and follow load, and the ability to instantaneously produce power when customers want it."

A-10. Confirmed.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 11

Responding Witness: Stuart A. Wilson

Q-11. Reference IRP Vol. 1, p. 5-15, the sentence: "As mentioned previously, the primary focus of resource planning is risk management." Explain whether the Companies can confirm that increasing the ratio of non-dispatchable to dispatchable resources increases risks to reliability. If the Companies cannot so confirm, explain fully why not.

A-11. The Companies will continue to plan their mix of generation resources such that the system meets reliability standards at the lowest reasonable cost. The Companies will work to ensure that the addition of non-dispatchable resources will not affect reliability.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILTIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 12

Responding Witness: Stuart A. Wilson

Q-12. Confirm that the instant IRP assumes the following retirement dates:

a. Mill Creek Unit 1 will retire in 2024 due to the projected inability to meet cost-effective compliance with the ELG Rule;

b. Mill Creek Unit 2 and Brown Unit 3 will retire in 2028.

c. All other CO_2-emitting units will retire at the end of their respective book depreciation lives

A-12.

a. Confirmed.

b. Confirmed.

c. Confirmed.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 13

Responding Witness: John Bevington

Q-13. Reference IRP Vol. 1, p. 5-21, footnote 25 regarding Ford Motor Company's announced plans for a major industrial manufacturing facility in Hardin County, the statement that, "[w]ith the new load, the Companies do not anticipate needing additional generation capacity prior to 2028." Explain whether Ford has indicated a preference for utilizing Green Tariff Option # 3 to meet any portion, or all of this projected new load.

a. Provide the amount of the projected new load, if known, or if it is only estimated at this point.

A-13. See the response to PSC 1-29 f.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 14

Responding Witness: Stuart A. Wilson

Q-14. Reference IRP Vol. 1, p. 5-24, "3. Cost of Service." Explain whether the forecasts for electricity prices the Companies relied upon take into consideration the need for and costs of more transmission and distribution infrastructure as the nation – and the Companies and their customers -- transition more toward electric space heating and EVs.

a. Confirm the statement in the last paragraph of that page, that in the event of higher-than-expected electricity prices, the Companies anticipate a decrease in sales from the current forecast.

b. Confirm the statement on p. 5-24 that increasing electricity prices could hinder the adoption of EVs.

c. Confirm the statement on p. 5-25 that in the event of higher-than-expected electricity prices, the Companies anticipate that large customers in highly competitive industries would be more likely to leave the service territory or find ways to significantly reduce their demand.

A-14. The forecast for electricity prices is consistent with the electric heating and EV penetrations assumed in the base load forecast.

a. Confirmed.

b. Confirmed.

c. Confirmed.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 15

Responding Witness: Stuart A. Wilson

Q-15. Explain whether the IRP provides any quantifications for any potential increases in CO_2 and other GHG emissions that could result from increased electrification of space heating as opposed to natural gas, and EV replacement of hydrocarbon-based transportation systems. If so:

a. explain further whether such analyses take into consideration that: (i) renewable sources of generation alone are highly unlikely to be able to provide the power necessary to transition from natural gas to electrified space heating, given that the need, by definition, always arises in winter when the capacity factor of renewables is negligible; and (ii) renewable sources of generation alone will be unable to meet the winter-time load for EV charging, due to their seasonal unavailability.

A-15. As shown in Table 20 in the Long-Term Resource Planning Analysis in Vol. III of the IRP, the Companies forecast higher CO_2 emissions for the high load cases, which include increased electrification of space heating and EV adoption compared to the base and low load cases. However, CO_2 emissions are still 22 to 42 percent lower than 2010 emissions due to replacement of existing generation with lower-emitting resources.

a. The Companies disagree with the assertion that the capacity factor of renewables is negligible in the winter. While the expected contribution from solar during winter peak hours is negligible, the expected contribution from wind during winter peak hours is assumed to be 32 percent and higher than during the summer peak. The analysis takes into consideration that renewable resources alone will be unlikely to meet additional load associated with electrification of space heating and EV charging, as expansion plans also incorporate simple-cycle combustion turbines and battery storage.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 16

Responding Witness: Stuart A. Wilson

Q-16. Reference IRP Vol. 1, p. 5-36. Confirm that under either the high or low case energy requirements forecasts, both LG&E and KU become winter-peaking utilities under normal weather conditions.

a. Provide all studies and analyses of bill impacts once the Companies become winter-peaking utilities.

b. Explain if the Companies are aware that some residential customers of at least one other winter-peaking utility in the Commonwealth experience monthly bills during the winter of over $1000.00.

A-16. Confirmed for the combined Companies. LG&E becomes winter peaking only in the high case, and KU is already a winter peaking utility.

a. The Companies have not conducted such studies. The KU and ODP service territories are already winter peaking because a high percentage of residential customers utilize electric space heating. Under normal weather conditions, the Companies' winter peak is currently only approximately 300 MW lower than their summer peak (see Table 5-8 on page 5-23 of Volume I). Since 2010, the combined Companies' peak occurred in the winter three times. See the responses to PSC 1-2 and PSC 1-20.

b. The Companies do not have direct knowledge of the situation to which this request refers because they do not issue or review other utilities' bills. The Companies' objective is to provide safe and reliable service at the lowest reasonable cost for their customers.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 17

Responding Witness: Stuart A. Wilson

Q-17. Reference IRP Vol. 1, p. 5-34, "High and Low Energy Requirement Forecasts." Explain why the assumption was made that electric heat pumps, rather than electric furnaces, would replace gas furnaces.

a. Are the Companies aware of any research, studies or analyses indicating that heat pumps alone would always be able to provide the heat necessary during all low temperature extremes experienced in the Commonwealth?

A-17. The Companies did not intend to differentiate between electric heating sources. The intent in the high load forecast was to model an increase in the incidence of electric heating generally.

a. Heat pumps utilize back-up heating elements during extremely low temperatures. According to the Energy Information Administration, "Improvements in electric heat pump technology have improved efficiency and extended the range of temperatures that heat pumps can operate in before resorting to back-up heating, which is most often an electric resistance element similar to that used in a toaster or an electric dryer. Electric resistance heating is effective but relatively expensive to operate."[3]

[3] https://www.eia.gov/todayinenergy/detail.php?id=18131

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 18

Responding Witness: Stuart A. Wilson

Q-18. Provide a discussion of the extent to which distributed generation would assist the Companies in meeting their winter-time peaks.

A-18. The Companies' winter peak typically occurs in the morning or evening during nighttime hours. Therefore, distributed solar generation is assumed to have no material impact on winter peak.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 19

Responding Witness: Stuart A. Wilson

Q-19. Reference IRP Vol. 1, p. 5-39, "Resource Screening Analysis." Provide the rationale for including wind generation located in Kentucky as a potential non-dispatchable resource, given that well-proven wind capacity factors in the Commonwealth are insufficient to justify such expenditures.

a. Explain if the data the Companies examined, including the net capacity factors from the NREL ATB data provided in Table 5-16, are based on national *averages,* or are broken down by geographic region as the U.S. Energy Information Administration ("USEIA") did when it concluded that on-shore wind power will remain economically unattractive until 2040, and will remain miniscule for the Southeast Region (which comprises Kentucky).[4]

b. Confirm that for capacity planning purposes, PJM ascribes wind resources a capacity credit of only 12.3% of nameplate.[5]

c. Provide the average wind capacity factor in: (i) Kentucky; and (ii) the on-shore PJM footprint.

d. Provide the average lifespan of a wind generation turbine.

A-19. See Volume III, Resource Screening Analysis, Section 2.2.2 where the Companies compared costs for Kentucky wind resources and Indiana wind resources. Because the Kentucky wind option has a lower LCOE compared to Indiana wind, it was evaluated in the Long-Term Resource Planning Analysis.

a. As stated in Volume III, Resource Screening Analysis on page 10, the Companies used "Class 9" and "Class 6" capacity factors from NREL's 2021 ATB for wind resources located in Kentucky and Indiana, respectively.

---

[4] USEIA, "Annual Energy Outlook 2020," p. 39, slide 77 (Jan. 29, 2020), accessible at: https://www.eia.gov/outlooks/aeo/pdf/aeo2020.pdf (Last accessed Jan. 21, 2022).
[5] "Effective Load Carrying Capability Analysis for Wind and Solar Resources," PJM Interconnect, Feb. 7, 2019.

b. PJM ascribes onshore wind resources an ELCC class rating of 15% for the 2023-2024 Base Residual Auction.[6]

c. As shown in Table 6 in Volume III, Resource Screening Analysis, the Companies used capacity factors from NREL's 2021 ATB Class 9 wind of 27.4% and 29.8% for 2022 and 2031 wind installations in Kentucky, respectively. The Companies do not have the average wind capacity factor in the on-shore PJM footprint. NREL's wind resource map shows average wind speeds of mostly 6.0-7.9 m/s in the PJM areas.[7] These wind speeds best correspond to Classes 7, 8, and 9 from NREL's 2021 ATB.[8] Capacity factors for Class 7 wind are 36% and 39% for 2022 and 2031 wind installations, respectively, and capacity factors for Class 8 wind are 32% and 35% for 2022 and 2031 wind installations, respectively.

d. The Companies assumed an expected life of 30 years for wind resources, based on the Technology Life provided in NREL's 2021 ATB.

[6] *See* https://www.pjm.com/-/media/planning/res-adeq/elcc/elcc-class-ratings-for-2023-2024-bra.ashx
[7] https://www.nrel.gov/gis/assets/images/wtk-100m-2017-01.jpg
[8] https://atb.nrel.gov/electricity/2021/land-based_wind

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 20

Responding Witness: David S. Sinclair

Q-20. Provide a discussion regarding the measures the Companies will take to protect ratepayers and landowners from environmental liabilities arising from the decommissioning of wind generation facilities. Include in your discussion the following:

a. Provide the average number of acres of land needed to generate 1 MW of wind-generated power.

b. What parties (*e.g.*, ratepayers, taxpayers, shareholders, project owners, landowners) will be responsible for paying costs of environmental contingencies and/or other tail liabilities in the case of both company-owned facilities, and wind generation procured via PPAs.

c. Explain whether any parties involved in wind generation developments are required to maintain sureties for decommissioning costs, and if so: (i) the amounts of such sureties; (ii) for how long a period of time, including whether the sureties extend beyond the projected lifespan of a project to cover tail liabilities.

d. Explain what will happen to wind turbine blades, and the actual wind turbines themselves once a facility is decommissioned, including whether blades will be recycled, or placed into landfills. If the latter, explain if the landfills will be located in Kentucky.

e. Provide the average cost to both recycle a wind turbine blade, and to dispose of it in a landfill. Explain which party(ies) will pay for those costs, and whether those costs are factored into the Companies' cost estimates for the price of wind power, and how those costs are factored into base rates.

f. How the Companies will factor and compute terminal net salvage into costs for wind generation facilities.

g. The ramifications of migratory bird deaths, including which parties will pay the costs of any fines levied by state or federal authorities for such deaths. If ratepayers are responsible for paying the costs of any such fines, explain how these costs are factored into both base rates, and costs for wind power utilized in the instant IRP.
h. Explain whether the planning models utilized in the current IRP contain any cost estimates regarding the obligation to landowners or Authorities Having Jurisdiction ("AHJ") for the decommissioning of any wind power projects or potential wind power projects. If so, provide all such estimates.

i. Explain whether the Companies anticipate having to pay any sums to owners of land adjacent to wind facilities, or to AHJs for assurances for decommissioning costs for wind power projects. If so: (1) provide the dollar value per MW of such payments; and (2) explain whether the assurance would be paid in the form of surety bond, cash deposit, or letter of credit.

j. Provide examples of the costs that may have to be updated periodically throughout the life of the wind power system.

k. Explain whether the costs of recycling wind generation components includes hazardous waste.

l. Explain whether the Companies are aware that some wind generating facilities have been required to reduce operations ("curtail") at various times of the year in order to comply with regulatory requirements pertaining to the number of bird and bat fatalities. Discuss whether such curtailments would impact the facility's capacity factor, and if so: (1) whether the facility's cost-competitiveness can be affected; and (2) whether ratepayers, or shareholders, bear the risk of additional costs incurred to procure replacement power when a wind facility experiences such a curtailment as a means to reduce bird and bat fatalities.

m. Provide a link to the 2021 U.S. Fish & Wildlife Service ("USFWS") Wind Energy Land Based Guidelines. Provide also a listing of all other federal regulations with which wind generation facilities are routinely required to comply.

n. Explain whether the Companies are aware of USFWS and/or any other governmental authorities having ever required wind generation facilities to provide additional spacing between turbines in order to mitigate the risk of bird and bat fatalities. If so, provide examples, as well as any increase in the average number of acres needed to generate 1 MW of wind-generated power.

o. Explain whether the Companies are aware of any wind generating facility owners having voluntarily entered into enforceable agreements with stakeholders and/or USFWS or other governmental authorities to curtail their operations as a means of addressing the risk of bird and bat fatalities. If so, explain which stakeholders (e.g., ratepayers, taxpayers, shareholders, project owners, landowners) bear the risk of loss in obtaining replacement power.

A-20.

a. According to NREL, an average of 44.7 acres of land are needed for 1 MW of wind capacity with a standard deviation of 25 acre per MW.[9]

b. - o. The Companies have not evaluated any of these topics. The Companies assumed in the 2021 IRP that future wind resources would be in the form of a PPA. The potential issues, costs, and risks raised in these questions would solely be the responsibility of the PPA supplier and included in the contracted PPA cost. The Companies assume that the PPA supplier would comply with all laws, regulations, and permitting requirements at the time in a least-cost manner from the supplier's perspective.

---

[9] See https://www.nrel.gov/analysis/tech-size.html

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 21

Responding Witness: Stuart A. Wilson

Q-21. Confirm that the efficiency of solar panels decreases over time due to module degradation. Provide the average percentage of efficiency degradation on an annual basis.

A-21. The general industry consensus is that solar panels degrade over time, though there is variation in this degradation rate. According to NREL, the median degradation rate is 0.5%/year.[10]

[10] See https://www.nrel.gov/docs/fy15osti/65040.pdf.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 22

Responding Witness: Stuart A. Wilson

Q-22. Confirm that based on the combination of: (i) improving efficiency rates of solar panels; and (ii) overall decreasing costs of new solar panels, in some cases it will prove more cost-effective for solar project owners to retire existing panels prior to the end of the panels' expected lifespan, and install new panels in their place.

A-22. The Companies cannot confirm this. While replacing solar panels could potentially be warranted, the Companies assume that a solar project owner will do what is least cost at the time.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 23

Responding Witness: Stuart A. Wilson

Q-23. Provide the Companies' projected costs to operate, maintain and decommission a solar project, including recycling costs.

A-23. The Companies' assumptions for costs to operate and maintain a solar project are shown in Table 2 in Volume III, Resource Screening Analysis and are based on NREL's 2021 ATB. The online documentation for NREL's 2021 ATB does not indicate inclusion of decommissioning or recycling costs.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 24

Responding Witness: David S. Sinclair

Q-24. Provide a discussion regarding the measures the Companies will take to protect ratepayers and landowners from environmental liabilities arising from the decommissioning of solar facilities. Include in your discussion the following:

a. Provide the average number of acres of land needed to generate 1 MW of solar-PV generated power.

b. Confirm that the average projected life span of a solar PV system is 20 years.

c. Which parties (*e.g.*, ratepayers, taxpayers, shareholders, project owners, landowners) will be responsible for paying costs of environmental contingencies and tail liabilities in the case of both company-owned facilities, and solar generation procured via PPAs.

d. Confirm that in the case of solar PPAs, project owners would likely factor the costs of decommissioning the project into the prices charged to the solar power PPA purchaser, even though the Companies (as a potential taker-purchaser under a solar PPA) would not themselves bear the obligation to decommission the project.

e. Explain whether any parties involved in solar developments are required to maintain sureties for decommissioning costs, and if so: (i) the amounts of such sureties; (ii) for how long a period of time, including whether the sureties extend beyond the projected lifespan of a project to cover tail liabilities.

f. Explain what will happen to solar panels once a facility is decommissioned, including whether panels will be recycled, or placed into landfills. If the latter, explain if the landfills will be located in Kentucky.

g. Provide the average cost to both recycle a solar panel, and to dispose of it in a landfill. Explain which party(ies) will pay for those costs, and whether those costs are factored into the Companies' cost estimates for the price of solar power utilized in the instant IRP.

h. How the Companies will factor and compute terminal net salvage into costs for solar generation facilities, and whether such costs are included in the Companies' cost estimates utilized in the instant IRP.

i. The ramifications of decreased vegetation growth on land with solar PV panels, including decreased carbon sink potential, water runoff, and land erosion and subsidence.

j. Explain whether the planning models utilized in the current IRP contain any cost estimates regarding the obligation to landowners or the AHJ for the decommissioning of any solar projects or potential solar projects. If so, provide all such estimates, including estimates based on both recycling of used panels, and disposing of them in landfills.

k. Explain whether it is currently more cost-effective to recycle used solar panels that have reached the end of their useful life span, or to dispose of them in landfills. If the latter, explain whether the used solar panels would be designated as hazardous waste under applicable federal and Kentucky law.

l. Provide a list of the jurisdictions of which the Companies and their affiliates are aware which regulate the disposal of solar panel components, and explain whether any such jurisdictions identify any solar panel components as hazardous waste.

m. Confirm that according to a 2016 EPRI study, the results of which are summarized in the slide presentation linked in the footnote below,[11] some PV modules are not classified as hazardous waste, but some modules contain hazardous materials; in fact, the study concluded in part that "Module disposal is potentially a major issue."[12]

n. Confirm that based on statements from Lu Chang, secretary general of the photovoltaics division of the China Renewable Energy Society, quoted in the article accessible in the footnote below:[13]

- "The problem of solar panel disposal will explode with full force in two or three decades and wreck the environment" because it "is a huge amount of waste and they are not easy to recycle."

---

[11] See especially slide nos. 18-20, at: https://www.solarpowerinternational.com/wpcontent/uploads/2016/09/N253_9-14-1530.pdf (Last accessed Jan. 21, 2022).
[12] *Id*. at slide 20.
[13] https://www.forbes.com/sites/michaelshellenberger/2018/05/23/if-solar-panels-are-so-clean-why-do-they-produce-so-much-toxic-waste/?sh=854d0a7121cc (Last accessed Jan. 21, 2022).

- "The reality is that there is a problem now, and it's only going to get larger, expanding as rapidly as the PV industry expanded 10 years ago."
- "Contrary to previous assumptions, pollutants such as lead or carcinogenic cadmium can be almost completely washed out of the fragments of solar modules over a period of several months, for example by rainwater."

o. Regarding self-built or self-owned solar projects, describe what policy(ies) the Companies and their affiliates have in place regarding disposal of decommissioned solar PV cells.

p. Explain whether the Companies and their affiliates are aware of any entities which recycle solar panel components.

q. Confirm the following quoted statement from the June 18, 2021 *Harvard Business Review* article, "The Dark Side of Solar Power," accessible in the footnote below, and provide any comments:[14]

> "The totality of these unforeseen costs could crush industry competitiveness. If we plot future installations according to a logistic growth curve capped at 700 GW by 2050 (NREL's estimated ceiling for the U.S. residential market) alongside the early replacement curve, we see the volume of waste surpassing that of new installations by the year 2031. By 2035, discarded panels would outweigh new units sold by 2.56 times. In turn, this would catapult the LCOE (levelized cost of energy, a measure of the overall cost of an energy-producing asset over its lifetime) to four times the current projection. The economics of solar — so bright-seeming from the vantage point of 2021 — would darken quickly as the industry sinks under the weight of its own trash. . . . It will almost certainly fall to regulators to decide who will bear the cleanup costs."

A-24.

a. According to NREL, an average of 6.1 acres of land are needed for 1 MW of solar-PV capacity with a standard deviation of 1.7 acres per MW.[15]

b. The Companies assumed an expected life of 30 years for solar PV resources, based on the Technology Life provided in NREL's 2021 ATB.

---

[14] https://hbr.org/2021/06/the-dark-side-of-solar-power (Last accessed Jan. 21, 2022).
[15] https://www.nrel.gov/analysis/tech-size.html

c.– n. The Companies have not evaluated any of these topics. The Companies assumed in the 2021 IRP that future solar resources would be in the form of a PPA. The potential issues, costs, and risks raised in these questions would solely be the responsibility of the PPA supplier and included in the contracted PPA cost. The Companies assume that the PPA supplier would comply with all laws, regulations, and permitting requirements at the time in a least-cost manner from the supplier's perspective.

o. Due to the newness of the Brown Solar and Solar Share facilities, the Companies have not yet developed a policy regarding disposal of decommissioned solar panels. But when the Companies eventually do dispose of solar panels, they will do so in an environmentally responsible manner that complies with all applicable law.

p - q. See response to parts c – n.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 25

Responding Witness: David S. Sinclair

Q-25. Reference IRP Vol. 1, pp. 5-39-40, "Resource Screening Analysis," wherein the Companies identify NGCCs with CCS as a potential resource.

a. Confirm that the Companies either currently are, or have completed, a joint study with the University of Kentucky at the Companies' Cane Run-7 NGCC regarding means of reducing carbon emissions from natural gas combustion generation units.

b. Please provide an update, if one is available, on the status of this project.

c. If the Companies are aware of any studies on the feasibility and cost-effectiveness of CCS at natural gas combustion generation units, please provide same.

d. Explain if CCS at a natural gas combustion generation unit is more feasible and cost effective than it is at a coal-fired unit.

e. Is it the Companies' understanding that the current Administration will not allow any natural gas combustion generation units *at all* to be constructed, or will the Administration take a utility's overall fleet emissions into consideration?

A-25.

a. Confirmed. The Companies are currently working with the University of Kentucky Center for Applied Energy Research on developing a research project at Cane Run-7 NGCC for reducing carbon emissions from NGCC units.

b. The research project proposal is under review. If the Companies decide to continue, the next step would be to apply in June 2022 for $60 million in US DOE funding to build a 10 megawatt pilot project. If the US DOE selects the proposal, an award announcement would be expected in December 2022. The Companies, with the University of Kentucky, conducted successful tests using the E.W. Brown carbon capture system and simulated natural gas combined cycle flue gas conditions in October to December of 2021.[16]

c. In the 2021 IRP, Vol. I, Resource Screening Analysis, Table 5-15, page 5-40 the Companies refer to the National Renewable Energy Laboratory Annual Technology Baseline for costs of natural gas combined cycle with CCS. The National Renewable Energy Laboratory 2021 Annual Technology Baseline evaluates the cost of coal and natural gas generation with carbon capture at different capacity factors and under three scenarios, conservative, moderate, and advanced.[17] To further refine these estimates, the Companies are currently working with the University of Kentucky. Summaries for several examples of feasibility and cost studies related to NGCC CCS can be found from the National Energy Technology Laboratory's Carbon Management and Oil and Gas Research Project Review Meeting, with reports from Southern Company,[18] EPRI,[19] University of Texas,[20] Betchtel National Inc.,[21] and National Energy Research Laboratory.[22]

d. Carbon capture on natural gas combined cycle flue gas is more feasible and cost effective than on a coal unit because there are less than half the carbon dioxide emissions per megawatt-hour to capture and store, the flue gas has lower water content, and contains no sulfur dioxide. According to the NREL 2021 Annual Technology Baseline,[23] the Kentucky Energy and Environment Cabinet's analysis of CCS technologies,[24] and numerous other sources, natural gas with carbon capture is more cost effective than coal with carbon capture.

---

[16] University of Kentucky https://uknow.uky.edu/research/lge-and-ku-uk-caer-collaborate-create-net-negative-co2-emissions

[17] NREL (National Renewable Energy Laboratory). 2021. "2021 Annual Technology Baseline." Golden, CO: National Renewable Energy Laboratory. https://atb.nrel.gov/electricity/2021/fossil_energy_technologies

[18] Landon Lunsford, Southern Company Services, Inc. 2021. "Front End Engineering Design of Linde-BASF Advanced Post-Combustion CO2 Capture Technology at a Southern Company Natural Gas-Fired Power Plant (FE0031847)" https://netl.doe.gov/sites/default/files/netl-file/21CMOG_CCUS_Lunsford.pdf

[19] Abhoyjit Bhown, Electric Power Research Institute, Inc.2021. "Front-End Engineering Design Study for Retrofit Post-Combustion Carbon Capture on a Natural Gas Combined Cycle Power Plant (FE0031842)". https://netl.doe.gov/sites/default/files/netl-file/21CMOG_CCUS_Bhown.pdf

[20] Gary Rochelle, University of Texas at Austin. 2021. "FEED for Piperazine with the Advanced Stripper on NGCC (FE0031844)" https://netl.doe.gov/sites/default/files/netl-file/21CMOG_CCUS_Rochelle.pdf

[21] Bill Elliott, Bechtel National, Inc.2020. "Front-End Engineering Design (FEED) Study for a Carbon Capture Plant Retrofit to a Natural Gas-Fired Gas Turbine Combined Cycle Power Plant (FE0031848)". https://netl.doe.gov/sites/default/files/netl-file/20CCUS_Elliott.pdf

[22] James III PhD, Robert E, Kearins, et al (NETL). 2019. "Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity". United States. https://doi.org/10.2172/1569246. https://www.osti.gov/servlets/purl/1569246.

[23] NREL 2021 ATB https://atb.nrel.gov/electricity/2021/fossil_energy_technologies

[24] Economic Challenges Facing Kentucky's Electricity Generation Under Greenhouse Gas Constraints, December 2013. https://stat.as.uky.edu/sites/default/files/EEC_Model_Report.pdf#page130

e. Under current law, the construction of natural gas combustion generation is permissible. The Companies do not know what future regulations will be, but would consider NGCC without CCS a plausible technology option under certain circumstances.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 26

Responding Witness: David S. Sinclair

Q-26. Reference IRP Vol. 1, p. 5-41, the first full paragraph regarding capital costs for solar and battery technology.

a. Confirm that the current Administration is continuing in place U.S. trade sanctions in the form of a Withhold Release Order ("WRO") against certain China-based manufacturers of metallurgical-grade silicon ("MGS") wafers utilized in the manufacturing of solar generation panels. [25]

b. Confirm that most solar panels today are manufactured in China utilizing MGS wafers.

c. Confirm that the Administration is considering expanding these sanctions to apply to other manufacturers utilizing Chinese-manufactured MGS wafers, whose facilities are located in certain other countries.

d. Confirm that these trade sanctions are leading to world-wide supply shortages, and further, that as a result prices for solar panels are increasing significantly.

e. Explain whether the Companies' price analyses pertaining to solar generation (whether company-owned or third-party owned) addressed the rising prices for solar panels, and if so: (i) where in the IRP these analyses occurred; (ii) how the price increases were taken into consideration; and (iii) whether the analyses in any manner affected any decisions regarding future portfolio choices, and if so, how.

f. Explain also whether the Companies' price analyses pertaining to solar generation (whether company-owned or third-party owned) included cadmium

---

[25] See, e.g. https://www.cnn.com/2021/06/24/politics/solar-materials-china-forced-labor/index.html ; (Last accessed Jan. 21, 2022); and the *SEIA/Wood Mackenzie Power & Renewables U.S. Solar Market Insight,TM "Solar Market Insight Report 2021 Q3," accessible at:* https://www.seia.org/research-resources/solar-market-insight-report-2021-q3 (Last accessed Jan. 21, 2022).

telluride solar technology (sometimes referred to as "thin film" solar cells) within its analyses, as an alternative to MGS.

A-26. Please note that the Companies state the following as a preface to their IRP (emphasis added):

> This Integrated Resource Plan represents a snapshot of an ongoing resource planning process using current business assumptions. *The planning process is constantly evolving and may be revised as conditions change and as new information becomes available.* Before embarking on any final strategic decisions or physical actions, the Companies will continue to evaluate alternatives for providing reliable energy while complying with all regulations in a least-cost manner. Such decisions or actions will be supported by specific analyses and will be subject to the appropriate regulatory approval processes.

a. The Companies are generally aware that the federal government has trade sanctions in place regarding China, particularly with regard to solar panels and solar panel components. It would be reasonable to expect that such sanctions could place upward pressure on solar panel prices, but the Companies do not have direct knowledge concerning this request.

b. The Companies do not have direct knowledge concerning this request. The Companies are generally aware that China supplies much of the world's solar panels and solar panel components.

c. The Companies do not have direct knowledge concerning this request.

d. Constraints on trade generally tend to increase prices, but the Companies do not have direct knowledge concerning this request.

e. As noted above, the IRP is a snapshot analysis. Conditions can and do change before, during, and after the Companies draft an IRP. In this case, the source of the Companies' forecast of cost and operating inputs for all generation resources including solar PV is NREL's 2021 ATB, which shows solar capital costs decreasing over time.

f. NREL's online documentation for the 2021 ATB does not mention "cadmium telluride solar technology" or MGS. The description includes, "utility-scale PV systems in the 2021 ATB are representative of one-axis tracking systems with performance and pricing characteristics in-line with a 1.34 DC-to-AC ratio-or inverter loading ratio (ILR) for current and future years."[26]

[26] https://atb.nrel.gov/electricity/2021/utility-scale_pv

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 27

Responding Witness: Christopher D. Balmer / Stuart A. Wilson

Q-27. With regard to any generation resources located outside of the Commonwealth, whether owned by the Companies or contracted through PPAs:

a. Provide a discussion regarding any and all transmission system improvements the Companies would have to undertake in order to wheel the generation output into their service territories. Include in your discussion whether the costs of such transmission improvements have been included in the cost analyses utilized in the current IRP, and if so, how and where they were included.

b. Provide a discussion regarding any and all transmission system constraints the Companies would encounter in order to wheel the generation output into their service territories. Include in your discussion whether the costs of such transmission constraints have been included in the cost analyses utilized in the current IRP, and if so, how and where they were included.

c. Provide a discussion regarding any and all transmission interconnections the Companies would have to undertake in order to wheel the generation output into their service territories. Include in your discussion whether the costs of such transmission constraints have been included in the cost analyses utilized in the current IRP, and if so, how and where they were included.

A-27. The Companies evaluated one out-of-state resource, Indiana wind, and determined in their Resource Screening Analysis that it was higher cost than Kentucky wind due to the assumed cost of the MISO firm transmission service required to import the wind power into the Companies' transmission system. Therefore, no out-of-state resources were evaluated in their more detailed Long-term Resource Planning Analysis.

a. The Companies would be required to submit a Transmission Service Request ("TSR") on both the transmission system of the source system and on the Companies' system (as well as an intervening transmission system, if any) in order to deliver energy from the generation resource located outside the Commonwealth. Each of the Transmission Service providers would undertake a study to identify any constraints to the delivery of energy from the identified external resource. Any constraints identified in the TSR study process would need to be mitigated before delivery of energy could occur from the external resource. Such studies were not conducted. The Companies have not included the costs of any transmission system improvements in the IRP analyses.

b. See the response to part (a).

c. As shown in Table 6 in Volume III, Resource Screening Analysis, Section 2.2.2, the Companies included transmission costs of $87/kW-yr in 2022 and $104/kW-yr in 2031 for the Indiana wind resource evaluated, based on current firm transmission costs to import power from an Indiana resource.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 28

Responding Witness: Stuart A. Wilson

Q-28. Explain whether the instant IRP modeled purchases from the PJM market, the MISO market, or both, and if so: (i) how the modeling was conducted; and (ii) where in the IRP market purchases were analyzed.

A-28. Market purchases were modeled in both the reserve margin analysis and RTO analysis. In the reserve margin analysis, the Companies modeled off-system purchase transactions with counterparties in MISO, PJM, and TVA in SERVM. Furthermore, in ELDCM, the Companies' ability to import power from neighboring regions was modeled as a single "market' resource where the availability of the resource is the sum of available transmission capacity in all regions. In the RTO analysis, the Companies estimated incremental market sales revenues and costs to native load by joining MISO and PJM versus the Companies' current business plan across the low/mid/high commodity price forecast scenarios for each RTO.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 29

Responding Witness: David S. Sinclair

Q-29. Reference the article[27] in the footnote below, discussing a letter from American Electric Power's Chairman, President and CEO Nick Akins to Congress and other utilities, in which he expresses concerns that the Biden Administration's climate proposals would force utilities to develop clean energy "too rapidly," and would "adversely impact the reliability and resilience of the electric grid."

a. Discuss whether the Companies have any reliability / resilience concerns arising from a rapid adoption of renewable energy.

A-29.

a. The Companies' reliability objectives are not impacted by changes in future generation technologies. The Companies' goal is always to provide safe and reliable service at the lowest reasonable cost. The Companies have considered and will continue to consider how renewable resources can help meet that goal, as the IRP under review in this proceeding shows. Part of that consideration is recognizing that current renewable technologies have intermittent energy production characteristics that prudent utility planners must take into account. Failing to do so adequately could adversely impact reliability.

---

[27]https://www.eenews.net/articles/major-utility-questions-bidens-signature-climate-plan/?utm_source=Energy+News+Network+daily+email+digests&utm_campaign=2e2bb87193-EMAIL_CAMPAIGN_2020_05_11_11_46_COPY_01&utm_medium=email&utm_term=0_724b1f01f5-2e2bb87193-89280531 (Last accessed Jan. 21, 2022).

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 30

Responding Witness: Stuart A. Wilson

Q-30. Reference IRP Vol. 1, p. 5-41, the second paragraph under the heading "Target Reserve Margin Range," regarding the following statement:

> "The results of the 2021 analysis show that the Companies' existing resources are economically optimal for meeting system reliability needs in 2025. In other words, it is not cost-effective to alter annual or summer peak hour reliability by either retiring existing resources or adding new resources; the reliability and generation production cost benefit for each of the Companies' marginal resources exceeds the costs that would be saved by retiring these units."

a. Confirm that this means that through at least 2025, either retiring existing units or procuring new ones in order to maintain existing reliability levels would not be cost effective. If so confirmed:

   i. Explain whether this statement ceases to be true by 2028, when Brown 3 and Mill Creek 2 are scheduled for retirement.

A-30.

a. Confirmed.

   i. In the analysis summarized in Exhibit LEB-2 in Case Nos. 2020-00349 and 2020-00350, Mill Creek 2, for example, was retired to avoid the cost of installing selective catalytic reduction ("SCR") on the unit. The reserve margin analysis did not include this cost as part of Mill Creek 2's stay-open costs. Therefore, this statement ceases to be true for 2028 when stay-open costs are assumed to be different.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 31

Responding Witness: Stuart A. Wilson

Q-31. Reference IRP Vol. 1, p. 5-42, Table 5-18. Confirm that the significant drop in summer and winter reserve margins in 2028 across all three scenarios is due to the scheduled retirements of Brown 3 and Mill Creek 2.

A-31. The noted drop in summer and winter reserve margins in 2028 across all three scenarios is due to the assumed retirements of Brown 3 and Mill Creek 2. See Table 14 and Table 15 of the Long-Term Resource Planning Analysis in Volume III for a more granular summary of assumed coal retirements.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 32

Responding Witness: David S. Sinclair

Q-32. Reference IRP Vol. 1, p. 5-42. Regarding the: (i) 125 MW Green Tariff Option # 3 that will exclusively serve five customers; (ii) the additional 160 MW Green Tariff # 3 solar PPA scheduled to come on-line in 2025; and (iii) the 100 MW Rhudes Creek Solar PPA scheduled to come on-line in 2023, explain:

a. what source of back-up power the customers participating in those tariff purchases will be relying on in order to deal with the intermittency of the solar generation;

b. whether the back-up source of power will have cost implications for the Companies' general customer base (in other words, will the general customer base in any manner be subsidizing the costs of obtaining that back-up power); and

c. what implications the back-up power sources will have for reliability and reserve margin analysis.

A-32.

a. The Companies' electric power system will continue to meet the Green Tariff Option #3 customers' around-the-clock power requirements. Note that, as required by the Commission's orders in Case No. 2020-00016, the Companies' tariffs do not permit Green Tariff Option #3 customers to offset demand or demand charges via renewable energy purchases under an Option #3 Renewable Power Agreement. Therefore, Green Tariff Option #3 customers pay full demand charges, and any tariff demand provisions apply to them, as though they did not have Renewable Power Agreements.

b. See the response to part (a). Also, as stated in the 2021 IRP Vol. 1, p. 5-42 through 5-43, the Companies developed least-cost resource plans which reflect the projected impact of the Green Tariff #3 PPAs, the current generation fleet, unit retirements, and expansion units. Specifically with respect to capacity, the Green Tariff #3 PPAs contribute capacity to the Summer Reserve Margin as detailed in the 2021 IRP Vol.3 Reserve Margin Analysis Table 2 and associated discussion.

c. See the responses to parts (a) and (b).

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 33

Responding Witness: Stuart A. Wilson

Q-33. Reference IRP Vol. 1, p. 5-43, in particular Table 5-19. Confirm that at least one reason why Simple Cycle Combustion Turbines (SCCT) are more cost competitive over NGCC with CCS is the assumption that CCS would not be utilized with SCCT, and would be utilized with NGCC. Explain how the results of the Companies' analysis would change if:

a. there was no CCS requirement associated with NGCC; and/or

b. gas prices continue to escalate during the two time frames depicted (2026-2030; and 2031-2036).

A-33. The Companies did not perform this analysis. The Companies confirm that NGCC without CCS has a lower initial capital cost than NGCC with CCS and would consider NGCC without CCS a plausible technology option under certain circumstances.

a. See the response above.

b. The Companies used three natural gas price forecasts – low, base, and high – in the Long-Term Resource Planning Analysis, all of which escalate over time. These price forecasts are shown in Table 10 of Volume III, Long-Term Resource Planning Analysis.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 34

Responding Witness: Stuart A. Wilson

Q-34. Reference IRP Vol. 1, p. 6-3. Explain whether any of the projected decline in industrial load is due to combined heat and power (CHP) facilities. If so, have any industrial customers planning to construct CHP facilities expressed willingness to sell that power production to the Companies?

A-34. No CHP facilities were specifically factored into the forecast.

LOUISVILLE GAS AND ELECTRIC COMPANY
KENTUCKY UTILITIES COMPANY

Response to Attorney General's First Request for Information
Dated January 21, 2022

Case No. 2021-00393

Question No. 35

Responding Witness: Stuart A. Wilson

Q-35. Reference IRP Vol. 1, p. 8-1, Table 8-1. Confirm that the reason for the increase in the reserve margin from 29.3% to 44.9% from the period 2028-2036 is due to the increased adoption of renewables, and the intermittency associated with renewables.

a. Provide all rate impact analyses the Companies may have conducted illustrating the effect that the increased adoption of the new resources depicted in Table 8-1 will have on customers, including impact on elasticities of demand.

b. Referring to p. IRP Vol. 1, p. 9-1, confirm that per kWh costs are projected to increase by 54.8% over the IRP planning period 2022-2036. Provide a discussion and any relevant statistics to illustrate how these projected increases will compare to other regional utilities (i.e., in the PJM and MISO regions) over the same time frames.

A-35. Partially confirmed. The increase in summer reserve margin is due to increased adoption of renewables, but not to account for any expected intermittency associated with renewables. The summer reserve margin increases because solar generation provides no contribution to winter reserve margin, and the Companies must add other forms of capacity to meet winter reserve margin requirements. See IRP Vol. 1, p. 8-2, Table 8-2, which shows that winter reserve margins are not growing over this same timeframe.

a. The Companies have not performed this analysis.

b. In Table 9-1, the cents per kWh cost in 2036 is 54.8% higher than the cents per kWh cost in 2022. However, the costs per kWh in Table 9-1 represent only a subset of total rates. The Companies are not forecasting total rates to increase by 54.8% over this period. The costs presented include costs of fuel, variable O&M, emissions costs, and fixed O&M for new and existing units, stay-open and overhaul costs for existing units, and capital or PPA costs for installation of new resources. The Companies have not performed an analysis to compare their projected costs from the 2021 IRP to other utilities' projected costs.