

COMMONWEALTH OF KENTUCKY
BEFORE THE PUBLIC SERVICE COMMISSION

ELECTRONIC APPLICATION OF LOUISVILLE GAS)
AND ELECTRIC COMPANY AND KENTUCKY) Case No.
UTILITIES COMPANY FOR THE 2021 JOINT) 2021-00393
INTEGRATED RESOURCE PLAN)

ATTORNEY GENERAL’S INITIAL DATA REQUESTS

The intervenor, the Attorney General of the Commonwealth of Kentucky, through his Office of Rate Intervention [“OAG”], hereby submits the following Initial Data Requests to Louisville Gas & Electric Co. [“LG&E”] and Kentucky Utilities Co. [“KU”] [hereinafter jointly referenced as “LG&E-KU” or “the Companies”] to be answered by the date specified in the Commission’s Orders of Procedure, and in accord with the following:

- (1) In each case where a request seeks data provided in response to a staff request, reference to the appropriate request item will be deemed a satisfactory response.
- (2) Identify the witness who will be prepared to answer questions concerning each request.
- (3) Repeat the question to which each response is intended to refer. The OAG can provide counsel for LG&E-KU with an electronic version of these questions in native format, upon request.
- (4) These requests shall be deemed continuing so as to require further and supplemental responses if the Companies receive or generate additional information within the scope of these requests between the time of the response and the time of any hearing conducted hereon.
- (5) Each response shall be answered under oath or, for representatives of a public or private corporation or a partnership or association, be accompanied by a signed certification of the preparer or person supervising the preparation of the response on behalf of the entity

that the response is true and accurate to the best of that person's knowledge, information, and belief formed after a reasonable inquiry.

(6) If you believe any request appears confusing, request clarification directly from Counsel for OAG.

(7) To the extent that the specific document, workpaper or information as requested does not exist, but a similar document, workpaper or information does exist, provide the similar document, workpaper, or information.

(8) To the extent that any request may be answered by way of a computer printout, identify each variable contained in the printout which would not be self-evident to a person not familiar with the printout.

(9) If the Companies have objections to any request on the grounds that the requested information is proprietary in nature, or for any other reason, notify OAG as soon as possible.

(10) As used herein, the words "document" or "documents" are to be construed broadly and shall mean the original of the same (and all non-identical copies or drafts thereof) and if the original is not available, the best copy available. These terms shall include all information recorded in any written, graphic or other tangible form and shall include, without limiting the generality of the foregoing, all reports; memoranda; books or notebooks; written or recorded statements, interviews, affidavits and depositions; all letters or correspondence; telegrams, cables and telex messages; contracts, leases, insurance policies or other agreements; warnings and caution/hazard notices or labels; mechanical and electronic recordings and all information so stored, or transcripts of such recordings; calendars, appointment books, schedules, agendas and diary entries; notes or memoranda of conversations (telephonic or otherwise), meetings or conferences; legal pleadings and transcripts of legal proceedings;

maps, models, charts, diagrams, graphs and other demonstrative materials; financial statements, annual reports, balance sheets and other accounting records; quotations or offers; bulletins, newsletters, pamphlets, brochures and all other similar publications; summaries or compilations of data; deeds, titles, or other instruments of ownership; blueprints and specifications; manuals, guidelines, regulations, procedures, policies and instructional materials of any type; photographs or pictures, film, microfilm and microfiche; videotapes; articles; announcements and notices of any type; surveys, studies, evaluations, tests and all research and development (R&D) materials; newspaper clippings and press releases; time cards, employee schedules or rosters, and other payroll records; cancelled checks, invoices, bills and receipts; and writings of any kind and all other tangible things upon which any handwriting, typing, printing, drawings, representations, graphic matter, magnetic or electrical impulses, or other forms of communication are recorded or produced, including audio and video recordings, computer stored information (whether or not in printout form), computer-readable media or other electronically maintained or transmitted information regardless of the media or format in which they are stored, and all other rough drafts, revised drafts (including all handwritten notes or other marks on the same) and copies of documents as hereinbefore defined by whatever means made.

(11) For any document withheld on the basis of privilege, state the following: date; author; addressee; indicated or blind copies; all persons to whom distributed, shown, or explained; and, the nature and legal basis for the privilege asserted.

(12) In the event any document called for has been destroyed or transferred beyond the control of the Companies, state: the identity of the person by whom it was destroyed or transferred, and the person authorizing the destruction or transfer; the time, place, and

method of destruction or transfer; and, the reason(s) for its destruction or transfer. If destroyed or disposed of by operation of a retention policy, state the retention policy.

(13) Provide written responses, together with any and all exhibits pertaining thereto, in one or more bound electronic volumes, separately indexed and tabbed by each response, in compliance with Kentucky Public Service Commission Regulations and Orders.

(14) “And” and “or” should be considered to be both conjunctive and disjunctive, unless specifically stated otherwise.

(15) “Each” and “any” should be considered to be both singular and plural, unless specifically stated otherwise.

Respectfully submitted,

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Certificate of Service

Pursuant to the Commission's Orders in Case No. 2020-00085, and in accord with all other applicable law, Counsel certifies that an electronic copy of the forgoing was served and filed by e-mail to the parties of record.

This 21st day of January, 2022



Assistant Attorney General

Electronic Application of Louisville Gas & Electric Company and Kentucky
Utilities Company for the 2021 Joint Integrated Resource Plan
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Attorney General's Initial Data Requests

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.
 - (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.
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.
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.

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

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- 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.
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").
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.
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.
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.
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).

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

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- 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.
9. Reference IRP Vol. 1, Table 5-2, p. 5-7. Explain whether the Zorn unit has been retired.
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."
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.
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 CO₂-emitting units will retire at the end of their respective book depreciation lives.
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.

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- a. Provide the amount of the projected new load, if known, or if it is only estimated at this point.
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.
15. Explain whether the IRP provides any quantifications for any potential increases in CO₂ 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.
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.

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?
18. Provide a discussion of the extent to which distributed generation would assist the Companies in meeting their winter-time peaks.
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).³
 - b. Confirm that for capacity planning purposes, PJM ascribes wind resources a capacity credit of only 12.3% of nameplate.⁴
 - 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.
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

³ 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).

⁴ "Effective Load Carrying Capability Analysis for Wind and Solar Resources," PJM Interconnect, Feb. 7, 2019.

- 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.

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- 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.
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.
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.
23. Provide the Companies' projected costs to operate, maintain and decommission a solar project, including recycling costs.
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,⁵ some PV modules are not classified as hazardous waste, but some modules

⁵ See especially slide nos. 18-20, at: https://www.solarpowerinternational.com/wp-content/uploads/2016/09/N253_9-14-1530.pdf (Last accessed Jan. 21, 2022).

contain hazardous materials; in fact, the study concluded in part that “Module disposal is potentially a major issue.”⁶

- 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:⁷
- “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.”
 - “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:⁸

“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.”

⁶ *Id.* at slide 20.

⁷ <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).

⁸ <https://hbr.org/2021/06/the-dark-side-of-solar-power> (Last accessed Jan. 21, 2022).

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?

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.⁹
- 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.

⁹ 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).

- f. Explain also whether the Companies' price analyses pertaining to solar generation (whether company-owned or third-party owned) included cadmium telluride solar technology (sometimes referred to as "thin film" solar cells) within its analyses, as an alternative to MGS.
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.
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.
29. Reference the article¹⁰ 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."

¹⁰ 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).

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

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- 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).
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?
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.