

**AUDIT OF THE LEGACY GENERATION RESOURCE
RIDER OF
DUKE ENERGY OHIO
FINAL REPORT**

PUBLIC VERSION

Prepared for

Public Utilities Commission of Ohio

By



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Audit of the Legacy Generation Resource Rider of Duke Energy Ohio: Final report

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London Economics International LLC (“LEI”) was selected by the Public Utilities Commission of Ohio to conduct an independent audit of the Legacy Generation Resource Rider (“LGR”) Rider of Duke Energy Ohio (“DEO”). The audit period covers January 1, 2020 through December 31, 2020. The Commission engaged LEI through RFP No. RA21-PPA-1.

LEI’s scope of work encompassed the following tasks:

- *providing industry context;*
- *reconciling OVEC bills and DEO riders;*
- *examining the prudence of OVEC’s disposition of energy and capacity;*
- *assessing prudence of fuel and variable costs incurred;*
- *examining prudence of capital expenses;*
- *reviewing environmental compliance activities; and*
- *reviewing power plant performance.*

LEI’s approach to the audit was to rely on information LEI requested from DEO, primarily through formal data requests. The financial information used in the audit is therefore from a reliable source. LEI also relied on publicly available data, which is used throughout this report to provide context, comparison, and benchmarks.

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Important Disclaimer Notice

Indemnity and limitation of liability

London Economics International LLC ("LEI") shall indemnify, defend, save and hold harmless the Public Utilities Commission of Ohio ("PUCO" or "the Commission"), the State of Ohio, its agents, officers and employees from any and all liabilities, claims, demands or causes of action of whatever kind or nature, including attorneys' fees and court costs arising from the performance of this Contract, to the extent these are caused by LEI's intentionally wrongful, reckless or negligent performance hereunder. If the Commission's tender of defense, based upon this indemnity provision, is rejected by LEI, and LEI is later found by a court of competent jurisdiction to have been required to indemnify the Commission, then in addition to any other remedies the Commission may have, LEI shall pay the Commission's reasonable expenses incurred in proving such indemnification, defending itself or enforcing this provision.

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LEI will only be liable in the case of gross negligence, and under no circumstances shall LEI's liability exceed the total fees actually received by LEI.

1 Executive summary and recommendations

1.1 Objective and purpose

Duke Energy Ohio ("DEO") is an investor-owned electric utility regulated by the Public Utilities Commission of Ohio ("PUCO" or "the Commission"). DEO is a Sponsoring Company of the Ohio Valley Electric Corporation ("OVEC"), meaning that DEO, under a contract known as the *Amended and Restated Inter-Company Power Agreement* ("ICPA"), is entitled to a share of OVEC's electricity generation, and must also pay that same share of OVEC's costs.¹ OVEC's generation is provided by two 60-plus year-old coal plants.

PUCO approved the establishment of a non bypassable rider, the Price Stabilization Rider ("PSR"), as part of DEO's third electric security plan in April 2015 (Case No. 14-841-EL-SSO, et al.). Although the PSR was set to zero, it was designed to allow DEO to pass the costs and benefits of its participation in the ICPA to DEO's customers. The third ESP was effective through May 31, 2018. In December 2018, as part of the resolution of DEO's fourth ESP (Case No. 17-1263-EL-SSO, et al), the PSR was extended through the term of the fourth ESP (effective through May 31, 2024) and was allowed to become operational. DEO began billing rider PSR in April 2019.

In 2019, House Bill 6 ("HB 6") defined a legacy generation resource ("LGR") in a way which encompassed the OVEC plants (RC 4928.01(A)(41)). New riders were needed to replace existing OVEC riders, starting on January 1, 2020.² DEO's Legacy Generation Resource Rider ("LGR") became effective January 1, 2020.³

The Commission engaged LEI to audit the LGR Rider for the period January 1 through December 31, 2020. The purpose of the audit is to establish the prudence of all the costs and sales flowing through the LGR Rider, and to investigate whether DEO's actions were in the best interest of its retail ratepayers.⁴

1.1.1 LEI general scope of work

LEI's scope of work covers the following items:

¹ LEI-DR-06-001 Attachment. *Amended and Re-Styled Inter-Company Power Agreement*.

² Dickinson Wright PLLC. *Ohio Enacts Sweeping Energy Legislation: HB 6 Bails Out Nuclear, Coal; Rolls Back Renewables and Energy Efficiency*. September 2019. <<https://www.dickinson-wright.com/news-alerts/ohio-enacts-sweeping-energy-legislation>>

³ DEO Tariff. LGR Rider. <https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-oh/sheet-no-128-rider-lgr-oh-e.pdf?la=en>

⁴ Public Utilities Commission of Ohio. Request for Proposal No. RA21-PPA-1. Issues January 29, 2020. P.2.

1. **Industry context:** A review of the current dynamics of the PJM wholesale markets in which OVEC operates, and the impact that changing market dynamics have on OVEC's operations and practices;
2. **OVEC bill and DEO LGR Rider reconciliation:** Examination of whether charges on the OVEC bill are accurately reflected in DEO's accounts, and also in the LGR Rider;
3. **Disposition of energy and capacity:** A review of the unit scheduling and offering of energy into PJM administered wholesale markets, offering behavior in PJM administered capacity markets, and offering behavior and/or participation in any other market that may provide revenue above and beyond that which is received in energy and capacity markets;
4. **Fuel and variable costs:** An assessment of OVEC's fuel operations and maintenance-related expenses, including comparison between incurred fuel costs and market prices to evaluate the reasonableness of fuel expenses during the audit period;
5. **Capital expense:** Examination of the prudence of OVEC's process for allocating capital and conducting capital projects, and an assessment of whether the fixed costs incurred by OVEC are properly allocated to DEO, including depreciation, debt service, and plant maintenance expenses;
6. **Environmental compliance:** A review of OVEC's environmental compliance activities. This includes, but is not limited to, the impact that compliance activities had on OVEC's fuel procurement strategy, overall emission allowance management strategy, and methods used to analyze compliance options and develop overall mitigation strategies; and
7. **Power plant performance:** A review of significant plant outages or other degradations observed in the operating availability, equivalent availability, or capacity factors of OVEC's generating plants, and an assessment of at least one of OVEC's generating stations based on a virtual site visit.

1.2 LEI's audit approach

LEI's approach to the audit was to rely on information LEI requested from DEO staff, primarily through formal data requests. LEI also used publicly available data from OVEC annual reports, and other sources of public data. The audit approach included the following steps:

- LEI issued formal data requests over the time period August 2021 through November 2021, and kept a database and numbering system which logged requests issued and responses received;
- LEI held conference calls and numerous email exchanges; and
- Owing to COVID-19 protocols in place at the OVEC plants, which prohibit non-essential personnel from visiting the plants, LEI did not conduct in-person interviews, site visits, or in-camera contract reviews. LEI conducted a single "virtual site visit" to audit the presence and use of environmental control equipment in the plants, and coal handling operations.

Another key component of LEI's audit was to compare and benchmark cost and operational results against industry data from publicly available data sources, such as the Energy Information Administration ("EIA"). This public data provided the important context for evaluating OVEC's fuel and power procurement results, as well as results of operations.

This audit report is presented in ten chapters:

- Chapter 1: Executive summary and recommendations
- Chapter 2: Introduction
- Chapter 3: Utility industry context
- Chapter 4: OVEC bill and rider reconciliation
- Chapter 5: Disposition of energy and capacity
- Chapter 6: Fuel and variable cost expenses
- Chapter 7: Capital expenses
- Chapter 8: Environmental compliance
- Chapter 9: Power plant operations
- Chapter 10: Appendix of acronyms

Chapters 4-9 are organized in the same way, beginning with a statement of the scope of the audit which applies to DEO's activities, and background information to provide context for these activities; followed by the evaluative criteria used in the audit, LEI's findings, and finally LEI's recommendations.

1.3 LEI's findings and recommendations

Overall, LEI found that the processes, procedures, and oversight were mostly adequate and consistent with good utility practice, given that the ICPA is in place and customers will be charged for the cost of the plants until at least May 2024.

LEI's analysis shows that, at this time, the OVEC plants cost customers more than the cost of energy and capacity that could be bought on the PJM wholesale markets. However, there may be other considerations, such as providing employment at the plants, or the plants' contributions to fuel diversity in the State, that outweigh the impact on ratepayers, which the Ohio legislature takes into consideration.

As detailed in this report, LEI has the following recommendations:

Components of fixed cost: The components of fixed costs were billed properly. However, one component of fixed costs, referred to as "Component (D)" in the OVEC bill, is identified by the ICPA as a payment per common share (similar to a dividend). ORC 4928.01(A)(42) requires that "*Prudently incurred costs ...must exclude any return on investment in common equity...*"⁵ Component D seems to be a such a return. Though it is not a large share of the overall OVEC bill to ratepayers, the annual [REDACTED] million per year for Component D amounted to nearly all OVEC's [REDACTED] million

⁵ PUCO. RFP No. RA21-PPA-1. Issued January 29, 2020. P.3, and <https://codes.ohio.gov/ohio-revised-code/section-4928.01> (A)(42).

of net income in 2020.⁶ OVEC's capital expenditures are not part of a rate base for which they are allowed a regulated rate of return, but Component D is itself a return to the owners of OVEC. The Commission may wish to examine this.

Disposition of energy and capacity: OVEC energy and capacity are sold into the PJM markets. OVEC typically self-schedules its units in the PJM day-ahead market (in other words, OVEC informs PJM that a unit's availability status is "must-run"). The alternative to must-run availability status for a unit which is not on outage is to offer the unit so that it may be committed by PJM (in other words, OVEC would inform PJM that the unit's availability status is "economic").⁷ Must-run units are committed by the market participant and then dispatched by PJM without regard to whether the hourly energy price is high enough to cover the unit's fuel and variable costs. LEI's analysis (based on monthly average PJM prices) shows that some of the time, the PJM energy price did not cover fuel and variable costs. LEI believes the temporary permission given by the OVEC Operating Committee (of which DEO is a member) to allow the OVEC plants to be committed either as must-run or based on economic commitment (discussed in Section 5) was prudent. That option was in place temporarily in 2020; LEI recommends that DEO and the other members of the Operating Committee allow this flexibility on an ongoing basis. Ideally, the units would be committed based on economics all or most of the time, but in the case of coal plants this can cause difficulties in managing staffing and fuel deliveries, and repeated start-up of coal plants can damage equipment. DEO's capacity offers were formulated prudently, and transparently reflect the risks and reward features of the PJM capacity construct.

Fuel and variable cost expenses: Coal inventories were much higher than target levels in 2020; part of this could be owing to inaccurate forecasting of coal burns. LEI recommends that DEO, through its role on the Operating Committee, encourage ongoing review and improvement to OVEC's coal burn forecasting methods, and coal procurement practices.

Capital expenses: The process of planning and executing individual capital projects appears to be well-managed. However, it appears there is no cap on annual capital expenses. This could lead to over-investment in the plants, as the Commission does not review and/or approve the OVEC capital expenditures.

Environmental compliance activities: Based on LEI's virtual site visit, LEI found that OVEC complied with environmental requirements during the audit period. Management of emissions allowance inventories was reasonable and prudent.

Power plant performance: The plants performed reliably in 2020, with forced outage rates generally better than PJM averages; and availability factors slightly higher than PJM averages for some units, and slightly lower availability factors for other units. However, heat rates were higher (i.e., efficiency was lower) than in 2019 owing to weaker demand and low energy prices in 2020, which resulted in plant dispatch at levels below optimal operating levels.

⁶ OVEC. *Annual Report 2020*. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

⁷ PJM Manual 11. P. 30. <<https://www.pjm.com/-/media/documents/manuals/m11.ashx>>.

In LEI's previous audit of DEO's Price Stabilization Rider, for Docket No. 20-167-EL-RDR, LEI made several recommendations.⁸ Figure 1 shows the current status of these.

Figure 1. LEI recommendations from DEO PSR audit for 2019

Topic	LEI recommendation	Status or outcome
The true up process for the PSR Rider	More recent estimates for annual sales should be used in estimating costs for the PSR Rider	No longer relevant, PSR replaced by LGR Rider with different methodology
Components of fixed costs	"Component (D)" in the OVEC bill is identified by the ICPA as a payment per common share	To be determined by Commission
Disposition of energy and capacity	LEI believes DEO's strategy of creating a process whereby OVEC re-considers its "must-run" offer strategy and utilize near-term demand and price forecasts to formulate energy offers is prudent	DEO/OVEC Operating Committee allowed economic-based commitment on a temporary basis in 2020
Fuel and variable cost expenses	Coal inventories higher than target; coal burn forecasts inaccurate	Does not appear to have been addressed
Capital expenses	No cap on annual capital expenses; LEI recommended that the Commission consider implementing such a cap	To be determined by Commission
Environmental compliance activities	No recommendation	n/a
Power plant performance	OVEC should inspect and fix the technical problems with the baffle wall at Clifty Creek Unit 6 to minimize forced outages	In 2020, reliability metrics for Clifty Creek Unit 6 were back to normal, indicating the problem had been addressed

⁸ London Economics International. *Audit of the Price Stabilization Rider of Duke Energy Ohio, Final Report*. Case No. 20-167-EL-RDR. October 15, 2020.

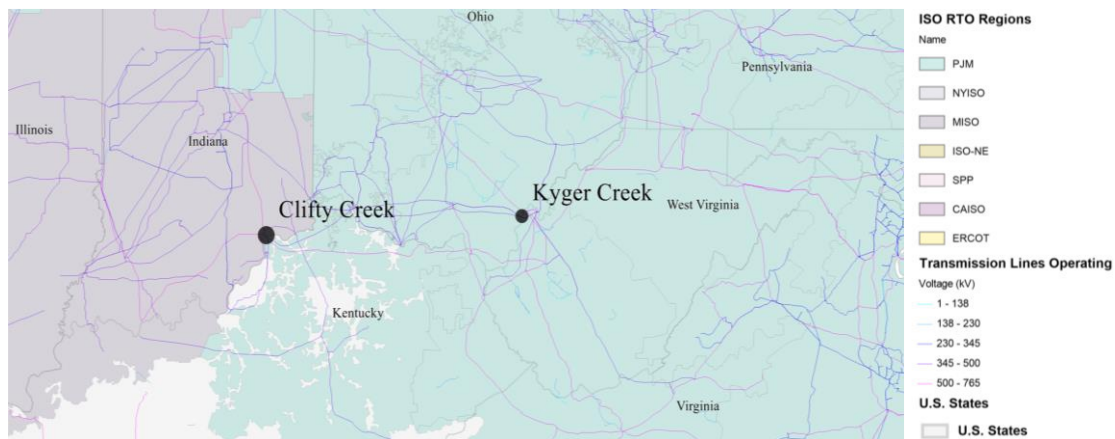
2 Introduction

2.1 Introduction to Ohio Valley Electric Corporation

Ohio Valley Electric Corporation ("OVEC") and its wholly owned subsidiary, Indiana-Kentucky Electric Corporation ("IKEC"), were established on October 1, 1952. OVEC and IKEC were established by investor-owned utilities ("IOUs") and their parent companies to serve the large electric power requirements projected for the uranium enrichment facilities under construction by the Atomic Energy Commission ("AEC") near Portsmouth, Ohio.⁹ As of 2020, OVEC is owned by various IOUs or utility holding companies and two affiliates of generation and transmission rural electric cooperatives. These entities or their affiliates comprise the Sponsoring Companies. The Sponsoring Companies purchase power from OVEC according to the terms of the Inter-Company Power Agreement ("ICPA"), which is in place until June 30, 2040.¹⁰

OVEC/IKEC owns two coal-fired power plants. OVEC's Kyger Creek Power Plant at Cheshire, Ohio, and IKEC's Clifty Creek Power Plant at Madison, Indiana, are coal plants with a nameplate generating capacity of 1,086.3 MW and 1,303.56 MW respectively.¹¹ The two generating stations began operating in 1955 and are connected by a network of 705 circuit miles of 345 kV transmission lines that also interconnect with the major power transmission network of several of the utilities in the area (see Figure 2).¹²

Figure 2. OVEC generating stations, 2021



Source: S&P Global Market Intelligence.

⁹ "Ohio Valley Electric Corporation." OVEC. October 29, 2021. <<https://www.ovec.com/OVECHistory.pdf>>

¹⁰ OVEC. *Annual Report 2020*. P. 8. <<https://www.ovec.com/FinancialStatements/2020-ConsolidatingFinancials.pdf>>

¹¹ "OVEC-IKEC." OVEC. October 29, 2021. <<http://www.ovec.com/ContinueReading.php>>

¹² Ibid.

Between 2019 and 2020, OVEC's net generation declined by 19.69% from 11,238,298 MWh to 9,025,018 MWh.¹³ During the same period, the total power cost to Sponsors declined by 5.54% from \$640.80 million to \$605.27 million.¹⁴ As a result, the average power cost (total power cost divided by net generation) increased by 17.54% from \$57.04/MWh to \$67.00/MWh. According to OVEC's 2020 annual report, "increased average power costs were directly related to reduced generation by the impact of COVID-19 on the energy demand."¹⁶

2.2 Introduction to DEO

Duke Energy Ohio ("DEO") was created through the acquisition of Cinergy in April 2006 and is one of the subsidiaries of Duke Energy. DEO is a regulated public utility engaged in the transmission of electricity in portion of Ohio and Kentucky, and distribution and sale of electricity and natural gas in portions of Ohio. DEO also conducts competitive auctions for retail electricity supply in Ohio in which recovery of the energy price is from retail customers. DEO is subject to the regulatory provisions of the Public Utilities Commission of Ohio ("PUCO"). DEO's service area covers approximately 3,000 square miles; DEO supplies electric service to approximately 880,000 residential, commercial, and industrial customers, and natural gas transmission and distribution services to approximately 545,000 customers.¹⁷

Based on the ICPA, as a Sponsoring Company, DEO is responsible for a 9% contractual share (that of the former Cincinnati Power Company) of the costs and revenues of the two OVEC plants.¹⁸ The total 9% share was billed to DEO customers in the LGR Rider for 2020.

2.3 The Inter-Company Power Agreement ("ICPA")

In the 1950s, OVEC, the AEC, and OVEC's owners or their utility company affiliates (the Sponsoring Companies) entered into power agreements to build the two coal plants to serve AEC's substantial power requirements. On October 15, 1952, a 25-year agreement was executed by OVEC and AEC. As part of this agreement, OVEC and the Sponsoring Companies later (in 1953) signed the ICPA which specified the allocation to each company of power not utilized by the Department of Energy ("DOE") or its predecessors. On September 29, 2000, the DOE informed OVEC of its cancellation of the DOE Power Agreement. On April 30, 2003, the DOE Power

¹³ OVEC. *Annual Report 2020*. P. 45. <<https://www.ovec.com/FinancialStatements/2020-ConsolidatingFinancials.pdf>>

¹⁴ Ibid.

¹⁵ Unless otherwise stated, all prices are in nominal US dollars.

¹⁶ Ibid. P. 4.

¹⁷ SEC. *Duke Energy Corporation – FORM 10K*. December 31, 2020. P. 26.

¹⁸ LEI-DR-06-001 Attachment. *Amended and Re-Stated Inter-Company Power Agreement*.

Agreement was terminated.¹⁹ Since the DOE Power Agreement termination, OVEC's entire generating capacity has been available to the Sponsoring Companies under the terms of the ICPA. The Sponsoring Companies and OVEC entered into an amended contract, the *Amended and Restated Inter-Company Power Agreement*, effective as of August 11, 2011, which is in effect until June 30, 2040.²⁰ Shares of the sponsoring companies in OVEC's power participation benefits and requirements are shown in Figure 3.

Figure 3. OVEC Sponsoring Company Power Participation Ratios ("PPRs")

Allegheny Energy Supply Company LLC ¹	3.01
Appalachian Power Company ⁶	15.69
Buckeye Power Generating, LLC ²	18.00
The Dayton Power and Light Company ³	4.90
Duke Energy Ohio, Inc. ⁴	9.00
Energy Harbor Corp	4.85
Indiana Michigan Power Company ⁶	7.85
Kentucky Utilities Company ⁵	2.50
Louisville Gas and Electric Company ⁵	5.63
Monongahela Power Company ¹	0.49
Ohio Power Company ⁶	19.93
Peninsula Generation Cooperative ⁷	6.65
Southern Indiana Gas and Electric Company ⁸	1.50
	<u>100.00</u>

Some of the Common Stock issued in the name of:

- * American Gas & Electric Company
- ** Columbus and Southern Ohio Electric Company

Subsidiary or affiliate of:

- ¹ FirstEnergy Corp.
- ² Buckeye Power, Inc.
- ³ The AES Corporation
- ⁴ Duke Energy Corporation
- ⁵ PPL Corporation
- ⁶ American Electric Power Company, Inc.
- ⁷ Wolverine Power Supply Cooperative, Inc.
- ⁸ CenterPoint Energy, Inc.

Source: OVEC. *Annual Report 2020*. P. 2. < <https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf> >

The most recent legislation authorizing cost recovery with respect to changes under the ICPA arrangement (HB 6) requires that the cost to residential customers cannot exceed \$1.50/month.²¹ HB 6 goes on to require that, with respect to OVEC (referred to as "legacy generation resource" in the following quote): *"for all other customer classes, the commission shall establish comparable monthly caps for each class at or below one thousand five hundred dollars per customer. Insofar as the prudently incurred costs related to a legacy generation resource exceed these monthly limits, the electric distribution utility shall defer the remaining prudently incurred costs as a regulatory asset or liability that*

¹⁹ OVEC. *Annual Report 2020*. P. 2. < <https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf> >

²⁰ Ibid.

²¹ The Ohio Legislature. House Bill 6. October 2019. P. 15. < <https://www.legislature.ohio.gov/legislation/legislation-summary?id=GA133-HB-6> >

*shall be recovered as determined by the commission subject to the monthly caps set forth in this division.”*²² This means that although there is a monthly cap on customer charges, there is no cap over time, and any prudently incurred costs greater than the caps can be recovered from customers in the future.

2.4 FirstEnergy Solutions bankruptcy impacted OVEC and DEO charges

A dispute starting in August 2018 which impacted OVEC cost and revenue shares came to a conclusion in 2020. The bankrupt FirstEnergy Solutions (“FES”), now Energy Harbor Corp., initially refused to pay its 4.85% power participation ration (“PPR”) share under the ICPA. A settlement of the case became effective on June 15, 2020. Per the settlement, Energy Harbor:²³

- assumed the ICPA;
- became a Sponsoring Company of OVEC, taking over FES’s 4.85% PPR;
- continued to perform its obligations under the ICPA arising on or after June 1, 2020, pursuant to the terms of the ICPA; and
- paid OVEC \$32.5 million in cash as full and final settlement of any cure amounts required to be paid in connection with the assumption of the ICPA.

In the meantime, however, as noted by OVEC “*Per the ICPA... OVEC made available to all other Sponsoring Companies FES’s entitlement to available energy under the ICPA.*”²⁴ DEO was allocated a portion of FES’s energy output and paid the associated variable costs, and received without additional cost a portion of FES’s capacity revenues as discussed in Section 4.

²² Ibid.

²³ OVEC. *Annual Report 2020*. P. 43. < <https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf> >

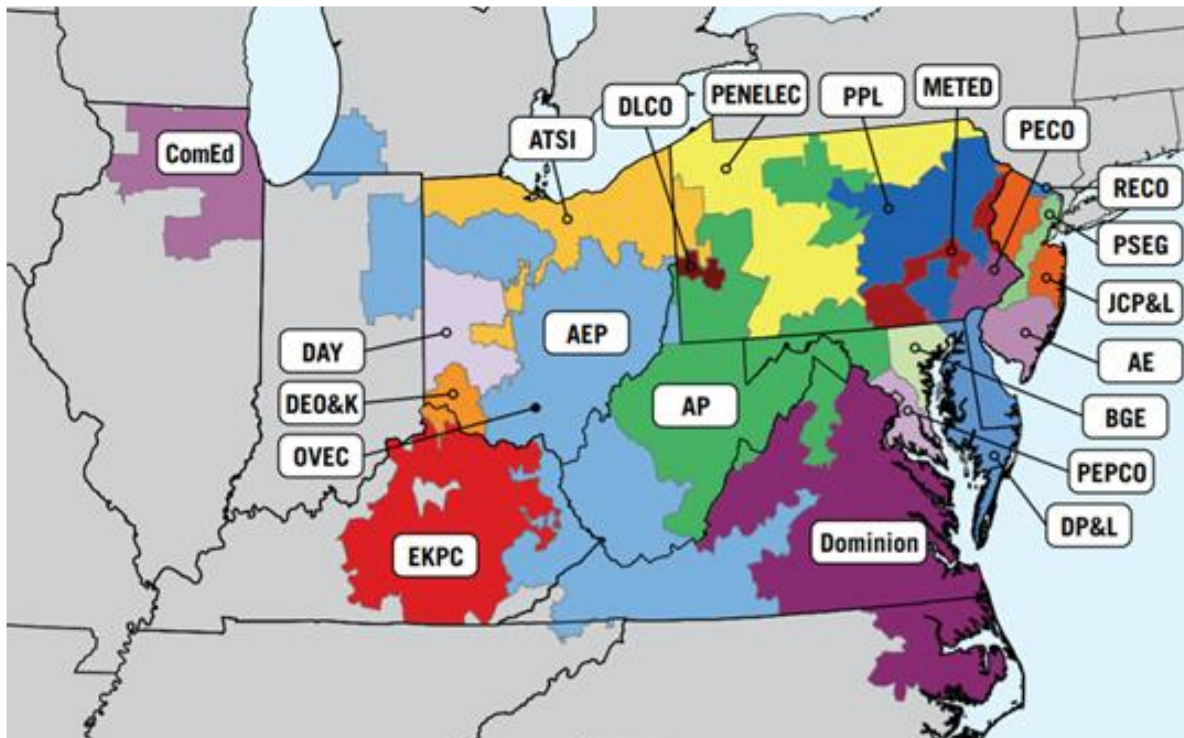
²⁴ Ibid. P. 42.

3 Industry context

To understand LEI's assessment of the prudence of the costs incurred related to DEO's LGR Rider, it is important to begin with the context of the electricity industry in the PJM Interconnection ("PJM").

DEO and the OVEC plants are located in PJM, which is a regional transmission organization ("RTO") that manages grid reliability and wholesale electricity markets for 13 states and the District of Columbia (see Figure 4).²⁵

Figure 4. PJM footprint



Source: Map of PJM territory served. <<https://www.pjm.com/-/media/about-pjm/pjm-zones.ashx>>

This chapter discusses the following:

- PJM energy and capacity markets;
- PJM ancillary services;
- PJM Minimum Offer Price Rule ("MOPR");

²⁵ PJM coordinates the movement of electricity through all or parts Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia.

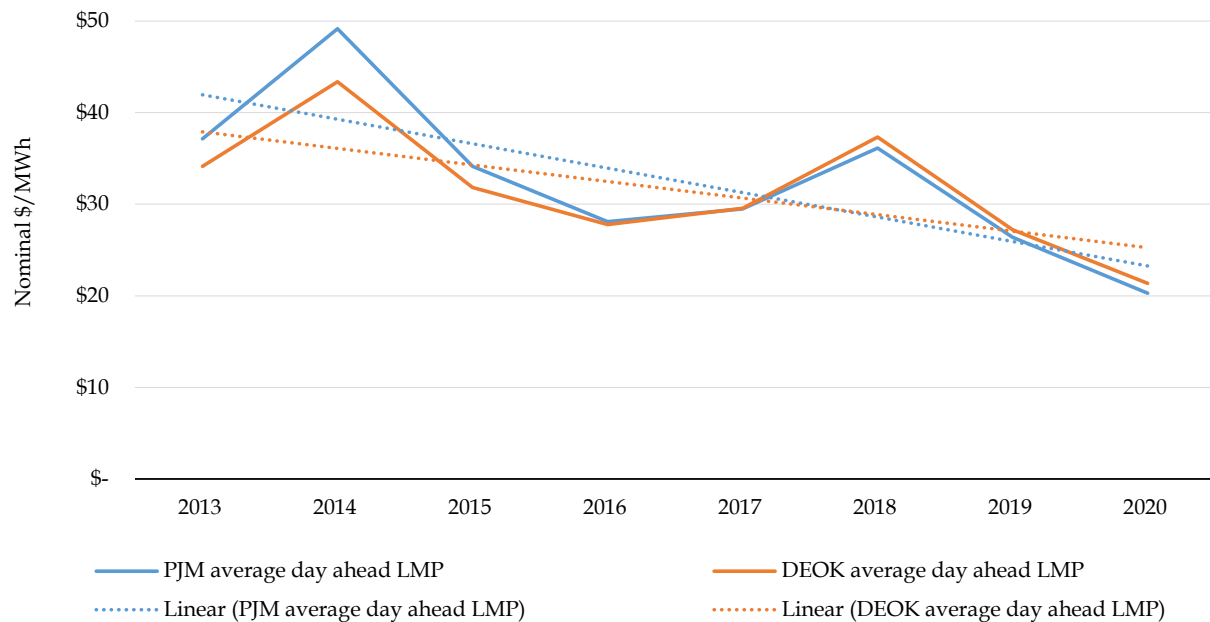
- LEI's estimated levelized cost of new entry for a combined-cycle gas turbine ("CCGT") in PJM; and
- Repeal of nuclear subsidy and introduction of solar subsidy in Ohio.

3.1 PJM energy and capacity prices

3.1.1 PJM energy prices

Wholesale electric energy prices have generally declined since 2013 in the PJM market, except for a spike in 2014 caused by extremely cold weather during the Polar Vortex and a smaller increase in 2018. Between 2013 and 2020, day-ahead energy prices decreased on average 8.3% per year across the PJM footprint and fell on average 6.5% per year in PJM's Duke Energy Ohio and Kentucky ("DEOK") zone (see Figure 5). The day-ahead energy prices in the DEOK zone averaged \$27.22/MWh in 2019 and \$21.35/MWh in 2020.

Figure 5. Annual average day-ahead energy prices (2013-2020)



Source: Day-ahead prices from PJM aggregated by S&P Global Market Intelligence.

3.1.2 PJM uplift payments

PJM provides payments for operating a unit under specific conditions as directed by PJM.²⁶ These uplift payments to units are intended to "ensure that they recover their total offered costs when market revenues are insufficient or when their dispatch instructions diverge from their dispatch

²⁶ PJM. "Drivers of uplift". <https://www.pjm.com/markets-and-operations/energy/drivers-of-uplift>

schedule.”²⁷ For example, if PJM wants to schedule a unit to operate for two hours at a given output (say, operate from 3pm – 5pm at 150 MW) the next day), but the unit requires four hours to start up, has a minimum run time of four hours, and a minimum generation level of 50 MW, then PJM would ensure that the costs of start-up and operations are reimbursed. i.e., that the unit’s costs are made whole. This applies to units which are available based on economics, but not to units which are self-scheduled, because uplift payments are “*intended to be one of the incentives to generation owners to offer their energy to the PJM energy market for dispatch based on incremental offer curves and to operate their units at the direction of PJM dispatchers.*”²⁸

3.1.3 PJM capacity prices

PJM has a capacity mechanism to support long-term reliability, conducting an annual three-year forward auction to procure the supply needed to meet predicted demand. The capacity mechanism is referred to as the Reliability Pricing Model (“RPM”). The RPM is a series of annual auctions for delivery in the future. The majority of capacity is procured in the first auction for a particular delivery year, which is known as the Base Residual Auction (“BRA”), conducted three years in advance of a given delivery year.²⁹ Capacity clearing prices in the BRA have fluctuated in recent years (see Figure 6). The 2022/2023 BRA is the third BRA for which PJM has procured only Capacity Performance (“CP”) Resources, which means that the resources are required to generate if called upon, and if they do not, they must pay substantial penalties to PJM.³⁰ On the other hand, if a resource overperforms, it can earn a bonus payment during PJM performance assessment hours (“PAH”). New entry, retirements, and changes in parameters affecting the demand curve impact capacity prices. The OVEC plants are located in the RTO capacity zone.

Figure 6. RPM base residual auction resource clearing price in PJM (\$/MW-day)

	2012/2013	2013/2014	2014/2015	2015/2016	2016/2017	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022	2022/2023
PJM	\$ 16.46	\$ 27.73	\$ 125.99	\$ 136.00	\$ 59.37	\$ 120.00	\$ 164.77	\$ 100.00	\$ 76.53	\$ 140.00	\$ 50.00
DEOK	-	-	-	-	-	-	-	-	\$ 130.00	\$ 140.00	\$ 71.69

Source: PJM. 2022/2023 RPM Base Residual Auction Results. P. 1, 6. <<https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2022-2023/2022-2023-base-residual-auction-report.ashx>>; PJM. 2021/2022 RPM Base Residual Auction Results. P. 4; PJM. 2020/2021 RPM Base Residual Auction Results. P. 1.

²⁷ Ibid.

²⁸ Monitoring Analytics. *PJM State of the Market Report 2020*. Section 4 : Energy Uplift. <https://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2020/2020-som-pjm-sec4.pdf>.

²⁹ Capacity Market/RPM FAQs. <<https://learn.pjm.com/three-priorities/buying-and-selling-energy/capacity-markets/capacity-markets-faqs.aspx>>

³⁰ PJM. 2022/2023 RPM Base Residual Auction Results. P. 26. <<https://www.pjm.com/-/media/markets-ops/rpm/rpm-auction-info/2022-2023/2022-2023-base-residual-auction-report.ashx>>

3.2 PJM ancillary services

Ancillary services help to balance the transmission system as it moves electricity from generating sources to ultimate consumers. A co-optimized solution is performed by PJM to optimize between energy and/or ancillary services supplied from a unit by using market offers for energy and operating reserves as well as physical constraints.³¹

Regulation and reserves are the two categories of ancillary services for which PJM operates a market:

- **Regulation** helps to control small mismatches between load and generation. Currently, steam (coal and natural gas), combustion turbines (natural gas, oil, methane, and biomass), hydro, storage (batteries, flywheels, and hot water heaters), and demand response participate in the PJM Regulation Market, which provides market-based compensation to those resources that can adjust output or consumption in response to an automated signal.
- **Reserves** are used to recover system balance by making up for generation deficiencies if there is loss of a large generator. There are three major categories of reserves: operating reserves, which must be available within 30 minutes; primary reserves, which must be available within 10 minutes; and synchronized reserves, which is grid-connected power that must be available within 10 minutes. All three reserves can be supplied by generators that are connected to the electric grid, and/or by demand side response. Operating reserves and primary reserves can also be supplied by offline generators.

PJM operates a market for regulation services (the Regulation Market), and for reserves (the Synchronized Reserve Market, the Non-Synchronized Reserve Market, and the Day-Ahead Scheduling Reserve Market).³²

There are other ancillary services, which are not purchased or sold through a market-based system. For example, reactive power (which helps maintain correct voltage on the transmission system and is essential to the flow of power) provided by generators is paid for by PJM based on a tariff, rather than procured through markets.³³

In its Quarterly State of the Market Report posted on August 12, 2021, PJM's independent market monitor evaluated the synchronized reserve market for the first six months of 2021 and reported that it was not competitive due to high levels of supplier concentration.³⁴ During the same period, the Day-Ahead Scheduling Reserve Market and the Non-Synchronized Reserve Market were also

³¹ LEI-DR-01-004.

³² PJM. *Learning Center - Regulation Market*. <<https://learn.pjm.com/three-priorities/buying-and-selling-energy/ancillary-services-market/regulation-market.aspx>>

³³ PJM. *Reactive Supply Compensation Overview*. February 10, 2021. <<https://www.pjm.com/-/media/committees-groups/committees/mic/2021/20210210/20210210-item-14-reactive-power-in-pjm.ashx>>.

³⁴ Monitoring Analytics. *Quarterly State of the Market Report for PJM*. August 2021. P. 20.

reported by the PJM's independent market monitor as not competitive as the markets would have failed a three pivotal supplier test in 45.8% and 87.1% of the hours respectively.³⁵ PJM's independent market monitor recommended that PJM review the design of these markets to improve competitiveness.

3.3 PJM's minimum offer price floor ("MOPR")

MOPR specifies a minimum dollar amount that a resource can offer into the capacity market. The MOPR is intended to prevent resources from offering into the market at artificially low prices, thereby limiting market power and ensuring that new resources are offered competitively into PJM's capacity markets. Historically, MOPR only applied to a limited number of new resources, such as natural gas-fired combustion turbine and combined cycle plants.

On December 19, 2019, FERC issued an Order expanding PJM's MOPR to include renewable energy resources, among other resources, benefitting from state subsidies (see text box below). The intent of expanding the MOPR was to mitigate the potential price-distorting impacts of state-subsidized resources participating in PJM's multibillion-dollar capacity market. Under the Order, all new and existing state-subsidized capacity resources would be subject to an administratively determined price floor. This ruling came as a response to a complaint filed against PJM in 2016 from a group of competitive power suppliers.³⁶

The FERC Order was met with opposition from clean energy advocates who argued that states with large renewable portfolios would have to pay twice for renewable capacity that does not clear PJM's market. Rehearing requests sought clarification of the definition of state subsidy, the scope of exemptions for existing renewables, and how the MOPR will be applied.

"State Subsidy shall include "direct or indirect payment, concession, rebate, subsidy, non-bypassable consumer charge, or other financial benefit that is a result of any action, mandated process or sponsored process of a state government, a political subdivision or agency of a state, or an electric cooperative formed pursuant to state law" and

- 1) "is derived from or connected to the procurement of (a) electricity or electric generation capacity sold at wholesale in interstate commerce, or (b) an attribute of the generation process for electricity or electric generation capacity sold at wholesale in interstate commerce; or
- 2) will support the construction, development, or operation of a new or existing capacity resource; or
- 3) could have the effect of allowing the unit to clear in any PJM capacity auction."

- PJM. "Compliance Filing Concerning the Minimum Offer Price Rule." March 18, 2020. p. 12.

³⁵ Ibid.

³⁶ FERC Docket No. EL16-49-000.

On March 18, 2020, PJM submitted its compliance filing to FERC. In this filing, PJM confirmed the price floors for various resources, and clarified exceptions to the MOPR, which included renewables in state Renewable Portfolio Standard (“RPS”) programs, demand response and energy efficiency, storage, self-supply, federal subsidies such as the Regional Greenhouse Gas Initiative (“RGGI”) as well as any resource that can demonstrate actual costs are less than the MOPR floor price.³⁷

On July 30, 2021, PJM filed an updated MOPR with FERC, intended to protect the market from buyer-side market power and from state actions that directly interfere with the auction clearing outcomes, while accommodating state public policies and self-supply models.³⁸ On September 29, 2021, FERC notified that PJM’s proposed amendments to its capacity market rules would take effect immediately and therefore, MOPR came into effect for the 2023/2024 delivery year capacity auction.³⁹

3.4 LEI’s estimated levelized cost of new entry in PJM is lower than full cost of OVEC plants

LEI’s analysis indicates that a new combined cycle gas turbine (“CCGT”) has an estimated levelized cost of energy (“LCOE”) of \$35.90/MWh for PJM West and \$42.20/MWh for PJM East in 2021 (see Figure 7). LCOE is an analytical tool that measures lifetime costs of a power plant divided by its lifetime energy production. It calculates the present value of the total cost of building and operating a new plant—including the fixed cost—and spreads this cost over all the MWhs the plant is assumed to produce in its lifetime. Thus, LCOE is a \$/MWh measure that can be compared to market prices. If expected market prices are higher than the LCOE of a plant, it is a signal that an investor could earn an attractive return—it is, therefore, a signal to build a plant. If expected market prices are lower than the LCOE, it is a signal not to build a plant (unless there is an additional source of revenues, such as a capacity market). The estimated LCOE of \$35.9/MWh for PJM West and \$42.2/MWh for PJM East include recovery of fixed costs of \$120.4 and \$128.2/kW/year.

The reported cost of the OVEC plants, at \$67.00/MWh,⁴⁰ is higher than the levelized cost of building a new CCGT in PJM. The LCOE analysis implies that the OVEC plants are not competitive with a new CCGT based on full-cycle costs.

³⁷ Hale, Z. PJM responds to FERC-ordered capacity market overhaul with tight timelines. S&P Global. March 18, 2020.

³⁸ FERC Docket No. ER21-2582-000.

³⁹ PJM. *PJM MOPR Proposal Takes Effect by Notice of FERC*. September 2021. <<https://insidelines.pjm.com/pjm-mopr-proposal-takes-effect-by-notice-of-ferc/>>

⁴⁰ OVEC. “OVEC’s average power cost to the Sponsoring Companies.” Annual Report 2020. P. 4. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

Figure 7. LEI's estimated levelized cost of generic new CCGT in PJM

2021	CCGT (PJM West)	CCGT (PJM East)
Capital cost (\$/kW)	\$ 859	\$ 922
Leverage (%)	60.0%	60.0%
Tax rate (%)	26.0%	26.0%
Debt interest rate (%)	6.0%	6.0%
Post-tax required equity return (%)	8.7%	9.0%
Equity contribution capital recovery term	20	20
Lead time	20	20
Heat rate (Btu/KWh)	6,339	6,339
Variable O&M (\$/MWh)	\$ 2.7	\$ 2.1
Fixed O&M (\$/MWh)	\$ 24.0	\$ 20.0
Fuel price (\$/MMBtu)	\$ 2.5	\$ 3.3
Capacity factor (%)	80%	80%
All-in fixed cost (\$/kW/year)	\$ 120.4	\$ 128.2
Levelized cost of new entry (\$/MWh)	\$ 35.9	\$ 42.2

Notes:

1. Capital cost of CCGT includes carrying charges over the construction period.
2. All-in fixed cost includes interest and principal debt payments and fixed O&M.
3. Forecast gas price for PJM West is based on Dominion South while the gas price for PJM East is based on Transco-Z5. For the purpose of modelling, LEI used average gas prices for 2020.

Sources: PJM MOPR Price Calculations, PJM BRA Parameters, LEI.

3.5 Repeal of nuclear subsidy in Ohio

The General Assembly of the State of Ohio amended substitute House Bill Number 128 ("HB 128"), which ended the \$9/MWh subsidy paid to the state's nuclear plants.⁴¹ HB 128 was passed on March 25, 2021, and effective June 30, 2021.⁴² HB 128 also included a solar energy credit paid under section 3706.55 of the Revised Code, at \$9/MWh. The total disbursements required under section 3706.55 of the Revised Code from the solar generation fund were set at \$20 million. The bill reduced the monthly charge for residential customers to \$0.10 per customer from \$0.85 and the per-customer monthly charge for industrial customers was capped at \$242 per month, a significant decline from the previous \$2,400 per month.⁴³

⁴¹ Sweeny, Darren. "Ohio House passes legislation to repeal nuclear subsidies." S&P Global. March 11, 2021.

⁴² Ohio State Legislature. *Revise electric utility service law; repeal portions of HB 6*. House Bill 128. March 2021. <<https://www.legislature.ohio.gov/legislation/legislation-summary?id=GA134-HB-128>>

⁴³ Ibid.

4 OVEC bill and LGR Rider reconciliation

4.1 Scope and background

4.1.1 Scope

As noted previously, as a Sponsoring Company, DEO is responsible for a 9% contractual share (that of the former Power Company) of the costs and revenues of the two OVEC plants, based on the ICPA.⁴⁴ The total 9% share is billed to DEO customers in the LGR Rider and is therefore within the scope of this audit.

This chapter addresses the following topics:

- details of the monthly OVEC bills from January 2020 to December 2020⁴⁵ in which all the charges and credits to DEO and the other members of the ICPA are detailed; and
- the LGR Rider, which details the forecasted monthly charges to DEO's customers, the actual monthly LGR charges, and the cumulative unrecovered balance in the LGR Rider.

In coming to LEI's conclusions, LEI issued formal data requests and held conference calls and phone calls with DEO personnel.

4.1.2 Background of the LGR Rider

As noted previously, in 2019 HB 6 defined a legacy generation resource in a way which encompassed the OVEC plants (RC 4928.01(A)(41)). The General Assembly decided to replace the existing OVEC riders.⁴⁶ The LGR Rider was implemented on January 1, 2020 and became effective on that date.⁴⁷ LGR Rider rates are updated every six months and are effective for a six-month period (January 1 through June 30; and July 1 through December 31, in a given year). When the rates are set for the coming half-year, the rates are also trued-up for the previous half-year. This process applies to all the EDUs which buy energy and capacity from OVEC and are allowed to recover the cost on the LGR Rider.

⁴⁴LEI-DR-06-001 Attachment. *Amended and Re-Styled Inter-Company Power Agreement*.

⁴⁵ LEI-DR-01-022 CONF Attachment_1 ("OVEC bill").

⁴⁶ Dickinson Wright PLLC. *Ohio Enacts Sweeping Energy Legislation: HB 6 Bails Out Nuclear, Coal; Rolls Back Renewables and Energy Efficiency*. September 2019. <<https://www.dickinson-wright.com/news-alerts/ohio-enacts-sweeping-energy-legislation>>

⁴⁷ DEO Tariff. LGR Rider. <https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-oh/sheet-no-128-rider-lgr-oh-e.pdf?la=en>

4.2 Evaluative criteria

LEI focused its audit of the OVEC bill and LGR Rider on answering the following questions:

- Are DEO's journal entries consistent with OVEC monthly bills?
- Are the actual monthly LGR Rider charges, which appear in the Rider statements, consistent with the monthly bills provided by OVEC, which DEO pays?
- On a net basis, does the ICPA cost customers more than the plants earn in the PJM markets?
- Are the under/(over) recovery balances consistent with monthly OVEC costs and revenues?

4.3 Findings and conclusions

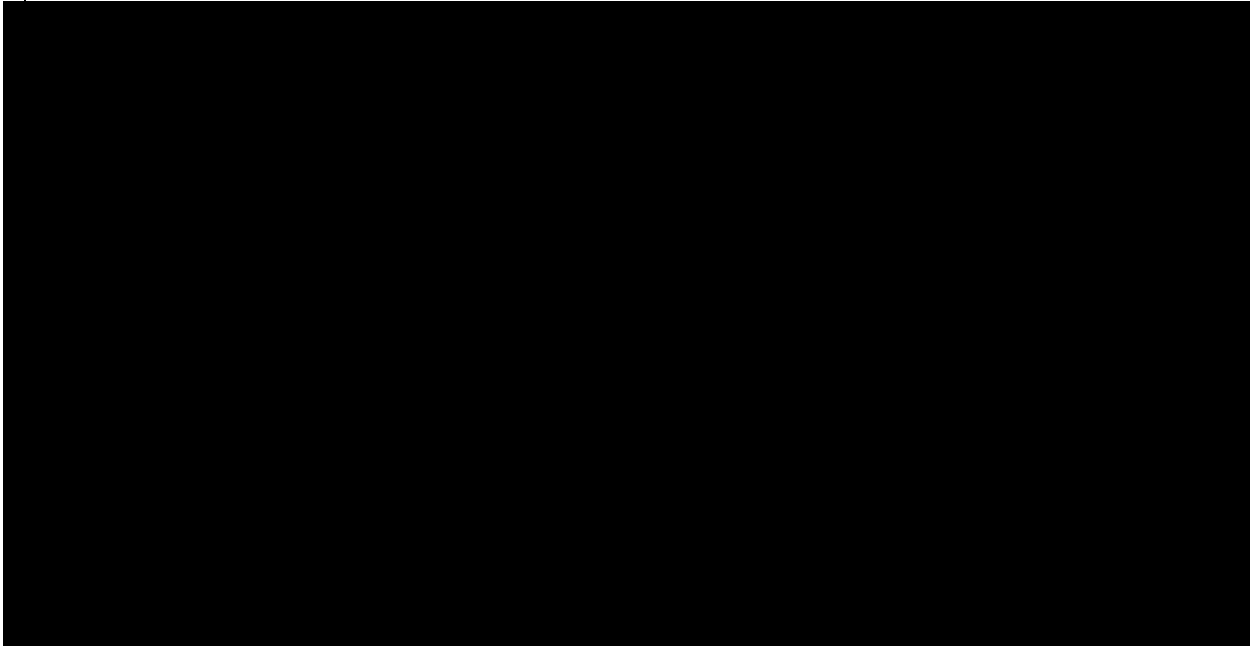
4.3.1 OVEC bill, journal entries, and rider charges are consistent

DEO provided its monthly OVEC bills and accounting entries, and LEI examined each month in 2020.

4.3.1.1 Analysis of OVEC actual charges

LEI examined DEO's journal entries for actual OVEC charges, provided in LEI-01-053 CONF Attachment E and compared them to the OVEC monthly bills provided in LEI-DR-01-022 CONF Attachment_1 (see Figure 8). DEO tracks the cost of the OVEC bills on a "risk month" basis, meaning these costs are tracked as they are incurred, rather than when they are billed. This is an accepted accounting practice.

LEI found that the OVEC bills and DEO's journal are consistent, as they should be: Column A in Figure 8 (the OVEC bill) matches Column B in Figure 8. The net charges paid to OVEC (column D in Figure 8) are somewhat lower than the OVEC bill, however, because DEO sold some of its capacity to OVEC (Column C in Figure 8). This is an acceptable practice, as it allows OVEC to meet capacity requirements, and DEO to offset some of the cost of the ICPA to its customers.

Figure 8. Reconciliation of OVEC bill and detailed monthly journal entries

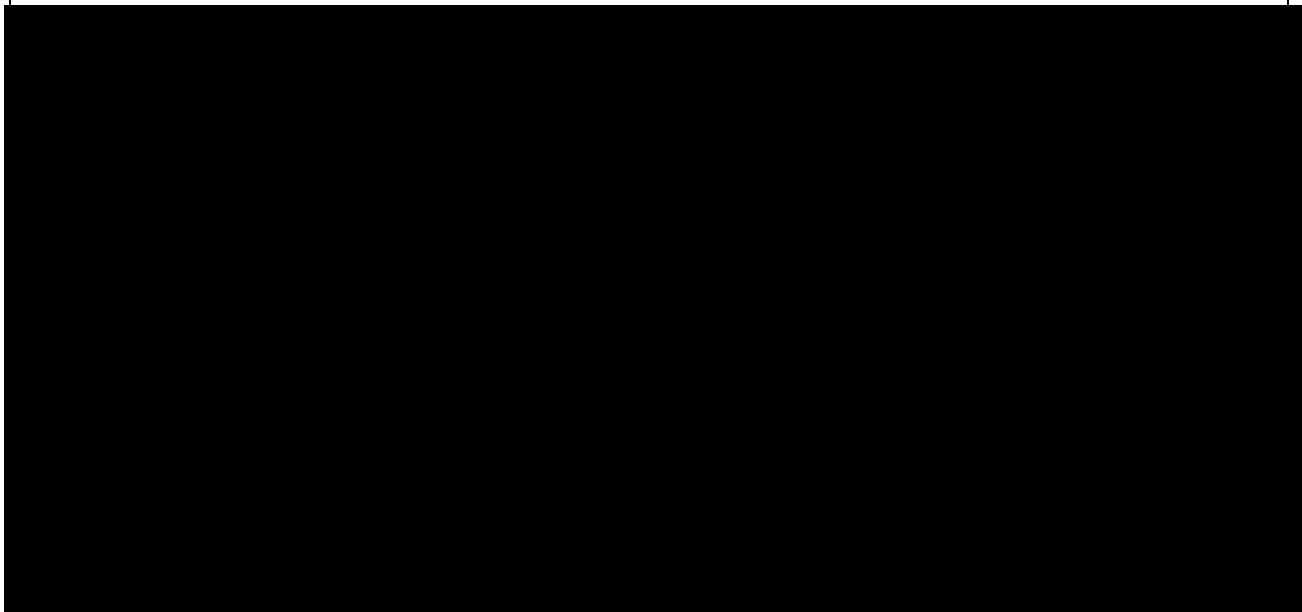
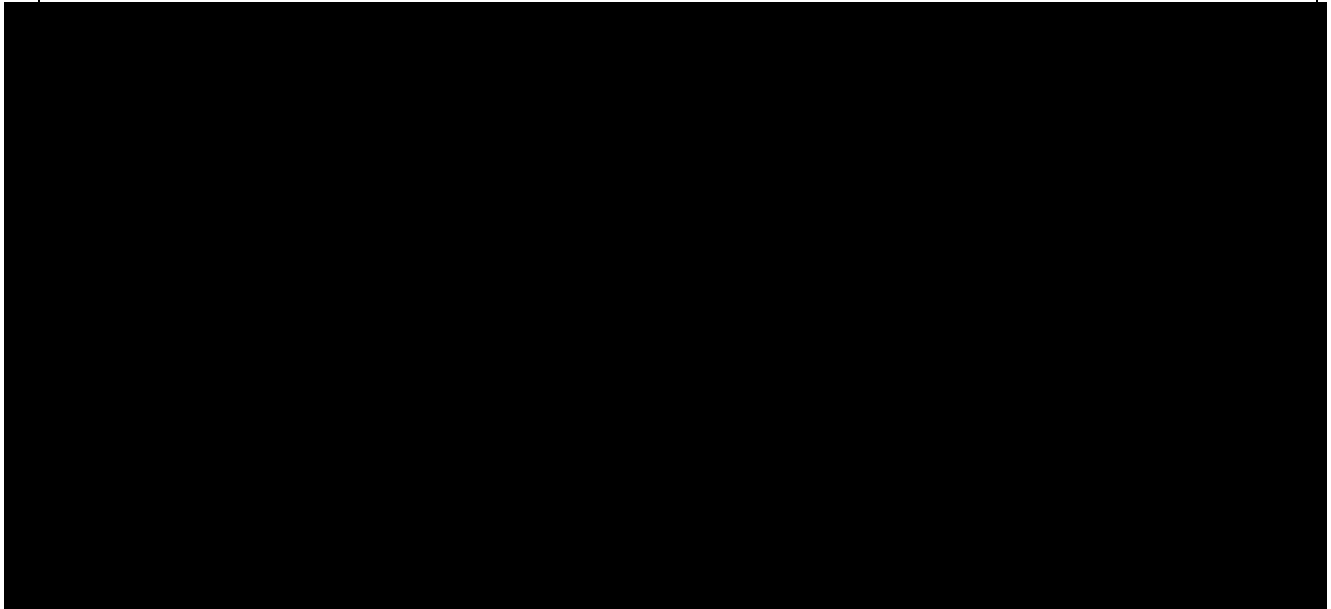
Source: Column A: LEI-DR-01-022 CONF Attachment_1 ("OVEC bill"); Column B: LEI-01-053 CONF Attachment E, tab "ovec risk month;" Column C: LEI-01-053 CONF Attachment E, tab "ovec-risk month," entry "OVEC E Actual primary settlement."

LEI next reconciled journal entries with the actual LGR Rider charges. For this purpose, LEI referred to DEO's accounting month entries, rather than their risk month entries. The accounting month entries track exactly when bills are received and paid.

The cost of the ICPA billed to DEO's customers represents the sum of the OVEC charges, less the credits associated with the sale of energy and capacity (mostly to PJM, except for the capacity sold to OVEC as noted above). The total actual charges net of capacity credits (Column C in Figure 9) are added to total estimated charges and credits (Column F in Figure 9). The transactions related to FES's entitlement a pro rata portion of which was allocated to DEO as well as the other remaining ICPA members, are added (Column G in Figure 9). Broker fees are also accounted for (Column H). DEO made adjustments for a one-time reversal of a reserve excluded until FES's bankruptcy was resolved (██████████), and for a one-time recovery of broker fees not recovered in previous filing (██████████), which is accounted for in Column I.⁴⁸ The grand total is shown in Column J. This total matches the charges on the LGR Rider (though charges appear as credits, and vice versa) shown in Column K in Figure 9. Therefore, LEI concludes that the LGR charges are consistent with the OVEC bills and offsetting earnings, as they should be.

⁴⁸ LEI DR-01-053 CONF Attachment B, tab "Adjustments."

Figure 9. Reconciliation of journal entries and rider charge



Source: Columns A-G, LEI DR 01-053 Confidential Attachment E tab "acct mo total"; Column H, LEI DR 01-053 Confidential Attachment E tab "broker fees," Column K, LEI DR 01-053 CONF Attachment B tab "Costs and Revenues", Actual OVEC net (gains) and loss (Column Q)."

*Includes two parts: (1) one-time reversal of FE reserve, and a one-time recovery of broker fees. See LEI DR-01-053 CONF Attachment B, tab "Adjustments."

4.3.1.2 Recommendations

LEI concludes that the OVEC bills, journal entries, and the actual charges on the LGR bills are consistent with one another. LEI has no recommendations.

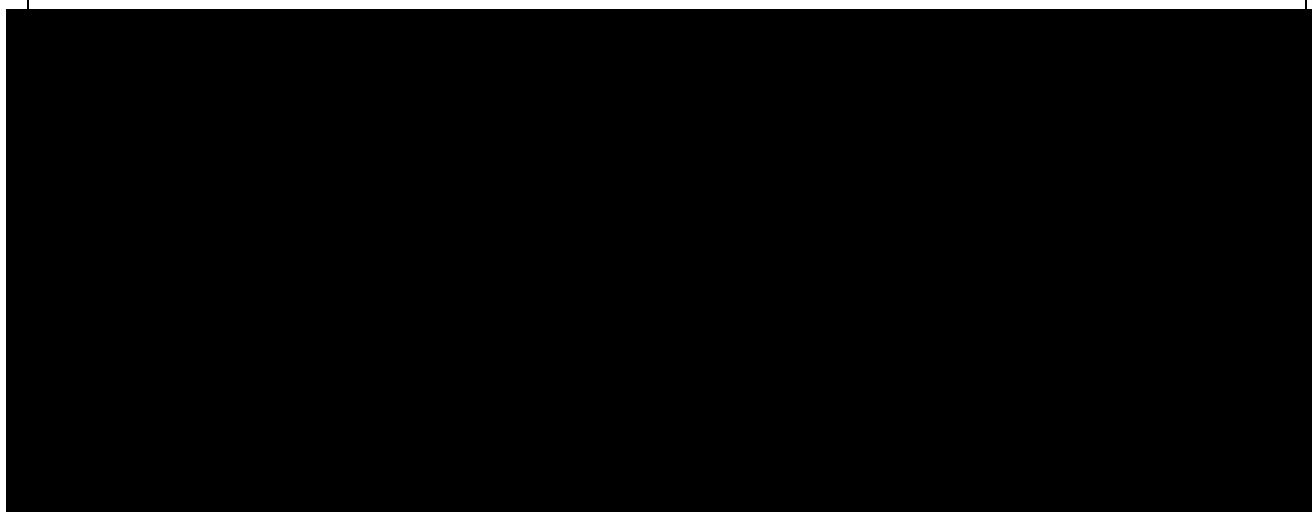
4.3.2 Components of fixed costs were billed properly

The RFP requires the auditor to ensure that any fixed costs incurred by OVEC are properly allocated to DEO, including depreciation, debt service, and plant maintenance expense. These fixed costs are components of the demand charges in the OVEC bill.

4.3.2.1 Analysis of billing of fixed cost

First, LEI examined OVEC bills to determine the overall components of fixed costs. These components included Components A-F as found in the OVEC bill (see Figure 10). The OVEC bill includes PJM fees and PJM charges or credits in the demand portion of the bill. These are shown in Column H of Figure 10.

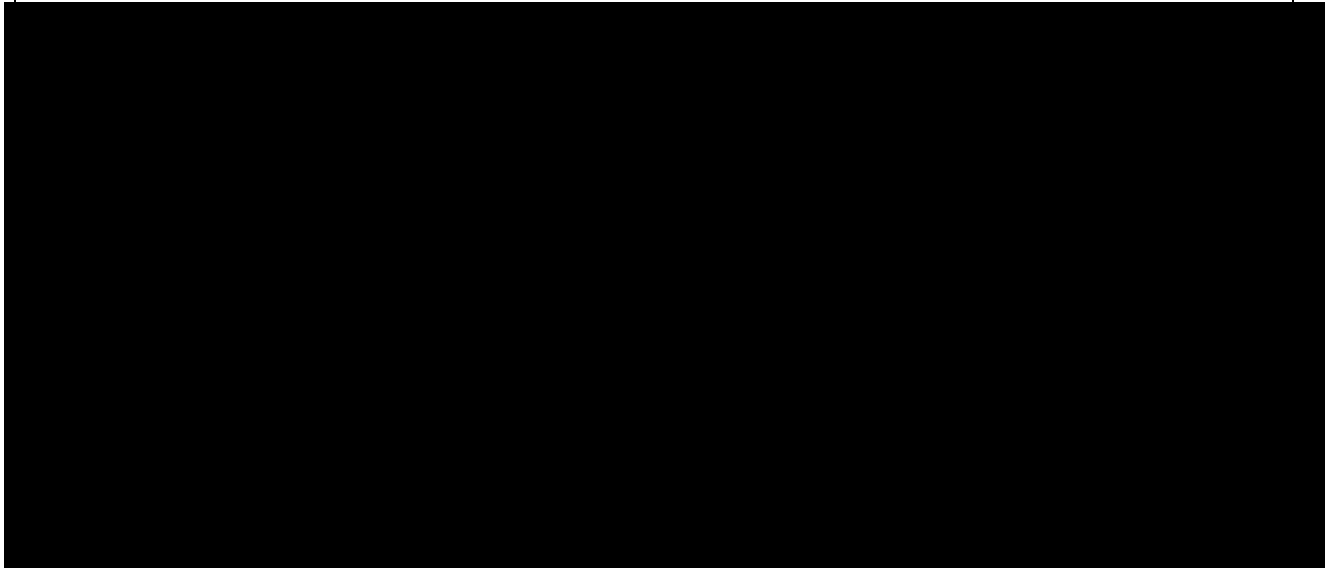
Figure 10. Total demand charges payable to OVEC from all participants



Source: LEI-DR-01-022 CONF Attachment_1 ("OVEC bill").

Next, LEI calculated DEO's share of the total OVEC demand charges in the following manner: DEO's share of the demand charges is equal to its PPR of 9%. Its share of the PJM charges is 9.96% (the share of PJM charges is higher than the share of demand charges because some of the Sponsoring Companies are not in PJM). Multiplying the PPR share by the total demand charges in Figure 10 gives the demand charges that should be billed to DEO; for example, for January 2020, the total demand charge to DEO was [REDACTED] (Column A in Figure 11). Multiplying DEO's PJM percentage share by total OVEC PJM charges (or credits) results in a PJM credit of [REDACTED] for January 2020 (Column B in Figure 11). To reconcile the total OVEC charges with DEO's journal, DEO's share of OVEC transmission charges ([REDACTED]) must also be added (Column C of Figure 11). The total of these components is shown in Column D of Figure 11. The entries in Column 10 show reconciliation to within one to two cents per month of demand charges paid based on DEO's OVEC risk month accounting. This is a tiny difference and is not an issue.

Figure 11. Total demand charges payable to OVEC from DEO, reconciled with journal



Source: LEI-DR-01-022 CONF Attachment_1 ("OVEC bill") and LEI-01-053 CONF Attachment E, tab "ovec-risk month"

* The OVEC bill does not include transmission as a demand charge, but the Duke journal includes it in the PJM demand charge, so LEI included it here to ensure OVEC and Duke journal would reconcile accurately.

** October 2020 includes a charge by OVEC of [REDACTED] to correct August 2020 PJM billing error.

4.3.2.2 Recommendations

The components of fixed costs were billed properly, and LEI has no recommendations for DEO.

LEI notes that Component (D) of the demand charge, defined as [REDACTED]

[REDACTED] "49 amounts to [REDACTED] million per year, which is ultimately paid by ratepayers including DEO's customers. ORC 4928.01(A)(42) requires that "*Prudently incurred costs ...must exclude any return on investment in common equity...*"50 Component D seems to be a such a return. Though it is not a large share of the overall OVEC bill to ratepayers, the [REDACTED] million per year amounted to [REDACTED] OVEC's [REDACTED] million of net income in 202051

⁴⁹ LEI-DR-01-022 CONF Attachment_1 ("OVEC bill").

⁵⁰ PUCO. RFP No. RA21-PPA-1. Issued January 29, 2020. P.3.

⁵¹ OVEC. *Annual Report 2020*. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

4.3.3 The OVEC plants cost more than they earn

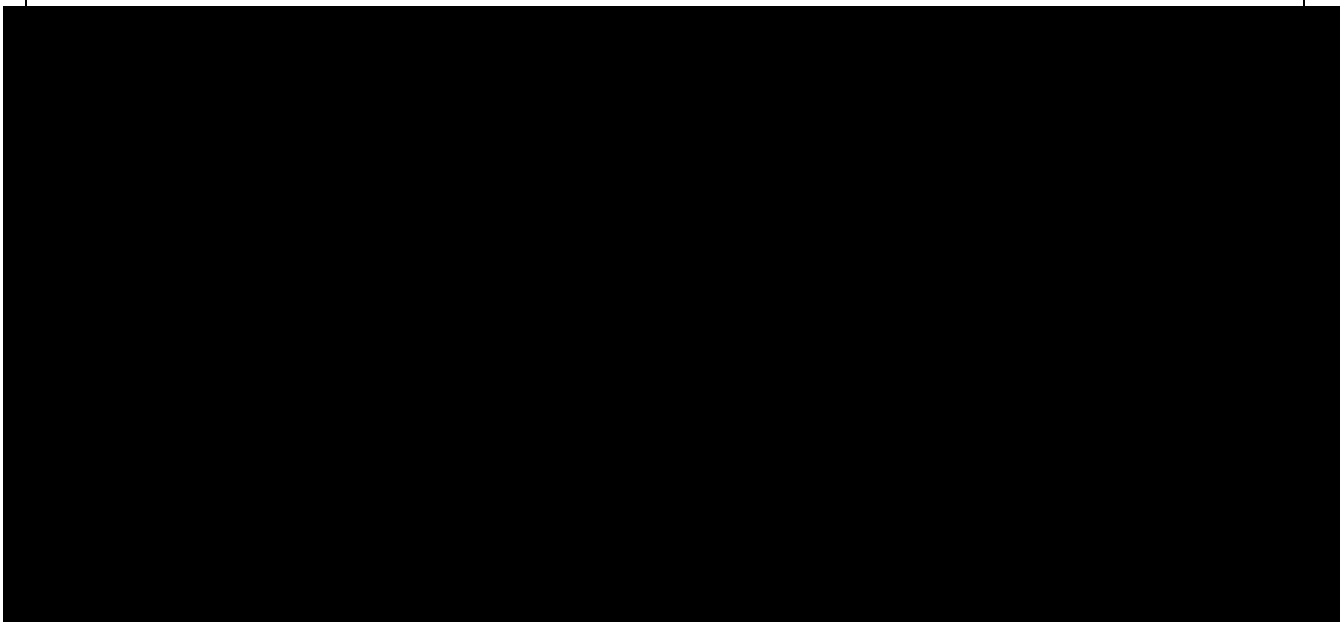
Although it is obvious from the fact that the LGR Rider is usually a charge to DEO's customers and not a credit, it is helpful to set the costs of the OVEC plants in the context of the PJM energy and capacity markets.

4.3.3.1 Analysis

During the audit period, LEI calculated the monthly average cost of OVEC demand charges as \$39.59/MWh; and energy charges as \$25.61/MWh, for a total cost for the year of \$65.19/MWh (see Figure 12). LEI calculated these numbers by summing together the total OVEC demand and energy costs (in dollars), and then dividing by the total available energy used to bill the Sponsoring Companies (in MWh). Monthly average costs were particularly high in April 2020 (as they were in April 2019) owing to extended outages (see Section 9 for details of plant performance).

LEI's results are consistent with reporting by OVEC, which noted: *"In 2020, OVEC's average power cost to the Sponsoring Companies was \$67.00 per MWh compared with \$57.04 per MWh in 2019... Increased average power costs were directly related to reduced generation by the impact of COVID-19 on the energy demand."*⁵²

Figure 12. OVEC cost of power (demand and energy charges)



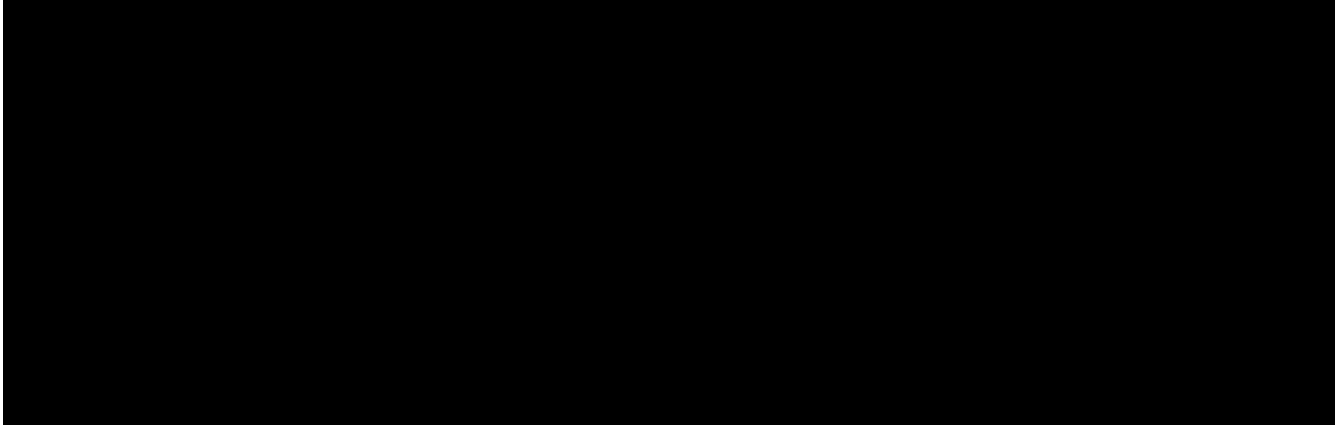
Source: LEI-DR-01-022 CONF Attachment_1 ("OVEC bill").

The net impact on DEO customers depends on the OVEC plants' energy market earnings and on DEO's capacity market revenues (DEO's capacity market offer strategy is discussed in detail in Section 5). DEO's total OVEC bill (energy plus demand) in 2020 was [REDACTED] (see Figure 13).

⁵² OVEC. *Annual Report 2020*. P. 3. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

DEO recovered a portion of this, [REDACTED] through its share of OVEC's revenue in the PJM capacity and energy markets (column D in Figure 13). The remaining [REDACTED] to DEO, that is reflected in the LGR Rider. The weighted average cost per MWh of this loss was [REDACTED]/MWh in 2020.

Figure 13. The cost of OVEC generation to DEO



Sources: Column A, LEI-01-053 CONF Attachment E, tab "ovec risk month" entry OVEC Power sched E demand charge; Column D, LEI DR 01-053 Confidential Attachment E tab "acct mo total"; Column F, LEI-DR-01-022 CONF Attachment_1 ("OVEC bill").

This conclusion is consistent with the LGR Rider calculations. OVEC invoices DEO for DEO's entitlement to the output of the plants. DEO sells this entitlement into PJM, which results in a net deficit. The difference is billed to DEO's customers through the LGR Rider.

4.3.3.2 Recommendations

The current ICPA does not expire until June 30, 2040. DEO's customers could be locked into paying a premium for energy and capacity from the OVEC plants in future years, though market prices could change in the future, so it is possible that the premium could become a discount. Commission may wish to re-examine the role of Component D, which appears to LEI to be a return to capital.

4.3.4 LGR Rider reporting components

The LGR Rider was implemented on January 1, 2020 and became effective on that date.⁵³ The current audit period covers the calendar year 2020, therefore, the LGR Rider cost covered in the audit includes the period from January 1, 2020, to December 31, 2020.

The LGR Rider features two parts, the second of which in turn consists of two parts:⁵⁴

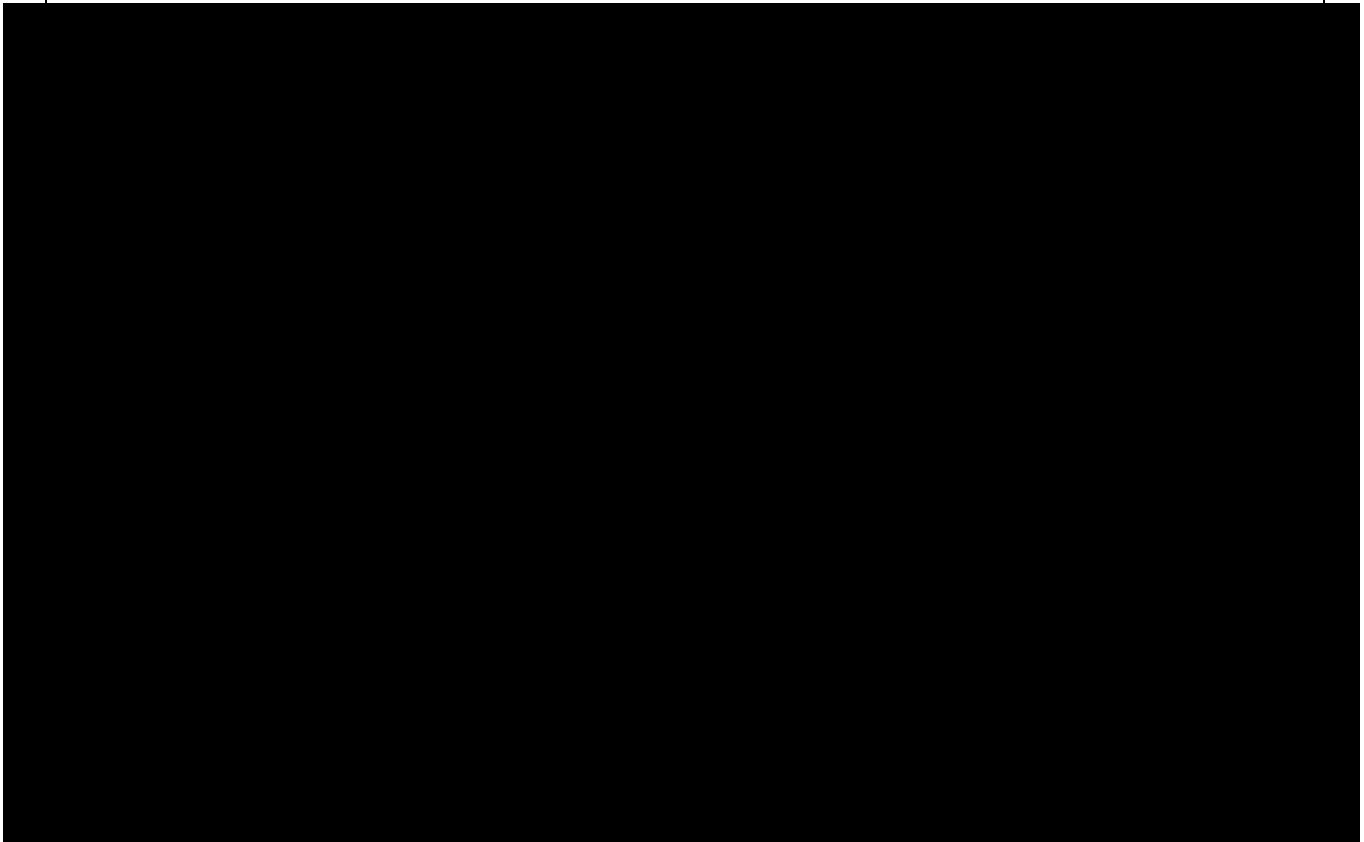
⁵³DEO Tariff. LGR Rider. <https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-oh/sheet-no-128-rider-lgr-oh-e.pdf?la=en>

⁵⁴ Ibid., and LEI-DR-06-008 Attachment 1.

- Part A (the statewide rate) is the LGR Rider cost for the coming six months, which is based on estimates provided by individual companies and then rolled up; and
- Part B (a rate particular to each EDU) which represents the true ups from estimated costs to actual costs. There are two separate sets of calculations in Part B: one for PSR true ups (for the PSR Rider which was in place until January 2020), and another for LGR Rider true ups.

The two sub-parts of Part B are shown in Figure 14 below, where the Part B PSR true up is calculated by DEO at \$0.92 per month for residential customers (adjusted for cap). LEI verified that the capped rates shown in Figure 14 below correspond to the rates published in the LGR Rider tariff sheet.⁵⁵

Figure 14. DEO's Rider LGR 2020, Part B



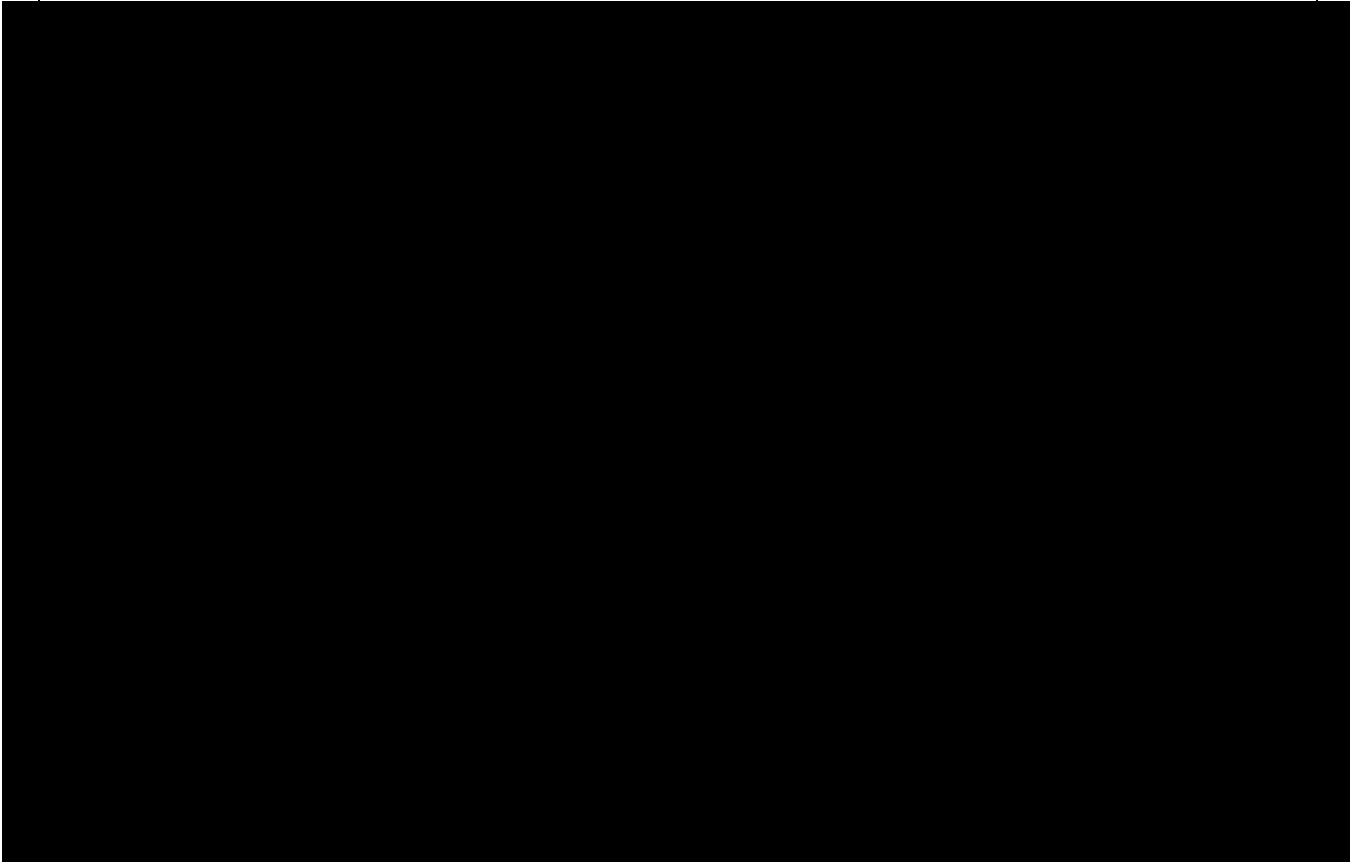
Source: LEI-DR-01-051 CONF Attachment B.

The rates in the Part B PSR true-up (the uncapped [REDACTED] for residential and [REDACTED] for non-residential customers) reflect the cumulative balance of the corrected (over)/under actual cost recovery from 2018 and 2019, as well as other true ups. The actual corrected cumulative PSR balance as of the end of December 2019 reflected an under-recovery of

⁵⁵ DEO Tariff. LGR Rider. <https://www.duke-energy.com/_/media/pdfs/for-your-home/rates/electric-oh/sheet-no-128-rider-lgr-oh-e.pdf?la=en>

██████████ This amount therefore represents a revenue requirement which is split across residential and non-residential customers as shown in Figure 15 below.

Figure 15. DEO's final true up of PSR in Rider LGR in Part B

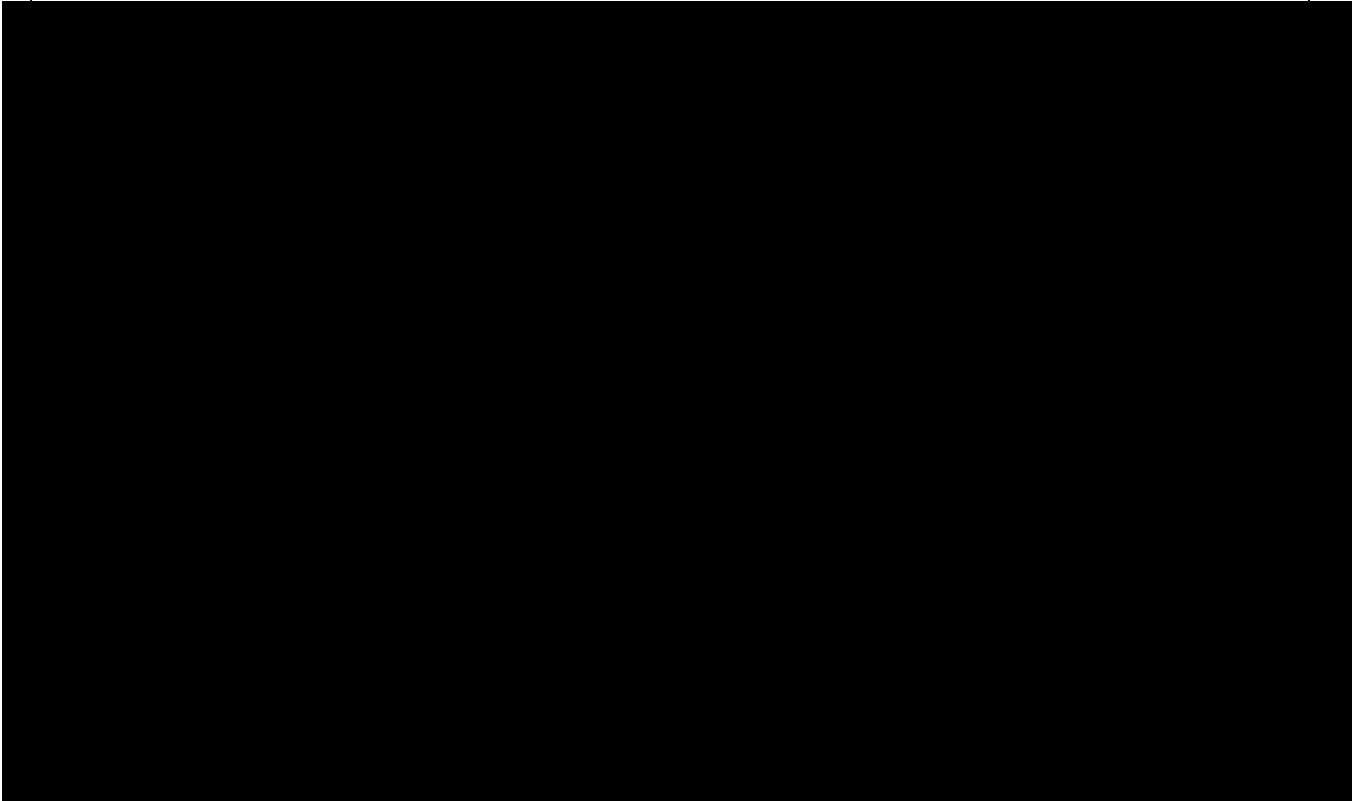


Source: LEI-DR-01-051 CONF Attachment B.

In addition to the cumulative balance of ██████████ must be recovered, the LGR Rider trues up LGR revenues from the first half of 2020 and PSR revenues for the first quarter of 2020. PSR revenues were small in the first quarter of 2020 because the PSR had already expired at the end of 2019, and the only charges and credits left to true up were from cancellations and re-bills.

The LGR Rider costs and revenues for July 1, 2020, to December 31, 2020, are trued up beginning with the January 2021 filing. The total residential rate of \$1.30/month for July 2021 through December 2021 includes a very small credit of ██████████ (see Figure 16).

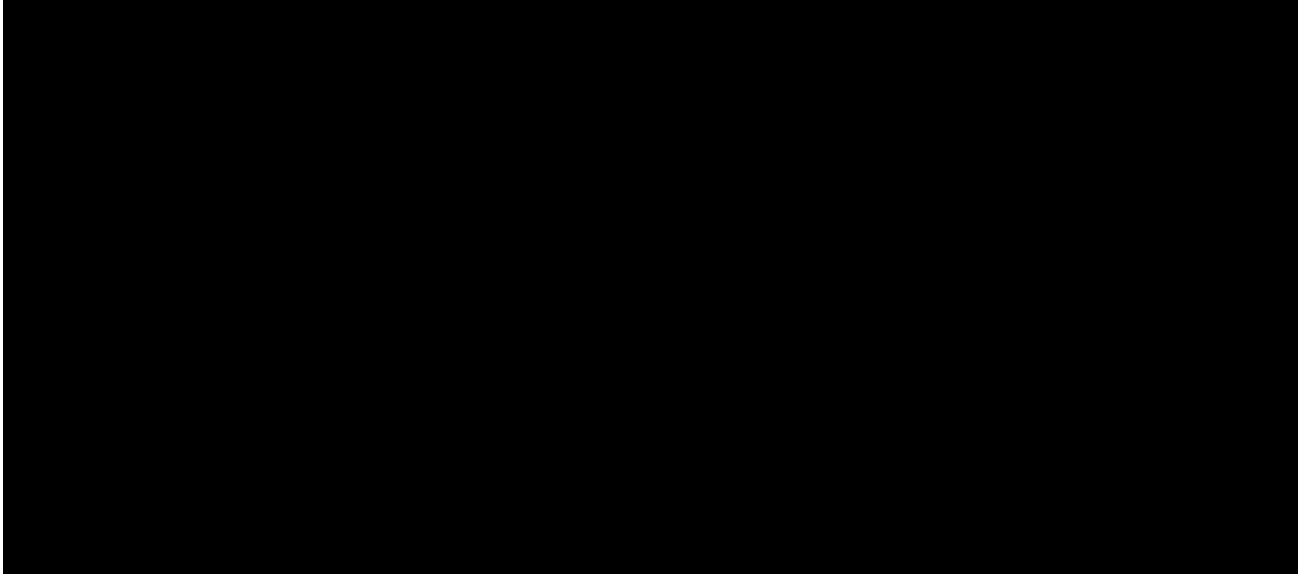
Figure 16. DEO's true-up of Part A LGR for July 1, 2020-December 31, 2020, in Part B



Source: LEI-DR-01-053 CONF Attachment B.

This amount is based on the difference between costs and revenues for the period from July 1, 2020, through December 31, 2020, as shown in Figure 17. Total Part A actual revenues for July 1, 2020 through December 31, 2020 (which totaled [REDACTED] for residential customers, for example) slightly exceeded the [REDACTED] projected revenues which were billed on the Rider. The [REDACTED] difference is spread over the billing determinant (the number of customer bills) resulting in a charge [REDACTED] per bill per month.

Figure 17. DEO's projected LGR Part A revenues trued-up to actual costs, in Part B

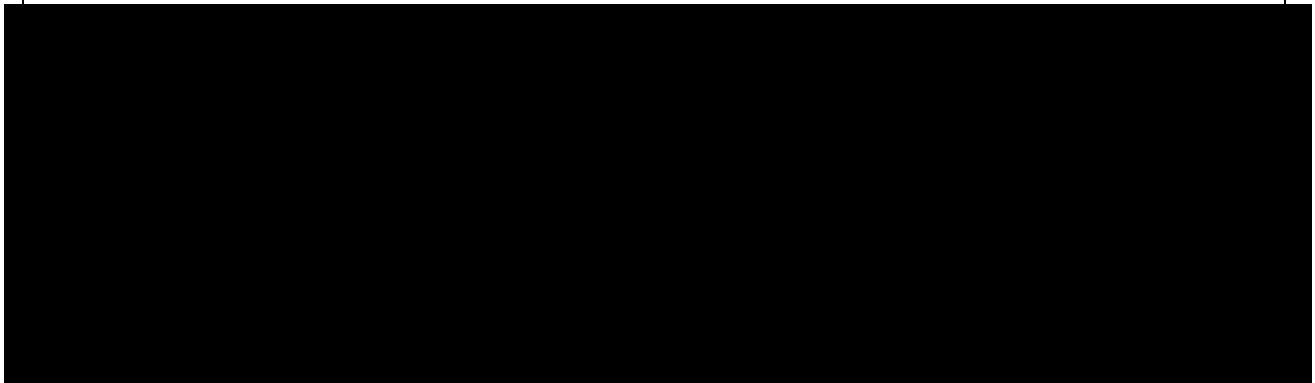


Source: LEI-DR-01-053 CONF Attachment B.

4.3.4.1 Under-recovery balances accumulated in 2020

The actual monthly revenues shown in Figure 17 from residential and commercial customers are not always sufficient to cover the actual monthly cost of the LGR, and in such cases DEO runs an under-recovery balance. Total actual OVEC LGR net costs (shown in the first column of Figure 18 below and detailed previously in Figure 9) are compared with actual LGR Part A revenues from residential and C&I customers, and revenue from FES residential and commercial customers. The net result during the audit period was nearly always a monthly under-recovery, and an increasing cumulative unrecovered balance (see the last column of Figure 18 below).

Figure 18. DEO (over)/under recovery calculations



Source: LEI-DR-01-053 CONF Attachment B.

- 1) One-time reversal of FE reserve excluded until FES's bankruptcy was resolved
- 2) One-time recovery of broker fees not recovered in previous filing

4.3.4.2 Recommendations

LEI found the LGR Rider tracking of under recovered balances was consistent with the costs of the OVEC agreement and has no recommendations.

5 Disposition of energy and capacity

5.1 Scope and background

5.1.1 Scope

OVEC's generation offer practices and outcomes impact DEO's ratepayers and, therefore, are within the scope of this audit.

The chapter addresses the following subtopics:

- organizational structure and qualifications of personnel;
- monitoring, evaluating, and responding to developments in the PJM market; and
- offers into the energy, capacity, and ancillary service markets.

In coming to LEI's conclusions, LEI issued formal data requests, talked with DEO personnel over the phone, and conducted additional research.

5.1.2 Background

PJM offers four types of competitive wholesale markets where large volumes of electricity are traded. The markets are:

- **The Day-Ahead ("DA") energy market** is a forward market (one day forward) for energy and operating reserves, which are cleared simultaneously. This market allows participants to *"place generation resource offers, load demand bids, physical schedules, and bilateral transactions for the next day"*; ⁵⁶ it calculates prices by physical location.
- **The Real-Time ("RT") energy market** is a spot market (five minutes) for energy and operating reserves, which are cleared simultaneously. The RT market allows participants to *"place updated generation resource offers and updated load forecasts; it then provides dispatch instructions for the lowest-cost resources to satisfy system demand without overloading the transmission network and calculates prices by physical location."* ⁵⁷
- **A forward capacity market, the RPM**, discussed previously. Generation resources which clear the capacity auction are required to offer power into the energy market for the year

⁵⁶ "Understanding the Differences Between PJM's Markets." PJM Interconnection. <<https://learn.pjm.com/-/media/about-pjm/newsroom/fact-sheets/understanding-the-difference-between-pjms-markets-fact-sheet.ashx?la=en>>

⁵⁷ Ibid.

for which they are committed. They also commit to serve PJM's emergency needs whenever called upon.⁵⁸

- **An ancillary service ("A/S") market** is operated to procure regulation and reserves to help balance the transmission system as electricity is moved from generators to end users.⁵⁹

5.2 Evaluative criteria

LEI focused its audit of disposition of energy and capacity on answering the following questions:

1. Is the current energy scheduling department's organization and staffing adequate? Do they follow operating procedures appropriately?
2. Does organization and staffing encourage best practices for interacting with the PJM markets?
3. Does OVEC adequately follow developments in the PJM stakeholder process?
4. Are generation resource offers prepared and submitted in the PJM markets so as to optimize utilization and revenues of OVEC's generation fleet?
5. Does OVEC have sound strategies to bid into the capacity markets?
6. Is the level of participation in the A/S market prudent?

5.3 Findings and conclusions

5.3.1 Organization and staffing

OVEC-IKEC's Energy Scheduling Department is responsible for maintaining a generation dispatch center for operation in the PJM RT market, participation in the DA market, and operational compliance. This Department operates in compliance with the North American Electric Reliability Corporation ("NERC") and the regional reliability organization's Operating Policies, keeps track of *"the latest practices and procedures with regard to energy scheduling and consistently apply standard work procedures to ensure efficiency and economy in the operation of the department – including applicable PJM requirements."*⁶⁰

⁵⁸ Understanding the Differences Between PJM's Markets. PJM Interconnection. <<https://learn.pjm.com/-/media/about-pjm/newsroom/fact-sheets/understanding-the-difference-between-pjms-markets-fact-sheet.ashx?la=en>>

⁵⁹ PJM ancillary service. <<https://www.pjm.com/markets-and-operations/ancillary-services.aspx>>

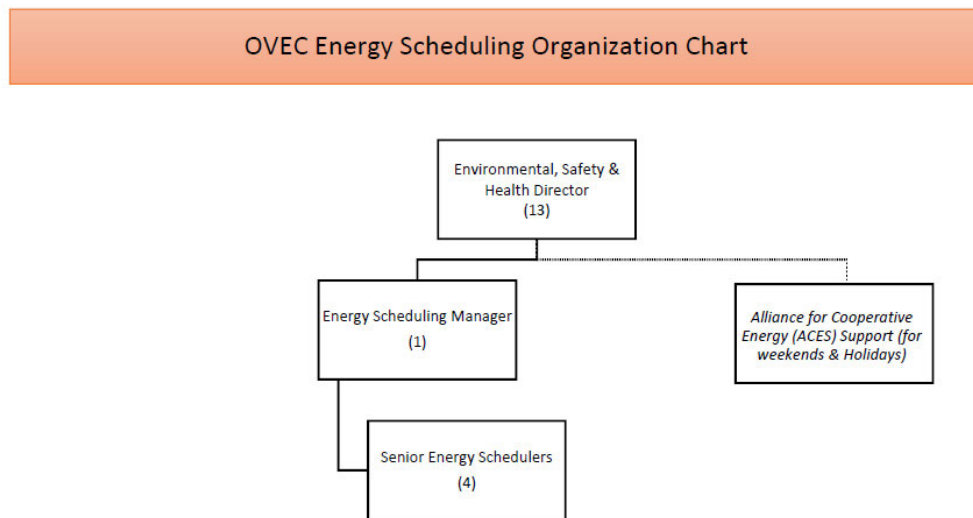
⁶⁰ LEI-DR-01-008.

There is one Energy Scheduling Manager in the Energy Scheduling Department, and four senior Energy Schedulers (see Figure 19).⁶¹

- The Energy Scheduling Manager provides daily supervision, direction, and oversight of the Department and serves as a point of contact for Sponsoring Companies, PJM, the OVEC leadership team, and the third-party contractor that provides energy scheduling support services on weekends and holidays.
- The Energy Schedulers' duties and responsibilities include but are not limited to: "1) determine the unit operating status and prepare and enter schedules for the sale of generation on behalf of Sponsor Companies on both a DA basis and a RT basis. The energy is offered in accordance with the terms of the Inter-Company Power Agreement, consistent with approved Operating Committee Procedures and PJM market requirements; 2) submit and confirm energy transaction tags using the electronic tagging system necessary to support the power transactions, and perform this function by approved backup procedures if tagging system fails; 3) receive, record, and maintain logs of normal and emergency operating conditions; 4) maintain records of generating units such as unit capabilities, unit de-rates and reasons for each de-rate, maintenance, and forced and planned unit outages; 5) request and coordinate through PJM unit outages, unit de-rates and special unit load requests for environmental testing, seasonal unit capability testing and other required unit performance testing via PJM software in a real time as well as a prospective basis; 6) prepare daily summaries of total generation and demand as required, including the requirements of NERC and the regional reliability organization."⁶²
- The Alliance for Cooperative Energy ("ACES") is a third-party contractor that provides energy scheduling support services during weekends and holidays.

⁶¹ LEI-DR-01-008.

⁶² LEI-DR-01-008.

Figure 19. OVEC Energy Scheduling Organization Chart

Note: There were no position vacancies in 2020.

Source: LEI-DR-01-008 CONF Attachment.

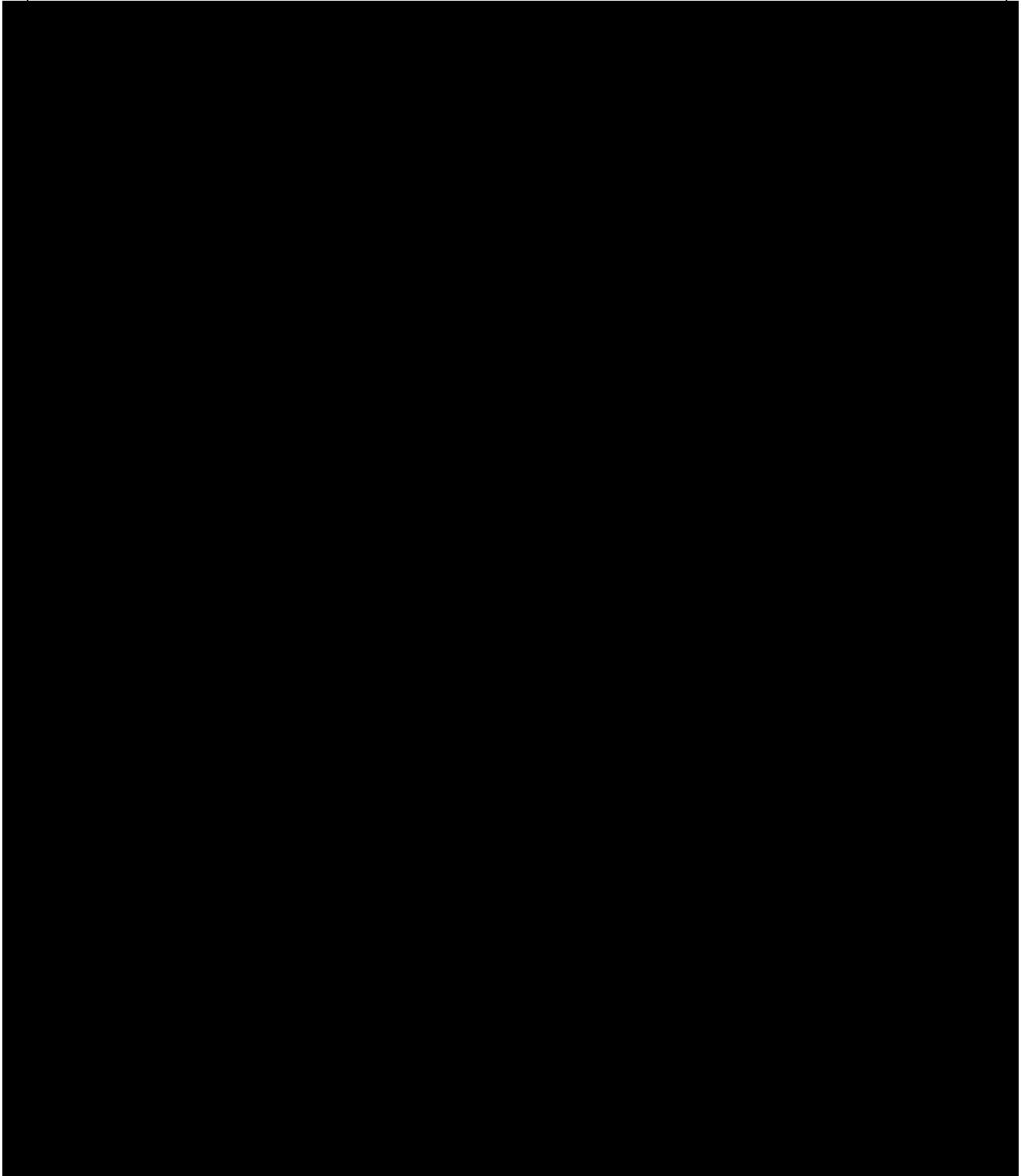
5.3.2 OVEC's processes for placing offers into the PJM energy markets

OVEC's energy must be offered in accordance with the terms of the ICPA, and consistent with approved Operating Committee Procedures and PJM market requirements.

LEI understands that OVEC's Energy Scheduling department has an internal daily call every non-holiday weekday morning to review unit status and availability, including applicable unit de-rates, potential unit liabilities, outage status, and expected unit return-to-service dates (see Figure 20). OVEC uses this information to formulate the DA unit offers into the PJM market. Before the morning call, the Energy Scheduling department also receives a daily unit status report from each plant and the information in the status report is updated during the morning calls based on real-time unit operating status. On weekends and holidays, OVEC holds a less formal daily meeting among the OVEC's system operations personnel and the contractor that provides Energy Scheduling functions.⁶³

⁶³ LEI-DR-01-003 CONF.

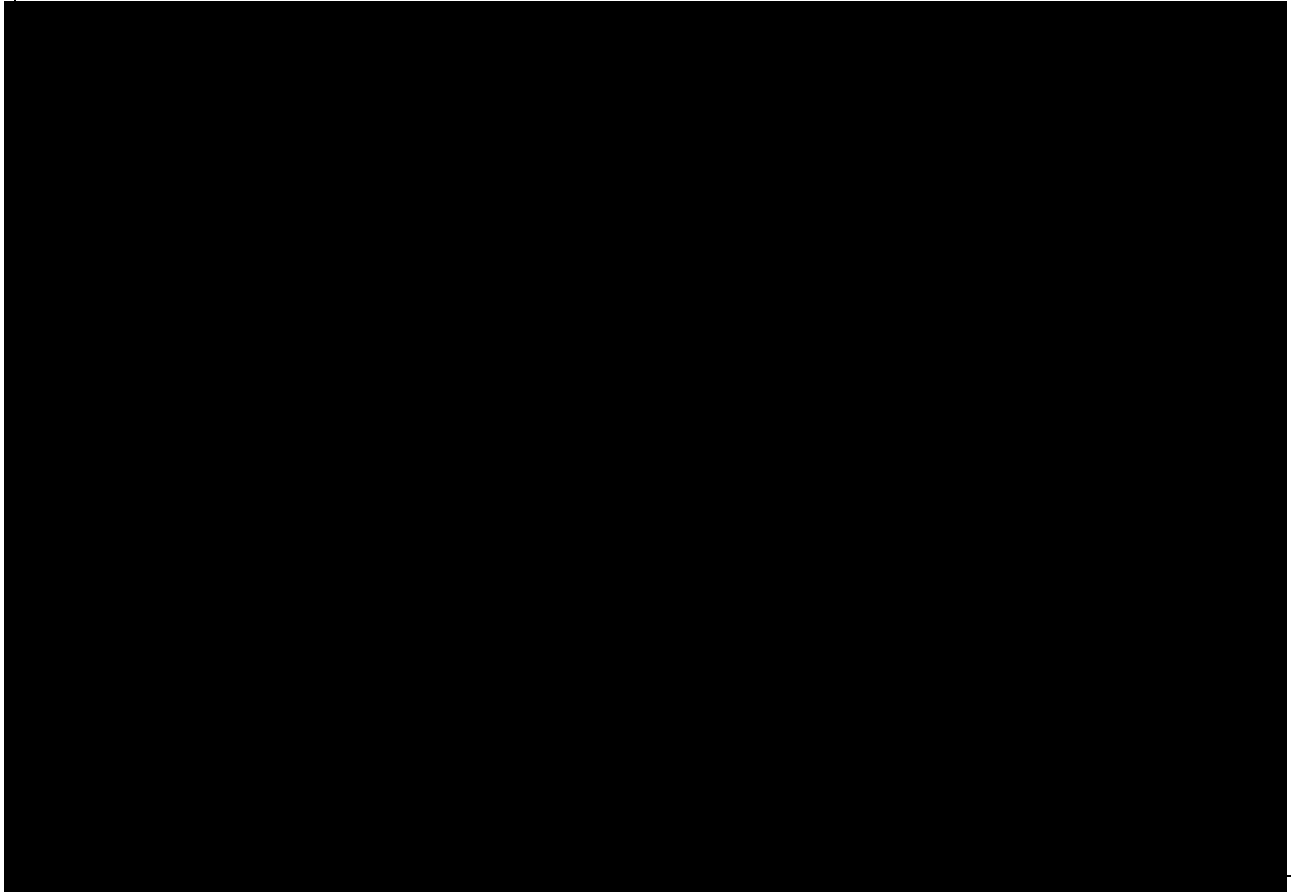
Figure 20. OVEC normal daily scheduling timeline



Source: LEI-DR-01-005 CONF Attachment A (OVEC Operating Procedures effective November 15, 2019).

Initially, when OVEC became fully integrated into the PJM market in November 2018, there was no formal process whereby OVEC could evaluate prior day performance data. OVEC subsequently established a daily internal PJM Demand Comparison Report (see Figure 21), which provides operating data that includes a unit by unit hourly comparison of actual net generation versus PJM demand, noting that “[t]his report is also made available to plant operations personnel to aid them in evaluating prior day unit and operations related performance.”⁶⁴

Figure 21. Sample of internal PJM Demand Comparison Report



5.3.3 Generation offers

All of DEO’s share of the energy output of the Kyger Creek and Clifty Creek power plants was sold into the PJM DA and RT markets. None was sold into the Midcontinent Independent System Operator (“MISO”) market or via bilateral contract.⁶⁵

OVEC has typically self-scheduled all but one of the units (i.e., it offers them as “must run”) in accordance with the OVEC Operating Committee procedures, as approved by the Operating

⁶⁴ LEI-DR-01-003 CONF.

⁶⁵ LEI-DR-01-001.

Committee. [REDACTED]

[REDACTED]⁶⁶

From the time OVEC joined PJM in 2018 until 2020, OVEC's strategy for the Kyger Creek and Clifty Creek units (except for Clifty Creek Unit 6) was to self-schedule the resource, which is consistent with the sponsor-approved Operating Committee procedures, to make sure the units were in service and available for dispatch in the DA market. The only time that this was not done was [REDACTED]

[REDACTED]⁶⁷

Unit 6 at Clifty Creek was the only unit that was not self-scheduled; it was (and is) offered based on economics during summer ozone non-attainment periods.⁶⁸

In 2020, owing to low energy prices, OVEC units were committed on an economic basis, rather than self-scheduled (i.e., offered as "must-run") during some parts of the year, as discussed below.⁶⁹

5.3.4 DEO's involvement in the energy offer process

Every business day, for each hour for the next 21-day period, DEO independently projects the expected energy market revenues from units operating in the PJM market, the variable costs to operate the unit at the forecasted unit hourly loading, as well as the resulting hourly energy margin, all of which is summarized in the Daily Profit and Loss Analysis report (see Figure 22).⁷⁰ This analysis is mainly used to monitor the expected energy market profitability from commitment of the OVEC units. If DEO observes a period in which the units are expected to be out of the money and therefore should not be committed, DEO informs OVEC, and this option is then discussed in the Operations Committee.⁷¹ In addition, DEO forecasts OVEC unit generation,

⁶⁶ LEI-DR-01-005 CONF Attachment A: OVEC Operating Procedures effective November 15, 2019.

⁶⁷ LEI-DR-01-003 CONF.

⁶⁸ In the summer, ozone is easily formed through the interaction with heat and sunlight, and as temperatures change throughout the day, so do the levels of ozone. The non-attainment status is based on the 3-year average of the 4th highest daily concentrations over an 8-hour period, as of July 31, 2019, EPA designated 51 non-attainment areas under the 2015 8-hour Ozone NAAQS, including part of Ohio and Indiana.

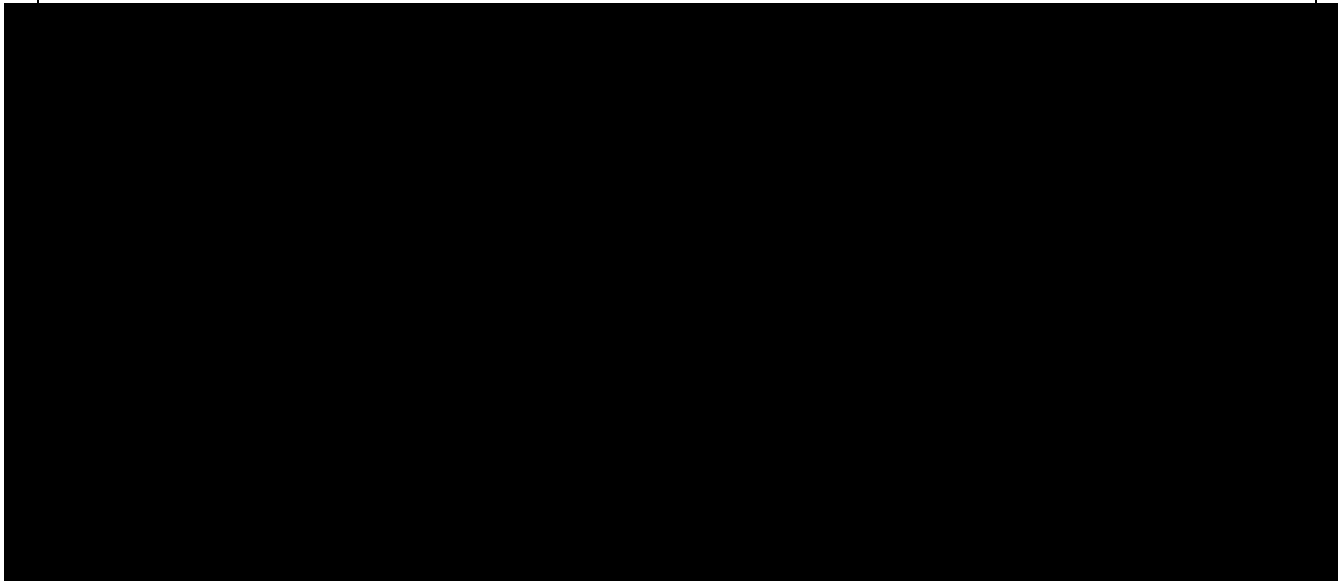
⁶⁹ LEI-DR-01-003 CONF.

⁷⁰ LEI-DR-01-003 CONF.

⁷¹ LEI-DR-01-003 CONF.

energy revenue, variable costs, and energy margin for a longer-term basis (up to 5-years) through the GenTrader model.⁷²

Figure 22. Sample of DEO's Daily Profit and Loss Analysis report



Source: LEI-DR-02-001 CONF Attachment.

The Operating Committee unanimously allowed OVEC management to offer units as must-run or based on economics temporarily, from April 14, 2020 through June 30, 2020. The decision was based on “multiple considerations, including COVID-19 staffing and related safety issues, operational requirements, and coal contract requirements and related potential liquidated damages.”⁷³

LEI recommends that DEO and the other members of the Operating Committee allow this flexibility on an ongoing basis. Financial risk is minimal because if a unit is offered based on economics and PJM needs to dispatch it, PJM will provide uplift payments to make whole the entire cost of operation (as discussed previously in Section 3.1.2). Therefore, ideally, the units would be committed based on economics all or most of the time. However, coal plants are generally not designed for this kind of operation, and repeated start-up of coal plants can damage equipment. Periods of non-operation also cause difficulties in managing staffing and fuel deliveries.

5.3.5 DEO's engagement in OVEC Operating Committees

The OVEC Operating Committee consists of one member from OVEC and one member from each of the Sponsoring Companies (if two or more Sponsoring Companies are affiliates, they can only

⁷² LEI-DR-01-003 CONF.

⁷³ LEI-DR-01-003 CONF.

have one member appointed to the Operating Committee). In support of ICPA, the Operating Committee establishes and modifies OVEC's scheduling, operating, testing and maintenance procedures, including the establishment or modification of "(1) procedures for scheduling delivery of available energy; (2) procedures for power and energy accounting; (3) procedures for the reservation and scheduling of firm and non-firm transmission service under the Tariff for the delivery of Available Power and Available Energy; (4) the Minimum Generating Unit Output; and (5) the form of notifications relating to power and energy and the price thereof."⁷⁴ Additionally, the Operating Committee provides recommendations to OVEC's Board of Directors when other problems arise which may affect the transactions under the ICPA. In order to reach a decision, the OVEC Operating Committee must receive at least two-thirds of the affirmative vote from the members, regardless of the number of participating members at any meeting.⁷⁵

DEO confirmed that the OVEC Operating Committee held one in-person meeting and one conference call in 2020. DEO appointed representatives to participate in all the meetings (see Figure 23).

Figure 23. DEO's participation in OVEC Operating Committee meetings in 2020

Meeting date	Meeting type	DEO's representatives in attendance	Subject
April 14, 2020	in-person	2	Discuss providing OVEC the ability, on a temporary basis (to May 31, 2020), to offer the units economic or must run due to direct and indirect impacts of COVID-19 pandemic
May 6, 2020	virtual	3	OVEC Operating Committee annual meeting

Source: LEI-DR-01-006 CONF.

The OVEC Operating Committee annual meeting, held on May 6, 2020, covered a variety of topics such as DOE Arranged Power Agreement Termination and System Reconfiguration Update, fuel updates and coal strategy, participation in the PJM regulation market, review of economic offers, ACES updates, environmental compliance update, power costs, and review of operational and financial performance and transmission revenue (see Figure 25). The OVEC Operating Committee's conferences served to review the operating and financial performances of OVEC as well as to discuss relevant updates in the PJM market. Figure 24 demonstrates the operational and financial performance data presented in the 2020 OVEC Operating Committee annual meeting. The minutes of the meeting were recorded by a Committee Chair-appointed Recording Secretary and saved in an electronic format.⁷⁶

⁷⁴ LEI-DR-01-050 Attachment.

⁷⁵ LEI-DR-01-050 Attachment.

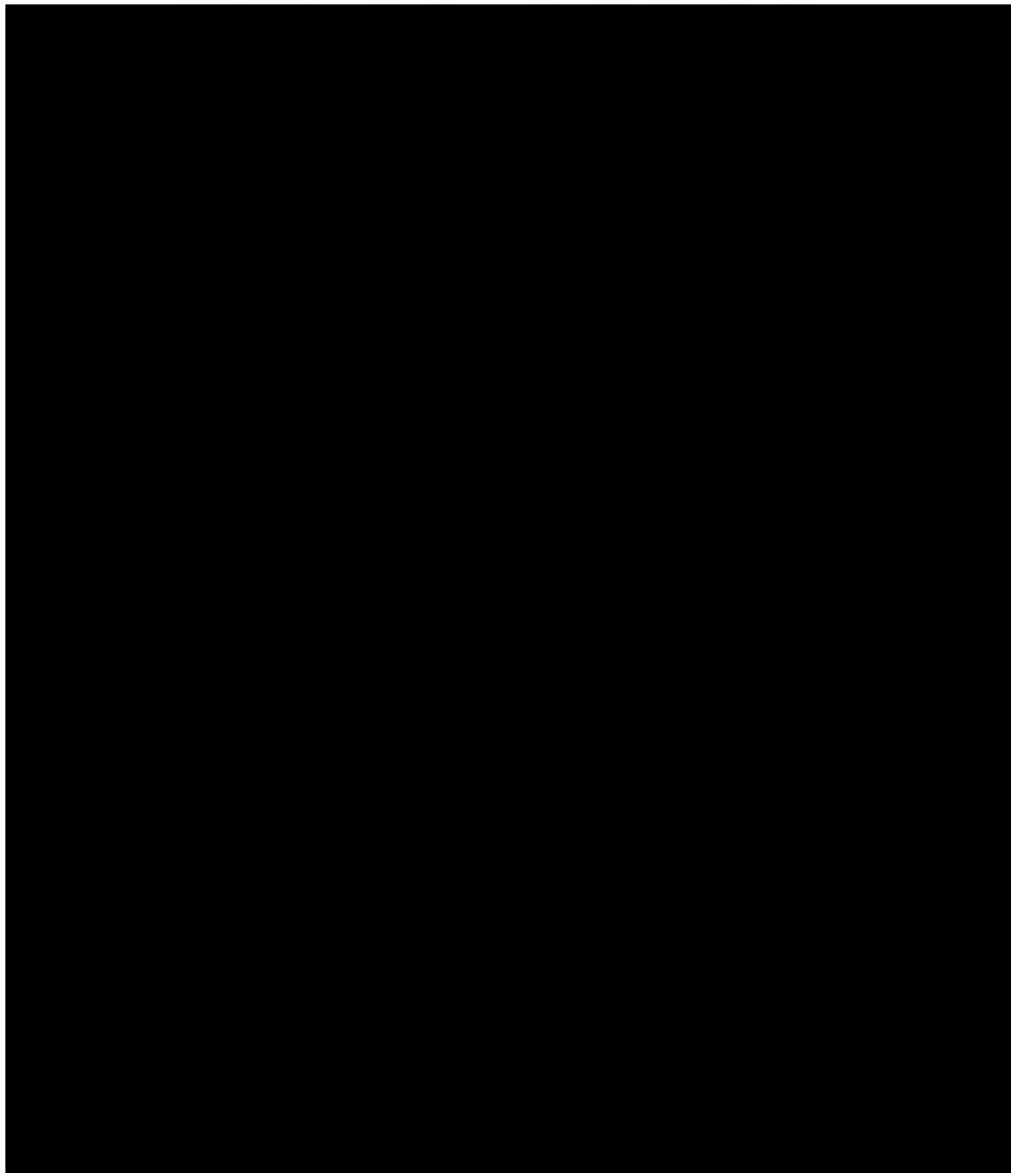
⁷⁶ LEI-DR-01-011.

Figure 24. OVEC operational and financial performance - 2020 OVEC Operating annual meeting

LEI believes DEO is well represented in OVEC Operating Committee's meetings based on its active engagement, and meeting notes that were appropriately documented by DEO.⁷⁷

⁷⁷ LEI-DR-01-006 CONF Attachment A.

Figure 25. OVEC Operating Committee May 6,2020 agenda and notes



Source: LEI-DR-01-006 CONF Attachment A.

5.3.6 OVEC's participation in the PJM stakeholder process

OVEC is a full member of PJM, and therefore has a multifaceted approach to participating and following developments in the PJM market, including attending via teleconference and/or in person various stakeholder meetings (e.g., Market Implementation Committee, Markets and Reliability Committee, Operating Committee, Planning Committee, Stakeholder Process Training, and the Tech Change Forum). In addition, multiple OVEC personnel subscribe to various PJM email lists associated with the stakeholder groups for additional awareness of

ongoing events and updates at PJM. Sponsoring Companies also contact OVEC to ensure that OVEC is aware of any applicable changes that may affect its operations in the PJM market.⁷⁸

5.3.7 Capacity market

DEO, through its ownership share of OVEC, offered capacity into the PJM annual BRA auctions, for the RTO Locational Delivery Area (“LDA”) during the audit period of January 1 through December 31, 2020.⁷⁹ As noted previously, the BRA capacity auctions are held three years before the delivery year. DEO noted that the BRAs for delivery in 2020 (both the 2019/20 and 2020/21 auctions) took place before OVEC joined PJM on December 1, 2018.⁸⁰

DEO offered its OVEC share as a Capacity Performance (“CP”) resource into the 2019/2020 BRA and the 2020/2021 BRA.⁸¹ These auctions were held in 2016 and 2017. DEO’s offer increased from a maximum of 150 MW in the 2019/2020 BRA to a maximum of 160 MW in the 2020/2021 BRA, reflecting a lower equivalent forced outage rate (“EFOR”)⁸² of 15%, down from 20% the previous year. PJM expected 20 performance assessment hours (“PAHs”) based on the latest historical performance hours under CP, which was the same as 2019/2020 BRA.⁸³

DEO utilized an indifference curve offer methodology to determine the bid price and quantity (see Figure 26). For example, if the number of expected PAH is 20 hours, and the assumed EFOR for a plant is 15%, then DEO’s indifference offer price would be [REDACTED]/MW-day (see 15% EFOR column in first part of Figure 26). This indifference price (the break-even offer price at which participating in the auction yields the same amount of expected net revenue as the option of not participating) determines DEO’s variable offer price in the BRA. DEO then calculates the impact of its BRA offer price on expected net revenues from the BRA, for various levels of capacity offers. For example, at \$[REDACTED]/MW-day, a capacity offer of 160 MW would earn [REDACTED] (see “P&L” column in second part of Figure 26). The profit and loss (“P&L”) calculation performed by DEO explicitly incorporates performance bonuses as well as performance penalties. These are based on PJM’s auction parameters, and the EFOR and PAH assumptions shown in Figure 26. For example, as the number of event hours goes up, the performance bonus initially increases because there are more hourly opportunities to earn a bonus. However, the performance bonus begins to decline after 120 MW offers, because the higher share of the total offer that 120 MW represents of

⁷⁸ LEI-DR-01-007.

⁷⁹ LEI-DR-01-013.

⁸⁰ Ibid.

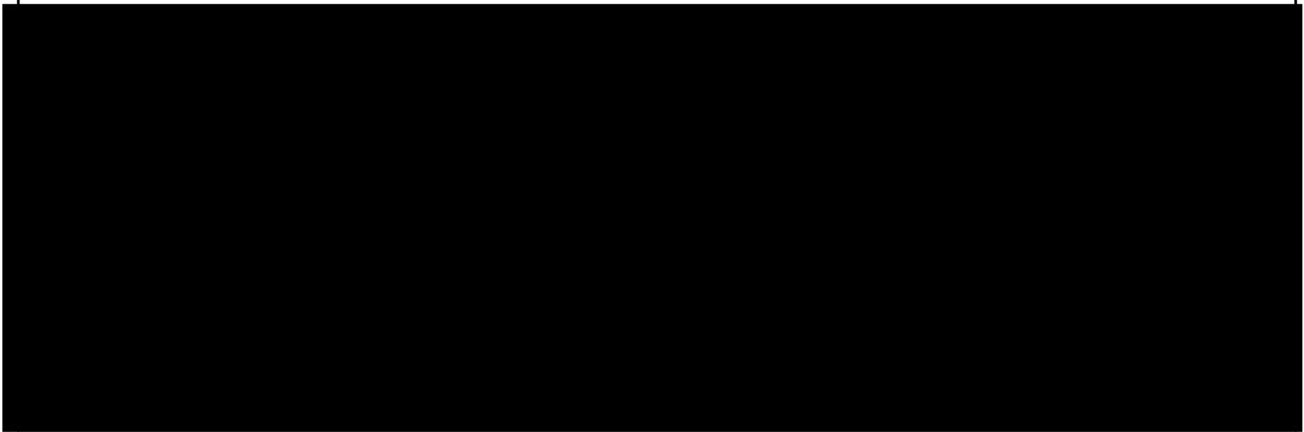
⁸¹ Capacity Performance Resource: A generating unit, demand resource, or energy efficiency resource that has obligated itself to deliver electricity whenever PJM determines it is needed to meet power system emergencies (Source: PJM Glossary).

⁸² Equivalent Forced Outage Rate (“EFOR”): A measure of the probability that generating unit will not be available due to a forced outage or forced deratings when there is a demand on the unit to generate (Source: PJM Glossary).

⁸³ LEI-DR-01-002 CONF.

the total 160 MW which DEO could offer means there is less spare capacity that DEO could use to overperform and earn higher bonuses. DEO updates the model's parameters based on historical data and expected results.⁸⁴

Figure 26. DEO indicative indifference curve offer methodology for Delivery Year 2020/2021 sample



Source: LEI-DR-01-002 CONF Attachment 2.

DEO offered 160 MW at \$[REDACTED]/MW-day at the high end of their indifference curve, and [REDACTED]/MW-day at the low end (20 MW) (see Figure 27), and eventually sold [REDACTED] MW of CP at [REDACTED]/MW-day in the 2020/2021 BRA.⁸⁵ LEI reviewed DEO's methodology in detail and believes the use of indifference curves to develop capacity offers is prudent, because it incorporates specific and transparent assumptions about risk, and the tradeoff between the possibility of bonus payments on the one hand, and penalties on the other .

Figure 27. DEO's price (\$/MW-day) and volume (MWs) offer pairs in the 2020/2021 RPM BRA auction.

Offer Price (\$)	[REDACTED]
Aggregate Offer Quantity (MW)	
Event Hours For Indifference	

Source: LEI-DR-01-002 CONFIDENTIAL

The BRA clears based on the highest-priced unit needed to meet demand ("pay as cleared").⁸⁶ In the PJM 2020/2021 BRA, not all of DEO's capacity offer pairs cleared the market because some had [REDACTED] clearing price in the PJM RTO LDA.

⁸⁴ Ibid.

⁸⁵ LEI-DR-01-002 CONF.

⁸⁶ PJM Manual 18. P. 34. <<https://www.pjm.com/~media/documents/manuals/m18.ashx>>

Figure 28. PJM RPM Base Residual Auctions (“BRA”) CP results (\$/MW-day)

Zone	2017/2018	2018/2019	2019/2020	2020/2021	2021/2022
RTO	\$120.00	\$164.77	\$100.00	\$76.53	\$140.00

Source: PJM Interconnection. 2021-2022-base-residual-auction-report.

The RPM construct is evolving as PJM continuously evaluates the markets it administers. DEO should keep monitoring developments in the capacity market.

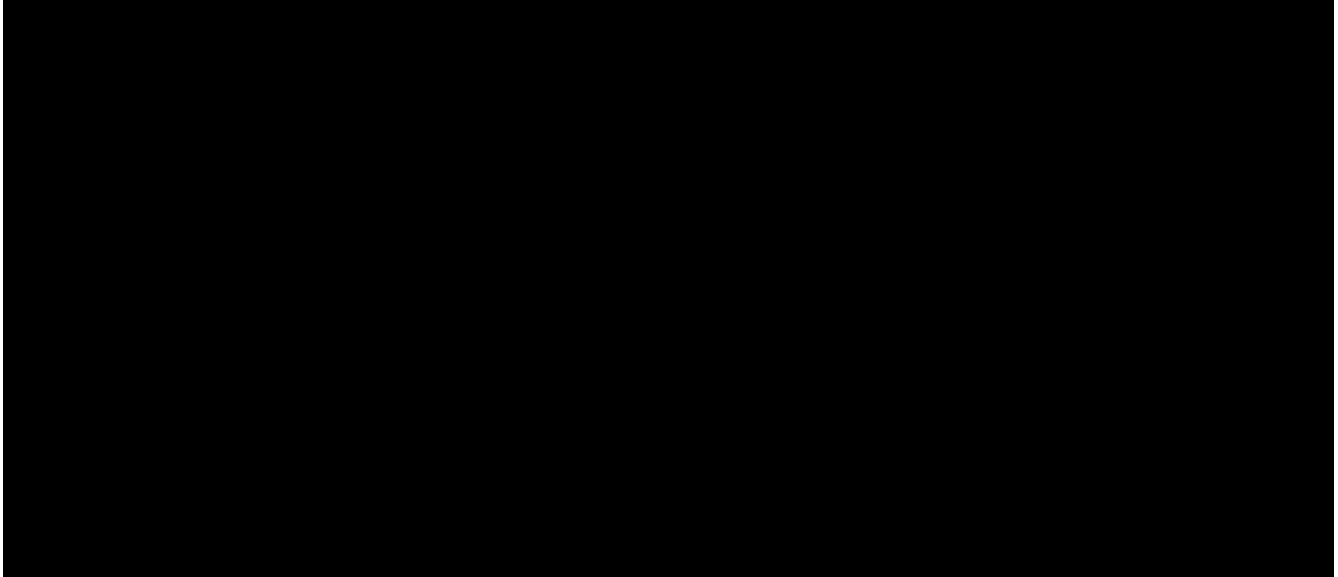
5.3.8 Ancillary services

In PJM, some A/S are provided by resources by default, based on the unit being online and integrated into the PJM system. These A/S are Synchronized Reserve, Day Ahead Scheduling Reserves, and the Balancing Operating Reserves associated with units that are online, but not fully loaded.⁸⁷ Units are paid if these services are called upon by PJM, but the unit owners do not make specific A/S offers. Other A/S are provided in separate markets, as detailed previously in Section 3.

DEO earned revenues in 2020 by supplying Synchronized Reserves and Day Ahead Scheduling Reserves. It incurred charges for Balancing Operating Reserves (see Figure 29). Between January 1, 2020 and May 31, 2020, DEO received 10.5239% of the cleared and deployed ancillary services charges and credits from OVEC units, and 9.9591% starting on June 1, 2020 (remaining at this percentage currently).⁸⁸

⁸⁷ LEI-DR-01-004 CONF.

⁸⁸ LEI-DR-01-010.

Figure 29. Prorated monthly DEO A/S net earnings

Source: LEI-DR-01-012 CONF Attachment C and LEI-DR-01-001 SUPP CONF Attachment C provided in the previous audit.

Currently, OVEC units are not providing Regulating Reserves.⁸⁹ OVEC hired a third-party consultant to conduct a study (which is in progress) and provide recommendations on the risks and potential opportunities of OVEC's participation in additional ancillary services markets, such as regulation.⁹⁰ A final report is expected to be issued in the first quarter of 2022.⁹¹ DEO noted that OVEC units are not technically capable of supplying Non-Synchronized Reserves and Black Start Reserves.⁹²

5.3.9 OVEC variable costs versus energy prices

There were times in 2020 during which the PJM DA prices did not cover the variable costs of running the plants. Under such circumstances, units which are self-scheduled incur losses for their owners; but economically committed units would receive an uplift payment to cover costs if day-ahead prices do not cover variable costs, as noted previously. LEI examined all twelve months in 2020; on a monthly average basis, PJM prices at the DEOK hub were lower than OVEC energy charges for most months in 2020, with the exception of July and December (see Figure 30).

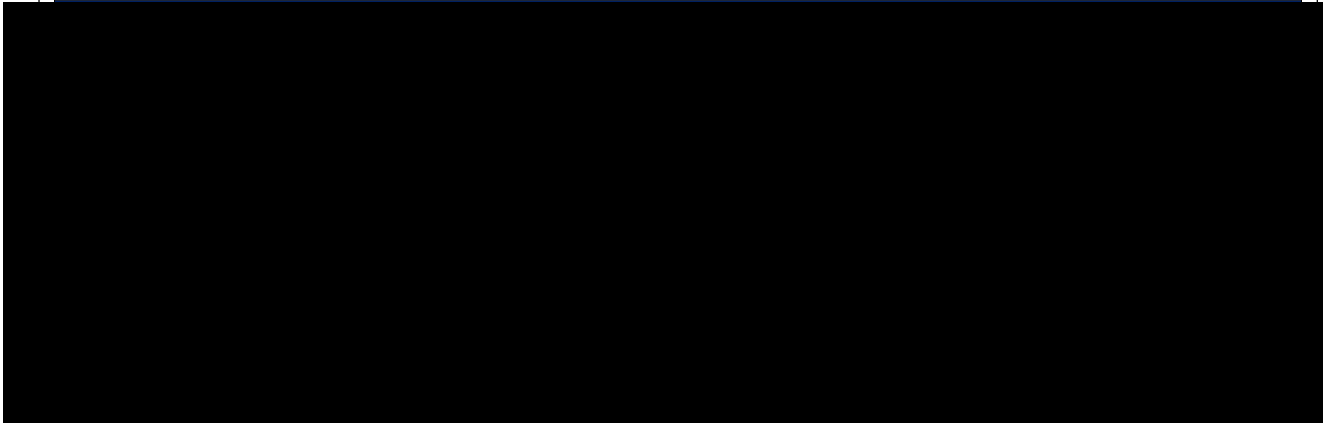
⁸⁹ LEI-DR-02-004.

⁹⁰ LEI-DR-01-004.

⁹¹ LEI-DR-02-002.

⁹² LEI-DR-01-011 CONF provided in the previous audit.

Figure 30. OVEC energy charges and monthly average PJM market prices at DEOK hub



Source: LEI-DR-01-022 CONF Attachment 1 and third-party data provider (DEOK Day Ahead LMP - Monthly Average).

5.4 Recommendations

Overall, LEI finds the OVEC energy management group organization and staffing are adequate, and that procedures are thorough and well documented. OVEC and DEO have multiple channels to actively participate in the PJM market developments and are well informed of the PJM market.

LEI makes the following recommendations:

- **Must-run offer strategy:** LEI believes the change to OVEC's must-run strategy due to COVID-19, as noted in Section 5.3.4, was prudent, compared with allowing must run commitment only. DEO should encourage the Operating Committee to allow OVEC the option to commit available units based on must-run or economics on an ongoing basis. Based on cost information (start-up costs, minimum run time, etc.) that OVEC would provide to PJM, PJM would dispatch the resource if it is economic. Ideally, the units would be committed based on economics all or most of the time, but LEI is aware that this can be an issue for coal plants, which are designed to operate continuously. LEI would not expect to see the plants committed based on economics all the time, but the option to do so provides additional flexibility and could reduce costs for customers.
- **OVEC Operating Committee:** LEI recommends that DEO encourage the OVEC Operating Committee meetings to be held more frequently to receive more timely updates on each plant's operating performance, cost of service, and profit/loss statements for market-based revenues derived from the PJM markets.
- **Offer strategy in PJM RPM auction:** LEI believes DEO's RPM offer strategy is prudent and has no recommendations.
- **Ancillary service market:** LEI notes that OVEC is evaluating the pros and cons of supplying Regulating Reserves in the PJM market. LEI agrees this will be a useful evaluation.

6 Fuel and variable costs

6.1 Coal procurement

6.1.1 Scope and background

6.1.1.1 Scope

Fuel and variable cost expenses comprise a significant portion of OVEC's costs to DEO's customers. American Electric Power ("AEP"), OVEC's largest Sponsoring Company, provides coal procurement related services for OVEC, via its American Electric Power Service Corporation ("AEPSC") subsidiary.⁹³ AEPSC's regulated Fuel Procurement organization has the responsibility for coal procurement, coal transportation and logistics, as well as coal inventory policy and management for the Kyger Creek and Clifty Creek power stations.⁹⁴ These procurement practices and outcomes impact DEO's ratepayers and, therefore, are within the scope of this audit.

This chapter addresses the following topics:

- overview of the coal and transportation procurement processes;
- purchasing process oversight;
- actual coal burn and forecast;
- overall approach to procurement and examination of sample contracts; and
- analysis of delivered coal costs and efficiency;

In coming to LEI's conclusions, LEI issued formal data requests and conducted additional research.

6.1.1.2 Background

As described in more detail below, AEPSC is the organization in charge of procuring fuel, reagents, and transportation for OVEC.

OVEC's two coal plants are nearly identical in design, construction, and operation. The plants were designed to burn bituminous coal from the Illinois Basin and Northern Appalachia regions, and came online in 1955/56.

6.1.2 Evaluative criteria

LEI focused its audit of the coal procurement process on answering the following questions:

⁹³ LEI-DR-01-014.

⁹⁴ LEI-DR-01-014 CONF Attachment A.

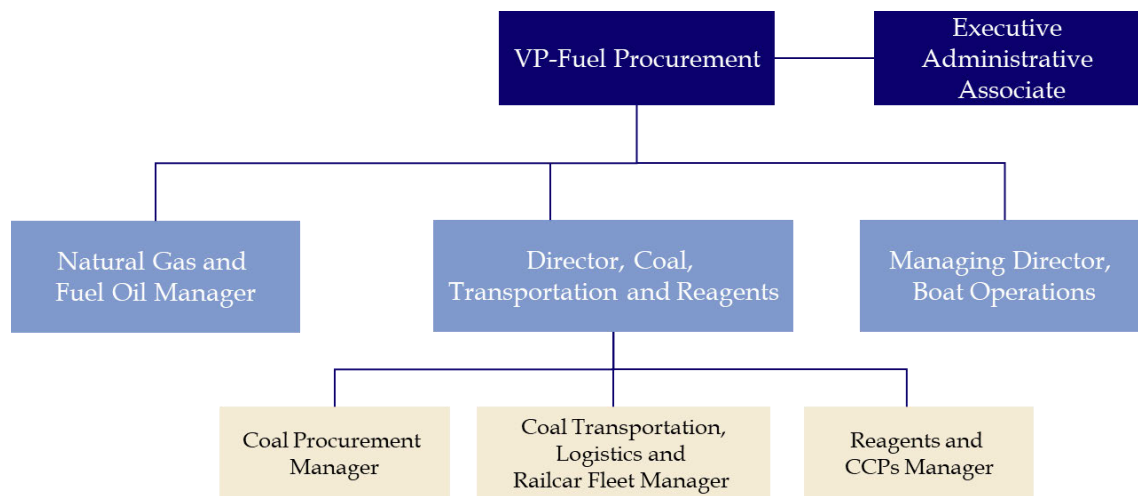
1. Does the coal procurement process provide for sufficient visibility and executive attention?
2. Does OVEC project future deliverability needs and adjust its portfolio to take advantage of new opportunities and/or avoid potential risks?
3. Does OVEC have a strategy in place to maintain a reliable coal supply at a reasonable cost to customers?
4. Does OVEC's long-term vs spot procurement strategy appropriately balance risk and costs?
5. Do contract terms reflect market awareness and prudence?
6. Is OVEC's coal procurement process conducted in an appropriately formal manner? Is there analytic rigor, oversight and management attention, and documentation of procurement decisions?
7. Were there any material issues or concerns with coal contract compliance or any disruptive events?

6.1.3 Findings and conclusions

6.1.3.1 AEPSC's fuel department organization

AEPSC's Regulated Fuel Procurement Policy and Procedures summarize the roles and responsibilities of the various groups within the regulated Fuel Procurement ("FP") organization as they pertain to the procurement of fuel, reagents, and transportation. The regulated FP organization operates within the Commercial Operations organization of AEPSC; it is led by a VP of fuel procurement, who reports to the Senior Vice President ("SVP") of the Commercial Operations organization of AEPSC (see Figure 31).

Figure 31. AEPSC regulated Fuel Procurement organization



Source: LEI-DR-01-014 CONF Attachment A. ("American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018").

AEPSC provides procurement and transportation services for the fleet of power plants owned and operated by AEP and its regulated operating companies, as well as OVEC and IKEC. AEPSC's regulated FP department is responsible for *"procuring all the fuel (coal, natural gas, and fuel oil), reagents (trona, urea, lime, limestone, activated carbon, sodium bicarbonate, anhydrous ammonia, calcium bromide) and associated transportation services required by the applicable power plants, including the management and operation of the River Transportation Division's barges and tow boats for delivery of coal and some reagents."*⁹⁵ This organization also provides AEP's Commercial Operations organization with "current market-based pricing information for generation-related functions on behalf of the regulated operating companies, OVEC, and IKEC."⁹⁶

The regulated FP organization *"communicates with the Production Optimization and the Bid, Offer and Cost Development groups on a daily and monthly basis so that the load forecasts and fuel purchasing are effectively coordinated to make sure plants are receiving adequate supplies of fuel to meet the planned dispatch for generating units over the short-term."*⁹⁷ In terms of long-term procurement planning, the regulated FP works with groups like the Corporate Planning and Budgeting organization which is responsible for developing the Integrated Resource Plan ("IRP"). In addition, the regulated FP organization provides support for fuel-related regulatory activities in response to state and federal agency requirements.⁹⁸

In the regulated FP organization, the Vice President ("VP") has the ultimate responsibility to make sure the generating stations of OVEC (Kyger Creek and Clifty Creek) maintain appropriate and reliable supplies of fuel and reagents in compliance with generating unit requirements, environmental regulations, and transportation.

The Directors and Managers of regulated FP oversee the development, negotiation, execution, and administration of supply and transportation agreements. The Directors and Managers performing the regulated FP organization's functions report to the VP of the regulated FP.⁹⁹ Under the direction of the management, the employees of the regulated FP organization attend meetings and conferences related to fuel, reagents, and transportation, and they also participate in regulatory proceedings when required. The regulated FP periodically reviews and considers changes to the regulated Fuel Procurement Policy and Procedures.¹⁰⁰

⁹⁵ Regulated Fuel Procurement Organization. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

⁹⁶ Ibid.

⁹⁷ Ibid.

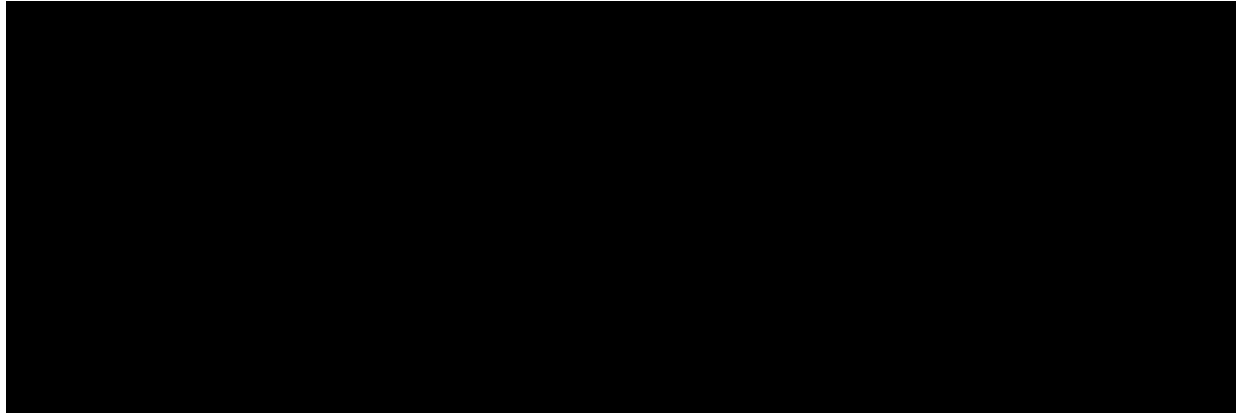
⁹⁸ "General administrative duties." LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

⁹⁹ Ibid.

¹⁰⁰ "General administrative duties." LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

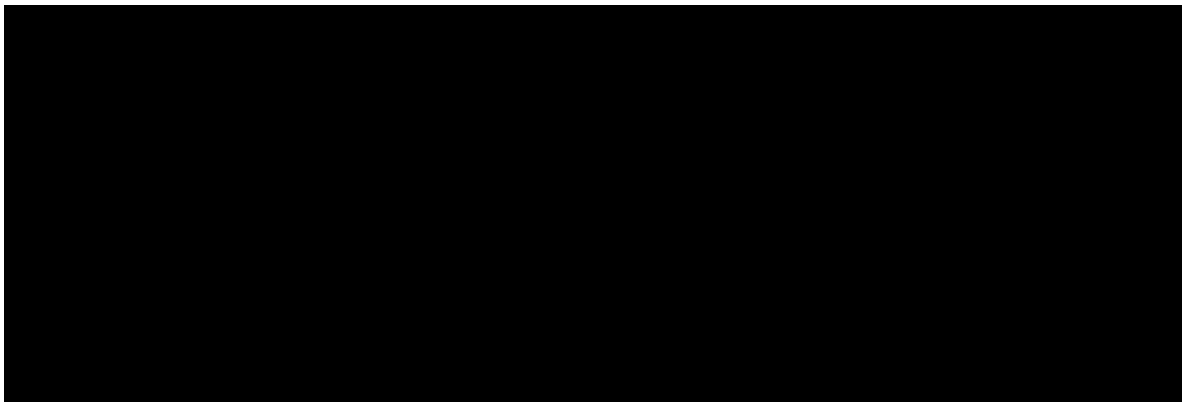
year and future years.¹⁰³ For the near term (upcoming year), forecasts are prepared during the annual budgeting process and finalized in November, then updated in June or July, in the middle of the budget year. Figure 33 and Figure 34 show forecasted coal burns compared with actual coal burns. Coal volume burned at both plants was consistently lower than the forecast.

Figure 33. Actual coal consumed versus monthly forecast estimate, Clifty Creek



Source: LEI-01-020 CONF Attachment 1 and LEI-3-001 Attachment.

Figure 34. Actual coal consumed versus monthly forecast estimate, Kyger Creek



Source: LEI-01-020 CONF Attachment 1 and LEI-3-001 Attachment.

6.1.3.4 Request for proposals for coal supplies

With respect to coal procurement RFPs, the regulated FP stipulates that with the VP's oversight, the RFPs should be issued to seek as many competitive offers as possible to obtain the lowest reasonable delivered cost over time, but the offers should comply with the state-specific requirements. Coal procurement RFPs can be issued *"both for long-term contracts or spot orders whenever appropriate and can be sent to any number of qualified suppliers so as to secure the competitive*

¹⁰³ LEI-DR-01-020.

price for the material or service needed."¹⁰⁴ All the purchase decisions made as a result of the RFPs should be documented to demonstrate that the Company acted prudently in procuring the commodity or service.¹⁰⁵

If unsolicited offers are received for commodities or services for short or long-term agreements, the regulated FP states that these types of offers can be considered and market-based indices, other contract prices or other reasonable methods of comparison should be used to determine whether it is prudent or not to accept those offers. If any of the unsolicited offers are accepted, similar to the RFP process, documentation should be prepared to explain the rationale for the decision.¹⁰⁶ LEI finds the practice of documenting all solicitation processes and outcomes is prudent.

If there are immediate and unavoidable circumstances requiring emergency procurement, *"the abovementioned formal approaches may be waived whenever the fuel or reagents must be purchased, or transportation services must be acquired."*¹⁰⁷ However, that should be the decision of the VP of the regulated FP organization, *"with the concurrence of the SVP of Commercial Operations and other senior management as needed."*¹⁰⁸ LEI recognizes the need for an emergency procurement process and deems it reasonable to implement such, given the joint decision of the VP, SVP, and other senior management in the absence of the formal process. However, appropriate documentation should still be prepared after the procurement and appropriate follow-up performed in order to help prevent such emergencies from happening again, and to help quickly locate commodity or service providers who can fill in any supply or transportation gaps.

During the audit period, DEO confirmed there were no RFP solicitations issued for coal supplies.¹⁰⁹

6.1.3.5 Coal supply sources

6.1.3.5.1 Supplier diversity

Based on OVEC's Coal Procurement Strategy provided in LEI-DR-01-024, OVEC states that their strategy of [REDACTED]

¹⁰⁴ Request for proposal. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

¹⁰⁵ Ibid.

¹⁰⁶ Request for proposal. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures. May 2018.

¹⁰⁷ Emergency procurement. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

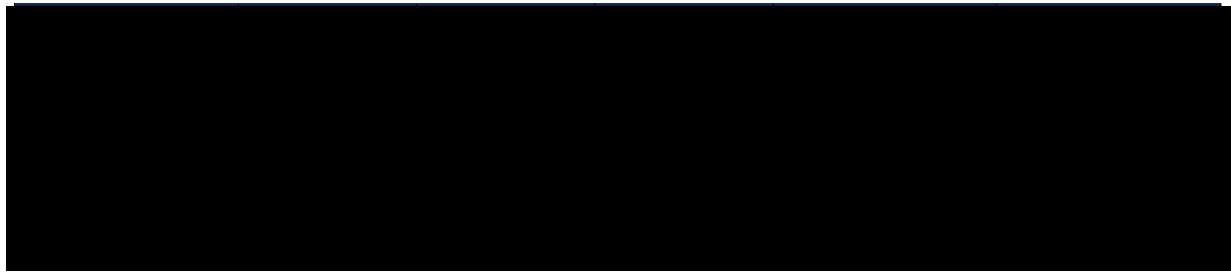
¹⁰⁸ Ibid.

¹⁰⁹ LEI-DR-01-017.

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During the audit period, Clifty Creek was served by variety of coal suppliers sourcing from the Illinois Basin. The table below shows a list of coal suppliers/sellers for Clifty Creek, the amount of coal procured, and the average unit price (see Figure 35). As mentioned before, OVEC did not execute new coal contracts in 2020. The coal contract with [REDACTED] which was entered into nearly ten years ago, [REDACTED] the rest of the coal supply contracts at an average delivered price of [REDACTED]/ton in 2020, followed by the coal contract with [REDACTED] with [REDACTED]/ton.

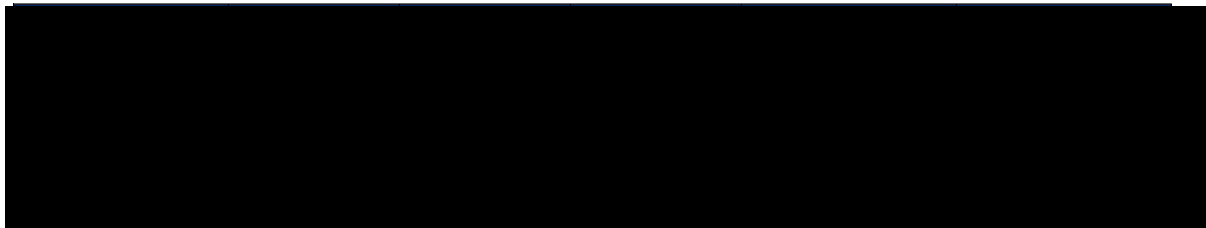
Figure 35. Coal procured for Clifty Creek Station, weighted average contract price



Sources: LEI-DR-01-019 CONF Attachment 2 and LEI-DR-01-018 CONF Attachments 3a, 3b, and 3c.

During the audit period, the majority of the coal procured for Kyger Creek was mainly Pittsburgh Seam/Northern Appalachia coal from [REDACTED] with another three smaller suppliers. Figure 36 below displays the list of suppliers for Kyger Creek, the volume of coal procured, and the average unit price. OVEC aims to maintain a seasonal inventory of 35-40 days of supply at Kyger Creek.¹¹¹

Figure 36. Coal procured for Kyger Creek Station, weighted average contract price



Note: [REDACTED] coal quality was specified in the contracts as “raw bituminous”. Generally, bituminous coals have heating values of 10,500 to 14, Btu/lb.

Sources: LEI-DR-01-019 CONF Attachment 2 and LEI-DR-01-018 CONF Attachments 2.

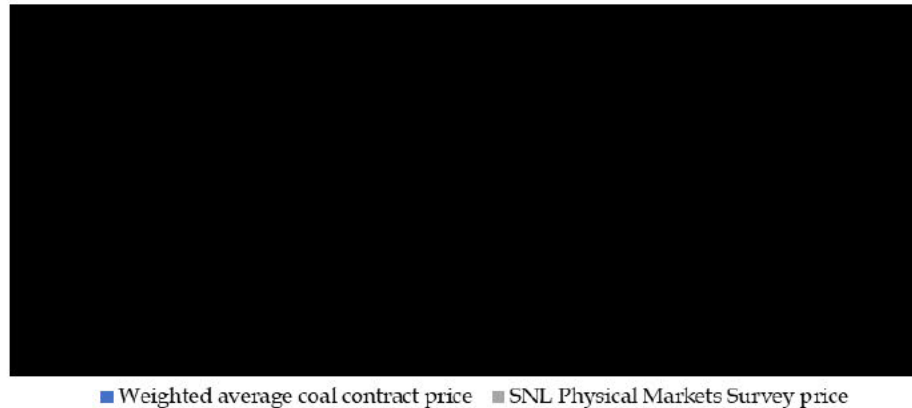
¹¹⁰ LEI-DR-01-024 CONF Attachment: Coal Procurement Strategy: Procurement Targets, Inventory Targets and Supplier Diversity.

¹¹¹ LEI-DR-01-024 CONF Attachment.

6.1.3.6 Coal spot price comparison

To assess the reasonableness of coal purchase prices during the audit period, based on the coal contracts provided by DEO, LEI compared the weighted average coal supply prices in 2020 for Clifty Creek and Kyger Creek against the spot prices from S&P Global Market Intelligence (formerly SNL) Physical Market Survey data, which Energy Information Administration ("EIA") also relies on as a primary source for coal commodity spot prices (see Figure 37 and Figure 38).

Figure 37. Weighted average coal contract price for Clifty Creek plant versus S&P Physical Market Survey price



Sources: LEI-DR-01-019 CONF Attachment 2 and third-party data provider.

Note: For Clifty Creek, the SNL Physical Market Survey price is the annual average of "Illinois Basin 11,000 5.00 Barge."

Figure 38. Weighted average coal contract price for Kyger Creek plant versus S&P Physical Market Survey price



Sources: LEI-DR-01-019 CONF Attachment 1 and third-party data provider.

Note: For Kyger Creek, the SNL Physical Market Survey price is the annual average of "Upper Ohio River 12,500 6.00 Barge."

LEI found that for the Clifty Creek plant, the coal purchase prices in 2020 were significantly higher (44%) than the spot prices from SNL. The high average price is mainly attributable to the expensive coal purchased from [REDACTED] through a contract entered into in 2012, which accounted for more than 40% of the total supply in 2020.

Coal prices for Kyger Creek plant were also higher (16%) than the S&P Physical Markets Survey prices. [REDACTED] is the largest coal supplier and provided more than 50% of the coal consumed by Kyger Creek. While the contract prices between [REDACTED] and OVEC might have been a good deal when the contract was secured, it is now above current market price.

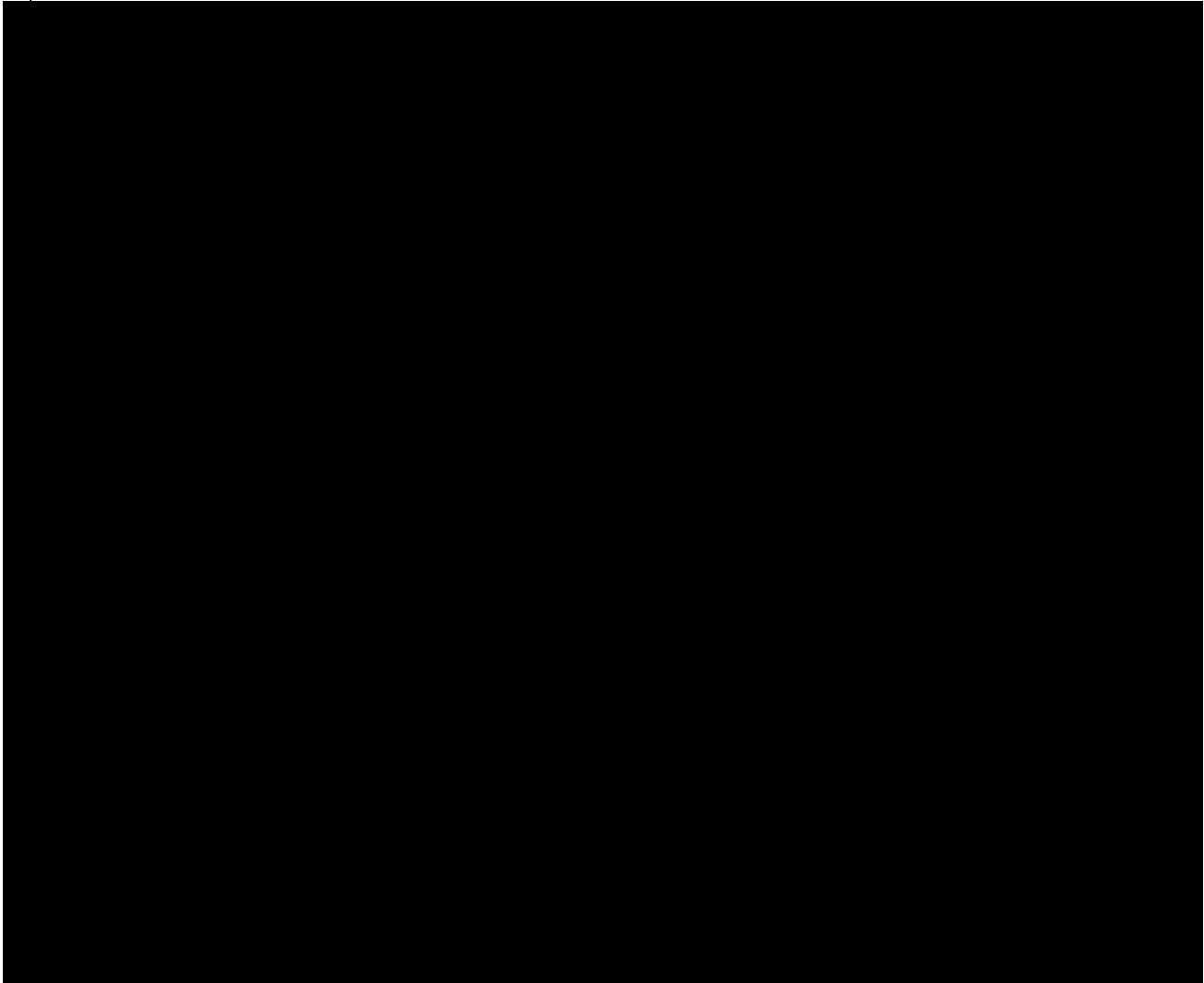
6.1.3.6.1 Interruption or loss of supply

OVEC's "Communication of Event" emergency strategy pertains to [REDACTED]

[REDACTED] OVEC has a very clear flow chart that covers what to report, and to whom, in the event of a loss of supply, in order to minimize losses and maintain regular operations (see Figure 39). DEO noted that OVEC has not ever had to utilize this process.¹¹²

¹¹² LEI-DR-02-006 and LEI-DR-02-030 CONF provided in the previous audit.

Figure 39. Communication of event process



Source: LEI-DR-01-024 CONF Attachment: Coal Procurement Strategy: Procurement Targets, Inventory Targets and Supplier Diversity.

6.1.3.7 Hedging policy

The regulated FP states the regulated FP organization may enter into fuel hedges to support key business objectives and reduce fuel price volatility. The primary means to do so is through a portfolio of physical supply agreements of various durations. They believe this *“portfolio ensures less volatile fuel prices, and it also allows some flexibility to leverage shorter-term pricing options when they become available.”*¹¹³

¹¹³ Hedging policy. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

Currently, the regulated FP group is not engaged in any financial fuel hedge transactions, citing the risk of losses and associated costs. But FP has not dismissed the option of evaluating hedging opportunities that may be settled financially. The implementation of specific operating company hedging programs would be subject to the appropriate regulatory approvals and cost recovery mechanisms.¹¹⁴

6.1.3.8 Coal and reagent quality specifications and compliance

AEPSC's Steam Generation Equipment Engineering ("SGEE") group defines the permissible coal specifications and sources for AEP's regulated operating companies' plants as well as OVEC's plants.¹¹⁵ These specifications and sources are utilized by the regulated FP organization to evaluate the coal offers from suppliers. [REDACTED]

[REDACTED]¹¹⁶ Periodically, new sources are considered through test burns to diversify the coal choice for each unit, which may lead to more favorable financial results. But new sources must be approved by SGEE before moving forward beyond the test burns.

The *"permissible reagent specifications and sources for AEP's regulated operating companies' plants, as well as OVEC's and IKEC's plants, are established by AEPSC's GET Engineering FGD Systems and Chemical Engineering."*¹¹⁷ Factors such as performance guarantees, profitability, service quality, and past experience are taken into account in the reagent proposals.

6.1.3.9 Coal contracts administration

The Energy Contracts and Confirmations group under Enterprise and Credit Risk Management of AEPSC administers the existing and proposed contractual agreements for the purchase and sale of coal, fuel oil, natural gas, reagents, transportation agreements, and ash marketing for OVEC.¹¹⁸ This group works with regulated FP Directors and Managers, Legal, Credit, Fuel Accounting, Audits, Regulatory Services, and power plant personnel to make sure that contracts appropriately represent the intended business relationship between the parties. They are also responsible for monitoring the regulated operating companies' rights and obligations under the existing contractual agreements.

¹¹⁴ Ibid.

¹¹⁵ Coal and reagent quality specifications and compliance. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

¹¹⁶ Ibid.

¹¹⁷ Ibid.

¹¹⁸ "Contract administration." LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

The support services from contract administration include the following:¹¹⁹

- *“Developing and/or reviewing contractual documents under existing and proposed agreements;”*
- *“Monitoring contractual deadlines with regard to volume elections, price reopeners, and term extension elections; issuing written notices to counterparties to inform regulated FP decisions;”*
- *“Determining contract value through pricing and rate development;”*
- *“Providing contractual review, such as analysis of proposed settlements, changes in law, governmental impositions, and other pricing claims;”*
- *“Managing data requirements for internal fuel administration systems which provide database of historical costs and volumes for invoice support and reporting requirements;”*
- *“Monitoring and reporting volume commitment status and tiered pricing under transportation agreements;”*
- *“Administering coal scale calibration adjustments including determination of any applicable pricing adjustments;”*
- *“Providing coal, reagent, fuel oil, natural gas, and transportation contract data for state and federal regulatory filing’s purpose;”*
- *“Administering Force Majeure claims initiated by the regulated FP or counter parties;” and*
- *“Providing accrual recommendations to the group responsible for fuel accounting.”*

6.1.3.10 Coal transportation and transportation costs

For OVEC’s operations, AEPSC’s regulated FP governs the coal transportation service procurement process to achieve compliance by the supplier and maintain adequate supplies of fuel and reagents to meet plant and system requirements.¹²⁰ The Coal Transportation, Logistics and Marketing group is responsible for the transportation of coal and other bulk commodities, logistics, and railcar leasing for OVEC’s power plants. They also manage the marketing activities of available capacity at Cook Coal Terminal. The Boat Operations group bears the responsibility for the management and operation of the River Transportation Division’s barges and tow boats for delivery of coal to the plants, and the delivery of some reagents. They have a contractual relationship with a large third-party barge operator for dispatching of the fleet, accounting, as well as cross-charter benefits.¹²¹

As discussed in 6.1.3.2, the procurement strategy for transportation service is to *“provide an appropriate amount of transportation with optimal supply flexibility, considering AEP’s long-term agreements and market conditions, at the lowest reasonable delivered cost over time.”*¹²² The

¹¹⁹ “Contract administration.” LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

¹²⁰ “Enforcement of agreements.” LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

¹²¹ “Organizational structure of regulated FP.” LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

¹²² “Regulated FP considerations.” LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

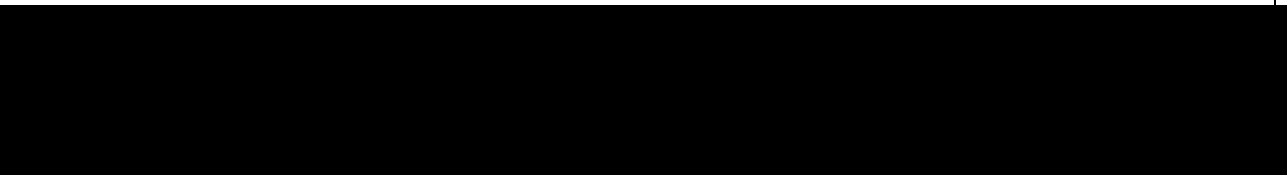
transportation service is “purchased with due consideration of all relevant factors, including: competitive pricing, the quantity needed to maintain an appropriate supply, the quality required to optimize the operating characteristics of the generating stations, the need to meet any applicable environmental standards, the production capability as well as the financial reliability of the supplier, existing contractual obligations, and the ability to address emergencies or other unusual circumstances.”¹²³

All the coal used by the Clifty Creek plant is delivered on the Ohio River, and all via barge transportation services provided by [REDACTED] [REDACTED]
[REDACTED]¹²⁴

All the coal used by the Kyger Creek plant is also delivered via barge on the Ohio River, but the service provider is [REDACTED] [REDACTED]
[REDACTED].¹²⁵

The transportation service cost represents the shipping cost per ton of coal from various shipping locations along navigable waterways (see Figure 40).

Figure 40. Coal transportation contracts



Notes:

1. Unit price via Ohio River for [REDACTED] range from [REDACTED] per ton depending on the coal loading points.
2. Unit price via Ohio River for [REDACTED] range from [REDACTED] per ton depending on the coal loading points.

Source: LEI-DR-02-007 CONF Attachments 1 and 2.

LEI compared OVEC’s transportation costs for the Clifty Creek and Kyger Creek Stations to the EIA average annual coal transportation costs using the EIA data set “Coal Basin to State by Waterway.” Given the limited publicly available data, for Kyger Creek Plant, LEI compared the actual annual average coal transportation cost of Northern Appalachian coal to Ohio via barge in 2019 and 2020 (see Figure 41). For the Clifty Creek Plant, the comparison was to average coal transportation costs for Illinois Basin coal in 2019 and 2020.¹²⁶ Figure 41 and Figure 42 show the costs for Kyger Creek and Clifty Creek compared to EIA transportation costs. In 2019, the transportation costs incurred by both plants were higher than the EIA but costs improved in 2020,

¹²³ Ibid.

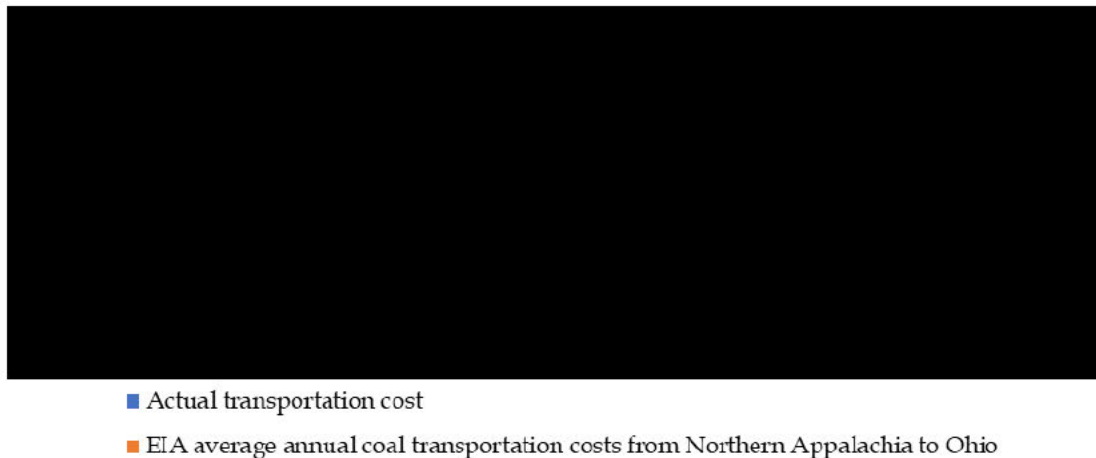
¹²⁴ LEI-DR-01-021.

¹²⁵ Ibid.

¹²⁶ Coal transportation costs from Illinois Basin to Indiana by waterway is withheld to avoid disclosure of individual company data in EIA website.

falling to levels closer to EIA averages. Overall, OVEC was able to secure competitive transportation costs to ship coal via barge to the two plants.

Figure 41. Kyger Creek plant coal transportation cost compared to EIA



Source: EIA data (Average Annual Coal Transportation Costs from Coal Basin to State by Waterway / 2020 data is preliminary); LEI-02-0057 CONF Attachments A and LEI-DR-02-007 CONF Attachment 2 provided in the previous audit.

Figure 42. Clifty Creek plant coal transportation cost compared to EIA



Source: EIA data (Average Annual Coal Transportation Costs from Coal Basin to State by Waterway / 2020 data is preliminary); LEI-02-005 CONF Attachments B and LEI-DR-02-007 CONF Attachment 1 provided in the previous audit.

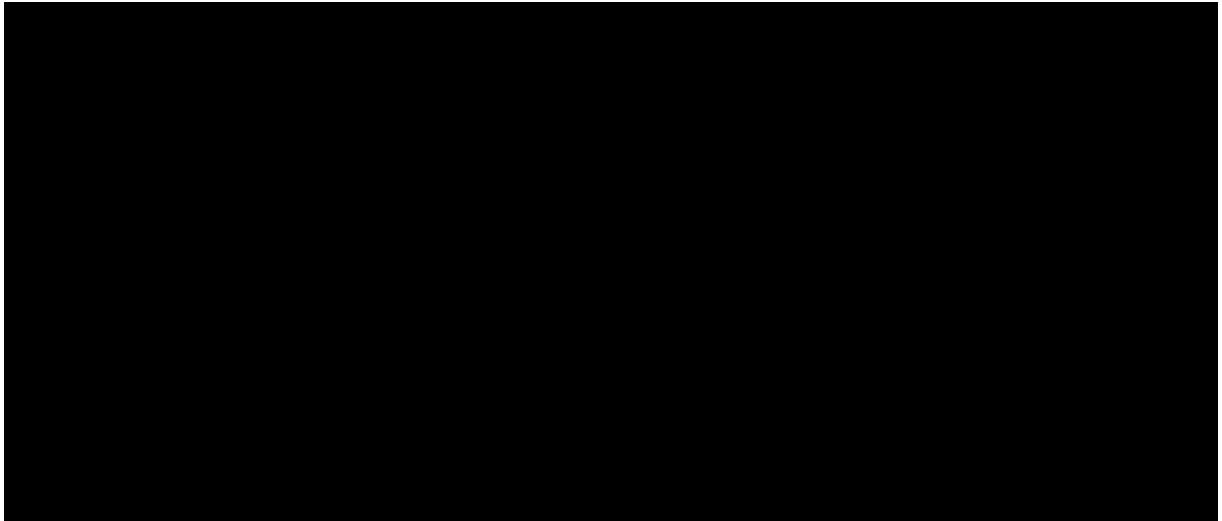
6.1.3.11 Additional costs

In addition to coal commodity and transportation, costs are incurred to procure and manage coal inventory for Kyger Creek and Clifty Creek. The reagent costs associated with pollution control facilities and allowances are the main variable costs incurred by OVEC to control emissions and

comply with environmental regulations. The reagents used in this audit period included trona, urea, limestone, and hydrated lime.¹²⁷

The reagent costs were somewhat higher in 2020 compared to 2019 and 2018 (see Figure 43). Allowance costs were also higher in 2020.¹²⁸

Figure 43. OVEC reagent costs



Source: LEI-DR-01-022 CONF Attachments; LEI-DR-02-020 CONF Attachments 1-24 provided in the previous audit; and third-party data provider.

6.1.4 Recommendations

Coal contract terms seem reasonable in terms of compliance with the coal procurement target strategy. Having long- and short-term contracts in place allowed for some volume flexibility. LEI believes the overall coal contracts reflect market awareness and prudence. While there were no formal internal audits conducted of the fuel procurement area, OVEC Management (including the COO, Environmental, Safety & Health Director, Treasurer, Plant Managers, and other OVEC management from the plant and the corporate office) holds a monthly coal strategy conference call with AEP Fuel Procurement.¹²⁹ These calls include discussions of procurement, inventory levels, planned unit outages, coal market, transportation, reagents and contract delivery or quality issues. The information discussed serves as a means of optimizing decisions and validating actions of procurement, inventory management and shipment/delivery.

LEI makes the following recommendations:

¹²⁷ LEI-DR-02-009.

¹²⁸ LEI-DR-01-022 CONF Attachments and LEI-DR-02-020 CONF Attachments 1-24 provided in the previous audit.

¹²⁹ LEI-DR-01-026 CONF.

- As illustrated in Figure 33 and Figure 34, the coal burn forecasts were consistently higher than the actual burns. LEI recommends that OVEC keep examining the process that creates these forecasts and conduct the forecast more frequently to reduce the discrepancies between the actual and estimated coal burns.
- The coal contract prices for Clifty Creek plant were higher than market prices in 2020. However, the [REDACTED] contract, which is a very large contract and the one which is most out of line with the current market, is set to expire at the end of 2021. LEI assumes that future contracts will reflect the lower prices currently prevailing in the market.

6.2 Coal inventory management

6.2.1 Scope and background

6.2.1.1 Scope

The regulated FP organization within AEPSC is responsible for coal inventory policy and management of the coal serving the Kyger Creek and Clifty Creek power stations. OVEC's procurement practices and outcomes related to coal inventories impact DEO's ratepayers, and are therefore within the scope of this audit.

This chapter addresses the following topics:

- overview of the coal inventory policy;
- coal inventory control and outcomes; and
- analysis of coal inventory costs and efficiency.

In coming to LEI's conclusions, LEI issued formal data requests and conducted additional research.

6.2.1.2 Background

Coal inventory management is an important part of reliably and optimally operating OVEC's coal power generation. Coal inventories provide protection against coal supplier default or delays in coal transportation. According to the regulated FP, its job is to ensure *"the availability of an adequate, reliable supply of fuel (and reagents) at the lowest reasonable delivered cost for the generation of electricity."*¹³⁰ An appropriate quantity of coal is supposed to be maintained at a plant.

6.2.2 Evaluative criteria

LEI focused its audit of coal inventory management on answering the following questions:

¹³⁰ Proper inventory levels. LEI-DR-01-014 CONF Attachment A. American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

1. Does the coal inventory policy provide for sufficient visibility and executive attention?
2. Did OVEC maintain an appropriate inventory level in compliance with Coal Inventory Policy to avoid excessive inventory surpluses or shortfalls by actively managing transportation capacity and commodity contracts?

6.2.3 Findings and conclusions

6.2.3.1 Coal inventory policy

The regulated FP states that a cross-functional team recommends a fuel inventory target, which is subject to the approval of senior management. The inventory target determination process helps to ensure that each plant's needs are met.¹³¹

During the audit period, OVEC considered the following factors when setting inventory targets: shipment distance to plant, lock risks, river conditions (i.e., water level or presence of ice), full load dispatch around the clock, maintenance/outage to plant and/or coal yard equipment (see Figure 44).

Figure 44. Coal inventory targets

	Kyger Creek	Clifty Creek
Fall/winter season		
Spring/summer season		

Source: LEI-DR-01-024 CONF Attachment: Coal Procurement Strategy: Procurement Targets, Inventory Targets and Supplier Diversity.

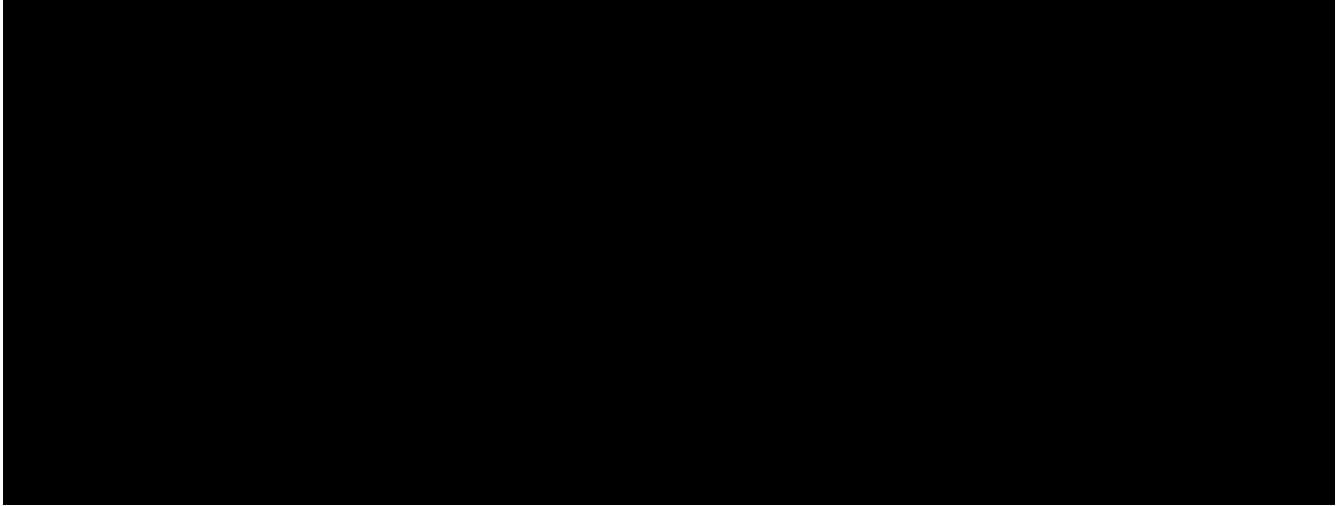
The full-load requirement depends on the units' summer and winter seasonal capability. Spring/summer capability is usually lower than winter by a few MW because of higher river temperatures (warm river water does not cool the plants as efficiently). The fall/winter season full-load inventory level of each power plant is higher than the spring/summer level.

¹³¹ LEI-DR-01-014 CONF Attachment A. "Proper inventory levels." American Electric Power Regulated Fuel Procurement Policy and Procedures May 2018.

6.2.3.2 Inventory control

Coal inventory levels at Clifty Creek averaged about [REDACTED] in 2020, compared to [REDACTED] in 2019¹³² (see Figure 45). The 2020 inventory levels remained significantly above OVEC's recommended seasonal inventory of [REDACTED] for the fall and winter seasons, and [REDACTED] for the spring and summer seasons.¹³³

Figure 45. Clifty Creek coal inventory level

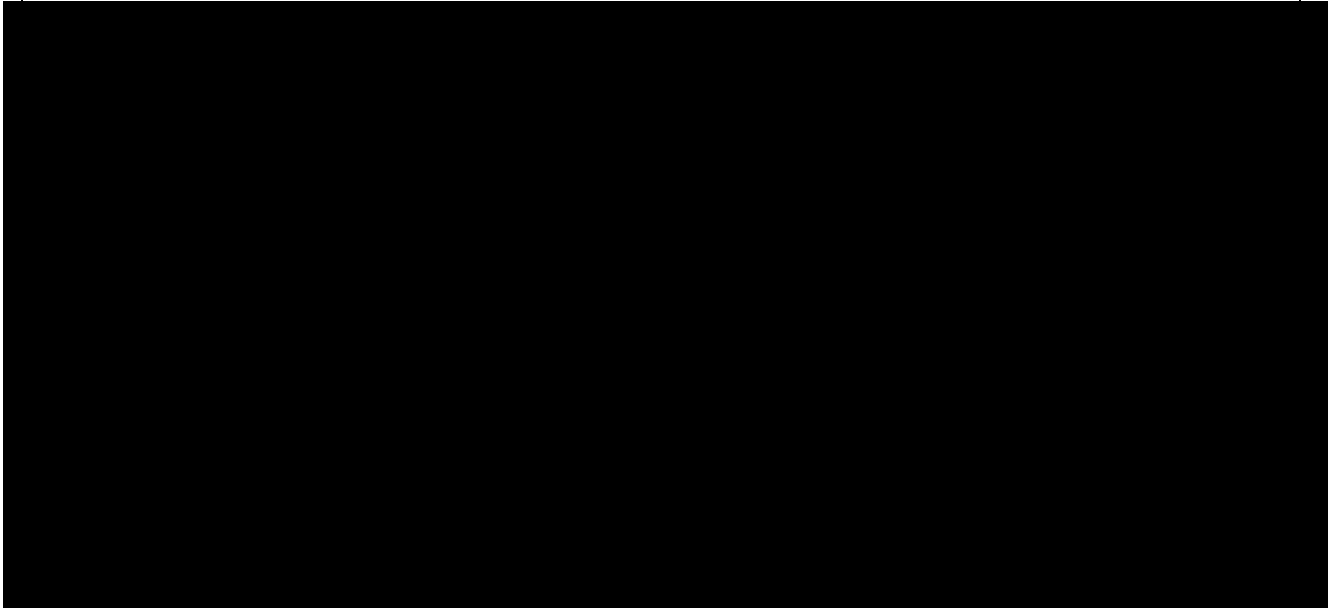


Source: LEI-DR-02-008 CONF Attachment.

¹³² PUCO. "Reply Comments of Duke Energy Ohio, Inc." In the Matter of the Review of the Reconciliation Rider of Duke Energy Ohio, Inc. / Case No. 20-167-EL-RDR. Filed August 1st, 2021.

¹³³ LEI-DR-01-024 CONF Attachments.

Figure 46. Clifty Creek historical generation and capacity factor



Source: LEI-DR-01-046 CONF Attachment 2 and LEI-DR-05-005 CONF Attachment provided in the previous audit.

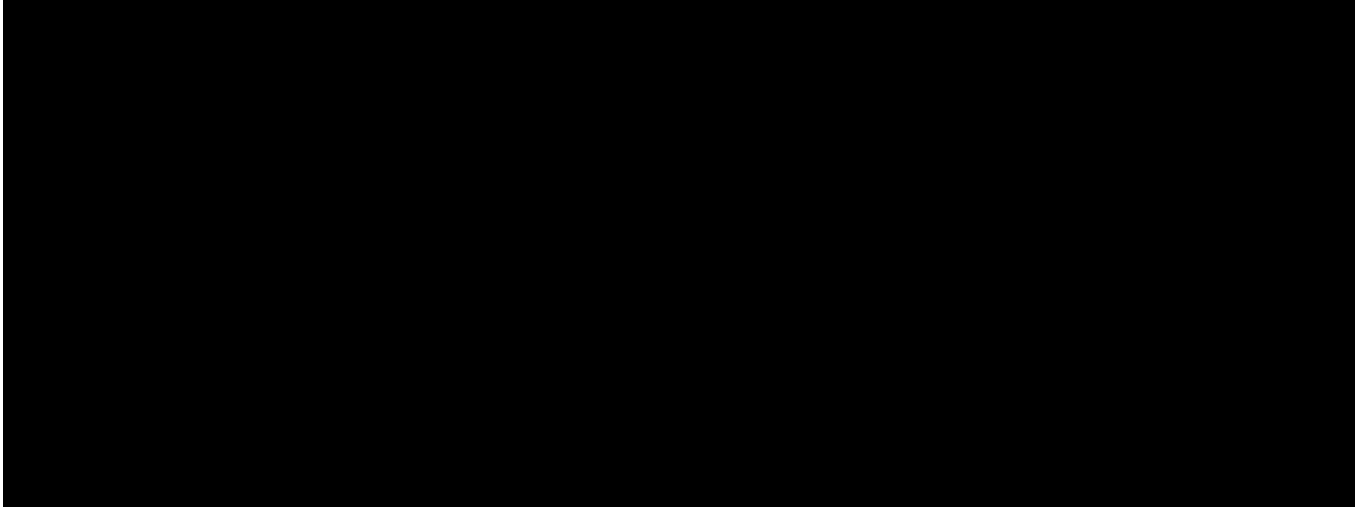
In 2020, the monthly net generation and capacity factor for Clifty Creek was consistently lower than its 2019 and 2018 levels except for December (see Figure 46). This may have resulted in a less accurate coal burn forecast, thus making the “days on hand” inventory level significantly above the target in the following months.

Kyger Creek’s inventory level averaged about [REDACTED] in 2020, compared to [REDACTED] in 2019¹³⁴ (see Figure 47). Inventory levels were significantly higher than OVEC’s recommended seasonal inventory of [REDACTED] for the fall and winter seasons, and [REDACTED] for the spring and summer seasons.

The monthly net generation and capacity factor in Kyger Creek was also mostly lower 2020 compared to 2019, except for June, August, and December (see Figure 48). Like Clifty Creek, this may have resulted in a less accurate coal burn forecast.

¹³⁴ PUCO. “Reply Comments of Duke Energy Ohio, Inc.” In the Matter of the Review of the Reconciliation Rider of Duke Energy Ohio, Inc. / Case No. 20-167-EL-RDR. Filed August 1st, 2021.

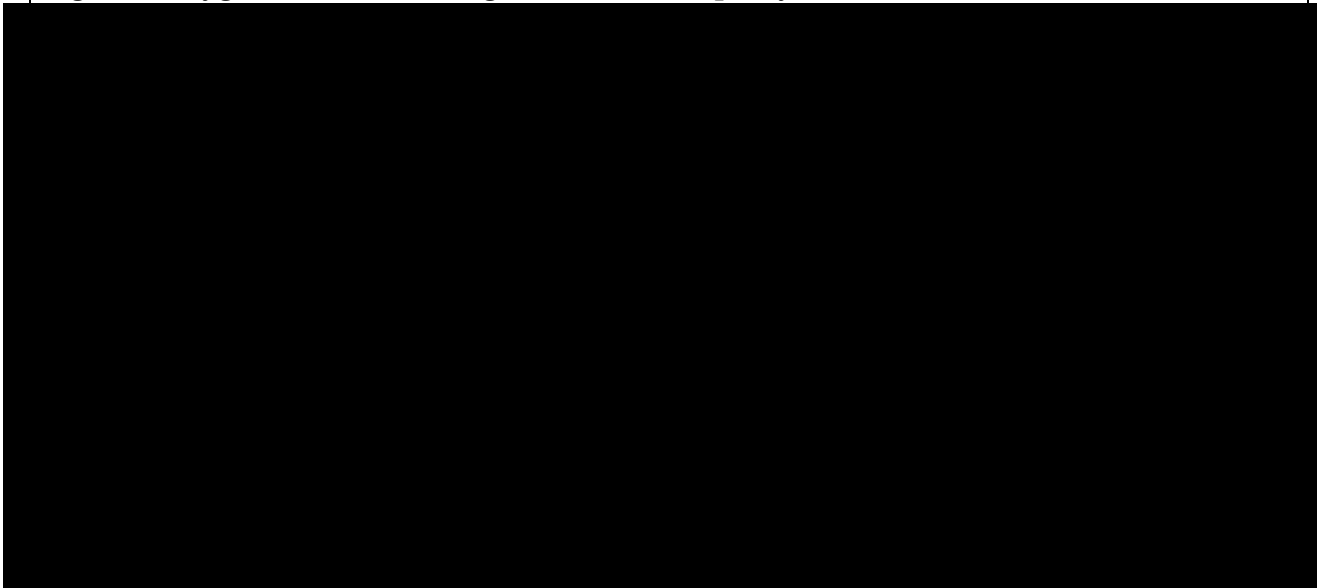
Figure 47. Kyger Creek coal inventory level



Source: LEI-DR-02-008 CONF Attachment.

OVEC's coal burn forecast is based on expected unit generating performance relative to required load. OVEC purchases coal to meet those requirements prior to receiving the coal for consumption. The scheduled coal deliveries are modified (to minimize inventory variation) within the parameters of the agreements to adjust the change in market or unit operating performance issues.¹³⁵

Figure 48. Kyger Creek historical generation and capacity factor



Source: LEI-DR-01-046 CONF Attachment 2 and LEI-DR-05-005 CONF Attachment provided in the previous audit.

¹³⁵ LEI-DR-02-035 provided in the previous audit.

6.2.4 Recommendations

At both power plants, coal inventory levels in 2020 were substantially higher than the inventory targets. LEI makes the following recommendations:

- To the extent current coal contracts might not feature flexibility for coal deliveries (i.e., requirements contracts), LEI recommends that DEO, in its role on the Operating Committee encourage OVEC to consider requirements contracts in the future. This will help keep inventories from exceeding targets.
- DEO, in its role on the Operating Committee, should encourage OVEC to procure slightly less through long-term contracts, and procure some coal through short-term contracts as needed. This will help keep inventories from exceeding targets.
- DEO, in its role on the Operating Committee, should encourage OVEC to examine the process it uses to create coal burn outlooks and its policy on taking deliveries of coal.

7 Environmental compliance

7.1 Scope and background

7.1.1 Scope

OVEC's environmental compliance activities are within the scope of this audit, as the Commission has specifically asked for this analysis.

This chapter addresses the following topics:

- overview of Ohio's air and solids regulations;
- organizational structure and qualifications of personnel;
- current status of OVEC's environmental controls;
- OVEC's emissions allowance management; and
- OVEC's preparation for compliance with proposed or newly enacted environmental regulations.

In coming to LEI's conclusions, LEI issued formal data requests, participated in an on-line virtual plant site visit with OVEC personnel, and conducted additional research.

7.1.2 Background on emissions regulations

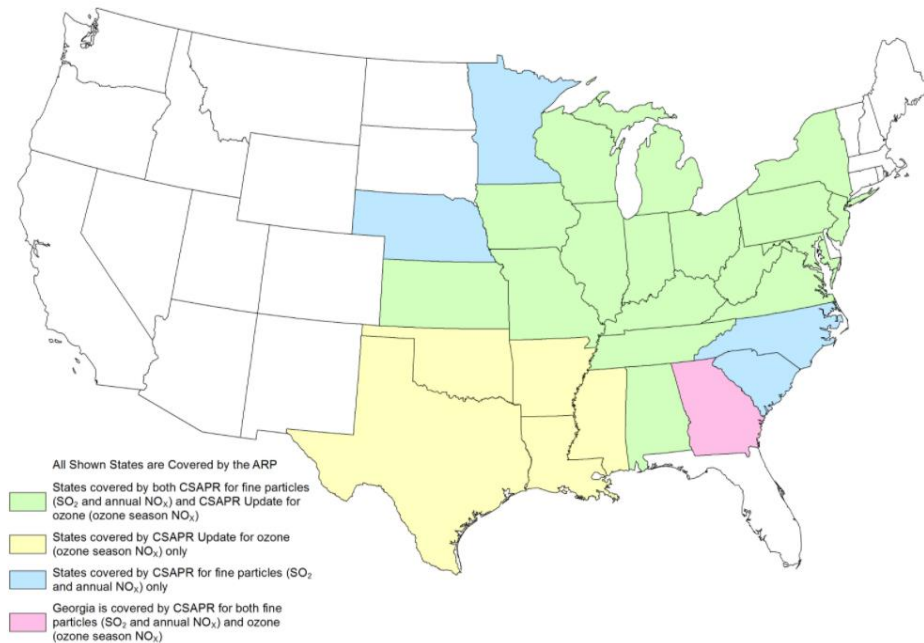
7.1.2.1 Air regulations

On March 10, 2005, the United States Environmental Protection Agency ("EPA") issued the Clean Air Interstate Rule ("CAIR") that required significant reductions of SO₂ and NO_x emissions from coal-burning power plants. On March 15, 2005, the EPA also issued the Clean Air Mercury Rule ("CAMR") that required significant mercury emission reductions for coal-burning power plants. These emission reductions were required in two phases: 2009 and 2015 for NO_x; 2010 and 2015 for SO₂; and 2010 and 2018 for mercury. Ohio subsequently finalized its state-level versions of CAIR and CAMR. In response, the OVEC shareholders determined that it would be necessary to install flue gas desulfurization ("FGD") systems at both coal plants to comply with these rules.

After the promulgation of CAIR and CAMR, a series of legal challenges to those rules resulted in their replacement. CAMR was replaced with the Mercury and Air Toxics Standards ("MATS") rule which became effective on April 16, 2012. The OVEC plants were required to demonstrate compliance with MATS emission limits by April 16, 2015. On August 8, 2011, the EPA promulgated the Cross-State Air Pollution Rule ("CSAPR"). On May 1, 2017, the CSAPR Update ozone season NO_x program replaced the original CSAPR ozone season NO_x program. On March 15, 2021, the EPA finalized the Revised CSAPR Update to reduce NO_x emissions from power

plants in the eastern United States, including Ohio by 17,000 tons.¹³⁶ Figure 49 below illustrates the CSAPR footprint across the United States.

Figure 49. States covered by CSAPR



Source: EPA, Clean Air Markets

7.1.2.2 Solids regulations

Solid emissions (fly ash, boiler slag, and gypsum) from coal plants are regulated under EPA's Coal Combustion Residuals ("CCR") rule, which went into effect in October 2015. As noted in OVEC's 2020 annual report "[t]he US EPA elected to regulate CCR as a non-hazardous solid waste...The rule applies to new and existing CCR landfills and CCR surface impoundments...The rule is self-implementing and currently does not require state action."¹³⁷

7.1.2.3 Water regulations

OVEC plants must comply with EPA's Effluent Limitations Guidelines ("ELG") limiting wastewater discharge (bottom ash transport wastewater and wastewater from the scrubbing process). EPA published the final ELG revisions in the Federal Register on October 13, 2020.¹³⁸ In

¹³⁶ "Revised Cross-State Air Pollution Rule Update". EPA. Accessed on November 01, 2021. <<https://www.epa.gov/csapr/revised-cross-state-air-pollution-rule-update>>

¹³⁷ OVEC. *Annual Report 2020*. P. 33. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

¹³⁸ LEI-DR-01-039.

light of the rules, OVEC will have until December 31, 2025, to determine the technology it will use to comply with the rules, and to have it in place. This is discussed in detail in Section 7.3.3.

7.2 Evaluative criteria

LEI focused its audit of environmental compliance activities on answering the following questions:

1. Is the current environmental department's organization and staffing adequate?
2. Has OVEC appropriately responded to environmental regulations relevant to the plants? Has this impacted fuel procurement, in terms of type and cost of fuel purchased?
3. Has OVEC ensured a rigorous emission allowance management strategy for the coal plants? What methods does OVEC use to analyze environmental compliance options and strategies?
4. Has OVEC appropriately monitored, evaluated, and implemented the environmental compliance options?
5. What is the overall emission allowance management strategy, including any emission allowance transactions in which OVEC participated?

7.3 Findings and conclusions

7.3.1 Organization and staffing

The Environmental, Safety, and Health Department ("ESH") of OVEC-IKEC is responsible for managing and directing environmental compliance activities to make sure OVEC-IKEC is fully compliant with new and existing federal, state, and local environmental laws and regulations. The ESH Department also works closely with System Office management, plant management, personnel from the environmental service and engineering of Sponsor Companies, as well as their environmental departments to effectively carry out environmental compliance activities.¹³⁹

The ESH Department consists of 13 staff (see Figure 50), and their duties and responsibilities include:¹⁴⁰

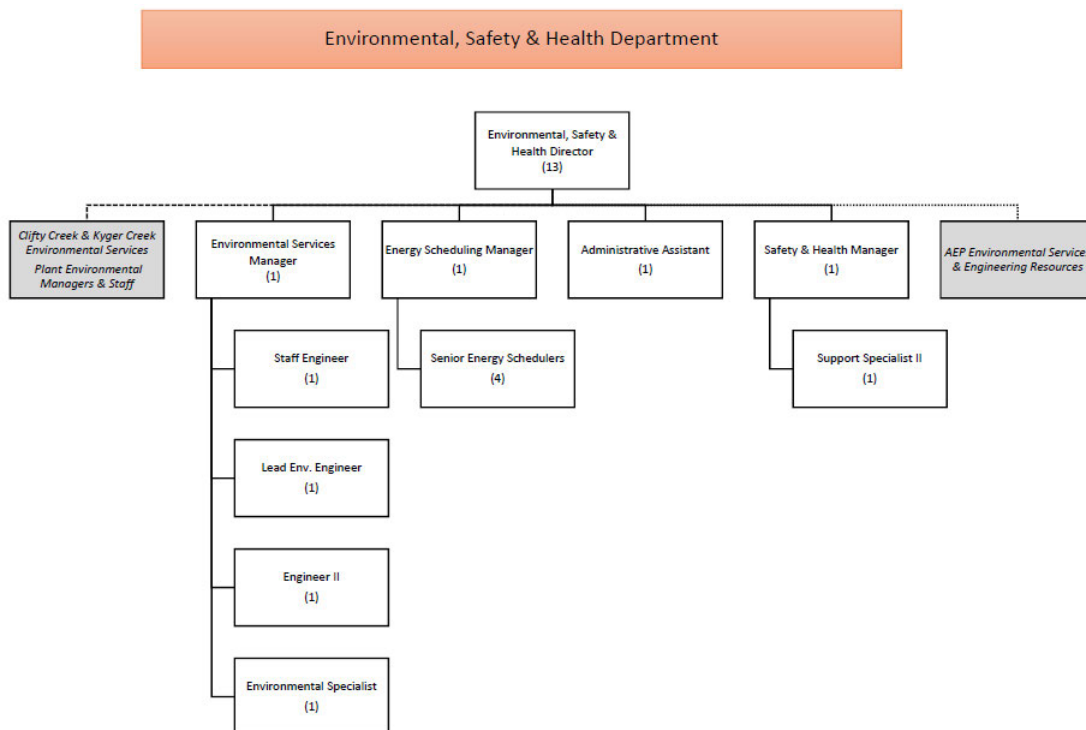
- *"Developing and administering programs and policies to ensure the Company is operating in full compliance with all applicable environmental regulatory requirements"; "Staying current with all new legal precedence and technology developments relating to environmental compliance with Company operations;" Staying current with all new legal precedence and technology developments relating to environmental compliance with Company operations;"*

¹³⁹ LEI-DR-01-032; LEI-DR-01-032 CONF Attachment.

¹⁴⁰ Ibid.

- *"Securing and renewing all federal and state air, water, and solid waste permits required to meet applicable compliance obligations at all company facilities;" Securing and renewing all federal and state air, water, and solid waste permits required to meet applicable compliance obligations at all company facilities;"*
- *"Maintaining relationships with federal, state, and local environmental regulatory agencies for the purpose of obtaining guidance, required construction and operating permits and other necessary approvals in a timely manner, and for the purpose of resolving any compliance matters in the most efficient and amicable way possible;" Maintaining relationships with federal, state, and local environmental regulatory agencies for the purpose of obtaining guidance, required construction and operating permits and other necessary approvals in a timely manner, and for the purpose of resolving any compliance matters in the most efficient and amicable way possible;"*
- *"Working with outside legal counsel, consultants, and contractors for the purpose of resolving legal issues, conducting studies, and implementing projects to ensure the Company is operating in full compliance with all applicable regulatory requirements;" Working with outside legal counsel, consultants, and contractors for the purpose of resolving legal issues, conducting studies, and implementing projects to ensure the Company is operating in full compliance with all applicable regulatory requirements;" and*
- *"Managing emission allowance compliance activities for the Acid Rain Program, CSAPR, and CSAPR Update rules."*

Figure 50. OVEC-IKEC ESH Department Organization Chart



Source: LEI-DR-01-032 CONF Attachment.

7.3.2 Current environmental control status of OVEC plants

Over the course of its operation, OVEC has installed and retrofitted a variety of equipment and systems at both Kyger Creek and Clifty Creek to comply with environmental laws and regulations at the federal, state, and local levels. The current installed environmental control and monitoring equipment for both plants are:¹⁴¹

- **Overfire air system ("OFA"):** to meet the emission requirements for NO_x, overfire air systems were put in place in the 1990s at all 11 units, to meet the requirements of the Acid Rain Program as part of the 1990 Clean Air Act Amendments ("CAAA"). The overfire air system effectively reduces NO_x emissions by 50%. The OFAs for each plant will last the life of the plant, with ongoing maintenance; for example, the burners are inspected, repaired, and replaced on an ongoing basis.¹⁴²
- **Selective catalytic recovery ("SCR") system:** SCR equipment was installed in 2002 and 2003 to meet additional NO_x reduction requirements applicable to the ozone seasonal cap and trade program under the US EPA's NO_x State Implementation Plan Call Rule. SCRs convert NO_x in the furnace exhaust gas into N₂, H₂O and CO₂. Each unit in OVEC has its own SCR except for Clifty Creek Unit 6 which is not self-scheduled, but offered based on economics during summer ozone season (see Figure 51 and Figure 52). According to a 2011 Louisville Gas and Electric Company and Kentucky Public Service Commission long-term PPA, "[s]ince the current NO_x regulations allow "bubbling" of the emissions from both Clifty and Kyger and since OVEC chose to design the reactors for a NO_x removal efficiency of 90%, sufficient margin existed to allow one unit to remain uncontrolled."¹⁴³ The SCR has the added benefit of converting trace amounts of mercury (Hg) into a form which can be removed by scrubbers (discussed below).¹⁴⁴ However, SCRs also create SO₃, which cannot be removed by scrubbers (also discussed below). To address this, the plants use dry sorbent injection equipment (which relies on injection of trona or hydrated lime) to capture the SO₃. The SCRs can last the life of the OVEC plant (until at least 2040) based on a maintenance regime and would not need new capital expenditure.¹⁴⁵

¹⁴¹ LEI-DR-01-038; LEI-DR-01-038 CONF Attachment; Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

¹⁴² Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

¹⁴³ Kentucky Public Service Commission. "Emission Control System". Long-term Purchase Contract - Case No. 2011-00099. July 2011. P. 45. <https://psc.ky.gov/pscscf/2011%20cases/2011-00099/20110711_LGEs%20Response%20to%20Commission%20Staffs%20Supplemental%20Response%20Question%20No%201.pdf>

¹⁴⁴ Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

¹⁴⁵ Ibid.

- **Electrostatic precipitator:** In the 1970s, the electrostatic precipitators were installed at all 11 OVEC-IKEC units to comply with the 1970 Clean Air Act (“CAA”). They remove small particles of ash and SO₃, by using reduced velocity and an electric charge. The electrostatic precipitators collect over 90% of the fly ash produced in the combustion process. They are inspected and maintained during plant outages and no new capital is needed for them to last the life of the plant.¹⁴⁶ At Clifty Creek, the fly ash is disposed of in a dry state and can be sold for re-use or deposited on site. At Kyger Creek, the fly ash is currently mixed with water and the resulting slurry is deposited into a settling pond, but OVEC is in the process of converting to dry fly ash removal to meet EPA EFL guidelines (equipment is expected to be online in 2023).¹⁴⁷
- **Flue gas desulfurization (“FGD”) systems:** FGD systems were completed in 2012 for Kyger Creek and 2013 for Clifty Creek. FGD systems are designed to remove SO₂. At Clifty Creek and Kyger Creek, the equipment chose for the main scrubbing task is the jet bubbling reactor (“JBR”) design and proper operation brings co-benefits of lower particulate matter and lower mercury emissions, which help comply with EPA’s MATS rule without the need for additional pollution control equipment. JBR 12 at Kyger Creek scrubs flue gas from generation Units 1 and 2, and JBR 35 scrubs Units 3, 4, and 5. Clifty Creek’s JBR 13 scrubs Units 1, 2, and 3, and JBR 46 scrubs Units 4, 5, and 6.
 - **JBR:** FGD systems at each plant included two JBRs. The JBR performs the actual scrubbing and reduces SO₂ emissions by up to 98% at the plants; and
 - **Related equipment:** FGD systems include a new stack with two flues (one for each JBR), a FGD wastewater treatment plant (“WWTP”) to treat the residual wastewater created by the JBRs, new landfills, a limestone barge unloader, limestone preparation and storage equipment, gypsum dewatering, and a trona dry sorbent injection system for SO₃ mitigation.
- **Continuous emissions monitoring system (“CEMS”):** Primary and redundant backup monitoring systems were installed on each new flue when the scrubbers were placed into service. CEMS continuously monitors the CO₂, NO_x, SO₂, particulate matter (“PM”) 10 and PM 2.5, mercury, and flue gas volumetric flowrates. CEMS output is processed through a data acquisition system to enable OVEC to provide quarterly emissions data to US EPA and other federal or state environmental organizations to demonstrate compliance. The NO_x, CO₂, and SO₂ flow monitors were installed to meet EPA reporting requirements. Mercury and PM monitoring systems were installed for MATS compliance. OVEC staff manage air pollution control in real time to make sure the emissions do not exceed the US EPA limit. The plants are in the process of replacing/updating the CEMS monitors.

¹⁴⁶ Ibid.

¹⁴⁷ Ibid.

Figure 51. Clifty Creek air pollution control process

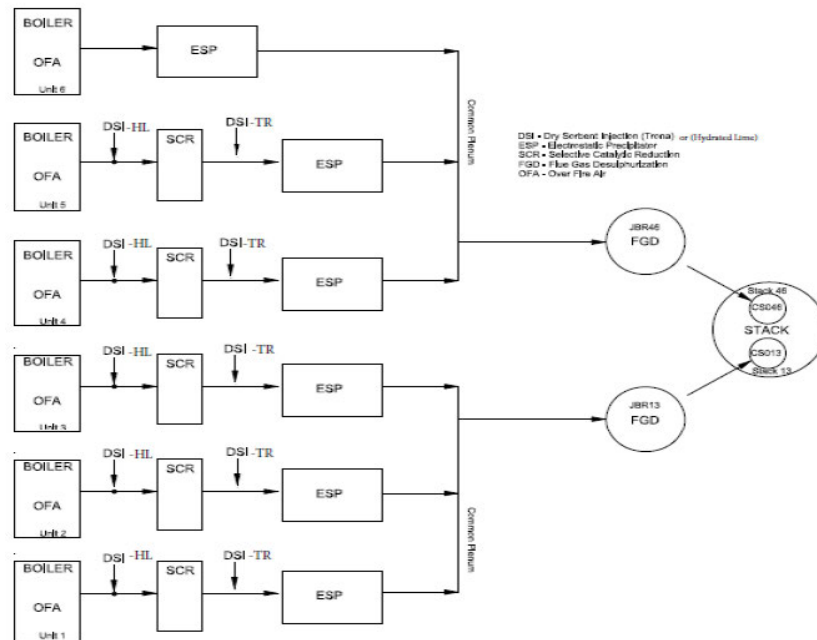
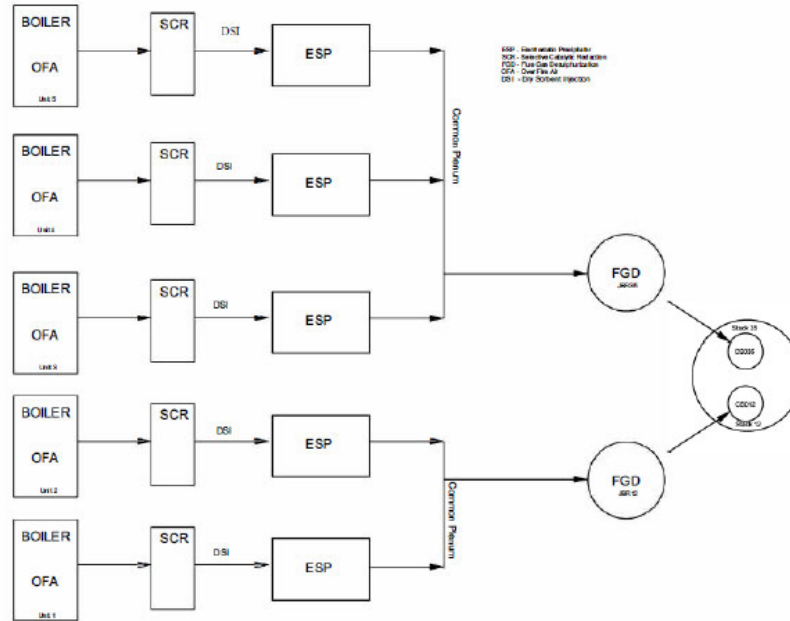


Figure 52. Kyger Creek air pollution control process



Source: LEI-DR-01-038 CONF Attachment; Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

As noted above, OVEC reported that through proper maintenance the pollution control equipment it can last for many decades.¹⁴⁸ Figure 53 lists the major equipment at Kyger Creek and Clifty Creek facilities installed since the late 1970s to comply with environmental regulations.

Figure 53. Kyger Creek and Clifty Creek environmental compliance equipment

Project	Purpose	Installation Date(s)
Clifty Creek and Kyger Creek Plant – Electrostatic Precipitator (ESP) installation on all units	To meet Clean Air Act requirements for the removal of fly ash/particulate matter from the flue gas	1977-1980
Clifty Creek and Kyger Creek Plants (all units) – boiler overfire air modifications	To meet Clean Air Act Amendment (Acid Rain Program) requirements for NOx emissions	1995-1999
Clifty Creek and Kyger Creek Plants (10 of 11 units) - installed selective catalytic reduction equipment	To comply with ozone season only NOx requirements following additional US EPA NOx SIP call rulemaking	2002-2003
Clifty Creek and Kyger Creek Installation of JBR Scrubbers	Compliance with CSAPR requirements for additional SO2 emission reductions, and gain co-benefit of Hg removal for compliance with the MATS rule	2011-2013

Source: LEI-DR-01-041.

7.3.3 OVEC's environmental compliance

7.3.3.1 OVEC's compliance with air, water, and solids regulations

With the adoption of EPA's CSAPR Update Rule, in 2019, OVEC managed its operations to comply with the more stringent NO_x constraints effective during the ozone season. The final rule revising the CSAPR Update was signed on March 15, 2021 and OVEC does not expect it to impact the near-term compliance strategy or materially change future operations.¹⁴⁹

OVEC has been using the Effluent Limitations Guidelines ("ELG") draft rules published in November 2019 as the basis for planning its compliance with rules limiting wastewater discharge (bottom ash transport wastewater and FGD wastewater). As noted above, OVEC will have until December 31, 2025, to modify how it manages both bottom ash transport wastewater and FGD wastewater. OVEC has engaged a third-party engineering firm to assist in developing an overall holistic compliance strategy based on terms of the final ELG rules, and other applicable federal and state regulations that may impact timelines for modifying treatment systems to meet new ELG requirements at both plants. The dry fly ash project for Kyger Creek discussed previously is under construction and set to be completed in 2023, to comply with ELG rules. Both plants are now undergoing other modifications to comply with the rules.¹⁵⁰

To comply with EPA Clean Water Act Section 316 (b) for cooling water intake structures, both Kyger Creek and Clifty Creek are participating in an Electric Power Research Institute ("EPRI")

¹⁴⁸ Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

¹⁴⁹ OVEC. *Annual Report 2020*. P. 32. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

¹⁵⁰ Ibid, and Virtual site visit November 5, 2021.

collaboration project. OVEC was obligated to conduct a two-year study of EPA Clean Water Act Section 316 (b) requirements and associated control technology recommendations, which OVEC completed, and submitted to the Ohio state regulatory agency in 2018.¹⁵¹ The report included a summary of the preliminary cost estimates for the technologies evaluated, conclusions and other information required under Section 122.21(r) of the 316(b) Rule. OVEC still expects to prepare a comprehensive and detailed cost estimate following consultation with Indiana Department of Environmental Management (“IDEM”) and Ohio EPA following their site-specific determination of what constitutes Best Available Technology (“BAT”) for each plant, consistent with Section 125.98(f) of the 316(b) Rule. That determination needs to be made before OVEC takes the next step in developing detailed costs and finalizing schedules, and neither state regulatory agency did so in 2020.

IDEM has stated they will be conducting their evaluation as part of the next National Pollution Discharge Elimination System (“NPDES”) permit renewal for the Clifty Creek Station. The current permit is effective through May 1, 2022, and OVEC expects IDEM’s evaluation to address the Station’s future 316(b) obligations to take place in late 2021 or early 2022. Ohio EPA is expected to make a similar determination for Kyger Creek Station permit renewal in either late 2021 or early 2022 as well.¹⁵²

To comply with EPA CCR, OVEC noted in its most recent annual report that all compliance is complete: *“The Companies have completed all compliance obligations associated with the rule to date.... currently, approximately 65 percent of the coal ash and other residual products from our generating facilities are reused in the production of cement and wallboard, as soil amendments, as abrasives of road treatment materials, and for other beneficial uses.”*¹⁵³

7.3.3.2 OVEC’s byproducts from environmental compliance activities

During the FGD process, air is needed to support the reaction of the SO₂ in the gas with the limestone slurry. This creates spent slurry, as known as gypsum. The absorber removes the dewatered gypsum which becomes a useful byproduct and source of revenue for OVEC.

As of 2018, Kyger Creek has a long term contractual relationship with one wallboard manufacturer, and Clifty Creek is also nearing completion of a long term contract with another wallboard manufacturer.¹⁵⁴ As of 2019, OVEC sold nearly all of the gypsum produced at each plant into the wallboard market.¹⁵⁵ For both plants, OVEC evaluated options for installing barge loading facilities on-site which could provide additional support for fly ash and boiler slag

¹⁵¹ OVEC. Annual Report 2017. P. 29. <<https://www.ovec.com/FinancialStatements/2017-ConsolidatedFinancials.pdf>>

¹⁵² LEI-DR-01-040.

¹⁵³ OVEC. Annual Report 2020. P. 34. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

¹⁵⁴ OVEC. Annual Report 2018. P. 3. <<https://www.ovec.com/FinancialStatements/AnnualReport-2018-Signed.pdf>>

¹⁵⁵ OVEC. Annual Report 2019. P. 4. <<http://www.ovec.com/FinancialStatements/AnnualReport-2019-Signed.pdf>>

marketing.¹⁵⁶ The revenues from the sales of gypsum are used to offset the fuel and reagent costs incurred by OVEC.

Another byproduct is bottom ash, removed from the bottom of the boilers. After further cleaning, the ash can be used for grid blasting and other uses. Clifty Creek sells some of its fly ash, and OVEC expects growing demand in that market. Kyger Creek is considering a marketing agreement for its dry fly ash in 2023 and beyond after the completion of the dry flash ash conversion project at the facility.¹⁵⁷ The revenue from the ash sales is expected to reduce total fuel and reagent costs. Modifications of the wastewater treatment systems began in 2021 as noted above.^{158, 159}

7.3.3.3 OVEC's compliance strategy

OVEC's overall compliance strategy involves installing equipment and maintaining a bank of emissions allowances. The OVEC 2020 annual report noted that *"As a result of the installation and effective operation of the FGD and SCR systems at each plant, management did not need to purchase additional annual SO₂ allowances, annual NO_x allowances, or ozone season allowances in 2020 to cover actual emissions. The Companies [OVEC and IKEC] also maintain a bank of allowances for all three programs as a hedge to cover future emissions in the event of any short-term operating events or other external factors. Depending on a variety of operational and economic factors, management may elect to consume a portion of these banked allowances and/or strategically purchase additional CSAPR annual and ozone season allowances in 2021 and beyond for compliance with the CSAPR and CSAPR Update rules."*¹⁶⁰

7.3.4 Emissions allowances and trading

7.3.4.1 OVEC's designated staff

The Environmental Safety & Health Director is the Designated Representative (or Authorized Account Representative ("AAR")) at OVEC and is responsible for overall emissions allowance inventory management and associated compliance activities, which include the allowance bank management and surrender of allowances via US EPA's Clean Air Markets Division ("CAMD") Business System website.¹⁶¹ Further, the AAR has an Alternate Authorized Account Representative ("AAAR"), who is the Environmental Services Manager based at OVEC's

¹⁵⁶ Ibid.

¹⁵⁷ OVEC. *Annual Report 2020*. P. 31 <<https://www.ovec.com/FinancialStatements/2020-ConsolidatedFinancials.pdf>>

¹⁵⁸ LEI-DR-01-039.

¹⁵⁹ Oral presentation from OVEC staff during the virtual plant site visit on November 5, 2021.

¹⁶⁰ Ibid.

¹⁶¹ LEI-DR-01-033.

corporate office in Piketon, Ohio, serves as a backup to fulfill purchasing, banking, inventory management, and annual allowance surrender responsibilities.

7.3.4.2 OVEC's purchasing strategy for emissions allowances

OVEC's strategy is to *"operate in a manner to comply with applicable environmental requirements under both the state and federal implementation plans applicable to NO_x and SO₂ emissions from the electric utility sector."*¹⁶² OVEC is required to manage emissions allowances under three regulatory programs: (1) CSAPR; (2) CSAPR Update Rule; and (3) Acid Rain Program. During the audit period, OVEC confirmed that they did not make any emissions allowances purchases in the secondary market and the only allowances received were those allowances allocated to each of the units by EPA under the three regulatory programs.¹⁶³

OVEC did not purchase SO₂ allowances during the audit period and does not expect to purchase SO₂ allowances in the near future because of the high efficiency of JBR scrubbers. Under the federal Acid Rain or CSAPR regulations, OVEC surrendered the allowances allocated to the units under those respective compliance programs.¹⁶⁴

As for NO_x emissions control, OVEC's overall strategy is to *"operate in a manner to limit or avoid the need to purchase annual or seasonal NO_x allowances in the secondary market."*¹⁶⁵ Generally, OVEC has very limited need to purchase additional allowances due to the stringent environmental compliance obligations and high efficiency of plants' pollution control equipment. During the audit period, OVEC confirmed that neither seasonal nor annual NO_x allowances were purchased.¹⁶⁶

7.3.4.3 OVEC's purchase of emissions allowances

As mentioned above, OVEC did not make any allowance purchases during the audit period. In the past, OVEC's purchasing process for emissions allowances was mainly through the trading services of one of its Sponsors (usually AEP Ohio) to make sure the purchase is made based on fair market prices and reasonable brokerage fees at the time of the purchase.¹⁶⁷ For each allowance purchase, there was a purchase agreement between OVEC and the seller. OVEC conducted an internal legal review of the agreement terms that define the type, number, vintage, and total

¹⁶² Ibid.

¹⁶³ LEI-DR-01-035.

¹⁶⁴ LEI-DR-01-033.

¹⁶⁵ Ibid.

¹⁶⁶ Ibid.

¹⁶⁷ LEI-DR-01-034.

prices of allowances of each purchase. The ESH Director or AAR is responsible for managing the emissions allowances purchase to meet OVEC's needs.¹⁶⁸

7.3.4.4 OVEC's banking strategy and management of emissions allowance inventories

OVEC's AAR and AAAR have the primary responsibility for fulfilling emission allowance management and associated compliance obligations, including banking and inventory management.¹⁶⁹ The general strategy for banking and inventory management is that allowances surrenders are made on a last-in, first-out basis to minimize the costs incurred and billed to sponsors.¹⁷⁰

For allowances purchased by OVEC, they are valued on a weighted average basis and sponsoring companies are billed for them based on the actual monthly emissions reported by Kyger Creek and Clifty Creek.¹⁷¹ However, allowances which are allocated to the plants are accounted for differently: *"Allowances directly allocated to the plants by EPA are not assigned a cost and sponsors are not billed when such allowances are surrendered."*¹⁷²

OVEC has not purchased any allowances on the secondary market since complying with the CSAPR and Acid Rain programs.¹⁷³

Figure 54 below shows a summary of the 2020 allowance bank totals, the weighted average cost of allowances that still have a value from prior year purchases, the number of allowances surrendered in 2020, the 2020 balance, and additional 2021 vintage allowances EPA has allocated to the units for 2020.

¹⁶⁸ Ibid.

¹⁶⁹ LEI-DR-01-036.

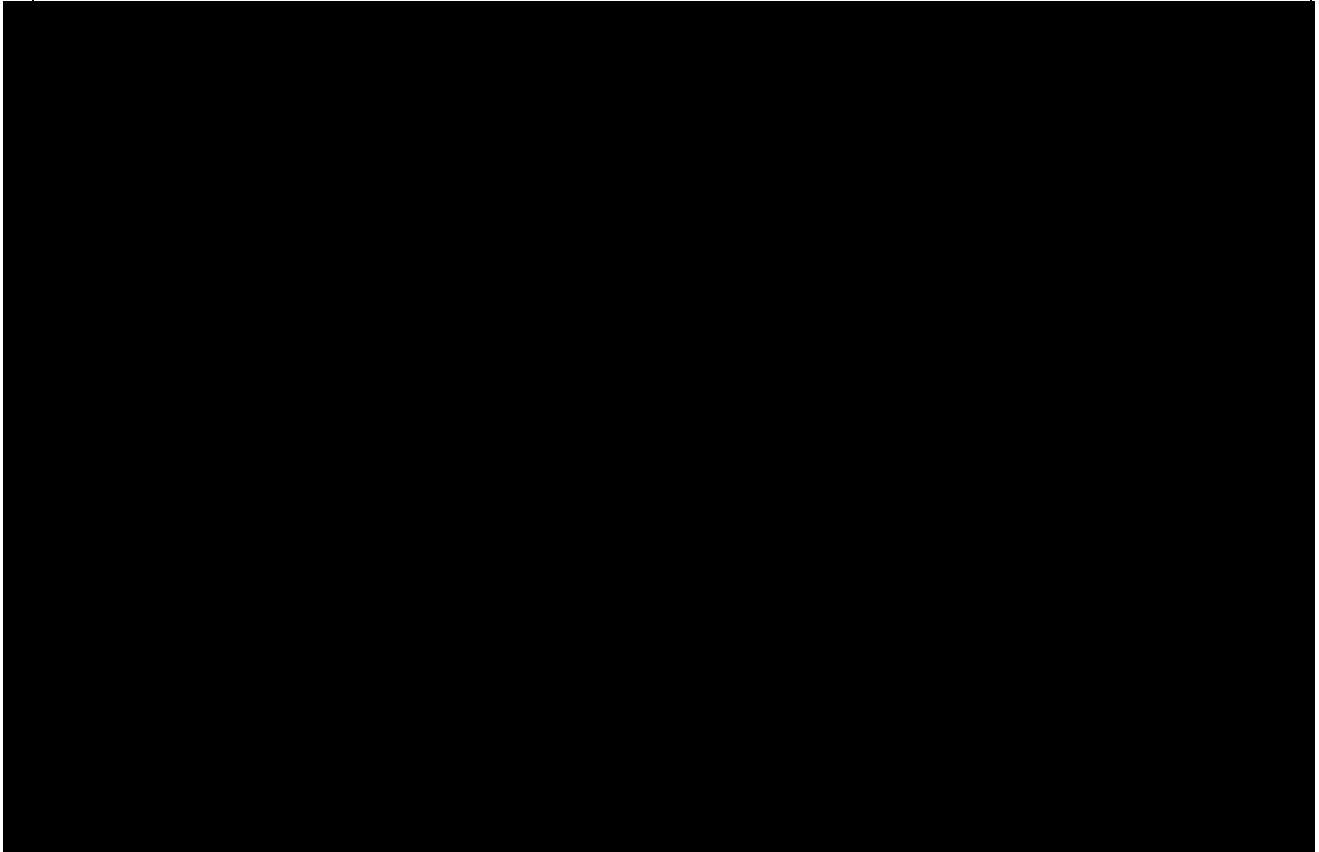
¹⁷⁰ Ibid.

¹⁷¹ LEI-DR-01-037.

¹⁷² Ibid.

¹⁷³ Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

Figure 54. OVEC emissions allowance account balance as of 2020



Source: LEI-DR-05-001.

LEI notes that, at [REDACTED]/ton, the 2020 year-end inventory of ozone season NO_x allowances for 2020 was worth [REDACTED].¹⁷⁴ This is the most expensive inventory of allowances—SO₂ and annual ozone inventory values are much lower, because the prices of allowances are lower. Because the EPA provides about the same number of ozone season NO_x allowances annually, the ozone season inventory level for 2020 is probably higher than needed. Though it may be overly conservative, LEI believes the inventory management for seasonal NO_x allowances is reasonable. Management of other emissions inventories was also reasonable.

7.3.5 Evaluating, and implementing compliance options

OVEC's strategy for evaluating options for compliance and implementing these options is based on what is required to meet state and federal regulations.¹⁷⁵ The capital budget for environmental

¹⁷⁴ NO_x allowances for [REDACTED] = 2021 EPA provided allowance allocation or [REDACTED] tons multiplied by weighted average cost of allowances held in inventory or [REDACTED]

¹⁷⁵ Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

compliance is approved by the OVEC Board of Directors. As discussed in Section 8, there is no cap on annual capital expenditures.

7.4 Recommendations

Based on the virtual plant site visit and data request responses from DEO, LEI concludes that OVEC's environmental equipment configuration and operations is consistent with the industry standard, and therefore, OVEC is well positioned to comply with environmental rules and regulations at federal and state levels. LEI found that OVEC has an effective management of emissions allowances given the dynamics in the market, regulatory changes, and efficiency of emission control system.

8 Capital expenses

8.1 Scope and background

8.1.1 Scope

Capital expenses incurred by OVEC are allocated and billed to DEO through the demand charge on the OVEC bill. In turn, these are billed to DEO customers in the LGR Rider and are therefore within the scope of the audit.

This chapter addresses the following topics:

- decision and budgeting procedures for capital expenses;
- budgeted and actual capital projects over the audit period; and
- prudence of project planning and management.

In coming to LEI's conclusions, LEI issued formal data requests and reviewed detailed project documents.

8.1.2 Background

LEI reviewed the capital project approval process as well as the budgeted and actual costs of capital projects during the audit period, to determine whether these projects were planned and managed prudently.

8.2 Evaluative criteria

LEI focused its audit on answering the following questions:

1. Were capital projects planned based on a prudent approval process?
2. Were capital projects well managed and completed within budget?

8.3 Findings and conclusions

8.3.1 Overview

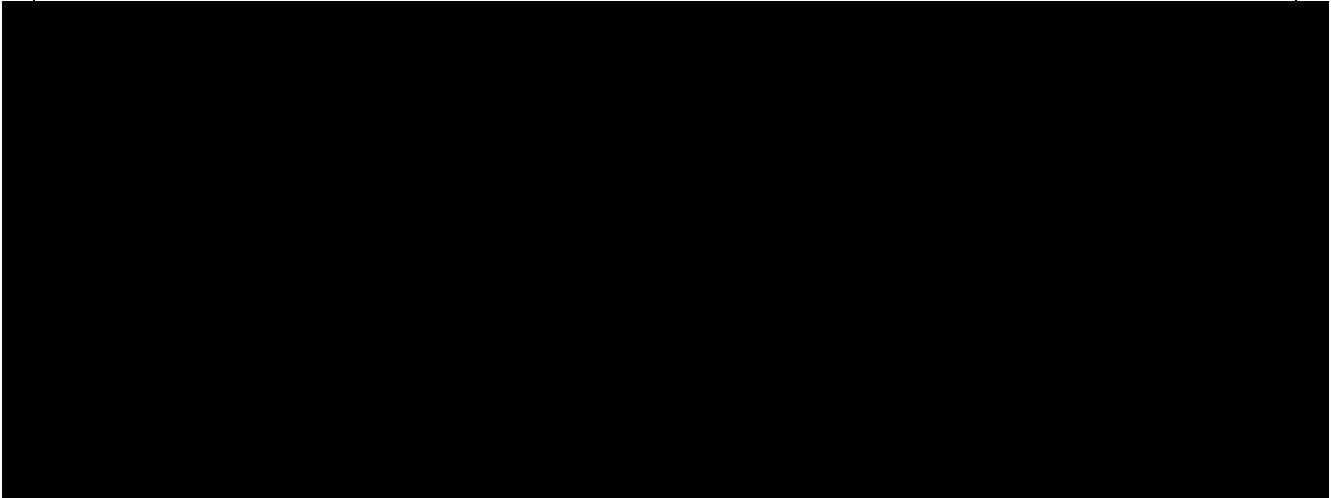
According to OVEC's 2020 annual report "[a]ll property additions and replacements are fully depreciated on the date the property is placed in service, unless the addition or replacement relates to a financed project. As the Companies' policy is to bill in accordance with the debt service schedule under the debt agreements, all financed projects are being depreciated in amounts equal to the principal payments on outstanding debt."¹⁷⁶

¹⁷⁶ OVEC. *Annual Report 2020*. P. 17. <<https://www.ovec.com/FinancialStatements/AnnualReport-2020-Signed.pdf>>

Capital expenses are billed to the Sponsoring Companies in the OVEC demand charge. The demand charge includes Component A which captures the cost of debt, depreciation, and amortization; and Component B which covers non-fuel expenses for the plants.¹⁷⁷

Total capital spending in 2020 was [REDACTED], [REDACTED] lower than in 2019 (see Figure 55). This annual amount is far lower than the 2020 total of Component A [REDACTED] and Component B [REDACTED] in the OVEC bill. The OVEC bill includes charges from capital spending in previous years.

Figure 55. Capital spending in OVEC, 2018-2020



Source: London Economics International LLC. "OVEC's capital projects". Audit of the Price Stabilization Rider of Duke Energy Ohio Final Report. October 15, 2020. pp. 93-94; LEI-DR-01-030 CONF Attachment 1.

8.3.2 Capital budget process at OVEC

At OVEC, any proposed capital project over \$100,000 goes through a six-step process before receiving internal approval (see Figure 56. The six-step capital budget process at OVEC).

¹⁷⁷ LEI-DR-01-022 CONF Attachment ("OVEC bill").

Figure 56. The six-step capital budget process at OVEC



Source: LEI-DR-01-029 CONF Attachment.

The six steps involve the following activities and teams:

- 1) At the **Capital Budget Kickoff**, requirements covering capital justifications and the planned timeline are reviewed;
- 2) In the **Capital Budget Submission** phase, Project Leads (typically asset owners or process leads) submit capital projections request and justifications to the Budget Excellence Team;
- 3) The **Budget Excellence Team Review** is led by a group of individuals with multidisciplinary backgrounds and from various locations and departments. The team reviews the quality of the project's justifications and alternatives;
- 4) The **Site Level Review** is led by a group consisting of the Plant Manager and plant Department Heads, who prioritize projects for their location and provide feedback regarding the projects and associated justifications;
- 5) The **Executive Management Review** is led by a team made up of the Chief Operation Officer ("COO"), Chief Financial Officer ("CFO"), Kyger Creek Plant Manager, Clifty Creek Plant Manager, Environmental, Safety & Health Director, and Electrical Operations Director. The team reviews the projects and then prioritizes them based on safety, environmental compliance, expected return, reliability risk, and capital budget targets; and
- 6) The **Board of Directors** ("BOD") reviews and approves capital budgets at the annual BOD meeting.

LEI believes that this capital project budget approval process provides a good foundation for capital project planning and implementing. However, it should specify more clearly the personnel in charge of each step. For example, at the Capital Budget Kickoff step, who is responsible for proposing a capital project and who reviews the proposal? In addition, OVEC should make transparent the standardized criteria (such as net present value, payback period,

and/or comparison to alternatives) for evaluating and approving the proposed capital projects at each step.

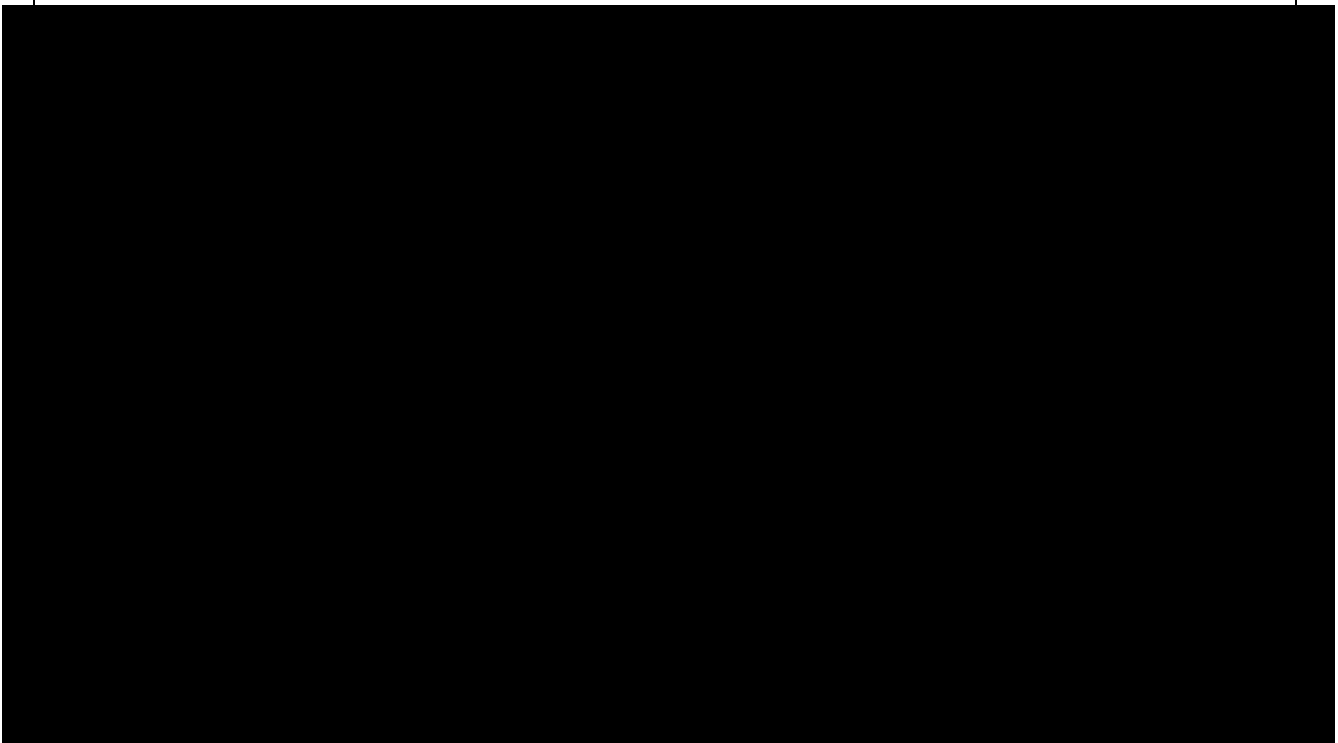
8.3.3 No ceiling on capital spending

As LEI understands it, the review and approval of the Commission is not needed for OVEC to engage in capital spending projects. Under such circumstances, a cap or ceiling on annual expenditures would be prudent, to prevent over-investment. LEI recommends that the Commission consider implementing such a cap. However, OVEC is not allowed to earn a return on capital projects as such.

8.3.4 Capital projects were generally completed within budget

LEI reviewed the budgeted and actual costs of OVEC's capital projects in 2020. LEI found that the capital projects were generally completed within or close to the budget, and that the total actual costs did not exceed the total budgeted costs in 2020 for major projects (see Figure 57 below). One fairly minor project, replacing core switches and router at Clifty Creek, exceeded the budget by a substantial margin.

Figure 57. Budgeted and actual costs of all OVEC capital projects, 2020



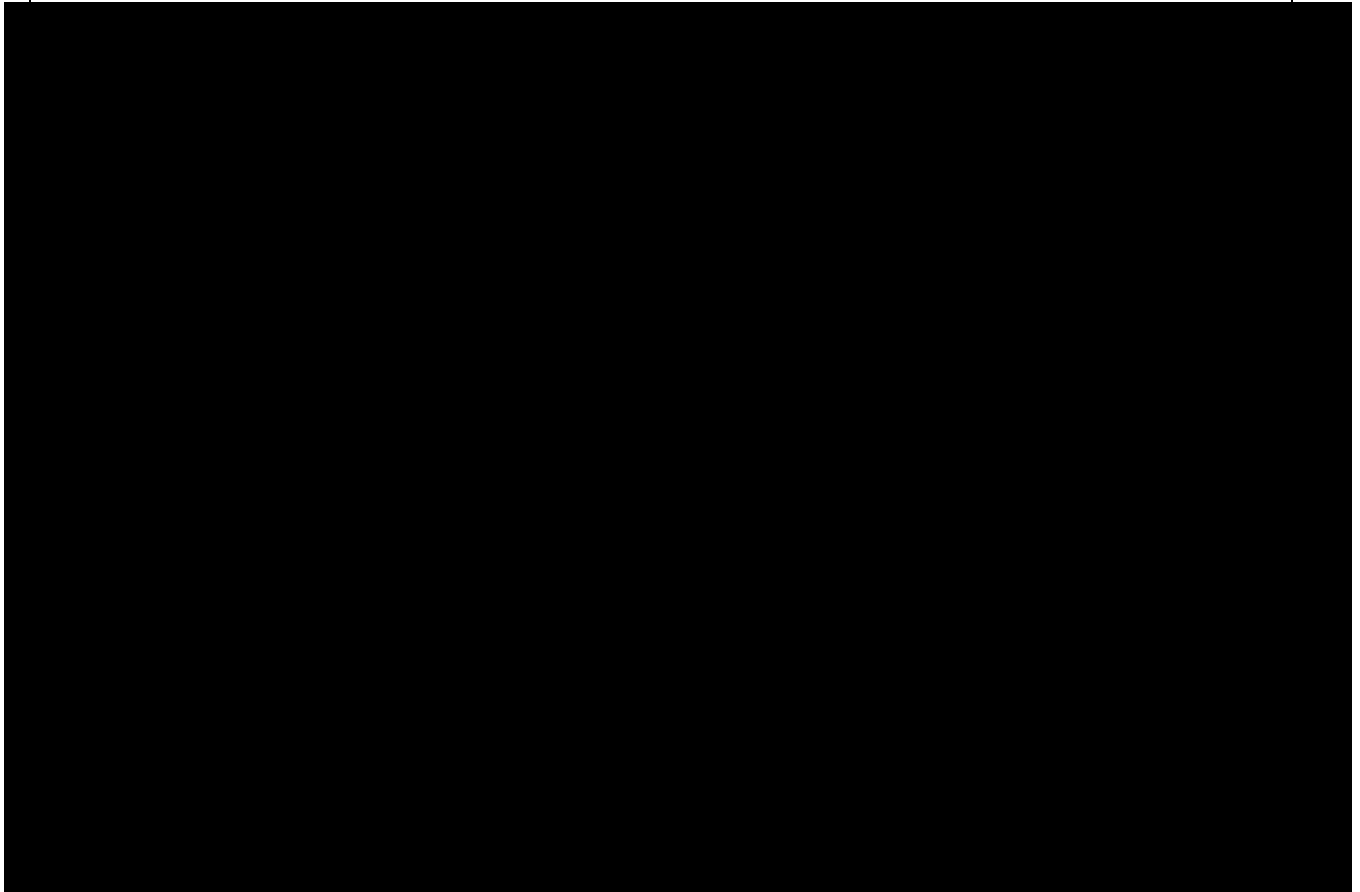
Note: Red highlights represent projects with actual capital spending higher than budgeted amount.

Source: LEI-DR-01-030 CONF Attachment 1.

8.3.5 Capital projects are typically for environmental and economic purposes with a payback period of around four years

LEI reviewed all [REDACTED] projects with budgeted amounts greater than \$500,000 and examined OVEC's project planning materials (provided in LEI-DR-01-030 CONF Attachment 2) to check the prudence of capital spending. The planning materials included detailed information such as project description, cost and benefit analysis and alternatives considered (see Figure 58 below). OVEC states that projects were focused on to delivering economic benefits and environmental compliance, went through a cost-benefit analysis (with an average simple payback timeline of around 3.3 years), and OVEC compared them to alternatives in terms of practicality and cost.

Figure 58. Detailed summary of selected capital projects of OVEC



Source: LEI-DR-01-030 CONF Attachment 2.

8.4 Recommendations

In general, capital projects at OVEC were completed within budget and followed a prudent evaluation process. The capital investment appears to have addressed environmental issues or improved plant economics.

However, this does not imply that the level of capital spending is justified by the revenues earned by the plants in the PJM market. Recent annual capital expenditures of about \$8 million to \$9 million represent a small portion of the demand charge paid by DEO and other Sponsoring Companies; the overall cost to recover the investment in the plants (recovered in Component A and Component B of the demand charge) is much larger, as noted above.

9 Power plant operations

9.1 Scope and background

9.1.1 Scope

OVEC's plant operation and maintenance activities impact the ultimate cost of power to OVEC consumers and are thus within the scope of this audit.

This chapter addresses the following topics:

- organizational structure and qualifications of personnel;
- power plant operation and maintenance;
- power plant performance tracking; and
- emergency procedures.

In coming to LEI's conclusions, LEI issued formal data requests, communicated with management, and conducted additional research.

9.1.2 Background

Clifty Creek includes six coal-fired generating units (total owned installed capacity 1,303.8 MW) and Kyger Creek includes five coal-fired generating units (total owned installed capacity 1,086.5 MW) (see Figure 59). The units are all relatively old (operating since 1955 or 1956) and small, with nameplate capacity of 217.3 MW each, while new coal steam turbines tend to be about 500 MW.

Figure 59. OVEC-owned generating units, 2020

Plant	Unit No.	Location	Technology	Initial Operation	Fuel	Nameplate Capacity	Max Avail Capacity
Clifty Creek	1	Jefferson County, IN	Steam Turbine	1955	Coal	217.3	200
Clifty Creek	2	Jefferson County, IN	Steam Turbine	1955	Coal	217.3	200
Clifty Creek	3	Jefferson County, IN	Steam Turbine	1955	Coal	217.3	200
Clifty Creek	4	Jefferson County, IN	Steam Turbine	1955	Coal	217.3	200
Clifty Creek	5	Jefferson County, IN	Steam Turbine	1955	Coal	217.3	200
Clifty Creek	6	Jefferson County, IN	Steam Turbine	1956	Coal	217.3	200
<i>Total</i>						1303.8	-
Kyger Creek	1	Gallia County, OH	Steam Turbine	1955	Coal	217.3	199
Kyger Creek	2	Gallia County, OH	Steam Turbine	1955	Coal	217.3	199
Kyger Creek	3	Gallia County, OH	Steam Turbine	1955	Coal	217.3	199
Kyger Creek	4	Gallia County, OH	Steam Turbine	1955	Coal	217.3	199
Kyger Creek	5	Gallia County, OH	Steam Turbine	1955	Coal	217.3	199
<i>Total</i>						1086.5	-

Source: S&P Global Market Intelligence; OVEC Website <<https://www.ovec.com/Clifty.php>>; <<https://www.ovec.com/Kyger.php>>

9.2 Evaluative criteria

LEI focused its audit of plant operations on answering the following questions:

1. Is staffing adequate in terms of numbers of employees and staff experience, training, oversight, performance incentives, and succession planning?
2. Do OVEC's plants perform at levels comparable to industry expectations?
3. How and on what criteria is plant performance benchmarked by OVEC? How does it compare to industry standards, best practices, or expectations?
4. How does OVEC plan and execute its maintenance activities?
5. What emergency procedures are in place to deal with extreme weather or flooding? How did plant managers respond to the impacts of COVID-19 in 2020?

9.3 Findings and conclusions

9.3.1 Organization and staffing are reasonable at Kyger Creek and Clifty Creek

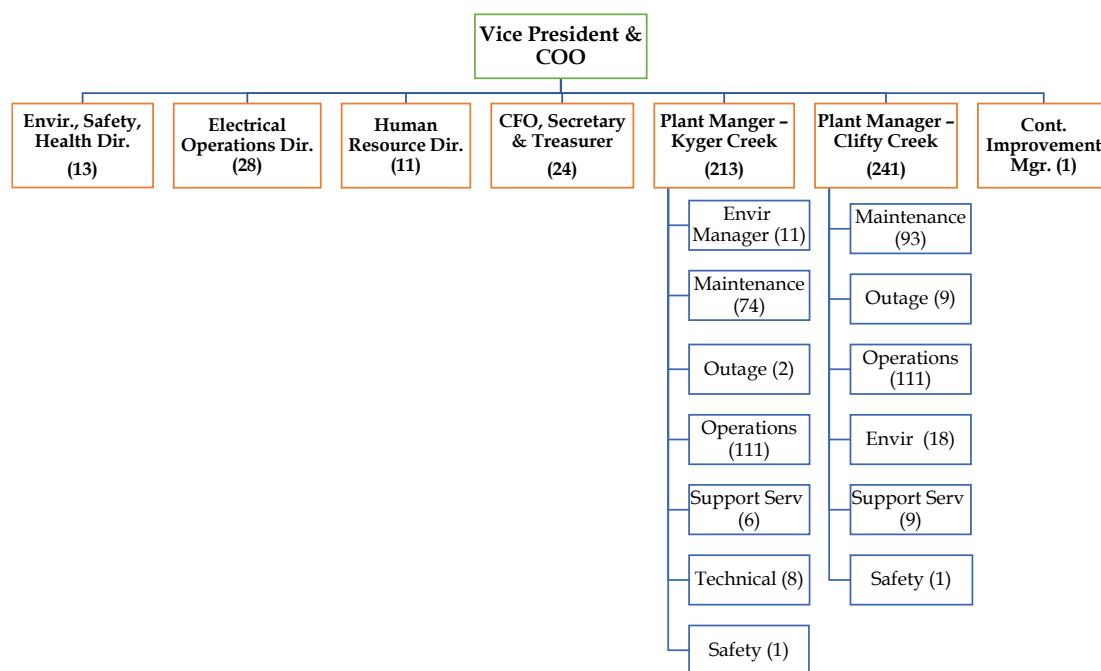
LEI examined the staffing of the OVEC and IKEC plant management teams. There are 213 staff members working at Kyger Creek and 241 at Clifty Creek (see Figure 60).¹⁷⁸ The number of employees is comparable to the average for coal plants in PJM, which is 238.¹⁷⁹

The total number of staff at both plants declined from 2019 to 2020. DEO reported that the differences in staffing levels between 2019 and 2020 at both plants were primarily driven by attrition due to employee retirements. When that takes place, each plant evaluates those vacancies and takes a disciplined approach to determine whether those positions can be consolidated, contracted to a third-party more effectively, and/or if that position needs to be filled with an external hire. In general, as operations positions become vacant, the plants have been hiring replacement employees to backfill those vacant positions. Positions from all other departments that become vacant are generally either consolidated or subcontracted warranted.¹⁸⁰

¹⁷⁸ LEI-DR-01-042 CONF Attachment 1; LEI-DR-01-042 CONF Attachment 2.

¹⁷⁹ S&P Global Market Intelligence.

¹⁸⁰ LEI-DR-03-004.

Figure 60. OVEC – IKEC plant management staffing, 2020

Source: LEI-DR-01-042 CONF Attachment 1; LEI-DR-01-042 CONF Attachment 2.

LEI examined the operations and maintenance (“O&M”) costs (labor plus non-labor) for the two plants. As shown in Figure 61, for the period of 2018-2020, the Clifty Creek and Kyger Creek plants cost an average of █████ million (or █████/kW-year) and █████ million per year (or █████/kW-year) for O&M, respectively. Around █████ of the total O&M cost at Clifty Creek and Kyger Creek is reported to have been spent on labor. This share is on the lower end of industry average based on LEI’s empirical knowledge but is not unreasonable given the considerable amount of spending on materials that might be required in the event of planned or unplanned outages.

Figure 61. OVEC – Labor and non-labor O&M costs for Clifty Creek and Kyger Creek, 2018-2020

Source: LEI-DR-01-048 CONF Attachment 1.

9.3.2 Plant maintenance processes unchanged from previous audit

Regular planned maintenance is important to ensure reliability of supply from the generating fleet. Given that the planned maintenance strategy at OVEC plants was unchanged from the previous audit period,¹⁸¹ we provide only a high-level summary as follows:

OVEC plant maintenance includes the day-to-day maintenance activities driven by the maintenance planning process, “emergent” (emergency) work, unplanned outage work, and outage preventative maintenance tasks. Major outage projects (including but not limited to SCR catalyst replacement, air heater basket major replacement, major boiler tube replacements, ash hopper rebuilds, booster fan rebuilds, JBR repairs, and turbine inspections) require large crews for a specific duration and are therefore contracted. Craft labor is contracted for scaffolding, insulation, and vacuuming needs. Plant employees conduct mostly routine maintenance, testing, and small calibration and repairs (such as damper repairs, precipitator routine maintenance, miscellaneous small valve repairs and replacements, air preheater seals and basket replacement, instrument calibrations and testing, electrical breaker cleaning and relay calibrations).¹⁸²

9.3.3 Planned outage process is well designed

OVEC uses a comprehensive handbook which clearly delineates roles and responsibilities related to planned outages.¹⁸³ Outages at OVEC’s plants are planned and executed by the Outage Management Team, which involves the following key members:¹⁸⁴

- **Outage Manager:** assigned by the Plant Manager, or delegate. The Manager is responsible for the maintenance of the opportunity outage pool lists (when unanticipated changes on the power system allow work to take place), planning, scheduling, and day-to-day management of the outage;
- **Outage Planner:** responsible for planning outage work orders to support pre-outage, outage execution and closure. The Planner serves as the single point contact responsible for communication of outage work order planning;
- **Outage Scheduler:** responsible for development, analysis, reporting, integration, maintenance and historical retention of outage schedules to support pre-outage, outage execution and closure;
- **Operations Production Superintendent/Gate Keeper:** represents the Operations organization and assists members of the Outage Management Team;

¹⁸¹ LEI-DR-01-044.

¹⁸² Ibid.

¹⁸³ LEI-DR-01-043 CONF Attachment.

¹⁸⁴ Ibid.

- **Clearance Coordinator:** assists members of the Outage Management Team;
- **System Lead/Engineer:** responsible for the planning, execution and closeout of specific planned outage systems or projects;
- **Maintenance Manager:** supports the outage by providing necessary resources and holding those assigned accountable to safely execute planned work;
- **Maintenance Production Superintendent:** coordinates resources to support the execution of the scheduled outages;
- **Maintenance Supervisor:** responsible for execution and closeout for labor and maintenance activities;
- **Safety Coordinator:** the point of contact for safety review, execution, and improvement at the plant;
- **Environmental Coordinator:** the point of contact for environmental review, execution, and improvement at the plant; and
- **Outage Coordinator:** responsible for coordinating assigned outage activities such as contracted cleaning services, or large-scale projects requiring oversight.

OVEC's handbook outlines a standard planned outage process that provides a structure for outage planning, implementation, and continuous improvement. The process monitors four key steps, namely: Preplanning, Planning, Execution, and Close-out (see Figure 62).¹⁸⁵

The **Preplanning process** provides the plan for all long-term strategic planning, budgeting, and material purchases. Five-year forecasts for O&M and capital budgets are developed, and the high-level scope for each outage is established. Long lead material purchases are identified, planned, budgeted, and ordered. On an annual basis the following year's budget is provisionally approved by top level management.

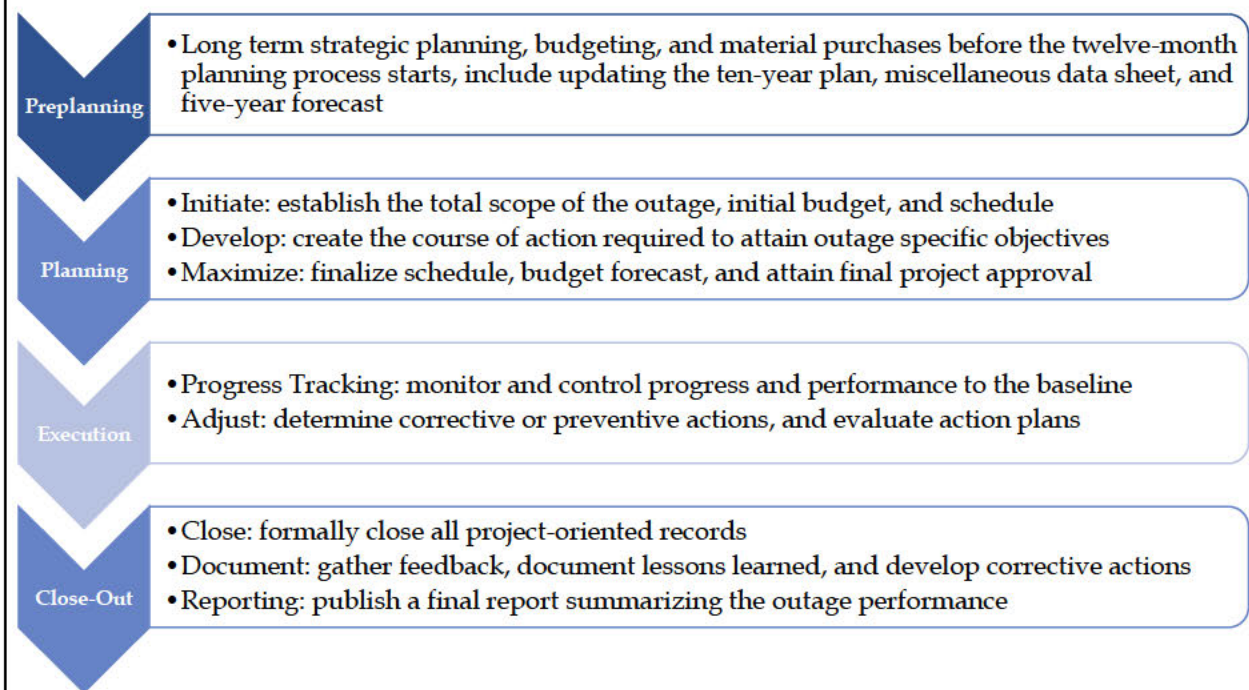
The **Planning** process develops the annual project plan and documents that will be used to carry out the outage. The Planning step is made up of three phases: *Initiate*, *Develop*, and *Maximize*. These phases encompass a twelve-month (48-week) timeline, and there is overlap among them.

- *initiate* phase consists of processes performed to establish the total scope of the outage and it is conducted during the first six months of the twelve-month planning timeline. The outage scope will include the required maintenance for continued safe and environmentally responsible operation of the unit. Along with the scope, an initial budget forecast and a level 1 schedule (i.e., a high-level overview) is developed which depicts the outage duration in the form of major milestones needed for successful completion.

¹⁸⁵ LEI-DR-01-043 CONF Attachment.

- *develop* phase consists of creating the course of action required to attain specific outage objectives (including cost, schedule, and scope) through the planning of each job. This takes two months of the twelve-month planning timeline. The outage scope is further developed to meet unit performance expectations within budget constraints.
- *maximize* phase finalizes the course of action required to attain specific outage objectives. This phase includes publishing the level 3 schedule (a detailed schedule with the critical path identified), finalizing the forecast and attaining final project approval through a formal readiness review with Plant Senior Management. This phase starts three months into the planning phase, while the initiate phase is still under way. The Maximize phase concludes with a Readiness Review, which presents to Senior Management the safety plans, work scope, budget, schedule, and project risks.

Figure 62. OVEC's outage planning process



Source: LEI-DR-01-043 CONF Attachment.

The **Execution** step consists of the processes to track, review, forecast, and regulate the progress and performance of the outage. Execution is made up of two phases: *Progress Tracking* and *Make Adjustments*. The *Track* phase acts as the embedded test measuring progress versus baseline expectations, while the *Adjust* phase represents the countermeasures put in place to rectify any change or deviations from the plan.

- *progress tracking* phase includes monitoring and controlling progress and performance to the baseline. Progress and performance are tracked through the Execution Key Performance Indicator's ("KPIs"): Safety, Budget, Schedule, Scope, and Quality.

- *adjust* phase involves determining corrective or preventive action and following up on action plans to determine if the actions taken resolved the performance issues. When changes occur, the System Lead reports effects of that change against the outage KPIs to Outage Manager.

The **Close-Out** process consists of the processes performed to finalize all activities and complete the outage. The Close-Out process is made up of three phases: *Close*, *Document*, and *Reporting*. The benefits of this phase are documented lessons learned, archived project documentation, contract closure, and process updates. This process encompasses a three-month timeline after the unit has been returned to operation.

- *close* phase includes involves the disposition of all unused material, rentals, and finalizing all contracts and work orders.
- *document* phase involves those processes necessary to gather feedback, document lessons learned, and develop corrective actions for any issues encountered during all phases of the outage process.
- *reporting* phase results in a final report. An outage summary is completed to evaluate project performance against the objectives of safety, scope, schedule, cost, and quality. Recommended future work will be included as well. The final report is completed by the Outage Manager following the OVEC/IKEC Outage Reporting procedure.

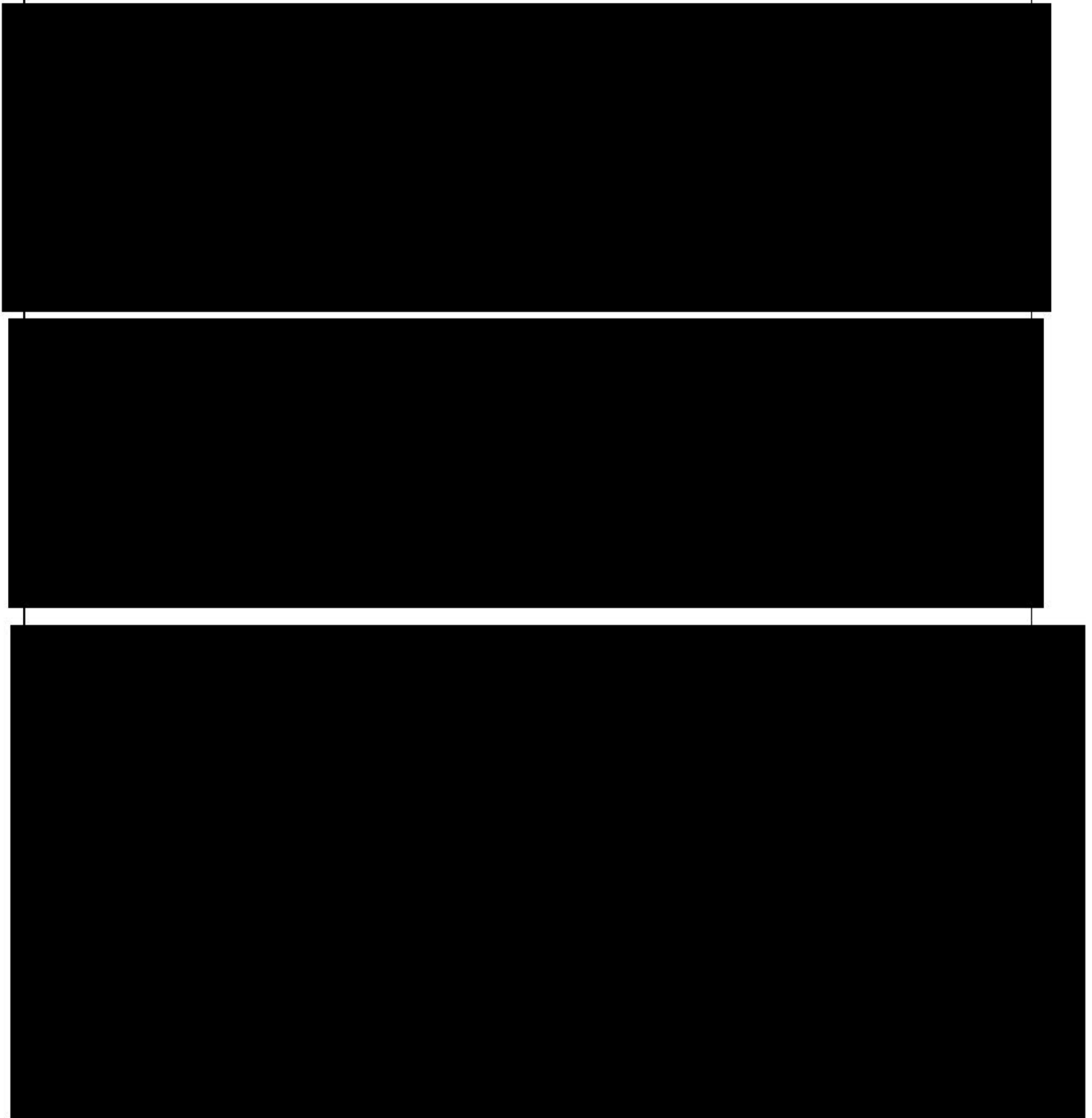
Upon reviewing the Planned Outage Handbook, LEI finds OVEC's outage planning to be thorough and well-documented. Activities involved in each step are laid out in an organized way and responsibilities regarding are clearly assigned to specific personnel.

9.3.4 Actual maintenance costs declined faster than planned costs

Actual outage maintenance costs are charged to DEO's customers through the LGR Rider. Therefore, it is important to evaluate the reasonableness and prudence of OVEC's outage costs.

LEI compared the generation assets' non-fuel O&M budget, which includes labor and non-labor/others, to actual maintenance costs for the audit period and 2018-2019. Actual outage maintenance costs were about [REDACTED] than the budgeted costs for 2020. In 2019, outage costs were [REDACTED] million, compared to budgeted costs of [REDACTED] million, which is [REDACTED] than forecasted. In 2020, the cost was about [REDACTED] million, which is [REDACTED] than the budgeted costs of [REDACTED] million. Overall, for 2018, 2019, and 2020, budgeted costs and actual costs have declined year-on-year consistently, while the difference between the budgeted costs and actual costs has increased (see Figure 63). In other words, actual costs were consistently lower than OVEC expected.

Figure 63. Maintenance costs for OVEC plants, budget vs actual, 2018-2020



Source: LEI-DR-01-048 CONF Attachment 1.

Note: Costs do not include routine maintenance or maintenance that does not require a unit outage.

9.3.5 Plant performance

OVEC-IKEC utilizes key indicators or metrics as part of their Open Book Leadership (“OBL”) initiative where metrics are reviewed on a weekly or monthly basis with employees. OBL is a management philosophy that OVEC-IKEC has utilized since 2015 to empower employees by providing them the information, education, and communication necessary to understand how the Company performs and how they can impact that performance. OVEC-IKEC utilizes an internal benchmarking process to set performance goals for improvement every year. Key plant metrics for OVEC-IKEC for 2018 through 2020 include safety, environmental compliance, budget adherence, and unit performance metrics such as equivalent forced outage rate, heat rate, capacity factor, equivalent unplanned outage factor, and equivalent availability factor.¹⁸⁶

For the purpose of this audit, LEI focused on the following key performance indicators:

- Heat Rate (“HR”), an indicator of the efficiency of converting thermal energy from fuel into electrical energy;
- Capacity Factor (“CF”), an indicator of capacity utilization defined as the ratio of actual energy output to the maximum possible energy output over a given period of time;
- Equivalent Forced Outage Rate (“EFOR”), a reliability metric defined as the proportion of a period where a unit is not available due to forced outages and forced de-ratings; and
- Equivalent Availability Factor (“EAF”), a reliability metric defined as the proportion of a period where a unit is available without any outages or equipment deratings.

¹⁸⁶ LEI-DR-05-005 CONF Attachment.

9.3.5.1 Heat rates worsened in 2020

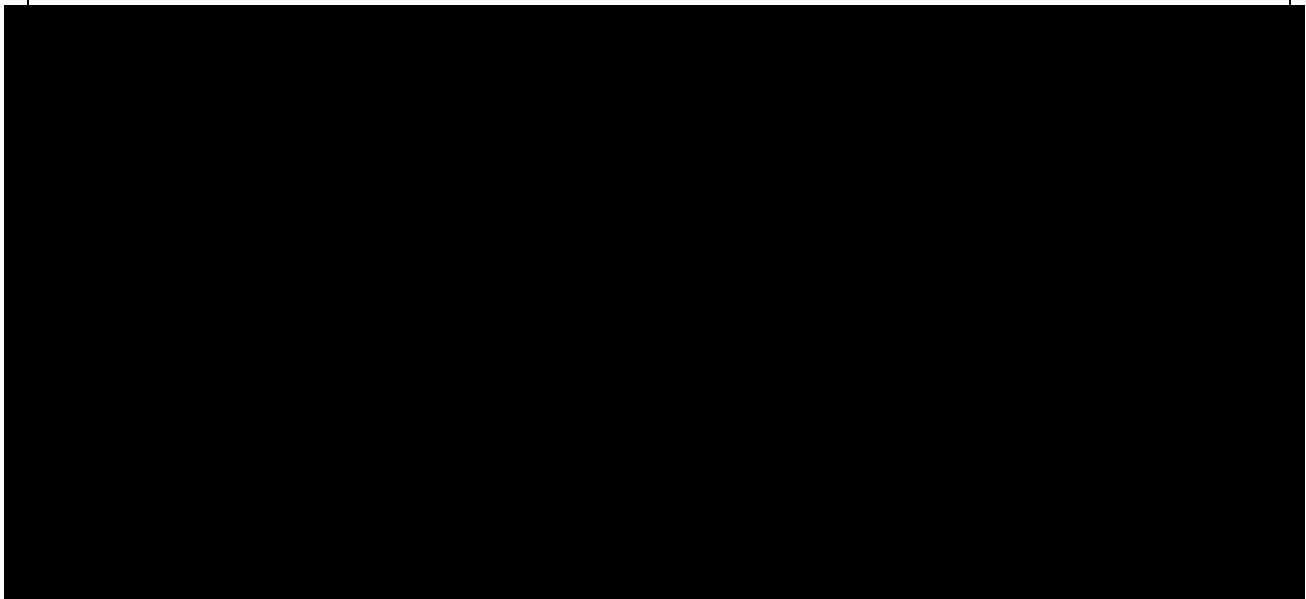
Heat rates, typically expressed in Btu/kWh, measure the efficiency with which a unit converts the energy from fuel (such as coal) into electricity. The lower the heat rate, the more efficient the unit is at generating electricity from a given amount of fuel. Plants with lower heat rates burn less fuel, and so cost less to generate a given amount of electricity (all else being equal).

Several factors can influence a unit's heat rate, such as original design, operating parameters, age, or unit load. Maintenance is important to ensure that the heat rate will not increase significantly as the unit ages.

LEI examined three years of annual heat rates, including the audit period (2020) and comparison years (2018 and 2019) (see Figure 64). Nearly all the OVEC units had higher heat rates (were less efficient) than the PJM average every year. The exceptions were Clifty Creek Units 1 and 5, and Kyger Creek Unit 3 in 2019. However, though all units had higher heat rates than the PJM average in 2020, the only unit with a heat rate more than 10% higher than the PJM average was Clifty Creek Unit 6.

All the coal units at both plants experienced an increased heat rate between 2019 and 2020 (worsening efficiency). Lower energy prices in PJM lead to more frequent dispatch at lower (less efficient) operating rates, thereby increasing heat rates.¹⁸⁷

Figure 64. Generation unit heat rates (Btu/kWh)



Source: LEI-DR-01-045 CONF Attachment. PJM average heat rate aggregated by S&P Global Market Intelligence.

Note: Highlights in yellow indicate heat rates that are higher than the PJM Average by [REDACTED] highlights in red indicate that the year-to-year (2019-2020) increase in heat rates of OVEC plants [REDACTED]

¹⁸⁷ Oral presentation from OVEC staff during the virtual plant site visit on November 05, 2021.

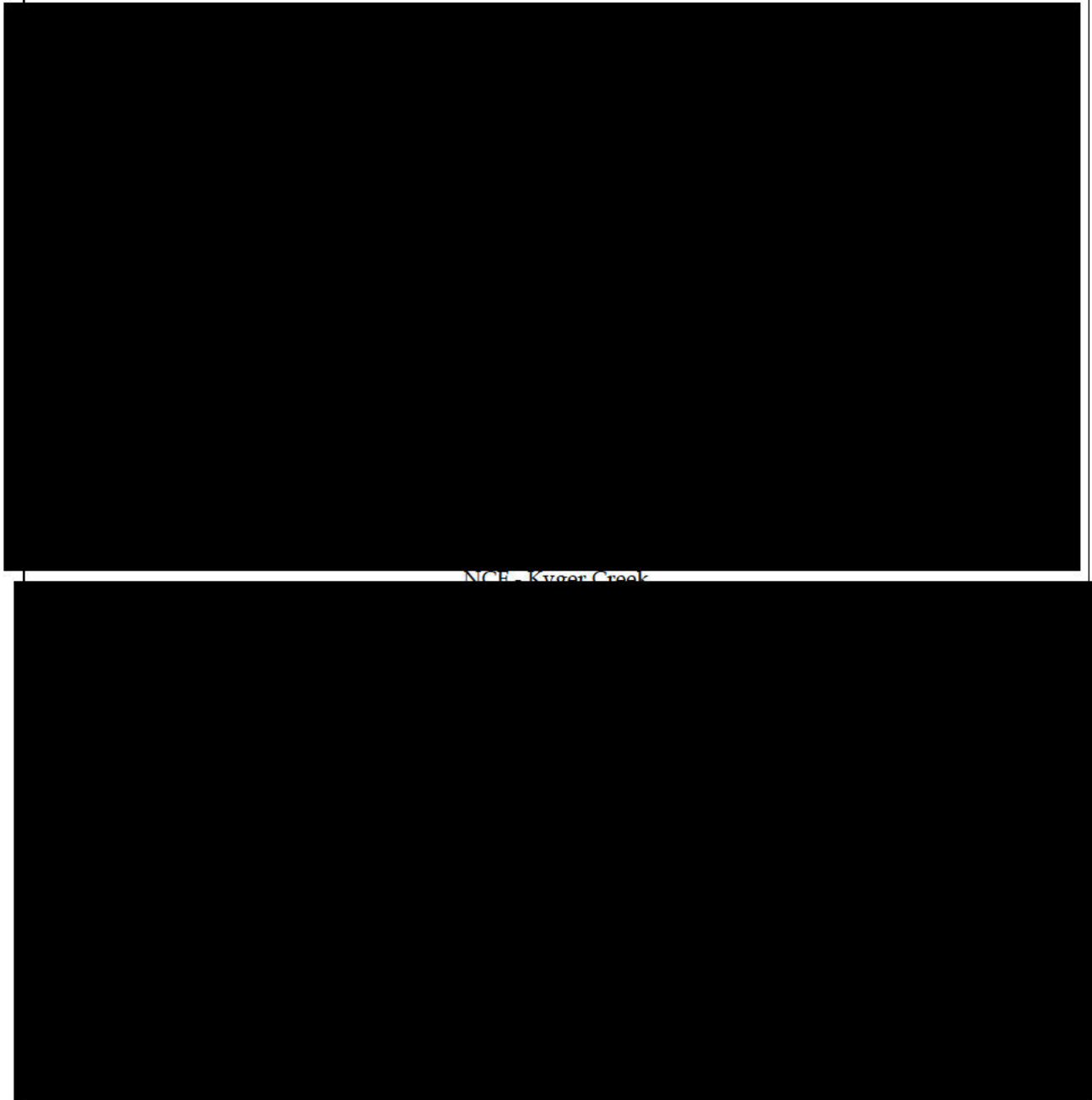
9.3.5.2 OVEC units' capacity factors declined in 2020

The CF is the ratio of the actual energy generation over a given period of time to the maximum possible generation over that period. Typically, plants with lower operating costs (based on cheaper fuel and/or lower heat rates) will have higher capacity factors, because they are dispatched more often, although other causes such as maintenance or planned outages can affect a plant's CF.

Net CF ("NCF")¹⁸⁸ all declined in 2020 compared to 2019 (see Figure 65).

¹⁸⁸ Net generation is the gross unit generation less the parasitic (auxiliary) load used by the unit to generate the gross output.

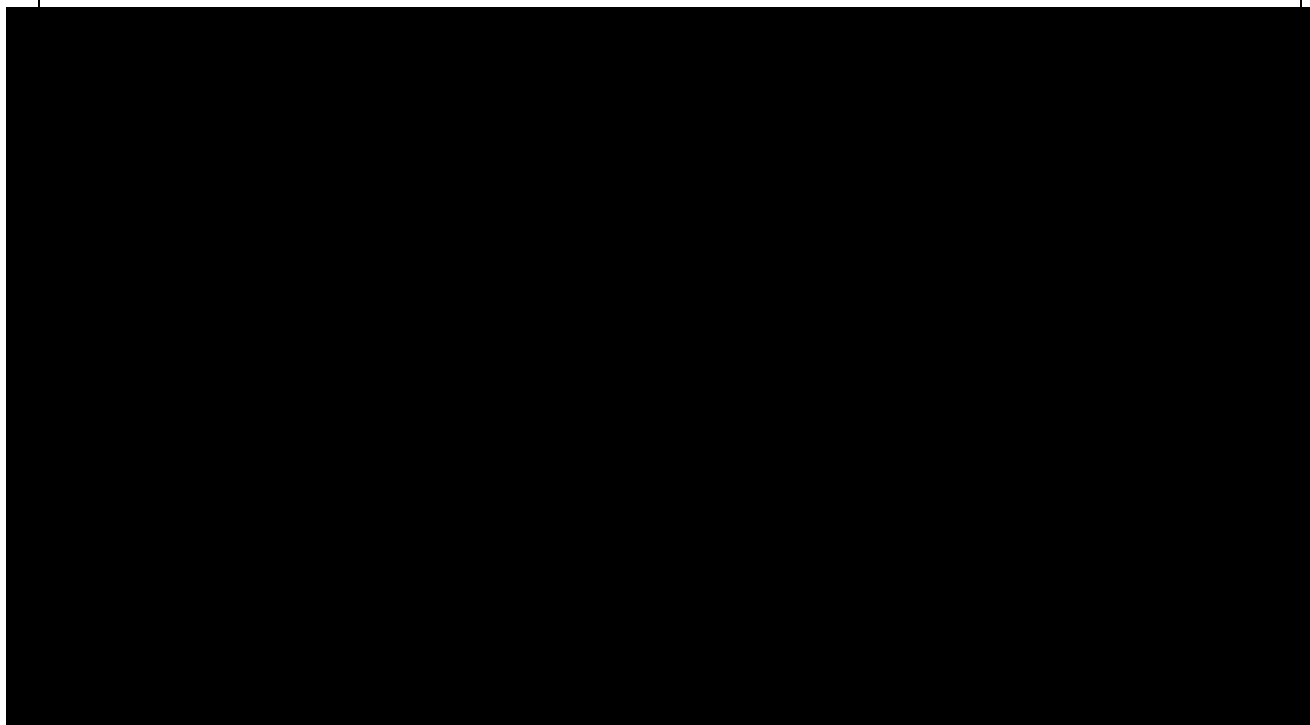
Figure 65. Monthly NCF of OVEC units, 2018-2020



Source: LEI-DR-01-046 CONF Attachment 2.

During the audit period, all plants experienced a year-on-year decline in the NCF, in the range of [REDACTED] for the Clifty Creek plant and between [REDACTED] or Kyger Creek (see Figure 66). In spite of this, with the exception of Clifty Creek Unit 6, all units had CFs higher than the average of other PJM coal plants of similar size.

Figure 66. Generation units average annual NCF (%), 2018-2020



Source: Plant data from LEI-DR-01-046 CONF Attachment 2; PJM Average data aggregated by S&P Global Market Intelligence.

Note: Highlights in yellow indicate NCFs that are lower than the PJM average by [REDACTED]

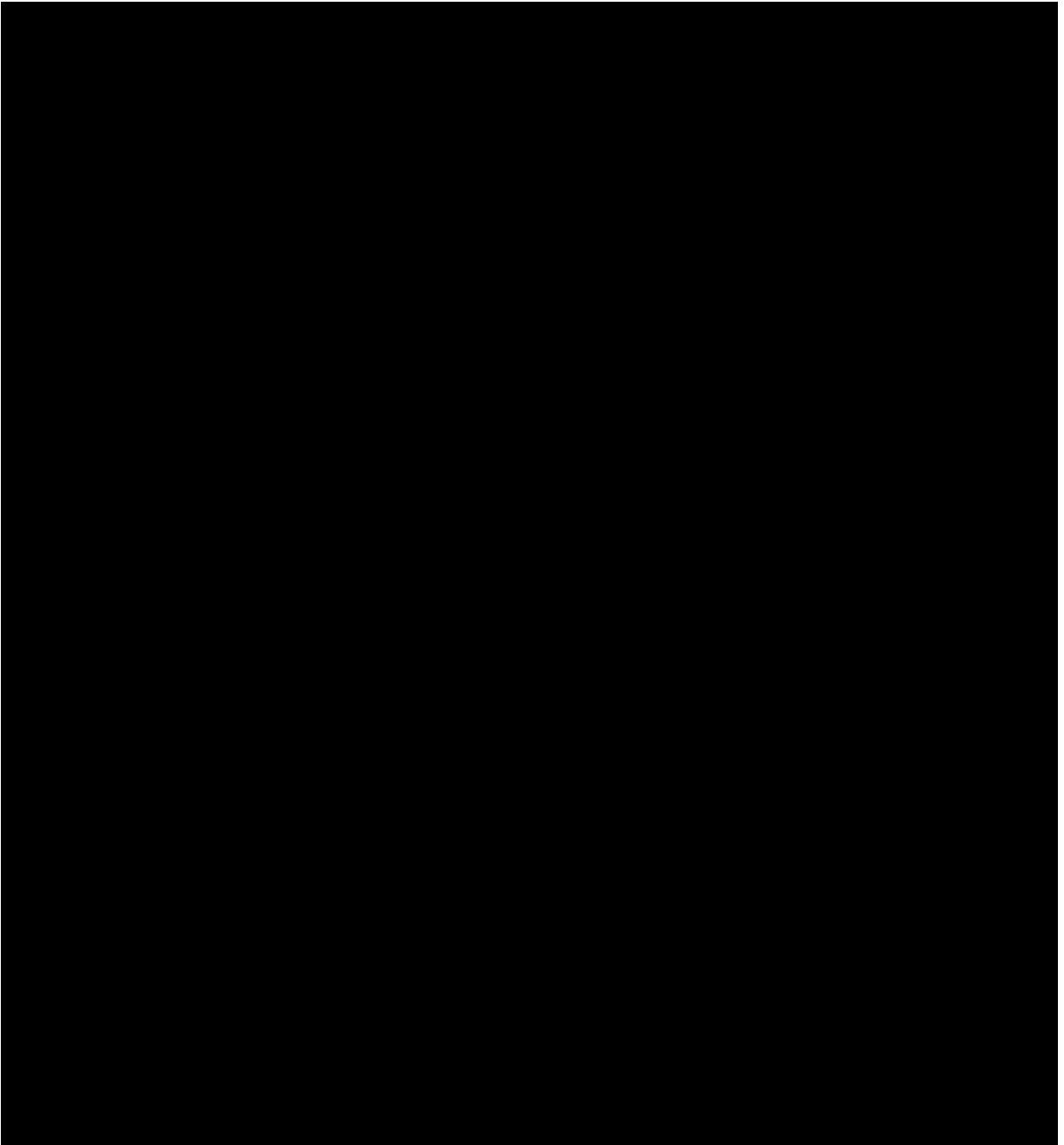
9.3.5.3 EFOR data indicate OVEC plants were more reliable than industry averages in 2020

EFOR reflects the number of hours a unit is forced off-line, compared to the number of hours a unit is running. For example, an EFOR of 5% indicates that the unit was forced off 5% of its running time. A lower EFOR therefore indicates a more reliable plant. During the audit period, the EFOR declined (improved) for four of the six Clifty Creek units and increased (deteriorated) for four of the five Kyger Creek units.

In comparison to the benchmark EFOR demand (EFORd) published by PJM (for coal plants) and weighted EFOR (“WEFOR”) published by the NERC (for coal plants), all OVEC units improved EFORs (see Figure 67). WEFOR is a mean outage rate calculated by taking the sum of each unit’s capacity weighted forced outage and derate hours divided by the sum of the total equivalent service, outage, and derate hours.¹⁸⁹

¹⁸⁹ NERC. 2020 *State of Reliability Report*. July 2020. P. 38.
<https://www.nerc.com/pa/RAPA/PA/Performance%20Analysis%20DL/NERC_SOR_2020.pdf>

Figure 67. EFOR of OVEC units, 2018-2020



Units	EFOR		
	2018	2019	2020
Clifty Creek 1			
Clifty Creek 2			
Clifty Creek 3			
Clifty Creek 4			
Clifty Creek 5			
Clifty Creek 6			
<i>Clifty Creek Average</i>			
Kyger Creek 1			
Kyger Creek 2			
Kyger Creek 3			
Kyger Creek 4			
Kyger Creek 5			
<i>Kyger Creek Average</i>			
<i>Industry Average</i>	10.47	9.56	10.59
<i>PJM Average</i>	10.91	10.92	8.26

Source: LEI-DR-01-046 CONF Attachment 2; Industry average WEFOR is published annually by NERC for all fuel types including coal. <<https://www.nerc.com/pa/RAPA/gads/Pages/Reports.aspx>>; PJM average EFORd is published on the PJM data miner.

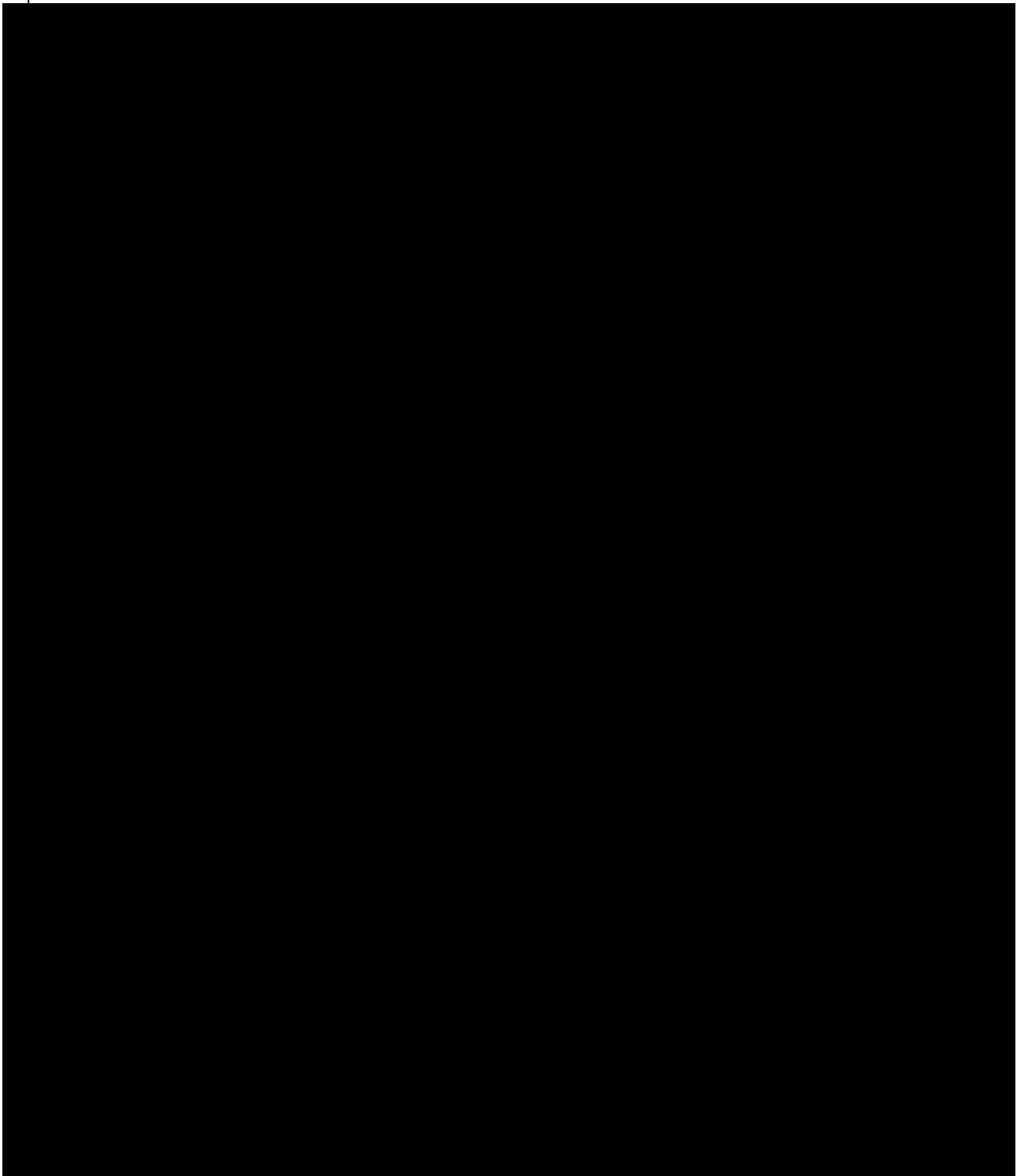
Note: Highlights in yellow indicate EFORs that are higher than the industry average by [REDACTED] while the highlights in red indicate EFORs that are higher than the [REDACTED]

9.3.5.4 EAF data indicates that most of the OVEC plants were available as often as PJM averages

EAF reflects the proportion of a period of time that energy could be generated if limited only by outages and deratings. A higher EAF reflects a better-maintained plant. During the audit period, EAF performance was mixed: EAFs at Clifty Creek Units 1 and 6 improved, but EAFs for Clifty Creek Units 2-5 declined; EAFs at Kyger Creek Units 1, 2, and 5 improved, while EAFs at Units 3 and 4 worsened (see Figure 68). In the previous audit, LEI noted that low EAFs and a high EFOR for Clifty Creek Unit 6 were related to technical problems with one of the baffle walls.¹⁹⁰ This unit's EFOR and EAF performance vastly improved in 2020, indicating that the baffle wall problem was fixed.

¹⁹⁰ LEI. *Audit of the Price Stabilization Rider of Duke Energy Ohio, Final Report*. October 15, 2020. P. 10.

Figure 68. EAFs of OVEC units, 2018-2020



Units	EAF		2020 (Audit period)
	2018 (Comparison year)	2019 (Comparison year)	
Clifty Creek 1			
Clifty Creek 2			
Clifty Creek 3			
Clifty Creek 4			
Clifty Creek 5			
Clifty Creek 6			
<i>Clifty Creek Average</i>			
Kyger Creek 1			
Kyger Creek 2			
Kyger Creek 3			
Kyger Creek 4			
Kyger Creek 5			
<i>Kyger Creek Average</i>			
<i>PJM Average</i>	83.2	83.5	84.8

Source: LEI-DR-03-002 CONF Attachment; Monitoring Analytics. 2020 *State of Market Report – PJM*. P. 44; Monitoring Analytics. 2019 *State of Market Report – PJM*. P. 45.

Note: Highlights in yellow indicate EAFs that are lower than the PJM average by [REDACTED]
red indicate EAFs that are [REDACTED]

9.3.6 Emergency procedures and COVID-19 response

OVEC managers reported that the plants each have operating procedures in place for summer and winter readiness, and to deal with localized flash flooding if that should occur.¹⁹¹ Managers reported that the coal piles have never frozen to the point at which they are unusable. However, if needed, coal can be loaded straight into the plants, or re-located to alternate conveyors. With respect to flooding, operators monitor water levels of the Ohio River, and access and escape plans are in place.

OVEC managers reported that COVID-19 procedures during the audit period included social distancing and mask-wearing, and remote working for non-essential personnel.¹⁹² Managers noted that COVID-19 protocols did not impact OVEC's available personnel to a level that resulted in an inability to operate the plants.

¹⁹¹ Virtual Site visit, November 5, 2021.

¹⁹² Ibid.

9.4 Recommendations

Based on the observations discussed in this section, LEI makes the following recommendations:

- In 2020, low energy prices led to generally lower operating levels and higher heat rates. This may be temporary but was in contrast to the PJM average heat rate which actually declined in 2020. DEO, in its role on the OVEC Operating Committee, should monitor performance to ensure efficient operation of the plants.
- During the audit period, availability improved generally compared to 2018, but a few units performed below NERC averages. LEI recommends that DEO, in its role on the Operating Committee, determine if it is cost-effective to take measures to improve availability.

10 Appendix of acronyms

AAAR	Alternate Authorized Account Representative
AAR	Authorized Account Representative
ACES	Alliance for Cooperative Energy
ACP	Alternative Compliance Payments
AEC	Atomic Energy Commission
AEP	American Electric Power
AEP Ohio	Ohio Power Company plus Columbus Power
AEPSC	American Electric Power Service Corporation
A/S	Ancillary Service
BAT	Best Available Technology
BOD	Board of Directors
BP	Base Product
BRA	Base Residual Auctions
BTU	British Thermal Unit
CAA	1970 Clean Air Act
CAAA	Clean Air Act Amendments
CAIR	Clean Air Interstate Rule
CAMD	Clean Air Markets Division
CAMR	Clean Air Mercury Rule
CCGT	Combined Cycle Gas Turbine
CCR	Coal Combustion Residuals
CEMS	Continuous Emissions Monitoring System
CF	Capacity Factor
CFO	Chief Financial Officer
COO	Chief Operation Officer
CO ₂	Carbon Dioxide
CP	Capacity Performance
CSAPR	Cross-State Air Pollution Rules
DA	Day Ahead
DEO	Duke Energy Ohio

PUBLIC VERSION - REDACTED

DEOK	Duke Energy Ohio-Kentucky
DOE	Department of Energy
DR	Data Request
EAF	Equivalent Availability Factor
EFOR	Equivalent Forced Outage Rate
EIA	Energy Information Administration
ELG	Effluent Limitations Guidelines
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ESH	Environmental, Safety, and Health Department
ESP	Electricity Security Plan
FERC	Federal Energy Regulatory Commission
FES	FirstEnergy Solutions
FGD	Flue Gas Desulfurization
FP	Fuel Procurement
FRR	Fixed Resource Requirement
HB 6	House Bill 6
HR	Heat Rate
ICPA	Inter-Company Power Agreement
IDEM	Indiana Department of Environmental Management
IKEC	Indiana-Kentucky Electric Corporation
IRP	Integrated Resource Plan
JBR	Jet Bubbling Reactor
KPI	Key Performance Indicator
kWh	Kilowatt Hour
LCOE	Levelized Cost of Energy
LDA	Locational Delivery Area
LEI	London Economics International
LGR	Legacy Generation Resource
LSE	Load Serving Entity
MATS	Mercury and Air Toxics Standards
MISO	Midcontinent Independent System Operator

PUBLIC VERSION - REDACTED

MOPR	Minimum Offer Price Rule
MW	Megawatt
NCF	Net Capacity Factor
NERC	North American Electric Reliability Corporation
NO _x	Nitrous Oxide
NPDES	National Pollution Discharge Elimination System
O&M	Operation and Maintenance
OBL	Open Book Leadership
OVEC	Ohio Valley Electric Corporation
PAH	Performance Assessment Hours
PM	Particulate Matter
PPA	Power Purchase Agreement
PPR	Power Participation Ratio
PSR	Price Stabilization Rider
PUCO	Public Utilities Commission of Ohio
REC	Renewable Energy Credit
RFP	Request for Proposal
RGGI	Regional Greenhouse Gas Initiative
RPM	Reliability Pricing Model
RPS	Renewable Portfolio Standard
RSR	Retail Stability Rider
RT	Real Time
RTO	Regional Transmission Owner
SCR	Selective Catalytic Recovery
SGEE	Steam Generation Equipment Engineering
SO ₂	Sulfur Dioxide
SREC	Solar Renewable Energy Credits
SVP	Senior Vice President
UCS	Union of Concerned Scientists
US	United States
VP	Vice President
WWTP	Wastewater Treatment Plant

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Summary: Audit of the Legacy Generation Resource Rider of Duke Energy Ohio
Final Report, Public Version electronically filed by Mrs. Kimberly M. Naeder on
behalf of PUCO