

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)
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)

Case No. 23-301-EL-SSO

DIRECT TESTIMONY OF

EDWARD C. MILLER

ON BEHALF OF

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

April 5, 2023

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, PA 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 and peak demand reduction programs
10 (“EE/PDR”) for the FirstEnergy Corp. (“FirstEnergy”) operating utilities in Ohio,
11 Maryland, New Jersey, Pennsylvania, and West Virginia. This primarily involves the
12 development of programs and filings to meet the FirstEnergy operating utilities’ EE/PDR
13 requirements and objectives in the various states. I was responsible for overseeing the team
14 that designed and developed the programs included in the Ohio EE/PDR plans of Ohio
15 Edison Company, The Cleveland Electric Illuminating Company, and The Toledo Edison
16 Company (collectively, “Companies”), that were previously approved by the Commission
17 in Case Nos. 12-2190-EL-POR *et al.* for the Ohio 2013–2015 EE/PDR Plans and in Case
18 No. 16-0743-EL-POR for the Ohio 2017–2019 EE/PDR Plans.

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

20 A. I hold a Bachelor of Science degree in Electrical Engineering from the University of
21 Pittsburgh. For over seventeen years, I was employed by Allegheny Energy Service
22 Corporation, the service company for Allegheny Energy Inc. (“Allegheny”), which merged
23 in 2011 with FirstEnergy. While with Allegheny, I held various engineering, customer

1 service and management positions in the Customer Service, Sales & Marketing, Customer
2 Management, and Energy Efficiency departments. In the Energy Efficiency department, I
3 was involved in the development of EE/PDR programs and filings for the utilities formerly
4 owned by Allegheny in Pennsylvania, Maryland, and West Virginia. After FirstEnergy
5 and Allegheny merged in 2011, I moved into my current position as Manager, Compliance
6 & Development where I have been involved in similar activities for the FirstEnergy utilities
7 in West Virginia, Maryland, Ohio, Pennsylvania, and New Jersey.

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

10 A. Yes. FESC's Energy Efficiency Department designs and implements the Companies'
11 energy efficiency programs. The FESC Energy Efficiency Department has been designing
12 and implementing EE/PDR program portfolio plans across the various operating
13 companies and jurisdictions in the FirstEnergy footprint since 2008. In Pennsylvania
14 ("PA"), these include the Energy Efficiency and Conservation ("EE&C") portfolio plans
15 the four FirstEnergy utilities filed at the Pennsylvania Public Utility Commission during
16 2009, with implementation beginning in 2010 to reduce energy demand and consumption
17 for the period June 1, 2010 through May 31, 2013 ("Phase I"). Since that time, the FESC
18 Energy Efficiency Department has successfully designed, filed, and implemented EE&C
19 portfolio plans for Phases II, III and IV for the FirstEnergy PA utilities, spanning the time
20 period from June 1, 2013 through May 31, 2025. In Maryland ("MD"), the FESC Energy
21 Efficiency Department designed for The Potomac Edison Company an EE&C portfolio
22 plan that was filed in 2008 and implemented beginning in 2009. Since that time, the FESC
23 Energy Efficiency Department has designed four additional EE&C portfolio plans which

1 The Potomac Edison Company has filed and implemented. In Ohio (“OH”), the FESC
2 Energy Efficiency Department designed the programs included in the FirstEnergy Utilities’
3 OH EE/PDR portfolio plans that were approved by the Commission in Case Nos. 09-1947-
4 EL-POR, 09-1948-EL-POR, and 09-1949-EL-POR for the period 2010 through 2012, Case
5 Nos. 12-2190-EL-POR *et al.* for the 2013–2015 EE/PDR portfolio plans and in Case No.
6 16-0743-EL-POR for the 2017-2019 EE/PDR portfolio plans. In West Virginia (“WV”),
7 the FESC Energy Efficiency Department designed Phase I and Phase II EE&C portfolio
8 plans that were implemented for the two FirstEnergy utilities during the period 2012 to
9 2018. In New Jersey (“NJ”), the FESC Energy Efficiency Department designed and filed
10 an EE&C portfolio plan in 2020 for Jersey Central Power & Light Company that was
11 implemented beginning in 2021. Since 2009, FESC Energy Efficiency Department has
12 managed over \$1.6 billion of energy efficiency programs collectively across the
13 FirstEnergy utilities.

14 **Q. HAVE YOU PREVIOUSLY TESTIFIED IN PROCEEDINGS BEFORE THE**
15 **PUBLIC UTILITIES COMMISSION OF OHIO?**

16 A. Yes. I have provided testimony before this Commission, as well as before the
17 Pennsylvania Public Utility Commission, the West Virginia Public Service Commission,
18 the Maryland Public Service Commission, and to the New Jersey Board of Public Utilities.

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

20 A. The purpose of my testimony is to describe the EE/PDR programs included in the
21 Companies’ Application and to quantify how those programs will benefit customers.

1 **Q. PLEASE SUMMARIZE YOUR TESTIMONY.**

2 A. The Companies are proposing a four-year plan (“EE/PDR Plan”) including five different
3 programs. Four of the programs benefit residential customers and one benefits commercial
4 and industrial customers. The residential programs include: (1) Residential Rebates; (2)
5 Energy Education; (3) Low Income Energy Efficiency; and (4) Demand Response for
6 Residential. The commercial and industrial program includes: (1) Energy Solutions for
7 Business.

8 The five energy efficiency and demand response programs are anticipated to have
9 an average annual total cost of \$72.1 million over the initial 4-year term of the EE/PDR
10 Plan. Those costs are outweighed by the \$637.9 million in estimated total benefits¹ over
11 the lifetime of the measures associated with these programs.

12 The Companies will evaluate the performance of the EE/PDR Plan prior to the end
13 of the initial 4-year term of the EE/PDR Plan, including through discussions with a
14 collaborative group as discussed below. After the Companies complete their evaluation of
15 the performance of the EE/PDR Plan the Companies may make a separate filing with the
16 Commission seeking approval to extend, modify, or cease these programs or implement
17 additional EE/PDR programs during the term of ESP V.

18 **Q. ARE YOU SPONSORING ANY ATTACHMENTS AND SUPPORTING**
19 **WORKPAPERS?**

20 A. Yes. I am supporting the following attachments that provide information for the
21 Companies’ proposed energy efficiency and demand response programs:

- 22
 - Attachment ECM-1, a chart showing the program descriptions;

¹ Total benefits calculated under the Total Resource Cost Test as shown in Attachment ECM-4.

- 1 • Attachment ECM-2, a chart showing the projected energy and demand savings and
2 budgets;
- 3 • Attachment ECM-3, a chart that provides the measures included in each program,
4 measure level participation and the measure assumptions; and
- 5 • Attachment ECM-4, a chart showing the projected benefits and costs, and benefit
6 cost ratios, under the Total Resource Cost (“TRC”) test, the Societal Cost Test
7 (“SCT”), and the Utility Cost Test (“UCT”).

9 **II. PROPOSED EE/PDR PROGRAMS**

10 **Q. WHAT IS THE COMPANIES’ POSITION ON ENERGY EFFICIENCY?**

11 A. The Companies fully support energy efficiency and recognize the numerous benefits of
12 providing energy efficiency programs to our customers. The Companies strongly believe
13 in providing energy efficiency programs to help our customers, help our communities, and
14 help our environment. Our belief in the benefits and commitment to providing energy
15 efficiency programs is widely echoed across the industry and government. As cited by
16 ENERGY STAR,² “Energy efficiency is one of the easiest ways to eliminate energy waste
17 and lower energy costs. It is also one of the most cost-effective ways to combat climate
18 change, clean the air we breathe, help families meet their budgets, and help businesses
19 improve their bottom lines.” Simply put, energy efficiency saves money, protects the
20 environment, and helps address energy equity.

² 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 (EPA). 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 **Q. WHAT WERE THE COMPANIES' OBJECTIVES IN DEVELOPING THE FIVE**
2 **ENERGY EFFICIENCY PROGRAMS PROPOSED IN THIS APPLICATION?**

3 A. The Companies developed the program proposals with the objectives of providing program
4 opportunities to all customer sectors, that are cost-effective, and that come at a reasonable
5 cost. As the customer's electric utility, the Companies are uniquely situated to educate,
6 promote, and provide energy efficiency programs to achieve the benefits provided by the
7 programs. The overarching objectives of the programs are to engage with customers,
8 educate customers, and promote adoption of EE/PDR.

9 The Companies designed the residential programs for both shopping and non-
10 shopping customers to: (1) address educational barriers; (2) address cost barriers; and (3)
11 tap a variety of delivery channels and vendors. The overall purpose of the residential
12 programs is to support customer engagement, education, and participation. The residential
13 programs include direct or targeted offerings that engage customers and serve as a portal
14 for other program offerings because they serve a dual purpose of providing customers with
15 both energy efficiency education and information regarding other program services and
16 opportunities upon which they can act. The residential programs incorporate strategies to
17 change behaviors and include incentives to address the cost barrier to promote the
18 participation of residential customers.

19 The residential programs also acknowledge that within the residential sector is a
20 special sub-sector of low-income customers. The residential and low-income program
21 offerings are also designed with a progression from general to specific to make energy
22 efficiency programs and services available to low-income customers.

1 Like the residential programs, the commercial and industrial programs were
2 designed to provide customer engagement and education. The commercial and industrial
3 programs were also designed to incorporate incentives to address the cost barrier. These
4 programs will reduce and optimize energy usage to promote the participation of customers.
5 Commercial businesses and industrial customers are addressed through programs that
6 include specific opportunities that ensure access for commercial and industrial customers
7 by providing opportunities for the range of single or multiple standard and/or custom
8 measures or projects.

9
10 **III. FURTHERANCE OF STATE AND FEDERAL POLICIES**

11 **Q. WHY IS EE/PDR IMPORTANT TO THE COMPANIES AND WORTHY OF**
12 **INCLUSION IN THIS ESP?**

13 A. The Companies believe that EE/PDR programs can provide significant benefits to
14 customers. As explained in detail below, the EE/PDR programs provide hundreds of
15 millions of dollars in benefits to customers. The programs are largely targeted at residential
16 and small and medium sized business customers who will directly benefit through lower
17 bills as they use less power, and over the longer term will indirectly benefit through peak
18 demand reductions.

19 The Companies are uniquely situated to provide these programs. While larger
20 business customers, including customer accounts served at the GP, GSU, or GT rate
21 schedules, accounts using 700,000 or more kWh per year, or corporate entities with 35 or
22 more accounts within FirstEnergy Ohio's combined service territory (collectively referred
23 to as "Large Customers") may have numerous options available to them to undertake

1 energy efficiency or demand reduction initiatives, residential and small and medium
2 business customers do not necessarily have that same access, time, awareness, or ability to
3 fund and pursue such projects. Therefore, the Companies' programs are largely targeted
4 at residential and small and medium business customers who do not have those same
5 opportunities. Large Customers are not harmed in any way through these programs
6 because they will have the ability to opt-out of these programs as discussed later in my
7 testimony.

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

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

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

Policy Objective	EE/PDR Plan Contribution
(A) Ensure the availability to consumers of adequate, safe, efficient, nondiscriminatory, and reasonably priced retail electric service	<ul style="list-style-type: none"> • Increasing customers' home or business energy efficiency while also reducing demand helps to ensure reasonable cost of energy. • Helping customers manage their peak demand further ensuring adequate and efficient service.
(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"> • Designed to provide incentives for cost-effective EE/PDR technologies that will reduce consumption and encourage appropriate disposal of appliances.
(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"> • Low-income programs which will provide savings to at-risk populations while educating them about energy-related issues.
(M) Encourage the education of small business owners in this state regarding the use of, and encourage the use of, energy efficiency programs and alternative energy resources in their businesses	<ul style="list-style-type: none"> • Educational programs targeted at small business owners, energy efficiency audits, and direct incentives to support the use of energy efficiency programs.
(N) Facilitate the state's effectiveness in the global economy	<ul style="list-style-type: none"> • Contributes to economic development through a focus on reducing the cost of energy efficiency products and services, improving the energy efficiency of businesses and making customers more competitive. • Adds a benefit for new business and industry considering local communities within the Companies' service territory.

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

3 A. The newly passed Inflation Reduction Act (“IRA”) provides funding for energy efficiency
4 improvements to Ohio. The EE/PDR Plan will be used to raise customer awareness of
5 available IRA rebates and tax credits. The Companies will work to help customers take
6 advantage of these rebates and tax credits. The combination of the IRA rebates and tax
7 credits and incentives available through the Companies’ EE/PDR Plan will further entice
8 customers to improve their overall energy efficiency, particularly in areas that require
9 significant investment.

10 For example, upgrades of certain equipment such as water heaters and HVACs
11 typically require thousands of dollars to replace and more to upgrade the efficiency of the
12 new unit. The Companies therefore are proposing to provide incentives for this equipment
13 to support the efficient upgrade. Through the EE/PDR Plan, the Companies will
14 incentivize an average of over 2,000 efficient heat pump installations and 1,400 heat pump
15 water heaters for residential customers annually.

16 Residential upgrades such as heat pump clothes dryers and induction cooking are
17 also included in the plan. The Companies’ proposed incentives will also help defray the
18 cost of efficient upgrades and will assist Ohio customers in combating rising energy costs.
19 As more details emerge about how the IRA will be implemented in Ohio, the Companies
20 will work to educate customers about both the IRA opportunities and funds available
21 through the EE/PDR programs to further promote participation in efficiency opportunities.

1 **IV. RESIDENTIAL SECTOR PROGRAMS**

2 **1. RESIDENTIAL REBATE**

3 **Q. PLEASE DESCRIBE THE “RESIDENTIAL REBATE” PROGRAM AND HOW IT**
4 **WILL BE IMPLEMENTED.**

5 A. This program will incentivize residential adoption of appliances which are energy efficient.
6 The Companies will provide enhanced rebate opportunities within the Residential Rebate
7 program to further promote energy efficiency in low-income homes and achieve additional
8 energy savings opportunities. The Companies will identify qualified ENERGY STAR
9 appliances, heat pumps, smart thermostats (incremental to what are being promoted under
10 the Companies’ Grid Mod II proposal), and other energy-efficient electric equipment for
11 residential customers including electric vehicle chargers, water coolers and induction
12 cooking equipment as listed under Attachment ECM-3 and other energy efficient measures
13 that the Companies identify throughout implementation of the programs that leverages
14 available program budgets to maximize the benefits of the program to customers
15 (“Residential Qualified Equipment”).

16 The Companies will promote the purchase of Residential Qualified Equipment by
17 offering rebates and discounts that will also reduce cost barriers for program eligible
18 products. Additionally, the Companies will provide enhanced rebate opportunities to
19 further promote energy efficiency in low-income homes and achieve additional energy
20 savings opportunities from this special subsector of customers. Rebate amounts will be
21 determined based on FirstEnergy’s experience in other states, industry experience, and the
22 incremental cost of the measure. The program may also include the opportunity for
23 customers to purchase equipment at no up-front cost such as through special campaigns for

1 select products. The Companies will also incentivize customers through appliance
2 recycling programs to turn-in and recycle older inefficient working appliances to remove
3 these from service.

4 The currently budgeted rebate amounts are shown on Attachment ECM-3. As
5 discussed above, the rebate amounts will be established and may change based on market
6 conditions and equipment tiers. For example, the Companies currently budget \$1,000 for
7 a rebate for energy efficient Heat Pumps-Air Source. That rebate amount may be increased
8 or decreased throughout implementation of the plan based on a variety of market factors,
9 including price changes and customer participation. The Companies reserve the right to
10 adjust rebates as needed to optimize the efficiency opportunities to customers.

11 Customers will be able to purchase Residential Qualified Equipment through a
12 variety of channels, including but not limited to downstream rebates (including but not
13 limited to in-store or online), reduced point of sale costs, and through an on-line website.

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

15 A. The Companies will contract with implementation vendors who will directly administer
16 and manage delivery of the program and provide program services. Implementation
17 activities include marketing the program through multiple channels, validating customer
18 eligibility, processing incentives, and conducting outreach to and securing partnerships
19 with retailers, wholesalers, distributors, manufacturers and/or trade allies, where
20 applicable, to ensure customers can easily purchase eligible energy efficient equipment
21 through the program.

22 Appliance recycling will be delivered through an implementation vendor that
23 specializes in proper appliance recycling. The vendor will be responsible for marketing,

1 scheduling appointments or special events, picking up/recycling of qualified working
2 appliances, processing rebates, and handling customer inquiries. Each unit collected is
3 disposed of in an environmentally responsible way, in compliance with the EPA's
4 Responsible Appliance Disposal ("RAD") criteria.

5 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**
6 **COSTS ASSOCIATED WITH THE RESIDENTIAL REBATE PROGRAM?**

7 A. As shown in Attachment ECM-2, the Residential Rebate program is projected to provide
8 44,296 MWh in average incremental annual energy savings, 7.3 MW in average
9 incremental annual demand savings, and \$8.0 million in average annual incentives to
10 customers, at an average annual total cost of \$17.9 million over the 4-year term of the
11 EE/PDR Plan.

12 This estimate assumes that approximately 388,000 customers, based on one
13 measure per customer, will be able to participate in the Residential Rebate program during
14 the 4-year term of the EE/PDR Plan.

15 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**
16 **THE RESIDENTIAL REBATE PROGRAM?**

17 A. Yes, the total benefits of this program under each methodology are: TRC- \$90,031,167;
18 SCT- \$147,225,480; and UCT- \$90,031,167. See Attachment ECM-4 for the costs and
19 benefit cost ratios under each test for this program.

1 **2. ENERGY EDUCATION**

2 **Q. PLEASE DESCRIBE THE “ENERGY EDUCATION” PROGRAM AND HOW IT**
3 **WILL BE IMPLEMENTED.**

4 A. The Energy Education program engages and educates residential customers about energy
5 efficiency and conservation through the combination of Home Energy Reports and School
6 Education. Through the Energy Education program, the Companies will provide school
7 education, and customized home energy reports that provide customers with basic energy
8 savings measures and/or energy efficiency education, recommendations, and information
9 regarding other services upon which they can act.

10 The Home Energy Reports component of this program educates customers
11 regarding their home energy usage and provides recommendations to undertake energy
12 efficiency and conservation measures to reduce their energy usage. This program
13 component provides monthly customized Home Energy Reports about each customer’s
14 energy usage, as well as analysis regarding their usage over time, with specific tips and
15 recommendations that promote energy efficiency and conservation opportunities and
16 programs available to them. The Companies will also provide customized Home Energy
17 Reports that provide low-income customers with energy efficiency education,
18 recommendations, and information regarding other low to no cost program opportunities
19 available to them. Home Energy Reports help customers to understand how their energy
20 consumption compares to similarly sized and equipped homes, and to their own home year
21 over year, and to identify opportunities to reduce their energy use. Home Energy Reports
22 will complement similar programs proposed by the Companies targeted at Advanced

1 Metering Infrastructure (“AMI”) customers who have provided the Companies with their
2 email addresses.

3 Under this program, Home Energy Reports will be mailed to customers who have
4 not provided their email addresses to the Companies. AMI customers who provided their
5 email addresses will be targeted under the Customer Energy Management program as
6 included in the Companies’ Grid Mod II proposal. This coordination of similar program
7 offerings will collectively achieve very broad and far-reaching customer engagement that
8 promotes and achieves energy efficiency education and savings opportunities with
9 residential customers.

10 The School Education component of this program provides energy efficiency
11 education and awareness intended to encourage conservation at home. This is a classroom-
12 based education program that is delivered by educators in schools. Those educators will
13 utilize simple energy efficiency measures that customers can install by themselves to better
14 promote adoption of energy efficiency. They will also more broadly encourage
15 conservation mindsets and measures by having the students work with their families.

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

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

21 A. The Companies will contract with implementation vendors who will directly administer
22 and manage delivery of the program and providing program services. The implementation
23 vendor for the Home Energy Reports component will conduct the energy usage analysis,

1 develop, and deliver customized home energy reports to customers. The implementation
2 vendor will also provide online functionality that customers can easily utilize to see
3 additional tips on how to save energy and review their historical usage.

4 The implementation vendor for the School Education component will be
5 responsible for developing an implementation plan that involves marketing activities to
6 target schools to inform them of the offering, components, and benefits and to achieve
7 program buy-in from school administration. The implementation vendor will develop
8 educational materials to support delivery, such as student curriculum with energy
9 conservation lessons and teacher materials for classroom instruction. The implementation
10 vendor will also provide energy efficiency measures during program delivery that will be
11 utilized to introduce simple retrofit measures that students can work with at home with
12 their parent's involvement.

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

15 A. As shown in Attachment ECM-2, the Energy Education program is projected to provide
16 32,952 MWh in average incremental annual energy savings, 5.8 MW in average
17 incremental annual demand savings, and \$1.1 million in average annual incentives to
18 customers, at an average annual total cost of \$3.6 million over the 4-year term of the
19 EE/PDR Plan.

20 This estimate assumes that approximately 291,900 customers will be able to
21 participate in the Energy Education program during the 4-year term of the EE/PDR Plan.

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

3 A. Yes. The total benefits of this program under each methodology are: TRC- \$18,561,585;
4 SCT- \$30,994,255; and UCT- \$18,240,639. *See* Attachment ECM-4 for the costs and
5 benefit cost ratios under each test for this program.

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

7 **Q. PLEASE DESCRIBE THE “LOW-INCOME ENERGY EFFICIENCY”**
8 **PROGRAM AND HOW IT WILL BE IMPLEMENTED.**

9 A. The Low-Income Energy Efficiency program is a continuation of the existing Community
10 Connections program. It is intended to provide energy efficiency programming for
11 customers up to 200% of the federal poverty level. The Companies propose to leverage
12 the considerable expertise and existing infrastructure of Community Based Organizations
13 (“CBOs”) and private contractors supporting the Community Connections program. This
14 long-standing and successful program has offered comprehensive energy efficiency
15 services to eligible Ohio households for years. Through this program, education as well as
16 basic to comprehensive services will be provided to minimize the percentage of household
17 income that is devoted to energy costs to give low-income households more control over
18 their energy spending.

19 The Low-Income Energy Efficiency program provides an opportunity for income
20 eligible customers to receive energy efficiency measures and upgrades at no additional
21 cost. Income eligible customers will undergo an energy efficiency audit and then receive
22 direct install and weatherization measures as a comprehensive approach to improve the
23 efficiency of the home. During the audit, customers will receive installation of direct install

1 measures such as LED lighting, energy-saving aerators, showerheads, smart thermostats,
2 and smart power strips. Customers will also receive energy education, behavioral
3 recommendations, and adjustment of thermostat and water heating setpoints to improve
4 efficiency of the home. Based on the audit, the customer may also be given the opportunity
5 for additional comprehensive building envelope measures (such as insulation, air sealing,
6 and duct sealing) to be installed. Homeowners with nonfunctional heating and/or cooling
7 systems may also be eligible to receive repairs or replacement at no additional cost. The
8 program will include a cap on each project with additional funding for health and safety
9 expenses.

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

11 A. The Companies will contract with an implementation vendor who will directly administer
12 and manage delivery of the program and provide program services to customers.
13 Implementation activities will include, where applicable, efforts to raise awareness of the
14 program, outreach, enrollment, fulfillment of program delivery, on-going refinements to
15 the program-provided services, validating customer eligibility, and conducting outreach to
16 and securing partnerships with trade allies to ensure customers are able to easily participate
17 in the program.

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

1 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**
2 **COSTS ASSOCIATED WITH THE LOW-INCOME ENERGY EFFICIENCY**
3 **PROGRAM?**

4 A. As shown in Attachment ECM-2, the Low-Income Energy Efficiency program is projected
5 to provide 5,382 MWh in average incremental annual energy savings, 0.8 MW in average
6 incremental annual demand savings, and \$7.4 million in average annual incentives to
7 customers, at an average annual total cost of \$8.6 million over the 4-year term of the
8 EE/PDR Plan. This represents an increase of approximately \$2 million annually to provide
9 program services to additional income qualified customers and provide greater benefits
10 under this program.

11 This estimate assumes that approximately 14,800 income qualified customers will
12 be able to participate in the Low-Income Energy Efficiency program during the 4-year term
13 of the EE/PDR Plan.

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

16 A. Yes. The total benefits of this program under each methodology are: TRC- \$16,476,169;
17 SCT- \$26,897,200; and UCT- \$16,476,169. See Attachment ECM-4 for the costs and
18 benefit cost ratios under each test for this program.

19 **4. DEMAND RESPONSE FOR RESIDENTIAL**

20 **Q. PLEASE DESCRIBE THE “DEMAND RESPONSE FOR RESIDENTIAL”**
21 **PROGRAM AND HOW IT WILL BE IMPLEMENTED.**

22 A. The Demand Response for Residential program includes a Behavioral component and a
23 Load Control component.

1 The Companies intend to engage a vendor to provide the Behavioral Demand
2 Response component to eligible AMI customers. The Behavioral Demand Response
3 component will provide notification messages to motivate customers with smart meters
4 installed to reduce usage during peak demand days. Customers will be provided notice via
5 email or telephone on a day ahead basis prior to peak days, referred to as a peak demand
6 event. This component will also provide post-event feedback to the customers about their
7 usage performance during the event, with normative comparisons to other customers, and
8 recommendations to reinforce their usage reduction behaviors in future events. Customers
9 will not be provided any financial incentive to participate in this program or assessed any
10 penalties if they fail to modify their usage on identified dates.

11 Unlike the Behavioral Demand Response component that targets customers with
12 AMI, the Load Control Demand Response component targets customers with program
13 eligible connected devices and does not require AMI. Customers who elect to join the
14 program will agree that a vendor selected by the Companies will be permitted to control,
15 cycle and/or optimize the use of their air conditioner or potentially other equipment through
16 a program eligible connected device. The program will initially include customers' smart
17 thermostats for control of air conditioning, and potentially electric vehicle charging or other
18 equipment to optimize the use of and reduce load of connected devices during peak demand
19 days. The customers will be provided an incentive for initially enrolling in the program
20 and an additional incentive for their ongoing enrollment and participation in the program.
21 The program will allow customers to override the control of their connected devices and
22 does not include any financial penalties for non-performance.

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

2 A. The Companies will contract with implementation vendors who will directly administer
3 and manage delivery of the program and provide program services. The implementation
4 vendor for the Behavioral Demand Response component will be required to market the
5 program to eligible customers, develop and provide notification messages to customers
6 with smart meters to promote their participation, and to analyze customer usage during the
7 event and provide post-event feedback.

8 The implementation vendor for the Load Control Demand Response component
9 will develop an implementation plan that involves marketing activities to target and
10 conduct outreach to customers to inform them of the program offering, components,
11 benefits, and to achieve program buy-in and participation. The implementation vendor will
12 also develop and provide educational materials to support delivery of this program,
13 including promotional brochures and presentation as well as promote the installation of
14 qualified products to customers.

15 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**
16 **COSTS ASSOCIATED WITH THE DEMAND RESPONSE FOR RESIDENTIAL**
17 **PROGRAM?**

18 A. As shown in Attachment ECM-2, the Demand Response for Residential program is
19 projected to provide 5,932 MWh in average incremental annual energy savings, 29.7 MW
20 in average annual demand savings, and \$1.2 million in average annual incentives to
21 customers, at an average annual total cost of \$3.5 million over the 4-year term of the
22 EE/PDR Plan.

1 This estimate assumes that approximately 288,500 customers will be able to
2 participate in the Demand Response for Residential program during the 4-year term of the
3 EE/PDR Plan.

4 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**
5 **THE DEMAND RESPONSE FOR RESIDENTIAL PROGRAM?**

6 A. Yes. The total benefits of this program under each methodology are: TRC- \$17,060,109;
7 SCT- \$18,165,768; and UCT- \$17,060,109. *See* Attachment ECM-4 for the costs and
8 benefit cost ratios under each test for this program.

9
10 **V. COMMERCIAL AND INDUSTRIAL SECTOR PROGRAMS**

11 **1. ENERGY SOLUTIONS FOR BUSINESS**

12 **Q. PLEASE DESCRIBE THE “ENERGY SOLUTIONS FOR BUSINESS” PROGRAM**
13 **AND HOW IT WILL BE IMPLEMENTED.**

14 A. The Energy Solutions for Business program has three components: (1) a rebate program
15 for prescriptive equipment; (2) incentives for “custom” equipment or projects intended to
16 address commercial and industrial customer equipment or projects which are not covered
17 by prescriptive equipment rebates; and (3) energy audits.

18 The Energy Solutions for Business rebate component will operate in essentially the
19 same manner as the Residential Rebate. The only difference is that the Energy Solutions
20 for Business rebate component includes energy efficient equipment utilized by the business
21 community, such as commercial lighting equipment, commercial heat pump equipment,
22 and food service equipment. The program will provide downstream rebates to customers
23 through various approaches described below and may also provide midstream or upstream

1 incentives or buydowns and support to manufacturers, distributors, contractors, and
2 retailers that sell select energy efficient equipment to business customers.

3 In addition to the “prescriptive” equipment rebates noted above, the Energy
4 Solutions for Business program also provides incentives for “custom” equipment or
5 projects. Custom equipment or projects includes equipment or projects where the energy
6 savings are variable for the equipment or project on an application or case-by-case basis.
7 The Energy Solutions for Business custom component will encourage customers to retrofit
8 or install specialized equipment, processes and applications (variable frequency drives,
9 process improvements, compressed air improvements, motors, refrigeration, servers, and
10 electronics, etc.) to reduce both customer energy usage and demand. Performance
11 incentives, an incentive per kWh of energy savings, will be provided to customers for the
12 installation of energy efficient custom equipment and projects.

13 The energy audits component of the Energy Solutions for Business program will
14 provide customers with an incentive for completing a detailed energy management audit
15 and other analyses that focus on the energy use of the business including buildings and
16 equipment, with the overall goal of installing more efficient equipment, improving the
17 energy efficiency of the buildings and providing business customers with energy usage
18 information that will help them to implement ongoing energy management strategies.

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

20 A. The Companies will contract with an implementation vendor who will be responsible to
21 administer, promote, and provide the program and program services to customers. The
22 implementation vendor will be responsible for administration, marketing, outreach,

1 fulfilling program services, application processing and documentation regarding purchased
2 products and completed projects, and processing incentives and rebates, where applicable.

3 The program will offer an on-line application portal for customers to submit rebates
4 for energy efficient products or projects and may also develop a midstream approach, work
5 with retailers, contractors, distributors, and/or manufacturers for midstream or upstream
6 incentives or point of purchase buydowns for select measures. The implementation vendor
7 will develop electronic rebate application forms that will guide applicants through
8 eligibility guidelines, program requirements, terms and conditions, and general
9 information. In addition, the implementation vendor will provide applications in web ready
10 formats to ensure participants have easy access to the forms. Completed applications to
11 the program will be processed online or be returned via email, where applicable.

12 Additionally, the implementation vendor will provide support and assistance to
13 retailers or distributors to support identification and promotion of eligible energy efficient
14 equipment. The implementation vendor will also provide technical support to customers
15 on the application of the eligible energy efficiency measures.

16 **Q. WHAT ARE THE EXPECTED CUSTOMER SAVINGS AND PROJECTED**
17 **COSTS ASSOCIATED WITH THE ENERGY SOLUTIONS FOR BUSINESS**
18 **PROGRAM?**

19 A. As shown in Attachment ECM-2, the Energy Solutions for Business program is projected
20 to provide 164,769 MWh in average incremental annual energy savings, 23.9 MW in
21 average incremental annual demand savings, and \$26.6 million in average annual customer
22 incentives, at an average annual total cost of \$38.6 million over the 4-year term of the
23 EE/PDR Plan.

1 This estimate assumes that business customers with 2,832,226 measures (energy
2 efficiency improvements) will be able to participate in the Energy Solutions for Business
3 program during the 4-year term of the EE/PDR Plan.

4 **Q. WILL THE COMPANIES OFFER AN OPT-IN OR OUT-OUT PROCESS FOR**
5 **PARTICIPATION IN THE ENERGY SOLUTION FOR BUSINESS PROGRAM?**

6 A. The Companies propose to develop and offer an opt-out process for Large Customers given
7 the prior history in the state and based on feedback provided to the Companies. Customers
8 that opt-out will be removed from the collection of the energy efficiency surcharge but will
9 no longer be eligible to participate in the rebate programs. Once a customer has taken a
10 rebate from the EE/PDR Plan, it is no longer eligible to opt-out for the duration of ESP V.

11 The Companies are not proposing an opt-in process for several reasons including
12 that customers may be unaware of the opt-in period and miss the opportunity to participate
13 in programs (not customer friendly) and that budgets may be undersized and unable to
14 support participation. The Companies also believe their proposed opt-out process will
15 entice greater efficiency gains and better advance the state policy objectives outlined earlier
16 in my testimony as compared to an opt-in approach.

17 **Q. CAN YOU QUANTIFY THE BENEFITS TO CUSTOMERS ASSOCIATED WITH**
18 **THE ENERGY SOLUTIONS FOR BUSINESS PROGRAM?**

19 A. Yes. The total benefits of this program under each methodology are: TRC- \$495,804,477;
20 SCT- \$799,856,047; and UCT- \$466,824,803. *See* Attachment ECM-4 for the costs and
21 benefit cost ratios under each test for this program.

1 **VI. PROGRAM BENEFITS AND COSTS**

2 **Q. WOULD THE BENEFITS OF THESE PROGRAMS BE REALIZED IF THE**
3 **COMPANIES DID NOT OFFER THE PROGRAMS?**

4 A. No. While some customers may elect to purchase and install energy efficient equipment
5 without the programs, most of the benefits of these programs would not be realized if the
6 Companies did not offer the programs. These programs are supported and recognized in
7 the industry for providing energy and demand savings benefits to customers. All the
8 program designs include proven approaches in the industry and provide verified energy
9 and demand savings benefits.

10 **Q. WHAT IS THE EE/PDR PLAN BUDGET AND HOW MUCH SAVINGS IS IT**
11 **PROJECTED TO GENERATE?**

12 A. The total average annual budget of the proposed Energy Efficiency Programs is \$72.1
13 million/year over the initial 4-year term of the EE/PDR Plan. As shown in the chart below,
14 the EE/PDR Plan will provide lasting energy savings to customers with a projected
15 weighted average measure life of 11.4 years.

Ohio ESP V - Projected Weighted Average Measure Life	
Program	Years
Residential Rebates	8.9
Energy Education	2.6
Low Income Energy Efficiency	15.0
Demand Response for Residential	1.0
Energy Solutions for Business	14.0
Total Plan	11.4

16
17 Collectively, the EE/PDR Plan is expected to achieve 253,332 MWh in energy savings and
18 67.6 MW in peak demand reduction on an average annual basis. Program-by-program

1 budget and savings estimates are provided in Attachment ECM-2 and program measure
2 lives are provided in Attachment ECM-3.

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

5 A. Yes. FirstEnergy is using three benefit-cost tests to calculate the cost-effectiveness of the
6 EE/PDR programs: the Total Resource Cost Test (“TRC”); the Societal Cost Test (“SCT”);
7 and the Utility Cost Test (“UCT”). The Companies are using the TRC as the primary cost
8 test for the programs and portfolio consistent with past practice in Ohio and in other
9 jurisdictions. The Companies performed the SCT and the UCT to provide the benefits and
10 costs of the programs and portfolio from different perspectives as additional supporting
11 information.

12 The TRC test, while also considering the primary assessment test for the programs
13 and portfolio by the Companies, functions both as a guidepost and comparative tool to
14 other jurisdictions, and as a comparison to past programmatic performance. The TRC test
15 examines the benefits and costs from the combined perspective of the utility system and
16 participants. The total non-incentive costs, and the customers’ incremental costs of
17 purchasing and installing the efficiency measures above the cost of standard equipment
18 that would otherwise be installed, are included. The avoided costs include the energy
19 benefits, comprised of avoided energy and capacity, and avoided transmission and
20 distribution costs, and avoided operations and maintenance expenses. Incentive costs are
21 not included, as these benefits to customers and costs to the utility cancel each other.

22 The SCT measures the benefits and costs from a viewpoint of the utility system,
23 consumers, and society as a whole. The SCT includes all the costs and benefits of the TRC

1 test and in addition includes the benefit of avoided air emissions. Fundamentally, this is
2 the Total Resource Cost Test with the cost and benefits to society added. The strength of
3 the SCT is its ability to view costs and benefits from a much broader perspective and to
4 include issues that society wants to address.

5 The UCT examines the costs and benefits of the program from the perspective of
6 the utility implementing the program. The avoided costs include the energy benefits,
7 comprised of avoided energy and capacity, and avoided transmission and distribution costs.
8 Costs included in the UCT are total program costs including incentive costs and excluding
9 the customer incremental costs.

10 **Q. DOES THE EE/PDR PLAN PROVIDE AN OVERALL BENEFIT TO**
11 **CUSTOMERS?**

12 A. Yes. The successful implementation of the EE/PDR Plan is projected to be cost-effective
13 at the portfolio level, having a benefit cost ratio of 1.3 under the TRC, and 2.1 under both
14 the SCT and UCT as shown in the table below. Furthermore, all programs, except the
15 Low-Income Energy Efficiency program, are projected to be cost-effective under the TRC
16 as the primary cost test, as well as under the SCT and UCT. *See Attachment ECM-4 for*
17 *more details of the benefit-cost results of the programs.*

18

Ohio ESP V - Projected Cost Effectiveness Ratios				
Program	Components	TRC Ratio	SCT Ratio	UCT Ratio
Residential Sector Programs				
Residential Rebates	Appliance Rebates Appliance Recycling Heat Pumps EE Products	1.2	2.0	1.3
Energy Education	Home Energy Reports School Education	1.3	2.2	1.3
Low Income Energy Efficiency	Audit/Education EE Products Weatherization	0.5	0.8	0.5
Demand Response for Residential	Behavioral DR Load Control - Res	1.9	2.0	1.2
Subtotal		1.1	1.7	1.1
Commercial & Industrial Sector Programs				
Energy Solutions for Business	EE Equipment Custom Projects Energy Management	1.4	2.2	3.0
Subtotal		1.4	2.2	3.0
Plan Total		1.3	2.1	2.1

1

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

4 A. Yes. As discussed earlier, the Companies completed cost-effectiveness testing consistent
5 with past practice, with the only difference being the addition of the SCT (including the
6 avoided cost of carbon) and UCT. This is a conservative view of cost-effectiveness from
7 the standpoint that there are numerous other energy and non-energy benefits that are
8 recognized in other jurisdictions or the industry that can also be considered in cost-
9 effectiveness calculations.³ Some of the more common energy impacts include other fuels

³ 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 (e.g., gas) costs and benefits and energy and/or capacity price suppression effects. Some
2 of the more common non-energy impacts include water resource cost and benefits, avoided
3 credit and collections costs, health and safety, comfort and economic development and jobs
4 impacts.

5 Additionally, the Companies will offer qualifying EE resources from its approved
6 EE/PDR Plan into PJM's Forward Capacity Market ("FCM") as opportunities are
7 available. EE resources would be offered into the applicable base residual auction and
8 incremental auctions for qualifying delivery years, with offer values determined at the
9 Companies' discretion. The Companies propose to utilize the previously approved
10 Commission practice in which 80% of PJM net revenues obtained from cleared EE
11 resources (revenues minus costs) from the FCM would offset the EE/PDR Plan revenue
12 requirements in the years the PJM FCM revenues are realized, with 20% of the PJM FCM
13 revenues retained by the Companies. This will allow the Companies to monetize these EE
14 resources while managing risk of performance penalties and changes to the PJM FCM
15 rules. In addition to lowering EE/PDR Plan costs to customers with the offsetting PJM
16 revenues, offering these qualifying EE resources into the PJM FCM may help reduce the
17 overall PJM Capacity price, which could reduce electric supply costs for all customers.

18 **Q. WILL THE COMPANIES USE A COLLABORATIVE PROCESS TO SHARE**
19 **TIMELY INFORMATION ON THE EE/PDR PROGRAMS WITH**
20 **STAKEHOLDERS?**

21 A. Yes. The Companies will meet twice per year with interested parties to discuss
22 implementation activities as well as program performance and progress toward meeting the
23 program savings goals.

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

3 A. The program costs will be recovered as specified in the testimony of the Companies’
4 Witness Brandon S. McMillen. The Companies will manage the EE/PDR Plan to the
5 proposed budgets included in Attachment ECM-2.

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

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

15

16 **VII. CONCLUSION**

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

18 A. Yes. I reserve the right to supplement my testimony.

Attachment ECM-1: Ohio ESP V - Program Descriptions

Program	Component	Description
Residential Program Sector		
Residential Rebates	Appliance Rebates Appliance Recycling Heat Pumps EE Products	This program will promote the installation of ENERGY STAR and other energy efficient electric equipment by residential customers by offering a broad range of energy efficient products, equipment and appliances through a variety of channels, including but not limited to downstream rebates (including but not limited to in-store or online), reduced point of sale costs, and through an on-line website. The program is designed to provide easy and cost-effective access to energy efficient measures through customers' preferred channels. Rebates are offered to reduce cost barriers for program eligible products, with enhanced rebates for income eligible customers for select measures. The program will provide incentives for energy efficient appliances, heat pumps, other energy efficiency products (e.g. smart thermostats) and appliance recycling. The program may also include customer opportunities to receive rebates or equipment at no up-front cost and for other new or emerging energy efficient equipment to engage and encourage customers to pursue energy savings opportunities and achieve additional energy savings.
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 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 receive installation of direct install measures such as LED lighting, energy-saving 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 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.
Demand Response for Residential	Behavioral DR Load Control - Res	The Residential Demand Response program includes a Behavioral component and a Load Control component. The Behavioral Demand Response component will provide notification messages to motivate customers with smart meters installed to reduce usage during peak demand days. This component will also provide feedback to the customer about their usage performance after the peak demand day, with normative comparisons to other customers, and recommendations to reinforce their usage reduction behaviors in future peak demand days. The Load Control component will provide incentives to customers for the direct control of connected devices, including but not limited to Smart Thermostats and other in-home devices meeting program requirements to provide energy and peak demand savings.
Commercial & Industrial Program Sector		
Energy Solutions for Business	EE Equipment Custom Projects Energy Management	The Energy Solutions for Business program will promote the installation of energy efficient electric equipment and projects to commercial and industrial customers, either via the installation of prescriptive or custom measures or projects. The program provides prescriptive or performance based incentives to commercial and industrial customers to purchase and install energy efficient measures including lighting, heat pumps, food service, other energy efficient equipment and for custom projects. The program is designed to provide easy and cost-effective access to energy efficient measures through customers' preferred channels. Rebates are offered to reduce cost barriers for program eligible measures. The program will provide downstream incentives and may also provide midstream or upstream incentives or buydowns and support to manufacturers, distributors, contractors, and retailers that sell select energy efficient equipment. The program will also provide incentives to promote customers to complete Energy Management audits and analysis, and will further engage customers through other activities to educate them on energy efficiency, and to identify and promote opportunities to reduce their energy use leveraging available program incentives. The program may also include other customer opportunities such as new or emerging energy efficient equipment to further engage and encourage customers to pursue energy savings opportunities and achieve additional energy savings.

Attachment ECM-2: Ohio ESP V - Projections ^{1,2}					
Program	Components	Energy Savings (MWh)	Demand Savings (MW)	Incentives	Total Budget
Residential Sector Programs					
Residential Rebates	Appliance Rebates Appliance Recycling Heat Pumps EE Products	44,296	7.3	\$ 8,027,477	\$ 17,883,228
Energy Education	Home Energy Reports School Education	32,952	5.8	\$ 1,100,000	\$ 3,592,681
Low Income Energy Efficiency	Audit/Education EE Products Weatherization	5,382	0.8	\$ 7,400,000	\$ 8,613,982
Demand Response for Residential	Behavioral DR Load Control - Res	5,932	29.7	\$ 1,241,125	\$ 3,456,539
Subtotal		88,563	43.7	\$ 17,768,602	\$ 33,546,430
Commercial & Industrial Sector Programs					
Energy Solutions for Business	EE Equipment Custom Projects Energy Management	164,769	23.9	\$ 26,620,552	\$ 38,581,786
Subtotal		164,769	23.9	\$ 26,620,552	\$ 38,581,786
Plan Total		253,332	67.6	\$ 44,389,154	\$ 72,128,215

¹ Average Annual over initial 4-year term of the Energy Efficiency and Peak Demand Reduction Programs

² Energy and demand savings per program are based on the Measure Assumptions in Attachment ECM-3

Attachment ECM-3: Ohio ESP V - Measure Assumptions

Sector	Program	Component	Measure	Avg Annual Participants	Measure Life	kWh per unit	kW per unit	Incremental Cost (\$/Yr)	Modeled Rebate / Incentive	O&M Benefit (\$/Yr)
Res	Residential Rebates	Appliance Recycling	Freezer Recycling	4,000	8	683	0.100	0	93	0
Res	Residential Rebates	Appliance Recycling	Refrigerator Recycling	16,500	8	923	0.150	0	94	0
Res	Residential Rebates	Appliance Recycling	Mini Refrig Recycling	400	8	378	0.040	0	42	0
Res	Residential Rebates	Appliance Recycling	Room Air Conditioner Recycling	6,200	3	91	0.034	0	42	0
Res	Residential Rebates	Appliance Recycling	Dehumidifier Recycling	8,000	3	654	0.100	0	42	0
Res	Residential Rebates	Appliance Rebates	Clothes Washer	2,000	14	182	0.020	39	62	0
Res	Residential Rebates	Appliance Rebates	Refrigerators	2,500	12	77	0.012	44	102	0
Res	Residential Rebates	Appliance Rebates	Beverage Cooler O/U Cntr	1	12	51	0.008	16	51	0
Res	Residential Rebates	Appliance Rebates	Beverage Cooler Portable	1	12	51	0.008	16	51	0
Res	Residential Rebates	Appliance Rebates	Freezers	275	11	31	0.005	13	51	0
Res	Residential Rebates	Appliance Rebates	Clothes Dryer	1,100	12	100	0.010	77	101	0
Res	Residential Rebates	Appliance Rebates	Air Purifier / Cleaner	3,800	9	635	0.078	80	51	0
Res	Residential Rebates	Appliance Rebates	Room Air Conditioner	13,000	12	23	0.021	28	50	0
Res	Residential Rebates	Appliance Rebates	Dehumidifiers	30,000	12	200	0.040	60	30	0
Res	Residential Rebates	Appliance Rebates	Water Heater - Heat Pump	1,400	13	1,922	0.050	1,050	750	0
Res	Residential Rebates	Appliance Rebates	Induction Cooktop	25	15	100	0.010	500	250	0
Res	Residential Rebates	Appliance Rebates	Water Cooler	1,200	10	361	0.232	49	25	0
Res	Residential Rebates	Appliance Rebates	EV Charging - Res	25	10	31	0.004	700	250	0
Res	Residential Rebates	Appliance Rebates	Smart Thermostat	2,000	8	335	0.000	154	50	0
Res	Residential Rebates	Appliance Rebates	Emerging/Other	1	0	0	0.000	0	0	0
Res	Residential Rebates	EE Products	Smart Thermostat	4,000	8	335	0.000	154	50	0
Res	Residential Rebates	EE Products	Advanced Power Strip	400	4	105	0.013	18	15	0
Res	Residential Rebates	EE Products	Heat Pump Water Heater	1	13	1,922	0.050	1,050	750	0
Res	Residential Rebates	EE Products	Air Purifier/ Cleaner	100	9	635	0.078	80	40	0
Res	Residential Rebates	EE Products	Emerging/Other	1	0	0	0.000	0	0	0
Res	Residential Rebates	Heat Pumps	Heat Pump - Air Source	900	18	1,015	0.262	1,896	1,000	0
Res	Residential Rebates	Heat Pumps	Heat Pump - Cold Climate	100	18	1,516	0.262	3,147	1,250	0
Res	Residential Rebates	Heat Pumps	Heat Pump - Wtr & Geo	90	20	3,618	0.300	11,323	3,500	0
Res	Residential Rebates	Heat Pumps	Heat Pump - Ductless Mini - Single Zone	800	18	523	0.300	500	500	0
Res	Residential Rebates	Heat Pumps	Heat Pump - Ductless Mini - Multi Zone	200	18	523	0.300	1,000	500	0
Res	Residential Rebates	Heat Pumps	Emerging/Other	1	0	0	0.000	0	0	0
Res	Energy Education	Home Energy Reports	Home Energy Reports 2024	203,900	1	90	0.016	0	0	0
Res	Energy Education	Home Energy Reports	Home Energy Reports 2025	203,900	1	125	0.023	0	0	0
Res	Energy Education	Home Energy Reports	Home Energy Reports 2026	203,900	1	153	0.030	0	0	0
Res	Energy Education	Home Energy Reports	Home Energy Reports 2027	203,900	1	158	0.030	0	0	0
Res	Energy Education	School Education	School Education	22,000	15	150	0.012	45	50	4
Res LI	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	LI - Audit/Education, EE Products & Weatherization	3,700	15	1,329	0.188	0	2,000	0
Res DR	Demand Response for Residential	Load Control - Res	Load Control - Res	19,750	1	37	0.900	0	25	0
Res DR	Demand Response for Residential	Load Control - Res	Enrollment Incentive - Res	9,965	0	0	0.000	0	75	0
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2024 DR	0	1	25	0.050	0	0	0
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2025 DR	250,000	1	25	0.050	0	0	0
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2026 DR	250,000	1	25	0.050	0	0	0
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2027 DR	250,000	1	25	0.050	0	0	0

¹ Average annual participants and Modeled Rebate/Incentive are Company estimates

Attachment ECM-3: Ohio ESP V - Measure Assumptions

Sector	Program	Component	Measure	Avg Annual Participants	Measure Life	kWh per unit	kW per unit	Incremental Cost (\$/Yr)	Modeled Rebate / Incentive	O&M Benefit (\$/Yr)
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I (<=5.4 Ton, 1 Ph)	100	15	592	0.051	1,896	1,000	0
C&I	Energy Solutions for Business	EE Equipment	Heat Pump - Cold Climate C&I (<=5.4 Ton, 1 Ph)	5	15	592	0.051	3,147	1,250	0
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I (<=5.4 Ton, 3 Ph)	10	15	592	0.051	1,896	1,000	0
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I - Wtr & GeoT (<=11.25 Tons)	35	20	6,661	0.879	11,323	3,500	0
C&I	Energy Solutions for Business	EE Equipment	Heat Pump DMS C&I (<=5.4 Ton)	50	18	326	0.031	1,000	500	0
C&I	Energy Solutions for Business	EE Equipment	PTHP C&I	50	15	168	0.049	500	500	0
C&I	Energy Solutions for Business	EE Equipment	HVAC Tune Up - C&I	300	5	417	0.233	175	300	0
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	1	0	0	0.000	0	0	0
C&I	Energy Solutions for Business	EE Equipment	Lighting Controls	14,250	10	866	0.081	80	520	0
C&I	Energy Solutions for Business	EE Equipment	LED Linear	569,668	14	101	0.017	69	10	8
C&I	Energy Solutions for Business	EE Equipment	Exit Signs	17,100	5	83	0.012	33	23	27
C&I	Energy Solutions for Business	EE Equipment	LED Fixture External	37,525	15	421	0.000	152	42	41
C&I	Energy Solutions for Business	EE Equipment	LED Fixture Internal	29,925	15	90	0.015	6	9	6
C&I	Energy Solutions for Business	EE Equipment	LED Lamps	22,729	15	40	0.007	2	4	11
C&I	Energy Solutions for Business	EE Equipment	Lighting - Other	238	15	21,322	2.434	11,940	2,132	0
C&I	Energy Solutions for Business	EE Equipment	Lighting - Custom	238	15	21,322	2.434	11,940	2,132	0
C&I	Energy Solutions for Business	EE Equipment	LED Reach in Refrig / Frzr Lights	13,300	15	69	0.011	24	7	2
C&I	Energy Solutions for Business	EE Equipment	Heat Pump Water Heater - C&I	240	10	1,649	0.302	1,338	1,200	0
C&I	Energy Solutions for Business	EE Equipment	EV Charging - Eff - C&I	75	10	31	0.004	3,000	1,000	0
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	1	0	0	0.000	0	0	0
C&I	Energy Solutions for Business	EE Equipment	Commercial Refrigerator - C&I	60	12	453	0.059	645	250	0
C&I	Energy Solutions for Business	EE Equipment	Commercial Freezer - C&I	25	12	850	0.112	951	500	0
C&I	Energy Solutions for Business	EE Equipment	Refrigerated Case Cover	125	5	158	0.000	42	20	0
C&I	Energy Solutions for Business	EE Equipment	Anti Sweat Heater Controls	40	12	624	0.050	308	50	0
C&I	Energy Solutions for Business	EE Equipment	Strip Curtains	425	4	177	0.022	4	5	0
C&I	Energy Solutions for Business	EE Equipment	Ice Machines	13	8	1,115	0.245	345	500	0
C&I	Energy Solutions for Business	EE Equipment	Beverage Vending Machine - Controls	5	5	1,410	0.000	180	100	0
C&I	Energy Solutions for Business	EE Equipment	Steam Cookers	40	12	14,415	3.291	457	450	0
C&I	Energy Solutions for Business	EE Equipment	Fryers	8	12	2,011	0.459	768	300	0
C&I	Energy Solutions for Business	EE Equipment	Griddles	8	12	3,308	0.755	500	300	0
C&I	Energy Solutions for Business	EE Equipment	Hot Food Holding Cabinet	8	12	4,435	0.810	895	400	0
C&I	Energy Solutions for Business	EE Equipment	Combination Oven	5	12	6,989	1.904	2,512	1,200	0
C&I	Energy Solutions for Business	EE Equipment	Convection Oven	1	12	161	0.044	374	400	0
C&I	Energy Solutions for Business	EE Equipment	Dishwasher, Commercial - C&I	2	15	5,406	0.864	738	1,200	0
C&I	Energy Solutions for Business	EE Equipment	Induction Warmer/Rethermalizer Well	5	15	400	0.046	500	200	0
C&I	Energy Solutions for Business	EE Equipment	Coffee Brewers	3	15	1,331	0.152	200	100	0
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	1	0	0	0.000	0	0	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Chillers	49	23	6,122	7.833	3,061	7,500	0
C&I	Energy Solutions for Business	Custom Projects	Custom - VFDs < 10HP	195	15	1,907	0.913	954	1,250	0
C&I	Energy Solutions for Business	Custom Projects	Custom - VFDs > 10 HP	228	15	26,950	12.909	13,475	6,750	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Process Improvement	195	15	133,250	15.211	66,625	19,988	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Compressed Air	81	13	84,935	9.696	42,468	12,740	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Motors	195	15	1,106	0.101	553	166	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Refrigeration	49	15	9,885	1.128	4,943	1,483	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Data Processing Eqpmnt/Servers	49	13	2,896	0.384	1,448	434	0
C&I	Energy Solutions for Business	Custom Projects	Custom - HVAC Eqp & Controls	179	15	28,188	4.665	14,094	4,228	0
C&I	Energy Solutions for Business	Custom Projects	Custom - Electronics/Systems/Cntrls	179	15	28,188	4.665	14,094	4,228	0
C&I	Energy Solutions for Business	Energy Management	Audit & Education - C&I	50	0	0	0.000	0	10,000	0

¹ Average annual participants and Modeled Rebate/Incentive are Company estimates

Attachment ECM-4: Ohio ESP V - Projected Cost Effectiveness										
Program	Components	TRC Benefits	TRC Costs	TRC Ratio	SCT Benefits	SCT Costs	SCT Ratio	UCT Benefits	UCT Costs	UCT Ratio
Residential Sector Programs										
Residential Rebates	Appliance Rebates Appliance Recycling Heat Pumps EE Products	\$ 90,031,167	\$ 74,956,335	1.2	\$ 147,225,480	\$ 74,956,335	2.0	\$ 90,031,167	\$ 71,532,912	1.3
Energy Education	Home Energy Reports School Education	\$ 18,561,585	\$ 13,930,722	1.3	\$ 30,994,255	\$ 13,930,722	2.2	\$ 18,240,639	\$ 14,370,722	1.3
Low Income Energy Efficiency	Audit/Education EE Products Weatherization	\$ 16,476,169	\$ 34,455,928	0.5	\$ 26,897,200	\$ 34,455,928	0.8	\$ 16,476,169	\$ 34,455,928	0.5
Demand Response for Residential	Behavioral DR Load Control - Res	\$ 17,060,109	\$ 8,861,657	1.9	\$ 18,165,768	\$ 8,861,657	2.0	\$ 17,060,109	\$ 13,826,157	1.2
Subtotal		\$ 142,129,030	\$ 132,204,642	1.1	\$ 223,282,703	\$ 132,204,642	1.7	\$ 141,808,083	\$ 134,185,719	1.1
Commercial & Industrial Sector Programs										
Energy Solutions for Business	EE Equipment Custom Projects Energy Management	\$ 495,804,477	\$ 366,452,586	1.4	\$ 799,856,047	\$ 366,452,586	2.2	\$ 466,824,803	\$ 154,327,143	3.0
Subtotal		\$ 495,804,477	\$ 366,452,586	1.4	\$ 799,856,047	\$ 366,452,586	2.2	\$ 466,824,803	\$ 154,327,143	3.0
Plan Total		\$ 637,933,507	\$ 498,657,227	1.3	\$ 1,023,138,750	\$ 498,657,227	2.1	\$ 608,632,887	\$ 288,512,862	2.1

Attachment ECM-2, Workpaper 1: 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, and common costs allocated to each program component. 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
Operations	Utility Administration and Other	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 regulatory reporting or meetings to support the plan. Utility Administration costs were estimated based on labor forecasts and actual results. Other costs includes costs for plan development vendor fees based on estimated vendor pricing. Utility Administration and Other costs were allocated to each program component based on Program Administration and Marketing costs.	Labor Forecast and Actuals Estimated Vendor Pricing
	Program Administration	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
	Marketing	Includes costs associated with developing and providing marketing for plan and program awareness, education and messaging. Program direct 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. Common marketing costs was estimated at the portfolio level and allocated to each program component based on Program Administration and Marketing costs.	Company Assumptions Estimated Vendor Pricing
	EM&V	Includes direct costs for evaluation, measurement and verification activities, such as surveys, processes, and evaluation meetings. The EM&V costs were estimated based on 4% of total program cost.	Company Assumptions
	Tracking and Reporting	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
Incentives	Incentives	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 V Budgets by Cost Category PY 1

Sector	Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Residential	Residential Rebates	Appliance Recycling	\$ 650,920	\$ 4,174,500	\$ 622,016	\$ 341,933	\$ 564,678	\$ 2,536,200	\$ 8,890,247
Residential	Residential Rebates	Appliance Rebates	\$ 262,182	\$ 1,793,000	\$ 138,976	\$ 234,485	\$ 227,445	\$ 3,440,527	\$ 6,096,616
Residential	Residential Rebates	EE Products	\$ 10,601	\$ 75,000	\$ 3,118	\$ 12,347	\$ 9,197	\$ 210,750	\$ 321,013
Residential	Residential Rebates	Heat Pumps	\$ 119,392	\$ 775,710	\$ 104,069	\$ 117,710	\$ 103,574	\$ 1,840,000	\$ 3,060,454
Residential	Residential Rebates		\$ 1,043,096	\$ 6,818,210	\$ 868,179	\$ 706,474	\$ 904,894	\$ 8,027,477	\$ 18,368,330
Residential	Energy Education	Home Energy Reports	\$ 212,020	\$ 1,539,445	\$ 22,891	\$ 78,331	\$ 183,929	\$ -	\$ 2,036,616
Residential	Energy Education	School Education	\$ 57,908	\$ 395,000	\$ 31,712	\$ 65,394	\$ 50,235	\$ 1,100,000	\$ 1,700,249
Residential	Energy Education		\$ 269,927	\$ 1,934,445	\$ 54,603	\$ 143,726	\$ 234,164	\$ 1,100,000	\$ 3,736,865
Residential	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 99,181	\$ 576,000	\$ 154,847	\$ 332,643	\$ 86,040	\$ 7,400,000	\$ 8,648,711
Residential Low Income	Low Income Energy Efficiency		\$ 99,181	\$ 576,000	\$ 154,847	\$ 332,643	\$ 86,040	\$ 7,400,000	\$ 8,648,711
Residential	Demand Response for Residential	Load Control - Res	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Residential	Demand Response for Residential	Behaviorial DR	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Residential DR	Demand Response for Residential		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
	Residential Total		\$ 1,412,204	\$ 9,328,655	\$ 1,077,629	\$ 1,182,843	\$ 1,225,098	\$ 16,527,477	\$ 30,753,906
Commercial & Industrial	Energy Solutions for Business	EE Equipment	\$ 543,589	\$ 3,827,333	\$ 178,280	\$ 897,048	\$ 471,568	\$ 17,405,433	\$ 23,323,252
Commercial & Industrial	Energy Solutions for Business	Custom Projects	\$ 624,461	\$ 4,365,522	\$ 236,018	\$ 579,314	\$ 541,724	\$ 8,715,118	\$ 15,062,157
Commercial & Industrial	Energy Solutions for Business	Energy Management	\$ 29,745	\$ 175,000	\$ 44,189	\$ 30,990	\$ 25,804	\$ 500,000	\$ 805,728
Commercial & Industrial	Energy Solutions for Business		\$ 1,197,796	\$ 8,367,856	\$ 458,486	\$ 1,507,351	\$ 1,039,097	\$ 26,620,552	\$ 39,191,137
	Commercial & Industrial Total		\$ 1,197,796	\$ 8,367,856	\$ 458,486	\$ 1,507,351	\$ 1,039,097	\$ 26,620,552	\$ 39,191,137
	Plan Total		\$ 2,610,000	\$ 17,696,510	\$ 1,536,116	\$ 2,690,194	\$ 2,264,195	\$ 43,148,029	\$ 69,945,044

Attachment ECM-2, Workpaper 2: Ohio ESP V Budgets by Cost Category PY 2

Sector	Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Residential	Residential Rebates	Appliance Recycling	\$ 627,715	\$ 4,299,735	\$ 619,559	\$ 327,145	\$ 95,409	\$ 2,536,200	\$ 8,505,762
Residential	Residential Rebates	Appliance Rebates	\$ 241,904	\$ 1,759,240	\$ 136,519	\$ 224,598	\$ 36,768	\$ 3,440,527	\$ 5,839,555
Residential	Residential Rebates	EE Products	\$ 6,656	\$ 51,500	\$ 661	\$ 10,823	\$ 1,012	\$ 210,750	\$ 281,401
Residential	Residential Rebates	Heat Pumps	\$ 105,061	\$ 721,731	\$ 101,612	\$ 111,375	\$ 15,969	\$ 1,840,000	\$ 2,895,747
Residential	Residential Rebates		\$ 981,336	\$ 6,832,206	\$ 858,349	\$ 673,941	\$ 149,157	\$ 8,027,477	\$ 17,522,466
Residential	Energy Education	Home Energy Reports	\$ 204,938	\$ 1,585,628	\$ 20,433	\$ 73,686	\$ 31,149	\$ -	\$ 1,915,835
Residential	Energy Education	School Education	\$ 45,791	\$ 329,600	\$ 29,254	\$ 60,464	\$ 6,960	\$ 1,100,000	\$ 1,572,069
Residential	Energy Education		\$ 250,729	\$ 1,915,228	\$ 49,688	\$ 134,150	\$ 38,109	\$ 1,100,000	\$ 3,487,904
Residential	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 95,149	\$ 593,280	\$ 152,390	\$ 330,211	\$ 14,462	\$ 7,400,000	\$ 8,585,492
Residential Low Income	Low Income Energy Efficiency		\$ 95,149	\$ 593,280	\$ 152,390	\$ 330,211	\$ 14,462	\$ 7,400,000	\$ 8,585,492
Residential	Demand Response for Residential	Load Control - Res	\$ 92,340	\$ 636,540	\$ 87,116	\$ 89,201	\$ 14,035	\$ 1,400,000	\$ 2,319,232
Residential	Demand Response for Residential	Behaviorial DR	\$ 140,802	\$ 1,094,375	\$ 9,064	\$ 50,626	\$ 21,401	\$ -	\$ 1,316,268
Residential DR	Demand Response for Residential		\$ 233,142	\$ 1,730,915	\$ 96,180	\$ 139,827	\$ 35,436	\$ 1,400,000	\$ 3,635,500
	Residential Total		\$ 1,560,356	\$ 11,071,629	\$ 1,156,607	\$ 1,278,129	\$ 237,165	\$ 17,927,477	\$ 33,231,363
Commercial & Industrial	Energy Solutions for Business	EE Equipment	\$ 502,181	\$ 3,767,053	\$ 168,450	\$ 876,778	\$ 76,328	\$ 17,405,433	\$ 22,796,224
Commercial & Industrial	Energy Solutions for Business	Custom Projects	\$ 587,138	\$ 4,367,738	\$ 233,560	\$ 559,712	\$ 89,241	\$ 8,715,118	\$ 14,552,508
Commercial & Industrial	Energy Solutions for Business	Energy Management	\$ 28,325	\$ 180,250	\$ 41,731	\$ 30,184	\$ 4,305	\$ 500,000	\$ 784,797
Commercial & Industrial	Energy Solutions for Business		\$ 1,117,644	\$ 8,315,041	\$ 443,741	\$ 1,466,674	\$ 169,875	\$ 26,620,552	\$ 38,133,528
	Commercial & Industrial Total		\$ 1,117,644	\$ 8,315,041	\$ 443,741	\$ 1,466,674	\$ 169,875	\$ 26,620,552	\$ 38,133,528
	Plan Total		\$ 2,678,000	\$ 19,386,671	\$ 1,600,348	\$ 2,744,803	\$ 407,040	\$ 44,548,029	\$ 71,364,891

Attachment ECM-2, Workpaper 2: Ohio ESP V Budgets by Cost Category PY 3

Sector	Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Residential	Residential Rebates	Appliance Recycling	\$ 629,490	\$ 4,424,970	\$ 619,559	\$ 331,732	\$ 83,080	\$ 2,536,200	\$ 8,625,031
Residential	Residential Rebates	Appliance Rebates	\$ 242,960	\$ 1,810,480	\$ 136,519	\$ 226,502	\$ 32,066	\$ 3,440,527	\$ 5,889,053
Residential	Residential Rebates	EE Products	\$ 6,696	\$ 53,000	\$ 661	\$ 10,880	\$ 884	\$ 210,750	\$ 282,870
Residential	Residential Rebates	Heat Pumps	\$ 105,365	\$ 742,752	\$ 101,612	\$ 112,145	\$ 13,906	\$ 1,840,000	\$ 2,915,781
Residential	Residential Rebates		\$ 984,512	\$ 7,031,202	\$ 858,349	\$ 681,259	\$ 129,936	\$ 8,027,477	\$ 17,712,735
Residential	Energy Education	Home Energy Reports	\$ 206,178	\$ 1,631,812	\$ 20,433	\$ 75,425	\$ 27,211	\$ -	\$ 1,961,060
Residential	Energy Education	School Education	\$ 45,978	\$ 339,200	\$ 29,254	\$ 60,820	\$ 6,068	\$ 1,100,000	\$ 1,581,321
Residential	Energy Education		\$ 252,157	\$ 1,971,012	\$ 49,688	\$ 136,245	\$ 33,280	\$ 1,100,000	\$ 3,542,381
Residential	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 95,206	\$ 610,560	\$ 152,390	\$ 330,829	\$ 12,565	\$ 7,400,000	\$ 8,601,550
Residential Low Income	Low Income Energy Efficiency		\$ 95,206	\$ 610,560	\$ 152,390	\$ 330,829	\$ 12,565	\$ 7,400,000	\$ 8,601,550
Residential	Demand Response for Residential	Load Control - Res	\$ 161,592	\$ 1,145,330	\$ 149,616	\$ 125,215	\$ 21,327	\$ 1,652,500	\$ 3,255,579
Residential	Demand Response for Residential	Behaviorial DR	\$ 141,672	\$ 1,126,250	\$ 9,064	\$ 51,827	\$ 18,698	\$ -	\$ 1,347,512
Residential DR	Demand Response for Residential		\$ 303,264	\$ 2,271,580	\$ 158,680	\$ 177,042	\$ 40,025	\$ 1,652,500	\$ 4,603,091
	Residential Total		\$ 1,635,138	\$ 11,884,354	\$ 1,219,107	\$ 1,325,375	\$ 215,806	\$ 18,179,977	\$ 34,459,757
Commercial & Industrial	Energy Solutions for Business	EE Equipment	\$ 504,790	\$ 3,876,773	\$ 168,450	\$ 880,883	\$ 66,622	\$ 17,405,433	\$ 22,902,952
Commercial & Industrial	Energy Solutions for Business	Custom Projects	\$ 590,056	\$ 4,494,954	\$ 233,560	\$ 564,463	\$ 77,876	\$ 8,715,118	\$ 14,676,026
Commercial & Industrial	Energy Solutions for Business	Energy Management	\$ 28,355	\$ 185,500	\$ 41,731	\$ 30,373	\$ 3,742	\$ 500,000	\$ 789,702
Commercial & Industrial	Energy Solutions for Business		\$ 1,123,202	\$ 8,557,227	\$ 443,741	\$ 1,475,718	\$ 148,240	\$ 26,620,552	\$ 38,368,681
	Commercial & Industrial Total		\$ 1,123,202	\$ 8,557,227	\$ 443,741	\$ 1,475,718	\$ 148,240	\$ 26,620,552	\$ 38,368,681
	Plan Total		\$ 2,758,340	\$ 20,441,581	\$ 1,662,848	\$ 2,801,094	\$ 364,046	\$ 44,800,529	\$ 72,828,438

Attachment ECM-2, Workpaper 2: Ohio ESP V Budgets by Cost Category PY 4

Sector	Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Residential	Residential Rebates	Appliance Recycling	\$ 632,359	\$ 4,550,205	\$ 619,559	\$ 336,969	\$ 85,890	\$ 2,536,200	\$ 8,761,181
Residential	Residential Rebates	Appliance Rebates	\$ 244,422	\$ 1,861,720	\$ 136,519	\$ 228,655	\$ 33,198	\$ 3,440,527	\$ 5,945,041
Residential	Residential Rebates	EE Products	\$ 6,747	\$ 54,500	\$ 661	\$ 10,943	\$ 916	\$ 210,750	\$ 284,517
Residential	Residential Rebates	Heat Pumps	\$ 105,853	\$ 763,774	\$ 101,612	\$ 113,025	\$ 14,377	\$ 1,840,000	\$ 2,938,640
Residential	Residential Rebates		\$ 989,382	\$ 7,230,199	\$ 858,349	\$ 689,592	\$ 134,382	\$ 8,027,477	\$ 17,929,380
Residential	Energy Education	Home Energy Reports	\$ 207,750	\$ 1,677,995	\$ 20,433	\$ 77,376	\$ 28,217	\$ -	\$ 2,011,772
Residential	Energy Education	School Education	\$ 46,243	\$ 348,800	\$ 29,254	\$ 61,223	\$ 6,281	\$ 1,100,000	\$ 1,591,801
Residential	Energy Education		\$ 253,993	\$ 2,026,795	\$ 49,688	\$ 138,599	\$ 34,498	\$ 1,100,000	\$ 3,603,573
Residential	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 95,437	\$ 627,840	\$ 152,390	\$ 331,545	\$ 12,963	\$ 7,400,000	\$ 8,620,174
Residential Low Income	Low Income Energy Efficiency		\$ 95,437	\$ 627,840	\$ 152,390	\$ 331,545	\$ 12,963	\$ 7,400,000	\$ 8,620,174
Residential	Demand Response for Residential	Load Control - Res	\$ 228,898	\$ 1,661,705	\$ 209,616	\$ 161,732	\$ 31,090	\$ 1,912,000	\$ 4,205,041
Residential	Demand Response for Residential	Behaviorial DR	\$ 142,769	\$ 1,158,125	\$ 9,064	\$ 53,174	\$ 19,392	\$ -	\$ 1,382,524
Residential DR	Demand Response for Residential		\$ 371,667	\$ 2,819,830	\$ 218,680	\$ 214,906	\$ 50,481	\$ 1,912,000	\$ 5,587,565
	Residential Total		\$ 1,710,478	\$ 12,704,664	\$ 1,279,107	\$ 1,374,642	\$ 232,325	\$ 18,439,477	\$ 35,740,692
Commercial & Industrial	Energy Solutions for Business	EE Equipment	\$ 508,228	\$ 3,986,493	\$ 168,450	\$ 885,505	\$ 69,030	\$ 17,405,433	\$ 23,023,139
Commercial & Industrial	Energy Solutions for Business	Custom Projects	\$ 593,947	\$ 4,622,169	\$ 233,560	\$ 569,819	\$ 80,672	\$ 8,715,118	\$ 14,815,286
Commercial & Industrial	Energy Solutions for Business	Energy Management	\$ 28,437	\$ 190,750	\$ 41,731	\$ 30,591	\$ 3,862	\$ 500,000	\$ 795,372
Commercial & Industrial	Energy Solutions for Business		\$ 1,130,612	\$ 8,799,413	\$ 443,741	\$ 1,485,915	\$ 153,565	\$ 26,620,552	\$ 38,633,797
	Commercial & Industrial Total		\$ 1,130,612	\$ 8,799,413	\$ 443,741	\$ 1,485,915	\$ 153,565	\$ 26,620,552	\$ 38,633,797
	Plan Total		\$ 2,841,090	\$ 21,504,076	\$ 1,722,848	\$ 2,860,557	\$ 385,889	\$ 45,060,029	\$ 74,374,490

Attachment ECM-2, Workpaper 2: Ohio ESP V Total Budgets by Cost Category

Sector	Program	Component	Utility Administration and Other	Program Administration	Marketing	EM&V	Tracking and Reporting	Incentives	Total
Residential	Residential Rebates	Appliance Recycling	\$ 2,540,485	\$ 17,449,410	\$ 2,480,692	\$ 1,337,778	\$ 829,057	\$ 10,144,800	\$ 34,782,222
Residential	Residential Rebates	Appliance Rebates	\$ 991,468	\$ 7,224,439	\$ 548,532	\$ 914,241	\$ 329,478	\$ 13,762,108	\$ 23,770,266
Residential	Residential Rebates	EE Products	\$ 30,700	\$ 234,000	\$ 5,100	\$ 44,992	\$ 12,008	\$ 843,000	\$ 1,169,801
Residential	Residential Rebates	Heat Pumps	\$ 435,671	\$ 3,003,967	\$ 408,904	\$ 454,255	\$ 147,826	\$ 7,360,000	\$ 11,810,623
Residential	Residential Rebates		\$ 3,998,325	\$ 27,911,816	\$ 3,443,228	\$ 2,751,266	\$ 1,318,369	\$ 32,109,908	\$ 71,532,912
Residential			\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Residential	Energy Education	Home Energy Reports	\$ 830,886	\$ 6,434,880	\$ 84,191	\$ 304,819	\$ 270,507	\$ -	\$ 7,925,283
Residential	Energy Education	School Education	\$ 195,920	\$ 1,412,600	\$ 119,474	\$ 247,902	\$ 69,544	\$ 4,400,000	\$ 6,445,440
Residential	Energy Education		\$ 1,026,805	\$ 7,847,480	\$ 203,665	\$ 552,720	\$ 340,052	\$ 4,400,000	\$ 14,370,722
Residential	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	\$ 384,973	\$ 2,407,680	\$ 612,016	\$ 1,325,228	\$ 126,030	\$ 29,600,000	\$ 34,455,928
Residential Low Income	Low Income Energy Efficiency		\$ 384,973	\$ 2,407,680	\$ 612,016	\$ 1,325,228	\$ 126,030	\$ 29,600,000	\$ 34,455,928
Residential	Demand Response for Residential	Load Control - Res	\$ 482,830	\$ 3,443,575	\$ 446,347	\$ 376,148	\$ 66,452	\$ 4,964,500	\$ 9,779,852
Residential	Demand Response for Residential	Behaviorial DR	\$ 425,243	\$ 3,378,750	\$ 27,193	\$ 155,627	\$ 59,491	\$ -	\$ 4,046,304
Residential DR	Demand Response for Residential		\$ 908,074	\$ 6,822,325	\$ 473,540	\$ 531,775	\$ 125,943	\$ 4,964,500	\$ 13,826,157
	Residential Total		\$ 6,318,177	\$ 44,989,302	\$ 4,732,449	\$ 5,160,989	\$ 1,910,394	\$ 71,074,408	\$ 134,185,719
			\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Commercial & Industrial	Energy Solutions for Business	EE Equipment	\$ 2,058,788	\$ 15,457,654	\$ 683,630	\$ 3,540,214	\$ 683,549	\$ 69,621,733	\$ 92,045,567
Commercial & Industrial	Energy Solutions for Business	Custom Projects	\$ 2,395,602	\$ 17,850,383	\$ 936,698	\$ 2,273,307	\$ 789,514	\$ 34,860,474	\$ 59,105,977
Commercial & Industrial	Energy Solutions for Business	Energy Management	\$ 114,863	\$ 731,500	\$ 169,383	\$ 122,138	\$ 37,714	\$ 2,000,000	\$ 3,175,599
Commercial & Industrial	Energy Solutions for Business		\$ 4,569,253	\$ 34,039,537	\$ 1,789,711	\$ 5,935,659	\$ 1,510,777	\$ 106,482,206	\$ 154,327,143
	Commercial & Industrial Total		\$ 4,569,253	\$ 34,039,537	\$ 1,789,711	\$ 5,935,659	\$ 1,510,777	\$ 106,482,206	\$ 154,327,143
	Plan Total		\$ 10,887,430	\$ 79,028,838	\$ 6,522,160	\$ 11,096,649	\$ 3,421,171	\$ 177,556,614	\$ 288,512,862

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

Sector	Program	Component	Measure	Source of Savings	Source of Inc Cost	Source of Measure Life
Res	Residential Rebates	Appliance Recycling	Freezer Recycling	PA Evaluation	N/A	MA TRM
Res	Residential Rebates	Appliance Recycling	Refrigerator Recycling	PA Evaluation	N/A	MA TRM
Res	Residential Rebates	Appliance Recycling	Mini Refrig Recycling	PA Evaluation	N/A	MA ISC
Res	Residential Rebates	Appliance Recycling	Room Air Conditioner Recycling	PA Evaluation	N/A	MA ISC
Res	Residential Rebates	Appliance Recycling	Dehumidifier Recycling	PA Evaluation	N/A	MA ISC
Res	Residential Rebates	Appliance Rebates	Clothes Washer	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Refrigerators	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Beverage Cooler O/U Cntr	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Beverage Cooler Portable	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Freezers	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Clothes Dryer	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Air Purifier / Cleaner	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Room Air Conditioner	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Dehumidifiers	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Water Heater - Heat Pump	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	Appliance Rebates	Induction Cooktop	Co Assumption	Co Assumption	Co Assumption
Res	Residential Rebates	Appliance Rebates	Water Cooler	PA TRM	Co Assumption	PA TRM
Res	Residential Rebates	Appliance Rebates	EV Charging - Res	ENERGY STAR	Co Assumption	Co Assumption
Res	Residential Rebates	Appliance Rebates	Smart Thermostat	MA ISC	IC Data 2020	MA ISC
Res	Residential Rebates	Appliance Rebates	Emerging/Other	N/A	N/A	N/A
Res	Residential Rebates	EE Products	Smart Thermostat	MA ISC	IC Data 2020	MA ISC
Res	Residential Rebates	EE Products	Advanced Power Strip	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	EE Products	Heat Pump Water Heater	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	EE Products	Air Purifier/ Cleaner	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	EE Products	Emerging/Other	N/A	N/A	N/A
Res	Residential Rebates	Heat Pumps	Heat Pump - Air Source	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Heat Pumps	Heat Pump - Cold Climate	MA TRM	IC Data 2020	MA TRM
Res	Residential Rebates	Heat Pumps	Heat Pump - Wtr & Geo	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	Heat Pumps	Heat Pump - Ductless Mini - Single Zone	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	Heat Pumps	Heat Pump - Ductless Mini - Multi Zone	PA Evaluation	IC Data 2020	MA TRM
Res	Residential Rebates	Heat Pumps	Emerging/Other	N/A	N/A	N/A
Res	Energy Education	Home Energy Reports	Home Energy Reports 2024	Vendor	N/A	Vendor
Res	Energy Education	Home Energy Reports	Home Energy Reports 2025	Vendor	N/A	Vendor
Res	Energy Education	Home Energy Reports	Home Energy Reports 2026	Vendor	N/A	Vendor
Res	Energy Education	Home Energy Reports	Home Energy Reports 2027	Vendor	N/A	Vendor
Res	Energy Education	School Education	School Education	Co Assumption	Co Assumption	MA & PA TRM
Res LI	Low Income Energy Efficiency	Audit/Education, EE Products & Weatherization	LI - Audit/Education, EE Products & Weatherization	Co Assumption	Actuals	Co Assumption
Res DR	Demand Response for Residential	Load Control - Res	Load Control - Res	Co Assumption	Co Assumption	Co Assumption
Res DR	Demand Response for Residential	Load Control - Res	Enrollment Incentive - Res	N/A	N/A	N/A
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2024 DR	Co Assumption	N/A	Vendor
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2025 DR	Co Assumption	N/A	Vendor
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2026 DR	Co Assumption	N/A	Vendor
Res DR	Demand Response for Residential	Behaviorial DR	Home Energy 2027 DR	Co Assumption	N/A	Vendor

Source Key:

MA TRM	Mid-Atlantic Technical Reference Manual
MA ISC	Mid-Atlantic Interim Supplements Catalog
PA TRM	Pennsylvania Technical Reference Manual
PA SWE DB	Pennsylvania Statewide Evaluator Incremental Cost Database
IC Data 2020	MD Incremental Cost Data 2020

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

Sector	Program	Component	Measure	Source of Savings	Source of Inc Cost	Source of Measure Life
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I (<=5.4 Ton, 1 Ph)	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Heat Pump - Cold Climate C&I (<=5.4 Ton, 1 Ph)	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I (<=5.4 Ton, 3 Ph)	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Heat Pump C&I - Wtr & GeoT (<=11.25 Tons)	MA TRM	MA TRM	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Heat Pump DMS C&I (<=5.4 Ton)	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	PTHP C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	HVAC Tune Up - C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	N/A	N/A	N/A
C&I	Energy Solutions for Business	EE Equipment	Lighting Controls	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	EE Equipment	LED Linear	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Exit Signs	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	LED Fixture External	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	EE Equipment	LED Fixture Internal	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	LED Lamps	MA TRM	MA TRM	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Lighting - Other	Co Assumption	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	EE Equipment	Lighting - Custom	Co Assumption	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	EE Equipment	LED Reach in Refrig / Frzr Lights	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Heat Pump Water Heater - C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	EV Charging - Eff - C&I	ENERGY STAR	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	N/A	N/A	N/A
C&I	Energy Solutions for Business	EE Equipment	Commercial Refrigerator - C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Commercial Freezer - C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Refrigerated Case Cover	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Anti Sweat Heater Controls	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Strip Curtains	PA TRM	PA SWE DB	PA TRM
C&I	Energy Solutions for Business	EE Equipment	Ice Machines	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Beverage Vending Machine - Controls	PA TRM	PA SWE DB	PA TRM
C&I	Energy Solutions for Business	EE Equipment	Steam Cookers	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Fryers	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Griddles	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Hot Food Holding Cabinet	MA TRM	PA SWE DB	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Combination Oven	MA TRM	PA SWE DB	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Convection Oven	MA TRM	PA SWE DB	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Dishwasher, Commercial - C&I	MA TRM	IC Data 2020	MA TRM
C&I	Energy Solutions for Business	EE Equipment	Induction Warmer/Rethermalizer Well	Mfg Data	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	EE Equipment	Coffee Brewers	ENERGY STAR	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	EE Equipment	Emerging/Other	N/A	N/A	N/A
C&I	Energy Solutions for Business	Custom Projects	Custom - Chillers	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - VFDs < 10HP	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - VFDs > 10 HP	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - Process Improvement	Co Assumption	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	Custom Projects	Custom - Compressed Air	Co Assumption	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - Motors	PA TRM	Co Assumption	PA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - Refrigeration	Co Assumption	Co Assumption	Co Assumption
C&I	Energy Solutions for Business	Custom Projects	Custom - Data Processing Eqpmnt/Servers	PA TRM	Co Assumption	PA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - HVAC Eqp & Controls	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Custom Projects	Custom - Electronics/Systems/Cntrl	MA TRM	Co Assumption	MA TRM
C&I	Energy Solutions for Business	Energy Management	Audit & Education - C&I	N/A	N/A	N/A

Source Key:	
MA TRM	Mid-Atlantic Technical Reference Manual
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Attachment ECM-4, Workpaper 1: Global Inputs

Parameter	Value	Notes
Discount Rate (All Tests)	7.23%	See calculation and sources below.
CO2 from gen	1220	lb./MWh, Taken from EIS State Profile for Ohio.
CO2 tons per kWh	0.000553288	Calculated (1.22 lb./kWh) / (2205 lb. / Metric Ton)
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)
(6)	Income Tax (federal & state)	22.36%	Assumption with 21% FIT Rate
(7)	After Tax WACC	7.23%	(Ln 1 x Ln 3 x (1 - Ln 6)) + (Ln 2 x Ln 4)

Attachment ECM-4, Workpaper 2: Avoided Energy

Year	On Peak	Off Peak	All Hours
2023	\$ 43.10	\$ 34.06	\$ 38.31
2024	\$ 53.22	\$ 38.02	\$ 45.16
2025	\$ 53.34	\$ 38.68	\$ 45.57
2026	\$ 48.66	\$ 40.01	\$ 44.08
2027	\$ 44.76	\$ 43.08	\$ 43.87
2028	\$ 42.26	\$ 47.99	\$ 45.30
2029	\$ 41.30	\$ 55.43	\$ 48.79
2030	\$ 44.00	\$ 59.06	\$ 51.99
2031	\$ 46.62	\$ 62.58	\$ 55.07
2032	\$ 48.44	\$ 65.02	\$ 57.23
2033	\$ 50.89	\$ 68.32	\$ 60.13
2034	\$ 52.16	\$ 70.03	\$ 61.63
2035	\$ 53.51	\$ 71.84	\$ 63.23
2036	\$ 55.10	\$ 73.98	\$ 65.11
2037	\$ 56.87	\$ 76.36	\$ 67.20
2038	\$ 58.72	\$ 78.85	\$ 69.39
2039	\$ 60.27	\$ 80.94	\$ 71.23
2040	\$ 62.57	\$ 84.03	\$ 73.95
2041	\$ 64.35	\$ 86.42	\$ 76.05
2042	\$ 65.59	\$ 88.09	\$ 77.51
2043	\$ 67.41	\$ 90.53	\$ 79.66
2044	\$ 67.85	\$ 91.12	\$ 80.18
2045	\$ 68.95	\$ 92.61	\$ 81.49
2046	\$ 70.51	\$ 94.70	\$ 83.33
2047	\$ 72.21	\$ 96.99	\$ 85.35
2048	\$ 74.67	\$ 100.30	\$ 88.25
2049	\$ 76.06	\$ 102.16	\$ 89.89
2050	\$ 77.86	\$ 104.59	\$ 92.02

For the years 2023 through 2025, the avoided generation 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.

For the years 2026 through 2028, the avoided generation costs are based on a weighted average of the PJM-day-ahead futures over this period (75%, 50% and 25% respectively) with a second projection for this period based on the EIA natural gas forecasts for Henry Hub (HH) with a Dominion South (DS) geographical basis adjustment.

The EIA HH to DS conversion was calculated using DS history/forward average (6-year) monthly basis and applied to the EIA HH monthly forecast. The heat rate conversion was calculated using history/forward average (6-year) on-peak and off-peak monthly prices for ATSI/DS and applied to the appropriate forecast.

From 2029 to 2050, the avoided generation prices are determined from EIA HH the same as described above.

Sources:

ATSI/HH/DS Forward prices come from the ICE ZEMA tables. These are based on the February 8, 2023 forecast.
<https://www.theice.com>

EIA Henry Hub forecast gas come from the EIA 2022 Annual Energy Outlook Table 13.
https://www.eia.gov/outlooks/aeo/tables_ref.php

Attachment ECM-4, Workpaper 3: Avoided Capacity

Year	Capacity \$/kW
2024	\$ 89.84
2025	\$ 93.41
2026	\$ 97.13
2027	\$ 101.00
2028	\$ 105.02
2029	\$ 109.20
2030	\$ 113.55
2031	\$ 118.07
2032	\$ 122.77
2033	\$ 127.65
2034	\$ 132.74
2035	\$ 138.02
2036	\$ 143.51
2037	\$ 149.23
2038	\$ 155.17
2039	\$ 161.35
2040	\$ 167.77
2041	\$ 174.45
2042	\$ 181.39
2043	\$ 188.61
2044	\$ 196.12
2045	\$ 203.93
2046	\$ 212.05
2047	\$ 220.49
2048	\$ 229.26
2049	\$ 238.39
2050	\$ 247.88

The Avoided Capacity forecast uses the average of the historical cleared capacity prices for Planning Year (PY) 2019-2020 through 2023-2024. The forecast escalates the average by the Handy Whitman - All Steam Gen rate beginning PY 2024-2025.

Sources:

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

Attachment ECM-4, Workpaper 4: Avoided T&D

Year	Avoided Transmission, \$/kW	Avoided Distribution, \$/kW
2024	\$ 13.82	\$ 20.42
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 to account for inflation.

Attachment ECM-4, Workpaper 5: GHG

Year	Amount
2024	\$ 81.52
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 (CO₂) 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 CO₂, 2020 – 2050 (in 2020 dollars per metric ton of CO₂)³

Emissions Year	Discount Rate and Statistic			
	5% Average	3% Average	2.5% Average	3% 95 th 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