FILE

PUCO EXHIBIT FILING

Date of Hearing: 2/27/2017

Case No. 16-576-EL-POR

PUCO Case Caption: In the Matter of the Application of Duke Energy Ohio, Inc., for Approval of the Energy Efficiency and Peak Demand Reduction Program Portfolio Plans

List of exhibits being filed:

Duke Exhibits 10, 11, 12

OCC Exhibits 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12

Environmental Intervenors 4, 5, 6

Reporter's Signature: Karen Sue Gibson

Date Submitted: _____

BEFORE THE PUBLIC UTILITIES COMMISSION OF OHIO

- - -

In the Matter of the Application of Duke Energy Ohio, Inc., for Approval of Its Energy Efficiency and Peak Demand Reduction Program Portfolio Plan. : Case No. 16-0576-EL-POR

- - -

PROCEEDINGS

before Mr. Richard Bulgrin, Attorney Examiner, at the Public Utilities Commission of Ohio, 180 East Broad Street, Room 11-D, Columbus, Ohio, called at 10:00 a.m. on Monday, February 27, 2017.

- - -

ARMSTRONG & OKEY, INC.
222 East Town Street, Second Floor
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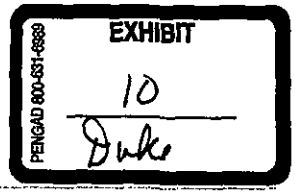

MEETING SIGN-IN SHEET

Project: **Meeting Date:**

Facilitator: **Place/Room:**

Name	Company	Phone	E-Mail
JIM ZIOLKOWSKI	DUKE ENERGY	513 287 2371	JIM.ZIOLKOWSKI@DUKE-ENERGY.COM
Ryan Gentil	Duke		
Devin Parram	OHA	614-227-8813	dparram@bricker.com
Rick Sites	OHA	614-221-7614	RICK.SITES@OHIOHOSPITALS.org
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Bob Wolfe	PUCO	614 644 7691	bob.wolfe@puco.ohio.gov
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Robert Dove	NRDC	614-286-4183	rdove@attorneydove.com
Joe Oliker	IGS	614-659-5069	joliker@igsenergy.com
Dane Stinson	OCC	614-227-4854	dstinson@bricker.com
Chris Healey	OCC		
Colleen Saltzmann	OCC		
Madeline Fleisher	ELPC	614-670-5586	mfleisher@elpc.org
Colleen Mooney	OPAE	614-488-5739	cmooney@ohiopartnership.org
Trisha Haemmerle	Duke Energy	513-287-2637	trisha.haemmerle@duke-energy.com

Watts, Elizabeth H

From: Watts, Elizabeth H
Sent: Monday, November 07, 2016 4:30 PM
To: 'Christopher.Healey@occ.ohio.gov'
Subject: RE: Duke 16-576 - OCC Settlement Terms

Thanks, Chris. Hoping to get a draft out tomorrow so please let me know if it won't be happening tomorrow.

Elizabeth

From: Christopher.Healey@occ.ohio.gov [mailto:Christopher.Healey@occ.ohio.gov]
Sent: Monday, November 07, 2016 4:05 PM
To: Watts, Elizabeth H
Subject: Duke 16-576 - OCC Settlement Terms

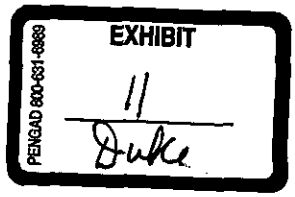
Hi Liz,

We do plan to provide some settlement terms, as per your request last week. I don't know that we'll get them to you today, but we will get them to you tomorrow at the latest.

Thank you again for a productive meeting last week.

Best,
Chris

Christopher M. Healey
Staff Attorney
Office of the Ohio Consumers' Counsel
10 West Broad Street, Suite 1800
Columbus, Ohio 43215-3485
614-466-9571
christopher.healey@occ.ohio.gov



Watts, Elizabeth H

From: Christopher.Healey@occ.ohio.gov
Sent: Friday, December 16, 2016 4:06 PM
To: Watts, Elizabeth H; natalia.messenger@ohioattorneygeneral.gov; John.Jones@ohioattorneygeneral.gov; 'Rick Sites' (Rick.Sites@ohiohospitals.org); mwarnock@bricker.com; dborchers@bricker.com; 'Kimberly W. Bojko'; 'cmooney@ohiopartners.org'; Christopher J. Allwein (callwein@keglerbrown.com); 'Madeline Fleisher'; 'Frank Darr'; mpritchard@mwncmh.com; 'tdougherty@theOEC.org'; 'Miranda Leppla'; 'jfinnigan@edf.org'; Robert Dove; Joseph Oliker (joliker@igsenergy.com); 'perko@carpenterlipps.com'; Stinson, Dane
Cc: Duff, Tim; Haemmerle, Trisha Ann
Subject: RE: Draft EE Stipulation - Case No.16-576-EL-POR

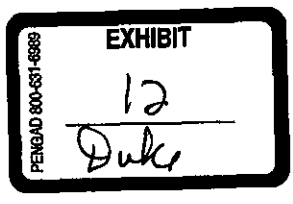
Follow Up Flag: Flag for follow up
Flag Status: Completed

Elizabeth,

Thank you for the draft stipulation. OCC would like to continue discussions with all parties. OCC will have comments/suggestions on this document early next week. We look forward to continued dialogue with everyone.

Regards,
Chris

From: Watts, Elizabeth H [mailto:Elizabeth.Watts@duke-energy.com]
Sent: Friday, December 16, 2016 1:58 PM
To: Messenger, Natalia; Jones, John; 'Rick Sites' (Rick.Sites@ohiohospitals.org); mwarnock@bricker.com; dborchers@bricker.com; 'Kimberly W. Bojko'; 'cmooney@ohiopartners.org'; Christopher J. Allwein (callwein@keglerbrown.com); 'Madeline Fleisher'; 'Frank Darr'; mpritchard@mwncmh.com; 'tdougherty@theOEC.org'; 'Miranda Leppla'; 'jfinnigan@edf.org'; Robert Dove; Joseph Oliker (joliker@igsenergy.com); 'perko@carpenterlipps.com'; Healey, Christopher
Cc: Duff, Tim; Haemmerle, Trisha Ann
Subject: Draft EE Stipulation - Case No.16-576-EL-POR



Privileged and Confidential – For Settlement Discussion Only

Dear Counsel:

Attached is a draft stipulation for your review. Please note that we have made significant progress in many respects. It is anticipated that we will file this stipulation next week. We are aware that this version does not yet have all provisions that parties may wish to include. We will continue to engage with folks and hope to still reach agreement with some additional parties. Given the approaching holidays and abbreviated work schedules, it is important to get this wrapped up as soon as possible. Please review, and if possible, let all

Duke Energy Ohio
Case No. 16-0576-EL-POR
OCC Sixth Set of Interrogatories
Date Received: December 23, 2016

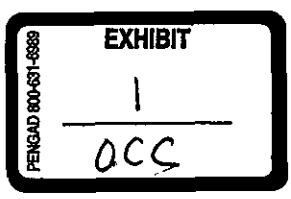
OCC-INT-06-067

REQUEST:

Please identify all communications between Duke and any party to this case on or after June 15, 2016. Limit your response to settlement communications and other communications related to the Stipulation. For purposes of this question, "party" includes PUCO Staff, any entity that has filed a motion to intervene in this case, and any entity that signed the Stipulation. For each such communication, please state (a) the date of the communication, (b) the form of the communication (telephone, in person, email, etc.), (c) the parties that were invited to participate in the communication, and (d) the parties that actually participated in the communication.

RESPONSE: Objection. This Interrogatory is overly broad and unduly burdensome, given that it seeks communications and related documents that are preliminary or otherwise not reflective of the actual filing made by the Company and, thus, are neither relevant to this proceeding nor likely to lead to the discovery of admissible evidence in this proceeding. Objecting further, to the extent that this Interrogatory calls for the disclosure of documents that include or reference legal advice or that include or reference efforts to provide information needed to facilitate the rendition of legal advice, it impermissibly seeks information that, on the basis of attorney-client privilege and O.A.C. Rule 4901-1-16(B), is not subject to disclosure. Objecting further, to the extent that this Interrogatory calls for the disclosure of documents that were prepared in anticipation of litigation, they were prepared with the expectation of confidentiality and are therefore, on the basis of the work-product doctrine and O.A.C. Rule 4901-1-16(B), not subject to disclosure. Without waiving said objection and without waiving the right of Duke Energy Ohio to object to admission of evidence that is not relevant to the present proceeding, to the extent discoverable, and in the spirit of discovery the Company has engaged in numerous telephone discussions with various parties to the proceeding most of which were not recorded in any fashion or logged. Nevertheless, the end result of such communications is the Stipulation and Recommendation that is of record in this proceeding.

PERSON RESPONSIBLE: Legal



Duke Energy Ohio
Case No. 16-0576-EL-POR
NRDC First Set of Interrogatories
Date Received: November 4, 2016

NRDC-INT-01-009

REQUEST:

Please answer the following questions regarding Table 3 on p. 12 of Duke's Amended Filing which identifies cumulative savings required by statute for 2017 through 2019:

a. What level of cumulative MWh savings did Duke achieve as of the end of 2015?
b. What level of cumulative MWh savings is Duke forecasting that it will have achieved by the end of 2016? If an updated forecast is not available, please provide an estimate assuming that planned savings for 2016 are achieved.

RESPONSE:

a. Consistent with the Company's annual compliance filing in Case No. 16-0513-EL-EEC the cumulative MWh savings achieved through 2015 is 1,541,645.

b. Based on the 2016 annual savings of 176,071 MWh projected in the Company Case No. 16-0664-EL-RDR the 2016 cumulative projected MWh savings will be 1,717,716.

PERSON RESPONSIBLE: Tim Duff

Duke Energy Ohio
Case No. 16-576-EL-POR
OCC Second Set of Interrogatories
Date Received: October 27, 2016

OCC-INT-02-002

REQUEST:

What are the monthly projected customer bill impacts of Duke's Application for each of the years 2017, 2018, and 2019?

RESPONSE:

The table below shows the estimated Rider EE-PDRR rates for each year for residential, non-residential, and Rates DS, DP, TS, and RTP customers. The table also shows estimated bill impacts from the portfolio, excluding any prior period reconciliations.

	Summary Revenue Requirement (Case No. 16-576-EL-POR)		
	1	2	3
Residential from Portfolio	$22,726,474	$22,579,645	$21,621,046
Non-Residential from Portfolio	$25,031,970	$24,107,801	$24,620,466
Total	**$47,758,444**	**$46,687,446**	**$46,241,512**
Lost Revenues (DS, DP, TS, RTP)	$409,199	$1,222,799	$2,068,312
	Estimated kWh (Case No. 16-664-EL-RDR)		
Residential	7,645,936,892	7,645,936,892	7,645,936,892
Non-Residential	13,050,587,315	13,050,587,315	13,050,587,315
Rate DS, DP, TS, RTP	12,281,523,209	12,281,523,209	12,281,523,209
	Estimated EE-PDRR Rate Excluding Prior Period True-Ups		
Residential	**$0.002972**	**$0.002953**	**$0.002828**
Non-Residential	**$0.001918**	**$0.001847**	**$0.001887**
Rate DS, DP, TS, RTP	**$0.001951**	**$0.001947**	**$0.002055**
	Monthly Bill Impact (1000 kWh)		
Residential	$2.97	$2.95	$2.83
Total Bill Excluding EE-PDRR (Nov 201	$117.12	$117.12	$117.12
% Impact	2.5%	2.5%	2.4%

PERSON RESPONSIBLE: James E. Ziolkowski

Duke Energy Ohio
Case No. 16-576-EL-POR
IGS First Set of Interrogatories
Date Received: August 5, 2016

IGS-INT-01-003

REQUEST:

The Executive Summary, page 51, Cost Recovery section states that Duke is eligible to earn an incentive of 10% of the after-tax net system benefits from the approved Portfolio Plan programs excluding any impacts from the Self-Direct Mercantile Program, as well as the benefits realized through smart grid and transmission and distribution investments.

a. Will all the programs listed in Appendix B, pages 1-13, be included in the calculation of the annual savings?

b. Identify balance sheet categories that will be used to calculate net system benefits.

c. Identify the estimated shared savings (after-tax) that Duke will earn in each year of the Portfolio Plan.

d. Does Duke propose a cap on the amount of shared savings that it may earn? If so, identify the cap amount.

RESPONSE:

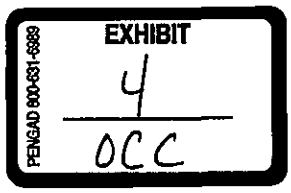
a. Yes

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 objection, to the extent discoverable, and in the spirit of discovery, the Company will calculate the net system benefit consistent with the Utility Cost Test. Duke Energy Ohio's net system benefit is the difference between the net present value of the avoid costs and the net present value of programs associated with its portfolio of energy efficiency and demand response programs, excluding the mercantile self-direct.

c. 2017: $7,576,084; 2018: $6,953,889; 2019: $6,677,028

d. No

PERSON RESPONSIBLE: Trisha A. Haemmerle – a, d
James E. Ziolkowski – c



Duke Energy Ohio
Case No. 16-576-EL-POR
IGS First Set of Interrogatories
Date Received: August 5, 2016

IGS-INT-01-007

REQUEST:

Identify the total Portfolio Plan budget that Duke proposes for each year. Identify whether these amounts are exclusive of shared savings.

RESPONSE:

2017: $38,788,550

2018: $38,053,602

2019: $36,700,012

These amounts are exclusive of shared savings.

PERSON RESPONSIBLE: James E. Ziolkowski

Duke Energy Ohio
Case No. 16-0576-EL-POR
NRDC First Set of Interrogatories
Date Received: November 4, 2016

NRDC-INT-01-012

REQUEST:

Please answer the following questions regarding the proposed "Free LED Program" and "Retail lighting" initiative:

a. Why has Duke proposed on-line ordering strategy for LEDs rather than exclusively promoting LED lamps through existing local retail channels?
b. Has Duke compared the program costs of its proposed option with the option of delivery through local retail channels, either through direct retail rebates customers or through midstream or upstream incentives to manufacturers or retailers? If so, please provide any such analysis.
c. Why has Duke proposed to provide LEDs for free through on-line ordering, rather than at a discounted price?
d. Has Duke analyzed the difference in installation rates and savings between products provided for free versus products provided at a discounted price (but for which the customer must still pay some cost)? If so, please provide any such analysis.

RESPONSE:

a. The Free LED Program is a proven channel that allows customers to easily enroll in the program and have lamps delivered directly to their home. The system provides customer level tracking and limits the number of A lamp LEDs a customer receives.

   The Retail Lighting Program allows customers to purchase discounted specialty LEDs and LED fixtures that fit the specific needs of their home.

b. Duke Energy Ohio did not complete a specific comparison using only a Retail Lighting delivery channel. The multi-channel lighting engagement option is designed for the convenience and quality experience to customers while delivering cost effective measures.

c. The Company's experience with the online, IVR and Online Services (OLS) engagement channels suggests the free opt-in channel creates deep market penetration, easy acquisition and high response rates, which more than offsets the benefit of having customers pay some portion of the lamp cost.

d. Duke Energy Ohio did not complete a specific analysis for installation rates and savings per lamp for a free vs. a discounted price offer. Previous EM&V results from

Duke Energy Ohio
Case No. 16-0576-EL-POR
NRDC First Set of Interrogatories
Date Received: November 4, 2016

NRDC-INT-01-015

REQUEST:

Please answer the following questions regarding the My Home Energy Report:

a. Why are the savings for the My Home Energy Report program roughly the same in each of the three years (see Appendix A, p. 3 of 14).
   i. Is that because the program is assumed to have only a one-year life so that there is no accumulation of savings from one year to the next?
   ii. Is that the way in which Duke plans to measure compliance relative to its statutory savings targets shown in Table 3 (p. 51)? If not, please explain.

RESPONSE:

i. Yes, the My Home Energy Report program only claims a measure life of one year, so each year the savings start new with no accumulation from the previous year(s).
ii. The Company will recognize the annualized savings for compliance purposes.

PERSON RESPONSIBLE:

i. Kevin Bright
ii. Tim Duff

Duke Energy Ohio
Case No. 16-576-EL-POR
IGS First Set of Interrogatories
Date Received: August 5, 2016

IGS-INT-01-001

REQUEST:

The testimony of Kevin Bright states at p. 11 that "Three incentive levels will be made available for customers replacing HVAC equipment. The two new measures include a smart thermostat and quality installation. The smart thermostat is a programmable Wi-Fi enabled thermostat to help customers monitor and manage their HVAC system from their smart device, and must be purchased and programmed as part of the HVAC equipment installation." Regarding this statement:

a. Does Duke propose to provide a rebate for smart thermostats only if they are purchased and programmed as part of an HVAC equipment installation? If the answer is yes, explain why?

b. Would the rebate level would be $125 per smart thermostat?

c. Would the rebate only be applicable to learning thermostats, or would it be available to any Wi-Fi enabled thermostat?

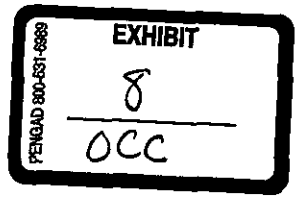
d. Is Duke proposing to allow a customer that purchases a smart thermostat to assign the value of the rebate to a contractor or "trade ally"?

e. Identify why Duke has not proposed to provide a rebate to customers that separately purchase a smart thermostat from a retail store or other vendor.

f. Is it Duke's position that a smart thermostat purchased on a standalone basis cannot reduce a customer's energy consumption or peak demand? If the answer is yes, explain your response.

RESPONSE:

a. Yes, the Smart $aver program is providing a rebate only for smart thermostats purchased, installed, and programmed at the same time as a qualifying HVAC system. The reason for this design is that presence of a smart thermostat alone does not guarantee energy savings and in order to ensure the maximum energy savings from each smart thermostat, the program is structured to ensure a professional installation, setup and configuration of these devices, minimizing issues



Duke Energy Ohio
Case No. 16-576-EL-POR
IGS First Set of Interrogatories
Date Received: August 5, 2016

IGS-INT-01-002

REQUEST:

The testimony of Kevin Bright at p. 8 states that Duke proposes a new Retail Lighting Program, stating, "This upstream, buy-down retail-based lighting program works through lighting manufacturers and retailers to offer discounts to Duke Energy customers selecting incentivized LEDs and energy-efficient fixtures at the shelf for purchase at the register. Retailers, such as, but not limited to, Home Depot, Lowe's, Sam's Club, Walmart and Costco will be evaluated at the store level for possible inclusion in this program. This program encourages those customers not likely to shop at the on-line stores to adopt energy efficient lighting through incentives on a wide range of efficient lighting technologies." Regarding the Retail Lighting Program:

a. Identify how customers are incentivized to purchase energy efficient lighting in retail stores.

b. Identify whether Duke proposes to provide compensation directly to retail stores after proof of purchase. Stated differently, would the retail lighting program allow retail stores to provide instant rebates to customers at the point of sale, with the retail store receiving the rebate directly from Duke?

c. If the answer to (b) is yes, identify the process Duke proposes to utilize to provide a rebate directly to retail stores.

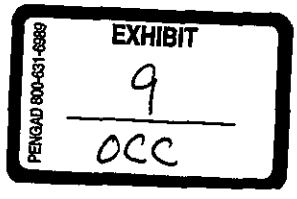
RESPONSE:

a. The program offers discounts or incentives at the point of purchase for selected products.

b. In most cases, the retail lighting program compensates the manufacturer for the instant rebates provided to the customers at point-of-sale.

c. Participating retailers (and manufacturers) are required to provide point-of-sale (POS) data that corresponds with the product(s) offered through the program.

PERSON RESPONSIBLE: Kevin Bright



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Duke Energy Ohio
Case No. 16-576-EL-POR
OCC Second Set of Interrogatories
Date Received: October 27, 2016

OCC-INT-02-031

REQUEST:

On page 26 of the Initial Bright testimony, Mr. Bright states that for the Low Income Neighborhood program: "Targeted low-income neighborhoods qualify for this program if approximately 50% of the households have incomes of 0%-200% of the Federal Poverty Guidelines."

a) How does Duke determine what constitutes a "neighborhood" for this purpose?

b) What does "approximately 50%" mean? Is there an exact percentage below which a neighborhood is ineligible? If so, what is that percentage? If not, how does Duke determine what "approximately 50%" means for any given neighborhood?

c) How does Duke determine the household income for each household in a neighborhood?

RESPONSE:

a) Duke Energy defines a neighborhood as a contiguous geographic region where at least 50% of the households earn less than 200% of the federal poverty guidelines.

b) Duke Energy endeavours to locate an area with a minimum of 50% of the households falling within the federal poverty guidelines. As it is not always possible to achieve the 50% threshold with precision, the Company allows latitude to serve as many customers as possible. Duke Energy identifies neighborhoods by purchasing data on customers which is appended to the customer record and overlayed on maps using specialized mapping software. The maps generated are then used to identify appropriate neighborhoods to serve with the program.

c) Duke Energy purchases data from external sources and then appends that data to our customer database.

PERSON RESPONSIBLE: Kevin Bright

Duke Energy Ohio
Case No. 16-576-EL-POR
OCC Second Set of Interrogatories
Date Received: October 27, 2016

OCC-INT-02-040

REQUEST:

On page 5 of the Supplemental Bright Testimony, Mr. Bright states that a small subset of measures that were recommended by the Market Assessment Study were not included in the portfolio because they are "incongruent with Duke Energy Ohio's experience."

a) Please identify all such measures.

b) Please state the TRC score for each such measure.

c) Please explain what Duke means by "incongruent with Duke Energy Ohio's experience."

RESPONSE:

a) Please identify all such measures.

- Water Heater Thermostat Setback
- Smart Strip Plug (Entertainment Center)
- LED Nightlight
- Energy Star Windows
- Ductless Mini-Split HP, 2 Tons 15 SEER, 9 HSPF
- Solar Electric Water Heater
- Heat Pump Pool Heater
- Energy Star Room AC - 12 SEER
- High Efficiency Bathroom Exhaust Fan
- Energy Star Doors
- Energy Star Ceiling Fan
- Energy Efficient Appliances & Electronics
- Lighting Controls
- Thermostatic Shower Restriction Valve

Duke Energy Ohio
Case No. 16-576-EL-POR
OCC Fourth Set of Interrogatories
Date Received: October 31, 2016

OCC-INT-04-059

REQUEST:

Approximately how many of Duke's customers are at or below 200% of the Federal Poverty Guidelines?

RESPONSE:

Based on purchased data, Duke Energy Ohio estimates that approximately 155,369 customers are at or below 200% of the Federal Poverty Guidelines. This represents over 23% of the Duke Energy Ohio residential customer base.

PERSON RESPONSIBLE:

Kevin Bright

Duke Energy Ohio
139 East Fourth Street
Cincinnati, Ohio 45202

RIDER DR-IM

INFRASTRUCTURE MODERNIZATION RIDER

Rider DR-IM is applicable to all jurisdictional retail customers in the Company's electric service area except transmission and non-metered service.

The DR-IM rate to be applied to customer bills beginning April 1, 2016:

Rate RS, RSLI & RS3P	$6.28 per month
Rate ORH	$6.28 per month
Rate TD	$6.28 per month
Rate TD-13	$6.28 per month
Rate CUR	$6.28 per month
Rate DS	$9.35 per month
Rate EH	$9.35 per month
Rate DM	$9.35 per month
Rate DP	$9.35 per month

Filed pursuant to an Order dated March 31, 2016 in Case No.15-0883-GE-RDR before the Public Utilities Commission of Ohio.

Issued: March 31, 2016 Effective: April 1, 2016

Issued by James P. Henning, President

RIDER DCI
DISTRIBUTION CAPITAL INVESTMENT RIDER

Applicable to all retail jurisdictional customers in the Company's electric service areas including those customers taking generation service from a Competitive Retail Electric Service Providers. This tariff does not apply to customers taking service under Rate TS, service at transmission voltage.

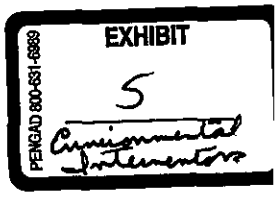
All retail jurisdictional customers shall be assessed a charge of 9.183% of the customer's applicable base distribution charges (*i.e.*, customer charge plus base distribution charge) to recover the revenue requirement associated with incremental distribution capital costs incurred by the Company. This Rider shall be adjusted periodically to recover amounts authorized by the Commission.

Filed pursuant to an Order dated April 2, 2015 in Case No.14-841-EL-SSO before the Public Utilities Commission of Ohio.

Issued: October 26, 2016

Effective: January 3, 2017

Issued by James P. Henning, President



Ohio | Public Utilities Commission

John R. Kasich, Governor
Thomas W. Johnson, Chairman

February 26, 2015

The Honorable Troy Balderson
Co-Chair
Energy Mandate Study Committee
Ohio Senate
1 Capitol Square, 1st Floor
Columbus, OH 43215

The Honorable Kristina Roegner
Co-Chair
Energy Mandate Study Committee
Ohio House of Representative
77 S. High Street, 11th Floor
Columbus, OH 43215

Dear Senator Balderson and Representative Roegner,

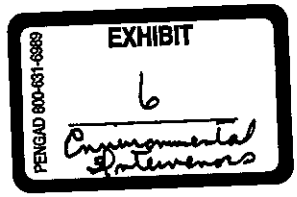
Thank you for the opportunity to provide you with more in-depth information on the complex questions presented through a letter of request received by the Public Utilities Commission of Ohio from the Energy Mandate Study Committee on Nov. 26, 2014.

The questions will be addressed in the order of which they were presented, beginning with question number one. Again, thank you for the opportunity to be involved in this important Study Committee and we look forward to assisting further as appropriate.

Sincerely,

Thomas W. Johnson

Chairman



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The following data and information has been compiled by the Public Utilities Commission of Ohio (PUCO) in order to respond to questions posed by the Energy Mandate Study Committee (Study Committee) on Nov. 26, 2014. The PUCO provides this information in the context of answers to the specific questions the Study Committee presented. In addition, the PUCO has attempted to provide this complex information in a simplified manner. Therefore, the following information should be viewed in this context and not more broadly used to compare other contexts or data, as it may be misplaced and misleading.

1. **The cost and benefits to all classes of customers in Ohio of renewable energy, energy efficiency, and peak demand reduction mandates, and, if possible, the projected costs of such mandates in the future for all customer classes**

Quantifying the costs and benefits of Ohio's energy requirements is no simple task. The PUCO would direct the Study Committee to "rider" charges assessed on consumers' bills as a result of energy efficiency, peak demand reduction and renewable energy to demonstrate the cost to ratepayers. In contrast, quantifying the benefits of renewable energy, energy efficiency and peak demand reduction requirements is far more nuanced and complex. Many of the benefits of energy efficiency are measured by the cost of energy that never was generated, therefore quantifying it is complicated.

First, the PUCO will provide an overview of different methods of measuring and comparing the cost of energy efficiency and renewable energy to the cost of electric generation. These comparisons assist in evaluating the potential least cost method of supplying the electricity. Then, in the section entitled market price suppression, at a high level, the PUCO provides the potential energy price change for the never-created-megawatts. As it would be impractical, if not impossible, to account for all variables, the PUCO cautions the analysis presented is non-exhaustive.

Rate making and energy choice

The best place to begin this discussion of cost is to examine the riders assessed to ratepayers to comply with Ohio's energy requirements. In order to aid discussion of costs, the following provides a high-level overview of rate making theory and mechanisms including rate cases and riders, as well as a brief description of Ohio's restructured energy market.

Electric distribution utilities (EDUs) are able to charge rates based on "cost of service." By law a utility is compensated for its costs plus a reasonable return, adequate to attract and maintain investment capital. Some of the costs are more fixed, such as operation and management of a substation, while others are variable, such as expenses for repairing electric infrastructure after a major storm.

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Distribution rate cases are proceedings before the Commission in which the utility requests rates be adjusted and set the basis for what costs the utility may incur, which can then be recovered from ratepayers.[1] Some costs may be part of what is called "rate base," which essentially means the set rates for certain services. These base rates for service are set in a rate case and essentially stay constant until the next rate case. However, sometimes a utility can use a mechanism called "riders," which is a charge outside of the rate base and is another rate mechanism or way for utilities to recover the costs. Riders are single-issue utility bill charges, meaning they address a specific cost area like transmission, universal service, economic development or energy efficiency. Customers benefit through the reduction in rate volatility while utilities benefit from the reduction in the lag time in recovering their costs. The riders are reviewed on a periodic basis by the PUCO, more frequently than rate cases, and adjusted to fluctuate with a decrease and/or increase in cost. Often times, riders can be a per kilowatt hour (kWh) charge, fixed monthly charge or a percentage of other costs. It is also important to note that a rider can provide a credit to customers. In addition, if the riders did not exist, these costs would be recovered by the utility in the base rates, often with interest[2].

Currently, energy efficiency, peak demand reduction and renewable energy costs are recovered through riders, rather than in the base rates set during a distribution rate case. While the rider mechanism provides a source of information on costs, the analysis is still more complex. There is debate on what costs are related to energy efficiency, peak demand reduction and renewable energy within the rider cost recovery mechanism and their relation to statutory requirements.[3]

As noted above, in Ohio, consumers may shop for an electric supplier, meaning they can choose who they purchase their energy generation from. The entities that provide electric generation are called competitive retail electric suppliers (CRES) providers. If a consumer chooses a new electric supplier, their local electric distribution utility (EDU), meaning your local utility, will continue to deliver the electricity to their home or business. The local utility continues to maintain and repair the poles and

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[1] Distribution rate case proceedings are held pursuant to Revised Code 4909.18.

[2] The capital component of the revenue requirement includes the return on equity, the interest on debt and the depreciation expense. Additionally, construction work in progress (CWIP) allows a utility to collect the carrying costs of a project during construction. The carrying costs include interest costs on the money used for construction expenses and a return on equity employed during construction. Collection of carrying costs during construction significantly reduces the allowance for funds used during construction (AFUDC) when the completed project is added to the customer rate base. If these carrying costs were not recovered during construction, they would be capitalized, rolled into total project cost, and recovered when the facility goes into commercial operation.

[3] In Case No. 14-1411, the Commission, addressing arguments of commenters, determined that shared savings was a cost attributable to energy efficiency and peak demand reduction statutory requirements, while lost distribution revenue and interruptible tariff credits are not. This case is still pending rehearing before the Commission. *In the Matter of the Amendment of Chapters 4901:1-10 and 4901:1-21 of the Ohio Administrative Code to Implement 2014 Sub.S.B 310,* Case No. 14-1411-EL-ORD (Dec. 17, 2014) at 15-20.

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wires delivering the electricity. In this restructured regulatory framework, the PUCO still oversee the safety and reliability of utility service. If a consumer chooses not to shop for their electric generation, they still receive standard service and rates from their local utility, and this is called default utility service or a standard service offer.

Energy efficiency and peak demand rider costs

Energy efficiency (EE) means to reduce the amount of electric energy consumed while maintaining or improving the customer's existing level of functionality, meaning more or the same services are delivered for less energy consumed. Peak demand reduction (PDR) is a reduction in energy usage achieved at times when electrical demand is at its peak, such as hot summer afternoons or a polar vortex. During this time, a manufacturer is asked to curtail operations in order to reduce their demand for electricity. Overall, both energy efficiency and peak demand reduction aim to reduce both the peak and overall level of electricity generated.

Because energy efficiency and peak demand reduction requirements apply only to EDUs, these costs are, for the most part, recovered through a "non-bypassable" rider. A rider charge is called non-bypassable when the costs are recovered from all customers of an electric distribution utility, regardless of whether the utility customer shops for electric generation.

The costs that go into the EE and PDR riders are broken out by customer class. A customer class is a grouping of customers that are categorized for billing purposes based on similar attributes, including electric consumption. For the purpose of simplicity, the various customer classes have been categorized into the three major customer classes: residential, commercial and industrial. Generally speaking, the residential customer class includes homes and apartments. The commercial customer class is comprised of small- to medium-sized businesses and organizations. The industrial customer class includes large commercial and industrial consumers.

While EDUs allocate overhead energy efficiency costs across the different rate classes, there are specific charges assessed by rate class. This means if an industrial customer receives a rebate from the utility to install an energy efficiency program the cost of that rebate is only allocated to customers in that industrial customer's rate class.

- Table 1 considers the three major customer classes within each service territory and depicts the average cost that a customer with typical monthly energy consumption levels paid for the EE and PDR rider as of Dec. 4, 2014.
- Table 2 depicts the average rate per kWh a customer was charged for the EE and PDR rider programs as of Dec. 4, 2014.

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Table 1

Energy Efficiency and Peak Demand Rider (EE/PDR) Typical Bill Cost as of December 4, 2014

	AEP		Dayton Power & Light	Duke Energy	FirstEnergy		
Customer Class	Columbus Southern Power	Ohio Power	DPL	Duke-Ohio	Cleveland Electric Illuminating	Ohio Edison	Toledo Edison
Average Residential	$ 3.42	$ 3.42	$ 3.43	$ 2.58	$ 3.31	$ 2.37	$ 1.42
Average Commercial	$ 1,001.70	$1,001.70	$ 762.27	$ 421.50	$ 830.70	$ 786.00	$ 955.20
Average Industrial	$ 5,719.80	$5,719.80	$ 13,050.60	$ 10,020.00	$10,248.00	$11,646.00	$18,978.00

Average Residential typical usage 750 kWh

Average Commercial typical usage 300,000 kWh

Average Industrial typical usage 6,000,000 kWh

Table 2

Energy Efficiency and Peak Demand Rider (EE/PDR) Typical Bill Cost as of December 4, 2014 ($/kWh)

	AEP		Dayton Power & Light	Duke Energy	FirstEnergy		
Customer Class	Columbus Southern Power	Ohio Power	DPL	Duke-Ohio	Cleveland Electric Illuminating	Ohio Edison	Toledo Edison
Average Residential	$0.004566	$0.004566	$ 0.004579	$ 0.003443	$0.004412	$0.003166	$0.001890
Average Commercial	$0.003339	$0.003339	$ 0.002541	$ 0.001405	$0.002769	$0.002620	$0.003184
Average Industrial	$0.000953	$0.000953	$ 0.002175	$ 0.001670	$0.001708	$0.001941	$0.003163

Alternative energy resource rider costs

With regard to renewable energy, both electric distribution utilities (EDUs) and CRES providers must annually demonstrate a certain percentage of their sales that come from renewable energy sources.[4] To achieve compliance with these requirements, EDUs and CRES providers purchase renewable energy credits[5] (REC) from PUCO-certified renewable generators. The costs of RECs are determined by the open market between buyers and sellers.

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[4] This requirement is contained in Revised Code 4928.64 and Ohio Administrative Code 4901:1-40-05.

[5] One REC is created for every 1 megawatt-hour (MWh) of electric generation. Every specific MWh of electric generation is individually certified with a unique serial number. This serial number is the finger print to that particular MWh of generation that has occurred and is owned only by that particular generator for that particular MWh. This certificate becomes a commodity the generation owner can now sell to an interested buyer. Buyers can vary from electric utilities to middle-people, such as brokers or aggregators, to environmental firms or to non-industry companies looking to neutralize their carbon footprint. (Source: http://www.pjm-eis.com/getting-started/about-GATS.aspx)

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The EDUs and CRES providers must demonstrate to the PUCO that they fulfilled their statutory requirements annually. The PUCO verifies and audits purchases of RECs for all electric services companies, meaning EDUs and CRES providers. In the case of EDUs, costs are passed on to ratepayers through alternative energy resource (AER) riders. EDU customers pay a per kWh charge assessed in each monthly bill, depending on their utility service territory and customer rate class.

Because the alternative energy portfolio standard applies to CRES providers as well as EDUs, the costs of recovery are bypassable. This means that if a customer selects a CRES provider, they no longer pay the AER rider charged by the EDU.

CRES providers' rates are not regulated and are outside the jurisdiction of the PUCO, and thus CRES providers may make any offer they deem reasonable to attract customers. Therefore, the PUCO does not have direct insight into how the renewable requirements affect CRES provider's rate offers.

Table 3 presents the current AER rider charges, as of November 2014, for each of the Ohio EDUs along with a calculation of the monthly cost for a customer using 750 kWh/month. For those companies with more than one AER rate, the table below shows the residential rate.

Table 3

Ohio Utility	AER Rate ($/kWh)	Monthly Cost (@ 750 kWh)
AEP-Ohio Power	0.0010312	$ 0.82
AEP-Columbus Southern Power	0.0017491	$ 1.40
DP&L	0.0007009	$ 0.56
Duke Energy-Ohio	0.0003640	$ 0.29
FE-Cleveland Electric Illuminating	0.0017320	$ 1.39
FE-Ohio Edison	0.0013400	$ 1.07
FE-Toledo Edison	0.0010270	$ 0.82

Benefit evaluation methods

There are several ways to compare energy efficiency, renewable generation and other sources of generating facilities. In order to do so, the PUCO first must explain how using a calculation method called levelized cost of electricity (LCOE) can assist in creating an apples-to-apples comparison. These calculations allow for a comparison of the cost of energy efficiency to the cost of current generation, future generation and current market prices. Lastly, using this calculation the PUCO conducts an examination of how a reduction in the demand for energy may create a suppression of the cost in the market place. These are complex issues that technical experts spend years researching. In short, though the cost-benefit question presented by the Study Committee may sound simple, the answer is quite complicated.

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Levelized cost of electricity

One of the challenges of quantifying the benefits of energy efficiency is that it is like comparing apples and oranges. In order to overcome these obstacles, an LCOE calculation brings data to a comparable level. LCOE calculates the cost over the lifetime of a project. Such projects could be as different as installing energy efficiency lights or building a new electric generating plant.

On a simplistic level, LCOE looks like:

$$LCOE = \frac{\text{Total costs over lifetime}}{\text{Electricity produced over lifetime}}$$

Key cost inputs to calculating the LCOE include but are not limited to capital costs, fuel costs, fixed and variable operations and maintenance costs, financing costs and an assumed utilization rate for each plant type or energy efficiency. A slight change in one of these cost inputs can change the calculation. For example, what is the lifespan of a generating facility or light-emitting diode (LED) light installation? These and other variables may be debated.

Generating plants are evaluated by the cost over the lifetime for energy produced; however, energy efficiency programs are evaluated by the cost over the lifetime for energy saved. Many energy efficiency programs require a significant upfront payment to install the technology and then achieve repayment through the energy savings over time. With LCOE calculations, energy efficiency is examined by the marginal cost, which is the difference between the cost of the standard equipment versus equipment that is more energy efficient.

Using data accumulated by the U.S. Energy Information Administration from 2006 through 2012, the PUCO calculated an annualized marginal LCOE ranging from 1.5 cents per kWh to 4.6 cents per kWh for all energy efficiency programs installed across the United States during that timeframe.

To calculate LCOE, a savings life must be determined as well as a financing cost. Adjusting a single variable, such as the equipment life or discount rate, can significantly vary the cost or benefit of a project. The PUCO attempts a neutral and conservative approach in selecting the variables used below in Table 4[6] to depict the LCOE of energy efficiency programs.

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[6] Energy Information Administration (EIA), Form 861. 2012. Energy Efficiency. http://www.eia.gov/electricity/data/eia861/index.html

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As depicted in Table 4, a project initiated in 2010, for example, with a discount rate, or finance rate, of five percent, and an expected 10-year equipment life would cost 2.8 cents per kWh for comparison purposes. However, the exact same project, depending on how one adjusted its expectations, could cost anywhere from 1.8 to 4.3 cents per kWh.

Table 4

2006 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.9	2.8	1.9
5%	4.2	3.0	2.1
9%	4.6	3.5	2.5

2007 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.7	2.7	1.8
5%	3.9	2.9	2.0
9%	4.4	3.3	2.3

2008 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.7	2.7	1.8
5%	4.0	2.9	2.0
9%	4.4	3.3	2.4

2009 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.1	2.2	1.5
5%	3.3	2.4	1.7
9%	3.7	2.7	2.0

2010 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.6	2.6	1.8
5%	3.8	2.8	1.9
9%	4.3	3.2	2.3

2011 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.1	2.3	1.5
5%	3.3	2.4	1.7
9%	3.7	2.8	2.0

2012 (cents/kWh)	EE Equipment Life in Years		
Discount Rate	7	10	15
3%	3.4	2.5	1.7
5%	3.6	2.6	1.8
9%	4.0	3.0	2.2

In summary, LCOE is an effective method to compare energy efficiency technologies. This method can be used to determine the long-term cost of energy efficiency versus current and future generation resources. These comparisons allow us to evaluate the broader benefits that energy efficiency projects can impart across the electric grid. While there are other potential methodologies to compare various generation related projects, the PUCO believes LCOE is the best and most straight-forward comparison method.

LCOE for new generation

Energy efficiency by definition reduces the demand for energy. Therefore, a benefit attributed to energy efficiency is a reduction in the need for new generation. To evaluate the cost benefit of energy efficiency to new generation, the industry again uses LCOE. As demonstrated in Table 5, and as presented in the American Council for an Energy-Efficient Economy (ACEEE) "Best Value for America's Energy Dollar"

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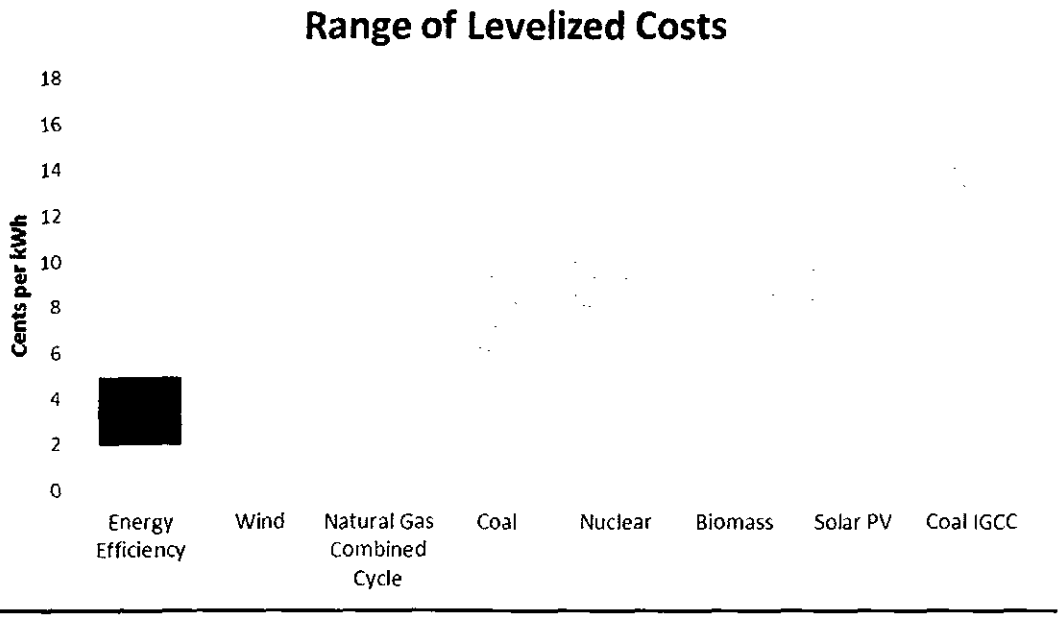
study[7], when compared to the LCOE of new generation, energy efficiency is more cost-effective than building new generation.

Table 5



Source: The American Council for Energy-Efficiency Economy (ACEEE) Best Value for America's Energy Dollar study.

Market prices

The cost of energy efficiency, specifically the marginal LCOE of energy efficiency, can also be compared to the market price of energy[8] within PJM. PJM determines the market price by choosing the cheapest generation to meet the demand for energy. This analysis allows one to determine if the cost of installing an energy efficiency product is more cost-effective than the market rate for generation.[9]

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[7] Maggie Molina. The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs. The American Council for Energy-Efficiency Economy (ACEEE). March 2014. Washington, DC (35).

[8] The market price in PJM is the locational marginal price (LMP). LMP is the marginal cost of supplying, at least cost, the next increment of electric demand at a specific location on the electric power network, taking into account both supply (generation/import) bids and demand (load/export) offers and the physical aspects of the transmission system including transmission and other operational constraints. LMP is an energy only charge and does not include capacity or ancillary services. LMP is used to set market-based prices to manage transmission congestion. Prices are determined by the bids submitted by market participants. The charge of the transmission congestion usage is the incremental cost of the redispatch required to accommodate that transmission usage. Prices differ by location when transmission congestion occurs.

[9] When making this comparison, please note that Ohio consumers are not billed directly based on LMP.

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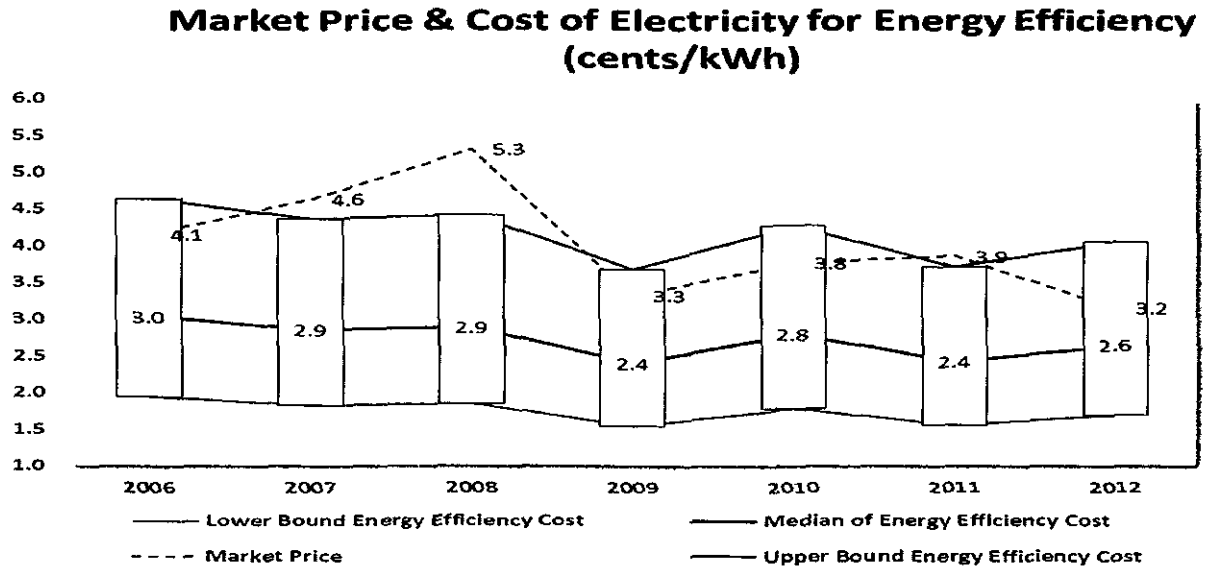
Table 6[10] compares the average market price for generation at a specific trading point on the electric grid[11] to the PUCO's calculated marginal cost for energy efficiency for the same time period, previously depicted in Table 4. In Table 6 below, the green and blue lines labeled the upper and lower bounds of energy efficiency costs show the range of costs possible depending on the interest rate and life span of the energy efficiency equipment. In other words, the PUCO has graphed the range of possible costs for energy efficiency found in Table 4 above.

Table 6



In 2012, for example, a project with a lifespan of seven years would have had a cost between 3.4 and 4 cents per kWh, based on the range of financing rates (see excerpt of Table 4). Compared to the market price of 3.2 cents per kWh, this project with a life span of seven years would not have been

Excerpt from Table 4

2012 (cents/kWh)	EE Equipment Life in Years			
Discount Rate		7	10	15
	3%	3.4	2.5	1.7
	5%	3.6	2.6	1.8
	9%	4.0	3.0	2.2

[10] Raw data sourced through Ventyx

[11] The trading point used by the PUCO is the AEP-Dayton Hub. The AEP-Dayton Hub is a weighted aggregation of energy delivery points that roughly corresponds to the AEP East and Dayton Power and Light service territories. This aggregation is used as a liquid trading point where buyers and sellers of electricity conduct trades on third-party platforms, such as the Intercontinental Exchange (ICE).

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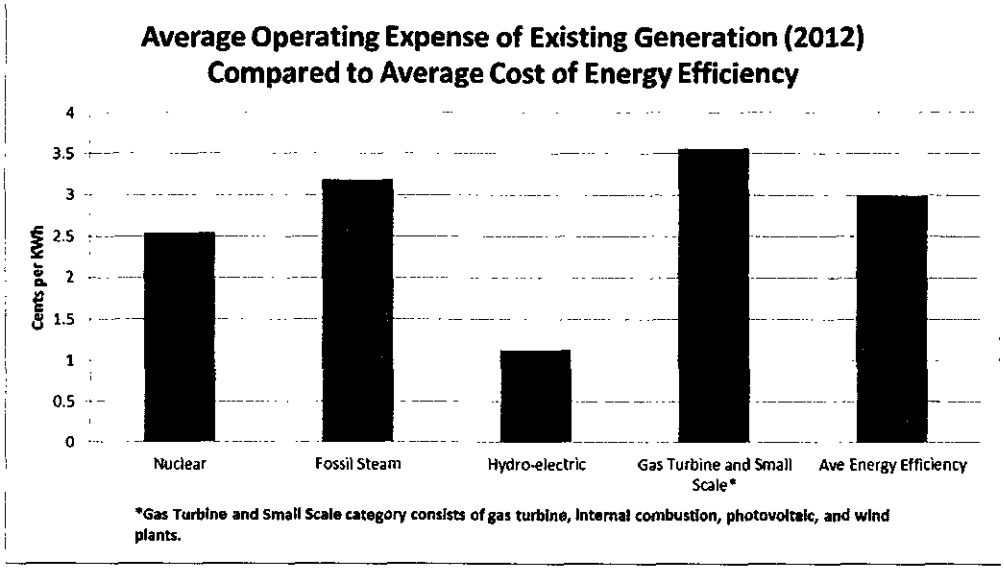
cost-effective. However, a project with a lifespan of 10 or 15 years would have been cost-effective for 2012. In 2008, the year with the highest market prices, every potential energy efficiency project would have proven to be cost-effective in comparison. If the median cost for energy efficiency is used, in all cases energy efficiency is lower than the market price.

LCOE for current generation's variable cost

A comparison between the costs of energy efficiency and current generation may be useful in a market with no need for new capacity. LCOE can be used to determine if it is more cost-effective to produce electricity with existing plants or to reduce demand through energy efficiency projects.

In order to compare energy efficiency to current generation, evaluating the cost inputs of the LCOE calculation of current generation is necessary. Generation is bid into the PJM Interconnection (PJM)[12] day-ahead market based on the power plants operation costs. The operation cost of a power plant consists of the daily operations, maintenance and fuel costs. Therefore, in the calculation below, the average operating expense of existing generation includes minimal, if any, capital or fixed costs, with the majority being variable costs which form the basis of the bid into the market. Table 7[13] demonstrates that the LCOE of energy efficiency remains comparable to variable costs of existing generation.

Table 7



Source: PUCO

[12] PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of 13 states and the District of Columbia, an area that includes more than 51 million people.

[13] Raw data sourced through Ventyx

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Market price suppression

Market price suppression is an added benefit of energy efficiency projects. Price suppression occurs when the demand for electricity is reduced. As less generation is needed to meet demand, market prices for electricity decrease. Through a series of forecasts, the potential effect of price suppression from energy efficiency on the wholesale market may be examined.

The PUCO forecasted[14] how an overall 1 percent reduction in demand affects wholesales pricing. The forecast began with an average wholesale market cost of $52.71 per MWh, and then held all variables constant but reduced the load or demand for energy by 1 percent. The resulting change was an annualized cost forecasted at $49.87 per MWh, a reduction of 5.7 percent. The forecast is a high level evaluation into the wholesale market with a multitude of variables and assumptions made to evaluate the potential market price suppression.

Conclusion

The information provided in response to question one is a non-exhaustive examination of the costs and benefits of energy efficiency, peak demand reduction and alternative energy. As noted, the calculations require value judgments as to the variables of costs and other inputs into the calculations. This makes discussions and analysis surrounding the cost-benefits vary. However, the PUCO has attempted to provide a high-level and neutral overview of the cost-benefit calculation methods.

2. **An explanation of the current standard(s) that the Commission uses when reviewing utilities' compliance with mandates, in addition to the Commission's recommendation on what standard(s) to utilize in the future**

The PUCO monitors and verifies compliance with energy efficiency and alternative energy benchmarks; however, tracking and verifying requires different measures to be taken by the PUCO. While energy efficiency program compliance is verified through more traditional regulatory means such as audits and calculations, alternative energy compliance can be tracked and verified through an electronic database system.

Energy efficiency

The evaluation, measurement and verification of energy efficiency programs are performed in several ways.

[14] Raw data sourced through Ventyx

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First each electric distribution utility (EDU) develops and submits to the PUCO a portfolio plan that must be shown to be cost-effective pursuant to Ohio Administrative Code 4901:1-39-04. The cost-effectiveness of energy efficiency is typically evaluated using one of several industry-accepted cost tests. In general, a cost test compares the costs associated with implementing an efficiency measure to the savings achieved by implementing the measure. If the savings are greater than the costs, then the measure is said to have passed the cost test, and would be beneficial to implement. Ohio's energy efficiency rules require the use of the "total resource cost test."[15] In this cost test, the costs of implementing the project include incremental costs of equipment, installation, operation and maintenance, as well as program overhead costs. The savings that are counted in this cost test include the avoided energy, capacity (i.e. demand for energy generation) and energy related costs, and other related resource savings. While Ohio's energy efficiency rules currently require an EDU's energy efficiency portfolio, in total, to be cost-effective, specific programs or measures within the portfolio may be acceptable without passing the cost-effectiveness test. If an energy efficiency program possesses other significant benefits and the overall portfolio remains cost effective when they are included, these programs may still be approved by the Commission.

As the EDU implements its plan an independent evaluator, selected by the EDU, verifies the energy savings and the cost effectiveness achieved by the EDU's portfolio activities. The evaluator's activities include both energy savings verifications and physical verification on a sample of installed measures. The EDU also must submit to the PUCO, on an annual basis, the results of its activities for review.[16]

Additionally, the PUCO selects a state-wide evaluator and requires each EDU to cooperate with the evaluator to conduct its own independent evaluation of the energy savings achieved by the EDU.[17] The state-wide evaluator's activities include physical audits of a sample of the customer facilities that have received energy efficiency rebates or incentives through the EDU's customer program. These physical audits ensure that the energy efficiency equipment was in fact installed and operational.

Renewable energy

Each EDU and CRES provider must demonstrate annually that the state's requirements are met or be assessed compliance payments. Pursuant to Ohio Administrative Code 4901:1-40-05, each EDU and CRES provider must submit an annual report to the PUCO. In the report the EDU or CRES provider must demonstrate how much renewable energy it was required to obtain and whether the renewable energy was properly obtained.

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[15] See Ohio Administrative Code 4901:1-39-01 and 4901:1-39-03.
[16] Pursuant to Revised Code 4928.66 and Ohio Administrative Code 4901:1-39-06.
[17] Pursuant to Ohio Administrative Code 4901:1-39-04 and 4901:1-39-05.

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Given the physical nature of electricity, it is virtually impossible to know from where any given consumed amount of electricity was generated. Ohio therefore uses RECs[18] and solar renewable energy credits (SREC) from PUCO-certified renewable energy generating facilities to track and verify renewable portfolio standards (RPS) compliance. EDUs and CRES providers obtain RECs and SRECs through several different methods including, but not limited to, self-generation, bilateral transactions, brokers, residential REC programs and the use of requests for proposals.

RECs and SRECs are accounted for in tracking systems. In a way, one might say that the RECs and SRECs are created by virtue of the construct of the tracking systems and the system's ability to track attributes of each renewable energy generating resource. In addition to creating the RECs and SRECs, tracking systems act as electronic book keepers for RECs and SRECs. This system creates an accounting system that facilitates several regulatory processes including compliance verification. The tracking systems also provide a venue for RECs and SRECs to be retired, officially removing them from marketplace circulation and preventing any potential double-counting. The PUCO mainly uses PJM's Generation Attribute Tracking System (GATS). GATS permit the PUCO to review the REC and SRECs that are retired by Ohio's EDUs and CRES providers, allowing the PUCO to verify their state of origin and associated renewable attributes, and assure compliance with Ohio's renewable requirements.

3. Causes and risks of increased grid congestion due to the availability and/or unavailability of various sources of electricity generation

Congestion can be viewed as a traffic jam on the electric distribution and transmission highway. The traffic jam is a result of too many electrons trying to travel on a wire that cannot handle that number of electrons. If you widen a road that is highly congested it could alleviate the congestion. Similarly if you increase the size of the transmission line it could alleviate congestion. Additional options to alleviate congestion are reducing demand in a particular location, creating new sources of generation and various other options. Congestion is caused and alleviated by a change in the traffic patterns of the electrons, similar to the ways one might avoid traffic congestion.

For pricing, congestion is a component of the wholesale electric price. If the most cost effective generation resource cannot be used to satisfy the demand or need for electricity on the "wires," then a

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[18] One REC is created for every 1 megawatt-hour (MWh) of electric generation. Every specific MWh of electric generation is individually certified with a unique serial number. This serial number is the finger print to that particular MWh of generation that has occurred and is owned only by that particular generator for that particular MWh. This certificate becomes a commodity the generation owner can now sell. Buyers can vary from electric utilities to middle-people, such as brokers or aggregators, to environmental firms or to non-industry companies looking to neutralize their carbon footprint. (Source: http://www.pjm-eis.com/getting-started/about-GATS.aspx)

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less cost effective resource may need to be utilized. Congestion results in price uncertainty; congestion costs are reflected in the market price[19] for PJM.

Generation deactivations can lead to higher congestion and price impacts across the area close to a deactivated generation resource. Due largely to changes in U.S. Environmental Protection Agency (U.S. EPA) clean air requirements (including the Mercury and Air Toxics Standards) several generation resources were deactivated in September 2012 in a specific transmission zone, resulting in the retirement of more than 1,500 MW of generating capacity. From June 2011 to October 2014, the average congestion price and the associated congestion price volatility in the transmission zone increased by 58 percent and 136 percent, respectively. Transmission projects have been approved to alleviate the congestion problems and the congestion prices have returned to normal.

On June 2, 2014, the U.S. EPA, under the authority of the Clean Air Act, proposed rules to reduce carbon pollution from existing electric-generating power plants. On Dec. 1, 2014, the PUCO submitted comments to the U.S. EPA. The PUCO's comments were provided during the PUCO's Dec. 8, 2014 testimony and are available on the PUCO website.

Ohio EPA Director Craig Butler and PUCO Commissioner Asim Haque testified on Feb. 5, 2015, regarding the U.S. EPA's Clean Power Plan. As they testified, those proposed rules could potentially cause additional coal generating units to become uneconomical and deactivate, as well as may change the way generation is dispatched in the PJM system, which could also have an impact on congestion.

The impact energy efficiency and peak demand reduction may have on mitigating the congestion price component is not quantifiable with the tools available to the PUCO, and would likely require information, in large part confidential, from an entity like PJM. However, reducing electricity demand in general and during times of peak demand at a specific location may reduce the strain on the electric grid and, therefore, decreases congestion in certain areas.

Similarly the impact renewable generation resources may have on the congestion price is not quantifiable with the tools available to the PUCO, and would likely require information, in large part confidential, from an entity like PJM. Increasing the supply of electricity at a specific location may reduce the strain on the electric grid and, decrease congestion in certain areas. However, due to the

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[19] The market price in PJM is the locational marginal price (LMP). LMP is the marginal cost of supplying, at least cost, the next increment of electric demand at a specific location on the electric power network, taking into account both supply (generation/import) bids and demand (load/export) offers and the physical aspects of the transmission system including transmission and other operational constraints. LMP is an energy only charge and does not include capacity or ancillary services. LMP is used to set market-based prices to manage transmission congestion. Prices are determined by the bids submitted by market participants. The charge of the transmission congestion usage is the incremental cost of the redispatch required to accommodate that transmission usage. Prices differ by location when transmission congestion occurs.

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intermittent nature of renewable generation resources, overbuilding renewable generating sources without building the proper transmission infrastructure could increase congestion constraints. Electricity storage technology and demand reduction should help alleviate this concern, but current technologies come at a significant cost.

4. The current status of advanced energy resources in Ohio, and any recommendations the Commission has on developing alternatives to advanced energy resources in Ohio

In general, the term "advanced energy resource" can be used to describe a wide range of technologies that either efficiently use fossil-fuels or are low/zero carbon-emitting electric generation units.

Ohio's statutory definition of "advanced energy resource" in Revised Code 4928.01(A)(34) includes the nine technologies listed below.

a) A power plant improvement that increases output without a carbon dioxide (CO2) increase;
b) Distributed generation that is combined heat and power;
c) Clean coal technology that reduces ash or metal oxides, or economically feasible carbon capture and sequestration;
d) Generation III nuclear (i.e. new nuclear power plant) or significant improvements to an existing nuclear power plant;
e) Fuel cells;
f) Advanced landfill waste conversion technology (i.e. solid waste or construction/demolition debris conversion that reduces greenhouse gas emissions);
g) Demand side management or energy efficiency improvement (waste energy recovery systems already included in EDU's EE program are specifically excluded as advanced energy);
h) New, retrofitted, refueled or repowered power plants located in Ohio that use any fuel;
i) Any capacity upgrades at existing power plants that are achieved through the use of advanced technology.

As Ohio does not regulate the generation of electricity, Ohio relies on market forces to prompt the construction of advanced energy facilities. Since the restructuring of Ohio's energy market, many generation facilities have become operational or have been certificated by the Ohio Power Siting Board, including, but not limited to the recent 22 natural gas combined cycle or cogeneration plants listed in Table 9.

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Table 9[20]

Plant	Capacity (MW)	Estimated Construction Cost	Status	(Projected) Year Online
Greenville	152.2	-	Online	2000
Madison	576	-	Online	2000
West Lorain	425	-	Online	2001
Darby	290	-	Online	2001
Richland	336	-	Online	2001
Washington Energy	626	-	Online	2002
RP Mone Plant	450.6	-	Online	2002
Troy	584	-	Online	2002
Tait	340	-	Online	2002
Darby	145	-	Online	2002
Waterford	810	-	Online	2003
Hanging Rock	1252	-	Online	2003
Rolling Hills Generating	825	-	Online	2003
Haverhill North Cogeneration	53	-	Online	2008
US Coking Cogeneration	135	-	Online	2011
Fremont	704	$485M	Online	2012
Dresden	580	$377M	Online	2012
Oregon	799	$860M	Under Construction	(2017)
Rolling Hills Expansion	614	$865M	Certificated	(2018)
Carroll County	742	$650M	Certificated	(2018)
Middletown	525	$550M	Certificated	(2018)
Lordstown	800	$800M	Pending	(2018)

Carbon capture and sequestration

The U.S. EPA suggests that partial carbon capture and sequestration is the best mitigation strategy available to reduce carbon dioxide. However, this technology is costly and has not been fully deployed. For example, FutureGen 2.0 is a carbon capture and sequestration retrofit of a 229 MW coal fired power plant in Illinois with a current cost of $1.65 billion. Another example is the partial carbon capture and sequestration demonstration project at AEP's Mountaineer facility in West Virginia, which cost $1.065 billion.

[20] Generation plants certified in Ohio are not guaranteed to be built by the projected online date, if at all.

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Integrated gasification combined cycle

Another clean coal technology is an integrated gasification combined cycle (IGCC) power plant that converts coal into a gas before ultimate combustion in a turbine. This process could allow for easier treatment of environmental pollutants. Duke Energy built a 618 MW IGCC power plant in Edwardsport, Indiana last year at a cost of $3.5 billion.

Advanced nuclear generation

While nuclear generation produces zero carbon emissions, it has an extremely high capital cost compared to other generation. Nationwide, there are five nuclear generation units currently under construction in Tennessee, Georgia and South Carolina. The Georgia Vogtle nuclear power plant will have a generating capacity of 2,430 MW and cost an estimated $6.76 billion.

In September 2014, the U.S. Department of Energy (DOE) proposed a $12.6 billion loan guarantee program for innovative nuclear projects. Four types of projects are eligible for this program: traditional nuclear reactors with "state-of-the-art design improvements," small modular reactors under 300MW, projects that improve or modify existing reactors to boost power production, and upgrades to existing reactors that need modifications to continue running.

Advanced landfill waste conversion technology

Currently, Ohio does not have an advanced landfill waste conversion facility as defined in Revised Code 4928.01 (A)(34). Landfill operators are pursuing a number of waste-to-energy technologies that are eligible for renewable energy credits such as biologically derived methane production, biomass energy utilization and compressed natural gas production. Advanced landfill waste conversion includes technologies that go beyond older style trash burning plants. Further, the advanced resource definition requires a technology that results in measurable greenhouse gas emission reductions pursuant to a specific greenhouse gas reduction model, which may be difficult to implement and verify.

Combined heat and power

Combined heat and power (CHP), also known as cogeneration, is the simultaneous production of electricity and heat from a single fuel source, such as natural gas, biomass, biogas, coal, waste heat or oil. Senate Bill 315 allows CHP systems (installed after September 2012) to count toward Ohio utility's energy efficiency requirements. To count, the CHP system must achieve thermal-efficiency levels of at least 60 percent, with at least 20 percent of the system's total useful energy in the form of thermal energy. According to the U.S. DOE, Ohio currently has approximately 766 MW of CHP.

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5. **Payments to third-party administrators to promote energy efficiency and peak demand reduction programs under the terms of the utilities' portfolio plans since the effective date of SB 221 of the 127th General Assembly; jobs created, retained, and impacted by the programs; and costs/benefits of such payments**

On Nov. 24, 2014, the PUCO testified before the Study Committee detailing information on how EDUs utilize third-party administrators to identify customer energy efficiency projects that are permissible to count toward annual energy efficiency targets under SB 221. During additional testimony on Dec. 8, 2014, the PUCO provided further explanation on how EDUs work with third-party administrators. However, at the time of both testimonies the PUCO was unable to provide information regarding payments made by the EDUs to third-party administrators and any benefits associated with those payments due to the ongoing legal process of evaluating confidentiality questions. This information is now available as demonstrated below.

Tables 10-12 detail the payments made and the kWh savings benefit provided by each third-party administrator for the EDUs that utilize third-party administrators.

Table 10

FirstEnergy

	2010			2011			2012		
Administrator	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh
COSE	$ 35,813	332,000	$0.108	$126,524	25,559,000	$0.005	$ 775,385	75,667,000	$0.010
County Commissioners Assoc.	$ -	-	-	$ 38,852	976,000	$0.040	$ 78,007	5,247,000	$0.015
IEU-Ohio	$ 22,500	-	-	$298,025	41,500,000	$0.007	$ 347,265	40,442,000	$0.009
OHA	$ 49,251	4,700,000	$0.010	$ 25,000	-	-	$ 168,924	13,376,000	$0.013
OMA	$ 86,765	16,706,000	$0.005	$169,011	9,425,000	$0.018	$ 129,367	2,004,000	$0.065
Ohio Schools Council	$ 12,500	-	-	$ 17,500	-	-	$ 101,269	8,620,000	$0.012
Roth Bros	$ 2,500	-	-	$133,426	16,198,000	$0.008	$ 492,194	51,470,000	$0.010
The E Group	$ 40,264	2,696,000	$0.015	$ 92,633	7,761,000	$0.012	$ 290,246	28,540,000	$0.010
AICUO	$ -	-	-	$ 50,000	-	-	$ 25,000	-	-
Total	**$ 249,593**	**24,434,000**	**$0.010**	**$950,971**	**101,419,000**	**$0.009**	**$2,407,657**	**225,366,000**	**$0.011**

	2013			2014			Total (2010 - 2014)		
Administrator	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh
COSE	$ 291,369	33,156,000	$0.009	$225,298	18,881,000	$0.012	$1,454,389	153,595,000	$0.009
County Commissioners Assoc.	$ 160,539	13,604,000	$0.012	$ 85,574	4,822,000	$0.018	$ 362,972	24,649,000	$0.015
IEU-Ohio	$ 95,784	8,683,000	$0.011	$ 83,471	6,016,000	$0.014	$ 847,045	96,641,000	$0.009
OHA	$ 156,168	12,729,000	$0.012	$ 75,000	49,000	$1.531	$ 474,343	30,854,000	$0.015
OMA	$ 121,481	2,571,000	$0.047	$ 50,000	-	-	$ 556,624	30,706,000	$0.018
Ohio Schools Council	$ 25,166	2,276,000	$0.011	$ 61,626	6,448,000	$0.010	$ 218,061	17,344,000	$0.013
Roth Bros	$ 334,232	32,329,000	$0.010	$ 24,710	5,870,000	$0.004	$ 987,062	105,867,000	$0.009
The E Group	$ 82,384	5,016,000	$0.016	$ 60,004	4,012,000	$0.015	$ 565,531	48,025,000	$0.012
AICUO	$ 25,000	-	-	$ 25,000		-	$ 125,000	-	-
Total	**$1,292,123**	**110,364,000**	**$0.012**	**$690,683**	**46,098,000**	**$0.015**	**$5,591,027**	**507,681,000**	**$0.011**

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Table 11

American Electric Power

	2010			2011			2012		
Administrator	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh
OMA	$ 100,000	25,671,213	$0.004	$100,000	56,590,883	$0.002	$ 100,000	33,896,000	$0.003
OHA	$ 60,000	4,532,348	$0.013	$ 30,000	5,879,461	$0.005	$ 85,000	7,721,224	$0.011

	2013			2014			Total (2010 - 2014)		
Administrator	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh
OMA	$ 100,000	53,027,569	$0.002	$100,000	77,257,541	$0.001	$ 500,000	246,443,206	$0.002
OHA	$ 85,000	2,185,824	$0.039	$ 85,000	3,520,580	$0.024	$ 345,000	23,839,437	$0.014

Table 12

Dayton Power and Light

	2014			2015			Total (2014 - 2015)		
Administrator	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh	Payments	kWh Savings	$/kWh
OHA	$ 355,100	3,450,000	$0.103	$ 75,000	N/A	-	$ 430,100	3,450,000	$0.125

Regarding jobs created, retained or impacted by energy efficiency or peak demand reductions programs since the effective date of SB 221 of the 127th General Assembly, the PUCO does not track or collect this information.

Conclusion

The information provided in response to these questions is generally a non-exhaustive examination of the costs and benefits of energy efficiency, peak demand reduction, and alternative energy, as well as a non-exhaustive examination of other issues like the impact of generation retirements on congestion and evaluation of compliance measurement methods. As noted, the calculations and much of the other discussions require value judgments as to the variables of costs and other inputs into the calculations or value judgments in selecting evaluation methods. This makes discussions and analysis surrounding many of the questions posed to vary across the industry. However, the PUCO has attempted to provide a high-level and neutral overview of the cost-benefit calculation methods.

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