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**From:** Matthew Miller <[matthew.miller@sierraclub.org](mailto:matthew.miller@sierraclub.org)>

**Sent:** Wednesday, September 9, 2020 2:03 PM

**To:** Chandler, Kent (PSC) <[Kent.Chandler@ky.gov](mailto:Kent.Chandler@ky.gov)>; Nguyen, Quang D (PSC) <[QuangD.Nguyen@ky.gov](mailto:QuangD.Nguyen@ky.gov)>; Cook, Larry (KYOAG) <[Larry.Cook@ky.gov](mailto:Larry.Cook@ky.gov)>

**Subject:** Fwd: PSC Case Nos. 2020-00060 & -00061: Public Comments of Sierra Club

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Commissioner Chandler, Quang, and Larry:

Erring on the side of flagging these public comments for you ahead of the hearing scheduled for tomorrow in these dockets, I am forwarding the public comments of Sierra Club just submitted for consideration in Case Nos. 2020-00060 and -00061. These dockets concern the applications of KU and LG&E for approval of their 2020 compliance plan for recovery by environmental surcharge in light of EPA's Effluent Limitation Guidelines (ELGs), which were finalized as revised on August 31, 2020.

As stated below in our cover email (on which counsel for the Companies were copied), analysis by Sierra Club shows an opportunity for great cost savings here--specifically, if the Companies elect to comply with the ELGs rule not by spending hundreds of millions of dollars in ELGs projects at the Ghent and Mill Creek plants, as the Companies currently propose, but rather by forgoing such costly projects at one or both plants and, by 2028, replacing either/both coal-fired plants with a more robust clean energy portfolio than the Companies have assessed to date.

Normally, Mr. Commissioner, I would not presume to write to you, but I saw that you were the signatory of the last data request in these dockets, in the capacity of PSC Executive Director. And Larry, I did not see the Attorney General as having intervened, but I wanted to copy you, on behalf of your office, given the implications of our comments for general ratepayer advocacy. I do not mean to overstep in emailing any of you here, nor do I presume that each of you necessarily has the time and prerogative to review these comments before tomorrow's hearing--though the comments are concise. But I want to give you the opportunity to do so in any event.

Please let me know if the Commission, Staff, or the Attorney General have any questions for Sierra Club; we would be pleased to follow up. (I am not able to remotely attend tomorrow's hearing, as a heads-up.)

Respectfully,



**Matthew E. Miller**  
Staff Attorney, Sierra Club  
1536 Wynkoop Street, Suite 200  
Denver, CO 80202  
303-454-3344 (email is more reliable)  
[matthew.miller@sierraclub.org](mailto:matthew.miller@sierraclub.org)

----- Forwarded message -----

From: **Matthew Miller** <[matthew.miller@sierraclub.org](mailto:matthew.miller@sierraclub.org)>  
Date: Wed, Sep 9, 2020 at 11:36 AM  
Subject: PSC Case Nos. 2020-00060 & -00061: Public Comments of Sierra Club  
To: <[psc.info@ky.gov](mailto:psc.info@ky.gov)>  
Cc: Riggs, Kendrick R. <[kendrick.riggs@skofirm.com](mailto:kendrick.riggs@skofirm.com)>, Sturgeon, Allyson <[allyson.sturgeon@lge-ku.com](mailto:allyson.sturgeon@lge-ku.com)>, Fackler, Andrea <[andrea.fackler@lge-ku.com](mailto:andrea.fackler@lge-ku.com)>

Dear Public Information Officer and counsel:

Please find attached the public comments of Sierra Club, on behalf of its many members who are ratepayers of KU and LG&E, to be considered in PSC Case Nos. 2020-00060 & -00061, concerning the respective applications of KU and LG&E for approval of their 2020 compliance plan for recovery by environmental surcharge. These comments follow EPA's August 31, 2020, finalization of revised Effluent Limitation Guidelines (ELGs), which require costly upgrades for the continued operation of many coal-fired power plants.

As discussed in the attached, Sierra Club analysis shows an opportunity for great cost savings here--specifically, if the Companies elect to comply with the ELGs rule not by spending hundreds of millions of dollars in ELGs projects at the Ghent and Mill Creek plants, as the Companies currently propose, but rather by forgoing such costly projects at one or both plants and, by 2028, replacing either/both coal-fired plants with a more robust clean energy portfolio than the Companies have assessed to date.

Sierra Club thanks the Commission as well as the Companies in advance for considering these comments. We enthusiastically welcome any inquiries or discussions pertaining to this analysis or ELGs compliance options generally.

Sincerely,



**Matthew E. Miller**  
Staff Attorney, Sierra Club  
1536 Wynkoop Street, Suite 200  
Denver, CO 80202  
303-454-3344 (email is more reliable)  
[matthew.miller@sierraclub.org](mailto:matthew.miller@sierraclub.org)

**COMMONWEALTH OF KENTUCKY  
BEFORE THE PUBLIC SERVICE COMMISSION**

In the Matter of:

ELECTRONIC APPLICATION OF KENTUCKY	)	
UTILITIES COMPANY FOR APPROVAL OF ITS 2020	)	CASE NO.
COMPLIANCE PLAN FOR RECOVERY BY	)	2020-00060
ENVIRONMENTAL SURCHARGE	)	

ELECTRONIC APPLICATION OF LOUISVILLE GAS	)	
AND ELECTRIC COMPANY FOR APPROVAL OF ITS	)	CASE NO.
2020 COMPLIANCE PLAN FOR RECOVERY BY	)	2020-00061
ENVIRONMENTAL SURCHARGE	)	

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**PUBLIC COMMENTS OF SIERRA CLUB**

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On behalf its many Kentucky members who are ratepayers of Louisville Gas and Electric Company (“LG&E”) and Kentucky Utilities Company (“KU”) (jointly the “Companies”), Sierra Club hereby submits public comments on the issues in the above-captioned dockets, for the Commission’s and Companies’ consideration. (Sierra Club is contemporaneously supplying these comments to the Companies.) Sierra Club’s comments follow the recent finalization on August 31, 2020, of the effluent limitations guidelines (“ELGs”) for coal-fired power plants by the Environmental Protection Agency’s (“EPA”)—a rulemaking that was anticipated to occur this summer and that ended up changing certain compliance deadlines, *inter alia*.

The essence of Sierra Club’s comments is to urge the Companies to pause, reconsider, and ultimately redirect their plans to incur hundreds of millions of dollars in ELGs compliance costs at the Ghent and/or Mill Creek power plants—and to urge the Commission to direct the Companies to do so. Sierra Club analysis indicates that it is more economic for the Companies to replace one or both plants by 2028 with a robust clean energy portfolio—a compliance option permitted by the ELGs rule that would avoid the need to invest in the costly proposed projects.

In these dockets, the Companies are proposing to spend \$216.5 million on capital projects for ELGs compliance at Ghent; \$74.7 million at the Trimble County coal-fired plant (*i.e.*, the net for which the Companies will be responsible at this plant, in which the Companies have a 75% ownership interest); and \$113.9 million at Mill Creek.<sup>1</sup> The Companies' initial testimony (filed on March 31, 2020, on the basis of the proposed ELGs rule) and supplemental testimony (filed on September 4, 2020, in reaction to the finalized rule) collectively indicate that, by the Companies' current thinking, the prudent way for these plants to comply with the revised ELGs is to remain coal-fired and to undergo capital projects to make them environmentally compliant as soon as possible or no later than 2025.<sup>2</sup> The Companies acknowledge, but dismiss as less economic or riskier, an alternative compliance method of keeping the plants running through 2028 as coal-fired without undertaking those environmental capital projects, coupled with a pledge to cease burning coal at the units by the close of 2028.<sup>3</sup> The Companies come to this conclusion by assessing, as the options for replacing the energy and capacity of Ghent and Mill Creek, only replacement portfolios that consist of predominantly gas combined cycle and peaker plants plus relatively limited quantities of wind and solar.<sup>4</sup>

Sierra Club submits that the Companies' analysis of 2028 replacement options was too limited and should be redone to include a more robust suite of clean energy options, which Sierra

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<sup>1</sup> See, e.g., Direct Testimony of Robert M. Conroy (Mar. 31, 2020), at 4-6, *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060.

<sup>2</sup> See, e.g., Supplemental Direct Testimony of Gary H. Revlett (Sept. 4, 2020), *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060.

<sup>3</sup> See, e.g., Direct Testimony of Stuart A. Wilson (Mar. 31, 2020), at 3 & Exhibit SAW-1, *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060; see also Pre-Publication Notice, at 37, Steam Electric Reconsideration Rule, EPA-HQ-OW-2009-0819, FRL-10014-OW, available at [https://www.epa.gov/sites/production/files/2020-08/documents/steam\\_electric\\_reconsideration\\_rule\\_final\\_frm\\_08\\_31\\_2020.pdf](https://www.epa.gov/sites/production/files/2020-08/documents/steam_electric_reconsideration_rule_final_frm_08_31_2020.pdf).

Club believes will show the cost-effectiveness of retiring and replacing at least one of the coal-fired plants by 2028. In the analysis attached hereto as Exhibit A, a Sierra Club Senior Analyst shows that it would be more economic (and feasible) for the Companies to forgo investing hundreds of millions of dollars in the ELGs capital projects at Ghent and/or Mill Creek, and to replace their coal-fired units by/before the end of 2028 with a clean energy portfolio consisting of wind, solar, storage, energy efficiency, and demand response technologies. The clean energy portfolio analyzed in Exhibit A is more robust than the limited alternatives scenarios, noted above, considered by the Companies to date. By Sierra Club's calculations, a clean energy portfolio could satisfy the same energy and capacity needs as the Ghent and Mill Creek coal-fired units, at a cheaper cost, as early as 2027 and 2028, respectively. In other words, to comply with the now-final ELGs, the Companies could more cost-effectively elect not to undertake the capital projects being proposed in these dockets, at one or both of Ghent and Mill Creek. This analysis is based on conservative assumptions about the future regulatory landscape, and the paces of technological development and cost-efficiency gains of clean energy and storage.

Sierra Club implores the Companies to pause and reassess their ELGs compliance plans for Ghent and Mill Creek—and implores the Commission to instruct the Companies to do so—in light of these comments and available information. The Companies have enough time to do this: utilities now have more than a year to advise of decisions to comply with ELGs by way of committing to cease coal combustion at a plant by the end of 2028.<sup>5</sup> Moreover, in light of newly extended deadlines in the final rule issued less than two weeks ago, coal plants now have until the end of 2025, not 2023, to comply with bottom ash transport water requirements, *inter alia*.<sup>6</sup>

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<sup>4</sup> See, e.g., Exhibit SAW-1 at 21.

<sup>5</sup> Pre-publication Rule, *supra* n.3, at 253-254. Any such retirement/replacement date for coal-fired units announced under this method of ELGs compliance ought to be enforceable.

<sup>6</sup> Compare Supplemental Direct Testimony of Gary H. Revlett, *supra*, at 3 (noting 2025 deadline for both

Therefore, the urgency expressed in the Companies’ initial testimony about the timeline of its ELGs compliance plans has diminished;<sup>7</sup> there is ample time to perform the analysis suggested in Exhibit A.

There is a great opportunity here for extraordinary cost savings, not to mention long-term public health and environmental benefits, by replacing Ghent and/or Mill Creek with a clean energy portfolio by 2028. Sierra Club would be pleased to provide further information in response to any inquiry from the Companies or the Commission, or otherwise to discuss the attached analysis and ELGs compliance generally. Sierra Club thanks the Commission as well as the Companies for giving all due consideration to these comments.

\* \* \*

Sierra Club is one of the oldest and largest conservation groups in the country, with approximately 3.5 million members and supporters across its sixty-four chapters, which cover all 50 states, the District of Columbia, and Puerto Rico. More than 6,300 Kentuckians belong to Sierra Club’s Kentucky Chapter, whose address is: Sierra Club, Cumberland Chapter, PO Box 1368, Lexington, KY 40588. Sierra Club has many years of experience working on energy and electric generation issues throughout the United States, including in the Commonwealth, advocating for robust cost-effective investments in clean generation, demand response, energy storage, energy efficiency, and renewable energy—all of which produce jobs while reducing electric system costs for both customers and utilities, and reducing reliance on dirty, climate-

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“for both bottom ash transport water wastewater and flue gas desulfurization wastewater”), *with, e.g.*, Direct Testimony of Robert M. Conroy at 5 (indicating that the then-proposed rule required compliance by 2023); Direct Testimony of R. Scott Straight (Mar. 31, 2020), at 4, *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060 (discussing a schedule under which various projects would be completed by the end of 2023).

<sup>7</sup> *See, e.g.*, Direct Testimony of Gary H. Revlett (Mar. 31, 2020), at 10, *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060.

threatening generation. Many of Sierra Club's Kentucky members are residential electricity customers of KU or LG&E, and thus are directly affected by the compliance plans and associated cost recovery of which the Companies have requested for approval in these dockets.

Dated: September 9, 2020

Respectfully submitted,

/s/ Matthew E. Miller

Matthew E. Miller, Esq.

Staff Attorney

Sierra Club Environmental Law Program

1536 Wynkoop Street, Suite 200

Denver, CO 80202

Office: 303-454-3344

Email: [matthew.miller@sierraclub.org](mailto:matthew.miller@sierraclub.org)

## **Exhibit A**

# ***Analysis: Robust Clean Energy Portfolio Could Cost-Effectively Replace Ghent and Mill Creek Coal Units by 2028, Avoiding ELG Compliance Costs***

## **I. Overview**

Based on an analysis of publicly available information, Sierra Club finds that a robust clean energy and storage portfolio could provide the same energy and capacity needs as the Ghent and Mill Creek coal-fired power plants, at a cheaper cost, by 2027 and 2028, respectively. This is a compliance option under the Effluent Limitation Guidelines (ELG) that would permit LG&E and KU to avoid spending hundreds of millions of dollars at either or both of the two plants.

My findings are based on a conservative forecast of technological, economic, and legal landscapes. Various possible interceding developments—such as more stringent public health and environmental regulations, or faster-than-foreseen technological advancements—could hasten the dates at which clean energy replacement becomes more economical.

The clean energy portfolio that I assess in this analysis consists of wind, solar, storage, energy efficiency, and/or demand-response technologies. Importantly, it is a mix of resources more robust than the alternatives that LG&E and KU have considered to date as possible replacement options for the Ghent and Mill Creek plants—namely, portfolios consisting only of predominantly gas combined cycle and peaker plants plus relatively limited wind and solar.<sup>1</sup>

My analysis suggests that, from a cost-savings perspective, LG&E and KU should refrain from sinking hundreds of millions of dollars into the coal-fired plants with the aim of running them into or beyond the 2030s, as the companies are currently proposing. Rather, the companies should commit to retiring one or both plants by the close of 2028, to be replaced with a cheaper clean energy portfolio. At the least, LG&E and KU should perform updated analysis featuring a replacement scenario along the lines suggested below, based on which I believe the companies would see the opportunity for great cost savings posed a more robust clean energy portfolio.

## **II. Analysis**

In my methodology, a clean energy portfolio (CEP) is constructed to match the energy, peak capacity, and ramping characteristics of both the Ghent and Mill Creek coal-fired power plants.

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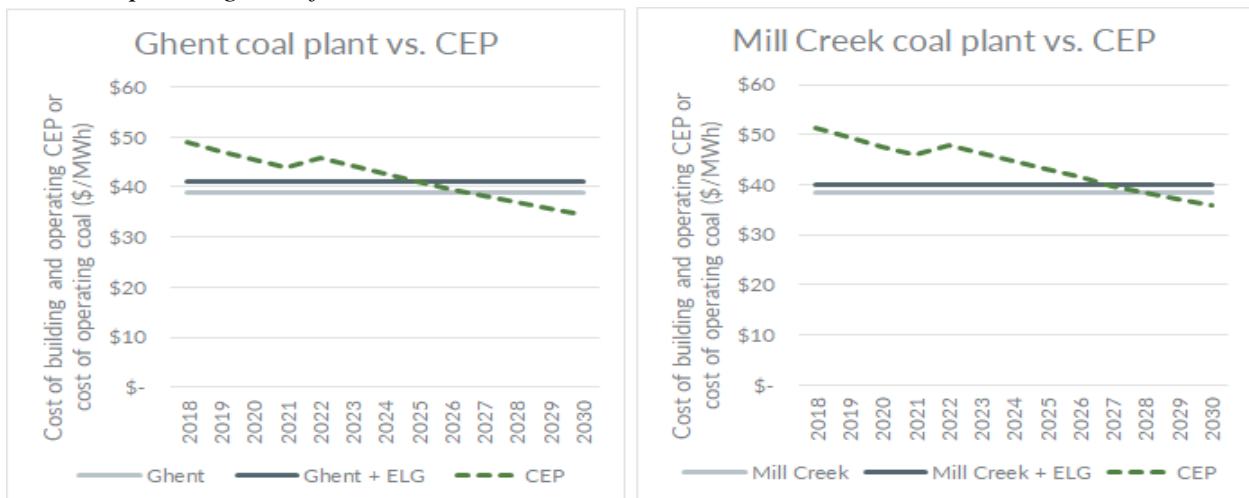
<sup>1</sup> See, e.g., Direct Testimony of Stuart A. Wilson (Mar. 31, 2020), Ex. SAW-1 at 21 (redacted), *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060.



Portfolios are optimized to satisfy these needs at the lowest cost possible. The technologies included in the model are various forms of energy efficiency and demand-response measures within residential, commercial, and industrial customer sets, as well as wind, utility-scale solar photovoltaics (PV), and battery storage. Once a CEP is modeled to match the coal plant’s performance, I compare the cost of building *and* operating that CEP to the going forward costs of operating the coal plant. When the CEP cost becomes cheaper, the coal plant is ‘stranded’ by the CEP. In an economist’s terms, this is when the *total* cost of a new solution becomes cheaper than the *marginal* cost of an existing solution. At this point, the sunk costs of the coal plant are the same in both the CEP case and the coal plant case, but going forward the only way to save customers money is to build and operate the CEP.

The results of the CEP modeling are shown below, in Figure 1 (cost comparison with coal plants) and Table 1 (technology mix of the clean energy portfolios). Currently, the cost of building a CEP is higher than the cost of operating the coal plant, largely because battery storage for these purposes is relatively high-cost at present. However, the CEP cost would be lower by the years 2027 and 2028 for Ghent and Mill Creek, respectively. Those dates each become a year earlier (2026 and 2027) if the plants move forward with ELG compliance, taking into account the companies’ projected costs for upgrading and operating ELG-compliant coal units, coupled with industry projections for storage and renewables costs—meaning that economics would militate for the replacement of the coal units by a CEP sooner rather than later even if the proposed ELG investments are approved and undertaken.<sup>2</sup> More details behind these calculations are discussed below under Sources and Methodology. In a word, these results mean that LG&E and KU should consider retiring the Mill Creek and Ghent coal-fired plants far earlier than planned, and replacing them with a fully clean energy portfolio.

*Figure 1: Cost comparison of building and operating a new clean energy portfolio vs. cost of operating coal-fired Ghent and Mill Creek units, with and without ELG controls*



<sup>2</sup> This is due in part to the operating costs posed by the coal-fired units subsequent to ELG upgrades.

A portion of a CEP is supplied by demand-side technologies that would be feasible and cheaper than constructing large new power plants, thus saving customers more money. For demand response, the technology mix selected in my model largely relied on residential and commercial water heating and space cooling as well as smaller levels of industrial demand response. For energy efficiency, the technology mix selected including commercial lighting, space cooling, space heating, residential lighting, and refrigeration. LG&E and KU can pursue higher levels of energy efficiency and demand response for their customers if they want to find the most cost-effective energy and capacity replacements for these aging coal plants.

*Table 1: Technology breakdown for clean energy portfolio to replace Ghent and Mill Creek*

	Solar	Wind	Battery Storage	Energy Efficiency	Demand Response
Ghent replacement CEP	3,936	1,274	1,889	291	693
Mill Creek replacement CEP	3,105	1,016	1,388	268	208

In 2019, the American Council for an Energy Efficient Economy (ACEEE) gave utilities in Kentucky a 1 out of 20 score (the lowest possible score) on their energy efficiency scorecard.<sup>3</sup> In their 2020 scorecard, ACEEE found that on average utilities will achieve energy efficiency savings equivalent to 1% of their annual sales.<sup>4</sup> According to EIA-861 filings, LG&E and KU together reported average annual incremental savings from energy efficiency of 83 thousand megawatt-hours (MWh) per year for the years 2013-2018.<sup>5</sup> Their total sales for those years were on average 31 million MWh/year, leading to an average energy efficiency achievement of 0.3% of sales per year. This is an incredibly low level of achievement; it means that the utilities are leaving most of the cost-effective energy efficiency potential unmet.

### III. Sources and Methodology

#### Sources

The data sources for this analysis are public, including data reported by Consumers Energy to the Energy Information Administration (EIA), Environmental Protection Agency (EPA), and Federal Energy Regulatory Commission (FERC):

<sup>3</sup> ACEEE State and Local Policy Database, Kentucky (navigate to the “Utilities” tab), available at: <https://database.aceee.org/state/kentucky>.

<sup>4</sup> 2020 Utility Energy Efficiency Scorecard (Feb. 2020), Grace Relf *et al.*, ACEEE, at p.26 table 8, available at: [https://www.aceee.org/sites/default/files/pdfs/u2004%20rev\\_0.pdf](https://www.aceee.org/sites/default/files/pdfs/u2004%20rev_0.pdf) (compilation of data in table).

<sup>5</sup> See below for EIA citations, among other sources.

- Coal prices and power plant deliveries: EIA-923, costs through 2019 reported as of February 2020, available at <https://www.eia.gov/electricity/data/eia923/>
- Coal and gas price forecasts: EIA Annual Energy Outlook 2020 Reference case, available at <https://www.eia.gov/outlooks/aeo/>
- Variable and fixed operations and maintenance: FERC Form 1 filed by KU and LG&E, 2015-2018, available at <https://www.ferc.gov/docs-filing/forms/form-1/data.asp>
- Capital expenditures: EIA Annual Energy Outlook, at 14, available at <https://www.eia.gov/outlooks/aeo/assumptions/pdf/electricity.pdf>
- ELG compliance costs: The figures publicly reported by LG&E and KU in these dockets, PSC Case Nos. 2020-00060 & 2020-00061, namely project costs at \$216.5 million for Ghent (with \$34.9 million of O&M over seven years) and \$113.9 million for Mill Creek (with \$21.5 million of O&M over six years)<sup>6</sup>
- Utility sales and energy efficiency reporting: EIA 861 Annual Electric Power Industry Reports, available at <https://www.eia.gov/electricity/data/eia861/>
- Clean Energy Portfolio algorithm: Rocky Mountain Institute, *The Growing Market for Clean Energy Portfolios*, available at <https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants/>

### Coal plant costs

In order to estimate the levelized cost of energy (LCOE) for Ghent and Mill Creek for the period 2020 to 2030, I constructed a model to project future costs. Because I assumed a constant escalation of the various costs and constant capacity factor, the LCOE (and, as a corollary, my ultimate conclusion) would be the same whether one assumes a retirement date in the late 2020s, into the 2030s, or beyond. All of the assumptions and projections are derived from publicly available information. To build the model, I created starting assumptions or built projections for the following values:

- Capacity factor: The capacity factor stays fixed for the 10-year period 67% and 66% for Mill Creek and Ghent respectively. These levels are representative of their 2018 capacity factor and fall within the plants' 5-year average capacity factor +/- 3%.
- Fuel costs: 2018 fuel costs as reported on EIA-923 for these plants were used as a starting point. From there, the costs were inflated in line with the EIA AEO 2020 reference coal price forecast for the East South Central region. I assumed a heat rate of 10,603 British thermal units (Btu) per kilowatt-hour (kWh) for Mill Creek, and 11,115 Btu/kWh for Ghent.
- Variable O&M expenses: 2018 variable O&M costs were used as a starting point and inflated by two percent per year, in line with standard inflation.

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<sup>6</sup> See, e.g., Direct Testimony of Robert M. Conroy (Mar. 31, 2020), at 4-6, *Electronic Application Of Kentucky Utilities Company For Approval Of Its 2020 Compliance Plan For Recovery By Environmental Surcharge*, PSC Case No. 2020-00060.

- Fixed O&M expenses: 2018 fixed O&M costs were used as a starting point and inflated by two percent per year, in line with standard inflation.<sup>7</sup>
- Annual capital expenses: Ongoing annual capital additions were calculated according to an equation found in EIA’s Annual Energy Outlook methodology. EIA found a generalized equation (listed below) that describes how much coal plant owners spend on capital expenditures on average per year, as a function of coal plant age and whether or not the coal plant had flue gas desulphurization (FGD).<sup>8</sup> For coal plants across the US, the range for ongoing capital expenditure (CapEx) is \$19 to \$30/kW-year. For Mill Creek and Ghent, the average ongoing CapEx is on the higher end of the range at \$28/kW-year (2017 dollars), as both of the plants have FGD and on average are 42 years old. From here, I inflate this figure by two percent per year to account for normal inflation.
- The LCOE was calculated by taking an annualized payment of the net present value of all costs (using a discount rate of eight percent) and dividing it by annual generation.

### Clean energy portfolio

Given that continuing to run the Ghent and Mill Creek coal units would pose a net cost to customers compared with the energy market, the next step in the analysis is to investigate whether they can be cost-effectively replaced with clean energy and on what timeline. For this analysis, I used the Rocky Mountain Institute’s (RMI) Clean Energy Portfolio’s algorithm from its 2019 report “The Growing Market for Clean Energy Portfolios” to identify a suite of clean energy technologies (wind, solar, storage, energy efficiency, and demand response) that could replace the services of the Ghent and Mill Creek units.

A clean energy portfolio, or CEP, is a combination of renewable energy, storage, and demand-side management (DSM) projects that meet the needs of the grid and a utility’s customers. I use the term DSM to refer collectively to energy efficiency projects, which lead to a reduction in load, and demand-response projects, which lead to the shifting or temporary reduction of load. The use of CEPs differs from traditional resource planning, which typically focuses on a specific technology. Instead, a CEP looks at how a range of available clean energy resources could contribute in each hour of the year, and finds the combination that meets the unique needs of customers at the lowest feasible cost. In this study, the CEPs are constructed to match the energy,

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<sup>7</sup> For variable O&M, the following categories of FERC reporting were included: Steam Expense, Electric Expense, Miscellaneous Power Expenses. For fixed O&M, the following categories were included: Operating Supervision and Engineering, Maintenance Supervision Expense, Maintenance of Structures, Maintenance of Boiler Plant, Maintenance of Electric Plant, Maintenance of Other Plant.

<sup>8</sup> That equation is:

$$CAPEX = 16.53 + (0.126 * age) + (5.68 * FGD)$$

where  $FGD = 1$  if a plant has an FGD,  $0$  if a plant does not have FGD

peak capacity, and ramping characteristics of each of the two coal-fired plants. Portfolios are optimized to satisfy these needs at the lowest possible cost.

The CEPs are conservatively designed to meet peak capacity needs in the top 50 hours of capacity need of the year in the LG&E and KU balancing areas, the grid region where those two utilities and their coal plants operate. Some of the 50 peak hours are in the summer, when solar output is high, and some of the hours are in the winter, when solar output is low. As such, the CEP must not rely on solar alone, but rather a complement of wind, solar, storage, and demand-side management technologies. The CEP also must meet the monthly energy requirement of the coal plant's total generation in each month of the year 2017. The CEP algorithm errs on the side of caution, in the sense that other grid resources such as existing gas plants or market purchases play no role in the replacement, whereas those resources are typically included in system dispatch or capacity expansion models that utilities utilize in portfolio analysis. In other words, the CEP algorithm accounts for a complete energy and capacity replacement of the coal plant *without the benefit of any other existing grid resources*. I assume that energy efficiency and demand response could only account for up to 25 percent of the replacement energy and capacity of replacement portfolios, respectively.

I populated RMI's model framework with storage and renewable cost assumptions from Lazard's Levelized Cost of Energy, Version 11, and Bloomberg New Energy Finance's New Energy Outlook 2018—both industry standard reports. In addition, the modeling includes the solar investment tax credit, excludes the wind production tax credit, and excludes an investment tax credit for storage, even though many storage projects qualify for that tax credit by pairing with solar. Any excess energy that renewables produced above and beyond the coal plant was valued at \$27/MWh, which was the off-peak average price in neighboring MISO in 2018.

\* \* \*

Dated: September 8, 2020

/s/ John Romankiewicz

John Romankiewicz

Senior Analyst

Sierra Club Beyond Coal Campaign