Large Customer Opt-Out: An Ohio Example

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Executive Summary

Utility-sector energy efficiency programs are a low-cost resource option for electric utilities to meet customer demand. These programs are generally targeted to all groups, including residential customers and businesses of all sizes. The programs serving businesses are historically the lowest cost, averaging 2.7 cents per kWh compared to 3.5 cents per kWh for residential programs.[1] Aside from reducing electric demand, the programs provide numerous benefits including reduced utility costs associated with building new infrastructure to meet higher demand, lower air pollution associated with power plants, greater regional economic activity through program implementation, and greater levels of disposable income earned through bill savings. These benefits lower costs for all customers.

Despite such benefits, some states have implemented opt-out policies. These policies allow some customers to forego participating in energy efficiency programs and avoid paying the costs associated with their implementation. The customers who choose to opt out enjoy the benefits of lower utility system costs (and correspondingly lower rates) that the energy savings funded by the remaining customers have made possible. In general, however, opt-out policies lead to higher utility system costs by removing some of the lowest-cost savings opportunities for utilities. Opt-out also conflicts with state policy goals of improving environmental quality, boosting economic development, and providing electric customers with least-cost service.

Several states currently allow some form of opt-out, and several more, including Ohio, are considering opt-out policies that will result in higher costs and lost savings opportunities. This paper examines some of the impacts of allowing some customers to opt out. We estimate the economic costs of an opt-out policy in multiple areas including increased utility system costs, air pollution, and pollution-related health costs. We also discuss the potential effects of such a policy on the cost of saving energy, economic growth, and compliance costs for federal air quality rules. Our analysis focuses on Ohio, a state currently considering expansion of its existing opt-out policy.

OPT-OUT IN OHIO

We estimate the economic impacts of an opt-out policy in Ohio under several scenarios because it is unknown how many customers would opt out. Although 5% of total sales had opted out in 2015, for ease of review we start with a baseline with no opt-outs. From this baseline our three scenarios assume an opt-out rate of 20%, 35%, and 45%, respectively. In the body of the report we analyze these scenarios under two generation-mix forecasts: business as usual and a low-coal generation case. Here we present the mid-case business-as-usual scenario, in which 35% of all energy savings opportunities are lost. This scenario also assumes that the opt-out would continue over a 10-year period, from 2015 through 2024. Because efficiency programs provide energy savings for more than a decade once installed,

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[1] I. Hoffman, G. Leventis, and C. Goldman, *Trends in the Program Administrator Cost of Saving Electricity for Utility Customer-Funded Energy Efficiency Programs* (Berkeley: Lawrence Berkeley National Laboratory, 2017). emp.lbl.gov/publications/trends-program-administrator-cost.

we consider the cumulative costs and benefits for each year to determine total impacts. We assume that conditions in the first year (2015) remain constant, including generation mix and lost energy savings.

Table ES1 presents results under the mid-range scenario for the three most significant categories of lost benefits.

Table ES1. Increased costs to Ohio under a 35% opt-out (2015–2024)

Metric	Potential lost benefit (billions)	Description
Utility costs	$1.85	Increased utility system costs
Health costs	$1.27*	Increased healthcare costs associated with increased air pollution
Bill savings	$3.30	Lost bill savings opportunities for participants

*This value represents the high estimate for health costs under this scenario.

Table ES1 shows substantial increased costs to Ohio from an opt-out policy. The total increased utility costs would exceed $1.85 billion if the opt-out policy were in place from 2015 to 2024, while Ohio's increased health-related costs would exceed $1.2 billion. The increase in regional health-related costs are also much higher (exceeding $9.2 billion), because of the regional nature of air pollution and power generation.[2] Finally, by forgoing the opportunity to participate in programs, customers would lose more than $3.3 billion in bill savings.

Our analysis of a potential expanded opt-out in Ohio produced the following more detailed results under the mid-range opt-out scenario.

Utility system costs. Our analysis shows large increases in utility system costs. Under the mid-range scenario, utility system costs would increase by nearly $1.85 billion. These costs include increasing transmission and distribution capacity, building new power plants, and increasing fuel costs related to energy production. The increased transmission and distribution capacity and power plant costs would increase the rates and bills for all Ohio customers. The loss of low-cost energy savings would require utilities to meet this demand with higher-cost energy from market purchases. The increased demand on wholesale markets would increase energy prices. In a 2013 study, ACEEE estimated that energy efficiency in amounts sufficient to meet the energy efficiency resource standard in Ohio

[2] The regional increase considers the increase in health-related costs in several states near Ohio that would see changes in air pollution and generation due to Ohio's opt-out-driven change in electric demand. These states include Wisconsin, Indiana, Michigan, Illinois, Kentucky, Virginia, West Virginia, Pennsylvania, and New Jersey. We present the methodology and detailed results of this analysis later in the paper and in Appendix B.

would create savings of $880 million from wholesale energy price mitigation and $1.3 billion in savings from wholesale capacity price mitigation through 2020 (Neubauer et al. 2013).[3]

Air pollution. We used the US Environmental Protection Agency's Avoiding Emissions and Generation Tool (AVERT) to estimate changes in air pollution based on changes in Ohio's electric demand. An expanded opt-out policy would increase air pollution in Ohio (and surrounding states) because increased demand for electricity would require reliance on traditional fossil-fueled generation. Table ES2 shows the estimated total change in air pollution under the mid-range (35%) opt-out scenario.

Table ES2. Increase in air pollution for Ohio and the surrounding region under 35% opt-out (2015–2024)

Air pollution	Ohio increase	Regional increase
Sulfur dioxide (tons)	18,095	86,625
Nitrogen oxide (tons)	5,775	34,705
Particulate matter 2.5 (tons)	1,815	6,221
Carbon dioxide (thousand tons)	7,370	40,810

Air pollution-related health costs. The additional air pollution emitted will result in a variety of health harms to the people of Ohio and surrounding states. Such harms include increased asthma attacks, hospitalizations, and lost work days, and they cost the state money. Under the mid-range scenario over a 10-year period (2015–2024), the increased health-related costs in Ohio would be between $564 million and $1.3 billion. For the surrounding region, the increased health-related costs would be between $4.1 and $9.3 billion.

Large-customer bills. Large commercial and industrial customers can avoid millions of dollars in electric charges by participating in energy efficiency programs. In an expanded opt-out, these customers lose the ability to participate in programs and enjoy these bill savings. We estimate lost participant bill savings of $3.3 billion under the mid-range scenario.

CONCLUSION

Our analysis of Ohio's expanded opt-out demonstrates that the policy could be costly for the state in several ways. Costs for utility infrastructure would increase because of higher demand on fossil-fueled power plants and the need for new transmission and distribution assets. These increased costs would raise costs for all customers in Ohio. The loss of the lowest-cost savings opportunities would require Ohio utilities to increase reliance on wholesale energy markets to meet higher demand, leading to higher wholesale energy prices. Air pollution in Ohio and the surrounding region would increase due to higher demand on power plants. The increased air pollution would inflict health harms on those in

[3] Our analysis did not consider the wholesale price mitigation costs to Ohio under opt-out; including wholesale price mitigation would increase the utility system costs.

the region, increasing health-related costs. Finally, the lost bill savings opportunities for the opt-out customers would be substantial, far exceeding what they would have spent on energy efficiency programs.

Introduction

Energy efficiency is an important utility system resource that saves money for customers, improves public health, creates jobs, and generates economic development. To achieve these benefits, many states and utilities have developed energy efficiency programs, which are typically funded by customers either through utility rates or as an additional surcharge on their bills.[1]

States, utilities, and program administrators have pursued a range of programs designed to meet the needs of all different types of customer classes. Some programs target the largest energy users, which rely heavily on the utility system and represent a significant opportunity for achieving low-cost energy savings. Despite this opportunity, most states harness only a fraction of the energy-savings potential from their largest customers. Indeed, instead of implementing utility programs that effectively respond to the unique needs of this customer class, some states let large users opt out of energy efficiency program participation and funding altogether. This not only leaves behind a sizable share of savings, but, if the sales goal is not adjusted under the opt-out policy, it also increases the cost of saved energy (CSE), measured in cents per kilowatt-hour (kWh), for the overall energy efficiency portfolio.

In this paper, we examine some of the impacts of allowing customers to opt out of participating in energy efficiency programs. We first define opt-out policies in general, briefly summarizing their history and describing their possible consequences. We then use data from utility service territories in Ohio to examine the impact of various opt-out scenarios in the state, including forgone utility cost savings, air pollution impacts, changes in portfolio CSE, and lost bill savings to industrial customers.

DEFINING OPT-OUT

Opt-out policies allow large customers to stop participating in utility-sector efficiency programs. These policies typically affect industrial customers, but may also include large institutional or commercial customers. Customers who have opted out are generally exempt from paying the costs associated with efficiency programs in rates or on bills and no longer have access to the energy-saving programs. They are under no obligation to make energy efficiency investments, and any energy savings they achieve on their own are not measured or counted. Typically, opt-out policies preclude utilities from incentivizing energy savings for these customers and prevent them from counting any efficiency they achieve in long-term resource planning efforts. Utility energy savings goals are then often adjusted to remove the potential savings from these customers, thereby reducing potential cost-effective energy savings opportunities. These opt-out policies have typically been enacted through legislation, usually driven by a few of the state's largest industrial companies. Most of these policies let large customers choose whether or not they want to stop participating in the programs. However some policies, such as those in Texas and Illinois, eliminate the option

[1] This surcharge is also variously known as an adjustment clause, cost-recovery mechanism, rider, or tracker.

to participate, simply excluding eligible large customers from efficiency programs altogether.

Self-direct is an alternative policy approach, distinct from opt-out, that some states use to address the needs of large customers. We use the term *self-direct* to describe policies that allow customers to control how some or all of their energy efficiency fees are used. Self-direct programs typically include an obligation for large customers to make energy efficiency investments on their own that are measured and count toward utility energy efficiency saving targets. These programs operate very differently from state to state, and not all of them are effective approaches to encouraging energy efficiency. The best examples have a formal structure that requires customers to make their own cost-effective energy efficiency investments, and allows utility program administrators to measure and verify energy efficiency savings.[2]

BRIEF HISTORY OF OPT-OUT

Texas became the first state to allow large customers to stop paying into programs when the legislature amended its energy efficiency rule in 2007 (PUCT 2007). Today, 13 states either provide an exemption for large customers or let them opt out of paying for and participating in utility-run energy efficiency programs. As of May 2017, states with opt-outs or exemptions include Arkansas, Illinois, Indiana, Kentucky, Maine, Missouri, North Carolina, Ohio, Oklahoma, South Carolina, Texas, Virginia, and West Virginia.

Of these states, most have developed their own state-specific approaches for implementing opt-outs. Some set the criteria for opt-out eligibility based on a customer's total electricity consumption (MWh), while others use peak demand (MW) or extend eligibility to an entire rate class. In some states, companies are restricted from aggregating consumption or demand across multiple meters in order to meet the eligibility threshold, while other states allow it. Some states choose to adjust the utility's savings target to reflect the load that is no longer participating through the opt-out policy; others do not.

Despite the fact that opt-out policies discourage energy savings by reducing utility goals, the trend continues and more states are considering this policy. For example, the Pennsylvania legislature is currently considering an opt-out policy that would allow very large companies to withdraw contributions from Act 129, the state's energy efficiency law. The Ohio legislature is also considering an expansion of its existing opt-out policy (originally passed in 2014). If this expansion passes, Ohio could have the lowest eligibility threshold in the country.[3]

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[2] For more information on best practices, program examples, and model language for developing good self-direct programs, see ACEEE's toolkit, *Self-Direct Programs for Large Energy Users,* available at aceee.org/sector/state-policy/toolkit/industrial-self-direct. The self-direct option currently available to mercantile customers in Ohio does not exhibit best practices in self-direct program design.

[3] In Ohio, customers using 45 million kWh per year are currently eligible to opt out. Expanding eligibility to the mercantile customer class would lower the threshold to 700,000 kWh per year. Other states use different thresholds to determine eligibility, but of the states that determine eligibility for opt-out on the basis of usage (kWh), North Carolina and South Carolina currently have the lowest thresholds at 1 million kWh.

CONSEQUENCES OF OPT-OUT

In the absence of energy savings from large customers, demand increases and electricity costs more for all customers. In many utility systems, large customers represent a majority of the energy demand and, therefore, a significant amount of the energy savings opportunity. Large customer savings are also often the cheapest to achieve. Losing access to this large, low-cost savings opportunity can make it more difficult to achieve savings targets and more expensive to deliver energy efficiency programs.

The higher demand also requires utilities to increase investment in transmission and distribution systems. Many examples show how energy efficiency can delay or avoid the need for new transmission and distribution infrastructure (Neme and Grevatt 2015). The loss of energy savings opportunities decreases these potential reductions in infrastructure costs, thus increasing costs for all customers.

Energy efficiency programs can also reduce wholesale market prices for energy and capacity. When customer demand or load is reduced, prices decrease. This concept is known as market price suppression or demand reduction induced price effect (DRIPE). The economic value of DRIPE can be substantial. In a 2013 study, ACEEE estimated that energy efficiency in amounts sufficient to meet Ohio's energy efficiency resource standard would create savings of $880 million from wholesale energy price mitigation and $1.3 billion from wholesale capacity price mitigation through 2020 (Neubauer et al. 2013).

Opt-out can make savings targets more difficult to reach because the utility's ability to achieve cost-effective energy savings and reduce load on the entire system is artificially limited. For example, in Oklahoma approximately 90% of the eligible electric customers opted out (ACEEE 2017). This represents a significant reduction in the pool of possible savings that utilities can draw upon.

Opt-out can also result in a higher cost of saving energy and can make energy efficiency programs more expensive to deliver. A recent study showed that the levelized cost of saved electricity for the commercial and industrial (C&I) sector averaged 2.7 cents per kWh compared to 3.5 cents per kWh in the residential sector (Hoffman, Leventis, and Goldman 2017).[4] In some cases, when utilities lose access to these least-cost energy savings, they must make up for them with other, higher-cost programs, which can drive up costs for the portfolio of programs. Alternatively, they may meet the additional demand for electricity by purchasing wholesale electricity or by building new power plants or transmission and distribution lines.

When utilities can work with all customers to meet and balance electric demand, they can avoid unnecessary and expensive investments, rates are reduced, and electricity bills are lower for all customers in the community. Consider the fairness issues that would be raised if, for example, the cost of a new power plant was covered only by small businesses and

[4] The cost of saved energy indicates how much a utility spends in order to save a kWh over the lifetime of a program or measure. We discuss this in more detail later in this paper.

residential customers, while larger customers paid nothing. The same holds true for the resource of energy efficiency. All customers should pay their fair share, because the resource benefits all customers. For these reasons, reaching large energy users is an important component of a comprehensive strategy for managing energy demand, achieving statewide energy savings targets, and improving the cost effectiveness of energy efficiency portfolios.[5]

We now explore some of these consequences under a range of potential large-customer opt-out scenarios in Ohio.

Estimated Impacts of Opt-Out in Ohio

In this section, we analyze three scenarios to illustrate a range of potential consequences of a large-customer opt-out in Ohio.

BACKGROUND

Energy Savings Requirement

In 2008, Ohio established energy savings and peak demand reduction targets for electric distribution utilities.[6] The law required these utilities to implement energy efficiency programs achieving gross energy savings of 0.3% of an average of the prior three years of weather-normalized electric sales. The energy savings requirement of 0.3% increased annually until reaching 1% in 2014. After 2020, the savings goal increases to 2% annually, with an eventual cumulative savings goal of 22% by the end of 2027.

In 2014, Ohio Governor John Kasich signed Senate Bill 310 into law. This enacted a two-year freeze at 2014 levels for renewable energy benchmarks for electric utilities in Ohio, and changed the calculation for determining the 2015 and 2016 energy efficiency benchmarks. It reduced energy savings requirements to 4.2% cumulative energy savings based on 2015. Additionally, utilities that had already achieved that level or more of energy savings cumulatively between 2009 and 2014 could not be required to achieve any more savings (Ohio Legislative Service Commission 2014). Essentially, this eliminated any efficiency savings requirements for Ohio utilities in 2015 and 2016. As a result, from 2014 to 2015, energy savings decreased by almost 27% across the six largest utilities.

Currently Ohio allows some large customers to opt out of utility-specific energy efficiency programs and also allows mercantile customers to participate in what is referred to in Ohio as a self-direct program.[7] Recent proposals seek to expand the currently available opt-out to include mercantile customers.

[5] For more information on the importance of keeping large customers in utility programs, see Kelly 2016.

[6] The details of the peak demand reduction are described in Ohio Revised Code 4928.66; we do not explore those details in this report as our focus is on energy efficiency targets.

[7] See Ohio Revised Code 4901:1-39-08. Mercantile customers are defined in Ohio as "a commercial or industrial customer if the electricity consumed is for nonresidential use and the customer consumes more than seven hundred thousand kilowatt hours per year or is part of a national account involving multiple facilities in one or more states." Ohio Revised Code 4928.01.

Self-Direct

The self-direct program for mercantile customers exempts them from paying utility costs associated with energy efficiency programs, but requires them to prove that they achieved energy savings. A mercantile customer is a commercial or industrial customer who uses more than 700,000 kWh per year or who is part of a national account that includes multiple facilities in one or more states.[8] The mercantile customer category is broad and could include larger customers such as a steel foundry, but could also include chains of smaller customers such as gas stations. To meet the eligibility requirements for the self-direct program, mercantile customers must provide an annual report on the energy savings and peak demand reductions they achieved in the most recent year.

Opt-Out

Under current law, C&I customers (subject to limited restrictions) and customers that receive service above the transmission or subtransmission voltage level can opt out of the utility's energy efficiency and peak demand reduction portfolio. To opt out, customers must notify their utility and provide a report to the Public Utility Commission of Ohio (PUCO) showing planned policies, projects, or actions they will take to reduce their energy intensity. Customers who opt out may be subject to notices, hearings, or placement back into the utility's portfolio if they do not show "substantial cumulative reduction in energy intensity" based on reports they must submit every two years.[9]

As of 2015, FirstEnergy Corporation was the only utility with customers who opted out; 12.57% of its companies' customers did so in that year. Table 1 shows data from FirstEnergy companies on reported customer opt-out for 2015.

Table 1. FirstEnergy companies' 2015 opt-out percentages

Utility	Sales (MWh)	Opt-outs (MWh)	Opt-out as % of sales
CEI	18,501,986	1,487,301	8.04%
OE	24,291,651	2,055,816	8.46%
TE	10,454,511	3,148,170	30.11%
Total	53,248,149	6,691,288	12.57%

CEI = Cleveland Electric Illuminating Company. OE = Ohio Edison Company. TE = Toledo Edison Company. CEI, OE, and TE are subsidiaries of FirstEnergy Corporation. *Source:* FirstEnergy 2015.

Consequences of Expanded Opt-Out

The opt-out policy and self-direct option affect how utilities calculate baseline sales used to determine energy savings benchmarks. Utilities can subtract the energy sales from customers that opt out from the total retail sales in that year. This reduces the overall

[8] See Ohio Revised Code 4928.01.

[9] See Ohio Revised Code 4928.6610 through 4928.6616.

benchmark (calculated as 1% of a three-year average of sales), as it reduces the sales for each year in which customers opted out.[10] In contrast, utilities can report energy savings from the mercantile customer self-direct programs to meet energy savings targets. The sales of mercantile customers who participate in these program remain part of the baseline calculation and so do not reduce the overall energy savings goals. This difference is important, as any expansion of the opt-out program will reduce savings goals. As more customers opt out, the requirements for energy savings decline.

METHODOLOGY

To consider a range of potential lost savings opportunities, we estimated the consequences of three opt-out scenarios: high, medium, and low. In the high scenario, we assumed that 45% of total sales opt out of energy efficiency portfolios. The high scenario could be considered a conservative estimate, as the C&I sector made up two-thirds of sales for these utilities in 2015 (see table 2). In the medium scenario, we assumed 35% of total sales opt out of energy efficiency programs, and we assumed 20% in the low case.

We considered the potential impacts of an expanded opt-out in several areas. We first examined the potential change in utility system costs due to energy efficiency reductions. We then examined the CSE for program years 2014 and 2015. Next, we considered the potential change in air pollution from increased reliance on traditional power plants, and we estimated the increased costs associated with that pollution. Finally, we considered lost bill savings opportunities for utility customers.

We relied on Ohio-specific data reported to the US Energy Information Administration (EIA) for utility revenues, sales, and customer counts. For energy efficiency program spending and savings figures, we relied on utility-specific annual reports and evaluations filed with PUCO.[11]

LOST ENERGY SAVINGS

In order to estimate the consequences of a potential opt-out in Ohio, we need to estimate the potential savings opportunities that would be lost under the current Ohio energy savings targets.

Savings Before Expanded Opt-Out

SAVINGS REQUIREMENTS BENCHMARK

The current energy savings targets require utilities to achieve savings of 1% of electric sales, calculated using a baseline of an average of three-year weather normalized sales. Table 2 shows the electric sales by sector for the six participating utilities in Ohio. The table also shows the percentage of sales by class for each utility and an estimate of a 1% savings goal based on 2015 sales for all customer classes.

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[10] For a more detailed discussion of the FirstEnergy benchmark calculations, see dis.puc.state.oh.us/TiffToPDf/A1001001A17B01B62312A01290.pdf.

[11] These documents are available on the PUCO website.

Table 2. 2015 electric sales by sector with assumed 1% energy savings goal

Utility	Residential (MWh)	Commercial (MWh)	Industrial (MWh)	Total sales (MWh)	% of sales residential	% of sales C&I	1% energy savings goal (MWh)
AEP	14,173,918	14,591,080	14,650,884	43,415,882	33%	67%	434,159
CEI	5,489,972	6,689,244	6,286,643	18,501,986	30%	70%	185,020
DPL	5,132,100	5,049,835	3,680,733	13,866,213	37%	63%	138,662
Duke	7,136,587	7,847,215	5,160,423	20,144,225	35%	65%	201,442
OE	9,221,743	6,804,023	8,265,885	24,291,651	38%	62%	242,917
TE	2,468,896	2,026,779	5,958,835	10,454,510	24%	76%	104,545
Total	43,623,216	43,008,176	44,003,403	130,674,467	33%	67%	1,306,745

AEP = Ohio Power or American Electric Power Ohio. CEI = Cleveland Electric Illuminating Company. DPL = Dayton Power and Light Company. Duke = Duke Energy Ohio. OE = Ohio Edison Company. TE = Toledo Edison Company. CEI, OE, and TE are subsidiaries of FirstEnergy Corporation. *Source:* EIA 2016a

However the energy savings goal is based on a three-year average of weather normalized sales. Utilities are also able to adjust the baseline for changes in the number of customers, sales, and peak demand to the extent that such changes are outside the utility's control. Utilities are required to file the calculation of this baseline to estimate energy savings benchmarks. Table 3 shows the adjusted baselines and benchmark requirements as filed by Ohio utilities. It includes the opt-out savings reported by FirstEnergy companies for 2015 (CEI, OE, and TE).

Table 3. 2015 annual energy efficiency benchmark and baseline by utility (MWh)

Utility	Baseline (three-year average of weather normalized sales)	Benchmark requirement
AEP	42,711,600	427,116
CEI	17,560,652	175,607
DPL	13,806,336	138,063
Duke	20,149,669	201,497
OE	22,401,327	224,013
TE	7,434,873	74,349
Total	124,064,457	1,240,645

Sources: AEP 2016b; DPL 2016a; Duke 2016a; FirstEnergy 2016.

For the purposes of this analysis, we rely on the energy savings benchmarks in table 3, but do not include the opt-out sales reported by FirstEnergy. This is because we sought to estimate the effect of opt-out scenarios using a baseline assuming no customers had opted out. Although there are multiple adjustments to the benchmark requirements, a comparison of these values with 1% of 2015 energy sales yields similar values (a difference of approximately 5%). Using these values, we analyzed three scenarios assuming 20, 35, and 45% of customers opting out. Table 4 presents the results for the three scenarios.

Table 4. Lost first-year energy savings

Scenario	Percentage of savings lost from opt-out	Energy savings (GWh)
Low	20%	261
Mid	35%	456
High	45%	588

FIRST-YEAR AND LIFETIME SAVINGS

The next step to estimating energy savings changes due to potential opt-out scenarios is to determine the magnitude of the savings opportunities lost. Table 5 shows the reported first-year energy savings by sector for Ohio utilities in 2014 and 2015.

Table 5. Reported first-year energy savings by sector for 2014 and 2015 (MWh)

Utility	Residential	C&I	Mercantile (self-direct)	Total
		2015		
AEP	223,800	282,200	18,500	539,200
DPL	69,033	97,145	3,736	171,377
Duke	61,013	87,626	5,162	154,265
OE	16,631	84,859	9,268	110,758
CEI	14,291	50,093	4,638	69,022
TE	6,124	60,320	34	66,478
Statewide	390,891	662,243	41,338	1,111,100
		2014		
AEP	331,700	258,800	6,200	636,900
DPL	84,331	89,129	4,535	178,478
Duke	75,465	59,951	7,057	143,241
OE	103,889	116,519	33,965	254,373
CEI	68,707	67,944	69,006	205,657
TE	214,210	45,323	22,304	99,679
Statewide	878,301	637,666	143,068	1,518,328

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016.

We reviewed 2015 program results, because 2015 is the most recent program year evaluated. However, due to a 2014 freeze on energy savings targets by the Ohio legislature, 2015 includes performance results that are inconsistent with prior years. Therefore we have also included a review of 2014 energy savings results. The 2015 data show that 63% of savings were from the C&I sector, but the 2014 data show only 51% from this sector. The remaining savings in both years are from residential customers.

The energy savings presented in table 5 are first-year energy savings, meaning only the savings occurring in the program's first year. Energy efficiency programs produce savings for many years beyond the first year. These *lifetime savings* estimates in Ohio are often based on data presented in the *Ohio Technical Resource Manual*, but they are also supplemented by evaluators with engineering estimates and other data. The lifetime savings are calculated by multiplying the first-year savings by the effective useful life for the program. To estimate the lifetime energy savings for this analysis, we collected program- and sector-level data, as available, on effective useful lives for the 2014 and 2015 program years. We calculated an average portfolio-level effective useful life of 10.59 years for 2014 and 2015 by weighting the program-level results. We then applied the average effective useful life of portfolio-level savings to 2015 benchmarks to estimate lifetime savings. Table 6 shows the effective useful life and lifetime savings, by utility, for 2015 energy savings.

Table 6. 2015 energy savings benchmarks and effective useful lives

Utility	Annual savings benchmark (MWh)	Portfolio effective useful life (years)	Lifetime savings for 2015 benchmark (MWh)
AEP	427,116	11.04	4,713,835
CEI	190,010	12.21	2,319,951
DPL	138,063	8.19	1,131,312
Duke	201,497	8.36	1,684,841
OE	243,370	11.69	2,844,867
TE	106,240	12.12	1,287,136
Total	1,306,296	10.59	13,836,686

See Appendix A for detailed effective useful life information used for this calculation.

Losses Under Expanded Opt-Out Policy

Given these lifetime energy savings estimates for the portfolio from the 2015 benchmarks, we can estimate the potential energy savings losses from our three opt-out scenarios. We can also estimate potential consequences from these energy savings losses. Opt-out policies also reduce energy savings in future years because savings opportunities are lost every year the policy is in place. Figure 1 shows the cumulative annual lost energy savings based on the three opt-out scenarios.

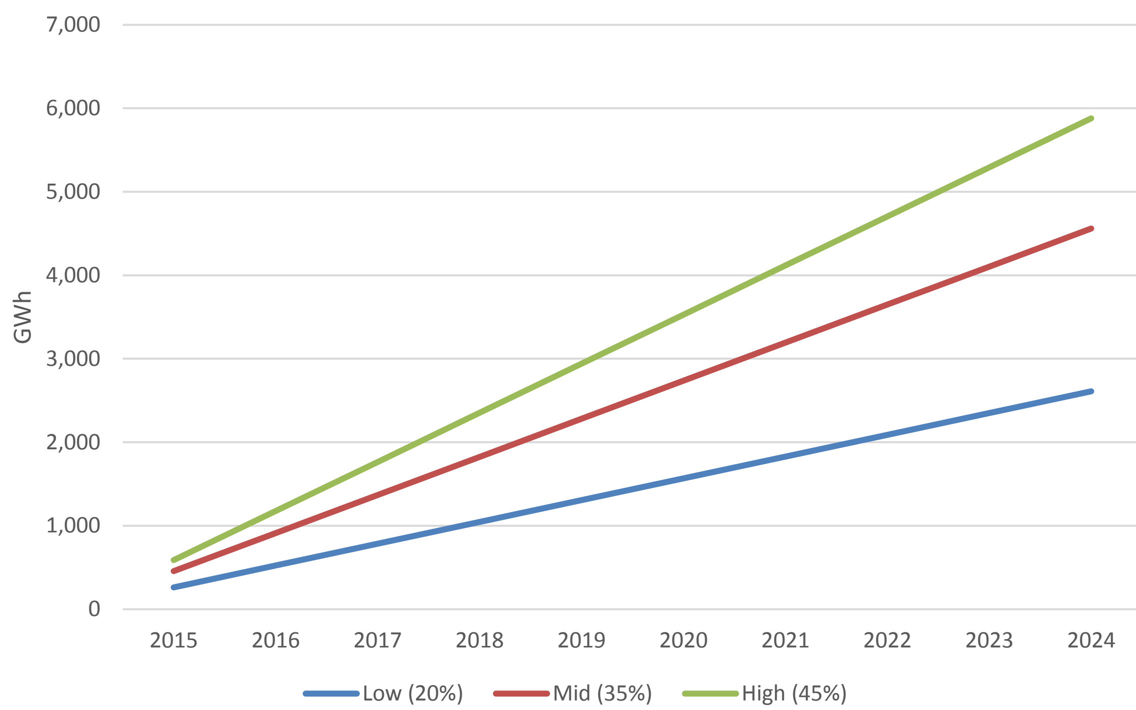

Figure 1. Cumulative annual lost energy savings over 10 years

According to EIA, Ohio's total retail electric sales were 149,213 GWh in 2015 (EIA 2017). As figure 1 shows, the mid-range opt-out scenario in 2024 would be more than 3% of these 2015 retail sales. Figure 1 shows only lost energy savings over the 10-year period of 2015–2024. However the lost energy savings would continue after 2024, because the measure life of programs implemented in 2024 would provide energy savings for 10 additional years.

IMPACT ON UTILITY SYSTEM COSTS

The primary benefit of utility-sector energy efficiency programs is to avoid or reduce costs associated with investment in utility system infrastructure. Energy efficiency reduces demand, which reduces the need for fuel and other costs associated with energy production, new power plants, and transmission and distribution infrastructure. Demand reductions also reduce wholesale electric prices. The cost savings achieved through reduced utility system investments reduce costs for all utility system customers. Thus, when a utility avoids building new infrastructure, all ratepayers benefit. The same is true for wholesale market price reductions from reduced demand.

Implementing an expanded opt-out policy reduces energy savings, thereby increasing the need for new infrastructure to meet higher demand; utility system costs increase as demand grows.

In Ohio, utilities estimate utility system benefits through the *utility cost test*, a cost-benefit test that measures the effectiveness of program investments. This test summarizes the cost and benefits from the utility perspective, comparing the total cost of implementing a program with the net present value of the benefits. Generally, the costs are assumed in the first year, while the benefits accrue over the life of the program. In Ohio, the utility system benefits included for cost-effectiveness purposes include avoided supply costs, including generation, transmission, and distribution capacity costs; avoided energy supply costs; and avoided operation and maintenance costs (FirstEnergy 2016).

To determine the lost value of utility system benefits through an expanded opt-out, we reviewed the results of the utility cost test using the most recent data. We used the test's projected net present value in the 2017–2019 plans to estimate the net present value of dollars per MWh saved. We then applied this to the forgone savings under potential opt-out scenarios to estimate the foregone utility system benefits.

For DP&L, Duke Energy, and AEP, we relied on the 2017–2019 program plan. Although not aligned with the 2015 energy savings, these values are the most recent estimates of utility system benefits. For FirstEnergy, these values were not transparent in the 2017–2019 plan, so we relied on the most recent annual report, filed in 2016. We used these results to determine a dollar per MWh of utility system benefits. Table 7 shows the data used for this analysis.

Table 7. Utility cost test data for Ohio utilities

Utility	Energy savings (MWh)	Program cost (millions)	Utility cost test (UCT) ratio	UCT net present value net benefits (millions)	UCT $ per MWh saved
AEP	1,622,500	$293	2.71	$792	$488
DP&L	578,900	$96	3.16	$176	$304
Duke	684,922	$110	3.12	$246	$359
FirstEnergy	379,652	$18	6.37	$114	$300
Total	3,265,974	$517		$1,328	$406

All utility data from 2017–2019 program plans except FirstEnergy (data from 2015 annual report).
Sources: AEP 2016b; DPL 2016b; Duke 2016b; FirstEnergy 2016.

The range of utility cost test benefits per MWh from the filings is $300–$488, with a statewide average value of $406. We multiplied the statewide utility cost test net present value of $406 per MWh with the potential lost energy savings from opt-out to determine the lost utility system benefits from opt-out. Table 8 shows the results of this analysis for the first year, the cumulative value in year 10, and the cumulative value for all 10 years of lost energy efficiency savings.

Table 8. Lost economic value of utility system benefits 2015–2024

Opt out scenario	First year lost value (millions)	Cumulative value for 10 years of lost savings (millions)
Low (20%)	$106	$1,060
Mid (35%)	$185	$1,850
High (45%)	$239	$2,390

The estimates show large increases in utility system costs under the opt-out scenarios. For the mid-range scenario, the increased costs could exceed $1.85 billion. Because Ohio's utilities report avoided costs from efficiency programs confidentially, our analysis on customer rates was limited. However the increased utility system costs would be recovered from customers in rates.

IMPACT ON COST OF SAVED ENERGY

The CSE indicates how much a utility spends in order to save a kWh over the lifetime of a program or measure. From a utility perspective, CSE allows a comparison between the cost of the energy saved in energy efficiency programs and the cost of traditional resources derived from natural gas or coal-fired generation. This approach uses the total utility program cost and the lifetime of the energy savings to estimate a per-unit CSE. This per-unit cost allows a comparison between energy efficiency and other potential resources a utility may use to meet demand. If low-cost energy efficiency savings are lost through an expanded opt-out, utilities will be required to meet demand through higher-cost resources.[12]

We calculated the CSE for Ohio utilities for 2014 and 2015. For program lifetime estimates, we relied on annual reports the utilities filed with PUCO, as well as publicly available data from EIA when data were not filed with PUCO. We focused on the CSE from the utility or program administrator perspective; that is, we did not include the participant costs of energy efficiency programs. We did not discount future costs, because Ohio's energy efficiency program costs are expensed in the first year.

To calculate the CSE of each utility's energy efficiency portfolio, we used the weighted average measure life for each sector. We assumed a measure life of 15 years for mercantile self-direct savings for FirstEnergy companies' mercantile programs, as their utility-reported data were unavailable. To calculate lifetime savings by sector, we multiplied each utility's annual energy savings by the associated measure life. We then divided sector-level annual costs by lifetime savings to calculate the CSE. This differs from a levelized CSE approach, as we did not levelize program costs over the life of the measures or discount these costs.

Table 9 shows CSE values for each utility by sector for 2014 and 2015.[13]

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[12] While CSE is a useful metric to compare energy efficiency with traditional supply-side resources, it should not be solely relied on in energy efficiency planning decisions. It does not test energy efficiency's cost effectiveness, because it does not account for the benefits usually considered when conducting a cost-benefit analysis of energy efficiency programs (Billingsley et al. 2014).

[13] See Appendix A for additional information on savings, useful lives, and lifetime savings.

Table 9. Cost of saved energy by utility and sector

	Residential	C&I	Mercantile (self-direct)	Total
		2015		
AEP	$0.012	$0.009	$0.003	$0.011
CEI	$0.031	$0.006	$0.008	$0.009
DPL	$0.010	$0.014	$0.008	$0.014
Duke	$0.028	$0.013	$0.002	$0.019
OE	$0.030	$0.006	$0.001	$0.007
TE	$0.044	$0.006	$0.019	$0.008
Total	$0.015	$0.009	$0.003	$0.011
		2014		
AEP	$0.011	$0.009	$0.011	$0.011
CEI	$0.018	$0.007	$0.002	$0.008
DPL	$0.009	$0.015	$0.005	$0.013
Duke	$0.060	$0.010	$0.003	$0.027
OE	$0.017	$0.007	$0.004	$0.009
TE	$0.003	$0.008	$0.004	$0.009
Total	$0.012	$0.009	$0.003	$0.011

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016; EIA 2016a.

The portfolio-level CSE is approximately 1.1 cents per kWh for both 2014 and 2015. This is less than half of the national average of 2.8 cents per kWh from 2009 to 2013 (Hoffman, Leventis, and Goldman 2017). The residential sector's CSE is higher than the C&I sector for most utility portfolios we reviewed for 2014 and 2015. On average, C&I savings were 40% less expensive than residential savings in both 2014 and 2015. The mercantile self-direct CSE was far below other sectors, likely because the cost of attaining these saving is not reported by the mercantile customers. The only mercantile self-direct costs reported by utilities are costs associated with verifying and reporting these savings. As a result, the CSE from mercantile programs are understated.

C&I CSE is approximately 1 cent per kWh for 2014 and 2015. If a large-customer opt-out policy reduced the potential energy savings at this low-cost rate, Ohio utilities would face higher costs by procuring energy in wholesale markets.

Wholesale Market Implications

The increased electricity demand stemming from lost energy efficiency opportunities also affects the wholesale price for energy and capacity in Ohio. Energy efficiency reduces electric demand, thereby reducing wholesale prices for electricity. This effect is known as DRIPE or market price suppression. Several recent studies have documented these benefits

(Taylor, Hedman, and Goldberg 2015; Chernick and Neme 2015; Baatz 2015; Exeter Associates 2014; Hornby et al. 2015).

The loss of energy efficiency causes an opposite effect. Increased demand for electricity and capacity in wholesale auctions leads to higher prices, which utilities pass on to ratepayers. In 2013, ACEEE completed an analysis of energy efficiency's benefits to the Ohio economy (Neubauer et al. 2013). This study quantified some of the many ways that energy efficiency benefits the electric system, including lowering wholesale energy and capacity prices. The study found that energy efficiency in amounts sufficient to meet the state's energy efficiency resource standard (EERS) would create savings of $880 million from wholesale energy price mitigation and $1.3 billion in savings from wholesale capacity price mitigation through 2020. These significant savings would be at least partially lost through decreased energy efficiency resources resulting from an opt-out policy. These induced market effects would have clear negative long-term economic consequences for Ohio's utilities and electric customers.

Impact on Economy and Employment

Efficiency programs provide economic benefits in two primary ways. First, jobs and economic growth are fostered when programs are implemented. The program delivery networks required to deliver savings require many employees. Second, the bill savings achieved through the implementation of energy efficiency increase the disposable income for both residential and business customers. These two aspects provide positive economic benefits, including job creation and increased state gross domestic product (GDP). While implementing efficiency programs requires resource investment, the benefits of properly designed programs typically outweigh their costs by a factor of two to one.

In this report, we did not estimate the change in employment or state GDP from expanding the industrial customer opt-out. However we recently conducted a similar analysis in Maryland to better understand how that state's new energy efficiency resource target could impact the state's economy over a 10-year period (Barrett and Baatz 2017). In that analysis, we estimated that implementing a 2% annual savings target over a 10-year period would create 68,000 net new jobs and increase state GDP by $3.75 billion. While the effects in Ohio would differ, we assume that any of the three opt-out scenarios would result in a loss in state GDP and a net overall decrease in employment.

Impact on Air Emissions

Air Pollution

Implementing a mercantile customer opt-out policy reduces energy savings opportunities; utilities must then turn to other sources to meet the electricity demand that these savings would have met. These other sources are often fossil-fueled generation. The process of converting fossil fuels into electricity produces several harmful airborne pollutants including sulfur dioxide (SO_2), nitrogen oxide (NO_x), carbon dioxide (CO_2), particulate matter (PM), carbon monoxide (CO), and mercury. These pollutants produce many negative effects including increased morbidity and risk of mortality, reduced agricultural and timber productivity, deteriorated materials, reduced visibility, and harm to ecosystems (Massetti 2017).

An opt-out policy in Ohio that increases reliance on fossil-fueled generation will also increase air pollution. To determine the degree of air pollution under the three opt-out scenarios, we used the Avoiding Emissions and Generation Tool (AVERT), a modeling tool that the US Environmental Protection Agency (EPA) developed (EPA 2017b). The tool allows air regulators to estimate how energy efficiency and renewable energy could affect compliance with existing federal air rules. The AVERT model estimates changes in air pollution by estimating the dispatch of power plants in a specific region, based on reductions in demand created through energy efficiency or renewable energy.

AVERT's estimates are based on probable dispatch scenarios, relying on heat rates and other operating characteristics of every fossil-fueled generation station with a capacity higher than 25 MW. The air pollution estimates are limited to CO_2, SO_2, and NO_x. The displaced generation's fuel source is a mix of coal and natural gas. Although AVERT's output is at the county level, the model is regional because the electric grid is regional and a MWh reduction of demand of energy efficiency in one state may not reduce net generation in that state, but rather in other states in the same region. Indeed, the majority of generation displaced by Ohio's energy efficiency savings takes place in other states. AVERT's Great Lakes/Mid-Atlantic region covers all or parts of 12 states. Figure 2 shows the region for this analysis. Appendix B presents detailed results of state-level generation and pollution displacement.

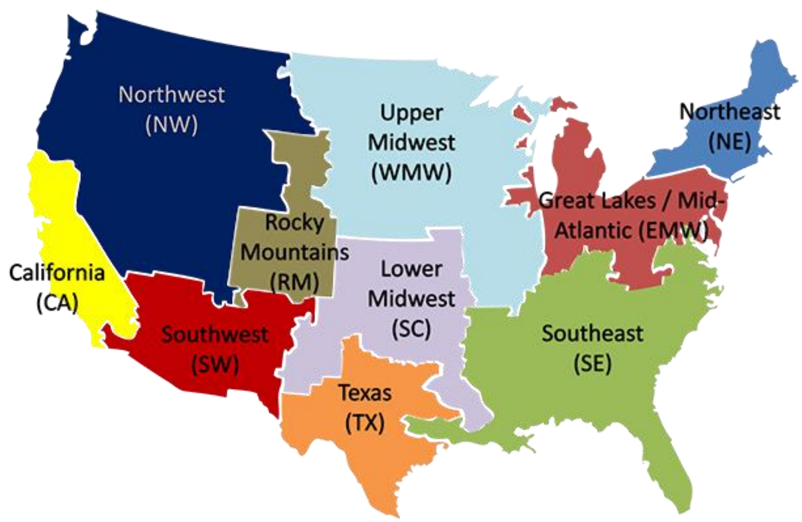

Figure 2. Regions used in AVERT analysis. Source: EPA 2017b

We estimated displaced generation and air emission under the three opt-out scenarios described in table 4. Table 10 shows the first-year increase in CO_2, SO_2, and NO_x in Ohio under these scenarios.

Table 10. First-year increase in Ohio air pollution (tons)

Scenario	Efficiency savings lost (GWh)	Generation displaced in Ohio (GWh)	SO_2 increase	NO_x increase	CO_2 increase
Low (20%)	261	46	94	30	38,000
Mid (35%)	457	80	164.5	52.5	67,000
High (45%)	588	103	211.5	67.5	86,000

The analysis results presented in table 10 are only first-year estimates. Ohio's portfolio of savings has an average lifetime of 10–11 years, depending on the mix of measures and programs. Estimating the displaced generation in future years is challenging because of changing market conditions. For example, in 2005, coal and nuclear generation accounted for 91% of the electricity in the PJM system. However, between 2010 and 2016, 79% of the retired megawatts were coal fired; by 2016, the installed capacity was 33% coal, 33% natural gas, 18% nuclear, and 6% renewables (PJM 2017). Given this trend and the current low cost of natural gas, coal plant retirements are expected to continue. Therefore we consider two cases to present future air pollution outcomes. The first case assumes that the generation mix used for the first-year savings estimates will continue. The second case assumes a decline in air pollution due to a greater reliance on natural-gas-fired generation. Natural gas results in fewer CO_2, SO_2, and PM 2.5 emissions than coal. In this case, we assume a linear decline of 50% of total emissions over the 10-year period. Table 11 shows the cumulative results under the two cases for our mid-range opt-out scenario.

Table 11. Cumulative increase in air pollution under the mid-range opt-out scenario (8,800 GWh lost energy savings)

Air pollution	Business as usual (Case 1)	Reduced reliance on coal (Case 2)
SO_2 (tons)	18,095	10,857
NO_x (tons)	5,775	3,465
CO_2 (thousand tons)	7,370	4,422

We estimated the cumulative change in air pollution for the three opt-out scenarios under both cases to determine a potential range of increased air pollution for each scenario. The cumulative increase includes the total air pollution increase over a 10-year period. It also includes the air pollution impacts beyond Year 10 because the energy savings continue beyond the first year. Appendix B presents the estimated results for all three scenarios, both cases, and all forms of pollution examined (CO_2, SO_2, NO_x, and PM 2.5).

Health Costs

The adverse environmental effects of increased air pollution include public health damages. We used the EPA's Co-Benefits Risk Assessment (COBRA) Screening model to estimate the economic value of health effects under various opt-out scenarios (EPA 2014). COBRA models the economic value of health harms from reduced air pollution. It estimates the number of health incidences avoided and the related economic value for the following: adult mortality, infant mortality, non-fatal heart attacks, respiratory hospital admissions, cardiovascular-related hospital admissions, acute bronchitis, upper respiratory symptoms, lower respiratory symptoms, asthma exacerbations (attacks, shortness of breath, and wheezing), asthma emergency room visits, minor restricted activity days, and work loss days (EPA 2014). Appendix C provides a more detailed review of the COBRA metrics and their results.

AVERT does not estimate changes in PM 2.5, but it does estimate displaced pollution at the county and state level.[14] To determine PM 2.5 pollution, we calculated the PM 2.5 pollution rate for each of the 12 states in the AVERT Great Lakes/Mid-Atlantic region. We used pollution data reported to the EPA and net generation from the EIA to estimate an average PM 2.5 emission rate (EPA 2017a, EIA 2016b). We then applied this value to AVERT's displaced generation results to estimate displaced PM 2.5 pollution.

Table 12 presents the high and low range of additional health costs that Ohio families would incur in just one year if the opt-out policy were implemented.

Table 12. Cost of health harms, first year only

Opt-out scenario	Total health costs	
	Low	High
Low (20%)	$2,930,615	$6,623,032
Mid (35%)	$5,127,504	$11,587,868
High (45%)	$6,596,106	$14,906,808

Table 12 considers only the first-year savings. An estimate of the economic value of health effects over the lifetime of these savings would be substantially higher. We estimated these scenarios under the two cases previously discussed. Case 1 considers the cost of health harms assuming the generation mix remains the same, while Case 2 assumes a decline in coal-fired generation. Table 13 shows cumulative results over the life of the measures for the entire region. Health harms are presented for low and high estimates from COBRA analysis under both potential cases.

[14] PM 2.5 is a fine, inhalable particulate matter, usually smaller than 2.5 micrometers. PM 2.5 can be emitted directly from fuel combustion in power plants, but is also the result of atmospheric interactions between substances such as sulfur dioxide and nitrogen oxides (EPA 2016).

Table 13. Cumulative health harm estimates

Health harm scenario	Case 1: Business as usual (millions)	Case 2: Reduced reliance on coal (millions)
Low (20% opt-out)		
Low	$322	$193
High	$729	$437
Mid (35% opt-out)		
Low	$564	$338
High	$1,275	$765
High (45% opt-out)		
Low	$726	$435
High	$1,640	$984

As we noted, most displaced generation and pollution takes place outside of Ohio. The majority of health effects also occur outside of Ohio. Table 14 shows the health costs for the Great Lakes/ Mid-Atlantic region based on first-year energy efficiency savings under the three opt-out scenarios.

Table 14. Great Lakes/Mid-Atlantic region—specific cost of health harms based on first-year energy efficiency savings

	Health effects costs	
Opt-out scenario	Low	High
Low (20%)	$21,257,518	$48,078,965
Mid (35%)	$37,224,650	$84,192,394
High (45%)	$47,860,964	$108,248,924

Table 14 considers only first-year savings. An estimate of the economic value of health effects over the lifetime of these savings would be substantially higher. We estimated these scenarios under the two cases previously discussed. Case 1 considers the cost of health harms assuming the generation mix remains the same, while Case 2 assumes a decline in coal-fired generation. Table 15 shows results for the entire region. Health harms are presented for low and high estimates from COBRA analysis under both potential cases.

Table 15. Great Lakes/Mid-Atlantic region—specific cumulative health harm estimates

Scenario	Case 1: Business as usual (millions)	Case 2: Reduced reliance on coal (millions)
Low (20% opt-out)		
Low	$2,338	$1,403
High	$5,289	$3,173
Mid (35% opt-out)		
Low	$4,095	$2,457
High	$9,261	$5,557
High (45% opt-out)		
Low	$5,265	$3,159
High	$11,907	$7,144

Air Rules Compliance Costs

As required under the Clean Air Act, the EPA sets National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. As of February 2017, the state of Ohio was determined to be in nonattainment with the standards for both PM 2.5 and SO_2. Any increase in pollution in a nonattainment area must be offset. However, with opt-out policies reducing Ohio's energy efficiency and thus increasing its electric generation, emission of these pollutants would increase. If the state allows power plants to increase pollution because of an opt-out policy, new emission limits would likely be imposed on other sectors.

Impact on Customer Bills

All Ohio electric customers benefit from energy efficiency programs through reduced utility system costs, lower harmful air emissions, and increased economic activity. Program participants earn additional benefits through immediate reductions in electricity bills. If Ohio expands the current opt-out policy to include more large customers, these customers could lose opportunities to save substantial costs on electric bills.

We estimated lost participant bill savings opportunities under the three opt-out scenarios based on EIA data for the average industrial price of electricity in Ohio. To determine bill savings over the life of the programs, we assumed the 2016 cost of energy remained constant. We calculated bill savings based only on energy savings; we did not attempt to estimate any reduction in bills through reduced demand charges, even though large C&I customers are billed partially based on demand charges. Because energy efficiency programs reduce peak demand, they could also lower this portion of a customer's bill.

Figure 3 shows the cumulative bill savings that would be lost over the next 10 years based on the 35% opt-out scenario. As the figure shows, the savings lost would be substantial, exceeding $300 million by 2024.

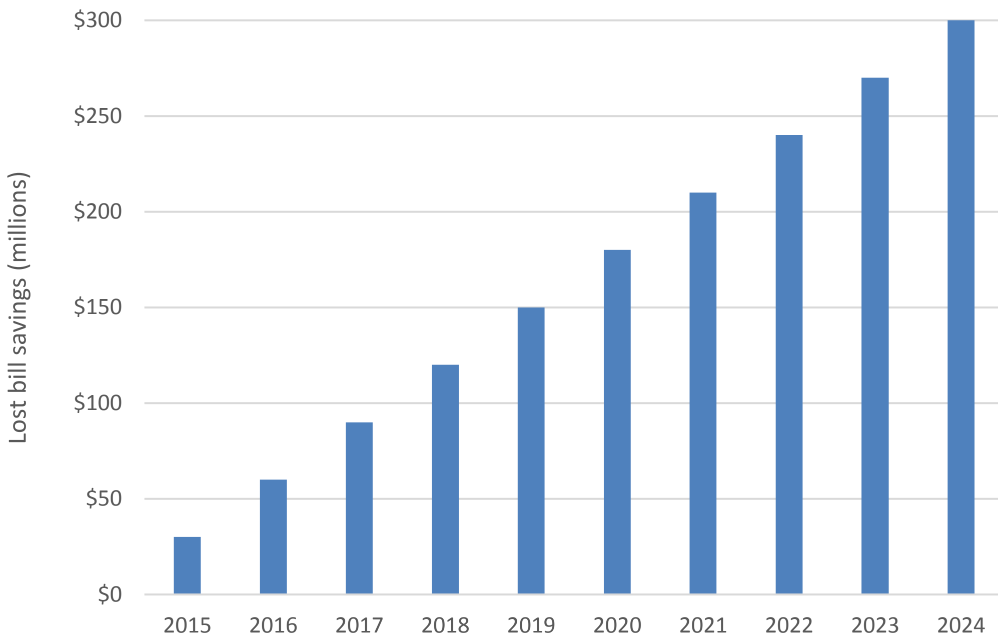

Figure 3. Bill savings lost through expanded opt-out under 35% scenario

As table 16 shows, the cumulative bill savings for program activity over the 10 -year period would be substantial as well.

Table 16. Cumulative bill savings from 10-year period of opt-out

Opt-out scenario	Cumulative bill savings lost (millions)
Low (20%)	$1,889
Mid (35%)	$3,300
High (45%)	$4,255

Future bill savings have not been discounted.

We estimate the lost participant bill savings under the 35% opt-out scenario at more than $3.3 billion over the lifetime of 10 years of lost savings. This value far exceeds the total cost of programs over 10 years, assuming 2014 spending levels of approximately $175 million per year. The lost participant bill savings under an expanded opt-out could also reduce economic growth in the state, as these dollars would be paid to power generators instead of other areas of the economy.

SUMMARY OF RESULTS

Our review of a potential expanded opt-out in Ohio produced the following results.

Utility system costs. Our analysis shows large increases in utility system costs in all three opt-out scenarios. The cumulative net present value of lost utility system benefits ranged from $1.06 to $2.39 billion, depending on the percentage of customers opting out. This increase in costs would be borne by ratepayers over a period of decades, unnecessarily increasing rates and bills.

Cost of saved energy. A review of Ohio reported results shows the CSE for C&I programs is approximately 40% less than residential programs and under 1 cent per kWh. The loss of these low-cost energy savings would require utilities to meet this demand with higher-cost energy from other sources.

Air pollution. An expanded opt-out policy will increase air pollution in Ohio (and surrounding states) because increased demand for electricity will require reliance on traditional fossil-fueled generation. We estimate that expanded opt-out will substantially increase air pollution. Under the mid-range scenario over a 10-year period (2015–2024), the lost energy savings would result in an increase of approximately 18,000 tons of SO_2, 5,700 tons of NO_x, more than 1,800 tons of PM 2.5, and 7.3 million tons of CO_2.[15] The regional impacts include an increase of nearly 87,000 tons of SO_2, 35,000 tons of NO_x, more than 6,200 tons of PM 2.5, and 40 million tons of CO_2.

The additional air pollution will result in a variety of health harms to the people of Ohio and surrounding states. Increased asthma attacks, hospitalizations, and lost work days are examples of these harms. Under the mid-range scenario over a 10-year period (2015–2024), the increased health-related costs in Ohio would be between $564 million and $1.3 billion. For the greater region, the increased health-related costs would be $4.1–9.3 billion.

Large-customer bill savings. Large C&I customers can avoid millions of dollars in electric charges by participating in energy efficiency programs. In an expanded opt-out, these customers lose the ability to participate in programs and enjoy these bill savings. We estimate lost participant bill savings to be between $1.9 and $3.3 billion, depending on the opt-out scenario.

Conclusion

Approving an opt-out is a state's choice, but these policies often work against desired policy outcomes in energy and other important areas including economic development and the environment. The availability of energy efficiency programs for large customers is an important tool to help states attract and retain businesses, but the programs benefit residential customers as well because highly cost-effective energy efficiency resources at large-customer sites displace the need for additional generation and save money for all utility customers. Less energy waste at large-customer facilities is also effective for reducing pollution, resulting in health benefits for local citizens. Taken from all angles, everyone is better off when all stakeholders pay for and participate in programs and policies for a more energy-efficient future.

[15] This assumes the business-as-usual case. We also estimated the changes in air pollution assuming a large decline in coal-fired generation. These results are presented in the report and in Appendix B.

The results of our Ohio example show that an expanded opt-out policy would increase costs in several areas. The loss of low-cost energy efficiency savings would likely require utilities to incur higher costs through market purchases. The increased need for generation would also increase air pollution in Ohio and elsewhere, leading to additional health costs. Utilities might also face a higher cost of compliance with existing air quality rules because of this pollution increase. Finally, the bill savings opportunities lost through an expanded opt-out would be greater than the cost of participation based on program spending. Overall, the reduced energy efficiency would have a negative impact on Ohio's economy and on prospects for employment, as we saw in ACEEE's recent Maryland study (Barrett and Baatz 2017).

The results of our scenario analysis in Ohio demonstrate large financial costs of allowing customers to opt out of energy efficiency programs. The policy reduces energy savings opportunities for utilities, thereby increasing utility costs over the long run. This translates into higher costs for all electric customers. The policy also increases power-plant-related air pollution, increasing health-related costs and compromising compliance with federal air quality regulations. The reduction in efficiency savings also increases wholesale energy costs because of increased regional demand. These negative consequences, along with others discussed in this report, would be unavoidable under an opt-out policy in any state.

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Appendix A. Ohio-Specific Data

Table A1. Energy efficiency spending for 2014 and 2015

Utility	Residential	C&I	Mercantile	Total
		2015		
AEP	$27,245,100	$30,853,200	$949,900	$65,147,500
CEI	$3,144,466	$4,100,269	$554,804	$7,800,959
DPL	$7,860,143	$8,964,791	$420,881	$19,685,819
Duke	$16,033,645	$13,637,508	$182,451	$29,853,604
OE	$3,081,207	$6,921,938	$76,827	$10,079,972
TE	$1,795,030	$4,943,655	$9,533	$6,748,218
Total	$59,159,591	$69,421,361	$2,194,396	$139,316,072
		2014		
AEP	$39,217,700	$28,650,400	$726,100	$76,576,400
CEI	$9,131,875	$6,374,482	$2,401,574	$18,156,887
DPL	$7,589,481	$8,279,234	$329,157	$18,173,233
Duke	$17,983,452	$6,857,568	$293,395	$25,134,415
OE	$11,968,699	$10,439,870	$1,894,668	$24,552,957
TE	$4,144,452	$4,673,201	$1,464,596	$10,531,675
Total	$90,035,659	$65,274,755	$7,109,490	$173,125,567

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016.

Table A2. Energy efficiency savings for 2014 and 2015 (MWh)

Utility	Residential	C&I	Mercantile	Total
		2015		
AEP	223,800,000	282,200,000	18,500,000	539,200,000
CEI	14,291,311	50,092,565	4,637,989	69,021,865
DPL	69,032,635	97,145,456	3,736,000	171,377,066
Duke	61,012,865	87,625,946	5,162,129	154,265,337
OE	16,631,054	84,858,936	9,267,685	110,757,675
TE	6,123,543	60,320,216	33,910	66,477,669
Total	390,891,408	662,243,119	41,337,713	1,111,099,612
		2014		
AEP	331,700,000	258,800,000	6,200,000	636,900,000
CEI	68,706,834	67,944,055	69,006,359	205,657,248
DPL	84,330,699	89,128,538	4,535,000	178,477,878

Utility	Residential	C&I	Mercantile	Total
Duke	75,464,801	59,951,257	7,057,366	143,240,761
OE	103,889,105	116,519,044	33,965,286	254,373,435
TE	214,209,522	45,323,082	22,304,355	99,678,540
Total	878,300,961	637,665,976	143,068,366	1,518,327,862

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016.

Table A3. Effective useful life for 2014 and 2015 (years)

Utility	Residential	C&I	Mercantile	Overall
		2015		
AEP	10.29	11.91	19.00	11.26
CEI	7.02	14.31	15.00	12.84
DPL	10.90	6.71	15.00	8.46
Duke	9.25	11.73	15.00	10.28
OE	6.26	14.21	15.00	13.08
TE	6.62	13.16	15.00	12.56
Total	9.88	11.71	16.79	11.05
		2014		
AEP	10.43	12.20	11.00	10.81
CEI	7.21	12.51	15.00	11.58
DPL	9.94	6.12	15.00	7.93
Duke	3.99	11.30	15.00	6.45
OE	6.59	12.23	15.00	10.30
TE	6.68	13.57	15.00	11.67
Total	8.21	11.40	14.83	10.13

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016; EIA 2016a

Table A4. Lifetime savings for 2014 and 2015 (MWh)

Utility	Residential	C&I	Mercantile	Total
		2015		
AEP	2,302,100,000	3,360,691,047	351,500,000	6,073,091,047
CEI	100,270,851	716,639,991	69,569,834	886,480,676
DPL	752,455,722	652,234,617	56,040,000	1,449,906,064
Duke	564,369,000	1,027,852,352	77,431,941	1,585,142,258
OE	104,127,968	1,205,825,249	139,015,269	1,448,968,486

Utility	Residential	C&I	Mercantile	Total
TE	40,521,858	793,750,453	508,643	834,780,954
Total	3,863,845,398	7,756,993,709	694,065,687	12,278,369,484
		2014		
AEP	3,458,000,000	3,157,500,000	68,200,000	6,884,700,000
CEI	495,324,673	850,221,375	1,035,095,383	2,380,641,431
DPL	838,078,487	545,343,962	68,025,000	1,414,968,586
Duke	301,104,555	677,449,204	105,860,488	923,592,928
OE	684,218,739	1,425,487,958	509,479,288	2,619,185,985
TE	1,431,642,440	614,814,136	334,565,326	1,163,588,984
Total	7,208,368,894	7,270,816,635	2,121,225,485	15,386,677,914

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016.

Table A5. Cost of saved energy for 2014 and 2015 ($/kWh)

Utility	Residential	C&I	Mercantile	Total
		2015		
AEP	$0.012	$0.009	$0.003	$0.011
CEI	$0.031	$0.006	$0.008	$0.009
DPL	$0.010	$0.014	$0.008	$0.014
Duke	$0.028	$0.013	$0.002	$0.019
OE	$0.030	$0.006	$0.001	$0.007
TE	$0.044	$0.006	$0.019	$0.008
Total	$0.015	$0.009	$0.003	$0.011
		2014		
AEP	$0.011	$0.009	$0.011	$0.011
CEI	$0.018	$0.007	$0.002	$0.008
DPL	$0.009	$0.015	$0.005	$0.013
Duke	$0.060	$0.010	$0.003	$0.027
OE	$0.017	$0.007	$0.004	$0.009
TE	$0.003	$0.008	$0.004	$0.009
Total	$0.012	$0.009	$0.003	$0.011

Sources: AEP 2015; AEP 2016a; DPL 2015; DPL 2016a; Duke 2015; Duke 2016a; FirstEnergy 2015; FirstEnergy 2016.

Table A6. Retail sales for 2014 and 2015 (MWh)

Utility	Residential	C&I	Total
2015			
AEP	14,173,918	29,241,964	43,415,882
CEI	5,489,972	12,975,887	18,501,986
DPL	5,132,100	8,730,568	13,866,213
Duke	7,136,587	13,007,638	20,144,225
OE	9,221,743	15,069,908	24,291,651
TE	2,468,896	7,985,614	10,454,510
Total	43,623,216	87,011,579	130,674,467
2014			
AEP	14,636,805	29,063,489	43,700,294
CEI	5,548,823	13,146,651	18,733,302
DPL	5,330,384	8,672,028	14,006,118
Duke	7,325,305	12,961,432	20,286,737
OE	9,353,079	15,574,213	24,927,292
TE	2,537,626	8,006,259	10,543,885
Total	44,732,022	87,424,072	132,197,628

Source: EIA 2016a

Appendix B. Displaced Generation and Pollution Data

Table B1. Generation and pollution displacement for 2015 under 20% (261 GWh) opt-out scenario

State	Generation (MWh)	SO_2 (tons)	NOx (tons)	CO_2 (tons)	PM 2.5 (tons)
DE	−4,000	−2	−1	−3,000	−0.16
IL	−23,000	−24	−9	−21,000	−0.90
IN	−44,000	−94	−38	−39,000	−18.58
KY	−4,000	−48	−4	−3,000	−0.46
MD	−15,000	−14	−10	−13,000	−1.06
MI	−23,000	−28	−11	−15,000	−1.52
NJ	−12,000	−1	−3	−7,000	−0.29
OH	−46,000	−94	−30	−38,000	−9.50
PA	−49,000	−113	−50	−39,000	−4.95
VA	−1,000	−3	−2	−1,000	−0.10
WI	−11,000	−1	−2	−8,000	−1.13
WV	−29,000	−29	−23	−25,000	−3.97
Total	−261,000	−450	−181	−212,000	−32.37

Sources: AVERT and ACEEE calculations

Table B2. Generation and pollution displacement for 2015 under 35% (457 GWh) opt-out scenario

State	Generation (MWh)	SO_2 (tons)	NOx (tons)	CO_2 (tons)	PM 2.5 (tons)
DE	−6,000	−3	−2	−5,000	−0.25
IL	−40,000	−43	−16	−36,000	−1.56
IN	−77,000	−165	−66	−68,000	−32.51
KY	−7,000	−84	−7	−6,000	−0.81
MD	−26,000	−25	−16	−23,000	−1.84
MI	−41,000	−48	−19	−26,000	−2.71
NJ	−21,000	−2	−5	−12,000	−0.51
OH	−80,000	−165	−53	−67,000	−16.52
PA	−87,000	−197	−87	−68,000	−8.79
VA	−2,000	−6	−3	−2,000	−0.21
WI	−18,000	−2	−4	−14,000	−1.84
WV	−51,000	−51	−39	−44,000	−6.98
Total	−456,000	−788	−316	−371,000	−56.56

Sources: AVERT and ACEEE calculations

Table B3. Generation and pollution displacement for 2015 under 45% (588 GWh) opt-out scenario

State	Generation (MWh)	SO_2 (tons)	NOx (tons)	CO_2 (tons)	PM 2.5 (tons)
DE	-8,000	-3	-3	-6,000	-0.33
IL	-51,000	-55	-21	-47,000	-1.99
IN	-100,000	-212	-85	-87,000	-42.22
KY	-9,000	-108	-9	-7,000	-1.04
MD	-34,000	-32	-21	-29,000	-2.41
MI	-53,000	-62	-24	-33,000	-3.51
NJ	-27,000	-3	-7	-15,000	-0.66
OH	-103,000	-212	-68	-86,000	-21.27
PA	-111,000	-253	-111	-88,000	-11.21
VA	-3,000	-7	-4	-3,000	-0.31
WI	-24,000	-2	-5	-18,000	-2.46
WV	-65,000	-65	-50	-57,000	-8.90
Total	-588,000	-1,012	-406	-476,000	-72.93

Sources: AVERT and ACEEE calculations

Table B4. Metric results for 20% opt-out scenario for Case 1 and Case 2

Metric	Case 1	Case 2
Ohio-specific		
Lost savings (GWh)	5,060	5,060
SO_2 (tons)	10,340	6,204
NOx (tons)	3,300	1,980
CO_2 (thousand tons)	4,180	2,508
PM 2.5 (tons)	1,045	627
Health costs low	$322,367,618	$193,420,571
Health costs high	$728,533,554	$437,120,132
Region-specific		
Lost savings (GWh)	28,710	28,710
SO_2 (tons)	49,445	29,667
NOx (tons)	19,855	11,913
CO_2 (thousand tons)	40,810	24,486
PM 2.5 (tons)	3,561	2,136

Metric	Case 1	Case 2
Health costs low	$2,338,326,949	$1,402,996,170
Health costs high	$5,288,686,204	$3,173,211,722

Results presented are cumulative assuming a 10-year opt-out policy (2015–2024)

Table B5. Metric results for 35% opt-out scenario for Case 1 and Case 2

Metric	Case 1	Case 2
Ohio-specific		
Lost savings (GWh)	8,800	8,800
SO_2 (tons)	18,095	10,857
NOx (tons)	5,775	3,465
CO_2 (thousand tons)	7,370	4,422
PM 2.5 (tons)	1,815	1,089
Health effects low	$564,025,494	$338,415,296
Health effects high	$1,274,665,497	$764,799,298
Region-specific		
Lost savings (GWh)	50,160	50,160
SO_2 (tons)	86,625	51,975
NOx (tons)	34,705	20,823
CO_2 (thousand tons)	40,810	24,486
PM 2.5 (tons)	6,221	3,733
Health effects low	$4,094,711,551	$2,456,826,930
Health effects high	$9,261,163,324	$5,556,697,994

Results presented are cumulative assuming a 10-year opt-out policy (2015–2024)

Table B6. Metric results for 45% opt-out scenario for Case 1 and Case 2

Metric	Case 1	Case 2
Ohio-specific		
Lost savings (GWh)	11,330	11,330
SO_2 (tons)	23,265	13,959
NOx (tons)	7,425	4,455
CO_2 (thousand tons)	9,460	5,676
PM 2.5 (tons)	2,310	1,386
Health effects low	$725,571,608	$435,342,965
Health effects high	$1,639,748,834	$983,849,300

Metric	Case 1	Case 2
Region-specific		
Lost savings (GWh)	64,680	64,680
SO_2 (tons)	111,265	66,759
NOx (tons)	44,605	26,763
CO_2 (thousand tons)	52,360	31,416
PM 2.5 (tons)	8,022	4,813
Health effects low	$5,264,706,029	$3,158,823,617
Health effects high	$11,907,381,673	$7,144,429,004

Results presented are cumulative assuming a 10-year opt-out policy (2015–2024)

Table B7. Description of health effects and economic values

Health effect	Description
Total health effects $ (low)	Economic value of all health effects combined in low case, using a discount rate of 3% or 7%
Total health effects $ (high)	Economic value of all health effects combined in high case, using a discount rate of 3% or 7%
Adult mortality (low)	Low estimate of the number of deaths, based on Krewski et al. (2009)
Adult mortality $ (low)	Low estimate of the economic value of the number of deaths, using Krewski et al. (2009) and a discount rate of 3% or 7%
Adult mortality (high)	High estimate of the number of deaths, based on Lepeule et al. (2012)
Adult mortality $ (high)	High estimate of the economic value of the number of deaths, using Lepeule et al. (2012) and a discount rate of 3% or 7%
Infant mortality	Number of infant deaths
Infant mortality $	Economic value of the number of infant deaths
Nonfatal heart attacks (low)	Low estimate of the number of nonfatal heart attacks, based on four acute myocardial infarction (AMI) studies
Nonfatal heart attacks $ (low)	Low estimate of the economic value of nonfatal heart attacks, based on four AMI studies and a discount rate of 3% or 7%
Nonfatal heart attacks (high)	High estimate of the number of nonfatal heart attacks, based on Peters et al. (2001)
Nonfatal heart attacks $ (high)	High estimate of the economic value of nonfatal heart attacks, using Peters et al. (2001) and a discount rate of 3% or 7%
Resp. hosp. adm.	Number of respiratory-related hospitalizations (e.g., all respiratory, asthma and COPD)
Resp. hosp. adm. $	Economic value of respiratory-related hospitalizations

Health effect	Description
CVD hosp. adm.	Number of cardiovascular-related hospitalizations (ICD codes 390-409, 411-429). ICD code 410 (nonfatal heart attacks) is counted here only in nonfatal heart attacks
CVD hosp. adm. $	Economic value of cardiovascular-related hospitalizations
Acute bronchitis	Cases of acute bronchitis
Acute bronchitis $	Economic value of acute bronchitis cases
Upper resp. symptoms	Episodes of upper respiratory symptoms (runny or stuffy nose; wet cough; and burning, aching, or red eyes)
Upper resp. symptoms $	Economic value of episodes of upper respiratory symptoms
Lower res. symptoms	Episodes of lower respiratory symptoms: cough, chest pain, phlegm, or wheeze
Lower res. symptoms $	Economic value of episodes of lower respiratory symptoms
Asthma ER visits	Number of asthma-related emergency room visits
Asthma ER visits $	Economic value of asthma-related emergency room visits
MRAD	Number of minor restricted activity days (days on which activity is reduced but not severely restricted. E.g., missing work or being confined to bed is too severe to be MRAD.)
MRAD $	Economic value of minor restricted activity days
Work loss days	Number of work days lost due to illness
Work loss days $	Economic value of work days lost due to illness
Asthma exacerbations	Shortness of breath, wheeze, and cough (in asthmatic individuals)
Asthma exacerbations $	Economic value of episodes of asthma exacerbations

Source: EPA 2015

Table B8. Ohio-specific COBRA results under opt-out scenarios

Area	20%	35%	45%
Total health effects $ (low)	$2,930,615	$5,127,504	$6,596,106
Total health effects $ (high)	$6,623,032	$11,587,868	$14,906,808
Adult mortality (low)	0.3425	0.5993	0.7709
Adult mortality $ (low)	$2,889,037	$5,054,757	$6,502,518
Adult mortality (high)	0.7752	1.3564	1.7449
Adult mortality $ (high)	$6,539,025	$11,440,886	$14,717,722
Infant mortality	0.0007	0.0012	0.0015
Infant mortality $	$6,376	$11,157	$14,354
Nonfatal heart attacks (low)	0.0414	0.0724	0.0932
Nonfatal heart attacks $ (low)	$5,117	$8,952	$11,517
Nonfatal heart attacks (high)	0.3846	0.673	0.8657

Area	20%	35%	45%
Nonfatal heart attacks $ (high)	$47,545	$83,187	$107,015
Resp. hosp. adm.	0.1005	0.1759	0.2263
Resp. hosp. adm. $	$2,778	$4,861	$6,253
CVD hosp. adm.	0.1221	0.2136	0.2747
CVD hosp. adm. $	$4,734	$8,282	$10,655
Acute bronchitis	0.452	0.7908	1.0174
Acute bronchitis $	$215	$377	$485
Upper res. symptoms	8.2387	14.4149	18.5445
Upper res. symptoms $	$272	$476	$612
Lower res. symptoms	5.7635	10.0841	12.9731
Lower res. symptoms $	$120	$210	$271
Asthma ER visits	0.1885	0.3298	0.4243
Asthma ER visits $	$80	$141	$181
MRAD	226.6952	396.6387	510.2606
MRAD $	$15,350	$26,856	$34,550
Work loss days	37.799	66.1354	85.0808
Work loss days $	$6,037	$10,562	$13,587
Asthma exacerbations	8.7112	15.2416	19.6081

Table B9. Midwest Mid-Atlantic region COBRA results under opt-out scenarios in Ohio

Area	20%	35%	45%
Total health effects $ (low)	$21,257,518	$37,224,650	$47,860,964
Total health effects $ (high)	$48,078,965	$84,192,394	$108,248,924
Adult mortality (low)	2.4826	4.3474	5.5896
Adult mortality $ (low)	$20,940,856	$36,670,130	$47,147,962
Adult mortality (high)	5.6251	9.8503	12.6648
Adult mortality $ (high)	$47,447,380	$83,086,401	$106,826,848
Infant mortality	0.0048	0.0084	0.0108
Infant mortality $	$45,001	$78,801	$101,342
Nonfatal heart attacks (low)	0.3103	0.5434	0.6987
Nonfatal heart attacks $ (low)	$37,978	$66,504	$85,510
Nonfatal heart attacks (high)	2.8836	5.0495	6.4926
Nonfatal heart attacks $ (high)	$352,902	$617,976	$794,584
Resp. hosp. adm.	0.7247	1.269	1.6317

Area	20%	35%	45%
Resp. hosp. adm. $	$19,676	$34,455	$44,303
CVD hosp. adm.	0.9059	1.5864	2.0398
CVD hosp. adm. $	$35,150	$61,553	$79,143
Acute bronchitis	3.4421	6.0275	7.7502
Acute bronchitis $	$1,640	$2,873	$3,694
Upper res. symptoms	62.717	109.8247	141.2137
Upper res. symptoms $	$2,070	$3,624	$4,660
Lower res. symptoms	43.8861	76.8494	98.8136
Lower res. symptoms $	$915	$1,603	$2,061
Asthma ER visits	1.3757	2.409	3.0972
Asthma ER visits $	$586	$1,027	$1,320
MRAD	1,798.64	3,149.70	4,049.69
MRAD $	$121,786	$213,266	$274,204
Work loss days	300.8633	526.8596	677.405
Work loss days $	$48,048	$84,139	$108,182
Asthma exacerbations	66.522	116.4878	149.7806
Asthma exacerbations $	$3,812	$6,676	$8,584