

**BEFORE  
THE PUBLIC UTILITIES COMMISSION OF OHIO**

|                                                                                                                                                                                                                                                                   |                                           |                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------|
| In the Matter of the Application of Duke Energy Ohio, Inc., for an Increase in Electric Distribution Rates.                                                                                                                                                       | )<br>)<br>)                               | Case No. 17-0032-EL-AIR |
| In the Matter of the application of Duke Energy Ohio, Inc., for Tariff Approval.                                                                                                                                                                                  | )<br>)                                    | Case No. 17-0033-EL-ATA |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Approval to Change Accounting Methods.                                                                                                                                                             | )<br>)                                    | Case No. 17-0034-EL-AAM |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Approval to Modify Rider PSR.                                                                                                                                                                      | )<br>)<br>)                               | Case No. 17-0872-EL-RDR |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Approval to Amend Rider PSR.                                                                                                                                                                       | )<br>)<br>)                               | Case No. 17-0873-EL-ATA |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Approval to Change Accounting Methods.                                                                                                                                                             | )<br>)<br>)                               | Case No. 17-0874-EL-AAM |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Authority to Establish a Standard Service Offer Pursuant to Section 4928.143, Revised Code, in the Form of an Electric Security Plan, Accounting Modifications and Tariffs for Generation Service. | )<br>)<br>)<br>)<br>)<br>)<br>)<br>)<br>) | Case No. 17-1263-EL-SSO |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Authority to Amend Its Certified Supplier Tariff, P.U.C.O. No. 20.                                                                                                                                 | )<br>)<br>)<br>)                          | Case No. 17-1264-EL-ATA |
| In the Matter of the Application of Duke Energy Ohio, Inc. for Authority to Defer Vegetation Management Costs.                                                                                                                                                    | )<br>)<br>)                               | Case No. 17-1265-EL-AAM |

In the Matter of the Application of Duke )  
Energy Ohio, Inc. to Establish Minimum )  
Reliability Performance Standards ) Case No. 16-1602-EL-ESS  
Pursuant to Chapter 4901:1-10, Ohio )  
Administrative Code. )

**REVISED**

**DIRECT TESTIMONY  
OF  
PAUL J. ALVAREZ**  
President, Wired Group

**IN OPPOSITION TO THE JOINT STIPULATION AND RECOMMENDATION**

**On Behalf of**  
**The Office of the Ohio Consumers' Counsel**  
*65 East State Street, 7<sup>th</sup> Floor*  
*Columbus, Ohio 43215-4213*

**June 25, 2018**

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*Direct Testimony of Paul J. Alvarez  
On Behalf of the Office of the Ohio Consumers' Counsel  
PUCO Case No. 17-0032-EL-AIR et al.*

1    **I.        INTRODUCTION, QUALIFICATIONS, PURPOSE, AND PREVIEW**

2

3    **Q1.    PLEASE STATE YOUR FULL NAME AND BUSINESS ADDRESS.**

4    **A1.**    My full name is Paul J. Alvarez. My business address is Wired Group, Post  
5        Office Box 150963, Lakewood, Colorado, 80215.

6

7    **Q2.    BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

8    **A2.**    I am the President of the Wired Group, a consultancy specializing in distribution  
9        utility performance and value creation.

10

11   **Q3.    PLEASE DESCRIBE YOUR PROFESSIONAL AND EDUCATIONAL**  
12        **BACKGROUND.**

13   **A3.**    My career in the electric utility industry began 17 years ago with Xcel Energy,  
14        one of the largest investor-owned utilities in the United States. As product  
15        development manager for Xcel, I oversaw the development of electric demand-  
16        side management (DSM) programs for residential, commercial, and industrial  
17        customers, as well as programs and rates in support of voluntary renewable  
18        energy purchases and renewable portfolio standard compliance.

19

20        In 2008, I left Xcel to establish a utility practice for the boutique sustainability  
21        consulting firm MetaVu. At MetaVu, I led two comprehensive evaluations of  
22        smart grid deployment performance: an evaluation of the SmartGridCity™

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1 deployment in Boulder, Colorado for Xcel Energy in 2010,<sup>1</sup> and an evaluation of  
2 the Duke Energy Ohio ("Duke") smart grid deployment for the Public Utilities  
3 Commission of Ohio ("PUCO") Staff in 2011.<sup>2</sup>

4 I started the Wired Group in 2012 to focus exclusively on distribution utility  
5 performance measurement and utility customer value creation. Since 2012, my  
6 team and I have completed detailed, formal reviews of grid modernization plans  
7 from 11 investor-owned utilities (IOUs) in regulatory proceedings, and less  
8 formal reviews of grid modernization plans from six other IOUs for clients  
9 outside of regulatory proceedings or out of professional interest. In addition to  
10 leading the Wired Group, I teach post-graduate courses based on my experience.  
11 Finally, I am the author of Smart Grid Hype & Reality: A Systems Approach to  
12 Maximizing Customer Return on Utility Investment. The book describes the  
13 challenges of translating smart grid investments into economic benefits for  
14 customers and offers organizational, operational, customer engagement, rate  
15 design, and regulatory solutions. The first edition was published in 2014, and the  
16 second edition was published earlier this year. I received an undergraduate  
17 degree in finance and marketing from Indiana University's Kelley School of

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<sup>1</sup> Colorado PUC Case No. 11A-1001E, SmartGridCity™ Demonstration Project Evaluation Summary, Exhibit MGL-1 (filed Dec. 14, 2011).

<sup>2</sup> *In re Application of Duke Energy Ohio, Inc. to Adjust Rider DR-IM & Rider AU for 2010 SmartGrid Costs & Mid-Deployment Review*, Case No. 10-2326-GE-RDR, Duke Energy Ohio Smart Grid Audit and Assessment (June 30, 2011).

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1 Business in 1983, and a master's degree in management from the Kellogg School  
2 at Northwestern University in 1991.

3

4 **Q4. HAVE YOU TESTIFIED PREVIOUSLY BEFORE THE COMMISSION?**

5 **A4.** No, but I have worked on behalf of the PUCO Staff. I led the evaluation team and  
6 prepared the report described above as the Duke Energy Ohio Smart Grid Audit  
7 and Assessment. This report is generally known as "the MetaVu report" or "the  
8 mid-term review" concerning Duke's first grid modernization project, portions of  
9 which are at issue in these cases. I also appeared before the PUCO in  
10 PowerForward Phase 2, making a presentation entitled "Getting a Smart Grid for  
11 Free."<sup>3</sup> The presentation focused on how to maximize the value of grid  
12 modernization investments with the goal of delivering benefits to customers in  
13 excess of costs, making it a "cost effective" deployment of advanced metering  
14 infrastructure.<sup>4</sup>

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<sup>3</sup> *Getting a Smart Grid for Free* (July 26, 2017), available at [https://www.puco.ohio.gov/puco/assets/File/12\\_Alvarez.pdf](https://www.puco.ohio.gov/puco/assets/File/12_Alvarez.pdf).

<sup>4</sup> See R.C. 4928.02(D) ("It is the policy of the state to ... [e]ncourage innovation and market access for cost-effective ... smart grid programs, and implementation of advanced metering infrastructure").

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PUCO Case No. 17-0032-EL-AIR et al.*

1   **Q5.   HAVE YOU TESTIFIED PREVIOUSLY BEFORE OTHER STATE UTILITY**  
2       **COMMISSIONS?**

3   **A5.**   Yes. I have testified regarding distribution business investments, benefits, costs,  
4       and performance measurement in cases before multiple state utility commissions,  
5       as shown in my full CV provided as Exhibit PJA-1 to this testimony.

6

7   **Q6.   WHAT IS THE PURPOSE OF YOUR DIRECT TESTIMONY?**

8   **A6.**   I am testifying on behalf of the Office of the Ohio Consumers' Counsel ("OCC")  
9       in opposition to the April 13, 2018 Stipulation and Recommendation filed in these  
10      cases (the "Settlement") and with recommendations for consumer protection.

11

12       I understand that the PUCO uses a three-prong test to evaluate whether to approve  
13       a settlement. It asks (i) was the settlement was the product of serious bargaining  
14       among capable, knowledgeable parties? (ii) does the settlement, as a package,  
15       benefit customers and the public interest? and (iii) does the settlement violate any  
16       important regulatory principle or practice? In addition to these three criteria, the  
17       PUCO also routinely considers whether the parties to the settlement represent  
18       diverse interest.

19

20       I have examined the direct testimony of Duke witnesses in this case, responses to  
21       OCC and other parties' discovery requests, and other relevant documents related  
22       to Duke's smart grid proposals in these cases. This includes Duke witness



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1 Schneider's proposal for Duke to replace substantially all of its residential  
2 metering system, which consists of electric meters, gas meter data transmitters,  
3 and the associated communications network (hereafter referred to as the Echelon  
4 metering system, after the name of the electric meter manufacturer). Mr.  
5 Schneider refers to this plan as involving two phases, a preliminary "Business  
6 Continuity Effort" and a more comprehensive "AMI Transition Plan."<sup>5</sup>

7  
8 Based on my review of Duke's proposed Business Continuity Plan, AMI  
9 Transition Plan, and the Settlement's communications network and billing system  
10 enhancement proposals, the Settlement does not benefit customers and thus fails  
11 the PUCO's three-prong test. The PUCO should reject the Settlement.

12  
13 **Q7. CAN YOU PLEASE SUMMARIZE YOUR RECOMMENDATIONS?**

14 **A7.** Yes. I recommend that the PUCO reject the Settlement because it does not  
15 benefit customers, is contrary to the public interest, and violates regulatory  
16 principles and practices. Under the Settlement, Duke proposes to replace  
17 substantially all of its Echelon metering system—which it just finished installing  
18 just three years ago<sup>6</sup>—and to charge customers for the cost of the new system,  
19 which I project to be about \$486 million.

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<sup>5</sup> Case No. 17-1263-EL-SSO, Direct Testimony of Donald L. Schneider, Jr. on Behalf of Duke Energy Ohio, Inc. at 9-10, 12-16 (June 1, 2017) ("Schneider" or the "Schneider Testimony"). Mr. Schneider filed substantially the same testimony in Case No. 17-32-EL-AIR. I will generally refer to his SSO testimony.

<sup>6</sup> Case No. 16-1404-EL-RDR, Testimony of Peggy A. Laub on Behalf of Duke Energy Ohio, Inc., Attachment PAL-1, pg. 3, "Plant Additions by Month" (June 29, 2016) (Rider DR-IM calculation).

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Specifically, the PUCO should not allow Duke to charge customers the proposed \$28.6 million to replace its communications system,<sup>7</sup> the proposed \$12.6 million in charges for data access (“billing system enhancements”) under component two of the proposed PowerForward Rider (Rider PF),<sup>8</sup> or any other costs related to the Business Continuity Effort and AMI Transition Plan. (I will refer to these proposals and plans collectively as the proposed Echelon metering system replacement.) The PUCO should clarify that any investment to replace the Echelon metering system shall not be charged to customers through the PowerForward Rider (Rider PF), Distribution Capital Investment Rider (Rider DCI or DCI), or any other rider. I also recommend that Connect My Data standard compliance be required in place of any PUCO approval of billing system enhancement Phase 2.

**Q8. CAN YOU PLEASE SUMMARIZE YOUR TESTIMONY IN SUPPORT OF YOUR RECOMMENDATIONS?**

**A8.** Yes. I support my recommendations through three arguments:

1. The Settlement’s smart grid proposals found primarily under the “Rider PF” heading in the Settlement, are vague and undefined. While the Stipulation specifies recovery of \$41.2 million in costs, I estimate the Echelon metering

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<sup>7</sup> See Settlement at 18 (“Cost recovery of the communications system shall not exceed \$28,625,000.”).

<sup>8</sup> See Settlement at 16-17, Attachment F.

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1                   system replacement, of which the stipulated  
2                   communications network replacement and billing system  
3                   enhancements are only an incomplete part, will cost  
4                   customers over \$486 million in total. It appears that  
5                   despite citing only \$41.2 million in upgrades for  
6                   communications network replacement and billing system  
7                   enhancements, it is Duke's intent to proceed with the full  
8                   AMI Transition Plan without further PUCO approval.<sup>9</sup>

- 9                   2.     Duke has not demonstrated that Echelon metering system  
10                  replacement is the most cost-effective way to fix existing  
11                  metering system shortcomings, or even that the customer  
12                  benefits of fixing the shortcomings will exceed customer  
13                  costs. The "benefit-cost analysis" of the Echelon metering  
14                  system replacement Duke supplied in Case No. 17-0032-  
15                  EL-AIR (the "rate case") understates the cost to customers  
16                  of replacing the metering system by \$317 million and  
17                  overstates the cost of maintaining the Echelon metering  
18                  system by \$76 million. The Settlement both harms  
19                  customers and violates the used and useful principle.

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<sup>9</sup> See Case No. 17-0032-El-AIR et al., Duke response to OCC-STIP-INT-05-109(b) (attached as exhibit PJA-5).

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1                   3.     Before approving any metering system replacement, the  
2                             PUCO should define, and make abundantly clear,  
3                             functional requirements for new metering systems in Ohio  
4                             (applicable to Duke) to reduce future financial risks to  
5                             customers. Done properly, this will reduce the likelihood  
6                             customers will have to pay for yet another non-functional  
7                             system in the future.

8  
9     **Q9.    PLEASE SUMMARIZE THE BACKGROUND CONCERNING DUKE'S**  
10           **CURRENT METERING SYSTEM AND PROPOSED REPLACEMENT.**

11    **A9.**    Duke finished installing its Echelon metering system just three years ago at a cost  
12           of several hundred million dollars, paid in part by Duke customers and in part by  
13           taxpayers. The system was subsidized by a \$200 million grant from the U.S.  
14           Department of Energy as part of the American Reinvestment and Recovery Act of  
15           2009. As described in OCC witness Alexander's testimony, the Echelon metering  
16           system has multiple shortcomings relative to Duke's promises in Case No. 07-  
17           0589-EL-SSO; relative to Duke's promises in the approved settlement in Case No.  
18           10-2326-GE-RDR; and relative to metering systems installed by other large  
19           utilities at the same time Duke installed its Echelon metering system.<sup>10</sup>

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<sup>10</sup> See Testimony of Barbara Alexander on behalf of the Office of the Ohio Consumers' Counsel (June 25, 2018) (the "Alexander Testimony").

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1 In its initial business case for the Echelon metering system, Duke claimed that the  
2 metering system would last 20 years and provided a 20-year benefit-cost analysis  
3 based on this claim.<sup>11</sup> Now, though the average age of the Echelon metering  
4 system is just six to seven years,<sup>12</sup> Duke is proposing to replace it—at a cost of  
5 around \$486 million—to correct two primary shortcomings:

- 6 1. The Echelon metering system's 140,000 communication  
7 nodes use a cellular standard (2G/3G) which Verizon  
8 Wireless will allegedly discontinue by 2022; and
- 9 2. The number of customers for whom billing-quality,  
10 customer energy usage data (CEUD) is available is  
11 extremely limited.

12  
13 I agree with OCC witness Alexander's assessment that customers should not be  
14 responsible for paying to correct these and other shortcomings of the Echelon  
15 metering system Duke designed and installed with full knowledge of the PUCO  
16 and customer performance expectations.<sup>13</sup>

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<sup>11</sup> Case No. 07-0589-GA-AIR, Direct Testimony of Christopher D. Kiergan on Behalf of Duke Energy Ohio at 11:11 (July 28, 2008) (the "Kiergan Testimony").

<sup>12</sup> Case No. 17-0032-EL-RDR, Duke's response to OCC-INT-02-044 (regarding Rider DR-IM cost recovery by year) (attached as exhibit PJA-6).

<sup>13</sup> See Alexander Testimony.

1        However, my testimony focuses specifically on the replacement cost issues I  
2        believe the PUCO should take into account when considering charges to customers  
3        for meter communications network replacement (\$28.6 million) and billing system  
4        enhancements (\$12.6 million) proposed in the Settlement, plus hundreds of  
5        millions of dollars more required to complete the full replacement of Duke's  
6        Echelon metering system, which harms customers and is not in the public interest.

7

8    **II.        DUKE IS USING STIPULATED APPROVAL OF THE**  
9        **COMMUNICATIONS NETWORK REPLACEMENT AND BILLING**  
10       **SYSTEM ENHANCEMENTS AS THE BASIS TO EXECUTE A \$486**  
11       **MILLION ECHELON METERING SYSTEM REPLACEMENT AT**  
12       **CONSUMER EXPENSE.**

13

14    **Q10.    HOW MUCH DOES DUKE PROPOSE TO CHARGE CUSTOMERS FOR**  
15        **ECHELON METERING SYSTEM REPLACEMENT UNDER THE**  
16        **PROPOSED SETTLEMENT?**

17    **A10.**    The Settlement identifies \$28.6 million in metering communications system  
18        replacement costs and \$12.6 million in billing system enhancements. However, I  
19        believe these estimates are grossly incomplete and misleading.

**Q11. WHY IS THE SETTLEMENT PROPOSAL TO ALLOW DUKE TO RECOVER  
\$28.6 MILLION IN METERING COMMUNICATIONS SYSTEM  
REPLACEMENT AND \$12.6 MILLION IN BILLING SYSTEM  
ENHANCEMENTS GROSSLY INCOMPLETE AND MISLEADING?**

**A11.** In the rate case, Duke proposed to spend \$169.2 million<sup>14</sup> to replace the Echelon metering system it finished installing just a few years ago. Duke claims the Echelon metering system must be replaced to: 1) avoid the cost of upgrading the metering communication system's 140,000 communication nodes from 2G/3G cellular to 4G cellular by 2022; and 2) to increase the number of customers for whom billing-quality, customer energy usage data (CEUD) is available.<sup>15</sup> However, it is clear from discovery that replacing the meter communications system and completing proposed billing system enhancements will not accomplish these objectives. To accomplish these objectives Duke is also proposing to replace 626,000 Echelon electric meters and 419,000 gas meter data transmitters<sup>16</sup> in what Duke witness Schneider calls the Business Continuity Effort (the first 23,700 of the existing meter communications nodes, the first 80,000 of the electric meters, and the first 48,800 of the gas meter data

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<sup>14</sup> Schneider Testimony, Attachment DLS-1.

<sup>15</sup> *Id.* at 14:4-9.

<sup>16</sup> *Id.* at 9:1-3.

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1 transmitters)<sup>17</sup> and the AMI Transition Plan (the balance of the nodes, meters, and  
2 transmitters).<sup>18</sup>

3

4 The Settlement makes no mention of the Business Continuity Effort or the AMI  
5 Transition Plan. The Settlement, however, does state that the third component of  
6 the proposed PowerForward rider is “an infrastructure modernization plan, which  
7 will be filed in a separate proceeding and subject to hearing.”<sup>19</sup> When I first  
8 reviewed the Settlement, I interpreted this to mean that any further grid  
9 modernization efforts beyond the \$41.2 million for metering communications  
10 system and billing system upgrades would be part of this future proceeding. In  
11 other words, Duke would not be allowed to charge customers for the Business  
12 Continuity Effort or AMI Transition Plan unless it obtained future PUCO  
13 approval.

14 But through discovery, Duke admitted that it intends to proceed with full Echelon  
15 metering system replacement, to include not only the communications system  
16 replacement and billing system enhancements specified in the Stipulation, but  
17 also all the Echelon electric meters and gas meter data transmitters as proposed in  
18 Duke witness Schneider’s testimony in the rate case. According to Duke, “The  
19 Ohio AMI Transition will proceed as proposed in the Testimony of Donald

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<sup>17</sup> *Id.* at 10:10-17.

<sup>18</sup> *Id.* at 13:14-18.

<sup>19</sup> Settlement at 17.



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1 Schneider, while component three of the PowerForward Rider will require a  
2 separate proceeding and subject to hearing.”<sup>20</sup> So not only is Duke planning to  
3 charge customers \$41.2 million now, it is also planning to charge them for the  
4 entire AMI Transition Plan—at a cost of hundreds of millions of dollars—and  
5 then, it will file yet *another* proceeding for *another* grid modernization plan with  
6 additional unknown costs to customers.

7  
8 **Q12. SO, IF THE COMMISSION APPROVES THE \$41.2 MILLION COST FOR**  
9 **METERING COMMUNICATION SYSTEM REPLACEMENT AND BILLING**  
10 **SYSTEM ENHANCEMENTS, YOUR TESTIMONY IS THAT THE TWO**  
11 **SHORTCOMINGS STILL WON'T BE FIXED, AND TO DO SO WILL**  
12 **ULTIMATELY COST CUSTOMERS \$169 MILLION?**

13 **A12.** No, the situation is dramatically worse than that for customers. Duke projects the  
14 total (nominal) cost to replace the Echelon metering system to be \$169 million.  
15 However, my examination of Duke's cost projection indicates that the ultimate  
16 cost to customers of Echelon metering system replacement will be over \$486  
17 million, not \$169 million. The Settlement's consideration of a \$41.2 million  
18 meter communications network replacement and billing system enhancements is  
19 therefore grossly incomplete and misleading by a factor of more than ten (\$486  
20 million divided by \$41 million). The PUCO needs to understand that if the  
21 Settlement is approved as is, Duke will use such approval as the basis to execute a

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<sup>20</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-STIP-INT-03-073(a) (attached as Exhibit PJA-7).

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1       \$486 million Echelon metering system replacement proposal that is not actually  
2       presented in the Settlement. And then, apparently, Duke will file another grid  
3       modernization plan under component three of the PowerForward rider, which will  
4       presumably cost customers many tens or hundreds of millions of dollars more.

5

6       With so many unknowns and priorities likely to come up as part of the  
7       PowerForward proceeding and in any event, the PUCO must carefully pick and  
8       choose investments that customers will be asked to pay, weighing benefits relative  
9       to costs and whether the services are used and useful and resulted in prudent  
10      expenditures. The proposed metering system replacement is no exception, and  
11      with its exorbitant costs, must be rigorously scrutinized.

12

13   **III.       THE SETTLEMENT VIOLATES REGULATORY PRINCIPLES AND**  
14   **PRACTICES BECAUSE DUKE HAS NOT DEMONSTRATED THAT THE**  
15   **ECHELON METERING SYSTEM REPLACEMENT IS THE MOST**  
16   **COST-EFFECTIVE WAY TO FIX SYSTEM SHORTCOMINGS, OR**  
17   **EVEN THAT THE CUSTOMER BENEFITS OF FIXING THE**  
18   **SHORTCOMINGS WILL EXCEED CUSTOMER COSTS.**

**Q13. WHAT IS YOUR OVERALL ASSESSMENT OF DUKE'S PROPOSAL TO  
REPLACE THE ECHELON METERING SYSTEM?**

**A13.** First, I believe the “Benefit-Cost Analysis” Duke submitted to be fundamentally flawed when viewed from a consumer perspective. Customers will ultimately pay almost three times the cost (\$486 million) Duke projects (\$169 million) to replace the Echelon metering system. Duke also overstates by \$76 million the cost of continuing its Echelon metering system. My calculations indicate that customers will be better off if Duke maintains the Echelon metering system, on both a nominal and net present value (“NPV”) basis.

Second, Duke has not rigorously evaluated any of several potentially less costly alternatives that might be available to address the two primary shortcomings of the Echelon metering system: 1) to avoid the cost of upgrading the metering communication system’s 140,000 communication nodes from 2G/3G cellular to 4G cellular by 2022; and 2) to increase the number of customers for whom billing-quality CEUD is available. I will describe several such options Duke does not appear to have evaluated.

Finally, Duke’s “Benefit-Cost Analysis” simply assumes the Echelon metering system must be replaced, and compares the cost of replacing it to the cost of maintaining it in place. It does not even attempt to calculate the benefits to customers of the proposed new system. A reasonable benefit-cost analysis would compare the incremental customer benefits from replacing the Echelon metering

1 system to the incremental customer costs of replacing the system. Duke has not  
2 provided any analysis indicating whether incremental customer benefits will  
3 exceed customer costs. Based on available experience and research, I do not  
4 believe a reasonable benefit-cost analysis of Duke's Echelon metering system  
5 replacement would indicate customer benefits in excess of customer costs.  
6

7 **A. THE "BENEFIT-COST ANALYSIS" DUKE SUBMITTED**  
8 **WITH ITS ECHELON METERING SYSTEM REPLACEMENT**  
9 **PROPOSAL IS FUNDAMENTALLY FLAWED AND THUS**  
10 **HARMS CUSTOMERS, IS NOT IN THE PUBLIC INTEREST,**  
11 **AND VIOLATES IMPORTANT REGULATORY PRINCIPLES**  
12 **AND PRACTICES.**  
13

14 **Q14. WHY DO YOU BELIEVE DUKE'S \$169 MILLION ECHELON METERING**  
15 **SYSTEM REPLACEMENT COST PROJECTION TO BE UNDERSTATED**  
16 **BY \$317 MILLION?**

17 **A14.** Duke has ignored many types of costs customers will be forced to pay if the  
18 PUCO approves Duke's Echelon metering system replacement proposal. The  
19 table below lists the costs Duke's projection ignores, and quantifies the amounts  
20 in nominal and net present value terms (using a 7.54% discount rate)<sup>21</sup> over 15

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<sup>21</sup> See Settlement at 7 ("Overall Rate of Return").

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years (the Average Service Life of the new system).<sup>22</sup> The carrying charge on the book value of assets to be retired prematurely if the Echelon metering system replacement proceeds is calculated over ten years per the PUCO Staff's recommendation.<sup>23</sup>

Table 1: Customer costs ignored in Duke's metering system replacement projection

| (\$ in millions)<br>Customer Cost Ignored in Duke's Projections                                          | Net<br>Present<br>Value | Nominal<br>Value |
|----------------------------------------------------------------------------------------------------------|-------------------------|------------------|
| AMI Business Continuity Effort Capital Spending <sup>24</sup>                                            | \$ 24.136               | \$ 24.136        |
| Book Value of Equipment to be Retired Prematurely <sup>25</sup>                                          | 125.011                 | 144.874          |
| Carrying Charge on "AMI Transition Plan" Capital                                                         | 55.847                  | 86.023           |
| Carrying Charge on "AMI Business Continuity Effort" Capital                                              | 10.143                  | 14.519           |
| Carrying Charge on Book Value of Equipment to be Retired Prematurely (10 years, not 15 per Staff Report) | 40.326                  | 56.025           |
| AMI Business Continuity Effort O&M Spending <sup>26</sup>                                                | 0.061                   | 0.061            |
| <b>TOTALS</b> (does not foot exactly due to rounding)                                                    | \$255.523               | \$325.638        |

The Net Present Value calculations can be found in Exhibit PJA-2; the Carrying Charge calculations can be found in Exhibit PJA-3; and the Net Book Value calculations can be found in Exhibit PJA-4, all of which are attached to this testimony.

<sup>22</sup> Case No. 17-32-EL-AIR, Schedule B-3.2, page 2, line 20, "Utility of the Future Meters," column "Average Service Life".

<sup>23</sup> Case No. 17-32-EL-AIR, PUCO Staff Report of Investigation at 11 (Sept. 26, 2017) (the "Staff Report").

<sup>24</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-09-184(a) (attached as Exhibit PJA-8).

<sup>25</sup> Exhibit PJA-4.

<sup>26</sup> Exhibit PJA-8.

1   **Q15.   WHY SHOULD THE AMI BUSINESS CONTINUITY EFFORT CAPITAL**  
2           **SPENDING BE INCLUDED IN METERING SYSTEM REPLACEMENT**  
3           **COSTS?**

4   **A15.**   The Business Continuity Effort is indistinguishable from the AMI Transition  
5           Plan. Both involve the replacement of the existing metering communications  
6           network nodes, electric meters, and gas meter data transmitters, so both types of  
7           cost should be included in any metering system replacement analysis. Duke's  
8           \$169.2 million projection for AMI Transition Plan costs did not include Business  
9           Continuity Effort costs.<sup>27</sup> Failing to include Business Continuity Effort costs  
10          underestimates the cost of Echelon metering system replacement customers will  
11          ultimately be forced to pay if approved by the PUCO.

12  
13   **Q16.   WHY SHOULD THE BOOK VALUE OF EQUIPMENT THAT IS**  
14           **PREMATURELY BEING RETIRED BE INCLUDED IN ECHELON**  
15           **METERING SYSTEM REPLACEMENT COSTS?**

16   **A16.**   According to the original smart meter business case in Case No. 07-0589-GA-  
17           AIR, the Echelon metering system was projected to deliver benefits to customers  
18           for 20 years.<sup>28</sup> Now, at an average age of about one-third of that,<sup>29</sup> Duke is  
19           proposing to retire the Echelon metering system. Customers are being deprived

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<sup>27</sup> Schneider Testimony, Attachment DLS-1.

<sup>28</sup> Kiergan Testimony at 11:11.

<sup>29</sup> Exhibit PJA-6.

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1 of two-thirds of the useful life of a metering system they will continue to (but  
2 should not) pay for in rates until 2031 (ten years from the date the last of the  
3 Echelon metering system is replaced if approved).<sup>30</sup> If customers are being asked  
4 to reimburse Duke's capital expense, profits, and federal income taxes, on  
5 equipment to be removed from service prematurely at Duke's request, ignoring  
6 such costs in a metering system replacement analysis is not justified.  
7 Furthermore, asking customers to pay for Echelon meters which have been  
8 removed from service is a clear violation of the "used and useful" principle.  
9 Indeed, the Massachusetts Department of Public Utilities recently rejected the  
10 smart meter deployments of all three investor-owned utilities in that state, citing  
11 the high cost of prematurely-retired assets as a primary consideration.<sup>31</sup> Failing to  
12 include the cost of prematurely-retired equipment underestimates the cost of  
13 Echelon metering system replacement that customers will ultimately be forced to  
14 pay if approved by the PUCO.

15  
16 **Q17. WHY SHOULD CARRYING CHARGES BE INCLUDED IN ECHELON**  
17 **METERING SYSTEM REPLACEMENT COSTS?**

18 **A17.** Duke's Echelon metering system replacement cost projections do not include  
19 carrying charges that customers will have to pay.<sup>32</sup> Duke profits, federal income

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<sup>30</sup> Staff Report at 11.

<sup>31</sup> Massachusetts Department of Public Utilities, DPU 15-120, 15-121, 15-122, Order at 121-22 (May 10, 2018).

<sup>32</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-02-007(f) (attached as Exhibit PJA-9).

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1        taxes on Duke profits, and interest expense on Duke debt, are all carrying charges  
2        ultimately paid by customers. Failing to include carrying charges underestimates  
3        the cost of Echelon metering system replacement that customers will ultimately  
4        be forced to pay if approved by the PUCO.

5

6        **Q18. YOU CLAIMED EARLIER THAT YOUR ECHELON METERING SYSTEM**  
7        **REPLACEMENT COST ESTIMATE WAS \$317 MILLION HIGHER THAN**  
8        **DUKE'S PROJECTION. WHY IS THAT SO?**

9        **A18.** Duke's "Benefit-Cost Analysis" used a 20-year benefit-cost period. Based on the  
10       experience with the Echelon metering system (6-7 year service life if replacement  
11       is approved), the Staff Report (15-year service life),<sup>33</sup> and Duke's own  
12       depreciation schedule (15-year service life),<sup>34</sup> I consider 15 years to be a better  
13       estimate of the new system's service life, and therefore a more appropriate  
14       benefit-cost time period. As indicated above, I used a 15-year period to calculate  
15       the table. To compare "apples to apples," I recalculated Duke's cost projection  
16       including only 15 years' cost, not 20 years' cost, from details provided by Duke in  
17       discovery.<sup>35</sup> Removing five years' costs from Duke's cost projection resulted in a  
18       nominal cost reduction of \$8.455 million. The reconciliation is: \$325.637 million

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<sup>33</sup> Staff Report at 11.

<sup>34</sup> Case No. 17-0032-EL-AIR. Schedule B-3.2, page 2, line 20, "Utility of the Future Meters", column "Average Service Life".

<sup>35</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-02-009(a) (attached as Exhibit PJA-10).



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1 in nominal cost increases less \$8.455 million in nominal cost decreases results in  
2 a \$317.182 million net increase above Duke projections.

3

4 **Q19. WHY DO YOU BELIEVE DUKE OVERSTATED (BY \$76 MILLION) THE**  
5 **COST OF CONTINUING THE ECHELON METERING SYSTEM?**

6 **A19.** In its “Benefit-Cost Analysis,” Duke projects that it would cost \$326.2 million (in  
7 nominal dollars) to continue the Echelon metering system but only \$169.2 million  
8 (in nominal dollars) to complete the AMI Transition Plan.<sup>36</sup> As I have already  
9 described above, the \$169.2 million projection grossly underestimates the cost of  
10 replacing Duke’s Echelon metering system under the proposed Business  
11 Continuity Effort and AMI Transition Plan. At the same time, however, Duke’s  
12 \$326.2 million projected cost of maintaining the Echelon metering system is  
13 overstated by \$76 million.

14

15 Duke calculated the \$326.2 million cost to continue its current node-based meter  
16 communications system using a 20-year benefit period, despite the fact that the  
17 average service life of the new metering system is only 15 years (see immediately  
18 preceding paragraph). I note that in the original smart meter benefit-cost analysis  
19 Duke submitted in Case No. 07-0589-GA-AIR, Duke also used a 20-year period  
20 to calculate benefits for meters which Duke depreciated over an average service  
21 life of only 15 years. These are the same meters it is now proposing to replace

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<sup>36</sup> Schneider Testimony, Attachment DLS-1.

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after just 6-7 years.) The period used to calculate cost avoidance should be the same as the average service life of the replacement metering system, as the replacement metering system may not avoid costs for customers beyond its average service life. I recalculated Duke's projection using 15 years' cost avoidance, not 20 years' cost avoidance, from details provided by Duke in discovery.<sup>37</sup> Removing five years' cost avoidance from Duke's cost projection resulted in a nominal benefit reduction of \$76.7 million, consisting of reductions in several types of avoided cost benefits as indicated in the table below. Details of the 15-year benefit calculations are available in Exhibit PJA-2 attached to this testimony.

*Table 2: Reductions in Avoided Cost Benefits Resulting from a 5-year Reduction in the Benefit Period*

| <b>(\$ in millions)</b>                                                           | <b>15-Year</b>           | <b>20-Year</b>                        | <b>Benefit</b>             |
|-----------------------------------------------------------------------------------|--------------------------|---------------------------------------|----------------------------|
| <b>Reductions in Avoided Cost Benefits By<br/>Eliminating Benefit Years 16-20</b> | <b>Nominal<br/>Value</b> | <b>Nominal<br/>Value<sup>38</sup></b> | <b>Over-<br/>statement</b> |
| NES Headend Upgrades not avoided                                                  | \$ 7.944                 | \$ 10.589                             | \$ 2.645                   |
| Cellular Data Backhaul Costs not avoided                                          | 22.992                   | 33.217                                | 10.225                     |
| Communications Device Failure Cost not<br>avoided                                 | 71.772                   | 118.384                               | 46.612                     |
| Vendor Maintenance Cost not avoided                                               | 38.789                   | 56.039                                | 17.250                     |
| <b>TOTALS</b>                                                                     | <b>\$141.497</b>         | <b>\$218.229</b>                      | <b>\$76.732</b>            |

<sup>37</sup> Exhibit PJA-10.

<sup>38</sup> Schneider Testimony, Attachment DLS-1.

1   **Q20. CAN YOU PROVIDE A SUMMARY COMPARING YOUR VERSION OF**  
2       **DUKE WITNESS SCHNEIDER ATTACHMENT DLS-1 TO THE**  
3       **ORIGINAL?**

4   **A20.** Yes. Please see the table below. Making the adjustments described in the above  
5       testimony, the nominal cost Duke projects for Echelon metering system  
6       replacement balloons from \$169.2 million to \$486 million, far in excess of the  
7       cost to maintain the Echelon metering system of \$249.5 million. The figures on a  
8       net present value basis are just as striking, as the proposal cost Duke projects  
9       balloons from \$134.7 million to \$388.6 million, far in excess of the cost to  
10      maintain the Echelon metering system of \$172.8 million. To summarize, Duke's  
11      proposed Echelon metering system replacement is not the most cost-effective way  
12      to address the shortcomings of that system, evaluated on either a nominal or net  
13      present value basis.

14

15   **Q21. GIVEN YOUR ANALYSIS, WHAT DO YOU CONCLUDE ABOUT DUKE'S**  
16       **PROPOSAL TO REPLACE THE ECHELON METERING SYSTEM?**

17   **A21.** My analysis indicates Duke's proposal to replace the Echelon metering system  
18       harms customers. Further, Staff's recommendation that prematurely retired  
19       Echelon meters be amortized in rates over a 10-year period violates the used and  
20       useful principle. These are reasons enough to reject the Settlement, but there are  
21       others I cover in the rest of my testimony.

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1 Table 3: Summary of Recommended Adjustments to Metering System Replacement Cost Analysis

| Total (All Electric and Gas Costs)                                                |                                                                   |                                         | (Exh. PJA-2)          | (Exh. DLS-1)           | (Exh. PJA-2)              | (Exh. DLS-1)               |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------|-----------------------|------------------------|---------------------------|----------------------------|
| Discount Rate (DEO before tax)                                                    | 7.54%                                                             | (Per STIP dated April 13, 2018. Page 7. | OCC NPV<br>(15 years) | Duke NPV<br>(20 years) | OCC Nominal<br>(15 years) | Duke Nominal<br>(20 years) |
| <b>A. Continue Node Environment (Benefits of Metering System Replacement)</b>     |                                                                   |                                         |                       |                        |                           |                            |
| O&M                                                                               | 4G Communication Node Upgrade                                     |                                         | 78,966,119            | 78,694,632             | 91,162,500                | 91,162,500                 |
|                                                                                   | EDMS to MDM Conversion                                            |                                         | 14,177,147            | 14,140,117             | 15,800,000                | 15,800,000                 |
|                                                                                   | Long-term Communication Node Solution                             |                                         | 929,887               | 928,247                | 1,000,000                 | 1,000,000                  |
|                                                                                   | NES Headend Upgrades                                              |                                         | 5,677,870             | 5,123,981              | 7,943,599                 | 10,589,310                 |
| -                                                                                 | Monthly Cellular Cost                                             |                                         | 12,971,408            | 15,487,719             | 22,991,529                | 33,216,510                 |
| -                                                                                 | Communication Device Failures                                     |                                         | 38,166,258            | 49,779,269             | 71,772,140                | 118,383,860                |
| -                                                                                 | Vendor Maintenance                                                |                                         | 21,884,016            | 26,129,276             | 38,788,928                | 56,039,456                 |
|                                                                                   |                                                                   |                                         | <b>172,772,705</b>    | <b>190,283,241</b>     | <b>249,458,696</b>        | <b>326,191,636</b>         |
| <b>B.1. Transition to Mesh Environment (Costs of Metering System Replacement)</b> |                                                                   |                                         |                       |                        |                           |                            |
| Capital                                                                           | Ohio AMI Transition                                               |                                         | 123,737,702           | 123,299,685            | 143,398,848               | 143,398,848                |
| O&M                                                                               | Monthly Cellular Cost                                             |                                         | 5,302,259             | 6,418,755              | 9,704,845                 | 14,237,970                 |
|                                                                                   | Communication Device Failures                                     |                                         | 274,337               | 372,557                | 536,810                   | 930,746                    |
|                                                                                   | Vendor Maintenance                                                |                                         | 3,745,063             | 4,615,356              | 7,115,800                 | 10,644,198                 |
|                                                                                   |                                                                   |                                         | <b>133,059,361</b>    | <b>134,706,353</b>     | <b>160,756,303</b>        | <b>169,211,762</b>         |
| <b>B.2. Costs Duke Failed To Include In Transition to Mesh Environment</b>        |                                                                   |                                         |                       |                        |                           |                            |
| Capital                                                                           | Business Continuity Effort (OCC-INT-09-184 in 17-0032)            |                                         | 24,136,045            | 24,136,045             | 24,136,045                | 24,136,045                 |
| (see Exh. PJA-4) Capital                                                          | BV meters/data transmitters retired early                         |                                         | 125,010,893           | 125,010,893            | 144,874,341               | 144,874,341                |
| (see Exh. PJA-3) Carrying Charges                                                 | on "Ohio AMI Transition" Capital                                  |                                         | 55,846,923            | 55,846,923             | 86,022,733                | 86,022,733                 |
| " Carrying Charges                                                                | on "Business Continuity Effort" Capital                           |                                         | 10,143,153            | 10,143,153             | 14,519,167                | 14,519,167                 |
| " Carrying Charges                                                                | on meters/data transmitters retired prematurely per April 13 Stip |                                         | 40,325,710            | 40,325,710             | 56,024,959                | 56,024,959                 |
| O&M                                                                               | Business Continuity Effort (OCC-INT-09-184 in 17-0032)            |                                         | 60,506                | 60,506                 | 60,506                    | 60,506                     |
|                                                                                   |                                                                   |                                         | <b>255,523,231</b>    | <b>255,523,231</b>     | <b>325,637,752</b>        | <b>325,637,752</b>         |
| <b>Total Cost of Transition to Mesh Environment (B.1 + B.2)</b>                   |                                                                   |                                         | <b>388,582,591</b>    | <b>390,229,584</b>     | <b>486,394,054</b>        | <b>494,849,514</b>         |

2

1        **B.        *DUKE HAS NOT RIGOROUSLY EVALUATED ANY OF***  
2                    ***SEVERAL POTENTIALLY LESS COSTLY ALTERNATIVES***  
3                    ***THAT MIGHT BE AVAILABLE TO ADDRESS THE***  
4                    ***PRIMARY SHORTCOMINGS OF THE ECHELON***  
5                    ***METERING SYSTEM***  
6

7        **Q22.    *DID DUKE RIGOROUSLY EVALUATE OTHER, POTENTIALLY LESS***  
8                    ***COSTLY ALTERNATIVES THAT MIGHT BE AVAILABLE TO ADDRESS***  
9                    ***THE PRIMARY SHORTCOMINGS OF THE ECHELON METERING***  
10                  ***SYSTEM FOR THE BENEFIT OF CONSUMERS?***

11        **A22.**    No. In discovery, when asked for the cost analyses for several types of alternative  
12                    solutions my experience indicates might be reasonable, Duke replied that it had  
13                    not prepared cost analyses for any of the types of alternatives I described.  
14

15        **Q23.    *WHAT TYPES OF ALTERNATIVE SOLUTIONS DID YOU CONSIDER?***

16        **A23.**    One example I can cite is the potential use of Duke's existing Energy Data  
17                    Management System (EDMS) for billing-quality CEUD. EDMS is a database  
18                    offered by Oracle to manage the data from existing electric meters. Although  
19                    EDMS could have performed the Validation, Estimation, and Editing ("VEE")  
20                    software routines required to produce billing-quality data, Duke simply chose not  
21                    to purchase this capability.<sup>39</sup> Thus, the current barrier to generating billing-quality

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<sup>39</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-02-036 (attached as Exhibit PJA-11).

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1 CEUD for large numbers of customers is self-imposed by Duke and is unrelated  
2 to Duke's Echelon electric meters or communications network.

3  
4 Due to EDMS VEE limitations, Duke has been installing new Itron smart meters  
5 for residential customers with "special" billing needs, such as those on residential  
6 time-of-use rates. Data from Itron smart meters is routed to a different Oracle  
7 database, the Meter Data Management (MDM) system, because it does offer the  
8 sophisticated VEE software routines required for billing-quality CEUD. It is  
9 possible that a translation program could be written to "map" the individual  
10 elements from an EDMS data record into the corresponding elements in an  
11 MDM-compatible data record, at potentially a much lower cost to consumers.  
12 From there, MDM's VEE routines could deliver billing-quality CEUD without  
13 having to change out the existing communications network, electric meters, and  
14 gas meter data transmitters. In fact, this is precisely how Duke developed bills for  
15 customers in its time of use ("TOU") pilot programs using the Echelon metering  
16 system.<sup>40</sup> Yet Duke appears not to have considered this option at all and did not  
17 evaluate whether such an approach would be more cost-effective for customers  
18 while still providing them the same capabilities.<sup>41</sup> If the PUCO were to reject  
19 Echelon metering system replacement, Duke would have ample incentive to  
20 consider less costly solutions.

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<sup>40</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-06-124 (attached as Exhibit PJA-12).

<sup>41</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-INT-02-021 (attached as Exhibit PJA-13).

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1       As another example, Duke could evaluate if customized VEE software routines  
2       could be written for EDMS, thereby delivering billing-quality CEUD without  
3       having to replace the Echelon metering system. Again, Duke did not even  
4       consider this option or what it might cost compared to Duke's proposal to replace  
5       the Echelon metering system.

6  
7       To summarize, I've described at least three alternatives (purchase EDMS VEE;  
8       translate meter data from EDMS format into MDM-compatible format for VEE;  
9       or custom-build a VEE routine for EDMS) to providing billing-quality CEUD  
10      without replacing the Echelon metering system at a cost to customers of \$486  
11      million. Duke did not consider any of these options, or any others.<sup>42</sup> It simply  
12      decided on a capital-intensive approach of replacing the Echelon metering system  
13      in advance of the end of their useful lives. Duke's proposal is not likely the least-  
14      cost approach and does not benefit Duke customers; it would harm customers.  
15      Duke's proposal does benefit Duke shareholders, at customer expense.

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<sup>42</sup> *Id.* See also Schneider Deposition at 61:14-17 (transcript filed Jan. 17, 2018) ("Q. What alternatives did Duke consider to this node upgrade. A. We didn't really consider any other alternatives.").

1   **Q24. DO YOU HAVE ANY OTHER EXAMPLES OF POTENTIAL**  
2       **ALTERNATIVE SOLUTIONS FOR WHICH DUKE DID NOT COMPLETE A**  
3       **COST ANALYSIS?**

4   **A24.** Yes. The meter communications network replacement proposal offers another  
5       good example. There are many ways for a utility to read its meters wirelessly.  
6       Plausible alternatives to upgrading 140,000 meter communications network nodes  
7       to 4G cellular from 2G/3G cellular, or to replacing 626,000 electric meters and  
8       419,000 gas meter data transmitters, include:

- 9           1.     Replacing the communications network cards in the  
10               existing electric meters with cards that could communicate  
11               directly with the public 4G cellular network (as Duke  
12               currently does for nearly 12,000 of its Ohio meters);<sup>43</sup>
- 13           2.     Replacing the communications network cards in the  
14               existing electric meters with cards that could be read by the  
15               new Cisco Connected Grid Routers;
- 16           3.     Replacing the communications network, including the  
17               communications cards in the existing electric meters, with  
18               the private 4G LTE network now supported by Ericsson  
19               (Ericsson acquired Ambient, the manufacturer of the  
20               existing meter communications network nodes, out of  
21               bankruptcy in 2014).

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<sup>43</sup> Case No. 17-32-EL-AIR, Duke's response to OCC-STIP-INT-05-127 (attached as Exhibit PJA-14).



1 Again, Duke did not consider any of these options.<sup>44</sup>

2

3 **Q25. ARE YOU RECOMMENDING THAT DUKE IMPLEMENT THESE**  
4 **ALTERNATIVES TO ADDRESS SHORTCOMINGS IN ITS ECHELON**  
5 **METERING SYSTEM?**

6 **A25.** No. These are only examples of potential solutions Duke should be considering.  
7 These examples demonstrate that Duke's replacement proposal is not the only way  
8 to address the shortcomings of the Echelon metering system. A variety of viable,  
9 less capital-intensive alternatives should be fully examined before the PUCO  
10 approves a proposal. This is especially true because the solution Duke has chosen  
11 will end up costing customers an additional \$486 million. Protection of consumers  
12 warrants consideration of options that could result in lower charges on their  
13 electric bills.

14

15 **Q26. WHAT ARE THE IMPLICATIONS OF DUKE'S FAILURE TO EVALUATE**  
16 **ANY OF SEVERAL ALTERNATIVES LESS COSTLY THAN ECHELON**  
17 **SYSTEM REPLACEMENT?**

18 **A26.** Duke has not proven that its proposal to replace the Echelon metering system  
19 benefits customers or is in the public interest. Further, Staff's recommendation  
20 that prematurely retired Echelon meters be amortized in rates over a 10-year

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<sup>44</sup> Exhibit PJA-9 (Duke's response to OCC INT-02-007(c)).

1       period violates the used and useful principle. The used and useful principle  
2       protects customers from being charged for assets that are not being used.

3  
4       **C.     DUKE’S “BENEFIT-COST ANALYSIS” SIMPLY ASSUMES**  
5       **THE ECHELON METERING SYSTEM MUST BE**  
6       **REPLACED, COMPARING THE COST OF REPLACING IT**  
7       **TO THE COST OF MAINTAINING IT IN PLACE. THIS IS**  
8       **NOT A REASONABLE, CUSTOMER-ORIENTED BENEFIT-**  
9       **COST ANALYSIS, THOUGH NO SUCH ANALYSIS IS**  
10       **LIKELY TO SHOW SYSTEM REPLACEMENT TO BE**  
11       **ECONOMICALLY FAVORABLE TO CUSTOMERS.**

12  
13   **Q27.   WHAT IS YOUR DEFINITION OF A CUSTOMER-ORIENTED BENEFIT-**  
14   **COST ANALYSIS?**

15   **A27.** A customer-oriented benefit-cost analysis should compare the incremental,  
16       economic benefits of an action to customers to the incremental costs of that action  
17       to customers. This is consistent with Ohio Revised Code 4928.02(D), which  
18       specifies that it is state policy to encourage “cost effective . . . implementation of  
19       advanced metering infrastructure.”

1   **Q28.   ISN'T THAT WHAT DUKE PROVIDED IN WITNESS SCHNEIDER'S**  
2           **ATTACHMENT DLS-1?**

3   **A28.**   No. DLS-1 simply compares the cost of maintaining the Echelon metering  
4           system in place for 20 years to the cost of replacing it.<sup>45</sup> DLS-1 is therefore just a  
5           cost comparison and, as described earlier in this testimony, it understates the cost  
6           of replacement and overstates the cost of maintaining the Echelon metering  
7           system. DLS-1 does so to such an extent that it masks the fact that replacing the  
8           Echelon metering system represents an economic harm to consumers. DLS-1 also  
9           ignores costs which would violate the used and useful principle, which protects  
10          customers from being charged for assets (Echelon meters) removed from service.

11  
12   **Q29.   IN YOUR OPINION, WHAT WOULD BE REQUIRED TO UPGRADE**  
13           **ATTACHMENT DLS-1 TO A CUSTOMER-ORIENTED COST BENEFIT**  
14           **ANALYSIS?**

15   **A29.**   First, I believe Duke would need to complete a rigorous analysis of all potential  
16           options available to deliver the benefits it proposes to deliver, proposing the most  
17           cost-effective option evaluated. As described above, this is missing from Duke's  
18           "benefit-cost analysis." The determination of the most cost-effective options  
19           must involve consideration of all costs, including the cost of any replacement  
20           already completed (the business continuity effort); assets for which customers are

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<sup>45</sup> See Deposition of Donald Schneider at 57:12-18 (transcript filed Jan. 17, 2018) (acknowledging that attached DLS-1 "does not purport to compare the benefits" of the AMI Transition Plan to the benefits of maintaining the Echelon metering system).

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1       paying in rates but will be unable to use (prematurely-retired assets); and carrying  
2       charges customers will be forced to pay. As described earlier, these are also  
3       missing from Duke's "benefit-cost analysis".  
4

5       **Q30. WHAT ABOUT INCREMENTAL BENEFITS? SHOULDN'T THOSE ALSO**  
6       **BE INCLUDED IN A CUSTOMER-ORIENTED BENEFIT-COST**  
7       **ANALYSIS?**

8       **A30.** Yes, incremental benefits should also be included in a customer-oriented benefit-  
9       cost analysis. However, as described in OCC witness Alexander's testimony,  
10      many of the benefits that Duke promises from its AMI Transition Plan are the  
11      same benefits that Duke promised in Case No. 07-0589-GA-AIR and 10-2326-  
12      GE-RDR, but still have not been delivered to customers.<sup>46</sup> As these benefits  
13      should already have been delivered to customers, it would be unfair to count them  
14      as benefits to customers from Duke's proposal to replace the Echelon metering  
15      system. Moreover, customers should not be expected to pay for Duke's smart  
16      grid deployment that did not benefit customers as promised and is now proposed  
17      to be replaced.

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<sup>46</sup> See Alexander Testimony.

1   **Q31.   WOULDN YOU AGREE THAT BILLING-QUALITY CEUD, AND THE**  
2           **TIME-VARYING RATES ENABLED, OFFER POTENTIAL ECONOMIC**  
3           **BENEFITS TO DUKE CUSTOMERS?**

4   **A31.**   I think the key word there is “potential.” While I believe there is potential for  
5           time-varying rates to be valuable in theory, in practice they have been a complete  
6           failure for delivering benefits to Duke’s customers in excess of costs.

7  
8   **Q32.   PLEASE EXPLAIN WHY YOU BELIEVE TIME-VARYING RATES HAVE**  
9           **FAILED TO DELIVER BENEFITS TO CUSTOMERS IN EXCESS OF**  
10          **COST.**

11   **A32.**   There are three determinants to the size of benefits from time-varying rates:

$$\begin{array}{ccccccc} & & & \text{Value of} & & & \text{Size of} \\ & & & \text{System Peak} & & & \text{Behavior} \\ \text{Time-Varying} & & & \text{Capacity Cost} & & & \text{Change per} \\ \text{Rate Benefit} & = & & \text{Avoidance} & \times & & \text{Participating} \\ \text{Size} & & & (\$/\text{MW}) & & & \text{Customer} \end{array}$$

12  
13  
14  
15   All of these determinants are problematic in Duke’s current situation, and indeed  
16   in many utilities’ situations. As a result, any metering system replacement costing  
17   \$486 million would be very unlikely to deliver benefits in excess of costs for  
18   customers.

1   **Q33.   WHY IS THE VALUE OF SYSTEM PEAK CAPACITY COST AVOIDANCE**  
2           **PROBLEMATIC?**

3   **A33.**   Two reasons. First, excess capacity in the PJM market has driven capacity prices  
4           down, making time-varying rates designed to reduce system peak less beneficial.  
5           Second, not all time-varying rates reduce demand at system peak. There is no  
6           research indicating that the most popular time-varying rates offered by  
7           competitive retail electric suppliers (“marketers”) in other markets, such as “Free  
8           Saturdays,” reduce system peak demand.

9

10   **Q34.   BUT WHAT ABOUT THE NEW ENERGY AND CAPACITY MARKET**  
11           **SETTLEMENT PROCESSES PROPOSED IN DUKE WITNESS**  
12           **NICHOLSON’S TESTIMONY? WON’T THAT ENCOURAGE MARKETERS**  
13           **TO OFFER RATES THAT REDUCE SYSTEM PEAK?**

14   **A34.**   Perhaps. But marketers can also cover high settlement costs for their customers  
15           by raising rates per kWh. Getting customers to participate in rates that actually  
16           reduce system peak is a huge challenge. In fact, such rates are so unattractive to  
17           most customers that the marketing cost to recruit them swallows up much or most  
18           of the available economic benefit potential. My experience as a product  
19           developer and product manager confirms these difficulties. Products and services  
20           which make consumers’ lives easier or more convenient, from smart phones to  
21           Amazon.com, have a history of success. Time-varying rates are more complex  
22           for consumers, and require more time and effort to manage. These time-varying

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1 rate attributes are the antithesis of easy and convenient, which is why time-  
2 varying rates designed to reduce system peak are such a tough sell to consumers  
3 and of such low benefit in a smart meter benefit-cost analysis.  
4

5 **Q35. WHAT EVIDENCE DO YOU HAVE THAT CUSTOMER PARTICIPATION**  
6 **RATES ARE PROBLEMATIC?**

7 **A35.** Probably the most compelling is Duke's own experience with time-varying rates  
8 in Ohio. The pilots conducted in 2011 secured only 619 participants,<sup>47</sup> and Duke  
9 proposed to cancel its optional "TD" (Time of Day) residential rate without  
10 complaint.<sup>48</sup> Research indicates Duke's experience is not unique. In a study of  
11 12 large smart meter deployments nationwide, an average participation rate in  
12 voluntary time-varying rate programs of less than 15% was observed.<sup>49</sup>  
13 Regulators are beginning to question the viability of smart metering investments  
14 given the questionable value of time-varying rates. The Massachusetts  
15 Department of Public Utilities recently rejected the smart meter deployments of  
16 all three investor-owned utilities in that state, citing uncertainty surrounding the  
17 value of time-varying rates in a retail choice state as a primary consideration.<sup>50</sup> It

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<sup>47</sup> *Overview of Duke Energy Ohio's Experience with Time Differentiated Rates*. Duke Energy Ohio presentation to the Ohio Smart Grid Collaborative. Slide 10. May 24, 2012 (attached as Exhibit PJA-15).

<sup>48</sup> *Notice of Application to The Public Utilities Commission Of Ohio For An Increase In Electric Rates To All Jurisdictional Customers For Duke Energy Ohio, Inc.* Case No. 17-0032-EL-AIR. Page 3.

<sup>49</sup> Todd, A., P. Cappers, and C. Goldman. *Residential Customer Enrollment in Time-based Rate and Enabling Technology Programs: Smart Grid Investment Grant Consumer Behavior Study Analysis*. Lawrence Berkeley National Laboratory, LBNL-6247E. Figure ES-6, page XXV. June 5, 2013.

<sup>50</sup> Massachusetts DPU 15-120 through 15-122. Order dated May 10, 2018. Pages 1-2.

1 is also worthwhile to note that the benefit-cost analyses of many initial smart  
2 meter deployments, including Duke's Ohio deployment, benefitted from huge  
3 grants from the American Recovery and Reinvestment Act of 2009. The \$200  
4 million grant (at taxpayer expense) that Duke received to subsidize the Echelon  
5 metering system will not be available to artificially improve the benefit-cost  
6 analysis for the metering system replacement Duke is now proposing.

7

8 **Q36. WHAT OF DUKE'S PLANS FOR HOME ENERGY MANAGEMENT**  
9 **SYSTEMS? WILL THAT HELP WITH THE SIZE OF BEHAVIOR**  
10 **CHANGE PER PARTICIPATING CUSTOMER?**

11 **A36.** Research indicates that automation of residential load control increases the size of  
12 customer response to time-varying rates designed to reduce system peak demand.  
13 However, I have significant concerns about the potential for consumer harm when  
14 a regulated monopoly is offering services to consumers in competitive markets  
15 such as home energy management services, particularly when that regulated  
16 monopoly can use rate-based assets to secure a competitive advantage.



1    **IV.        BEFORE APPROVING ANY METERING SYSTEM REPLACEMENT,**  
2        **THE PUCO SHOULD DEFINE, AND MAKE ABUNDANTLY CLEAR,**  
3        **FUNCTIONAL REQUIREMENTS FOR SUCH SYSTEMS IN OHIO**  
4        **(APPLICABLE TO DUKE) TO REDUCE FUTURE FINANCIAL RISKS**  
5        **TO CUSTOMERS.**

6  
7    ***Q37.    PLEASE DESCRIBE THE DEFINING CHARACTERISTICS OF UTILITY***  
8        ***METERING SYSTEMS FROM THE PERSPECTIVE OF A FORMER***  
9        ***PRODUCT DEVELOPER.***

10   ***A37.*** As we have seen in the Duke metering system saga, metering systems are enablers  
11        or limiters of critical capabilities for electric distribution companies and their  
12        customers. Metering systems are characterized by huge costs (\$486 million  
13        equates to about \$773 per residential customer over 15 years)<sup>51</sup> and long-term  
14        inflexibility. Any investment of significant consequence and enormous size that  
15        is difficult to change entails a great deal of risk. It is not wise to leave decisions  
16        as significant as metering system design solely in the hands of monopoly utilities.  
17        Rather, significant stakeholder and regulator involvement in design and  
18        performance is warranted. Stakeholder engagement will increase transparency,  
19        result in a better end product, and reduce economic risk for customers and  
20        shareholders.

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<sup>51</sup> Based on a residential customer count of 629,102 per Duke Energy Ohio's 2016 Form 861 submitted to the U.S. Energy Information Administration.

1   **Q38. AS SOMEONE WHO WAS INVOLVED IN THE DUKE METERING**  
2       **SYSTEM DEPLOYMENT FAIRLY EARLY, WHAT LESSONS DO YOU**  
3       **BELIEVE HAVE BEEN LEARNED?**

4   **A38.** I believe the reason the existing metering system has such significant  
5       shortcomings. And the fact that the PUCO is even considering Duke's proposal to  
6       replace a metering system installed just a few years ago at a cost of hundreds of  
7       millions of dollars, is due to a lack of adequate functional specifications and  
8       enforcement. In the free market, corporate executives expect product developers  
9       to define the capabilities of a successful product (i.e., what it helps a user  
10      accomplish); detail product attributes (i.e. what it will weigh or how much it will  
11      cost); confirm these through market research (i.e., stakeholder input); and  
12      faithfully follow these specifications as the product is built (i.e., design  
13      compliance). In Duke's Ohio metering system planning, design, and build stages,  
14      all of these steps seem to have been missed. Duke knew that billing-quality  
15      customer energy usage data is important, but did not specify how many customers  
16      should have the capability, or what those customers (or their third party suppliers)  
17      might need from the system to actually reduce system peak. Duke claimed the  
18      metering system would last for 20 years, but it failed to look 20 years (or even 10  
19      years) ahead. In addition, the PUCO has failed to aggressively enforce the  
20      functional specifications that were defined in the approved settlement in Case No.  
21      10-2326-GE-RDR.

1   **Q39.   WHAT DO THESE LESSONS MEAN FOR THE PUCO TODAY**  
2           **REGARDING DUKE’S METERING SYSTEM SHORTCOMINGS?**

3   **A39.**   The PUCO still has an opportunity to impose consumer protections by rejecting or  
4           modifying the Settlement. The single most important role the PUCO can fulfill  
5           regarding Duke’s metering system shortcomings is to ensure the same mistakes  
6           are not made twice. The PUCO should not approve the meter communications  
7           network replacement and billing system enhancements in the Stipulation—and by  
8           implication should not approve the entire \$486 million Echelon metering system  
9           replacement plan. There should be a full and clear defining of functional  
10          specifications and imposing of other consumer protections for such plans, before  
11          it can be decided if any approval is warranted. Otherwise, there is the potential for  
12          the consumer concerns I have identified to be repeated in a future case.

13

14   **Q40.   COMPETITIVE ELECTRIC MARKETS HAVE BEEN HELD BACK IN**  
15           **SOUTHWEST OHIO UNNECESSARILY FOR YEARS ALREADY. WHAT**  
16           **NEW SPECIFICATIONS WOULD WE IDENTIFY, DETAIL, AND**  
17           **CONFIRM WITH ALLOWING FURTHER STAKEHOLDER INPUT?**

18   **A40.**   I do not agree with a premise that time-varying rates are essential for competitive  
19           electric markets. However, setting this issue aside, I believe there are many  
20           important questions to be resolved which would almost certainly impact metering  
21           system choices. For example, there are outstanding data access, communications  
22           bandwidth, and communications latency specifications that could impact the type

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1 of metering system that are needed to meet stakeholders' needs. Examples  
2 include:

- 3 1. Should the communications network support the potential  
4 need for thousands of customers and authorized third  
5 parties to access interval data in near-real time,  
6 simultaneously, to automate load management/demand  
7 response event participation?
- 8 2. If not, does Duke's home energy management system  
9 proposals to communicate with smart meters via  
10 proprietary wireless home gateways for near-real time data  
11 access<sup>52</sup> constitute the use of rate-based meters to provide  
12 competitive advantages in markets for unregulated  
13 services?
- 14 3. Should Duke be required to comply with the Connect My  
15 Data standard? The Connect My Data standard would  
16 satisfy the needs expressed by proposed billing system  
17 enhancement Phase 2 (the automation of data access  
18 authorization by customers and retrieval by third parties)<sup>53</sup>

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<sup>52</sup> Case No. 17-0032-EL-AIR. Testimony of Duke witness Weintraub at 12:16.

<sup>53</sup> Settlement, Attachment F.

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1                   while facilitating data access to all customers at about the  
2                   same cost.

3                   4.       What opportunities does the approaching 5G revolution  
4                   offer for Duke meter communications, as well as for load  
5                   management by consumers, Duke, and third-party energy  
6                   management services providers? (I note that the Rhode  
7                   Island PUC is examining this question in its Power Sector  
8                   Transformation proceeding.)<sup>54</sup>

9                   I also suggest some big policy questions related to metering systems be addressed  
10                  (which the Rhode Island PUC is also examining):<sup>55</sup>

11                  1.       Should customers have the option to purchase a meter that  
12                  provides billing-quality customer energy usage data? Why  
13                  should every customer pay \$773 over 15 years to make  
14                  billing-quality customer energy usage data available to the  
15                  few that may have an interest?

16                  2.       Is it necessary for the utility to own the communications  
17                  networks to systems (like meters) not critical to reliability

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<sup>54</sup> Rhode Island Power Sector Transformation. Phase 1 Interagency Report to the Governor. Pages 36-39. November 2017.

<sup>55</sup> *Id.* at 40-41.

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1 or safety, particularly given that meter communications are  
2 clearly not a core utility competency?

3 I am sure stakeholders and other experts could come up with many more good  
4 questions in need of answers. I understand that marketers have been promised  
5 billing-quality CEUD for several years, and that these continued delays are  
6 frustrating to them. However, Duke is responsible for the shortcomings of the  
7 existing system, not customers. I do not believe customers should incur the costs  
8 required to address the shortcomings of the system Duke designed, but customers  
9 would be even more aggrieved if the PUCO were to approve a second  
10 dysfunctional metering system. In fact, if Duke's metering system replacement  
11 proposal is approved, it would effectively reward Duke for poor management  
12 decisions with earnings growth. The message it sends to Duke and every other  
13 utility in the state is that it does not matter if it makes critically wrong, imprudent  
14 decisions on smart grid because when things go badly, a utility can simply come  
15 back to the PUCO and seek to charge its monopoly customers hundreds of  
16 millions of dollars more for a new system.

17

18 **Q41. ASSUME A METERING SYSTEM SPECIFICATION PROCEEDING WERE**  
19 **HELD. HOW WOULD THAT HELP THE COMMISSION DECIDE WHAT**  
20 **TO DO ABOUT DUKE'S ECHELON METERING SYSTEM?**

21 **A41.** Once ideal functional specifications have been established, and the benefits of  
22 each quantified where possible, the shortcomings of and fixes to the Echelon

metering system can be examined in a new light. Using the specifications and value propositions as evaluation criteria, the pros and cons of various approaches to addressing the shortcomings could be considered with greater clarity. For example, answers to the questions listed above might make clear that a less capital-intensive solution to providing billing-quality customer energy usage data should be pursued in the short term, allowing the existing metering system to continue until 5G arrives (perhaps as early as 2020) while still enabling optional time-varying rates for those with an interest. Such a proceeding could also be used to more rigorously evaluate, in a transparent manner, all options available to addressing the shortcomings of the Echelon metering system in order to find the most advantageous approach for the least cost to customers.

**V. SUMMARY AND RECOMMENDATIONS**

**Q42. PLEASE SUMMARIZE YOUR TESTIMONY.**

**A42.** For all the reasons identified in this testimony, the Settlement should be rejected as a package because it harms customers. Specifically, in this testimony I have provided information in support of the following points:

1. Duke is using stipulated approval of the communications network replacement and billing system enhancements (\$41.2 million) as the basis to execute a \$486 million meter system replacement proposal.

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- 1                   2.       Duke has not demonstrated that replacing the Echelon  
2                   metering system is the most cost-effective way to fix  
3                   system shortcomings, or even that the customer benefits of  
4                   fixing the shortcomings will exceed customer costs. As a  
5                   result, Duke has not proven its replacement proposal  
6                   benefits customers. Further, the PUCO Staff's  
7                   recommendation that prematurely retired Echelon meters  
8                   be amortized in rates over a 10-year period violates the  
9                   used and useful principle. I support this point with three  
10                  arguments:  
11                 a.       Considering \$325 million in customer costs Duke  
12                   ignored and \$76 million in overstated costs of  
13                   continuing the current system, my analysis indicates  
14                   that Echelon metering system replacement is not the  
15                   most cost-effective approach to addressing the  
16                   shortcomings of the system.  
17                 b.       Duke did not rigorously evaluate several potentially  
18                   viable and less costly approaches to securing  
19                   billing-quality CEUD and avoiding upgrades to  
20                   140,000 meter communication nodes without  
21                   replacing the Echelon meters.



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1                   c.       Even a proper benefit-cost analysis is unlikely to  
2                               deliver a favorable benefit-cost analysis for Echelon  
3                               metering system replacement given the  
4                               uncertainties around the level of benefit from the  
5                               time-varying rates that billing-quality CEUD makes  
6                               possible.

7                   3.       Before approving any metering system replacement, the  
8                               Commission should define, and make abundantly clear,  
9                               functional requirements for metering systems in Ohio  
10                              (applicable to Duke) to reduce future financial risks to  
11                              customers.

12  
13   **Q43.   BASED ON THIS TESTIMONY, WHAT ARE YOUR**  
14           **RECOMMENDATIONS?**

15   **A43.**   I recommend that, regarding the issues I have addressed, the Commission should:

- 16                   1.       Reject the Settlement or at least eliminate the portions of  
17                               the Settlement that propose charging consumers for  
18                               Communications Network Replacement and Billing System  
19                               Enhancements totaling \$41.2 million.  
20                   2.       Clarify to Duke in a written Order that:

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- 1                   a.       Duke's investments in the AMI Business Continuity
- 2                               Effort and AMI Transition Plan have not been
- 3                               approved;
- 4                   b.       Duke is not permitted to charge customers for
- 5                               replacement of the Echelon metering system in
- 6                               Rider PF, Rider DCI, or any other rider; and
- 7                   c.       If Duke chooses to make any of these investments
- 8                               anyway, it does so at its own risk.
- 9               3.       Clearly define functional specifications and policies for
- 10                           metering systems in Ohio as soon as possible, ideally with
- 11                           stakeholder input on this consumer issue. A distinct
- 12                           proceeding would be ideal for a transparent investigation
- 13                           and examination regarding the best way to address for
- 14                           Duke and its customers the shortcomings of the Echelon
- 15                           metering system.
- 16               4.       Require Connect My Data standard compliance if the
- 17                           Commission deems Phase 2 of proposed billing system
- 18                           enhancements appropriate, as Connect My Data
- 19                           compliance will benefit more customers for a similar cost.

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1    **Q44. DOES THIS CONCLUDE YOUR TESTIMONY?**

2    **A44.** Yes, it does. I reserve the right to incorporate new information that may  
3       subsequently become available through outstanding discovery or otherwise.

## **CERTIFICATE OF SERVICE**

I hereby certify that a true copy of the foregoing *Revised Direct Testimony* of Paul J. Alvarez on Behalf of the Office of the Ohio Consumers' Counsel was served via electronic transmission to the persons listed below on this 25th day of June 2018.

/s/ William J. Michael  
William J. Michael  
Assistant Consumers' Counsel

### **SERVICE LIST**

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| <b>Case No. 17-0872-EL-RDR et al.</b><br><br><a href="mailto:Steven.beeler@ohioattorneygeneral.gov">Steven.beeler@ohioattorneygeneral.gov</a><br><a href="mailto:cmooney@ohiopartners.org">cmooney@ohiopartners.org</a><br><a href="mailto:mkurtz@BKLlawfirm.com">mkurtz@BKLlawfirm.com</a><br><a href="mailto:kboehm@BKLlawfirm.com">kboehm@BKLlawfirm.com</a><br><a href="mailto:jkylercohn@BKLlawfirm.com">jkylercohn@BKLlawfirm.com</a><br><a href="mailto:dborchers@bricker.com">dborchers@bricker.com</a><br><a href="mailto:dparram@bricker.com">dparram@bricker.com</a><br><a href="mailto:whitt@whitt-sturtevant.com">whitt@whitt-sturtevant.com</a><br><a href="mailto:campbell@whitt-sturtevant.com">campbell@whitt-sturtevant.com</a><br><a href="mailto:glover@whitt-sturtevant.com">glover@whitt-sturtevant.com</a><br><a href="mailto:rsahli@columbus.rr.com">rsahli@columbus.rr.com</a><br><a href="mailto:mleppla@theoec.org">mleppla@theoec.org</a><br><a href="mailto:tdougherty@theOEC.org">tdougherty@theOEC.org</a><br><br><b>Case No. 17-0032-EL-AIR et al.</b><br><br><a href="mailto:Steven.beeler@ohioattorneygeneral.gov">Steven.beeler@ohioattorneygeneral.gov</a><br><a href="mailto:Robert.eubanks@ohioattorneygeneral.gov">Robert.eubanks@ohioattorneygeneral.gov</a><br><a href="mailto:cmooney@ohiopartners.org">cmooney@ohiopartners.org</a><br><a href="mailto:mfleisher@elpc.org">mfleisher@elpc.org</a><br><a href="mailto:fdarr@mwncmh.com">fdarr@mwncmh.com</a><br><a href="mailto:mpritchard@mwncmh.com">mpritchard@mwncmh.com</a><br><a href="mailto:paul@carpenterlipps.com">paul@carpenterlipps.com</a><br><a href="mailto:mleppla@theOEC.org">mleppla@theOEC.org</a><br><a href="mailto:tdougherty@theOEC.org">tdougherty@theOEC.org</a><br><a href="mailto:dborchers@bricker.com">dborchers@bricker.com</a><br><a href="mailto:dparram@bricker.com">dparram@bricker.com</a><br><a href="mailto:whitt@whitt-sturtevant.com">whitt@whitt-sturtevant.com</a> | <a href="mailto:Jeanne.kingery@duke-energy.com">Jeanne.kingery@duke-energy.com</a><br><a href="mailto:Elizabeth.watts@duke-energy.com">Elizabeth.watts@duke-energy.com</a><br><a href="mailto:Rocco.dascenzo@duke-energy.com">Rocco.dascenzo@duke-energy.com</a><br><a href="mailto:chris.michael@icemiller.com">chris.michael@icemiller.com</a><br><a href="mailto:Mike.Mizell@icemiller.com">Mike.Mizell@icemiller.com</a><br><a href="mailto:Kay.pashos@icemiller.com">Kay.pashos@icemiller.com</a><br><a href="mailto:Camal.Robinson@duke-energy.com">Camal.Robinson@duke-energy.com</a><br><a href="mailto:fdarr@mwncmh.com">fdarr@mwncmh.com</a><br><a href="mailto:mpritchard@mwncmh.com">mpritchard@mwncmh.com</a><br><a href="mailto:Bojko@carpenterlipps.com">Bojko@carpenterlipps.com</a><br><a href="mailto:perko@carpenterlipps.com">perko@carpenterlipps.com</a><br><a href="mailto:paul@carpenterlipps.com">paul@carpenterlipps.com</a><br><a href="mailto:joliker@igsenergy.com">joliker@igsenergy.com</a><br><a href="mailto:kboehm@BKLlawfirm.com">kboehm@BKLlawfirm.com</a><br><br><a href="mailto:Jeanne.kingery@duke-energy.com">Jeanne.kingery@duke-energy.com</a><br><a href="mailto:Elizabeth.watts@duke-energy.com">Elizabeth.watts@duke-energy.com</a><br><a href="mailto:Rocco.dascenzo@duke-energy.com">Rocco.dascenzo@duke-energy.com</a><br><a href="mailto:chris.michael@icemiller.com">chris.michael@icemiller.com</a><br><a href="mailto:Mike.Mizell@icemiller.com">Mike.Mizell@icemiller.com</a><br><a href="mailto:Kay.pashos@icemiller.com">Kay.pashos@icemiller.com</a><br><a href="mailto:Camal.Robinson@duke-energy.com">Camal.Robinson@duke-energy.com</a><br><a href="mailto:mkurtz@BKLlawfirm.com">mkurtz@BKLlawfirm.com</a><br><a href="mailto:kboehm@BKLlawfirm.com">kboehm@BKLlawfirm.com</a><br><a href="mailto:jkylercohn@BKLlawfirm.com">jkylercohn@BKLlawfirm.com</a><br><a href="mailto:joliker@igsenergy.com">joliker@igsenergy.com</a><br><a href="mailto:eakhbari@bricker.com">eakhbari@bricker.com</a> |
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| <p><b>Case No. 17-1263-EL-SSO et al.</b></p> <a href="mailto:Steven.beeler@ohioattorneygeneral.gov">Steven.beeler@ohioattorneygeneral.gov</a><br><a href="mailto:fdarr@mwncmh.com">fdarr@mwncmh.com</a><br><a href="mailto:mpritchard@mwncmh.com">mpritchard@mwncmh.com</a><br><a href="mailto:mkurtz@BKLawfirm.com">mkurtz@BKLawfirm.com</a><br><a href="mailto:jkylercohn@BKLawfirm.com">jkylercohn@BKLawfirm.com</a><br><a href="mailto:cmooney@ohiopartners.org">cmooney@ohiopartners.org</a><br><a href="mailto:Bojko@carpenterlipps.com">Bojko@carpenterlipps.com</a><br><a href="mailto:dressel@carpenterlipps.com">dressel@carpenterlipps.com</a><br><a href="mailto:slessor@calfee.com">slessor@calfee.com</a><br><a href="mailto:jang@calfee.com">jang@calfee.com</a><br><a href="mailto:talexander@calfee.com">talexander@calfee.com</a><br><a href="mailto:mkeaney@calfee.com">mkeaney@calfee.com</a><br><a href="mailto:eakhbari@bricker.com">eakhbari@bricker.com</a><br><a href="mailto:nhewell@bricker.com">nhewell@bricker.com</a><br><a href="mailto:paul@carpenterlipps.com">paul@carpenterlipps.com</a><br><a href="mailto:whitt@whitt-sturtevant.com">whitt@whitt-sturtevant.com</a><br><a href="mailto:campbell@whitt-sturtevant.com">campbell@whitt-sturtevant.com</a><br><a href="mailto:glover@whitt-sturtevant.com">glover@whitt-sturtevant.com</a><br><a href="mailto:rsahli@columbus.rr.com">rsahli@columbus.rr.com</a><br><a href="mailto:tony.mendoza@sierraclub.org">tony.mendoza@sierraclub.org</a> | <a href="mailto:Jeanne.kingery@duke-energy.com">Jeanne.kingery@duke-energy.com</a><br><a href="mailto:Elizabeth.watts@duke-energy.com">Elizabeth.watts@duke-energy.com</a><br><a href="mailto:Rocco.dascenzo@duke-energy.com">Rocco.dascenzo@duke-energy.com</a><br><a href="mailto:chris.michael@icemiller.com">chris.michael@icemiller.com</a><br><a href="mailto:Mike.Mizell@icemiller.com">Mike.Mizell@icemiller.com</a><br><a href="mailto:Kay.pashos@icemiller.com">Kay.pashos@icemiller.com</a><br><a href="mailto:Camal.Robinson@duke-energy.com">Camal.Robinson@duke-energy.com</a><br><a href="mailto:charris@spilmanlaw.com">charris@spilmanlaw.com</a><br><a href="mailto:dwilliamson@spilmanlaw.com">dwilliamson@spilmanlaw.com</a><br><a href="mailto:lbrandfass@spilmanlaw.com">lbrandfass@spilmanlaw.com</a><br><a href="mailto:mfleisher@elpc.org">mfleisher@elpc.org</a><br><a href="mailto:tdougherty@theOEC.org">tdougherty@theOEC.org</a><br><a href="mailto:mleppla@theOEC.org">mleppla@theOEC.org</a><br><a href="mailto:joliker@igsenergy.com">joliker@igsenergy.com</a><br><a href="mailto:mnugent@igsenergy.com">mnugent@igsenergy.com</a><br><a href="mailto:dborchers@bricker.com">dborchers@bricker.com</a><br><a href="mailto:dparram@bricker.com">dparram@bricker.com</a><br><a href="mailto:mjsettineri@vorys.com">mjsettineri@vorys.com</a><br><a href="mailto:glpetrucci@vorys.com">glpetrucci@vorys.com</a><br><a href="mailto:mdortch@kravitzllc.com">mdortch@kravitzllc.com</a><br><a href="mailto:sean.mcglone@ohiohospitals.org">sean.mcglone@ohiohospitals.org</a> |
| <p><b>Case No. 16-1602-EL-ESS</b></p> <a href="mailto:Thomas.lindgren@ohioattorneygeneral.gov">Thomas.lindgren@ohioattorneygeneral.gov</a><br><a href="mailto:Elizabeth.watts@duke-energy.com">Elizabeth.watts@duke-energy.com</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## **Curriculum Vitae -- Paul J. Alvarez MM, NPDP**

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Wired Group, PO Box 150963, Lakewood, CO 80215 [palvarez@wiredgroup.net](mailto:palvarez@wiredgroup.net)  
720.308.2407

### **Profile**

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After 15 years in Fortune 500 product development and product management, including P&L responsibility, Mr. Alvarez entered the utility industry by way of demand-side management rate and program development, marketing, and impact measurement in 2001. He has since designed renewable portfolio standard compliance and distributed generation rates and incentive programs. These experiences led to unique projects involving the measurement of grid modernization costs and benefits (energy, capacity, operating savings, revenue capture, reliability, environmental, and customer experience), which revealed the limitations of current utility regulatory and governance models. Mr. Alvarez currently serves as the President of the Wired Group, a boutique consultancy serving consumer and environmental advocates, regulators, associations, and suppliers.

### **Research Projects, Thought Leadership, Regulatory Appearances**

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**Support for Considering Grid Modernization Investments in a Distinct Proceeding.** Testimony before the North Carolina Utilities Commission on behalf of the Environmental Defense Fund. E-2 Sub 1142, October 18, 2017; also E-7 Sub 1146, January 19, 2018.

**Evaluation of Southern California Edison's Request to invest \$2.3 Billion in Its Grid to Accommodate Distributed Energy Resources.** Testimony before the California Public Utilities Commission on behalf of The Utility Reform Network in A16-09-001. May 2, 2017.

**Evaluation of National Grid's Massachusetts Smart Meter Deployment Plan.** Testimony before the Massachusetts Department of Public Utilities on behalf of the Attorney General in 15-120. March 10, 2017.

**Evaluation of Eversource's Smart Meter Deployment Plan.** Testimony before the Massachusetts Department of Public Utilities on behalf of the Attorney General in 15-122. March 10, 2017.

**Evaluation of Kentucky Utilities/Louisville Gas & Electric Smart Meter Deployment Plan.** Testimony before the Kentucky Public Service Commission on behalf of the Attorney General, 2016-00370 & 371. March 3, 2017. Also 2018-00005. May 18, 2018.

**Recommendations on Metropolitan Edison's Grid Modernization Plan.** Testimony before the Pennsylvania Public Utilities Commission on behalf of the Environmental Defense Fund in R-2016-2547449. July 21, 2016.

**Arguments to Consider Duke Energy's Smart Meter CPCN Request in the Context of a Rate Case.** Testimony before the Kentucky Public Service Commission on behalf of the Attorney General in 2016-00152. July 18, 2016.

**Arguments to Reject Pacific Gas & Electric's Request to Invest \$100 Million in Its Grid to Accommodate Distributed Energy Resources.** Testimony before the California Public Utilities Commission on behalf of The Utility Reform Network, A15-09-001. April 29, 2016

**Arguments to Reject Westar Energy's Proposal to Mandate a Rate Specific to Distributed Generation-Owners.** Testimony before the Kansas Corporation Commission on behalf of the Environmental Defense Fund, case 15-WSEE-115-RTS. July 9, 2015.

**Regulatory Reform Proposal to Base a Significant Portion of Utility Compensation on Performance in the Public Interest.** Testimony before the Maryland PSC on behalf of the Coalition for Utility Reform, case 9361. December 8, 2014.

**Best Practices in Grid Modernization Capability Optimization: Visioning, Strategic Planning, and New Capability Portfolio Management.** Top-5 US utility; client confidential. 2014.

**Smart Grid Economic and Environmental Benefits: A Review and Synthesis of Research on Smart Grid Benefits and Costs.** Secondary research report prepared for the Smart Grid Consumer Collaborative. October 8, 2013. Companion piece: Smart Grid Technical and Economic Concepts for Consumers.

**Duke Energy Ohio Smart Grid Audit and Assessment.** Primary research report prepared for the Public Utilities Commission of Ohio case 10-2326-GE. June 30, 2011.

**SmartGridCity™ Demonstration Project Evaluation Summary.** Primary research report prepared for Xcel Energy. Colorado Public Utilities Commission case 11A-1001E. Filed December 14, 2011 as Exhibit MGL-1. Report dated October 21, 2011.

### **Books**

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**Smart Grid Hype & Reality: A Systems Approach to Maximizing Customer Return on Utility Investment.** First edition 327 pages, 2014. Second edition 358 pages, 2018. ISBN 978-0-615-88795-1. Wired Group Publishing.

### **Noteworthy Publications**

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**Measuring Distribution Performance? Benchmarking Warrants Your Attention.** With Sean Ericson. Electricity Journal. Volume 31 (April, 2018), pages 1-6.

**Busting Myths: Investor-Owned Utility Performance Can be Credibly Benchmarked.** With Joel Leonard. Electricity Journal. Volume 30 (October, 2017), pages 45-48.

**Price Cap Electric Ratemaking: Does it Merit Consideration?** With Bill Steele. Electricity Journal. Volume 30, (October, 2017), pages 1-7.

**Integrated Distribution Planning: An Idea Whose Time has Come.** Public Utilities Fortnightly. Nov, 2014. Republished in the ICER Chronicle, 3rd Edition, March, 2015.

**Maximizing Customer Benefits: Performance Measurement and Action Steps for Smart Grid Investments.** Public Utilities Fortnightly. January, 2012.

**Buying Into Solar: Rewards, Challenges, and Options for Rate-Based Investments.** Public Utilities Fortnightly. December, 2009.

**Smart Grid Regulation: Why Should We Switch to Performance-based Compensation?** Smart Grid News. August 15, 2014.

**A Better Way to Recover Smart Grid Costs.** Smart Grid News. September 3, 2014.

**Is This the Future? Simple Methods for Smart Grid Regulation.** Smart Grid News. October 2, 2014.



**The True Cost of Smart Grid Capabilities.** Intelligent Utility. June 30, 2014.

### **Noteworthy Presentations**

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**NASUCA Mid-Year Meeting.** *Utility Evaluator™ Software: Benchmarking Distribution Utility Performance Using Publicly-Available Data.* New Orleans, LA. June 7, 2016.

**NARUC Committee on Energy Resources and the Environment.** *How big data can lead to better decisions for utilities, customers, and regulators.* Washington DC. February 15, 2016.

**National Conference of Regulatory Attorneys 2014 Annual Meeting.** *Smart Grid Hype & Reality.* Columbus, Ohio. June 16, 2014.

**NASUCA 2013 Annual Conference.** *A Review and Synthesis of Research on Smart Grid Benefits and Costs.* Orlando. November 18, 2013.

**NARUC Subcommittee on Energy Resources and the Environment.** *The Distributed Generation (R)Evolution.* Orlando. November 17, 2013.

**IEEE Power and Energy Society, ISGT 2013.** *Distribution Performance Measures that Drive Customer Benefits.* Washington DC. February 26, 2013.

**Canadian Electric Institute 2013 Annual Distribution Conference.** *The (Smart Grid) Story So Far: Costs, Benefits, Risks, Best Practices, and Missed Opportunities.* Keynote. Toronto, Canada. January 23, 2013.

**Great Lakes Smart Grid Symposium.** *What Smart Grid Deployment Evaluations are Telling Us.* Chicago. September 26, 2012.

**Mid-Atlantic Distributed Resource Initiative.** *Smart Grid Deployment Evaluations: Findings and Implications for Regulators and Utilities.* Philadelphia. April 20, 2012.

**DistribuTECH 2012.** *Lessons Learned: Utility and Regulator Perspectives.* Panel Moderator. January 25, 2012.

**DistribuTECH 2012.** *Optimizing the Value of Smart Grid Investments.* Half-day course. January 23, 2012.

**NARUC Subcommittee on Electricity.** *Maximizing Smart Grid Customer Benefits: Measurement and Other Implications for IOUs and Regulators.* St. Louis. Nov. 13, 2011.

### Teaching

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**Post-graduate Adjunct Professor.** University of Colorado, Global Energy Management Program. Course: Renewable Energy Commercialization: Electric Technologies, Markets, and Policy.

**Guest Lecturer.** Michigan State University, Institute for Public Utilities. Courses: Performance Measurement of Distribution Utility Businesses; Introduction to Grid Modernization.

### Education

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**Master of Management, 1991, Kellogg School of Management, Northwestern University.** Concentrations: Accounting, Finance, Information Systems, and International Business.

**Bachelor's Degree in Business Administration, 1984, Kelley School of Business, Indiana University.** Concentrations: Marketing and Finance.

### Certifications

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**New Product Development Professional.** Product Development and Management Association. 2007.

Exhibit PJA-2  
Net Present Value Calculations  
Page 1 of 1

| Discount Rate (DEO before tax) |                                                                      | Total (All Electric and Gas Costs)      |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
|--------------------------------|----------------------------------------------------------------------|-----------------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-----------|------------|------------|------------|------------|------------|-------------|--|
| 7.54%                          |                                                                      | (Per STIP dated April 13, 2018. Page 7. |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
|                                |                                                                      | NPV                                     | 2019       | 2020       | 2021       | 2022       | 2023       | 2024       | 2025       | 2026       | 2027       | 2028      | 2029       | 2030       | 2031       | 2032       | 2033       | TOTAL       |  |
| O&M                            | Continue Node Environment                                            |                                         |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
|                                | 4G Communication Node Upgrade                                        | 78,966,119                              | 30,387,500 | 30,387,500 | 30,387,500 |            |            |            |            | -          | -          | -         | -          | -          | -          | -          | -          | 91,162,500  |  |
|                                | EDMS to MDM Conversion                                               | 14,177,147                              | 7,900,000  | 7,900,000  |            | -          | -          | -          | -          | -          | -          | -         | -          | -          | -          | -          | -          | 15,800,000  |  |
|                                | Long-term Communication Node Solution                                | 929,887                                 | 1,000,000  |            |            |            |            |            |            |            |            |           |            |            |            |            |            | 1,000,000   |  |
|                                | NES Headend Upgrades                                                 | 5,677,870                               | 800,000    |            | 848,720    |            | 900,407    |            | 955,242    |            | 1,013,416  |           | 1,075,133  |            | 1,140,609  |            | 1,210,072  | 7,943,599   |  |
|                                | Monthly Cellular Cost                                                | 12,971,408                              | 1,236,176  | 1,273,261  | 1,311,459  | 1,350,803  | 1,391,327  | 1,433,067  | 1,476,059  | 1,520,340  | 1,565,951  | 1,612,929 | 1,661,317  | 1,711,157  | 1,762,491  | 1,815,366  | 1,869,827  | 22,991,529  |  |
|                                | Communication Device Failures                                        | 38,166,258                              | 2,531,878  | 3,027,026  | 3,197,096  | 3,475,274  | 3,712,735  | 3,966,676  | 4,238,251  | 4,528,697  | 4,839,336  | 5,171,583 | 5,526,953  | 6,215,848  | 6,644,434  | 7,102,926  | 7,593,428  | 71,772,140  |  |
|                                | Vendor Maintenance                                                   | 21,884,016                              | 2,085,548  | 2,148,114  | 2,212,558  | 2,278,935  | 2,347,303  | 2,417,722  | 2,490,253  | 2,564,961  | 2,641,910  | 2,721,167 | 2,802,802  | 2,886,886  | 2,973,493  | 3,062,698  | 3,154,578  | 38,788,928  |  |
|                                |                                                                      | 172,772,705                             | 45,941,102 | 44,735,901 | 37,957,333 | 7,105,012  | 8,351,771  | 7,817,464  | 9,159,805  | 8,613,999  | 10,060,612 | 9,505,679 | 11,066,206 | 10,813,891 | 12,521,026 | 11,980,990 | 13,827,905 | 249,458,696 |  |
|                                |                                                                      |                                         |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
| Capital                        | Ohio AMI Transition                                                  | 123,737,702                             | 32,657,008 | 73,503,945 | 34,944,977 | 2,292,918  |            |            | -          | -          | -          | -         | -          | -          | -          | -          | -          | 143,398,848 |  |
| O&M                            | Monthly Cellular Cost                                                | 5,302,259                               | 144,045    | 480,306    | 581,420    | 598,863    | 616,828    | 635,333    | 654,393    | 674,025    | 694,246    | 715,073   | 736,525    | 758,621    | 781,380    | 804,821    | 828,966    | 9,704,845   |  |
|                                | Communication Device Failures                                        | 274,337                                 | 5,540      | 16,510     | 21,815     | 24,243     | 25,042     | 25,868     | 36,419     | 37,794     | 39,225     | 41,963    | 44,990     | 48,343     | 52,064     | 56,198     | 60,798     | 536,810     |  |
|                                | Vendor Maintenance                                                   | 3,745,063                               | -          | 115,427    | 385,041    | 466,130    | 480,114    | 494,517    | 509,353    | 524,633    | 540,372    | 556,584   | 573,281    | 590,480    | 608,194    | 626,440    | 645,233    | 7,115,800   |  |
|                                |                                                                      | 133,059,361                             | 32,806,593 | 74,116,188 | 35,933,253 | 3,382,153  | 1,121,984  | 1,155,719  | 1,200,165  | 1,236,452  | 1,273,843  | 1,313,619 | 1,354,796  | 1,397,444  | 1,441,637  | 1,487,459  | 1,534,996  | 160,756,303 |  |
|                                |                                                                      |                                         |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
|                                | Costs Duke Failed To Include In Transition to Mesh Environment       |                                         |            |            |            |            |            |            |            |            |            |           |            |            |            |            |            |             |  |
| Capital                        | Business Continuity Effort (OCC-INT-09-184 in 17-0032)               | 24,136,045                              | 24,136,045 |            |            |            |            |            |            |            |            |           |            |            |            |            |            | 24,136,045  |  |
| (See Exhibit PJA-4)            | Value of nodes/meters/data transmitters retired prematurely          | 125,010,893                             | 32,993,030 | 74,260,259 | 35,304,541 | 2,316,511  |            |            |            |            |            |           |            |            |            |            |            | 144,874,341 |  |
| (See Exhibit PJA-3)            | Carrying Costs on "Ohio AMI Transition" Capital                      | 55,846,923                              | 2,619,333  | 8,327,797  | 10,522,435 | 9,897,934  | 9,076,388  | 8,254,842  | 7,433,296  | 6,611,750  | 5,790,204  | 4,968,658 | 4,147,111  | 3,325,565  | 2,504,019  | 1,682,473  | 860,927    | 86,022,733  |  |
| "                              | Carrying Costs on "Business Continuity Effort" Capital               | 10,143,153                              | 1,935,889  | 1,797,611  | 1,659,333  | 1,521,056  | 1,382,778  | 1,244,500  | 1,106,222  | 967,944    | 829,667    | 691,389   | 553,111    | 414,833    | 276,556    | 138,278    | (0)        | 14,519,167  |  |
| "                              | Carrying Costs on nodes/meters/data transmitters retired prematurely | 40,325,710                              | 2,551,774  | 8,011,743  | 9,820,599  | 8,774,673  | 7,529,673  | 6,284,674  | 5,039,675  | 3,794,676  | 2,549,677  | 1,304,678 | 343,209    | 19,907     | 0          | -          | -          | 56,024,959  |  |
| O&M                            | Business Continuity Effort (OCC-INT-09-184 in 17-0032)               | 60,506                                  | 60,506     |            |            |            |            |            |            |            |            |           |            |            |            |            |            | 60,506      |  |
|                                |                                                                      | 255,523,231                             | 64,296,578 | 92,397,410 | 57,306,909 | 22,510,173 | 17,988,840 | 15,784,017 | 13,579,194 | 11,374,371 | 9,169,547  | 6,964,724 | 5,043,432  | 3,760,306  | 2,780,575  | 1,820,751  | 860,927    | 325,637,752 |  |

Exhibit PJA-3  
Carrying Charge Calculations  
Page 1 of 1

|                                                                                     |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
|-------------------------------------------------------------------------------------|--------------|---------|-----|------------|------------|-------------|-------------|-------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|
| ASSUMPTIONS                                                                         |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Overall ROR (Equity & Debt)                                                         | 7.54%        |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| ROE Percentage                                                                      | 9.84%        |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Equity Percentage                                                                   | 50.75%       |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Debt Percentage                                                                     | 49.25%       |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Interest Percentage (Imputed)                                                       | 5.18%        |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Federal Income Tax Rate                                                             | 21%          |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Useful Life: New Equipment                                                          | 15 years     |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| Amortization: Retired Equipment                                                     | 10 years     |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
| CARRYING COSTS: AMI Transition Plan Capital                                         |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
|                                                                                     |              |         | NPV | 2019       | 2020       | 2021        | 2022        | 2023        | 2024       | 2025       | 2026       | 2027       | 2028       | 2029       | 2030       | 2031       | 2032       | 2033       | TOTAL       |             |
| Investments                                                                         | 2019         |         |     | 32,657,008 | 32,657,008 | 32,657,008  | 32,657,008  | 32,657,008  | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 | 32,657,008 |             |             |
|                                                                                     | 2020         |         |     |            | 73,503,945 | 73,503,945  | 73,503,945  | 73,503,945  | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 | 73,503,945 |             |             |
|                                                                                     | 2021         |         |     |            |            | 34,944,977  | 34,944,977  | 34,944,977  | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 | 34,944,977 |             |             |
|                                                                                     | 2022         |         |     |            |            |             | 2,292,918   | 2,292,918   | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  | 2,292,918  |             |             |
| Depreciation                                                                        | on 2019      |         |     | 2,177,134  | 2,177,134  | 2,177,134   | 2,177,134   | 2,177,134   | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 2,177,134  | 32,657,008  |             |
|                                                                                     | on 2020      |         |     |            | 4,900,263  | 4,900,263   | 4,900,263   | 4,900,263   | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 4,900,263  | 68,603,682  |             |
|                                                                                     | on 2021      |         |     |            |            | 2,329,665   | 2,329,665   | 2,329,665   | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 2,329,665  | 30,285,647  |             |
|                                                                                     | on 2022      |         |     |            |            |             | 152,861     | 152,861     | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 152,861    | 1,834,334   |             |
| Book Value                                                                          | on 2019      |         |     | 30,479,874 | 28,302,740 | 26,125,606  | 23,948,473  | 21,771,339  | 19,594,205 | 17,417,071 | 15,239,937 | 13,062,803 | 10,885,669 | 8,708,535  | 6,531,402  | 4,354,268  | 2,177,134  | (0)        |             |             |
|                                                                                     | on 2020      |         |     |            | 68,603,682 | 63,703,419  | 58,803,156  | 53,902,893  | 49,002,630 | 44,102,367 | 39,202,104 | 34,301,841 | 29,401,578 | 24,501,315 | 19,601,052 | 14,700,789 | 9,800,526  | 4,900,263  |             |             |
|                                                                                     | on 2021      |         |     |            |            | 32,615,312  | 30,285,647  | 27,955,982  | 25,626,316 | 23,296,651 | 20,966,986 | 18,637,321 | 16,307,656 | 13,977,991 | 11,648,326 | 9,318,661  | 6,988,995  | 4,659,330  |             |             |
|                                                                                     | on 2022      |         |     |            |            |             | 2,140,057   | 1,987,196   | 1,834,334  | 1,681,473  | 1,528,612  | 1,375,751  | 1,222,890  | 1,070,028  | 917,167    | 764,306    | 611,445    | 458,584    |             |             |
| Total Book Value                                                                    |              |         |     | 30,479,874 | 96,906,422 | 122,444,337 | 115,177,332 | 105,617,409 | 96,057,486 | 86,497,562 | 76,937,639 | 67,377,716 | 57,817,793 | 48,257,870 | 38,697,946 | 29,138,023 | 19,578,100 | 10,018,177 |             |             |
| Profits (BV X Equity % X ROE)                                                       |              |         |     | 1,522,104  | 4,839,313  | 6,114,625   | 5,751,726   | 5,274,322   | 4,796,919  | 4,319,515  | 3,842,112  | 3,364,708  | 2,887,305  | 2,409,901  | 1,932,498  | 1,455,095  | 977,691    | 500,288    | 49,988,122  |             |
| Taxes on Profits                                                                    |              |         |     | 319,642    | 1,016,256  | 1,284,071   | 1,207,863   | 1,107,608   | 1,007,353  | 907,098    | 806,843    | 706,589    | 606,334    | 506,079    | 405,825    | 305,570    | 205,315    | 105,060    | 10,497,500  |             |
| Interest Exp. (BV X Debt % X Int Rate)                                              |              |         |     | 777,587    | 2,472,228  | 3,123,739   | 2,938,347   | 2,694,459   | 2,450,571  | 2,206,683  | 1,962,795  | 1,718,907  | 1,475,019  | 1,231,131  | 987,243    | 743,355    | 499,467    | 255,579    | 25,537,106  |             |
| Carrying Costs on AMI Transition Plan Capital                                       |              |         |     | 55,846,923 | 2,619,333  | 8,327,797   | 10,522,435  | 9,987,934   | 9,076,388  | 8,254,842  | 7,433,296  | 6,611,750  | 5,790,204  | 4,968,658  | 4,147,111  | 3,325,565  | 2,504,019  | 1,682,473  | 86,022,733  |             |
| CARRYING COSTS: Business Continuity Effort Capital                                  |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
|                                                                                     |              |         | NPV | 2019       | 2020       | 2021        | 2022        | 2023        | 2024       | 2025       | 2026       | 2027       | 2028       | 2029       | 2030       | 2031       | 2032       | 2033       | TOTAL       |             |
| Investments                                                                         | 2019         |         |     | 24,136,045 | 22,526,975 | 20,917,906  | 19,308,836  | 17,699,766  | 16,090,697 | 14,481,627 | 12,872,557 | 11,263,488 | 9,654,418  | 8,045,348  | 6,436,279  | 4,827,209  | 3,218,139  | 1,609,070  |             |             |
| Depreciation                                                                        | on 2019      |         |     | 1,609,070  | 1,609,070  | 1,609,070   | 1,609,070   | 1,609,070   | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 1,609,070  | 24,136,045  |             |
| Book Value                                                                          | on 2019      |         |     | 22,526,975 | 20,917,906 | 19,308,836  | 17,699,766  | 16,090,697  | 14,481,627 | 12,872,557 | 11,263,488 | 9,654,418  | 8,045,348  | 6,436,279  | 4,827,209  | 3,218,139  | 1,609,070  | (0)        |             |             |
| Profits                                                                             |              |         |     | 1,124,952  | 1,044,598  | 964,245     | 883,891     | 803,537     | 723,183    | 642,830    | 562,476    | 482,122    | 401,769    | 321,415    | 241,061    | 160,707    | 80,354     | (0)        | 8,437,141   |             |
| Taxes on Profits                                                                    |              |         |     | 236,240    | 219,366    | 202,491     | 185,617     | 168,743     | 151,969    | 134,994    | 118,120    | 101,246    | 84,371     | 67,497     | 50,623     | 33,749     | 16,874     | (0)        | 1,771,800   |             |
| Interest Expense                                                                    |              |         |     | 574,697    | 533,647    | 492,597     | 451,548     | 410,498     | 369,448    | 328,398    | 287,348    | 246,299    | 205,249    | 164,199    | 123,149    | 82,100     | 41,050     | (0)        | 4,310,227   |             |
| Carrying Costs on Business Continuity Effort Capital                                |              |         |     | 10,143,153 | 1,935,889  | 1,797,611   | 1,659,333   | 1,521,056   | 1,382,778  | 1,244,500  | 1,106,222  | 967,944    | 829,667    | 691,389    | 553,111    | 414,833    | 276,556    | 138,278    | 14,519,167  |             |
| CARRYING COSTS: Meters and Data Transmitters Retired Early                          |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
|                                                                                     |              |         | NPV | 2019       | 2020       | 2021        | 2022        | 2023        | 2024       | 2025       | 2026       | 2027       | 2028       | 2029       | 2030       | 2031       | 2032       | 2033       | TOTAL       |             |
| (see PJA-4 for book value, and PJA-2 for spread through retirement years 2019-2022) | Retirements  | 2019    |     | 32,993,030 | 32,993,030 | 32,993,030  | 32,993,030  | 32,993,030  | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 | 32,993,030 |             |             |
|                                                                                     |              | 2020    |     |            | 74,260,259 | 74,260,259  | 74,260,259  | 74,260,259  | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 | 74,260,259 |             |             |
|                                                                                     |              | 2021    |     |            |            | 35,304,541  | 35,304,541  | 35,304,541  | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 | 35,304,541 |             |             |
|                                                                                     |              | 2022    |     |            |            |             | 2,316,511   | 2,316,511   | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  | 2,316,511  |             |             |
| (10 years per Staff Report, p. 11)                                                  | Amortization | on 2019 |     | 3,299,303  | 3,299,303  | 3,299,303   | 3,299,303   | 3,299,303   | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 3,299,303  | 49,489,545  |             |
|                                                                                     |              | on 2020 |     |            | 7,426,026  | 7,426,026   | 7,426,026   | 7,426,026   | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 7,426,026  | 103,964,363 |             |
|                                                                                     |              | on 2021 |     |            |            | 3,530,454   | 3,530,454   | 3,530,454   | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 3,530,454  | 45,895,903  |             |
|                                                                                     |              | on 2022 |     |            |            |             | 231,651     | 231,651     | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 231,651    | 2,779,813   |             |
| Book Value                                                                          | on 2019      |         |     | 29,693,727 | 26,394,424 | 23,095,121  | 19,795,818  | 16,496,515  | 13,197,212 | 9,897,909  | 6,598,606  | 3,299,303  | -          | -          | -          | -          | -          | -          |             |             |
|                                                                                     | on 2020      |         |     |            | 66,834,233 | 59,408,207  | 51,982,181  | 44,556,155  | 37,130,129 | 29,704,104 | 22,278,078 | 14,852,052 | 7,426,026  | -          | -          | -          | -          | -          |             |             |
|                                                                                     | on 2021      |         |     |            |            | 31,774,087  | 28,243,633  | 24,713,179  | 21,182,725 | 17,652,271 | 14,121,816 | 10,591,362 | 7,060,908  | 3,530,454  | (0)        | -          | -          | -          |             |             |
|                                                                                     | on 2022      |         |     |            |            |             | 2,084,860   | 1,853,209   | 1,621,558  | 1,389,906  | 1,158,255  | 926,604    | 694,953    | 463,302    | 231,651    | 0          | -          | -          |             |             |
| Total Book Value                                                                    |              |         |     | 29,693,727 | 93,228,657 | 114,277,415 | 102,106,492 | 87,619,058  | 73,131,624 | 58,644,190 | 44,156,756 | 29,669,321 | 15,181,887 | 3,993,756  | 231,651    | 0          | -          | -          |             |             |
| Profits                                                                             |              |         |     | 1,482,845  | 4,655,653  | 5,706,786   | 5,098,994   | 4,375,521   | 3,652,047  | 2,928,574  | 2,205,100  | 1,481,627  | 758,153    | 199,440    | 11,568     | 0          | -          | -          | 32,556,307  |             |
| Taxes on Profits                                                                    |              |         |     | 311,398    | 977,687    | 1,198,425   | 1,070,789   | 918,859     | 766,930    | 615,000    | 463,071    | 311,142    | 159,212    | 41,882     | 2,429      | 0          | -          | -          | 6,836,824   |             |
| Interest Expense                                                                    |              |         |     | 757,532    | 2,378,403  | 2,915,388   | 2,604,890   | 2,235,294   | 1,865,697  | 1,496,101  | 1,126,505  | 756,909    | 387,313    | 101,887    | 5,910      | 0          | -          | -          | 16,631,828  |             |
| Carrying Costs on Meters & Transmitters Retired Early                               |              |         |     | 40,325,710 | 2,551,774  | 8,011,743   | 9,820,599   | 8,774,673   | 7,529,673  | 6,284,674  | 5,039,675  | 3,794,676  | 2,549,677  | 1,304,678  | 343,209    | 19,907     | 0          | -          | 56,024,959  |             |
| SUMMARY: Profits and Taxes (for information only)                                   |              |         |     |            |            |             |             |             |            |            |            |            |            |            |            |            |            |            |             |             |
|                                                                                     |              |         | NPV | 2019       | 2020       | 2021        | 2022        | 2023        | 2024       | 2025       | 2026       | 2027       | 2028       | 2029       | 2030       | 2031       | 2032       | 2033       | TOTAL       |             |
| Profits                                                                             |              |         |     | 4,129,901  | 10,539,564 | 12,785,656  | 11,734,611  | 10,453,380  | 9,172,149  | 7,890,919  | 6,609,688  | 5,328,457  | 4,047,227  | 2,930,757  | 2,185,127  | 1,615,802  | 1,058,045  | 500,288    | 90,981,570  |             |
| Taxes on Profits                                                                    |              |         |     | 867,279    | 2,213,308  | 2,684,988   | 2,464,268   | 2,195,210   | 1,926,151  | 1,657,093  | 1,388,034  | 1,118,976  | 849,918    | 615,459    | 458,877    | 339,318    | 222,189    | 105,060    | 19,106,130  |             |
| TOTAL Profits and Taxes                                                             |              |         |     | 74,754,391 | 4,997,181  | 12,752,872  | 15,470,643  | 14,198,879  | 12,648,590 | 11,098,301 | 9,548,011  | 7,997,722  | 6,447,433  | 4,897,144  | 3,546,215  | 2,644,004  | 1,955,120  | 1,280,234  | 605,348     | 110,087,699 |

Exhibit PJA-4  
Net Book Value Calculations  
Page 1 of 1

|                             | Original Plant | Accumulated<br>Depreciation | Net Book Value     | Date       | Source                                                                                       |
|-----------------------------|----------------|-----------------------------|--------------------|------------|----------------------------------------------------------------------------------------------|
| Comm Nodes                  | 101,758,692    | 27,879,807                  | 73,878,885         | 6/30/2016  | Case No. 17-0032-EL-AIR, Schedule B-3.2, page 3, line 16                                     |
| Echelon Meters              | 68,730,098     | 19,505,785                  | 49,224,313         | 6/30/2016  | Case No. 17-0032-EL-AIR, Schedule B-3.2, page 2, line 21                                     |
| Gas Meter Data Transmitters | n/a            | n/a                         | 21,771,143         | 12/31/2016 | Case No. 17-690-GA-RDR. Testimony of Peggy A. Laub, Attachment PAL-1, page 2. March 24, 2017 |
|                             |                |                             | <u>144,874,341</u> |            |                                                                                              |
|                             |                |                             |                    |            |                                                                                              |

**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR, et al.**  
**OCC Fifth Set of Interrogatories - Stipulation**  
**Date Received: May 23, 2018**

**OCC-INT-05-109**

**REQUEST:**

In response to OCC-STIP-INT-03-073, Duke stated: “The Ohio AMI Transition, which will replace Echelon AMI meters with Itron AMI meters, is a separate, independent effort from component three of the PowerForward Rider. The Ohio AMI Transition will proceed as proposed in the Testimony of Don Schneider, while component three of the PowerForward Rider will require a separate proceeding and subject to hearing, the timelines of which cannot be assumed at this time.”

- a) Please provide a summary of all costs that Duke intends to incur under the Ohio AMI Transition, including a description of the investment, the cost, and the applicable cost recovery mechanism (PowerForward Rider, DCI, etc.).
- b) Regarding Duke’s response that the AMI Transition “will proceed as proposed in the Testimony of Don Schneider,” does this mean that the AMI Transition will proceed if the Stipulation is approved without modification, or does it mean that the AMI Transition will proceed even if the Stipulation is not approved? If your response is that the AMI Transition will proceed without approval of the Stipulation, then please explain the basis for Duke’s implementation of the AMI Transition Plan prior to any Commission approval.
- c) Regarding Duke’s response that the AMI Transition “will proceed as proposed in the Testimony of Don Schneider,” does this mean that the AMI Transition will proceed prior to any further PUCO approval of the infrastructure modernization plan described in PowerForward component three?
- d) Regarding Duke’s response that the AMI Transition “will proceed as proposed in the Testimony of Don Schneider,” does this mean that Duke will implement the AMI Transition in full, including all of the costs identified on Attachment DLS-1 to the testimony of Donald Schneider?
- e) Please describe any portion of the proposed AMI Transition that will be subject to component three of the proposed PowerForward Rider in the Stipulation.

**RESPONSE:**

- a) See testimony of Don Schneider for a description and summary of all costs that Duke Energy Ohio intends to incur under the AMI Transition. Costs for electric metering fall under FERC Accounts eligible for recovery through Rider DCI and costs for communication devices are eligible for recovery through component two of the PowerForward Rider, as described in the Stipulation.
- b) Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would

have to engage in speculation or conjecture to ascertain the intended meaning of this request. Without waiving said objections, Duke Energy Ohio will proceed with the Ohio AMI Transition as proposed in the Testimony of Don Schneider if the Commission approves the Stipulation.

- c) See response to OCC-STIP-INT-03-073.
- d) Yes.
- e) See response to OCC-STIP-INT-05-109(a).

**PERSON RESPONSIBLE: Donald L. Schneider, Jr.**

**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR**  
**OCC Second Set of Interrogatories**  
**Date Received: April 12, 2017**

**OCC-INT-02-044**

**REQUEST:**

Referring to Mr. Wathen's testimony, identify the dollar amount and customer class revenue impact for revenues collected in Rider DR-IM for each year since its inception.

**RESPONSE:**

**RIDER DR-IM REVENUES BY CUSTOMER CLASS AND YEAR**  
**MAY 2010 - FEBRUARY 2017**

| <u>YEAR</u> | <u>COMMERCIAL</u> | <u>INDUSTRIAL</u> | <u>OPA</u> | <u>RESIDENTIAL</u> | <u>STREET LIGHTING</u> | <u>TOTAL</u> |
|-------------|-------------------|-------------------|------------|--------------------|------------------------|--------------|
| 2010        | \$343,896         | \$12,516          | \$19,568   | \$2,259,547        | \$74                   | \$2,635,602  |
| 2011        | \$1,092,578       | \$39,374          | \$61,825   | \$6,801,217        | \$228                  | \$7,995,221  |
| 2012        | \$1,905,950       | \$67,231          | \$105,468  | \$12,271,474       | \$454                  | \$14,350,576 |
| 2013        | \$3,477,441       | \$120,116         | \$189,341  | \$22,739,189       | \$2,658                | \$26,528,745 |
| 2014        | \$5,071,628       | \$178,982         | \$272,137  | \$33,223,671       | \$19,467               | \$38,765,884 |
| 2015        | \$6,628,609       | \$223,894         | \$350,893  | \$43,443,714       | \$25,942               | \$50,673,051 |
| 2016        | \$7,236,651       | \$242,028         | \$378,151  | \$47,518,385       | \$29,250               | \$55,404,465 |
| 2017        | \$1,225,199       | \$40,816          | \$63,584   | \$8,034,428        | \$5,024                | \$9,369,050  |

**PERSON RESPONSIBLE:** William Don Wathen



**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR, *et al.***  
**OCC Third Set of Interrogatories - Stipulation**  
**Date Received: May 11, 2018**

**OCC-INT-03-073**

**REQUEST:**

Regarding the infrastructure modernization plan under “component three” of the PowerForward Rider:

- a) Does Duke intend to replace residential Echelon meters with Itron meters (or other meters compatible with the mesh system) before any such infrastructure modernization plan is approved?
- b) If your answer to (a) is yes, please state, using the best available information, how many residential Echelon meters will be replaced and over what period of time, the projected cost of replacing such meters, how Duke will determine which meters to replace, and how the Stipulation proposes for Duke to charge customers for the cost of such meters.
- c) Does Duke expect that the infrastructure modernization plan will include a proposal to replace all residential Echelon meters with Itron meters (or other meters compatible with the mesh system)?

**RESPONSE:**

- a) The Ohio AMI Transition, which will replace Echelon AMI meters with Itron AMI meters, is a separate, independent effort from component three of the PowerForward Rider. The Ohio AMI Transition will proceed as proposed in the Testimony of Don Schneider, while component three of the PowerForward Rider will require a separate proceeding and subject to hearing, the timelines of which cannot be assumed at this time.
- b) See response to OCC-INT-03-073(a).
- c) See response to OCC-INT-03-073(a).

**PERSON RESPONSIBLE:** Donald L. Schneider, Jr.

**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR**  
**OCC Ninth Set of Interrogatories**  
**Date Received: August 15, 2017**

**OCC-INT-09-184**

**REQUEST:**

Referring to the Direct Testimony of Donald L. Schneider, Jr. at page 10:

- a. What is the total projected cost for the business continuity effort for the years 2017 and 2018?
- b. What are the total projected costs associated with removal of the approximate 23,700 communication nodes?
- c. What are the total projected capital costs in 2017 and 2018 associated with purchasing the Itron electric meters that will replace approximately 80,000 Echelon electric meters?
- d. What are the total projected capital costs in 2017 and 2018 associated with purchasing the Itron gas communication modules that will replace 48,800 Badger gas communication modules?
- e. How does the Company intend to recover the capital costs associated with the business continuity effort 2017 and 2018?
- f. How does the Company intend to recover O&M costs associated with the business continuity effort in 2017 and 2018?

**RESPONSE:**

- a. See table below:

|              | Total             | 2017              | 2018              |
|--------------|-------------------|-------------------|-------------------|
| Capital      | 24,136,045        | 10,081,979        | 14,054,066        |
| O&M          | 60,506            | 60,506            | 0                 |
| <b>Total</b> | <b>24,196,551</b> | <b>10,142,485</b> | <b>14,054,066</b> |

- b. Objection: question is unclear. See response to OCC-INT-09-184(a) which includes the node removal costs.

- c. See table below:

|              | Total      | 2017      | 2018      |
|--------------|------------|-----------|-----------|
| Itron Meters | 10,111,082 | 4,266,984 | 5,844,099 |

- d.

|                   | Total     | 2017      | 2018      |
|-------------------|-----------|-----------|-----------|
| Itron Gas Modules | 2,949,511 | 1,249,254 | 1,700,257 |

- e. If the capital costs are included in FERC distribution capital accounts they will be included in Rider DCI. Capital costs that are included in FERC general plant accounts will also be included in Rider DCI if the Company's request in this case to include general and intangible accounts in Rider DCI is

approved. If this request is not approved there will be no recovery on general and intangible plant until the Company's next base electric case.

- f. O&M costs not included in the Company's test period in this case will not be recovered by customers unless the Company has another base electric rate case in calendar year 2018.

**PERSON RESPONSIBLE:**

Parts a-d: Donald L. Schneider, Jr.; Parts e, f: Peggy Laub

**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR**  
**OCC Second Set of Interrogatories**  
**Date Received: April 12, 2017**

**OCC-INT-02-007**

**REQUEST:**

Referring to Mr. Schneider's testimony generally, and to Attachment DLS-1 specifically.

- a. Does the proposed transition to the mesh environment involve the replacement of Echelon meters with Itron meters? If not, please explain how the Echelon meters will communicate with the Cisco Connected Grid Routers (CGRs).
- b. If the proposed transition to the mesh environment does involve the replacement of Echelon meters with Itron meters, please quantify the portion of the AMI transition capital (\$143.4 million) which relates to:
  - i. new meters;
  - ii. new meter installation;
  - iii. new gas meter modules;
  - iv. new gas meter module installation;
  - v. Cisco CGRs;
  - vi. CGR installation;
  - vii. all other devices/software (please list).
- c. Please provide the results of any cost analyses the Company completed to evaluate options which avoid replacing the Echelon meters, including, but not limited to:
  - i. Replacing the communications cards in the Echelon meters with communications cards which could be read directly by the public 4G cellular network;
  - ii. Replacing the communications cards in the Echelon meters with communications cards which could be read by the Cisco Connected Grid routers;
  - iii. Replacing the communications network, including the communications cards in the Echelon meters, with the L&G communications network solution Ericsson is now using;
  - iv. Replacing the communications nodes with Ericsson's SGN 3200 product; and
  - v. Other scenarios to avoiding Echelon meter replacement the Company may have considered.

- d. If any of the options which avoid replacing the Echelon meters is infeasible, please explain the nature of such infeasibility.
- e. Please quantify the current (December 31, 2016) book value of:
  - i. Existing Echelon meters;
  - ii. Existing Ambient Communications nodes; and
  - iii. EDMS.
- f. Please explain whether or not the \$143.4 million capital required for the proposed transition to a Mesh environment includes Company return on equity or interest on debt.
- g. Assuming the Company's current authorized rate of return, debt-equity ratio, cost of capital, weighted average debt interest rate, 7.73% discount rate, and 20-year asset life, please estimate the net present value of the \$143.4 million capital required for the proposed transition to a mesh environment. Please provide details of this calculation in Excel native format with formulas intact.
- h. Using the same assumptions listed in (g) above, please estimate the NPV to customers of the \$143.4 million capital required for the proposed transition to a mesh environment using a 15-year asset life. Please provide details of this calculation in Excel native format with formulas intact.
- i. Using the same assumptions listed in (g) above, please estimate the net present value of the \$143.4 million capital required for the proposed transition to a mesh environment using a 10-year asset life. Please provide details of this calculation in Excel native format with formulas intact.
- j. Provide any cost benefit analysis prepared by the Company's proposed AMI transition investment using the same categories and methodologies required to justify the Company's original AMI investment in 2009.

**RESPONSE:**

- a. Yes.
- b. See response to OCC-INT-02-009.
- c. Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, Duke Energy Ohio cannot confirm the OCC's claim that certain "options" it contemplates would actually allow Duke

Energy Ohio to “avoid replacing the Echelon meters”. These “options” appear to require development of a new and unique AMI solution which would not be in service elsewhere in North America, presenting similar issues we have today with the Ambient/Echelon AMI solution. Duke Energy Ohio’s proposed solution is a marketable proven AMI solution that Duke has chosen to standardize across all jurisdictions, keeping AMI systems and inventory costs down.

- i. Duke Energy Ohio did not perform a formal cost analysis for this exact “option”.
  - ii. Duke Energy Ohio did not perform a formal cost analysis for this exact “option”.
  - iii. Duke Energy Ohio did not perform a formal cost analysis for this exact “option”.
  - iv. Duke Energy Ohio did not perform a formal cost analysis for this exact “option”.
  - v. Attachment DLS-1 represents Duke Energy Ohio’s cost analysis of avoiding Echelon meter replacement.
- d. Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, Duke Energy Ohio cannot confirm the OCC’s claim that certain “options” it contemplates would actually allow Duke Energy Ohio to “avoid replacing the Echelon meters.” Duke Energy Ohio neither confirms nor denies whether any of the “options contemplated by the OCC are infeasible.
- e.
  - i. The Net Book Value of Echelon meters as of December 31, 2016, was \$49,053,660.
  - ii. The Net Book Value of communication nodes as of December 31, 2016, was \$89,843,793 (includes electric and gas).
  - iii. The Net Book Value of EDMS as of December 31, 2016, was \$0
- f. The figure is the cash expenditure projected for the capitalized portion of the project; consequently, it excludes any carrying costs (debt or equity).
- g. The question assumes that the currently authorized weighted-average cost of capital equals the discount rate. Therefore, the NPV equals \$143.4 million.
- h. See response to OCC-INT-02-007(g).
- i. See response to OCC-INT-02-007(g).
- j. Duke Energy Ohio did not perform such a cost analysis.

**PERSON RESPONSIBLE:**

- a. Donald Schneider, Jr.
- b. Donald Schneider, Jr.
- c. As to Objection - Legal  
As to response - Donald Schneider, Jr.
- d. Legal
- e. Cindy Lee
- f. Donald Schneider, Jr.
- g. Donald Schneider, Jr.
- h. Donald Schneider, Jr.
- i. Donald Schneider, Jr.
- j. Donald Schneider, Jr.

**Duke Energy Ohio**  
**Case No. 17-0032-EL-AIR**  
**OCC Second Set of Interrogatories**  
**Date Received: April 12, 2017**

**OCC-INT-02-009**

**REQUEST:**

Referring to attachment DLS-1 of Mr. Schneider's testimony, please provide the details, including all calculations and assumptions, behind each line item in the column "TOTAL (2019-2038)" for "Electric Costs Only" and "Gas Costs Only" sections of the attachment. Please provide these details in a working Microsoft Excel spreadsheet with all cell references and formulas intact.

**RESPONSE:**

See Attachment OCC-INT-02-009(a) for a summary level breakdown of annual costs between electric and gas service. Attachment OCC-INT-02-009(b) includes tabs showing detailed cost estimates for for all line items from Attachment DLS-1, except for the "Ohio AMI Transition" costs. Attachment OCC-INT-02-009(c) is the detailed cost estimate for the "Ohio AMI Transition" costs from Attachment DLS-1.

**PERSON RESPONSIBLE:** Donald Schneider, Jr.



| Gas Costs Only                 |                                |                                       |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
|--------------------------------|--------------------------------|---------------------------------------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|------------|------------|
| Discount Rate (DEO before tax) |                                | 7.73%                                 |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
|                                |                                | NPV                                   | 2019       | 2020       | 2021      | 2022      | 2023      | 2024      | 2025      | 2026      | 2027      | 2028      | 2029      | 2030      | 2031      | 2032      | 2033      | 2034      | 2035      | 2036      | 2037      | 2038       | TOTAL      |            |
| Comms - Gas Only Portion       | O&M                            | Continue Node Environment             | 9,207,272  | 3,555,338  | 3,555,338 | 3,555,338 |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            | 10,666,013 |            |
|                                |                                | 4G Communication Node Upgrade         | 5,514,645  | 3,081,000  | 3,081,000 |           | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -         | -          | -          | 6,162,000  |
|                                |                                | EDMS to MDM Conversion                | 362,016    | 390,000    |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            | 390,000    |
|                                |                                | Long-term Communication Node Solution |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
|                                |                                | NES Headend Upgrades                  |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
|                                | 39%                            | Monthly Cellular Cost                 | 6,040,211  | 482,109    | 496,572   | 511,469   | 526,813   | 542,617   | 558,896   | 575,663   | 592,933   | 610,721   | 629,042   | 647,914   | 667,351   | 687,372   | 707,993   | 729,233   | 751,110   | 773,643   | 796,852   | 820,758    | 845,380    | 12,954,439 |
|                                |                                | Communication Device Failures         | 5,824,174  | 296,230    | 354,162   | 374,060   | 406,607   | 434,390   | 464,101   | 495,875   | 529,858   | 566,202   | 605,075   | 646,654   | 727,254   | 777,399   | 831,042   | 888,431   | 949,828   | 1,015,515 | 1,085,795 | 1,160,989  | 1,241,444  | 13,850,911 |
|                                |                                | Vendor Maintenance                    | 7,055,839  | 563,173    | 580,067   | 597,470   | 615,394   | 633,856   | 652,871   | 672,458   | 692,631   | 713,410   | 734,812   | 756,857   | 779,563   | 802,950   | 827,038   | 851,849   | 877,405   | 903,727   | 930,839   | 958,764    | 987,526    | 15,132,659 |
|                                |                                |                                       | 34,004,158 | 8,367,848  | 8,067,139 | 5,038,337 | 1,548,814 | 1,610,863 | 1,675,868 | 1,743,996 | 1,815,422 | 1,890,333 | 1,968,929 | 2,051,425 | 2,174,168 | 2,267,720 | 2,366,073 | 2,469,513 | 2,578,342 | 2,692,885 | 2,813,486 | 2,940,511  | 3,074,351  | 59,156,021 |
|                                |                                |                                       |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
| Capital                        | Transition to Mesh Environment | 31,714,995                            | 8,373,984  | 18,849,519 | 9,082,420 | 587,371   |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            | 36,893,294 |            |
|                                | Ohio AMI Transition            |                                       |            |            |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |           |            |            |            |
|                                | O&M                            | Monthly Cellular Cost                 | 2,503,314  | 56,178     | 187,319   | 226,754   | 233,556   | 240,563   | 247,780   | 255,213   | 262,870   | 270,756   | 278,879   | 287,245   | 295,862   | 304,738   | 313,880   | 323,297   | 332,996   | 342,985   | 353,275   | 363,873    | 374,789    | 5,552,808  |
|                                |                                | Communication Device Failures         | 43,589     | 648        | 1,932     | 2,552     | 2,836     | 2,930     | 3,027     | 4,261     | 4,422     | 4,589     | 4,910     | 5,264     | 5,656     | 6,091     | 6,575     | 7,113     | 7,713     | 8,382     | 9,129     | 9,965      | 10,901     | 108,896    |
|                                |                                | Vendor Maintenance                    | 1,087,267  | -          | 28,442    | 94,076    | 109,391   | 112,673   | 116,053   | 119,535   | 123,121   | 126,814   | 130,619   | 134,537   | 138,573   | 142,731   | 147,012   | 151,423   | 155,966   | 160,645   | 165,464   | 170,428    | 175,541    | 2,503,044  |
|                                | 35,349,165                     | 8,430,809                             | 19,067,212 | 9,405,802  | 933,154   | 356,166   | 366,860   | 379,009   | 390,413   | 402,159   | 414,408   | 427,046   | 440,091   | 453,560   | 467,467   | 481,833   | 496,675   | 512,012   | 527,868   | 544,266   | 561,231   | 45,058,042 |            |            |

**Duke Energy Ohio  
Case No. 17-0032-EL-AIR  
OCC Second Set of Interrogatories  
Date Received: April 12, 2017**

**OCC-INT-02-036**

**REQUEST:**

Referring to Mr. Nicholson's testimony at page 7, lines 15-16, in your statement that, "EDMS does not have scalable VEE functionality for internal AMI CEUD," please explain whether Duke was aware of this lack of functionality at the time of the purchase of this system.

**RESPONSE:**

Objection. This Interrogatory is vague, ambiguous, and unduly burdensome. The question is susceptible to different interpretations and Duke Energy Ohio would have to engage in speculation or conjecture to ascertain the intended meaning of this request. Objecting further, this Interrogatory is overly broad and unduly burdensome, given that it seeks information that is unlimited as to time and that is neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Objecting further, this Interrogatory seeks to elicit information that is of public record and thus is equally accessible to the Office of the Consumers' Counsel. Without waiving said objection, to the extent discoverable, and in the spirit of discovery, at the time of purchase, Duke Energy Ohio was aware that EDMS did have VEE functionality for interval AMI CEUD in a scalable manner. Duke Energy Ohio found that the cost and long-term support of that functionality was not optimal.

**PERSON RESPONSIBLE:** As to Objection - Legal  
As to Response - Donald Schneider, Jr.

**Duke Energy Ohio  
Case No. 17-0032-EL-AIR  
OCC Sixth Set of Interrogatories  
Date Received: June 2, 2017**

**OCC-INT-06-124**

**REQUEST:**

With regard to the request for how or whether the Echelon metering system met certain functionalities for AMI metering systems identified in OCC-INT-02-013, describe what type of AMI meter and meter data management system were used to implement the TOU pilot program in light of Duke's admission that the Echelon meter and EDMS does not produce billing quality CEUD on an hourly basis.

**RESPONSE:**

Residential customers that had Echelon meters and participated in the TOU pilot were manually migrated to the MDM system for inclusion in the pilots.

**PERSON RESPONSIBLE:** Don Schneider, Jr.

**Duke Energy Ohio  
Case No. 17-0032-EL-AIR  
OCC Second Set of Interrogatories  
Date Received: April 12, 2017**

**OCC-INT-02-021**

**REQUEST:**

Provide the analysis undertaken by Duke to determine the least cost method to maintain and operate its current AMI system for both Echelon and Itron meters. In your response, identify all the alternatives and cost estimates for each action identified and considered prior to the approach reflected in Duke's filing in this proceeding. In your response, provide the date that each option was identified and developed.

**RESPONSE:**

Duke Energy Ohio provided this analysis in Attachment DLS-1, as described in the testimony of Donald Schneider, Jr.

**PERSON RESPONSIBLE:** Legal

**Duke Energy Ohio  
Case No. 17-0032-EL-AIR, *et al.*  
OCC Fifth Set of Interrogatories - Stipulation  
Date Received: May 23, 2018**

**OCC-INT-05-127**

**REQUEST:**

As of December 31, 2017, how many electric meters was Duke Energy using the public Verizon Wireless network to read directly (i.e., not through an Ambien communications node or Cisco Connected Grid Router?)

**RESPONSE:**

11,952.

**PERSON RESPONSIBLE: Donald L. Schneider, Jr.**



## Overview of Duke Energy Ohio's Experience with Time Differentiated Rates

May 24, 2012

## All Customers with a Smart Meter have Access to Daily Usage Details

**Online Services**

[Contact Us](#) | Welcome, Doe Family | [\(Log Out\)](#)

[Add an Account](#) | Account Number: 12345-6789 | Address: 125 Anonymity Lane

[Online Services Home](#) | [Print](#)

**Current Bill**  
[Pay Bill](#)  
[View Bill](#)

**Billing & Payment**  
[Payment Activity](#)  
[Bill History](#)  
[Billing & Payment Options](#)  
[Bill Inserts](#)  
[Billing FAQs](#)  
[Energy Usage & Cost Details](#)  
[Compare Bills](#)

**Paperless Billing & Online Payment**  
[Edit Bank Information](#)  
[Edit Payment Reminders](#)  
[Cancel Paperless Billing & Online Payment](#)

**Energy Savings**  
[CFL Order/Status](#)  
[Home Energy Center](#)  
[Energy Saving Tools](#)  
[Learn about Energy](#)

**Moving**  
[Start Service](#)  
[Stop Service](#)

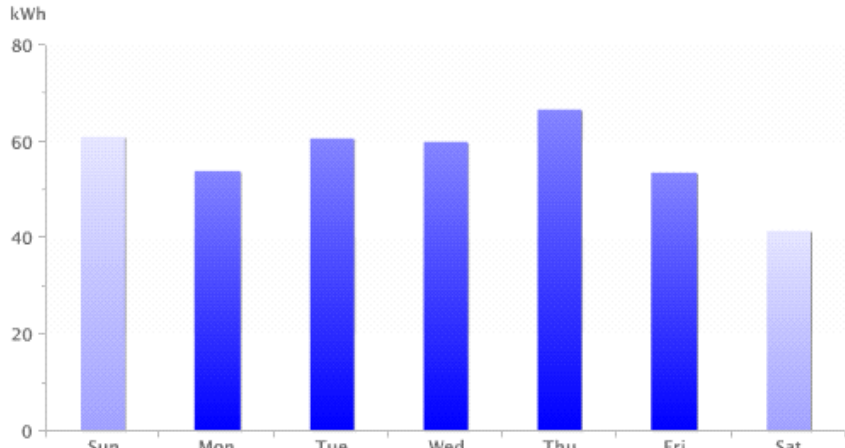
**Daily Energy Usage**  
To change Meter, Graph, or Date, make new selections from the options below.

**Meter:** Electric - 100264032 | 125 Anonymity Lane  
**Graph:** Average Energy by Day-of-Week | **Date:** 12/12/2011

**Period:** ☐ Billing Cycle ☐ Month ☒ Week [Export Data](#)

Average Energy by Day-of-Week

■ Total



| Day | kWh |
|-----|-----|
| Sun | 61  |
| Mon | 54  |
| Tue | 61  |
| Wed | 60  |
| Thu | 67  |
| Fri | 54  |
| Sat | 42  |

Look for trends or irregularities. Are your weekdays pretty even or does one stand out? How about



## All Customers with a Smart Meter Have Access to Hourly Usage Details

**Online Services**

[Contact Us](#) Welcome, Doe Family  [\(Log Out\)](#)

[+ Add an Account](#) **Account Number** 12345-6789 **Address** 125 Anonymity Lane

[Online Services Home](#) [Print](#)

**Current Bill**

[Pay Bill](#)

[View Bill](#)

**Billing & Payment**

[Payment Activity](#)

[Bill History](#)

[Billing & Payment Options](#)

[Bill Inserts](#)

[Billing FAQs](#)

[Energy Usage & Cost Details](#)

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**Paperless Billing & Online Payment**

[Edit Bank Information](#)

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**Energy Savings**

[CFL Order/Status](#)

[Home Energy Center](#)

[Energy Saving Tools](#)

[Learn about Energy](#)

**Moving**

[Start Service](#)

[Stop Service](#)

**Meter Reading**

[Submit Meter Reading](#)

[How to Read Your Meter](#)

**Daily Energy Usage**

To change Meter, Graph, or Date, make new selections from the options below.

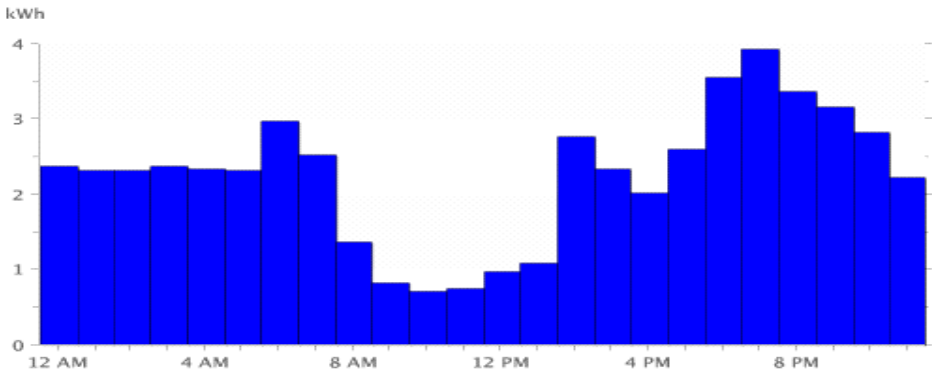
**Meter:**  125 Anonymity Lane

**Graph:**  **Date:**

**Period:** ☐ Week ☒ Day [Export Data](#)

**Hourly Energy Usage**

■ Total



| Hour  | Usage (kWh) |
|-------|-------------|
| 12 AM | 2.4         |
| 1 AM  | 2.3         |
| 2 AM  | 2.3         |
| 3 AM  | 2.3         |
| 4 AM  | 2.4         |
| 5 AM  | 2.3         |
| 6 AM  | 2.3         |
| 7 AM  | 3.0         |
| 8 AM  | 2.5         |
| 9 AM  | 1.4         |
| 10 AM | 0.8         |
| 11 AM | 0.7         |
| 12 PM | 0.7         |
| 1 PM  | 1.0         |
| 2 PM  | 1.1         |
| 3 PM  | 2.8         |
| 4 PM  | 2.4         |
| 5 PM  | 2.0         |
| 6 PM  | 2.6         |
| 7 PM  | 3.6         |
| 8 PM  | 4.0         |
| 9 PM  | 3.4         |
| 10 PM | 3.2         |
| 11 PM | 2.8         |
| 12 PM | 2.3         |

Use your daily charts first to identify the days with the highest energy usage, then continue to these hourly charts to identify key hours of energy usage.

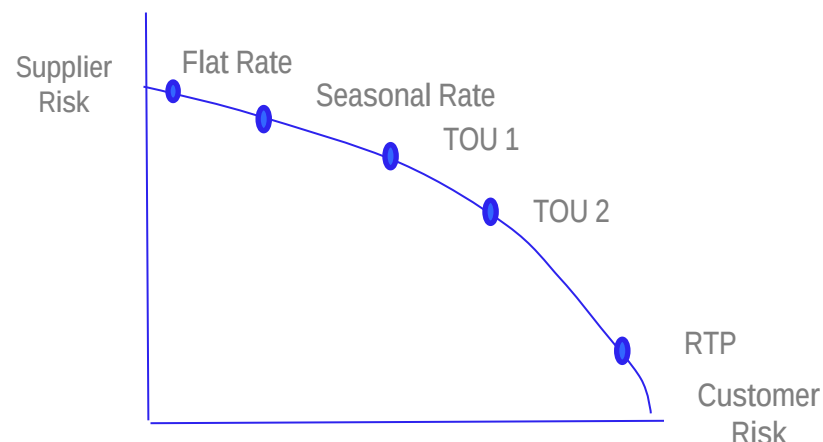
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## Duke Energy embarked on a deliberate path of testing multiple Time Based Rates (TBRs) in an effort to answer a number of questions key to developing future products that are scalable and sustainable

- What level of risk will customers accept
- What happens to customer bills
- What rate designs will generate widespread adoption of TBRs
- What are the residential TBR options that work for customers and can be considered cost justified
- What information tools are needed by customers and how should they be delivered
- What are the impacts of TBRs on customers' peak and total usage
- What impact do TBRs have on customer service and customer care



# 2010 Pilots

[← HOME](#) [→](#)

## Duke Energy Ohio “Time Based Rate” Pilot Program Design for 2010

| Pilot Project                                                     | Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TD-AM<br>(Time of Use)<br><br>Less than 15<br>participants        | 2 Season “Time of Use” Rate: <ul style="list-style-type: none"><li>• Summer (June-Sept) and Winter (Oct-May) seasons</li><li>• Both Seasons have three time blocks per day (Peak, Off-Peak and Shoulder)</li><li>• Customers will also have the option to participate in Peak Time Rebate</li><li>• Summer Peak to Off-Peak ratio of 3.39 :1</li><li>• Winter Peak to Off-Peak ratio of 2.95 :1</li></ul>                                                                                                                                                                                |
| PTR (Peak Time Rebate)<br><br>Less than 40 opt-in<br>participants | Summer Season Demand Response Program <ul style="list-style-type: none"><li>• Up to 10 (8hr) Peak Rebate Events called from June-Sept on hot weekdays when high-demand is anticipated</li><li>• Customers will be notified a day ahead of these peak events</li><li>• If customers reduce their consumption during the peak events compared to an individually calculated usage baseline they will receive a credit of \$0.28 for each KWH they reduce</li><li>• This rebate will appear directly on their electric bill</li><li>• Used two baseline calculation methodologies</li></ul> |

## Duke Energy Ohio Time of Use Pilot Configuration Details

| Pilot                 | TD-AM                                                                                                                        | PTR (opt-in)                                             |
|-----------------------|------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| Peak Event Timing     | N/A                                                                                                                          | Up to 10 events during the Summer<br>8 hrs (12PM to 8PM) |
| Rate Plan Summer      | On Peak (12PM-7PM): 18.00¢/kWh<br>Shoulder Period (9AM-12PM & 7PM-10PM): 14.01¢/kWh<br>Off Peak (10PM-9AM): 5.31¢/kWh        | Standard RS Rate<br>9.6¢/kWh                             |
| Rate Plan Winter      | On Peak (7AM-1PM & 5PM-10PM): 13.26¢/kWh<br>Shoulder Period (6AM-7AM & 1PM-5PM): 7.01¢/kWh<br>Off Peak (10PM-6AM): 4.50¢/kWh | Standard RS Rate<br>9.6¢/kWh                             |
| Rate Plan Spring/Fall | N/A                                                                                                                          | Standard RS Rate<br>9.6¢/kWh                             |
| Customer Incentive    | N/A                                                                                                                          | Rebate of 28¢/kWh of load reduction during peak event    |
| Participants          | 13                                                                                                                           | 36                                                       |

# 2011 Pilots

## Duke Energy Ohio “Time Based Rate” Pilot Program Design for 2011

| Pilot Project                                                                                      | Overview                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>TD-Lite, (Time of Use)</p> <p>72 participants</p>                                               | <p>4 Season “Time of Use” Rate:</p> <ul style="list-style-type: none"> <li>• Summer (June-Sept) and Winter (Dec-Feb) seasons will have more expensive On Peak rates and less expensive Off Peak rates during weekdays</li> <li>• Spring and Fall seasons will only have Off Peak</li> <li>• Customers will also have the option to participate in Peak Time Rebate</li> <li>• Summer Peak to Off-Peak ratio of 7.62 :1</li> <li>• Winter Peak to Off-Peak ratio of 2.95 :1</li> </ul>                                                                                                               |
| <p>TD-Lite with HEM,<br/>(Home Energy Manager)</p> <p>43 participants</p>                          | <p>4 Season “Time of Use” Rate with Home Energy Manager Equipment</p> <ul style="list-style-type: none"> <li>• Same rate structure as TD-Lite, but customers are also provided Wi-Fi enabled technology and in-home, touchpad displays that assist in controlling electric usage by HVAC, water heaters, pool pumps, etc.</li> </ul>                                                                                                                                                                                                                                                                |
| <p>CPP-Lite,<br/>(Time of Use Plus)</p> <p>87 participants</p>                                     | <p>4 Season “Time of Use” Rate with Critical Peak Pricing</p> <ul style="list-style-type: none"> <li>• Summer (June-Sept) and Winter (Dec-Feb) seasons will have more expensive On Peak rates and less expensive Off Peak rates during weekdays</li> <li>• Spring and Fall seasons will only have Off Peak</li> <li>• Up to 10 (4hr) Critical Peak Events can also be called during the Summer Season on hot weekdays where high-demand is anticipated</li> <li>• Customers are notified a day ahead and the per KWH price during the peak events is even greater than the On Peak price</li> </ul> |
| <p>PTR 2.0,<br/>(Peak Time Rebate)</p> <p>198 opt-in participants<br/>219 opt-out participants</p> | <p>Summer Season Demand Response Program</p> <ul style="list-style-type: none"> <li>• Up to 10 (5hr) Peak Rebate Events called from June-Sept on hot weekdays when high-demand is anticipated</li> <li>• Customers will be notified a day ahead of these peak events much like the CPP-Lite program</li> <li>• If customers reduce their consumption during the peak events compared to an individually calculated usage baseline they will receive a credit of \$0.28 for each KWH they reduce</li> <li>• This rebate will appear directly on their electric bill</li> </ul>                       |



## Duke Energy Ohio Time of Use Pilot Configuration Details

| Pilot                 | CPP-Lite                                                                               | PTR (opt-in)                                            | PTR (opt-out) | TD-Lite                                                      | TD-Lite w/ Home Energy Manager |
|-----------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------|---------------|--------------------------------------------------------------|--------------------------------|
| Peak Event Timing     | Up to 10 events during the Summer<br>4 hrs (2PM to 6PM)                                | Up to 10 events during the Summer<br>5 hrs (2PM to 7PM) |               | Up to 10 events during the Summer<br>5 hrs (2PM to 7PM)      |                                |
| Rate Plan Summer      | On Peak (2PM-7PM): 23.2¢/kWh<br>Off Peak(7PM-2PM): 7.6¢/kWh<br>Critical Peak : 35¢/kWh | Standard RS Rate<br>9.6¢/kWh                            |               | On Peak (2PM-7PM): 40.4¢/kWh<br>Off Peak (7PM-2PM): 5.3¢/kWh |                                |
| Rate Plan Winter      | On Peak (7AM-1PM): 14.3¢/kWh<br>Off Peak(1PM-7AM): 7.2¢/kWh                            | Standard RS Rate<br>9.6¢/kWh                            |               | On Peak (7AM-1PM): 35.4¢/kWh<br>Off Peak (1PM-7AM): 4.5¢/kWh |                                |
| Rate Plan Spring/Fall | 7.2¢/kWh                                                                               | Standard RS Rate<br>9.6¢/kWh                            |               | 4.5¢/kWh                                                     |                                |
| Customer Incentive    | N/A                                                                                    | Rebate of 28¢/kWh of load reduction during peak event   |               | Rebate of 28¢/kWh of load reduction during peak event        |                                |
| Participants          | 87                                                                                     | 198                                                     | 219           | 72                                                           | 43                             |



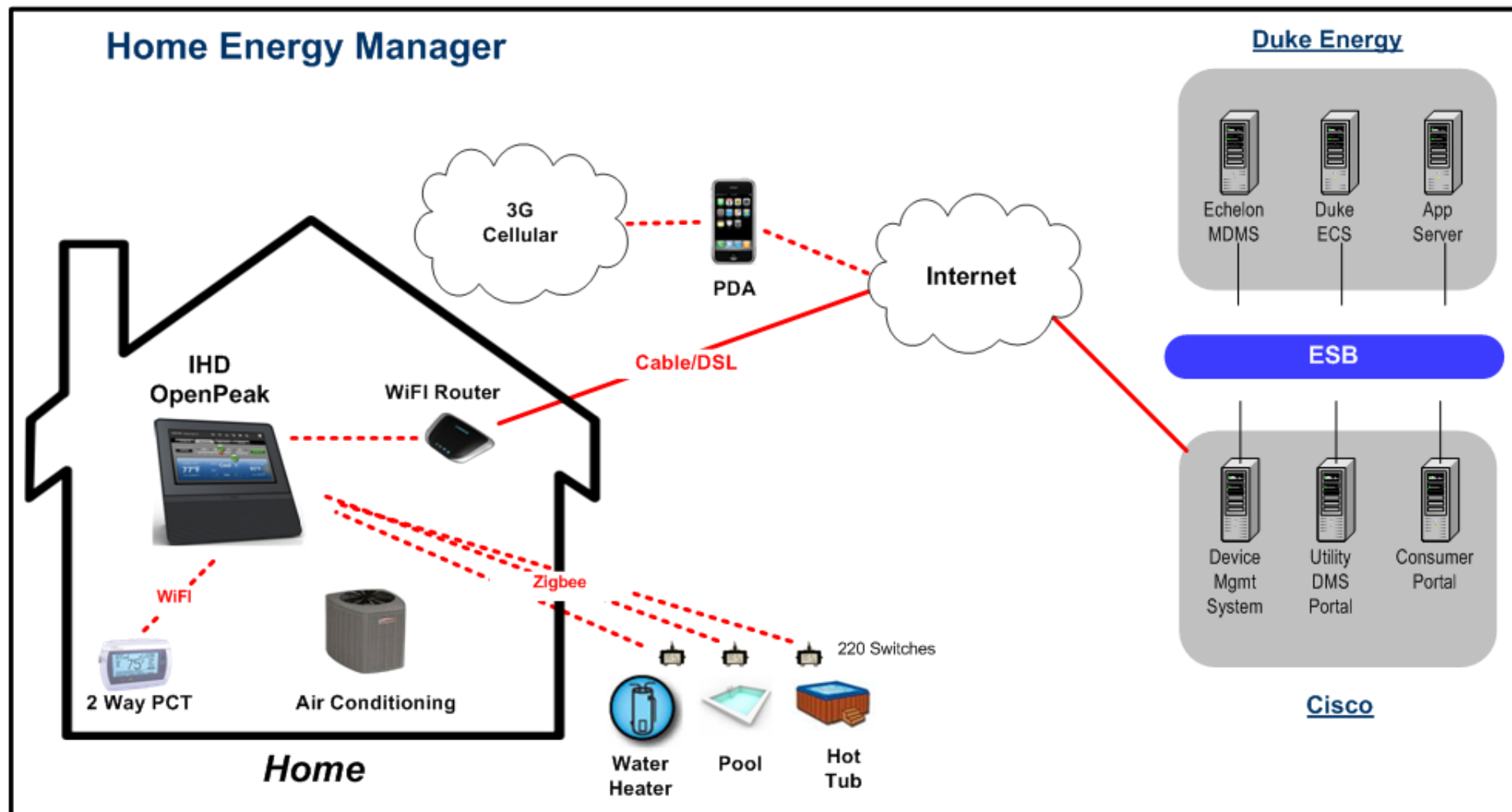
Exhibit PJA-15  
Page 12 of 18



- One time wizard for easy setup
- Two way programmable thermostat with Home, Away, Sleep and Savings modes
- Vacation and Home/Away mode – Put your house to “sleep” while you are away
- Savings mode – During Peak Time Rebate events, customer can set it and forget it for automatic savings
- Manage your house remotely via a PDA (iPhone or Android)



## Home Energy Manager (HEM) High Level Design



# 2012 Pilots

## Duke Energy Ohio Time of Use Pilot Configuration Details

| Pilot                 | PTR (opt-in)                                                       | PTR (opt-out) | <u>Base</u>                                                        | TD- 2012<br><u>Plus</u>                                            | <u>Max</u>                                                         |
|-----------------------|--------------------------------------------------------------------|---------------|--------------------------------------------------------------------|--------------------------------------------------------------------|--------------------------------------------------------------------|
| Peak Event Timing     | Up to 15 events during the Summer (June-August) 5 hrs (2PM to 7PM) |               | N/A                                                                | N/A                                                                | N/A                                                                |
| Rate Plan Summer      | Standard RS Rate<br>9.35¢/kWh                                      |               | On Peak (2PM-7PM):<br>17.5¢/kWh<br>Off Peak (7PM-2PM):<br>5.5¢/kWh | On Peak (2PM-7PM):<br>24.5¢/kWh<br>Off Peak (7PM-2PM):<br>4.8¢/kWh | On Peak (2PM-7PM):<br>31.5¢/kWh<br>Off Peak (7PM-2PM):<br>4.1¢/kWh |
| Rate Plan Winter      | Standard RS Rate<br>9.35¢/kWh                                      |               | On Peak (7AM-1PM):<br>15.2¢/kWh<br>Off Peak (1PM-7AM):<br>5.5¢/kWh | On Peak (7AM-1PM):<br>21.2¢/kWh<br>Off Peak (1PM-7AM):<br>4.8¢/kWh | On Peak (7AM-1PM):<br>27.3¢/kWh<br>Off Peak (1PM-7AM):<br>4.1¢/kWh |
| Rate Plan Spring/Fall | Standard RS Rate<br>9.35¢/kWh                                      |               | 5.5¢/kWh                                                           | 4.8¢/kWh                                                           | 4.1¢/kWh                                                           |
| Customer Incentive    | Rebate of 28¢/kWh of load reduction during peak event              |               | N/A                                                                | N/A                                                                | N/A                                                                |
| Targeted Participants | 250                                                                | 250           | 250 +                                                              | 250 +                                                              | 250 +                                                              |

Duke is trying to make the concept of time differentiated rates more real to customers by making the comparison to other everyday situation where pricing is differentiated on time





## Straightforward mail and e-mail communications utilize simple graphical depictions of the time to money relationship...and potential benefits

We're changing the face of energy rates. 

Select your Rate and Save!

**SUMMER RATES • JUN – AUG**

**OFF-PEAK RATE**  
7 pm - 2 pm



**PEAK RATE**  
2 pm - 7 pm



**WINTER RATES • DEC – FEB**

**PEAK RATE**  
7 am - 1 pm



**OFF-PEAK RATE**  
1 pm - 7 am



**SPRING, FALL, WEEKEND & HOLIDAY RATES**

**OFF-PEAK RATE**  
24 hours/day



NOTE: My Select Rate is voluntary; however you must commit to participate for a full year. The program offers great potential for annual savings on energy; however, there is also potential for an annual increase if customers do not manage energy use to shift from peak hours to off-peak hours.

Name,

**Shift** your energy use **to** off-peak hours and **save**.

Introducing **My Select Rate**, a new pilot program from Duke Energy, that enables you to save money just by changing when you use energy and using less energy during peak hours.

In this program **off-peak electric rates are lower** and peak rates are higher than your current flat rate. And peak rates only occur during certain hours in winter and summer, while spring and fall are always off-peak. So the majority of the year (92%), the rate you pay is **lower than what you pay now**. Duke Energy will also make it easier with tips and helpful info to shift or reduce your energy use.

You have been **selected to participate** in this pilot program. If you can shift away from or use less energy during peak times, you can save money.

Use the reference number below and **sign up by May 6** to participate. To learn more visit [duke-energy.com/MySelectRate](http://duke-energy.com/MySelectRate).

# Questions

**This foregoing document was electronically filed with the Public Utilities**

**Commission of Ohio Docketing Information System on**

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**in**

**Case No(s). 17-0032-EL-AIR, 17-0033-EL-ATA, 17-0034-EL-AAM, 17-0872-EL-RDR, 17-0873-EL-ATA, 1**

Summary: Testimony REVISED Direct Testimony of Paul J. Alvarez in Opposition to the Joint Stipulation and Recommendation On Behalf of The Office of the Ohio Consumers' Counsel electronically filed by Ms. Jamie Williams on behalf of Michael, William Mr.