

**BEFORE  
THE PUBLIC UTILITIES COMMISSION OF OHIO**

In the Matter of the Application of Ohio	)	
Edison Company, The Cleveland Electric	)	
Illuminating Company, and The Toledo	)	Case No. 25-0092-EL-SSO
Edison Company for Authority to Provide	)	
for a Standard Service Offer Pursuant to	)	
R.C. 4928.143 in the Form of an Electric	)	
Security Plan	)	

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**DIRECT TESTIMONY OF**

**EDWARD C. MILLER**

**ON BEHALF OF**

**OHIO EDISON COMPANY  
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY  
THE TOLEDO EDISON COMPANY**

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**January 31, 2025**

1 **I. INTRODUCTION**

2 **Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

3 A. My name is Edward C. Miller, and my business address is 800 Cabin Hill Drive,  
4 Greensburg, Pennsylvania 15601.

5 **Q. PLEASE IDENTIFY YOUR EMPLOYER AND DESCRIBE YOUR CURRENT**  
6 **POSITION.**

7 A. I am employed by FirstEnergy Service Company (“FESC”) as Manager, Compliance &  
8 Development in the Energy Efficiency Department. I am responsible for development and  
9 compliance activities related to energy efficiency (“EE”) and peak demand reduction  
10 programs (collectively, “EE/PDR”) for the FirstEnergy Corp. (“FirstEnergy”) operating  
11 utilities in Ohio, Maryland, New Jersey, Pennsylvania, and West Virginia. This primarily  
12 involves the development of programs and filings to meet the FirstEnergy operating  
13 utilities’ EE/PDR requirements and objectives in the various states. I was responsible for  
14 overseeing the team that designed and developed the programs included in the Ohio  
15 EE/PDR plans of Ohio Edison Company, The Cleveland Electric Illuminating Company,  
16 and The Toledo Edison Company (collectively, “Companies”), that were previously  
17 approved by the Public Utilities Commission of Ohio (“Commission”) in Case Nos. 12-  
18 2190-EL-POR *et al.* for the Ohio 2013–2015 EE/PDR Plans and in Case No. 16-0743-EL-  
19 POR for the Ohio 2017–2019 EE/PDR Plans. I was also responsible for overseeing the  
20 design and development of the EE/PDR programs proposed in the Companies’ electric  
21 security plan in Case No. 23-0301-EL-SSO (“ESP V”) and the second phase of the  
22 Companies’ grid modernization business plan in Case No. 22-0704-EL-UNC (“Grid Mod  
23 II”).

1 **Q. WHAT IS YOUR EDUCATIONAL AND PROFESSIONAL BACKGROUND?**

2 A. I hold a Bachelor of Science degree in Electrical Engineering from the University of  
3 Pittsburgh. For over seventeen years, I was employed by Allegheny Energy Service  
4 Corporation, the service company for Allegheny Energy Inc. (“Allegheny”), which merged  
5 with FirstEnergy in 2011. While with Allegheny, I held various engineering, customer  
6 service, and management positions in the Customer Service, Sales & Marketing, Customer  
7 Management, and Energy Efficiency Departments. In the Energy Efficiency Department,  
8 I was involved in the development of EE/PDR programs and filings for the utilities  
9 formerly owned by Allegheny in Pennsylvania, Maryland, and West Virginia. After  
10 FirstEnergy and Allegheny merged in 2011, I moved into my current position as Manager,  
11 Compliance & Development, where I have been involved in similar activities for the  
12 FirstEnergy utilities in West Virginia, Maryland, Ohio, Pennsylvania, and New Jersey.

13 **Q. DOES THE FESC ENERGY EFFICIENCY DEPARTMENT HAVE EXPERIENCE**  
14 **DESIGNING AND IMPLEMENTING ENERGY EFFICIENCY PROGRAMS?**

15 A. Yes. FESC’s Energy Efficiency Department designs and implements the Companies’ EE  
16 programs. The FESC Energy Efficiency Department has been designing and implementing  
17 EE/PDR program portfolio plans across the various operating companies and jurisdictions  
18 in the FirstEnergy footprint since 2008, and since that time, has managed approximately  
19 \$2 billion of EE programs collectively across the FirstEnergy utilities.

20 In Pennsylvania, these include the Energy Efficiency and Conservation (“EE&C”)  
21 portfolio plans the four FirstEnergy utilities filed with the Pennsylvania Public Utility  
22 Commission in 2009, with Phase I implementation beginning in 2010 to reduce energy  
23 demand and consumption for the period June 1, 2010 through May 31, 2013. Since that

1 time, the FESC Energy Efficiency Department has successfully designed, filed, and  
2 implemented EE&C portfolio plans for Phases II, III, and IV for the FirstEnergy  
3 Pennsylvania utilities, spanning the time period from June 1, 2013 through May 31, 2025.

4 In Maryland, the FESC Energy Efficiency Department designed an EE&C portfolio  
5 plan for The Potomac Edison Company that was filed in 2008 and implemented beginning  
6 in 2009. Since that time, the FESC Energy Efficiency Department has designed five  
7 additional EE&C portfolio plans, which The Potomac Edison Company has filed and  
8 implemented.

9 In Ohio, the FESC Energy Efficiency Department designed the programs included  
10 in the Companies' EE/PDR portfolio plans that were approved by the Commission in Case  
11 Nos. 09-1947-EL-POR *et al.* for the period 2010 through 2012, Case Nos. 12-2190-EL-  
12 POR *et al.* for the 2013–2015 EE/PDR portfolio plans, and in Case No. 16-0743-EL-POR  
13 for the 2017–2019 EE/PDR portfolio plans. The FESC Energy Efficiency Department also  
14 designed the Companies' most recent EE/PDR proposals in ESP V and Grid Mod II.

15 In West Virginia, the FESC Energy Efficiency Department designed Phase I and  
16 Phase II EE&C portfolio plans that were implemented for the West Virginia FirstEnergy  
17 utilities during the period 2012 to 2018.

18 In New Jersey, the FESC Energy Efficiency Department designed and filed EE&C  
19 portfolio plans for Jersey Central Power & Light Company in 2020, which was  
20 implemented beginning in 2021, and in 2023, which will be implemented beginning in  
21 2025.

1 **Q. HAVE YOU PREVIOUSLY TESTIFIED IN PROCEEDINGS BEFORE THE**  
2 **COMMISSION?**

3 A. Yes. I have provided testimony before this Commission, including in support of ESP V, as  
4 well as before the Pennsylvania Public Utility Commission, the West Virginia Public  
5 Service Commission, the Maryland Public Service Commission, and the New Jersey Board  
6 of Public Utilities.

7 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?**

8 A. The purpose of my testimony is to describe the EE programs included in the Companies’  
9 Application for their sixth electric security plan (“ESP VI”), and to quantify how those  
10 programs will assist customers in achieving their energy efficiency goals.

11 **Q. PLEASE SUMMARIZE YOUR TESTIMONY.**

12 A. For ESP VI, the Companies are proposing an EE plan that includes three different programs  
13 for the Companies’ residential customers: (1) Smart Thermostat Rebate (“STR”); (2)  
14 Energy Education; and (3) Low-Income Energy Efficiency (collectively, the “EE Plan”).  
15 These three programs are identical to those approved by the Commission in ESP V,  
16 adjusted to align the term of the EE Plan with the term of ESP VI. Collectively, the EE  
17 Plan is anticipated to have an average annual cost of \$15.1 million and result in significant  
18 estimated total benefits over the lifetime of the measures associated with these programs.<sup>1</sup>

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<sup>1</sup> The total cost estimate for these programs is dependent on the approved term of ESP VI. The Companies’ average annual cost estimates are based on an assumed 29-month term of January 1, 2026 to May 31, 2028. These annual average costs are subject to change, depending on the approved term of ESP VI. See Attachment ECM-2 for the total projections by program.

1 **Q. ARE YOU SPONSORING ANY ATTACHMENTS?**

2 A. Yes. I am supporting the following attachments that provide information for the  
3 Companies' proposed EE programs:

- 4 • Attachment ECM-1, a chart showing the program descriptions;
- 5 • Attachment ECM-2, a chart showing the projected energy, demand, gas, and water  
6 savings and budgets;
- 7 • Attachment ECM-3, a chart that provides the measures included in each program,  
8 measure level participation, and measure assumptions; and
- 9 • Attachment ECM-4, a chart showing the projected benefits and costs, and benefit-  
10 cost ratios, under the Total Resource Cost Test ("TRC"), the modified Total  
11 Resource Cost Test, formerly referred to as the Societal Cost Test ("mTRC/SCT"),  
12 and the Utility Cost Test ("UCT").

13

14 **II. PROPOSED EE PROGRAMS**

15 **Q. WHAT IS THE COMPANIES' POSITION ON ENERGY EFFICIENCY?**

16 A. The Companies support energy efficiency and recognize the numerous advantages of  
17 providing energy efficiency programs to our customers. The Companies believe in  
18 providing energy efficiency programs to help our customers, our communities, and our  
19 environment. Our belief in and commitment to providing energy efficiency programs is  
20 widely echoed across the industry and government. As cited by ENERGY STAR,<sup>2</sup>

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<sup>2</sup> ENERGY STAR® is the government-backed symbol for energy efficiency, providing simple, credible, and unbiased information that consumers and businesses rely on to make well-informed decisions. ENERGY STAR is administered by the U.S. Environmental Protection Agency. Thousands of industrial, commercial, utility, state, and local organizations—including nearly 40% of the Fortune 500®—partner with the program to deliver cost-saving energy efficiency solutions that protect the climate while improving air quality and protecting public health.

1 “[e]nergy efficiency is one of the easiest ways to eliminate energy waste and lower energy  
2 costs. It is also one of the most cost-effective ways to combat climate change, clean the air  
3 we breathe, help families meet their budgets, and help businesses improve their bottom  
4 lines.” Energy efficiency saves money, protects the environment, and helps address energy  
5 equity, and the Companies are committed to supporting energy efficiency for their  
6 customers.

7 **Q. WHAT WERE THE COMPANIES’ OBJECTIVES IN DEVELOPING THE**  
8 **ENERGY EFFICIENCY PROGRAMS PROPOSED IN THIS APPLICATION?**

9 A. The Companies’ proposed programs in ESP VI are identical to those approved by the  
10 Commission in ESP V, adjusted for the shorter proposed term of ESP VI.<sup>3</sup> The Companies  
11 developed the program proposals with the purpose of providing opportunities to residential  
12 customers that are cost-effective and align with regulatory objectives outlined by the  
13 Commission in prior cases. As the customers’ electric utility, the Companies are uniquely  
14 situated to educate, promote, and provide energy efficiency programs to customers. The  
15 overarching objectives of the programs are to engage with and educate residential  
16 customers and promote adoption of energy efficiency measures. The programs are also  
17 supported and recognized in the industry for providing energy and demand savings to  
18 customers, and each program was designed to include proven approaches in the industry.

19 The Companies designed the residential programs for both shopping and non-  
20 shopping customers to: (1) address educational barriers; (2) address cost barriers; and (3)  
21 tap into a variety of delivery channels and vendors. The overall purpose of the programs is

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<sup>3</sup> See *In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company for Authority to Establish a Standard Service Offer Pursuant to R.C. 4928.143 in the Form of an Electric Security Plan*, Case No. 23-0301-EL-SSO, Opinion & Order at ¶¶ 229, 232–33 (May 15, 2024) (“ESP V Order”).

1 to support customer engagement, education, and participation. The programs include direct  
2 or targeted offerings that engage customers and serve as a portal for other program  
3 offerings because they serve a dual purpose of providing customers with both energy  
4 efficiency education and information regarding other program services and opportunities  
5 upon which they can act. The programs incorporate strategies to change behaviors and  
6 include incentives to address the cost barrier to promote the participation of residential  
7 customers, including low-income customers.

8 These program offerings also acknowledge that the residential sector includes low-  
9 income customers. The Companies were motivated to design programs that would be  
10 useful and effective for residential customers that they serve, including low-income  
11 customers, who often face disproportionately high energy burdens and affordability  
12 challenges compared to non-low-income households. Thus, consistent with the  
13 Commission’s more recent approach,<sup>4</sup> the Companies’ proposed programs were designed  
14 in part to offer these low-income customers the opportunity to participate in energy  
15 efficiency programs that the competitive market does not otherwise provide.

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17 **III. FURTHERANCE OF STATE AND FEDERAL POLICIES**

18 **Q. WHY IS ENERGY EFFICIENCY IMPORTANT TO THE COMPANIES AND**  
19 **WORTHY OF INCLUSION IN THIS ESP?**

20 A. The Companies believe that the programs included in the EE Plan can provide significant  
21 savings to customers. As explained in detail below, the programs included in the EE Plan  
22 are estimated to provide millions of dollars in benefits to customers. The programs are

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<sup>4</sup> See ESP V Order at ¶ 231.



1 targeted at residential customers who will directly be impacted by lower bills as they use  
2 less power.

3 The Companies are uniquely situated to provide these programs. While larger  
4 business customers may have numerous options available to them to undertake energy  
5 efficiency, residential customers do not necessarily have that same access, time, awareness,  
6 or ability to pursue such projects. Therefore, the Companies' programs are targeted at  
7 residential customers who do not have those same opportunities.

8 **Q. DO THE COMPANIES' CUSTOMER PROGRAMS ADVANCE THE STATE'S**  
9 **POLICY OBJECTIVES?**

10 A. Yes. The Companies' proposed EE Plan advances both R.C. 4905.70 and the state's energy  
11 policy in R.C. 4928.02. Specifically, R.C. 4905.70 states that "the [Commission] shall  
12 initiate programs that will promote and encourage conservation of energy and a reduction  
13 in the growth rate of energy consumption." As shown throughout my testimony, each of  
14 the Companies' proposals is specifically targeted at encouraging "conservation of energy  
15 and a reduction in the growth rate of energy consumption." Therefore, the EE Plan was  
16 specifically designed to address this statutory mandate to the Commission.

17 The Companies' proposed EE Plan also encourages the following state policy  
18 objectives in R.C. 4928.02:

<b>Policy Objective</b>	<b>EE Plan Contribution</b>
(A) Ensure the availability to consumers of adequate, safe, efficient, nondiscriminatory, and reasonably priced retail electric service	<ul style="list-style-type: none"> <li>• Increasing customers' home energy efficiency while also reducing demand helps to ensure reasonable cost of energy.</li> </ul>
(D) Encourage innovation and market access for cost-effective . . . demand-side management	<ul style="list-style-type: none"> <li>• Encourages installation of innovative home energy efficiency technologies.</li> </ul>
(J) Provide coherent, transparent means of giving appropriate incentives to technologies that can adapt successfully to potential environmental mandates	<ul style="list-style-type: none"> <li>• Designed to promote and provide incentives for smart thermostats that will reduce energy consumption.</li> </ul>
(L) Protect at-risk populations, including, but not limited to, when considering the implementation of any new advanced energy or renewable energy resource	<ul style="list-style-type: none"> <li>• Low-income program will provide savings to at-risk populations while educating them about energy-related issues.</li> </ul>
(N) Facilitate the state's effectiveness in the global economy	<ul style="list-style-type: none"> <li>• Contributes to economic development through education that can lead to increased demand for energy efficiency products and services reducing the cost of energy and related products and services.</li> </ul>

1 **Q. HOW WILL THE COMPANIES' PROPOSED EE PLAN WORK WITH THE**  
2 **INFLATION REDUCTION ACT?**

3 A. The Inflation Reduction Act (“IRA”) provides funding to Ohio for energy efficiency  
4 improvements. The EE Plan will be used to raise customer awareness of available IRA  
5 rebates and tax credits. As opportunities to use the incentives provided by the IRA continue  
6 to emerge, the Companies will work to educate customers about those opportunities. The  
7 combination of the IRA rebates and tax credits and education through the Companies’ EE  
8 Plan will further entice customers to participate in efficiency opportunities and improve  
9 their overall energy efficiency, particularly in areas that require significant investment.

10

11 **IV. RESIDENTIAL SECTOR PROGRAMS**

12 **1. SMART THERMOSTAT REBATE**

13 **Q. PLEASE DESCRIBE THE STR PROGRAM.**

14 A. The STR program will provide the Companies’ residential customers with a rebate  
15 opportunity for the purchase of an ENERGY STAR certified Smart Thermostat (“Smart  
16 Thermostat”). The program is designed to provide easy access to energy efficient Smart  
17 Thermostats through customers’ preferred channels. Rebates are offered to reduce cost  
18 barriers for program eligible Smart Thermostats. Eligible customers will be able to  
19 purchase a Smart Thermostat and receive either a rebate directly from the Companies or  
20 an instant rebate through a dedicated website or other delivery channels. The STR program  
21 will offer an incentive for Smart Thermostats using \$50 per unit as an initial rebate level.

1 **Q. HOW WILL THE COMPANIES IMPLEMENT THIS PROGRAM?**

2 A. Through a competitive bidding process, the Companies will select an experienced third-  
3 party implementation vendor to manage and deliver the program to eligible residential  
4 customers throughout the term of ESP VI. The implementation vendor will be responsible  
5 for coordinating the STR program with the STR program approved under Grid Mod II,  
6 described in further detail below, to support customer awareness and participation in both  
7 offerings, and to market the rebate offering through potential activities, such as, but not  
8 limited to, email and direct mail campaigns, as well as digital ads, via the Home Energy  
9 Reports under the proposed Energy Education program and through other initiatives. The  
10 implementation vendor will also verify and process rebates to all eligible residential  
11 customers of the Companies for the purchase of a qualified Smart Thermostat.

12 Further, the Companies will develop a Smart Thermostat working group for the  
13 Companies, Commission Staff, Competitive Retail Electric Service providers, and other  
14 interested stakeholders (such as smart thermostat vendors) to collaborate to discuss  
15 implementation, ensure market coordination and mitigate concerns, and identify ways to  
16 maximize program incentives and savings. Thus, while the Companies have developed the  
17 STR program design that I discuss in this testimony, the Companies also propose that final  
18 implementation and design details be subject to input from the STR working group.

1 **Q. HAVE THE COMPANIES PREVIOUSLY PROPOSED A SMART THERMOSTAT**  
2 **REBATE PROGRAM?**

3 A. Yes. The Companies proposed a smart thermostat rebate program in the Stipulation and  
4 Recommendation filed in Grid Mod II (“Grid Mod II STR”).<sup>5</sup> The Commission approved  
5 the Grid Mod II STR on December 18, 2024.<sup>6</sup>

6 **Q. HOW WILL THE SMART THERMOSTAT REBATE PROGRAM PROPOSAL IN**  
7 **ESP VI BE COORDINATED WITH THE GRID MOD II STR?**

8 A. While both the STR proposed in ESP VI and the Grid Mod II STR would provide a rebate  
9 for residential customers who purchase a Smart Thermostat for their home, each proposed  
10 program has different eligible customers, program costs, and implementation details. If the  
11 ESP VI STR is approved, the Companies will coordinate implementation of both programs  
12 to assist customers in achieving the savings of whichever program they participate in.

13 **Q. WHAT CUSTOMERS WILL BE ELIGIBLE TO RECEIVE THE ESP VI STR**  
14 **REBATE?**

15 A. The STR rebates under ESP VI will be available to the Companies’ residential customers  
16 who do not participate in the STR program proposed under Grid Mod II.

17 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**  
18 **COSTS ASSOCIATED WITH THE STR PROGRAM?**

19 A. As shown in Attachment ECM-2, the STR program is projected to provide 6,428 MWh in  
20 average incremental annual energy savings, 1.4 MW in average annual demand savings,

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<sup>5</sup> See *In the Matter of the Application by Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company for Approval of Phase Two of Their Distribution Grid Modernization Plan*, Case Nos. 22-0704-EL-UNC, *et al.*, Stipulation and Recommendation at 10–12 (Apr. 12, 2024).

<sup>6</sup> See *In the Matter of the Application by Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company for Approval of Phase Two of Their Distribution Grid Modernization Plan*, Case Nos. 22-0704-EL-UNC, *et al.*, Opinion and Order (Dec. 18, 2024).

1 and \$1.4 million in average annual incentives to customers, at an average annual total cost  
2 of \$2.0 million during ESP VI.<sup>7</sup>

3 This estimate assumes that approximately 45,500 customers will be able to  
4 participate in the STR program during ESP VI.<sup>8</sup>

5 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**  
6 **THE SMART THERMOSTAT REBATE PROGRAM?**

7 A. Yes. The total benefits of this program under each cost-benefit methodology are:

- 8 • TRC – \$10,893,756;
- 9 • mTRC/SCT – \$15,451,150; and
- 10 • UCT – \$10,290,352.

11 Attachment ECM-4 shows the costs and benefit-cost ratios under each test for this program.

12 **2. ENERGY EDUCATION**

13 **Q. PLEASE DESCRIBE THE ENERGY EDUCATION PROGRAM.**

14 A. The Energy Education program engages and educates residential customers about energy  
15 efficiency and conservation through the combination of Home Energy Reports and School  
16 Education. Through the Energy Education program, the Companies will provide  
17 customized home energy reports, and school education that provides customers with basic  
18 energy savings measures and/or energy efficiency education, recommendations, and  
19 information.

20 The Home Energy Reports component of this program educates customers  
21 regarding their home energy usage and provides recommendations to undertake energy

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<sup>7</sup> All values presented here are based on an assumed 29-month term of January 1, 2026 to May 31, 2028. See Attachment ECM-2 for the total projections by program. These annual averages are subject to change, depending on the approved term of ESP VI.

<sup>8</sup> See Attachment ECM-3.

1 efficiency and conservation measures to reduce their energy usage. This program  
2 component provides monthly customized Home Energy Reports about each customer's  
3 energy usage, as well as analysis regarding their usage over time, with specific tips and  
4 recommendations that promote energy efficiency and conservation opportunities. The  
5 Companies will also provide customized Home Energy Reports that provide low-income  
6 customers with energy efficiency education, recommendations, and information regarding  
7 other low to no cost program opportunities available to them. Home Energy Reports help  
8 customers to understand how their energy consumption compares to similarly sized and  
9 equipped homes, and to their own home year over year, and to identify opportunities to  
10 reduce their energy use. Home Energy Reports will complement the Companies' similar  
11 programs that are targeted at Advanced Metering Infrastructure ("AMI") customers who  
12 have provided the Companies with their email addresses.

13 Under this ESP VI program, Home Energy Reports will be mailed to customers  
14 who have not provided their email addresses to the Companies. AMI customers who  
15 provided their email addresses will be targeted under the Customer Energy Management  
16 program approved in the Companies' Grid Mod II. This coordination of similar program  
17 offerings will collectively achieve broad customer engagement that promotes and achieves  
18 energy efficiency education and savings opportunities with residential customers.

19 The School Education component of this program provides energy efficiency  
20 education and awareness intended to encourage conservation at home. This is a classroom-  
21 based education program that is delivered by educators in schools. Those educators will  
22 utilize common energy efficiency measures that customers can install by themselves to

1 better promote adoption of energy efficiency. They will also more broadly encourage  
2 conservation mindsets and measures by having the students work with their families.

3 Collectively, the Home Energy Reports and School Education program components  
4 target customer engagement, education, and awareness of energy efficiency and  
5 conservation, and have become an industry staple for achieving broad levels of customer  
6 participation and energy savings.

7 **Q. HOW WILL THE COMPANIES IMPLEMENT THIS PROGRAM?**

8 A. Through a competitive bidding process, the Companies will contract with implementation  
9 vendors who will directly administer and manage delivery of the program and provide  
10 program services. The implementation vendor for the Home Energy Reports component  
11 will conduct the energy usage analysis and develop and deliver customized home energy  
12 reports to customers. The implementation vendor will also provide online functionality that  
13 customers can easily utilize to see additional tips on how to save energy and review their  
14 historical usage.

15 The implementation vendor for the School Education component will be  
16 responsible for developing an implementation plan that involves marketing activities to  
17 target schools to inform them of the offering, its components, and its benefits and to achieve  
18 program buy-in from school administration. This vendor will develop educational  
19 materials to support delivery, such as student curriculum with energy conservation lessons  
20 and teacher materials for classroom instruction. The implementation vendor will also  
21 provide energy efficiency measures during program delivery that will be utilized to  
22 introduce simple curriculum-related retrofit measures that students can implement with  
23 their families to facilitate energy efficient behavior at home.



1 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**  
2 **COSTS ASSOCIATED WITH THE ENERGY EDUCATION PROGRAM?**

3 A. As shown in Attachment ECM-2, the Energy Education program is projected to provide  
4 23,695 MWh in average incremental annual energy savings, 4.5 MW in average  
5 incremental annual demand savings, and \$836,000 in average annual incentives to  
6 customers, at an average annual total cost of \$3.6 million during ESP VI.<sup>9</sup>

7 This estimate assumes that approximately 257,067 customers will be able to  
8 participate in the Energy Education program during ESP VI.<sup>10</sup>

9 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**  
10 **THE ENERGY EDUCATION PROGRAM?**

11 A. Yes. The estimated total benefits of this program under each cost-benefit methodology are:

- 12 • TRC – \$8,929,942;
- 13 • mTRC/SCT – \$13,012,166; and
- 14 • UCT – \$7,596,934.

15 Attachment ECM-4 shows the costs and benefit-cost ratios under each test for this program.

16 **3. LOW-INCOME ENERGY EFFICIENCY**

17 **Q. PLEASE DESCRIBE THE LOW-INCOME ENERGY EFFICIENCY PROGRAM.**

18 A. The Low-Income Energy Efficiency program is a continuation of the Companies’  
19 Community Connections program, which was approved in ESP V and also continued  
20 during the Companies’ return to their fourth electric security plan (“ESP IV”). In alignment  
21 with the Companies’ key objectives of affordability and stewardship, it is intended to

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<sup>9</sup> All values presented here are based on an assumed 29-month term of January 1, 2026 to May 31, 2028. See Attachment ECM-2 for the total projections by program. These annual averages are subject to change, depending on the approved term of ESP VI.

<sup>10</sup> See Attachment ECM-3.

1 provide energy efficiency programming for customers up to 200% of the federal poverty  
2 level. The Companies propose to leverage the considerable expertise and existing  
3 infrastructure of Community Based Organizations (“CBOs”) and private contractors  
4 supporting the Community Connections program. This long-standing and successful  
5 program has offered comprehensive energy efficiency services to eligible Ohio households  
6 for years. Through this program, education as well as basic to comprehensive services will  
7 be provided to minimize the percentage of household income that is devoted to energy  
8 costs to give low-income households more control over their energy spending and improve  
9 their ability to pay their energy bills over the long term.

10 The Low-Income Energy Efficiency program provides an opportunity for income-  
11 eligible customers to receive energy efficiency measures and upgrades at no additional  
12 cost. Income-eligible customers will undergo an energy efficiency audit and then receive  
13 direct install and weatherization measures as a comprehensive approach to improve the  
14 efficiency of their home. Potential direct install energy-saving measures include, but are  
15 not limited to, LED lighting, faucet aerators, showerheads, smart thermostats, and smart  
16 power strips. Customers will also receive energy education, behavioral recommendations,  
17 and adjustment of thermostat and water heating setpoints to improve efficiency of the  
18 home. Based on the audit, the customer may also be given the opportunity for additional  
19 comprehensive building envelope measures, such as, but not limited to, insulation, air  
20 sealing, and duct sealing to be installed. Homeowners with nonfunctional heating and/or  
21 cooling systems may also be eligible to receive repairs or replacement at no additional cost.  
22 The program will include a cap on each project with additional funding for health and  
23 safety expenses.

1 **Q. HOW WILL THE COMPANIES IMPLEMENT THIS PROGRAM?**

2 A. The Companies will conduct a competitive bid to contract with an implementation vendor  
3 who will directly administer and manage delivery of the program and provide program  
4 services to customers. Implementation activities will include, where applicable, efforts to  
5 raise awareness of the program, outreach, enrollment, fulfillment of program delivery,  
6 ongoing refinements to the program-provided services, validating customer eligibility, and  
7 conducting outreach to and securing partnerships with trade allies to ensure customers are  
8 able to easily participate in the program.

9 The implementation vendor will also recruit professional or Building Professional  
10 Institute Certified subcontractors and/or trade allies to participate in the program, including  
11 CBOs and/or additional vendors, to perform the energy efficiency audits and installation  
12 services.

13 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**  
14 **COSTS ASSOCIATED WITH THE LOW-INCOME ENERGY EFFICIENCY**  
15 **PROGRAM?**

16 A. As shown in Attachment ECM-2, the Low-Income Energy Efficiency program is projected  
17 to provide 5,240 MWh in average incremental annual energy savings, 0.7 MW in average  
18 incremental annual demand savings, and \$8.0 million in average annual incentives to  
19 customers, at an average annual total cost of \$9.5 million during ESP VI. Compared to the  
20 Companies' ESP IV program, this represents an annual increase of approximately \$2.5  
21 million in incentives and \$3 million in total program costs to provide program services to

1 additional income-qualified customers and provide greater customer savings under this  
2 program.<sup>11</sup>

3 This estimate assumes that approximately 8,942 income-qualified customers will  
4 be able to participate in the Low-Income Energy Efficiency program during ESP VI.<sup>12</sup>

5 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**  
6 **THE LOW-INCOME ENERGY EFFICIENCY PROGRAM?**

7 A. Yes. The total benefits of this program under each cost-benefit methodology are:

- 8 • TRC – \$15,077,664;
- 9 • mTRC/SCT – \$20,418,624; and
- 10 • UCT – \$10,658,680.

11 Attachment ECM-4 shows the costs and benefit-cost ratios under each test for this program.

12  
13 **V. PROGRAM BENEFITS AND COSTS**

14 **Q. WHAT IS THE EE PLAN BUDGET AND HOW MUCH IN SAVINGS IS IT**  
15 **PROJECTED TO GENERATE?**

16 A. The total average annual budget of the proposed EE Plan is approximately \$15.1 million  
17 per year during ESP VI. Collectively, the EE Plan is expected to achieve 35,363 MWh in  
18 energy savings and 6.6 MW in peak demand reduction on an average annual basis.<sup>13</sup>

19 Program-by-program budget and savings estimates are provided on a total program basis

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<sup>11</sup> All values presented here are based on an assumed 29-month term of January 1, 2026 to May 31, 2028. See Attachment ECM-2 for the total projections by program. These annual averages are subject to change, depending on the approved term of ESP VI.

<sup>12</sup> See Attachment ECM-3.

<sup>13</sup> All values presented here are based on an assumed 29-month term of January 1, 2026 to May 31, 2028. See Attachment ECM-2 for the total projections by program. These annual averages are subject to change, depending on the approved term of ESP VI.

1 in Attachment ECM-2 and program measure assumptions are provided in Attachment  
2 ECM-3.

3 **Q. DID THE COMPANIES CALCULATE THE BENEFITS AND COSTS**  
4 **ASSOCIATED WITH THE ENERGY EFFICIENCY PROGRAMS?**

5 A. Yes. The Companies estimated benefits and costs for each program in the EE Plan using  
6 three cost-benefit tests to calculate the cost-effectiveness of the EE programs: the TRC; the  
7 mTRC, formerly referred to as the SCT; and the UCT. The Companies are using the TRC  
8 as the primary cost test for the programs and portfolio, consistent with past practice in Ohio  
9 and in other jurisdictions. The Companies performed the mTRC/SCT and the UCT to  
10 provide the benefits and costs of the programs and portfolio from different perspectives as  
11 additional supporting information.

12 **Q. PLEASE DESCRIBE AND COMPARE THE TRC, SCT, AND UCT.**

13 A. The TRC, while also considered the primary assessment test for the programs and portfolio  
14 by the Companies, functions both as a guidepost and comparative tool to other  
15 jurisdictions, and as a comparison to past programmatic performance. The TRC test  
16 examines the benefits and costs from the combined perspective of the utility system and  
17 participants. The total non-incentive costs, and the customers' incremental costs of  
18 purchasing and installing the efficiency measures above the cost of standard equipment  
19 that would otherwise be installed, are included. The avoided costs include the energy  
20 benefits, comprised of avoided energy<sup>14</sup> and capacity,<sup>15</sup> and avoided transmission and

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<sup>14</sup> For the years 2025 through 2028, the avoided generation costs were calculated using PJM day-ahead futures. For the years 2029 through 2050, the avoided generation costs are escalated based on the escalation of the long-term residential electric price projections in the U.S. Department of Energy, Energy Information Administration's 2023 Annual Energy Outlook.

<sup>15</sup> Avoided capacity was calculated using the historical cleared capacity prices for Planning Year 2021–2022 through 2025–2026, with the average being escalated by the Handy Whitman – All Steam Gen rate beginning in Planning Year 2026–2027.

1 distribution costs.<sup>16</sup> For ESP VI, the Companies also included avoided costs for gas and  
2 water savings and avoided costs for reduced arrearages and collections costs associated  
3 with low-income customer participation. Incentive costs are not included, as these benefits  
4 to customers and costs to the utility cancel each other out.

5 The mTRC/SCT measures the benefits and costs from a viewpoint of the utility  
6 system, consumers, and society as a whole. The mTRC/SCT includes all the costs and  
7 benefits of the TRC discussed above and additionally includes the benefit of avoided air  
8 emissions. Fundamentally, the mTRC/SCT is the TRC with the benefits of avoided air  
9 emissions to society added. The strength of the mTRC/SCT is its ability to view costs and  
10 benefits from a broader perspective and to include issues that society wants to address,  
11 such as avoided air emissions.

12 The UCT examines the costs and benefits of the program from the perspective of  
13 the utility implementing the program. The avoided costs include the energy benefits,  
14 comprised of avoided energy and capacity, and avoided transmission and distribution costs.  
15 For ESP VI, the Companies' included avoided costs for reduced arrearages and collections  
16 costs associated with low-income customer participation. Costs included in the UCT are  
17 total program costs including incentive costs and excluding the customer incremental costs.  
18 Because the UCT does not examine or include the costs and benefits of a program from the  
19 perspective of non-utility stakeholders, this test generally tends to underestimate benefits  
20 and present conservative results.

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<sup>16</sup> Avoided transmission and distribution ("T&D") costs are derived from the Avoided T&D Cost Study completed by Harbourfront Associates.

1 **Q. HAVE THE COMPANIES EVALUATED THE PROJECTED COST-**  
 2 **EFFECTIVENESS OF THE EE PLAN?**

3 A. Yes. The EE Plan mirrors the plan approved in ESP V and is designed to provide education,  
 4 bill savings, and rebate opportunities that residential customers can utilize to maximize the  
 5 energy efficiency of their homes. The successful implementation of the STR and Energy  
 6 Education Programs are projected to be collectively cost-effective, having a combined  
 7 benefit-cost ratio of 1.2 under the TRC, 1.8 under the mTRC/SCT, and 1.3 under the UCT,  
 8 as shown in the table below. The Low-Income Energy Efficiency program is projected to  
 9 have costs that exceed its quantified benefits when this program is viewed separately;  
 10 however, the complete portfolio proposed by the Companies, including the Low-Income  
 11 Energy Efficiency program, is cost effective under the mTRC/SCT. Attachment ECM-4  
 12 provides additional details of the cost-benefit results of the programs.

<b>Ohio ESP VI – Projected Cost Effectiveness Ratios</b>				
<b>Program</b>	<b>Components</b>	<b>TRC Ratio</b>	<b>mTRC/SCT Ratio</b>	<b>UCT Ratio</b>
Smart Thermostat Rebate	Smart Thermostat Rebate	1.4	2.0	2.2
Energy Education	Home Energy Reports School Education	1.1	1.5	0.9
<b>Residential Total</b>		<b>1.2</b>	<b>1.8</b>	<b>1.3</b>
Low-Income Energy Efficiency	Audit/Education EE Products Weatherization	0.7	0.9	0.5
<b>Low-Income Total</b>		<b>0.7</b>	<b>0.9</b>	<b>0.5</b>
<b>Plan Total</b>		<b>0.9</b>	<b>1.2</b>	<b>0.8</b>

13  
 14 **Q. SHOULD OTHER FACTORS BE CONSIDERED WHEN EVALUATING THE**  
 15 **PROPOSED LOW-INCOME ENERGY EFFICIENCY PROGRAM?**

16 A. Yes, several factors justify inclusion of the Low-Income Energy Efficiency Program in the  
 17 EE Plan. First, continuation of the existing Community Connections program, which has

1 long supported the Companies' most at-risk customers, is consistent with the state's energy  
2 policy codified in R.C. 4928.02(L). This program has provided these customers with more  
3 opportunities to reduce energy burdens, improve energy security, and ultimately control  
4 household energy costs. Continuing this programming will allow the Companies' at-risk  
5 customers to maintain access to energy efficiency measures. As cited earlier, the  
6 Companies project that almost 9,000 at-risk customers will directly participate in this  
7 program.<sup>17</sup>

8 Second, it is not uncommon for a low-income program, when viewed in isolation  
9 from the rest of an EE portfolio, to not be cost-effective under traditional cost-benefit  
10 analyses. This is due to the design of these programs to target greater options and more  
11 comprehensive projects for low-income customers, such as providing full installation  
12 services and covering all associated measure and installation costs. These additional  
13 incentives are necessary to overcome barriers specific to low-income customers, such as  
14 financial or existing structural problems with aging homes that may mitigate the  
15 effectiveness of energy efficiency measures. The comprehensive nature of these types of  
16 programs typically reduces their benefit-to-cost ratios, but also ensures that at-risk  
17 customers have the opportunity to access more extensive measures that improve their long-  
18 term energy security.

19 In addition, energy efficiency is particularly important for low-income individuals  
20 who shoulder higher energy burdens, meaning that a larger proportion of their income goes  
21 to electricity bills relative to other segments of the population. In the more extreme cases,  
22 increased energy burdens mean that individuals sometimes must choose between heating

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<sup>17</sup> See Attachment ECM-3 (showing a projected program participation of 8,942 low-income customers).



1 or cooling their living space or purchasing food and medicine. Low-income programming  
2 seeks to mitigate these burdens and assist at-risk households in increasing and maintaining  
3 energy security while enhancing long-term affordability for those customers that face the  
4 most significant challenges. By providing energy efficiency measures targeted at low-  
5 income customers, customers who utilize this programming to improve the efficiency of  
6 their homes will likely see reduced energy bills and, in turn, an improved ability to afford  
7 those bills.

8 Finally, the Commission previously approved this low-income program multiple  
9 times, including this same offering in ESP V. There, the Commission found that the low-  
10 income program proposed by the Companies would provide significant savings for the  
11 Companies' low-income customers,<sup>18</sup> even though the projected cost-effectiveness ratios  
12 under each test were similar in ESP V compared to ESP VI; in fact, the cost-effectiveness  
13 ratios for the proposed ESP VI low-income programs are higher than those associated with  
14 the same programs in ESP V.<sup>19</sup> Thus, despite the results of the cost-effectiveness testing  
15 for this program in ESP V, the Commission recognized that significant benefits would still  
16 be achieved.

17 For these reasons, the Companies believe that the Low-Income Energy Efficiency  
18 Program is a crucial component of the EE Plan, as it will provide substantial support to at-  
19 risk customers who may otherwise have limited access to energy efficiency measures and  
20 associated savings.

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<sup>18</sup> ESP V Order at ¶ 229.

<sup>19</sup> See *In the Matter of the Application of Ohio Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison Company for Authority to Establish a Standard Service Offer Pursuant to R.C. 4928.143 in the Form of an Electric Security Plan*, Case No. 23-0301-EL-SSO, Direct Testimony of Edward C. Miller at 29 (Apr. 5, 2023) (showing cost-effectiveness ratios for the proposed low-income program of 0.5 (TRC), 0.8 (SCT, *i.e.*, mTRC), and 0.5 (UCT)).

1 **Q. ARE THERE ADDITIONAL BENEFITS OF THE PROGRAMS THAT YOU**  
2 **HAVE NOT QUANTIFIED AND INCLUDED IN ATTACHMENT ECM-4?**

3 A. Yes. As discussed earlier, while the Companies expanded their avoided costs from ESP V  
4 to recognize gas and water savings and for reduced arrearages and collections costs  
5 associated with low-income customer participation, this approach is still a conservative  
6 view of cost-effectiveness, as there are other energy and non-energy benefits that the  
7 Companies did not include or quantify, but that are often recognized in the industry for  
8 cost-effectiveness calculations.<sup>20</sup> Some of the more common impacts that can also be  
9 considered include energy and/or capacity price suppression effects, health and safety,  
10 comfort, economic development, and jobs impacts.

11 **Q. WILL THE COMPANIES USE A COLLABORATIVE PROCESS TO SHARE**  
12 **TIMELY INFORMATION ON THE EE PROGRAMS WITH STAKEHOLDERS?**

13 A. Yes. For the EE Plan as a whole, the Companies will meet twice per year with interested  
14 parties to discuss implementation activities as well as program performance and progress  
15 toward meeting the program savings goals.

16 Further, as described above, the Companies have proposed to create a working  
17 group for stakeholders to discuss implementation of the STR program and ways to  
18 maximize its incentives. By convening this working group, the Companies seek to create  
19 collaboration opportunities with interested stakeholders (such as competitive suppliers and  
20 smart thermostat providers) to ensure that program participants maximize their program  
21 benefits in the most efficient, cost-effective manner.

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<sup>20</sup> For example, see *Applying Non-Energy Impacts from Other Jurisdictions in Cost-Benefit Analyses of Energy Efficiency Programs: Resources for States for Utility Customer-Funded Programs*, available at <https://emp.lbl.gov/publications/applying-non-energy-impacts-other>.

1 **Q. HOW WILL CUSTOMER PROGRAM COSTS AND SAVINGS BE MANAGED**  
2 **AND REPORTED?**

3 A. The Companies will manage the EE Plan to the approved budgets. As discussed above,  
4 Attachment ECM-2 provides the Companies' estimated total budget based on an assumed  
5 29-month ESP VI term. The total budget is subject to change based on the approved term  
6 of ESP VI.

7 **Q. HOW WILL THE COMPANIES VERIFY THAT PROGRAM BENEFITS ARE**  
8 **OBTAINED?**

9 A. The Companies will use multiple strategies to manage and evaluate the effectiveness of the  
10 proposed programs, including active ongoing program management to monitor program  
11 performance and impact and process evaluations conducted by an expert third-party  
12 evaluation, measurement, and verification contractor. The Companies will discuss the  
13 program performance at collaborative meetings with interested parties, as discussed above,  
14 and will file annual reports with the Commission on the evaluated savings and program  
15 results no later than five months following each program year.

16

17 **VI. CONCLUSION**

18 **Q. DOES THIS CONCLUDE YOUR TESTIMONY?**

19 A. Yes.

**Attachment ECM-1: Ohio ESP VI - Program Descriptions**

Program	Component	Description
Smart Thermostat Rebate	Smart Thermostat Rebate	The STR program will provide the Companies' residential customers with a rebate opportunity for the purchase of an ENERGY STAR certified Smart Thermostat "Smart Thermostat". The program is designed to provide easy access to energy efficient Smart Thermostats through customers' preferred channels. Rebates are offered to reduce cost barriers for program eligible Smart Thermostats. Eligible customers will be able to purchase a Smart Thermostat and receive a rebate directly from the Companies or an instant rebate through a dedicated website or a rebate through other delivery channels.
Energy Education	Home Energy Reports School Education	The Energy Education Program engages and educates customers about energy efficiency and conservation through the combination of Home Energy Reports and School Education. The Home Energy Reports component of this program educates customers regarding their home energy usage and provides recommendations to undertake energy efficiency and conservation measures to reduce their energy usage. This program component provides customized Home Energy Reports, including customized reports for income eligible customers, about each customer's energy usage, as well as analysis regarding their usage over time, with specific tips and recommendations that promote energy efficiency and conservation opportunities and programs available to them. The reports help customers to understand how their energy consumption compares to similarly sized and equipped homes, how their home compares to their own home year over year, and to identify opportunities to reduce their energy use. The School Education component of this program provides energy efficiency education and awareness through students for customers to conserve energy in their homes. This program component is a classroom-based education program that is delivered by educators in schools and utilizes common energy efficiency measures that customers can install by themselves to better promote adoption of energy efficiency. They will also more broadly encourage and conservation mindsets and measures by having the students work with their families. Collectively, the Home Energy Reports and School Education program components targets customer engagement, education and awareness of energy efficiency and conservation and have become an industry staple for achieving broad levels of customer participation and energy savings.
Low-Income Energy Efficiency	Audit/Education EE Products Weatherization	The Low-Income program provides an opportunity for income eligible customers to receive energy efficiency measures and upgrades at no additional cost. Income eligible customers will undergo an audit and then receive direct install of energy efficient products and weatherization measures as a comprehensive approach to improve the efficiency of the home. During the audit, customers will potentially receive installation of direct install energy-saving measures such as, but not limited to, LED lighting, energy-saving faucet aerators, showerheads, smart thermostats and smart power strips, in addition to energy education, behavioral recommendations and adjustment of thermostat and water heating setpoints to improve efficiency of the home. Based on the audit, the customer may also be given the opportunity for additional comprehensive building envelope measures, (such as, but not limited to, insulation, air sealing, and duct sealing) to be installed. Also, homeowners with nonfunctional heating and/or cooling systems may also be eligible to receive repairs or replacement at no additional cost. The program will include a cap on each project with additional funding for health and safety expenses.

<sup>1</sup> The Companies will administer and oversee implementation of the programs and will select experienced third-party implementation vendors to manage and deliver the programs and fulfill program services to customers throughout the term of the programs.

Attachment ECM-2: Ohio ESP VI - Projections <sup>12</sup>							
Program	Components	Energy Savings (MWh)	Demand Savings (MW)	Gas Savings (MMBTU)	Water Savings (Gallons)	Incentives	Total Budget
Smart Thermostat Rebate	Smart Thermostat Rebate	15,535	3.4	29,442	-	\$ 3,412,500	\$ 4,751,739
Energy Education	Home Energy Reports School Education	57,264	10.8	23,666	7,810,596	\$ 2,020,333	\$ 8,715,017
Low-Income Energy Efficiency	Audit/Education EE Products Weatherization	12,662	1.8	34,606	5,257,700	\$ 19,314,000	\$ 23,040,609
<b>Plan Total</b>		<b>85,461</b>	<b>16.1</b>	<b>87,714</b>	<b>13,068,296</b>	<b>\$ 24,746,833</b>	<b>\$ 36,507,365</b>

<sup>1</sup> Plan Totals represents Program Years as follows: PY1 - 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

<sup>2</sup> Savings per program are based on the Measure Assumptions in Attachment ECM-3

Attachment ECM-3: Ohio ESP VI - Measure Assumptions

Program	Component	Measure	Total Participants <sup>1</sup>	Measure Life	kWh per unit	kW per unit	Incremental Cost (\$)	Modeled Rebate / Incentive	Water Savings (Gallons per Unit)	Gas Savings (MMBTu per Unit)
Smart Thermostat Rebate	Smart Thermostat Rebate	Smart Thermostat	45,500	9	312	0.07	\$ 140	\$ 75	-	0.65
Energy Education	Home Energy Reports	Home Energy Reports PY1	203,900	1	70	0.01	\$ -	\$ -	-	-
Energy Education	Home Energy Reports	Home Energy Reports PY2	203,900	1	100	0.02	\$ -	\$ -	-	-
Energy Education	Home Energy Reports	Home Energy Reports PY3	203,900	1	49	0.01	\$ -	\$ -	-	-
Energy Education	School Education	School Education	53,167	8	143	0.01	\$ 33	\$ 38	146.91	0.45
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	LI - Audit/Education, EE Products & Weatherization	8,942	15	1,293	0.18	\$ -	\$ 2,160	588.00	3.87

<sup>1</sup> Plan Totals represents Program Years as follows: PY1 - 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

**Attachment ECM-4: Ohio ESP VI - Projected Cost Effectiveness**

<b>Program</b>	<b>Components</b>	<b>TRC Benefits</b>	<b>TRC Costs</b>	<b>TRC Ratio</b>	<b>mTRC/SCT Benefits</b>	<b>mTRC/SCT Costs</b>	<b>mTRC/SCT Ratio</b>	<b>UCT Benefits</b>	<b>UCT Costs</b>	<b>UCT Ratio</b>
Smart Thermostat Rebate	Smart Thermostat Rebate	\$ 10,893,756	\$ 7,709,239	1.4	\$ 15,451,150	\$ 7,709,239	2.0	\$ 10,290,352	\$ 4,751,739	2.2
Energy Education	Home Energy Reports School Education	\$ 8,929,942	\$ 8,449,183	1.1	\$ 13,012,166	\$ 8,449,183	1.5	\$ 7,596,934	\$ 8,715,017	0.9
<b>Residential Total</b>		<b>\$ 19,823,698</b>	<b>\$ 16,158,423</b>	<b>1.2</b>	<b>\$ 28,463,316</b>	<b>\$ 16,158,423</b>	<b>1.8</b>	<b>\$ 17,887,286</b>	<b>\$ 13,466,756</b>	<b>1.3</b>
Low-Income Energy Efficiency	Audit/Education EE Products Weatherization	\$ 15,077,664	\$ 23,040,609	0.7	\$ 20,418,624	\$ 23,040,609	0.9	\$ 10,658,680	\$ 23,040,609	0.5
<b>Low-Income Total</b>		<b>\$ 15,077,664</b>	<b>\$ 23,040,609</b>	<b>0.7</b>	<b>\$ 20,418,624</b>	<b>\$ 23,040,609</b>	<b>0.9</b>	<b>\$ 10,658,680</b>	<b>\$ 23,040,609</b>	<b>0.5</b>
<b>Plan Total</b>		<b>\$ 34,901,363</b>	<b>\$ 39,199,032</b>	<b>0.9</b>	<b>\$ 48,881,939</b>	<b>\$ 39,199,032</b>	<b>1.2</b>	<b>\$ 28,545,966</b>	<b>\$ 36,507,365</b>	<b>0.8</b>

**Attachment ECM-2, Workpaper 1: Ohio ESP VI - Cost Assumptions**

The model used for developing the programs involves a build-up of direct costs based on program or component fixed costs and variable costs based on measure level projections. Program cost elements of this plan include operations costs and Incentive costs. Operations costs include Utility Administration and Other costs associated with portfolio and program development and management, Program Administration costs associated with program management and implementation, Marketing costs of the portfolio and programs, Evaluation, Measurement and Verification (EMV) costs associated with EMV of the programs, and Tracking and Reporting costs for tracking and reporting of the program results. The following details the assumptions for the program cost categories included in this plan:

Cost Elements	Cost Category	Description	Sources
<b>Operations</b>	<b>Utility Administration and Other</b>	Includes costs incurred by the Companies for dedicated employee labor to develop, oversee and manage the portfolio and programs, and to perform duties associated with activities such as reporting or meetings to support the plan. Utility Administration costs were estimated based on labor forecasts and estimates and allocated to each program component based on Program Administration and Marketing costs. Other costs include costs for Low-Income software and support, providing for program management reporting, based on estimated vendor pricing.	Labor Forecast and Estimates Estimated Vendor Pricing
	<b>Program Administration</b>	Includes costs associated with the administration, implementation and ongoing management of the programs including staffing, contractors, website(s), call centers, quality assurance and control processes, and other program specific activities supporting successful program implementation. Program Administration costs, including (1) fixed costs for each program component, and (2) variable measure unit costs based on measure level projections, were informed based on estimated vendor pricing and experience of the Companies with similar programs operated by affiliates in other States.	Company Assumptions Estimated Vendor Pricing
	<b>Marketing</b>	Includes costs associated with developing and providing marketing for plan and program awareness, education and messaging. Program specific marketing costs, including (1) fixed costs for each program component, and (2) variable costs based on measure level projections, were informed based on estimated vendor pricing and experience of the Companies with similar programs operated by affiliates in other States.	Company Assumptions Estimated Vendor Pricing
	<b>EM&amp;V</b>	Includes direct costs for evaluation, measurement and verification activities, such as surveys, processes, and evaluation meetings. The EM&V costs were estimated based on 3% of total program cost.	Company Assumptions
	<b>Tracking and Reporting</b>	Includes costs associated with the development and maintenance of a data collection, tracking and reporting system, to develop and generate standard reports, and provide the functionality for program management ad hoc reporting. These costs were informed by existing contracts and estimates, and were allocated to each program component based on Program Administration and Marketing costs.	Company Assumptions Estimated Vendor Pricing
<b>Incentives</b>	<b>Incentives</b>	Incentives include direct rebates paid to customers as well as costs associated with providing services or measures directly to customers, and mid-stream or upstream payments to program allies where applicable. Incentives were estimated based on measure level incentive and participation assumptions.	Company Assumptions



Attachment ECM-2, Workpaper 2: Ohio ESP VI Budgets by Cost Category PY 1 <sup>1</sup>								
Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Smart Thermostat Rebate	Smart Thermostat Rebate	\$ 55,940	\$ 250,000	\$ 175,000	\$ 57,817	\$ 96,279	\$ 1,350,000	\$ 1,985,036
	<b>Smart Thermostat Rebate</b>	<b>\$ 55,940</b>	<b>\$ 250,000</b>	<b>\$ 175,000</b>	<b>\$ 57,817</b>	<b>\$ 96,279</b>	<b>\$ 1,350,000</b>	<b>\$ 1,985,036</b>
Energy Education	Home Energy Reports	\$ 201,823	\$ 1,533,328	\$ -	\$ 62,475	\$ 347,360	\$ -	\$ 2,144,986
Energy Education	School Education	\$ 73,775	\$ 225,000	\$ 335,500	\$ 47,918	\$ 126,975	\$ 836,000	\$ 1,645,168
	<b>Energy Education</b>	<b>\$ 275,598</b>	<b>\$ 1,758,328</b>	<b>\$ 335,500</b>	<b>\$ 110,393</b>	<b>\$ 474,335</b>	<b>\$ 836,000</b>	<b>\$ 3,790,154</b>
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 213,462	\$ 720,000	\$ 180,000	\$ 279,280	\$ 203,886	\$ 7,992,000	\$ 9,588,628
	<b>Low-Income Energy Efficiency</b>	<b>\$ 213,462</b>	<b>\$ 720,000</b>	<b>\$ 180,000</b>	<b>\$ 279,280</b>	<b>\$ 203,886</b>	<b>\$ 7,992,000</b>	<b>\$ 9,588,628</b>
	<b>Plan Total</b>	<b>\$ 545,000</b>	<b>\$ 2,728,328</b>	<b>\$ 690,500</b>	<b>\$ 447,490</b>	<b>\$ 774,500</b>	<b>\$ 10,178,000</b>	<b>\$ 15,363,818</b>

<sup>1</sup> Plan Year terms are as follows: PY1- 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

Attachment ECM-2, Workpaper 2: Ohio ESP VI Budgets by Cost Category PY 2 <sup>2</sup>								
Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Smart Thermostat Rebate	Smart Thermostat Rebate	\$ 48,182	\$ 175,000	\$ 175,000	\$ 57,860	\$ 30,474	\$ 1,500,000	\$ 1,986,516
	<b>Smart Thermostat Rebate</b>	<b>\$ 48,182</b>	<b>\$ 175,000</b>	<b>\$ 175,000</b>	<b>\$ 57,860</b>	<b>\$ 30,474</b>	<b>\$ 1,500,000</b>	<b>\$ 1,986,516</b>
Energy Education	Home Energy Reports	\$ 211,084	\$ 1,533,328	\$ -	\$ 56,337	\$ 133,504	\$ -	\$ 1,934,253
Energy Education	School Education	\$ 66,836	\$ 150,000	\$ 335,500	\$ 42,918	\$ 42,271	\$ 836,000	\$ 1,473,526
	<b>Energy Education</b>	<b>\$ 277,920</b>	<b>\$ 1,683,328</b>	<b>\$ 335,500</b>	<b>\$ 99,256</b>	<b>\$ 175,775</b>	<b>\$ 836,000</b>	<b>\$ 3,407,779</b>
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 218,898	\$ 720,000	\$ 180,000	\$ 275,678	\$ 78,361	\$ 7,992,000	\$ 9,464,936
	<b>Low-Income Energy Efficiency</b>	<b>\$ 218,898</b>	<b>\$ 720,000</b>	<b>\$ 180,000</b>	<b>\$ 275,678</b>	<b>\$ 78,361</b>	<b>\$ 7,992,000</b>	<b>\$ 9,464,936</b>
	<b>Plan Total</b>	<b>\$ 545,000</b>	<b>\$ 2,578,328</b>	<b>\$ 690,500</b>	<b>\$ 432,793</b>	<b>\$ 284,610</b>	<b>\$ 10,328,000</b>	<b>\$ 14,859,231</b>

<sup>2</sup> Plan Year terms are as follows: PY1- 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

Attachment ECM-2, Workpaper 2: Ohio ESP VI Budgets by Cost Category PY 3								
Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Smart Thermostat Rebate	Smart Thermostat Rebate	\$ 20,076	\$ 72,917	\$ 72,917	\$ 22,724	\$ 29,054	\$ 562,500	\$ 780,187
	<b>Smart Thermostat Rebate</b>	<b>\$ 20,076</b>	<b>\$ 72,917</b>	<b>\$ 72,917</b>	<b>\$ 22,724</b>	<b>\$ 29,054</b>	<b>\$ 562,500</b>	<b>\$ 780,187</b>
Energy Education	Home Energy Reports	\$ 87,952	\$ 638,887	\$ -	\$ 25,624	\$ 127,283	\$ -	\$ 879,745
Energy Education	School Education	\$ 27,848	\$ 62,500	\$ 139,792	\$ 18,563	\$ 40,302	\$ 348,333	\$ 637,338
	<b>Energy Education</b>	<b>\$ 115,800</b>	<b>\$ 701,387</b>	<b>\$ 139,792</b>	<b>\$ 44,187</b>	<b>\$ 167,585</b>	<b>\$ 348,333</b>	<b>\$ 1,517,084</b>
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 91,207	\$ 300,000	\$ 75,000	\$ 116,128	\$ 74,710	\$ 3,330,000	\$ 3,987,045
	<b>Low-Income Energy Efficiency</b>	<b>\$ 91,207</b>	<b>\$ 300,000</b>	<b>\$ 75,000</b>	<b>\$ 116,128</b>	<b>\$ 74,710</b>	<b>\$ 3,330,000</b>	<b>\$ 3,987,045</b>
	<b>Plan Total</b>	<b>\$ 227,083</b>	<b>\$ 1,074,303</b>	<b>\$ 287,708</b>	<b>\$ 183,038</b>	<b>\$ 271,349</b>	<b>\$ 4,240,833</b>	<b>\$ 6,284,316</b>

<sup>1</sup> Plan Year terms are as follows: PY1- 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

Attachment ECM-2, Workpaper 2: Ohio ESP VI Total Budgets by Cost Category								
Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Smart Thermostat Rebate	Smart Thermostat Rebate	\$ 124,199	\$ 497,917	\$ 422,917	\$ 138,400	\$ 155,807	\$ 3,412,500	\$ 4,751,739
	<b>Smart Thermostat Rebate</b>	<b>\$ 124,199</b>	<b>\$ 497,917</b>	<b>\$ 422,917</b>	<b>\$ 138,400</b>	<b>\$ 155,807</b>	<b>\$ 3,412,500</b>	<b>\$ 4,751,739</b>
		<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>	<b>\$ -</b>
Energy Education	Home Energy Reports	\$ 500,859	\$ 3,705,543	\$ -	\$ 144,436	\$ 608,147	\$ -	\$ 4,958,984
Energy Education	School Education	\$ 168,459	\$ 437,500	\$ 810,792	\$ 109,399	\$ 209,549	\$ 2,020,333	\$ 3,756,032
	<b>Energy Education</b>	<b>\$ 669,318</b>	<b>\$ 4,143,043</b>	<b>\$ 810,792</b>	<b>\$ 253,835</b>	<b>\$ 817,695</b>	<b>\$ 2,020,333</b>	<b>\$ 8,715,017</b>
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 523,567	\$ 1,740,000	\$ 435,000	\$ 671,086	\$ 356,957	\$ 19,314,000	\$ 23,040,609
	<b>Low-Income Energy Efficiency</b>	<b>\$ 523,567</b>	<b>\$ 1,740,000</b>	<b>\$ 435,000</b>	<b>\$ 671,086</b>	<b>\$ 356,957</b>	<b>\$ 19,314,000</b>	<b>\$ 23,040,609</b>
	<b>Plan Total</b>	<b>\$ 1,317,083</b>	<b>\$ 6,380,959</b>	<b>\$ 1,668,708</b>	<b>\$ 1,063,321</b>	<b>\$ 1,330,459</b>	<b>\$ 24,746,833</b>	<b>\$ 36,507,365</b>

<sup>1</sup> Plan Year terms are as follows: PY1- 12 months, PY2 - 12 months, PY3 - 5 months, Total - 29 months

**Attachment ECM-3, Workpaper 1: Ohio ESP VI - Measure Assumptions**

Program	Component	Measure	Source of Savings <sup>1</sup>	Source of Inc Cost	Source of Measure Life
Smart Thermostat Rebate	Smart Thermostat Rebate	Smart Thermostat	PA & MA TRM	PA ICD V4.0	PA TRM
Energy Education	Home Energy Reports	Home Energy Reports PY1	Vendor	N/A	Vendor
Energy Education	Home Energy Reports	Home Energy Reports PY2	Vendor	N/A	Vendor
Energy Education	Home Energy Reports	Home Energy Reports PY3	Vendor	N/A	Vendor
Energy Education	School Education	School Education	Co Assumption	Co Assumption	MA & PA TRM
Low-Income Energy Efficiency	Audit/Education, EE Products & Weatherization	LI - Audit/Education, EE Products & Weatherization	Co Assumption	Actuals	Co Assumption

<sup>1</sup> Electric, Gas, and Water

Source Key:	
MA TRM	Mid-Atlantic Technical Reference Manual
PA ICD	Pennsylvania Incremental Cost Database
PA TRM	Pennsylvania Technical Reference Manual

## Attachment ECM-4, Workpaper 1: Ohio ESP VI - Global / General Inputs

Parameter		Value	Notes
Discount Rate (All Tests)		7.23%	See calculation and sources below.
Inflation		2.00%	Assumption
CO2 from gen		1044	lb./MWh, Taken from EIA 2024 State Profile for Ohio.
CO2 tons per kWh		0.000473	Calculated (1.044 lb./kWh) / (2205 lb. / Metric Ton)
Reduced Arrearages & Collections (Low Income)		\$ 18.10	\$/MWh (\$2026), based on PA 2026 TRC Order
Water Impacts		\$ 0.01452	\$/gallon (\$2026), based on PA 2026 TRC Order
Res Line Loss Factor		1.0949	Customer Class Loss Factors
C&I Line Loss Factor		1.0701	Customer Class Loss Factors, 60% Commercial, 40% Industrial
Estimated Discount Rate for NPV Calculation		Value	Notes
(1)	LT Debt	51.00%	Case No. 07-551-EL-AIR
(2)	Common Equity	49.00%	Case No. 07-551-EL-AIR
(3)	Cost of LT Debt	5.41%	Case No. 07-551-EL-AIR
(4)	Return on Equity (After-Tax)	10.38%	Case No. 14-1297-EL-SSO
(5)	Return on Equity (Pre-Tax)	13.37%	Ln 4 / (1 - Ln 6)

## Attachment ECM-4, Workpaper 2: Ohio ESP VI - Avoided Energy

Year	On Peak	Off Peak	All Hours
2025	\$ 48.75	\$ 33.20	\$ 40.51
2026	\$ 51.77	\$ 35.98	\$ 43.40
2027	\$ 55.54	\$ 38.18	\$ 46.34
2028	\$ 57.43	\$ 39.40	\$ 47.87
2029	\$ 58.25	\$ 39.96	\$ 48.55
2030	\$ 59.38	\$ 40.73	\$ 49.50
2031	\$ 61.01	\$ 41.85	\$ 50.85
2032	\$ 62.81	\$ 43.09	\$ 52.36
2033	\$ 64.58	\$ 44.30	\$ 53.83
2034	\$ 66.45	\$ 45.58	\$ 55.39
2035	\$ 67.88	\$ 46.56	\$ 56.58
2036	\$ 69.57	\$ 47.72	\$ 57.99
2037	\$ 71.39	\$ 48.97	\$ 59.50
2038	\$ 73.37	\$ 50.33	\$ 61.16
2039	\$ 75.21	\$ 51.59	\$ 62.69
2040	\$ 77.35	\$ 53.05	\$ 64.47
2041	\$ 79.47	\$ 54.51	\$ 66.24
2042	\$ 81.51	\$ 55.91	\$ 67.94
2043	\$ 83.42	\$ 57.22	\$ 69.54
2044	\$ 85.60	\$ 58.72	\$ 71.35
2045	\$ 87.90	\$ 60.29	\$ 73.27
2046	\$ 89.71	\$ 61.53	\$ 74.78
2047	\$ 91.60	\$ 62.83	\$ 76.36
2048	\$ 93.44	\$ 64.09	\$ 77.89
2049	\$ 95.19	\$ 65.30	\$ 79.35
2050	\$ 96.68	\$ 66.32	\$ 80.59

For the years 2025 through 2028, the avoided energy supply costs are PJM day-ahead futures in units of nominal \$/MWh for the ATSI zone, reported separately for on-peak and off-peak periods for each month of the year.

Beginning in 2029, the avoided ~~generation~~ energy supply costs are escalated based on the U.S. Energy Information Administration Annual Energy Outlook, March 2023 Report (EIA 2023 AEO).

Sources:

ATSI Forward prices come from the ICE ZEMA tables. These are based on the November 1, 2024 forecast. <https://www.theice.com>

Escalation based on the EIA 2023 AEO, Table 54, Reference case for the PJM West Region, Residential Electricity prices in nominal \$.

**Attachment ECM-4, Workpaper 3: Ohio ESP VI - Avoided Capacity**

Year	Capacity \$/kW
2025	\$ 170.22
2026	\$ 180.79
2027	\$ 119.86
2028	\$ 124.63
2029	\$ 129.59
2030	\$ 134.75
2031	\$ 140.12
2032	\$ 145.70
2033	\$ 151.50
2034	\$ 157.53
2035	\$ 163.80
2036	\$ 170.32
2037	\$ 177.10
2038	\$ 184.15
2039	\$ 191.48
2040	\$ 199.10
2041	\$ 207.03
2042	\$ 215.27
2043	\$ 223.84
2044	\$ 232.75
2045	\$ 242.01
2046	\$ 251.65
2047	\$ 261.67
2048	\$ 272.08
2049	\$ 282.91
2050	\$ 294.18

The avoided generation capacity costs are based on results of recent PJM BRA Auctions. Through May 31, 2026 the forecast is based on the auction results. Beginning the following PJM year, the 5-year Auction average price from PJM Calendar Years 2021-2022 through 2025-2026 is used. Starting in June 1, 2026, the 5 year Auction average price is escalated using the average escalator derived from the ten years ending 2022 average historical Handy Wittman values for "Total Steam Production Plant: North Atlantic Region".

Sources:

Historical Capacity prices:  
<http://www.pjm.com/markets-and-operations/rpm.aspx>

Handy Wittman values:  
<https://www.pjm.com/-/media/committees-groups/subcommittees/cds/postings/handy-whitman-index.ashx>

**Attachment ECM-4, Workpaper 4: Ohio ESP VI - Avoided T&D**

<b>Year</b>	<b>Avoided Transmission, \$/kW</b>	<b>Avoided Distribution, \$/kW</b>
2025	\$ 14.24	\$ 21.03
2026	\$ 14.66	\$ 21.66
2027	\$ 15.10	\$ 22.31
2028	\$ 15.56	\$ 22.98
2029	\$ 16.02	\$ 23.67
2030	\$ 16.50	\$ 24.38
2031	\$ 17.00	\$ 25.12
2032	\$ 17.51	\$ 25.87
2033	\$ 18.03	\$ 26.65
2034	\$ 18.57	\$ 27.44
2035	\$ 19.13	\$ 28.27
2036	\$ 19.70	\$ 29.12
2037	\$ 20.30	\$ 29.99
2038	\$ 20.90	\$ 30.89
2039	\$ 21.53	\$ 31.82
2040	\$ 22.18	\$ 32.77
2041	\$ 22.84	\$ 33.75
2042	\$ 23.53	\$ 34.77
2043	\$ 24.23	\$ 35.81
2044	\$ 24.96	\$ 36.88
2045	\$ 25.71	\$ 37.99
2046	\$ 26.48	\$ 39.13
2047	\$ 27.28	\$ 40.30
2048	\$ 28.09	\$ 41.51
2049	\$ 28.94	\$ 42.76
2050	\$ 29.81	\$ 44.04

Avoided transmission and distribution (T&D) costs are derived from the Avoided T&D Cost Study completed by Harbourfront Associates. Harbourfront worked with the Companies to identify specific T&D investments for a given period that, potentially, could be avoided, deferred or downsized as a result of reductions in growth in peak demand. The study included separate transmission and distribution avoided costs for each of the three Ohio operating companies. The avoided costs in the EEC/PDR Plan represent a weighted average over the three operating companies, based on number of customers. The study results are escalated at 3% per year.

**Attachment ECM-4, Workpaper 5: Ohio ESP VI - Natural Gas**

<b>Year</b>	<b>Avoided Natural Gas, \$/mmBTU</b>	
2025	\$	14.24
2026	\$	14.66
2027	\$	15.10
2028	\$	15.56
2029	\$	16.02
2030	\$	16.50
2031	\$	17.00
2032	\$	17.51
2033	\$	18.03
2034	\$	18.57
2035	\$	19.13
2036	\$	19.70
2037	\$	20.30
2038	\$	20.90
2039	\$	21.53
2040	\$	22.18
2041	\$	22.84
2042	\$	23.53
2043	\$	24.23
2044	\$	24.96
2045	\$	25.71
2046	\$	26.48
2047	\$	27.28
2048	\$	28.09
2049	\$	28.94
2050	\$	29.81

For the years 2025 through 2028, the avoided natural gas forecast uses the forwards for the Eastern Gas-South Region.

For the years 2029 through 2050, the avoided natural gas costs are escalated based on the escalation of the long term residential natural gas price projections in the Department of Energy, Energy Information Administration’s 2023 Annual Energy Outlook (EIA AEO 2023), Reference Case, for the East North Central Region (Table 53).

Sources:  
 Eastern Gas-South Region Forward prices come from the ICE ZEMA tables. These are based on the November 1, 2024 forecast. <https://www.theice.com>



Attachment ECM-4, Workpaper 6: Ohio ESP VI - GHG

Year	Amount
2025	\$ 83.00
2026	\$ 84.16
2027	\$ 85.34
2028	\$ 86.54
2029	\$ 87.75
2030	\$ 89.00
2031	\$ 90.34
2032	\$ 91.69
2033	\$ 93.07
2034	\$ 94.46
2035	\$ 96.00
2036	\$ 97.34
2037	\$ 98.71
2038	\$100.09
2039	\$101.49
2040	\$103.00
2041	\$104.44
2042	\$105.90
2043	\$106.89
2044	\$108.23
2045	\$110.00
2046	\$110.91
2047	\$112.26
2048	\$113.60
2049	\$114.94
2050	\$116.00

Benefits associated with greenhouse gas (CO<sub>2</sub>) reduction are taken from Table ES-1 (for 2.5% discount rate) from the Interagency Working Group of the United States Government report:

*Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990.*

The report provides projections at 5-year intervals, from which annual values are linearly interpolated.

**Technical Support Document: Social Cost of Carbon, Methane, and Nitrous Oxide Interim Estimates under Executive Order 13990**

Interagency Working Group on Social Cost of Greenhouse Gases, United States Government

With participation by

- Council of Economic Advisers
- Council on Environmental Quality
- Department of Agriculture
- Department of Commerce
- Department of Energy
- Department of Health and Human Services
- Department of the Interior
- Department of Transportation
- Department of the Treasury
- Environmental Protection Agency
- National Climate Advisor
- National Economic Council
- Office of Management and Budget
- Office of Science and Technology Policy

February 2021

Table ES-1: Social Cost of CO<sub>2</sub>, 2020 – 2050 (in 2020 dollars per metric ton of CO<sub>2</sub>)<sup>3</sup>

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95 <sup>th</sup> Percentile
2020	14	51	76	152
2025	17	56	83	169
2030	19	62	89	187
2035	22	67	96	206
2040	25	73	103	225
2045	28	79	110	242
2050	32	85	116	260