

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 SUPPLEMENTAL DATA REQUESTS

The intervenor, the Attorney General of the Commonwealth of Kentucky, through his Office of Rate Intervention [“OAG”], hereby submits the following Supplemental 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) Definitions:

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

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

c. “LSE” means Load Serving Entity.

d. “NGCC” means Natural Gas Combined Cycle.

e. “SCCT” means Simple Cycle Combustion Turbine.

f. “CCS” means Carbon Capture and Sequestration.

g. “RTO” means Regional Transmission Organization.

h. “EV” means Electric Vehicle.

i. “SEEM” means Southeast Energy Exchange Market.

j. “PPA” means Purchased Power Agreement.

k. “NREL” means National Renewable Energy Laboratory.

l. “LCOE” means Levelized Cost of Energy.

Respectfully submitted,

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ATTORNEY GENERAL



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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 4th day of March, 2022



Assistant Attorney General

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1. Given that the Companies expect to become winter-peaking utilities in the near future, provide a discussion regarding the impact of the following issues on the Companies' IRP process:
 - a. the presence, or absence of any winter-time distributed energy resources (including any behind-the-meter resources);
 - b. any increased adoption of EVs;
 - c. capacity factor ratings, and projected dispatch rates of the Companies:' (i) fossil fuel plants; and (ii) renewable energy plants (including renewable energy procured via PPAs, and customers' exercising of Green Tariff Option # 3);
 - d. what potential, if any, there may be for enhancing summertime off-system sales into RTOs such as PJM in which most LSEs are summer-peaking;
 - e. what potential, if any, there may be for purchasing energy during wintertime peaks through the SEEM. Include in your response whether each SEEM member is a winter or summer peaking utility.

2. Reference the 2021 IRP Vol. III, 2021 RTO Membership Analysis.
 - a. Explain whether the impact of the Companies becoming winter-peaking utilities in any manner affects the conclusions of the 2021 RTO Membership Analysis, and if so, how.
 - b. Referring in particular to pp. 5-6, explain the factors and "combination of assumptions" upon which the Companies relied for the high-favorability case as reflected in the green bars in Figures 1 and 2.
 - c. Referring to Table 2 on p. 7: (i) explain whether the row depicting Energy Market Benefits takes into consideration any additional benefits the Companies may realize through participating in the SEEM; and (ii) explain the degree of certainty the Companies have with the row depicting the elimination of depancaking.
 - d. Referring to p. 7, discuss: (i) whether the Companies anticipate that prices for financial hedge products through the planning period will increase or decrease; and (ii) whether the Companies' analysis included the potential for joint purchase / construction of generation resources with other utilities / LSEs, and if not, why not.
 - e. Explain whether the procurement of energy for purposes of meeting customer demand via exercises of Green Tariff Option # 3 was modelled in the RTO membership analysis; in other words, whether procuring the power to meet a Green Tariff Option # 3 demand would be more cost effective if the Companies were to become members of an RTO, and if so, how that in turn affects the overall analysis of whether RTO membership is cost-effective.
 - f. Referring also to the 2021 IRP Vol. III, Resource Screening Analysis, § 2.1.3 "Energy Storage," discuss whether the addition of battery storage could affect the cost-effectiveness of the decision of whether to join an RTO, and if so: (i)

how; and (ii) what level of battery storage adoption begins to affect this decision.

3. Provide a discussion regarding how the failure of the U.S. to secure a stable supply chain independent of China for the minerals involved in the production of EV batteries could affect the planning set forth in the current IRP regarding the penetration and adoption of EVs in the Commonwealth.
4. Reference the article, "*Overwhelmed by Solar Projects, the Nation's Largest Grid Operator Seeks a Two-Year Pause on Approvals*," accessible at the link in the footnote below.¹ Provide a discussion regarding the impact that PJM's recent decision to impose a two-year delay on approving pending interconnection requests will have on the Companies' plans to procure more solar PV generation, whether through PPAs, Green Tariff Option # 3, or self-built facilities. Include in your discussion, at a minimum, the following:
 - a. What weight, if any, the Companies give to new solar generation projects having a PJM or MISO interconnection whether for PPAs, Green Tariff Option # 3, or self-built facilities, and how such an interconnection contributes to the project's cost-effectiveness.
 - b. Confirm that according to the article, PJM is cautioning that interconnection requests not yet filed may take even longer than the 2-year wait being imposed on projects that have already been filed.
 - c. Explain whether any delays in obtaining the requisite PJM interconnection approvals would cause the Companies to examine alternative sources.
5. Reference the 2021 IRP Vol. III, Resource Screening Analysis, Executive Summary, p. 3.
 - a. Provide a foundational source for the statement that "Based on the Biden administration's energy policy and the national focus on moving to clean energy, the current environment does not support the installation of NGCC without CCS due to its CO₂ emissions."
 - b. If the Companies are aware of a successful, operational CCS project anywhere in the world, please provide the name, location and all available operational statistics establishing its cost viability.

¹ https://insideclimatenews.org/news/02022022/pjm-solar-backlog-eastern-power-grid/?utm_source=Energy+News+Network+daily+email+digests&utm_campaign=61787f76f4-EMAIL_CAMPAIGN_2020_05_11_11_46_COPY_01&utm_medium=email&utm_term=0_724b1f01f5-61787f76f4-89280531 (last accessed February 2, 2022).

- c. If the Companies are unable to provide an example in response to subpart b., above, please confirm this means that tying CCS to NGCC effectively eliminates NGCC as a viable resource option.
6. Reference the 2021 IRP Vol. III, Resource Screening Analysis, Executive Summary, p. 3. Confirm that the “battery storage” identified as a resource in Table 1 assumes the batteries would be composed of rare earth lithium-ion, and other rare earths such as nickel and cobalt.
 - a. Based on the article accessible at the footnote below,² confirm that due to demand outstripping supply, prices for lithium-ion batteries are forecasted to skyrocket.
 - b. Explain whether the Companies’ capital cost (which apparently is based on NREL’s 2021 Annual Technology Baseline) calculations took into consideration this forecast for skyrocketing lithium-ion prices.
7. Reference the 2021 IRP Vol. III, 2021 RTO Membership Analysis generally. Discuss how EV penetration will or could affect the decision on whether to remain a stand-alone combined utility, or to join an RTO.
8. Discuss whether the Companies believe that as more of its fossil fuel plants are retired in the near future and replaced by a growing amount of renewable resources, the Companies may have to consider utilizing grid-forming technologies. Include in your discussion: (i) any cost implications; and (ii) whether this potential need increases if the Companies remain as stand-alone utilities.
9. Reference the 2021 IRP Vol. III, 2021 IRP Resource Screening Analysis, p. 4.
 - a. Confirm that compared with the Companies’ 2018 IRP analysis, capital costs for a 2022 installation of wind and battery technologies has decreased, while capital costs for solar generation have increased; however, capital costs for all three technologies are lower by the end of the current IRP planning period than they were in the 2018 IRP.
 - (i) Regarding battery technology capital costs, explain the effect that heavy demand from competing sources for lithium ion and other rare earth metals (and, as discussed more fully in the article regarding rising battery prices accessible at the link in the footnote below) will have.

² <https://www.wsj.com/articles/rising-battery-prices-add-uncertainty-to-electric-vehicle-costs-11644062402>
(last accessed Feb. 25, 2022).

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- b. Confirm that with the exception of wind resources, fixed O&M costs have increased significantly since the 2018 IRP for all evaluated technologies. If confirmed, explain whether the Companies have any way to determine whether supply chain shortages play any role in the fixed O&M cost escalation.
10. Reference the 2021 IRP Vol. III, 2021 IRP Resource Screening Analysis, § 2.2.1, "Solar," p. 10. Regarding NREL's 2021 ATB projection for increased fixed O&M costs for utility-scale solar, describe the cost elements that constitute fixed O&M.
11. Reference the 2021 IRP Vol. III, 2021 IRP Resource Screening Analysis, § 2.2.2, "Wind," p. 10. Confirm that both the Indiana-based, and the Kentucky-based wind options have higher LCOEs than utility-scale solar.
 - a. Given that the Kentucky-based wind option had a 27-31% capacity factor while the Indiana-based wind option had a capacity factor of 39-44%, explain if the reason why the Kentucky-based option has a lower LCOE than the Indiana wind option is because no transmission cost was factored into the Kentucky-based option.
 - b. Explain whether a Kentucky-based wind resource could be sited in a location without access to transmission which the Companies own.
12. Reference the 2021 IRP Vol. III, 2021 IRP Reserve Margin Analysis, Generation Planning & Analysis generally.
 - a. Explain and discuss whether the analysis forecasted the potential for future off-system sales. If so, explain whether off-system sales in any manner off-set potential costs with maintaining the Companies' projected reserve margin needs through the IRP planning period. Include in your discussion any potential barriers to enhancing off-system sales.
 - b. Confirm that under this analysis, the Companies' target reserve margin range during winter is 26% - 35%.
 - c. Confirm that given the intermittent availability of renewable resources during winter months, batteries would not be a cost-effective resource to meet winter peaks.
13. Reference the 2021 IRP Vol. III, 2021 IRP Reserve Margin Analysis, Generation Planning & Analysis at pp. 26-27. Confirm that the Companies' careful evaluation of the moment-to-moment availability of the Rhudes Creek Solar Facility will play a key role in any further decisions regarding the Companies' generation portfolio, and winter and summer target reserve margin rates.
14. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis, "Table 3: New Generation in Least-Cost Resource Plans." Confirm that:

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- a. for the period 2026-2030, and depending on the fuel load scenario (low, base or high), the base load scenario projects: (i) solar generation in quantities ranging from 300 MW – 1 GW; (ii) zero batteries; (iii) zero wind; (iv) two SCCTs (each having approximately 220 MW summer capacity).
 - b. for the period 2031-2036, and depending on the fuel load scenario (low, base or high), the base load scenario projects: (i) solar generation in quantities ranging from 0 MW – 2.4 GW; (ii) batteries in quantities ranging from zero to 1.1 GW; (iii) wind in quantities ranging from zero to 300 MW; (iv) between 0 – 5 SCCTs (each having approximately 220 MW summer capacity).
15. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis generally. Provide the parameters for determining whether a fuel price is considered to fall within the low, base or high fuel scenario price. Include in your response an explanation of whether gas prices prevailing at the current time would be considered to fall within the low, base or high fuel scenario price.
16. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis, “Table 7: Assumed Unit Retirement Dates.” For each unit depicted therein, provide the amount of any projected stranded cost arising from the retirement of that unit.
17. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis, “Table 17: New Generation in Least-Cost Resource Plans, Base Load Scenario.” Confirm that under this scenario:
- a. in 2028 the Companies are likely to submit CPCN applications for: (i) two SCCTs; and (ii) solar generation in quantities ranging from 300 MW to 1 GW, depending on the fuel price scenario.
 - b. between 2034-2036, the Companies are projected to submit CPCN applications for various types of generation in quantities ranging from 1.1 GW to as much as 3.8 GW, depending on the fuel price scenario.
 - c. the generation in the 2034-2036 timeframe is cumulative and in addition to the generation forecasted for 2028.
18. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis, “Table 18: New Generation in Least-Cost Resource Plans, High Load Scenario.” Confirm that under this scenario, the total quantities of new generation the Companies forecast by 2036 ranges from 4.8 GW to as much as 9 GW, depending on the fuel price scenario.
19. Reference the 2021 IRP Vol. III, 2021 IRP Long-Term Resource Planning Analysis, “Table 19: New Generation in Least-Cost Resource Plans, Low Load Scenario.” Confirm that under this scenario, the total quantities of new generation the Companies

forecast by 2036 ranges from 1.1 GW to as much as 3.8 GW, depending on the fuel price scenario.

20. Explain whether the Companies agree with the following hypothetical scenario, based on the assumption that the Companies procure or build 1,000 MW of solar generation:
- a. That solar generation would be available 8 hours of every day (assuming no clouds or other unavoidable curtailments);
 - b. This means the Companies need 16 hours of storage, equating to 16,000 MWh of battery storage;
 - c. 2,000 MW of generating capacity is necessary to charge the batteries every day.
 - d. Therefore, in order to reliably generate 1,000 MW for 24 hours each day, the total resources required would be: 3,000 MW of solar generating capacity and 16,000 MWh of storage capacity.
 - e. Provide cost estimates for this scenario; provide also a cost estimate for procuring this resource via dispatchable resources.
21. Assuming the same hypothetical scenario involving the procurement of 1,000 MW of solar generation as discussed in the preceding question, discuss and explain whether the Companies agree with the following:
- a. Utility planning for wind and solar generation must include planning for minimum supply;
 - b. Prudent planning for the meteorological conditions experienced in the Companies' service territories would dictate assumptions for at least 5 consecutive dark cloudy days.
 - c. Providing a fully reliable 1,000 MW for 24 hours every day during those 5 days of dark cloudy skies means that 120,000 MWh of storage is required.
 - d. If the Companies under this hypothetical scenario procured 16 hours of storage for evening usage, as discussed in the preceding question, this means an additional 104 hours of storage would have to be procured in order to meet the risk of cloudy days common in this region of the nation.
 - e. Assuming two sunny days are available to provide the charging time to yield 120,000 MWh, this would require 7,500 MW of generating capacity, which would be in addition to the 3,000 MW of generation capacity necessary to provide the 16,000 MWh of stored energy to meet reliability during the hours when sunlight is unavailable.
 - f. Therefore, 10,500 MW of capacity would be necessary to insure that 1,000 MW of renewable power is available around the clock.

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22. Explain whether the Companies' storage assumptions are based on operating batteries between 20% to 80%, and not on charging 100% and then draining the battery to zero. If agreed, then explain whether the Companies agree that this reduces available storage to 60% of nameplate capacity, which in turn means the "dark days" 120,000 MWh figure used in the preceding question should not actually be 200,000 MWh.
23. Provide cost estimates for battery resources identified in each scenario of the instant IRP docket.
24. Provide a discussion regarding the degree with which it will be necessary for the Companies to have stand-by sources of power online and ready to "kick-in" when renewable sources of generation, due to their inherent intermittency, become unavailable. Include in your discussion: (i) the types of resources -- technological, human, and monetary -- required to maintain reliability when a growing amount of the total fleet is based on renewable resources; and (ii) how the Companies' participation in SEEM may assist the Companies in their ability to manage the coordination necessary between renewable and dispatchable resources.
25. Provide all cost projections the Companies have prepared of the additional O&M costs that will or may be incurred at the Companies' dispatchable resource plants as additional non-dispatchable resources are brought online in the later part of the IRP planning period, resulting from the dispatchable plants having to be throttled-back in order to make greater use of the non-dispatchable resources. Include in your response any additional stranded costs projected to occur from earlier retirements of dispatchable resources as a result of the increased usage of non-dispatchable resources.
26. Reference the response to AG-DR-1-23. Explain whether shareholders, or ratepayers would pay the costs for decommissioning and/or recycling of a self-built solar facility.
 - a. Provide all estimates the Companies have prepared for costs of decommissioning the Brown Solar Facility, and state whether such costs are imbedded to any extent in current rates.