

OCC EXHIBIT NO. _____

**BEFORE
THE PUBLIC UTILITIES COMMISSION OF OHIO**

| | | |
|---|---|-------------------------|
| In the Matter of the Application Seeking |) | |
| Approval of Ohio Power Company's |) | |
| Proposal to Enter into an Affiliate Power |) | Case No. 14-1693-EL-RDR |
| Purchase Agreement for Inclusion in the |) | |
| Power Purchase Agreement Rider. |) | |
| |) | |
| In the Matter of the Application of Ohio |) | |
| Power Company for Approval of Certain |) | Case No. 14-1694-EL-AAM |
| Accounting Authority. |) | |

(PUBLIC VERSION)

**DIRECT TESTIMONY
OF
SARAH E. JACKSON**

**On Behalf of the
Office of the Ohio Consumers' Counsel**
*10 West Broad Street, Suite 1800
Columbus, Ohio 43215*

SEPTEMBER 11, 2015

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(PUBLIC VERSION)
Direct Testimony of Sarah E. Jackson
On Behalf of the Office of the Ohio Consumers' Counsel
PUCO Case No. 14-1693-EL-RDR, et al.

I. INTRODUCTION

Q1. PLEASE STATE YOUR NAME, BUSINESS ADDRESS, AND POSITION.

A1. My name is Sarah E. Jackson. I am a Senior Associate at Synapse Energy Economics, Inc. ("Synapse"), which is located at 485 Massachusetts Avenue, Suite 2, Cambridge, Massachusetts.

Q2. PLEASE SUMMARIZE YOUR WORK EXPERIENCE AND EDUCATIONAL BACKGROUND.

A2. I have over 10 years of experience analyzing federal and state regulations, policies, and environmental planning documents for municipal governments, consumer advocate clients, and environmental organizations. I have been a consultant at Synapse for four years, where I apply my experience to evaluate the impacts of policies and regulations on the electric sector, the costs and impacts of electricity production options, and the environmental compliance assumptions used by utilities in major regulatory filings.

I have provided consulting services for various clients, including the U.S. Environmental Protection Agency ("EPA"), the National Association of State Utility Consumer Advocates ("NASUCA"), the Regulatory Assistance Project ("RAP"), the Maine Office of the Public Advocate, the New Hampshire Office of the Consumer Advocate, the Massachusetts Attorney General's Office,

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1 PowerOptions, Vermont Energy Investment Corporation, and Conservation
2 Services Group the Union of Concerned Scientists (“UCS”), Sierra Club,
3 Earthjustice, Natural Resources Defense Council (“NRDC”), Citizens Action
4 Coalition of Indiana, the Civil Society Institute, and Clean Wisconsin.

5
6 Prior to joining Synapse, I worked for six years as a research and policy analyst at
7 the not-for-profit law firm Earthjustice in Oakland, California, where I analyzed
8 the impacts of proposed federal, state, and local regulations, policies, and
9 environmental compliance plans, with a focus on air emissions and energy.

10
11 I hold a bachelor’s degree from Mount Holyoke College and a Master of
12 Environmental Law and Policy from Vermont Law School.

13
14 My full curriculum vita is attached as Exhibit SEJ-1.

15
16 ***Q3. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE PUBLIC UTILITIES***
17 ***COMMISSION OF OHIO?***

18 ***A3.*** Yes. I previously testified before the Public Utilities Commission of Ohio (“the
19 Commission” or “PUCO”) in Case No. 14-841-EL-SSO.

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1 ***Q4. WHAT IS THE PURPOSE OF YOUR TESTIMONY?***

2 ***A4.*** I was retained by the Office of the Ohio Consumers' Counsel to review and
3 evaluate the Ohio Power Company's ("AEP Ohio" or the "Utility") materials in
4 this proceeding related to Factor 3 of the PUCO's February 25, 2015 Opinion and
5 Order in case no. 13-2385-EL-SSO ("February 25 Order").

6
7 It is my understanding of Factor 3 of the PUCO's February 25 Order that the
8 Utility must describe how each generating unit it seeks to include in the existing
9 PPA Rider is compliant with all pertinent environmental regulations and describe
10 its plan for compliance with pending environmental regulations.¹ My testimony
11 addresses the Utility's environmental compliance plan and discusses the potential
12 financial risks these units pose to customers.

13
14 ***Q5. PLEASE DESCRIBE THE UTILITY'S PROPOSAL.***

15 ***A5.*** In its Affiliated PPA, AEP Ohio proposes to purchase all of the energy, capacity,
16 and ancillary services from specific generating units owned by AEP Generation
17 Resources, Inc. ("AEPGR") and sell it into the PJM market. All of the revenues
18 from such sales will offset the cost of the Affiliated PPA. Any difference
19 between the PJM revenues and Affiliated PPA costs will be passed on to AEP
20 Ohio's customers through the PPA Rider. The Utility is also asking to include the
21 net impacts of its OVEC PPA—an agreement regarding its contractual entitlement

¹ February 25 Order at page 25.

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1 to a share of the electrical output from the generating units that are owned by the
2 Ohio Valley Electric Corporation—in the PPA Rider.

3
4 **Q6. PLEASE SUMMARIZE YOUR MAJOR CONCLUSIONS AND**
5 **RECOMMENDATIONS REGARDING THE AFFILIATED AND OVEC**
6 **PPAS.**

7 **A6.** In the Amended Application, AEP Ohio states that:

8 (T)he purpose of the proposed PPA Rider is to stabilize rates for
9 both shopping customers and SSO customers alike—by passing
10 through to customers the differential between PJM market prices
11 and a cost-based contractual price, in this case the cost-based
12 prices of the Affiliated and OVEC PPAs.²

13
14 The Utility admits that the generating units that fall under the Affiliated and
15 OVEC PPAs are on the economic bubble, and that price signals in PJM could lead
16 to the retirement of the units in the absence of the PPA.³

17
18 In my testimony, I describe the additional pollution control investments that may
19 be needed to bring these units into compliance with current and future
20 environmental rules and describe the ways in which these investments would
21 affect the economics of the generating units. I describe how customers could

² Amended Application. Case No. 14-1693-EL-RDR and Case No. 14-1694-EL-AAM. Page 4, paragraph 4.

³ Amended Testimony of Toby L. Thomas. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 11, line 7.

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1 likely pay much more than the [REDACTED] the Utility has estimated for
2 environmental compliance over the years 2015 through 2024.

3 I conclude that the proposed PPAs are not in the best interest of customers, as
4 they shift potentially significant cost risks, including but not limited to
5 environmental cost risks, onto consumers.

6
7 **II. ANALYSIS OF THE AFFILIATED AND OVEC PPAs**

8
9 ***Q7. WHAT IS THE UTILITY'S STATED REASON FOR THE PPAs?***

10 ***A7.*** The Utility's Amended Application states that "inclusion of the Affiliated PPA
11 and the OVEC PPA in the PPA Rider would always provide a measure of stability
12 in parallel to, and as a hedge against, more volatile market prices."⁴ The PPAs
13 would also "reduce the likelihood of premature retirements of the relevant
14 AEPGR generating plants due to short-term economic signals,"⁵ and would
15 "incorporate a long-term solution for other Ohio coal plants that are on the
16 economic bubble going forward."⁶

⁴ Amended Application. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. Page 4, paragraph 4.

⁵ Amended Application. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. Page 4, paragraph 5.

⁶ Amended Application. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. Page 6, paragraph 9.

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1 ***Q8. PLEASE BRIEFLY DESCRIBE THE UNITS THAT WOULD BE COVERED***
2 ***UNDER THE AFFILIATED PPA AND THE OVEC PPA.***

3 ***A8.*** Table 1, below, gives a list of the units included under each of the PPAs
4 (collectively, the “PPA Units”), as well as their PPA entitlement in megawatts
5 (MW) and their expected retirement years.

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1

Table 1. PPA Rider Units^{7,8,9}

| Plant | Location | Unit | PPA Entitlement (MW) | Currently Planned Retirement Year | Control Technologies |
|--------------------|----------|------|----------------------|-----------------------------------|----------------------|
| AEPGR Units | | | | | |
| Cardinal | OH | 1 | 592 | 2033 | LNB, ESP, FGD, SCR |
| Conesville | OH | 4 | 339 | 2033 | LNB, ESP, OFA, |
| Conesville | OH | 5 | 405 | 2036 | LNB, ESP, OFA, FGD |
| Conesville | OH | 6 | 405 | 2038 | LNB, ESP, OFA, FGD |
| Stuart | OH | 1 | 150 | 2033 | LNB, ESP, FGD, SCR |
| Stuart | OH | 2 | 150 | 2033 | LNB, ESP, FGD, SCR |
| Stuart | OH | 3 | 150 | 2033 | LNB, ESP, FGD, SCR |
| Stuart | OH | 4 | 150 | 2033 | LNB, ESP, FGD, SCR |
| Zimmer | OH | 1 | 330 | 2051 | LNB, ESP, FGD, SCR |
| OVEC Units | | | | | |
| Kyger | OH | 1 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Kyger | OH | 2 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Kyger | OH | 3 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Kyger | OH | 4 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Kyger | OH | 5 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 1 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 2 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 3 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 4 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 5 | 40 | 2040 | ESP, OFA, FGD, SCR |
| Clifty | IN | 6 | 40 | 2040 | ESP, OFA, FGD |
| Total | | | 3,111 | | |

2

⁷ Amended Testimony of Pablo Vegas. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 12, Table 2.

⁸ Amended Testimony of Toby L. Thomas. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 3, line 10 through page 4, line 22.

⁹ Amended Testimony of John M. McManus. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 4, lines 7-13.

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Utility witness Thomas describes each of the AEPGR units in more detail in his Direct Testimony in support of AEP Ohio's Amended Application. The OVEC plants – Kyger Creek and Clifty Creek – are coal-fired steam generating plants capable of producing 1,086 MW and 1,303 MW, respectively. Both OVEC plants began operation in 1955.¹⁰

III. FUTURE ENVIRONMENTAL COMPLIANCE RISKS

Q9. WHAT ADDITIONAL COST RISKS DO THE AFFILIATE PPA AND OVEC PPA UNITS FACE DURING THE TERMS OF THEIR RESPECTIVE CONTRACTS?

A9. Coal-fired generation produces significant amounts of air, water, and waste pollution. Environmental regulations pose risks that will likely lead to higher costs for these units in the future. Most of the PPA Units are fairly well-controlled from a criteria air pollutant standpoint and some appear to be in the process of upgrading water and waste controls. But over the life of the PPA Rider—which ends only after the units are retired and all post-retirement obligations and removal projects are complete¹¹—these facilities are likely to be impacted by increasingly stringent environmental controls.

¹⁰ See OVEC Annual Report – 2014, p. 1 available at: <http://www.ovec.com/FinancialStatements/AnnualReport-2014-Signed.pdf>.

¹¹ See Exhibit KDP-1, p. 1.

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1 A number of regulations covering air, water, and waste pollution from electric
2 generators have been proposed or are under development by the EPA that could
3 increase compliance costs at the PPA Units. These include the Mercury and Air
4 Toxics Standard ("MATS"), Effluent Limitations Guidelines and Standards
5 ("ELG"), Disposal of Coal Combustion Residuals ("CCR"), Section 316(b)
6 Cooling Water Intake Structures at Existing Facilities rule ("316b"), National
7 Ambient Air Quality Standards ("NAAQS") for ozone and sulfur dioxide, and the
8 Cross State Air Pollution Rule ("CSAPR").
9

10 ***Q10. PLEASE BRIEFLY DESCRIBE THE PURPOSE AND IMPACT OF THE***
11 ***MERCURY AND AIR TOXICS RULE.***

12 ***A10.*** The MATS Rule, finalized in 2012, established emissions rates for various
13 pollutants, including: mercury; acid gases; non-mercury metals like arsenic, lead,
14 cadmium, and selenium; and various organic hazardous air pollutants ("HAPs").
15 The rule is described in the Direct Testimony of AEP Ohio witness John M.
16 McManus.
17

18 ***Q11. HOW WILL THE MATS RULE AFFECT THE AEPGR PLANTS THAT ARE***
19 ***PART OF THE AFFILIATED PPA?***

20 ***A11.*** According to Utility witness Thomas, Conesville Units 5 and 6 will install:

21 a new technology designed to filter mercury from the flue gas
22 exiting the FGD system on those units. Based on pilot scale

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1 testing, it is anticipated that these projects will allow Conesville 5
2 and 6 to comply with the MATS rule.¹²

3
4 According to Mr. Thomas, the remaining AEPGR units have ESP, SCR, and FGD
5 systems installed and will not require additional controls to meet the MATS
6 requirements.

7
8 ***Q12. PLEASE DESCRIBE THE MATS TECHNOLOGY THAT IS BEING***
9 ***INSTALLED AT CONESVILLE 5 AND 6.***

10 ***A12.*** According to AEP Ohio's response to Sierra Club Interrogatory INT-2-051, the
11 new technology is a mercury capture technology developed by Gore, consisting of
12 a series of filters that captures mercury downstream of installed FGD
13 technologies.¹³ Expected capital costs for the Gore technology is approximately
14 [REDACTED], with [REDACTED] variable or fixed O&M costs.¹⁴

¹² Amended Testimony of Toby L. Thomas. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 7, lines 12-19.

¹³ Ohio Power Company's Responses to Sierra Club's Discovery Requests. PUCO Case NO. 14-1693-EL-RDR. Second Set. INT-2-051.

¹⁴ SC-INT-2-051 Confidential Attachment 1.

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1 ***Q13. ARE THESE COSTS FOR CONTROLLING MERCURY AND OTHER AIR***
2 ***TOXICS AT CONESVILLE UNITS 5 AND 6 THE ONLY COSTS THE PPA***
3 ***UNITS WILL INCUR UNDER THIS STANDARD FOR THE DURATION OF***
4 ***THE PPA RIDER?***

5 ***A13.*** That is unlikely. There may be additional costs associated with the Gore
6 technology that AEP Ohio has not accounted for in its analysis. The Utility has
7 only done pilot testing on these technologies, and it is possible that additional
8 filters will be necessary to achieve required mercury reductions, increasing the
9 capital costs. And while AEP Ohio states that the fixed and variable O&M costs
10 are [REDACTED], the Gore technology informational brochure, attached as Exhibit SEJ-2,
11 states that operating costs are very low. So while [REDACTED], these costs [REDACTED]
12 [REDACTED], and operation of the technology could incur additional costs to AEP Ohio,
13 which would be passed on to consumers under the PPA.

14

15 Furthermore, mercury is a dangerous neurotoxin. It is possible that, over the
16 course of the 18-36+ years that AEP Ohio is proposing to have the PPA Rider in
17 place, the MATS standard will be revised to include more stringent requirements
18 on some or all of the PPA Units, requiring additional capital expenditures. Such
19 expenditures would be expenses included under the PPA, and charged to
20 customers.

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Q14. WHAT OTHER FUTURE ENVIRONMENTAL COSTS HAS THE UTILITY INCLUDED IN ITS FORECASTS FOR THE AFFILIATE PPA AND OVEC UNITS?

A14. The Utility's estimates include costs for several planned environmental projects. Regarding the Affiliate PPA units, the Utility provided estimates of control costs for the 316(b) rule, the CCR rule, and the ELG rule.¹⁵ Regarding the OVEC units, the Utility provided the projected costs of environmental controls that will be installed at the Kyger and Clifty Creek plants starting in [REDACTED].¹⁶ The controls appear to be planned to comply with the 316(b) rule, the CCR rule, and the ELG rule. Table summarizes the assumed capital costs for the compliance with the rules described above.

**Table 2:
Summary of Select Environmental Compliance Costs
for the Affiliated and OVEC Units¹⁷**

| PPA Rider Plant | Capital costs (2015-2024, \$mil) |
|-------------------------------------|-------------------------------------|
| Cardinal | [REDACTED] |
| Conesville | [REDACTED] |
| Stuart | [REDACTED] |
| Zimmer | [REDACTED] |
| Clifty Creek (19.93% share of OVEC) | [REDACTED] |
| Kyger Creek (19.93% share of OVEC) | [REDACTED] |
| Total | [REDACTED] |

¹⁵ Data Response to SC INT 2-89 Confidential Attachment 1.

¹⁶ SC INT 2-89 Supplemental Confidential Attachment 2.

¹⁷ Costs provided in Data Response to SC INT 2-89 Confidential Attachment 1 & Data Response to SC INT 2-89 Supplemental Confidential Attachment 2. Note that capital costs are summation of nominal dollars in the years 2015 through 2024.

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1 ***Q15. DO THESE COSTS APPEAR TO BE REASONABLE ESTIMATES FOR***
2 ***COMPLYING WITH THESE RULES AS THEY STAND TODAY?***

3 ***A15.*** Without more detailed information on the characteristics and requirements of each
4 unit, it is difficult to evaluate whether these cost estimates are reasonable for
5 compliance with the listed rules. While these estimates demonstrate that the
6 Utility is considering some costs related to near-term environmental obligations,
7 as I explain in more detail below, they certainly do not represent the full range of
8 environmental risks facing these units. I recommend that the Utility evaluate a
9 range of potential control costs that could result from varying levels of stringency
10 from these and other future environmental regulations.

11

12 ***Q16. WHAT ADDITIONAL RISKS MIGHT BE ASSOCIATED WITH THE 316(B)***
13 ***RULE?***

14 ***A16.*** All of the OVEC units as well as Stuart units 1-3 and Cardinal unit 1 have once-
15 through cooling processes which will likely require additional investments to
16 comply with 316(b). One means of compliance is installation of intake screens to
17 reduce impingement of marine life. Another more stringent possibility is the
18 installation of cooling towers (i.e., closed-cycle cooling). The Utility has
19 assumed that no new cooling towers would be required on any of the 15 units
20 involved in this transaction that currently have once-through cooling.

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1 My estimate of cooling tower installation costs include: \$365 million for Stuart
2 units 1-3, \$108 million for Cardinal unit 1, \$229 million for Clifty Creek units 1-
3 6, and \$191 million for Kyger Creek units 1-5.¹⁸ In sum, cooling towers on all 15
4 units could cost nearly \$900 million (\$2012).

5
6 These costs are not engineering estimates but rather reasonable estimates based on
7 publicly available cost estimates developed by the EPA.¹⁹ They represent a high
8 bound of risk for the 316(b) rule as it currently stands. The Utility, on the other
9 hand, has assumed the low bound of risk—that none will require cooling towers.
10 These are large once-through cooling units that withdraw vast quantities of water
11 from the surrounding water bodies, and it is reasonable to believe that at least
12 some of these units may require advanced cooling systems.

13
14 Furthermore, it is likely that, over the course of the 18-36+ years that AEP Ohio is
15 proposing to have the PPA Rider in place, the 316(b) rule will be revised to
16 include more stringent requirements on some or all of the PPA Units, requiring
17 additional capital expenditures and additional costs to be paid by consumers.

¹⁸ EPA. Technical Development Document for the Proposed Section 316(b) Phase II Existing Facilities Rule. March 28, 2011. Retrieved from: <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P100B63C.txt>. Costs are in 2012 dollars.

¹⁹ *Id.*

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1 ***Q17. WHAT ADDITIONAL RISKS MIGHT BE ASSOCIATED WITH THE CCR***
2 ***AND ELG RULES?***

3 ***A17.*** Utility witnesses Thomas and McManus explain that the Kyger Creek units,
4 Stuart units 1-4, and Cardinal unit 1 all utilize wet ash handling, which may need
5 to be converted to dry ash handling for the CCR rule. The costs for converting
6 these units to dry ash handling have been included in the Utility's 10-year
7 forecast.²⁰ However, the Utility is still analyzing other potentially necessary
8 modifications to the PPA units' surface impoundments. If significant
9 modifications are required, such as closure and remediation of existing surface
10 impoundments, this could lead to additional CCR spending that has not been
11 accounted for in the Utility's 10-year forecast. The Utility has included cost
12 estimates for certain projects intended to comply with the pending ELG rule,
13 which is due to be finalized at the end of this month. If the final rule turns out to
14 be more stringent than what the Utility is anticipating, this could lead to additional
15 costs to comply with this rule—costs that would be charged to customers under
16 the PPA.

17
18 Furthermore, it is likely that, over the course of the 18-36+ years that AEP Ohio is
19 proposing to have the PPA Rider in place, the CCR and ELG rules will be revised
20 to include more stringent requirements on some or all of the PPA Units, requiring
21 additional capital expenditures. Moreover, as air pollution standards continue to

²⁰ Amended Testimony of Toby L. Thomas. Page 8, lines 1-3.

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1 get more stringent, the waste streams coming from the pollution controls will
2 become more concentrated, which may in turn require more stringent regulation
3 under the CCR and ELG standards. For instance, coal waste could one day be
4 reclassified as a hazardous material, as was initially contemplated under the
5 proposed CCR rule.

6
7 ***Q18. DID THE UTILITY FORECAST ENVIRONMENTAL COMPLIANCE***
8 ***COSTS AFTER 2024?***

9 ***A18.*** No. The Utility only provided environmental compliance costs from 2015
10 through 2024. The cumulative capital costs reported by the Utility over this
11 period is over \$ [REDACTED] (\$2015)—shown in Figure 1 below. The terms of the
12 Affiliate PPA are through the retirement of each plant and beyond.²¹ According to
13 the Utility, Stuart and Cardinal will retire fully by 2033; Conesville will retire
14 fully by 2038; and Zimmer will retire in 2051. This means that the Affiliate PPA
15 will be in effect after 2051. Given this fact, the Utility should have estimated
16 capital compliance costs through 2051—at the very least. Instead, AEP Ohio has
17 neglected to even estimate costs after 2024, leaving customers “on the hook” for
18 unknown costs over a minimum 27-year period (2025 through 2051).

²¹ Exhibit KDP-1, p.1.

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Figure 1: 

***Q19. ARE THERE OTHER EXISTING OR PENDING ENVIRONMENTAL
REGULATIONS THAT MAY LEAD TO CUSTOMERS BEARING
ADDITIONAL ENVIRONMENTAL COMPLIANCE COSTS DURING THE
TERM OF THE PPA RIDER THAT THE UTILITY DID NOT DESCRIBE?***

A19. Yes. In particular, the National Ambient Air Quality Standards (“NAAQS”) pose a risk for certain units associated with the proposed transaction.

***Q20. PLEASE BRIEFLY DESCRIBE THE PURPOSE AND IMPACT OF
NATIONAL AMBIENT AIR QUALITY STANDARDS (“NAAQS”).***

A20. NAAQS set maximum air quality limitations that must be met at all locations across the nation for specific pollutants. Compliance with the NAAQS can be determined through data collected from air quality monitoring stations or through

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1 air quality dispersion modeling. If, upon evaluation, a state has areas found to be
2 in “nonattainment” of a particular NAAQS, the state is required to set enforceable
3 requirements to reduce emissions from sources contributing to nonattainment
4 such that the NAAQS are attained and maintained. EPA has established short-
5 term and/or annual NAAQS for six pollutants: sulfur dioxide (“SO₂”), nitrogen
6 dioxides (“NO₂”), carbon monoxide (“CO”), ozone, particulate matter (measured
7 as particulate matter less than or equal to 10 micrometers in diameter (“PM₁₀”)
8 and particulate matter less than or equal to 2.5 micrometers in diameter (“PM_{2.5}”),
9 and lead. EPA is required to periodically review and evaluate the need to
10 strengthen the NAAQS if necessary to protect public health and welfare. For
11 example, EPA is currently evaluating the NAAQS for ozone and is likely to make
12 that standard more stringent based on the latest science regarding health effects.

13
14 In nonattainment areas, sources must comply with emission reduction
15 requirements known as “Reasonably Available Control Technology” (“RACT”)
16 to bring the areas into attainment of the NAAQS. New major sources, including
17 major modifications at existing sources, must comply with very strict emissions
18 reductions consistent with “lowest achievable emissions reductions” (“LAER”) as
19 well as obtain emission offsets.

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1 ***Q21. WHICH NAAQS ARE MOST LIKELY TO IMPACT THE PPA UNITS?***

2 ***A21.*** The 1-hour SO₂ NAAQS and the 8-hour Ozone NAAQS are likely to have the
3 greatest impacts on coal-fired units.
4

5 ***Q22. PLEASE BRIEFLY DESCRIBE THE 1-HOUR SO₂ NAAQS.***

6 ***A22.*** In 2010, EPA promulgated a new 1-hour standard for SO₂, which became
7 effective in June of that year. The new 1-hour SO₂ standard set a limit—75 ppb
8 or 195 µg/m³—on the allowable concentration of SO₂ in the ambient air for each
9 hour of the day. An area is in compliance with—or attaining—the standard if the
10 three-year average of the fourth highest daily maximum 1-hour average
11 concentration for each year is less than or equal to 75 ppb.

12

13 As mentioned above, for most NAAQS, EPA determines whether an area is
14 attaining the standard by reviewing ambient air quality monitoring data from the
15 area. With SO₂, however, EPA found that, due to the limited geographic
16 coverage of the existing monitoring network, there was not sufficient monitoring
17 data available in all areas to determine whether the standard was being met.

18 Because of these data limitations, and because of the “source-oriented” nature of
19 the 1-hour SO₂ standard, EPA determined that refined dispersion modeling may

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1 also be used to determine whether an area with significant SO₂ sources meets the
2 standard.²²

3
4 ***Q23. WHAT IS THE CURRENT STATUS OF THE 1-HOUR SO₂ NAAQS AND***
5 ***WHAT ARE THE IMPLICATIONS FOR THE PPA UNITS?***

6 ***A23.*** In July 2013, EPA made initial “non-attainment” designations for a limited
7 number of areas that had sufficient monitoring data to demonstrate
8 noncompliance with the 1-hour SO₂ standard. EPA found that only 29 areas in 16
9 states had sufficient monitoring data to make these initial non-attainment
10 findings.²³ Only the Cardinal plant is currently located in a designated non-
11 attainment area for the 1-hour SO₂ standard, and the State of Ohio recently
12 submitted a request to EPA asking that this area be redesignated to attainment
13 following the addition of SO₂ control technology on the last uncontrolled Cardinal
14 unit and several years of monitoring data showing an improvement in the ambient
15 air quality in the area.²⁴

16
17 On March 2, 2015, the EPA entered into a Consent Decree with Sierra Club and
18 the Natural Resources Defense Council in which EPA must make designations for

²² U.S. Environmental Protection Agency, “Next Steps for Area Designations and Implementation of the Sulfur Dioxide National Ambient Air Quality Standard,” February 6, 2013.

²³ US EPA, 2013. Final Nonattainment Areas for the 2010 SO₂ Standards, Round 1 – July 2013.
<http://www.epa.gov/airquality/sulfurdioxide/designations/pdfs/july2013SO2nonattainmentcounties.pdf>.

²⁴ See Ohio Environmental Protection Agency, Redesignation Request and Maintenance Plan for the Ohio Portion of the Campbell-Clermont Counties, KY-OH 1-Hour SO₂ Nonattainment Area. August 2015.

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1 any area in which monitored air quality shows violations of the standard, or where
2 there is a stationary source that is not announced for retirement that, based on
3 2012 Air Markets Program Data, emitted more than 16,000 tons of SO₂ or emitted
4 more than 2,600 tons of SO₂ and had an annual average emission rate of 0.45 lbs
5 SO₂/MMBtu or higher. Zimmer unit 1 meets this criteria and will, therefore, be
6 designated as nonattainment for the 1-hour SO₂ standard on or before July 2,
7 2016. Though Zimmer unit 1 currently has what appears to be an older wet FGD
8 installed, it does not appear to be performing well compared to what is
9 achievable. A nonattainment designation under the 1-hour SO₂ standard will
10 likely require additional capital expenditures at the Zimmer plant.

11
12 The Consent Decree further requires EPA to designate all remaining areas by
13 December 31, 2017. It is possible that areas where other PPA units are located
14 could be designated nonattainment and would have to reduce their SO₂ emissions.

15
16 ***Q24. IS IT POSSIBLE THAT NEW FGDS MAY BE REQUIRED ON PPA UNITS***
17 ***DURING THE PPA RIDER PERIOD, CAUSING CUSTOMERS TO FUND***
18 ***THESE EXPENSES?***

19 ***A24.*** Yes. While all of the PPA Units have FGDs currently, some of these controls will
20 likely need to be upgraded or replaced in the near or medium-term. For instance,
21 it appears that Conesville units 5 and 6 are equipped with FGDs that are 39 and 37

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1 years old, respectively.²⁵ It is unlikely that these FGDs will last another 23
2 years—i.e., until the Conesville plant is slated to retire.
3

4 ***Q25. PLEASE BRIEFLY DESCRIBE THE 8-HOUR OZONE NAAQS.***

5 ***A25.*** The 8-hour ozone NAAQS is intended to protect public health and welfare from
6 the dangerous effects of exposure to ground-level ozone. These effects include
7 harm to the respiratory system, aggravation of asthma and other lung diseases,
8 and premature death.²⁶
9

10 In March 2008, EPA strengthened the 8-hour ozone standard from 84 ppb (parts
11 per billion) to 75 ppb—which was still less stringent than recommended by EPA's
12 panel of science advisors. On September 16, 2009, in response to numerous
13 petitions for reconsideration, EPA announced that it would reconsider the 75 ppb
14 standard. In January 2010, EPA proposed lowering the 75 ppb primary ozone
15 standard to between 60 and 70 ppb.
16

17 On September 2, 2011, however, the Obama Administration announced that EPA
18 would not finalize its proposed reconsideration of the 75 ppb standard ahead of

²⁵ 2014 Form EIA-860 Data - Schedule 6B, 'Emission Standards and Control Strategies'. Sulfur compliance year is 1976 for unit 5 and 1978 for unit 6.

²⁶ See U.S. Environmental Protection Agency Fact Sheet on Ozone and Health, November 25, 2014, available at: <http://www.epa.gov/airquality/ozonepollution/pdfs/20141125fs-health.pdf>.

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1 the Agency's regular five-year NAAQS review cycle. The next five-year review
2 for the 8-hour ozone standard was set to start in 2013.

3
4 On November 25, 2014, EPA released its proposal to strengthen the 8-hour ozone
5 NAAQS to a standard in the 65 to 70 ppb range, based on extensive scientific
6 evidence about ozone's negative health effects. EPA also took comment on
7 whether a 60 ppb standard would be appropriate. This standard is due to be
8 finalized on October 1, 2015.

9
10 ***Q26. WHAT IS THE STATUS OF THE OZONE NAAQS IN OHIO AND INDIANA***
11 ***WHERE THE PPA UNITS ARE LOCATED?***

12 ***A26.*** Several counties in Ohio and Indiana are still not meeting the current 2008 ozone
13 standard of 75 ppb, and it appears likely that additional areas in these states will
14 be designated as non-attainment for the new, more stringent standard when it is
15 finalized.²⁷ In particular, Clermont County, where the Zimmer plant is located, is
16 at 79 ppb based on 2011-2013 monitoring data and will likely be designated as a
17 nonattainment area under the new standard.²⁸ Clermont, Clinton, and Warren
18 Counties, which all border Brown County, where the Stuart plant is located (but
19 where there is no ozone monitor) all exceed the 2008 8-hour ozone standard.²⁹

²⁷ See US EPA, 2014. Counties Violating the Primary Ground-level Ozone Standard:
<http://www.epa.gov/airquality/ozonepollution/pdfs/20141126-20112013datatable.pdf>.

²⁸ *Id.*

²⁹ *Id.*

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1 Likewise, Licking and Knox Counties, which border Coshocton County, where
2 the Conesville plant is located (and where there is no ozone monitor), both exceed
3 70 ppb. There are no ozone monitors in Gallia County, Ohio, where the Kyger
4 Creek plant is located, but neighboring counties with monitors do exceed the
5 proposed standard. In Jefferson County, Ohio, where the Cardinal plant is
6 located, the 2011-2013 ozone monitoring data shows that the area is exceeding a
7 70 ppb limit and may be designated as a non-attainment area under the revised
8 ozone standard.³⁰ Finally, Clark County in Indiana, which borders Jefferson
9 County, where the Clifty Creek plant is located, is exceeding the 75 ppb standard
10 based on 2011-2013 monitoring data (there is no ozone monitor located in
11 Jefferson County, Indiana) and other nearby counties are also exceeding the 70
12 ppb standard.³¹

13
14 ***Q27. WHAT ARE THE IMPLICATIONS OF THE 8-HOUR OZONE NAAQS FOR***
15 ***THE PPA UNITS?***

16 ***A27.*** NO_x is a precursor to ozone, meaning that areas that are found to be in non-
17 attainment for ozone will need to seek the most effective source controls for NO_x.
18 Because large emissions sources—such as coal-fired generating stations—
19 contribute disproportionately to emissions of NO_x and are effectively controlled
20 with post-combustion controls such as selective catalytic reduction (SCR), it is

³⁰ *Id.*

³¹ *Id.*

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1 not unlikely that if areas of Ohio and Indiana within the dispersion area of the
2 PPA Units are found to be in nonattainment for the ozone standard, the states and
3 EPA could require rigorous NOx controls or operational limits at these units to
4 meet the standards. An ozone standard in the 65-70 ppb range would cause many
5 of the monitors in Ohio and southern Indiana to show violations,³² and hence
6 would require these states to develop rigorous State Implementation Plans with
7 tight limits on NOx emissions from major sources.

8
9 Specifically, this could mean that Clifty Creek Unit 6 and Conesville units 5 and 6
10 would need to be retrofit with SCRs in order to comply with a more stringent 8-
11 hour ozone standard.³³ I estimate that SCRs on the Conesville units would require
12 capital costs of approximately \$127 million (\$2012) per unit and that an SCR on
13 Clifty Creek Unit 6 would cost approximately \$69 million (\$2012). These are not
14 engineering estimates but rather reasonable estimates based on publicly available
15 cost estimates developed by Sargent & Lundy.³⁴

16
17 Under the proposed PPA Rider, AEP Ohio customers would be required to pay
18 the Utility's 19.93 percent of the total capital costs to install the SCR on Clifty

³² See <http://www.epa.gov/airquality/ozonepollution/pdfs/CountyPrimaryOzoneLevels0608.pdf>.

³³ See OVEC Annual Report – 2014, p. 29 available at:
<http://www.ovec.com/FinancialStatements/AnnualReport-2014-Signed.pdf>.

³⁴ EPA IPM v.5.13 Appendix 5-3 (Sargent & Lundy) – *Revisions to Cost and Performance for APC Technologies: SCR Cost Development Methodology*, available at:
http://www.epa.gov/powersectormodeling/docs/v513/attachment5_3.pdf.

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1 Creek Unit 6. Customers would be responsible for the total costs of any upgrades
2 required on the Conesville units.

3
4 ***Q28. PLEASE BRIEFLY DESCRIBE THE CROSS STATE AIR POLLUTION***
5 ***RULE.***

6 ***A28.*** The Cross State Air Pollution Rule (“CSAPR”) established the obligations of 28
7 affected states (including Ohio) to reduce emissions of NO_x and SO₂ that
8 significantly contribute to another state’s PM_{2.5} and ozone non-attainment
9 problems. CSAPR establishes NO_x and SO₂ emission budgets for states and
10 allocates allowances to emitting units for use during the compliance period.

11
12 ***Q29. HOW WILL THE REINSTATED CSAPR IMPACT PPA RIDER PLANTS?***

13 ***A29.*** Initially, perhaps not much more than requiring additional purchases of
14 allowances. But as I said above, NO_x is a precursor to ozone as well as PM_{2.5}
15 pollution, meaning that areas that are not currently in attainment for these two
16 pollutants will seek the most effective source controls for precursors. Because
17 large emissions sources – such as coal-fired generating stations – contribute
18 disproportionately to emissions of these precursors and are effectively controlled
19 with post-combustion controls such as SCR (selective catalytic reduction), it is
20 not unlikely that if the PPA Units are found to be contributing to downwind
21 states’ non-attainment problems for the PM_{2.5} or ozone standards, the state and
22 EPA could require rigorous NO_x controls at these units to meet the standards.

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Furthermore, with the regular promulgation of new, more stringent PM_{2.5} and ozone NAAQS over the course of the 18-36+ year PPA Rider, it is likely that future versions of CSAPR will be more rigorous than the current rule, which is designed to help states meet now-outdated NAAQS. This would almost certainly require the installation of SCRs on Clifty Creek Unit 6 and Conesville units 5 and 6, with customers picking up the tab for such costs.

Q30. IS OVEC AWARE OF THE POTENTIAL NEED FOR AN SCR ON CLIFTY CREEK UNIT 6?

A30. Yes. In its 2014 Annual Report, OVEC states that:

[T]he purchase of additional NOx allowances or the installation of additional NOx controls may be necessary for Clifty Creek Unit 6 either under the CSAPR rule or any future NOx regulations.³⁵

With that rule now reinstated, it seems very likely that additional NOx controls will be required at Clifty Creek Unit 6.

Q31. DID THE UTILITY ACCOUNT FOR ALL ENVIRONMENTAL COSTS RISKS FROM 2015 THROUGH 2024?

A31. No. For the near-term, the Utility has assumed little risk for certain regulations—such as 316(b)—while ignoring any additional risks from pending and likely

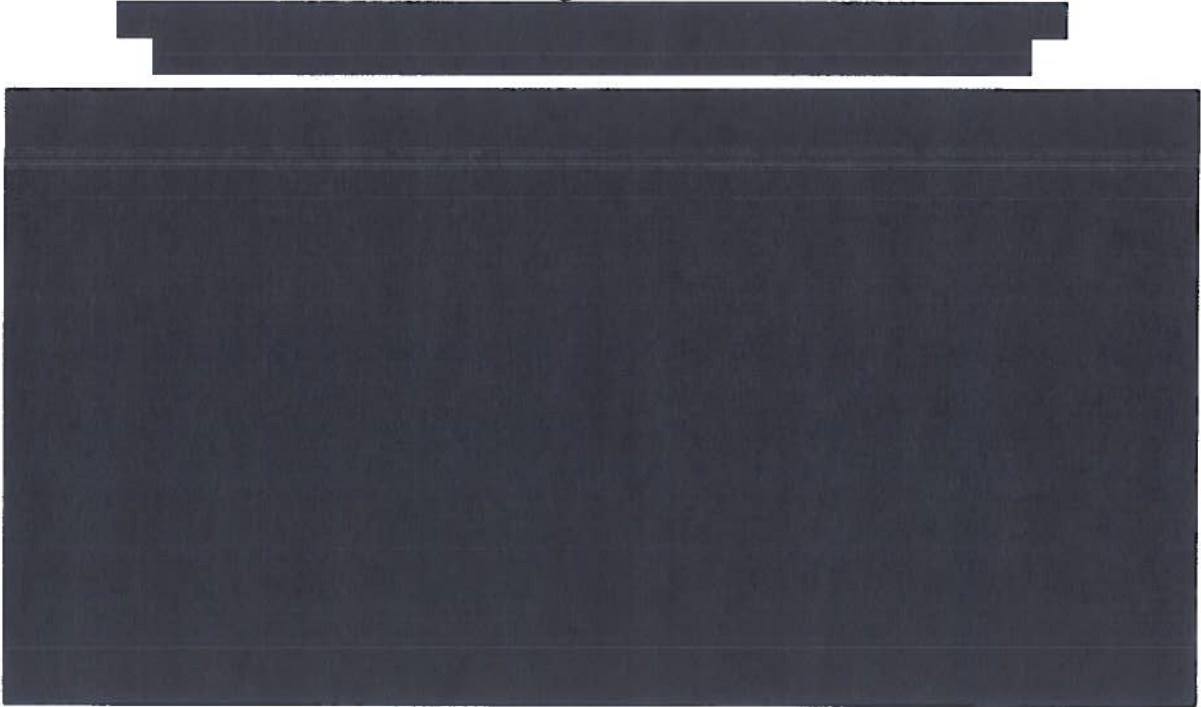
³⁵ OVEC Annual Report – 2014, p. 29 available at:
<http://www.ovec.com/FinancialStatements/AnnualReport-2014-Signed.pdf>

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1 future regulations such as NAAQS and CSAPR. As I have described, the latter
2 regulations could obligate additional NOx control installations at Conesville units
3 5 and 6 and Clifty Creek unit 6.

4
5 Figure 2 shows cumulative capital costs presented by the Utility along with an
6 estimate that includes SCR costs for these three units. This estimate leads to
7 nearly \$ [REDACTED] (\$2015) in capital costs over the next ten years—assuming
8 the SCRs are installed on the three units in 2020.

9 **Figure 2:**



14 I have focused on the costs of installing SCRs since this represents one of the
15 more significant investments that may be required under foreseeable
16 environmental regulations and therefore represents a significant risk to the Utility
17 and its customers. However, as described above in my testimony, there are many

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1 other potential cost risks from environmental regulations that the Utility has not
2 included, which could negatively impact consumers.

3
4 ***Q32. DID THE UTILITY PROPERLY ACCOUNT FOR ANY FUTURE***
5 ***ENVIRONMENTAL COST RISKS AFTER 2024?***

6 ***A32.*** No. The Utility has not included any estimate of environmental costs after 2024,
7 despite the much longer term of the PPA Rider. As the costs of these future
8 environmental compliance obligations will be borne by customers, it is imperative
9 that a full range of these risks be evaluated. Ideally, the Utility should have taken
10 all potential future costs into account in its economic analysis.

11
12 ***Q33. DO THE CAPITAL COSTS DISCUSSED IN THIS SECTION REPRESENT***
13 ***ALL ENVIRONMENTAL COSTS THAT WOULD BE PAID BY***
14 ***CUSTOMERS?***

15 ***A33.*** No. The costs shown above are upfront capital costs only. In addition, the
16 controls will have operations and maintenance (O&M) costs that are passed
17 though as an expense to retail customers. Also, customers will be charged the
18 cost of equity and debt for financing the investments for the Affiliate PPA units.³⁶

³⁶ Exhibit KDP-1, p.3.

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1 ***Q34. WILL CUSTOMERS BEAR THE COSTS OF ADDITIONAL CONTROLS IF***
2 ***THE PPAS ARE TERMINATED EARLY?***

3 ***A34.*** Yes, most likely. According to the PPA, termination of the agreement will require
4 that the Utility pay AEPGR “an amount equal to the sum of the net book value
5 and retirement-related costs associated with the PPA Units at that time.”³⁷ Thus,
6 customers would have to pay any undepreciated value of the plants, including
7 investments in environmental controls.

8
9 ***Q35. PLEASE BRIEFLY DESCRIBE EPA’S FINAL CLEAN POWER PLAN***
10 ***THAT WAS RELEASED ON AUGUST 3, 2015.***

11 ***A35.*** The final Clean Power Plan, like the proposal, aims to reduce carbon dioxide
12 (CO₂) emissions from existing fossil fuel-fired electric generators. Unlike the
13 proposal, which established unique carbon intensity targets for each state, the
14 final Clean Power Plan establishes technology-specific emission performance
15 standards—one for fossil steam units and one for stationary combustion turbines
16 (mainly natural gas combined cycle units, or “NGCCs”)—that apply to all
17 existing units nationwide. These targets are determined by applying three building
18 block measures—heat rate improvements at existing coal units, shifting
19 generation from higher-emitting coal and oil steam to lower-emitting NGCC
20 units, and integrating generation from new renewable energy onto the system—to
21 a 2012 baseline of emissions and generation. In a change from the proposal to the

³⁷ *Id.* p.5.

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1 final rule, EPA no longer includes demand-side energy efficiency or the
2 preservation of existing nuclear energy in the calculation of the national emission
3 performance rates.

4
5 Once these technology-specific target performance rates are established, EPA
6 then translates them into state-specific rate- and mass-based goals. This facilitates
7 the wide array of compliance pathways EPA allows states to choose from in
8 meeting the Clean Power Plan requirements. For states choosing a rate-based
9 approach, a state can choose to develop a compliance strategy in which each unit
10 subject to the Clean Power Plan must simply meet the relevant national emission
11 performance rate set by EPA. Alternatively, states may require all affected units
12 to meet a single, statewide average emission performance rate calculated by EPA.

13 A third rate-based alternative would allow a state to assign unique emission
14 performance standards to its units, so long as the average of all the rates is less
15 than or equal to the statewide average rate. Compliance with these rate-based plan
16 approaches would most likely be accomplished through the establishment of
17 trading programs in which affected units would need to acquire “emission rate
18 credits”—or “ERCs”—representing one megawatt hour of zero-emission
19 generation in order to reduce the carbon intensity of their own generation. It is
20 important to note that units in rate-based states can only trade ERCs with units in
21 other states that have chosen the same compliance pathway.

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1 In the final rule, EPA has also calculated state-specific mass-based goals (in total
2 tons of CO₂). States choosing a mass-based compliance approach can choose from
3 four different compliance pathways. A state can choose to apply a mass-based cap
4 to its existing affected units, or it can design its compliance strategy to apply to
5 both existing and new fossil sources by adopting a mass-based cap plus EPA's
6 calculation of emissions from new sources needed to meet load growth (called the
7 "new source complement"). Both of these options put the compliance obligation
8 on affected units (or affected units and new units). However, EPA also allows
9 mass-based states to adopt compliance strategies in which the compliance
10 obligation is on the state to achieve the emissions cap through state programs such
11 as energy efficiency resource standards (EERS) or renewable portfolio standards
12 (RPS). This "state measures plan" approach can also apply to existing sources or
13 existing plus new sources using the new source complement. Compliance with
14 these mass-based compliance approaches would most likely be met through an
15 allowance trading system in which units or states meet their caps through the
16 exchange of allowances representing the ability to emit one ton of CO₂ emissions.

17
18 States must submit their compliance plans by September 6, 2016 unless they
19 receive an extension. States can request an extension of up to two additional
20 years, making all final plans due to EPA by September 6, 2018. The start of the
21 compliance period has also been delayed from 2020 in the proposal to 2022 in the
22 final rule. States must still comply with the final targets by 2030, as well as with a

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1 series of interim steps in order to show reasonable progress toward the 2030
2 goals. Together with the final rule, EPA has also proposed two model rules (one
3 rate-based and one mass-based) that states can use to simplify compliance
4 planning. Each model rule includes a ready-made trading program that states can
5 adopt to enable trading with all other states that have chosen the same approach.
6 EPA has indicated that if a state were to choose one of the model rules as its
7 compliance plan, the plan would be presumptively approvable.

8
9 ***Q36. IS THE UTILITY'S PROXY CO₂ COST REASONABLE IN LIGHT OF THE***
10 ***REQUIREMENTS OF THE FINAL CLEAN POWER PLAN?***

11 ***A36.*** The final Clean Power Plan was released at the beginning of August 2015 and is
12 comprised of several thousands of pages of technical and regulatory materials, not
13 all of which have been released yet, so it is not possible to know exactly what will
14 be required of the PPA Units at this time; however, at this early stage in our
15 understanding of the requirements of the final Clean Power Plan, the Utility's
16 proxy cost for CO₂ of \$15 per ton starting in 2022 and escalating at the rate of
17 inflation appears reasonable. This may change as more information is released or
18 as Ohio develops its compliance strategy, depending on what is ultimately
19 required of the PPA Units.

20
21 I would also note that, over the course of the 18-36+ years that AEP Ohio is
22 proposing to have the PPA Rider in place, the state of climate policy is likely to

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1 continue to evolve toward more stringent controls of greenhouse gases. Many
2 cities, states, and nations have already established goals to reduce CO₂ emissions
3 more significantly than what would be achieved by the final Clean Power Plan.³⁸ I
4 do not believe it is in the best interest of consumers to take on the risks associated
5 with twenty aging coal-fired generating units for several decades in the face of
6 what is likely to be increasingly stringent CO₂ requirements.

7
8 **IV. CONCLUSIONS AND RECOMMENDATIONS**

9
10 ***Q37. WHAT ARE YOUR FINDINGS?***

11 ***A37.*** I find that the proposed Affiliated PPA and OVEC PPA are not in the best interest
12 of the customers in Ohio. Utility witness Thomas states that:

13 The Affiliated PPA units are on the economic “bubble,” meaning
14 that the market conditions, as described by Company witness
15 Pearce, are not providing the necessary economic signals for the
16 incremental investment in these units. The plants have been
17 saddled with increased fixed costs resulting from recent
18 environmental installations. Market volatility and unpredictability
19 only serve to make the situation, faced by these generating units,
20 more tenuous. Because of these factors, any major capital spending
21 that might be required in the future, whether for existing
22 equipment repairs or for new environmental requirements, could
23 lead to premature retirements...Approval by the Commission of

³⁸ See, e.g., New York City Mayor DeBlasio's commitment to reduce the city's CO₂ emissions by 80 percent below 2005 levels by 2050 available at: <http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf>; see also Governor Brown of California's Executive Order B-30-15 (April 29, 2015) to reduce California's CO₂ emissions by 80 percent below 1990 levels by 2050, available at: <http://gov.ca.gov/news.php?id=18938>; see also the United Kingdom's 2008 Climate Change Act, which commits the U.K. to achieve CO₂ reductions of 80 percent below 1990 levels by 2050 (updated May 8, 2015), available at: <https://www.gov.uk/government/publications/2010-to-2015-government-policy-greenhouse-gas-emissions/2010-to-2015-government-policy-greenhouse-gas-emissions>.

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1 the PPA Rider and the prudence of AEP Ohio's decision to enter
2 into the life-of-unit PPAs substantially reduces the likelihood that
3 the PPA units will face closure before their useful life has ended.³⁹

4
5 As I have shown in my testimony, it is likely that the AEPGR PPA units will
6 indeed require additional capital investments to comply with current and pending
7 environmental rules, disadvantaging the economics of these units even further to
8 the detriment of retail customers. The operational life of the AEPGR plants
9 should be based on their ability to compete in the competitive market, and not
10 simply the Utility's predetermined retirement dates. Many power plants across
11 the country would be capable of generating for many years into the future, but
12 market economics have dictated that they retire, and that customers not be saddled
13 with the costly investments necessary to keep them online.

14
15 **Q38. WHAT ARE YOUR RECOMMENDATIONS TO THIS COMMISSION?**

16 **A38.** I recommend that the Commission deny the Utility's request for approval of the
17 Affiliated PPA and OVEC PPA and not allow these environmental compliance
18 risks to be passed on to AEP Ohio's customers.

³⁹ Amended Testimony of Toby L. Thomas. Case Nos. 14-1693-EL-RDR and 14-1694-EL-AAM. May 15, 2015. Page 11, lines 7-20.

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1 ***Q39. DOES THIS CONCLUDE YOUR TESTIMONY?***

2 ***A39.*** Yes, it does. However, I reserve the right to update or supplement my testimony
3 based on new information that may become available.

CERTIFICATE OF SERVICE

I hereby certify that a true copy of the foregoing *Direct Testimony (Public Version) of Sarah E. Jackson on Behalf of the Office of the Ohio Consumers' Counsel* was served via electronic transmission to the persons listed below on this 11th day of September, 2015.

/s/ Jodi J. Bair

Jodi J. Bair

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**Sarah E. Jackson, Senior Associate**

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PROFESSIONAL EXPERIENCE

Synapse Energy Economics Inc, Cambridge, MA. Senior Associate, 2015 – present, Associate, September 2011 – 2015.

Analyze economic and environmental implications of renewable portfolio standards and clean energy policy scenarios. Investigate electricity market price trends and fluctuations. Maintain our end user and alternative resource sector clients' interests at ISO-NE and PJM stakeholder meetings. Assist clients in navigating RTO market rules, especially regarding reliability assessments for coal-fired power plants and participation of energy efficiency and distributed generation in wholesale capacity markets.

Earthjustice, Oakland, CA. Research and Policy Analyst, 2005 – 2011.

Analyzed federal, state, and local regulations, policies, and environmental planning documents in support of clean air and climate change campaigns. Drafted substantial comment letters on priority issues, often leading to significant policy changes. Advocated at public hearings critiquing proposed policies or regulatory actions. Developed and maintained strong relationships with federal, state, and local agency staff, client groups, community and grassroots groups, technical and scientific experts, and key media contacts. Developed factual basis for and evaluated environmental significance of lawsuits to advance clean air and climate change campaigns

Central Valley Air Quality Coalition, Central Valley, CA.

Chair, Watchdog Committee, 2007 – 2011.

Analyzed and prioritized federal, state, and local regulatory and legislative activities affecting air quality in California's polluted Central Valley. Managed and coordinated with technical consultants on complex regional air pollution clean-up plans. Educated and mobilized committee members and affected communities, empowering them to participate on priority issues. Developed and facilitated technical trainings and educational events for coalition members and citizens.

Steering Committee Member, 2005 – 2011.

Managed and set policy priorities for a diverse coalition of more than 75 community, public health, faith, environmental, and environmental justice organizations and individuals working for clean air in California's Central Valley. Helped develop Strategic Plan for advancing policy priorities and making coalition more effective.

Kopelman & Paige, P.C., Boston, MA. Land Use Paralegal, 2003 – 2005

Performed legal research on subjects such as wetlands protection, coastal management, legality of municipal bylaws, and validity of comprehensive permits in support of Land Use department.

Reviewed and prepared administrative records, briefs, litigation status reports, and other legal documents.

Governor's Office of Energy and Community Services, Concord, NH. *Energy Program Intern*, 2001

Assisted in the research and organizational stages of drafting a State Energy Plan. Participated in the initial implementation of the Energy, Environmental & Economic Integration Project. Special projects relating to energy efficiency and renewable energy.

EDUCATION

Vermont Law School, South Royalton, VT
Master of Environmental Law and Policy, 2003

Mount Holyoke College, South Hadley, MA
Bachelor of Arts in English and Environmental Studies, 2001

PUBLICATIONS

Knight, F., S. Fields, S. Jackson, W. Ong, N. R. Santen, B. Biewald, E. A. Stanton. 2015. *Multi-State Compliance with the Clean Power Plan in CP3T*. Synapse Energy Economics for the National Association of State Utility Consumer Advocates.

Stanton, E. A., T. Comings, S. Jackson, E. Karaca. 2015. *Atlantic Coast Pipeline Benefits Review*. Synapse Energy Economics for Southern Environmental Law Center.

Wilson, R., M. Whited, S. Jackson, B. Biewald, E. A. Stanton. 2015. *Best Practices in Planning for Clean Power Plan Compliance*. Synapse Energy Economics for the National Association of State Utility Consumer Advocates.

Luckow, P., E. A. Stanton, S. Fields, B. Biewald, S. Jackson, J. Fisher, R. Wilson. 2015. *2015 Carbon Dioxide Price Forecast*. Synapse Energy Economics.

Comings, T., S. Jackson, K. Takahashi. 2015. *Comments on Indianapolis Power & Light Company's 2014 Integrated Resource Plan*. Synapse Energy Economics for the Sierra Club.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Alabama's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Calculating Georgia's 111(d) Target*. Synapse Energy Economics for the Southern Environmental Law Center.

Fields, S., E. A. Stanton, P. Knight, B. Biewald, J. Daniel, S. Jackson, E. Karaca, J. Rosenkranz, K. Takahashi. 2014. *Alternate Scenarios for 111(d) Implementation in North Carolina*. Synapse Energy Economics for the Southern Environmental Law Center.

- Stanton, E. A., S. Jackson, B. Biewald, M. Whited. 2014. *Final Report: Implications of EPA's Proposed "Clean Power Plan."* Synapse Energy Economics for the National Association of State Utility Consumer Advocates.
- Stanton, E.A., B. Biewald, S. Jackson. 2014. *111(d): Next Steps for States*. Synapse webinar presented July 2014.
- Stanton, E.A., S. Jackson. 2014. *Draft 111(d) Rule: Issues on Which EPA is Seeking Comment*.
- Luckow, P., E. A. Stanton, B. Biewald, S. Fields, S. Jackson, J. Fisher, F. Ackerman. 2014. *CO₂ Price Report, Spring 2014: Includes 2013 CO₂ Price Forecast*. Synapse Energy Economics.
- Keith, G., S. Jackson, J. Daniel, K. Takahashi. 2014. *Idaho's Electricity Sources: Current Sources and Future Potential*. Synapse Energy Economics for the Idaho Conservation League.
- Ackerman, F., S. Jackson, S. Fields. 2014. *Sustainable Development for the Navajo Nation: Replacing the Navajo Generating Station with Renewable Energy*. Synapse Energy Economics for Chorus Foundation.
- Stanton, E. A., S. Jackson, G. Keith, E. Malone, D. White, T. Woolf. 2013. *A Clean Energy Standard for Massachusetts*. Synapse Energy Economics for the Massachusetts Clean Energy Center and the Massachusetts Departments of Energy Resources, Environmental Protection, and Public Utilities.
- Stanton, E.A., J. Daniel, F. Ackerman, S. Jackson. 2013. *Review of EPA's June 2013 Steam Electric Effluent Limitations and Guidelines (40 CFR Part 423)*. Synapse Energy Economics for Earthjustice, Environmental Integrity Project, and Sierra Club.
- Jackson, S., P. Peterson, D. Hurley, T. Woolf. 2013. *Forecasting Distributed Generation Resources in New England: Distributed Generation Must Be Properly Accounted for in Regional System Planning*. Synapse Energy Economics for E4 Group.
- Whited, M., D. White, S. Jackson, P. Knight, E.A. Stanton. 2013. *Declining Markets for Montana Coal*. Synapse Energy Economics for Northern Plains Resource Council.
- Keith, G., S. Jackson, A. Napoleon, T. Comings, J. Ramey. 2012. *The Hidden Costs of Electricity: Comparing the Hidden Costs of Power Generation Fuels*. Synapse Energy Economics for Civil Society Institute.
- Fisher, J., S. Jackson, B. Biewald. 2012. *The Carbon Footprint of Electricity from Biomass: A Review of the Current State of Science and Policy*. Synapse Energy Economics.
- Peterson, P., D. Hurley, S. Jackson, M. Schultz. 2012. *The Road to Better System Planning: ISO-New England's Revised Energy Efficiency Forecast*. Synapse Energy Economics for Connecticut Office of Consumer Counsel.

TESTIMONY

Ohio Public Utilities Commission (Case Nos. 14-841-EL-SSO and 14-842-EL-ATA): Direct testimony on Duke Energy Ohio's proposed Price Stabilization Rider and the potential risk it poses to ratepayers. On behalf of Sierra Club. November 19, 2014.

Resume dated July 2015



GORE™ Mercury Control System

Simply Compliant

The GORE™ Mercury Control System (GMCS) is a revolutionary fixed sorbent system for capturing gas phase mercury from industrial flue gas. The system is based on discrete stackable modules that are installed downstream of a particulate collection system. The modules are passive – they will continuously capture mercury for many years without requiring any adjustment, regeneration or replacement. They also provide a SO₂ removal co-benefit, which can alleviate the need for a scrubber upgrade.

The preferred installation location for applications with wet scrubbers is either at the scrubber (above the mist eliminators) or immediately after the scrubber vessel. In this location, the

modules will remove mercury that passes through the scrubber as well as capturing re-emissions from the scrubber in a way that doesn't impact gypsum quality or scrubber operation.

Since there are no injected sorbents, there is absolutely no concern of fly ash contamination or introducing additional particulate matter. Chemicals for mercury oxidation are also not required thus eliminating concerns over halogen-induced corrosion or wastewater treatment complications. Each module captures a fixed percentage of the mercury in the gas stream, so that the total amount of mercury removal needed will determine the number of module layers required.

Realize the Benefits

LOW PROCESS IMPACT

- **No injection of sorbents:**
No impact on fly ash properties. No impact on PM emissions. Significantly reduced quantity of solid waste vs. carbon injection.
- **No oxidizing chemical injection:**
No corrosion of air preheater. No WWT system complications.
- **Re-emissions barrier:**
No need for re-emissions additives. No gypsum contamination.
- **Zero footprint technology:**
No gas conditioning required. No booster fan required.

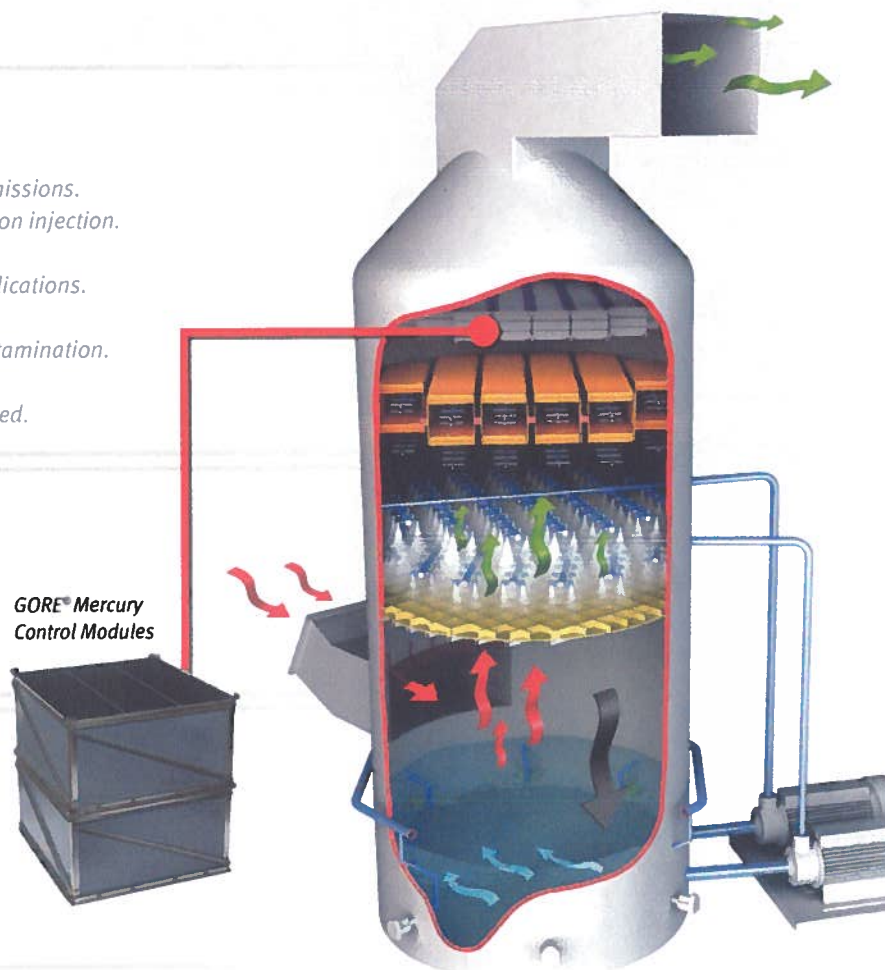
SIMPLE OPERATION

- No moving parts
- Simple supply logistics
- Long module lifetime, very low operating cost

ROBUST COMPLIANCE SOLUTION

- Insensitive to coal changes or load changes
- Not impacted by SO₂
- SO₂ polishing co-benefit
- Modular solution:
can provide 20–90+ % mercury removal

GORE® Mercury Control Modules





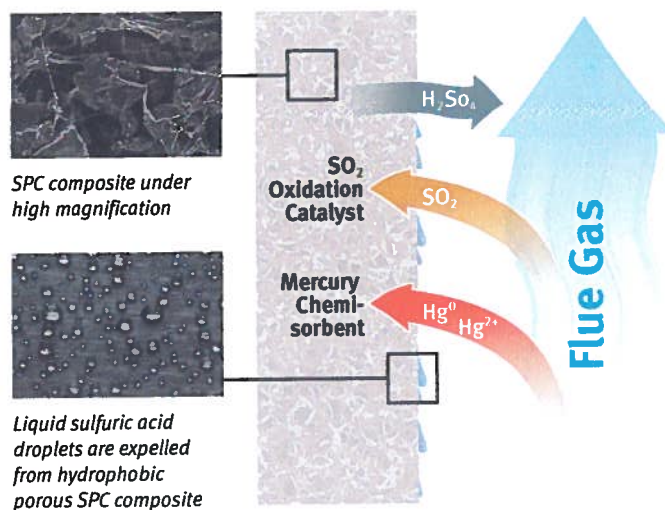
GORE™ Mercury Control System

THE SCIENCE BEHIND THE SOLUTION

Scientists at W. L. Gore and Associates developed the Sorbent Polymer Catalyst (SPC) technology, a unique material that removes elemental and oxidized mercury efficiently from a gas stream, and through chemical reactions sequesters the mercury in the form of stable mercury compounds. The material has an extremely high capacity for mercury storage, which enables a very long module lifetime to be achieved. The SPC has been developed to be able to operate in a challenging environment for gas phase adsorption: moisture-saturated low temperature gas streams containing acid gases. The hydrophobic structure not only resists becoming flooded by liquids, but the material also converts SO_2 to sulfuric acid which is expelled from the material – thus, SO_2 polishing is a valuable co-benefit of this mercury control system. This continuous production of acid also helps prevent the modules from becoming impacted by residual process dust or scrubber carryover. In addition, the SPC is not impacted by SO_2 in the gas stream, eliminating this interference concern that exists with traditional mercury sorbents.



GORE® Mercury Control Modules being installed in a 500 MW scrubber.



PROVEN PERFORMANCE

Several full-scale commercial installations are currently in operation in coal-fired power applications, and several more are currently under design and/or construction for start-up in 2015 and 2016. Up to date results can be provided upon request. In addition, a number of other installations in nonpower applications will start-up in 2015.

This technology can be utilized in applications that do not currently have wet scrubbers. In such a case, the Gore system can be a stand-alone system following a gas quench. Such a system would provide mercury control as well as SO_2 polishing, and can be an attractive alternative to a new wet or dry scrubber. Numerous slip stream pilot tests have been conducted in unscrubbed applications demonstrating the feasibility of this concept over the past 10 years.

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Summary: Testimony Direct Testimony of Sarah E. Jackson (PUBLIC VERSION) by the Office of the Ohio Consumers' Counsel electronically filed by Patti Mallarnee on behalf of Bair, Jodi Ms.