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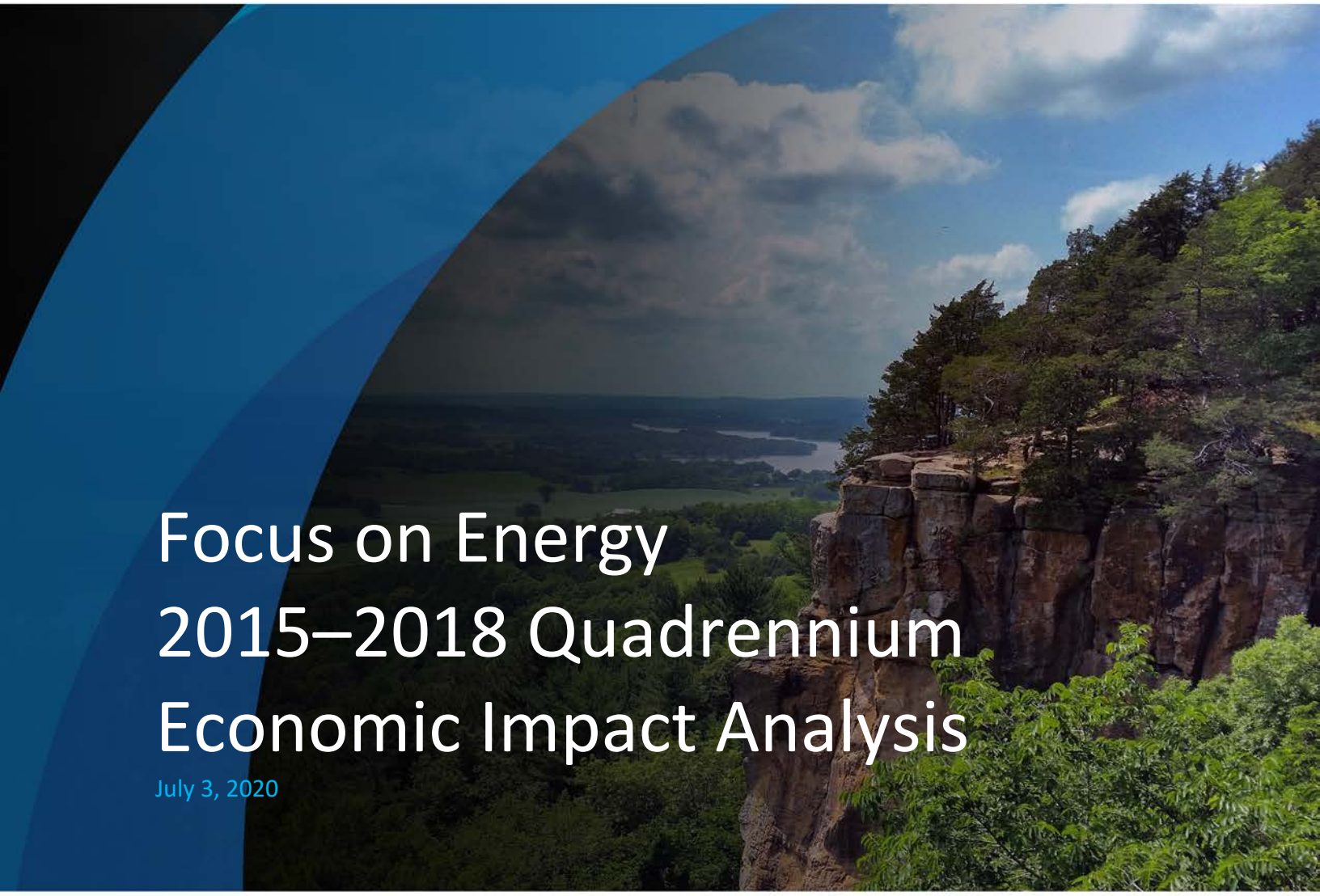

# Focus on Energy 2015–2018 Quadrennium Economic Impact Analysis

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# Glossary of Terms

| Term | Definition |
|---|---|
| Baseline Energy Payments | Electric and natural gas ratepayer spending on energy and supply chain resources that otherwise would have been saved through Focus on Energy programs. |
| Direct Effects | Impacts that result from changes in demand that are attributable to Focus on Energy, such as program- and project-level investments or reduced demand for energy resources. |
| Disposable Personal Income | The net change in money available to Wisconsin consumers for purchasing goods and services, saving money, and paying taxes. Personal income is incorporated into value added impacts, along with profits and taxes, but is presented separately to show impacts specific to Wisconsin households. |
| Employment | The estimates of the number of jobs, full-time plus part-time, by place of work for all industries. Full-time and part-time jobs are counted at equal weight. Employees, sole proprietors, and active partners are included, but unpaid family workers and volunteers are not included. |
| Incentives | Focus on Energy program funds spent on direct financial and service-based incentives that encourage investments in energy-saving technologies and behaviors. |
| Indirect Effects | Impacts that are generated in supply chains when directly affected industries purchase factor inputs from supporting industries. |
| Induced Effects | Impacts that result when participating households that save money on energy bills and employees in the directly and indirectly affected industries spend their saved income on goods and services in the regional economy, some of which come from outside Wisconsin. |
| Net Economic Impacts | The difference between economic impacts from Focus on Energy cash flows and impacts from a hypothetical scenario in which Focus on Energy does not exist and equal funds are instead spent on other goods and services. |
| Participant Bill Reductions | The estimated decrease in participant spending on utility bills resulting from Focus on Energy programs, viewed as cost savings by participants and lost revenues by utilities. |
| Participant Co-Funding | Participant payments for project goods and services, which represent the combination of financial incentives received and participant co-funding. |
| Program Payments | Funding for Focus on Energy, which originates from participating utilities' revenues, collected from Wisconsin ratepayers. |
| Program Spending | Focus on Energy program funds that are spent on technical and customer support, marketing, evaluation, and administrative activities and services. |
| Program Year | Year during which energy efficiency and renewable energy programs are administered. For Focus on Energy, the program year coincides with the calendar year, also denoted as "CY" (for example, program year 2015 is called "CY2015"). |
| Economic Benefits (Value Added) | The net contribution of each private industry and the government to Wisconsin's gross state product. This is the total net economic benefit to Wisconsin, including wages, profits (minus intermediate goods purchased), and taxes (minus subsidies). All value-added impacts in this analysis are presented as "economic benefits" and refer to marginal (that is, net) impacts on Wisconsin's gross state product. |
| Utility Avoided Costs | Avoided utility expenditures on fuel, purchased power, and infrastructure due to reduced demand for utility energy resources from Focus on Energy activities and resulting energy savings. |

# Executive Summary

This report describes the net statewide economic impacts of Focus on Energy's 2015–2018 energy efficiency and renewable energy programs. Cadmus modeled changes in regional spending patterns caused by Focus on Energy using the Energy, Environment, Economy (E3+) model from Regional Economic Models, Inc. (REMI). The model simulates the annual and long-term effects of different spending choices and emissions reductions on multiple components of the state economy.

Cadmus used evaluated Focus on Energy spending and energy-savings data to model its programs' net economic impacts in REMI E3+. This analysis includes short-term program investments made in the 2015 through 2018 program years and the long-term impacts of those investments from 2019 through 2042. The economic impacts of measures installed in program years prior to and after these program years are not included in this analysis.

Cadmus factored in both positive and negative effects; the resulting net economic impacts represent the difference between the economy with Focus on Energy and a no-program baseline (one where ratepayers do not fund Focus on Energy and participants do not experience utility bill reductions). Focus on Energy achieves positive net economic impacts by affecting the flow of money through the Wisconsin and regional economies in three ways:

- ***Direct economic effects*** represent increases in employment, income, and economic activity among industries directly involved with Focus on Energy, such as companies that manufacture, sell, and install energy technologies or firms that provide project services.
- ***Indirect economic effects*** account for increases in employment, income, and economic activity among industries in the energy efficiency and renewable energy supply chains, such as companies that supply raw manufacturing inputs to directly affected industries.
- ***Induced economic effects*** lead to additional increases in employment, income, and economic activity among other industries because Focus on Energy participants and the employees of directly and indirectly affected industries spend money in Wisconsin.

***Focus on Energy has positive net economic impacts largely because it increases in-state spending.*** Utilities import fuel and power from other states, so a significant share of Wisconsin ratepayer funds are spent outside the state economy. Focus on Energy reduces electricity and natural gas purchases by promoting investments in Wisconsin's energy efficiency and renewable energy industries. This provides long-term savings that support increased in-state spending on other local goods and services. Moreover, emissions reductions generated by energy savings make Wisconsin a more attractive place to live, thus increasing in-migration and stimulating additional economic activity.

## *Summary of Study Findings*

Table ES-1 summarizes the employment and economic benefit impacts attributable to each program year and the full quadrennium. Employment impacts are presented in units of the number of full- and part-time jobs, counted at equal weight, consistent with the definition of employment used by the U.S.

Bureau of Economic Analysis (BEA). Economic benefit impacts describe the net effects on Wisconsin's gross state product. Each program year of activity is projected to create 5,250 jobs or more cumulatively through 2042, with 11% of job growth attributable exclusively to emissions reductions (520 to 570 jobs added per program year of activity).

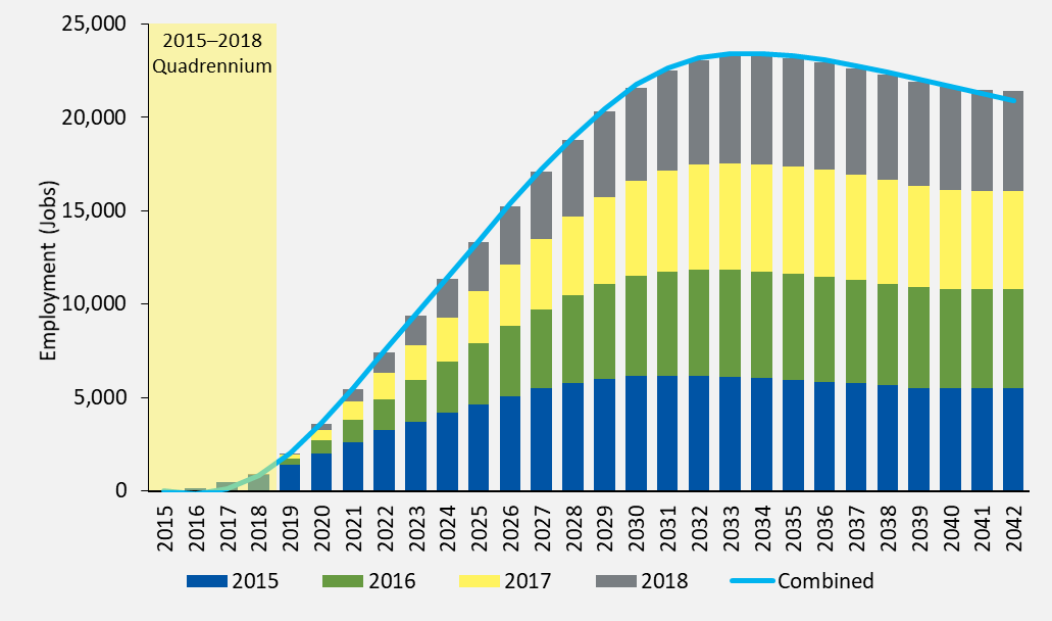
**Table ES-1. Summary of Cumulative Economic Impacts by Program Year[1]**

| Economic Impact | Program Year(s) | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | Quadrennium |
| Employment (jobs) | 5,520 | 5,270 | 5,250 | 5,350 | 20,870 |
| Economic Benefit (millions of 2018 dollars) | $569 | $542 | $551 | $524 | $2,200 |
| Disposable Personal Income (millions of 2018 dollars) | $458 | $392 | $407 | $334 | $1,566 |

[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Figure ES-1 shows how employment impacts generated by Focus on Energy investments accumulate over time. Total employment impacts peak in 2034 at more than 24,000 jobs, then slowly declines as the long-term effects of the initial program activity, including ongoing participant bill reductions and utility avoided costs, begin to wear off. Each year of program activity not only increases peak job growth but also delays when the positive effects of Focus on Energy wear off and the regional economy returns slowly to equilibrium (the no-program baseline).

**Figure ES-1. Cumulative Net Employment Impacts Over Time**




***The largest cumulative employment increases are projected to occur in the retail trade, health care, and manufacturing sectors.*** Increased purchases of energy efficiency and renewable energy technologies through Focus on Energy impacted specialized fields in the short-term, and the benefits of bill reductions and emissions reductions in the longer-term will impact Wisconsin's largest sectors

(manufacturing, health care and social assistance, state and local government, and retail trade). Focus on Energy is projected to create at least 1,000 jobs through 2042 in each of the following 10 sectors:

1. Retail trade (3,810 jobs)
2. Health care and social assistance (3,170 jobs)
3. Manufacturing (2,760 jobs)
4. State and local government (2,280 jobs)
5. Other services (except public administration) (2,200 jobs)
6. Accommodation and food services (2,110 jobs)
7. Professional, scientific, and technical services (1,750 jobs)
8. Administrative, support, waste management, and remediation services (1,010 jobs)
9. Real estate and rental and leasing (1,010 jobs)
10. Wholesale trade (1,000 jobs)

***Focus on Energy investments in energy efficiency and renewable energy during the 2015–2018 quadrennium will add $2.2 billion in economic benefits to the Wisconsin economy through 2042.*** Figure ES-2 illustrates Focus on Energy's positive net economic benefits, which will exceed $520 million cumulatively for each program year of activity. The impacts of emissions reductions are expected to comprise roughly 10% of cumulative economic benefits.

**Figure ES-2. Spending and Emissions Impacts on Economic Benefits by Program Year[1]**


[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

***When economic impacts are included, cost-benefit analysis finds Focus on Energy provided $5.85 in benefits for every dollar invested during the 2015–2018 quadrennium.*** Table ES-2 summarizes the benefit/cost ratios previously reported for Focus on Energy, which did not include economic benefits, and shows the revised benefit/cost ratios achieved when economic impacts are included as benefits.

**Table ES-2. Focus on Energy Benefit/Cost Ratios with and without Economic Benefits**

| Program Year(s) | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| 2015 | $3.51 | $5.91 |
| 2016 | $3.00 | $5.07 |
| 2017 | $4.07 | $7.01 |
| 2018 | $3.66 | $5.93 |
| **2015–2018** | **$3.62** | **$5.85** |

Since the previous study of the economic impacts of Focus on Energy's 2015–2016 program years, Cadmus' estimates of economic benefits—and, thus, its calculations of program year benefit/cost ratios—have changed. The causes of these changes include updates in program data, macroeconomic software, and modeling assumptions and are described in further detail in *Appendix C: Changes in Methodology/Assumptions*.

# Introduction

Focus on Energy is Wisconsin's statewide energy efficiency and renewable resource program. As required under Wisconsin Statute §196.374(2)(a), Focus on Energy is funded by the state's investor-owned energy utilities and participating municipal utilities and electric cooperatives. APTIM serves as the Program Administrator and is responsible for designing, managing, and coordinating all of Focus on Energy's programs.

The Public Service Commission of Wisconsin (PSC) provides oversight of Focus on Energy. In 2014, the PSC contracted with a team of energy consulting and market research firms to verify Focus on Energy savings and evaluate the program's 2015–2018 quadrennium achievements. As part of this contract, Cadmus quantified net statewide economic impacts attributable to Focus on Energy.

Focus on Energy provides information, technical support, and financial incentives to eligible Wisconsin residents and businesses to complete energy projects. Focus on Energy thus helps Wisconsin residents and businesses manage rising energy costs, protect the environment, and promote in-state economic activity while controlling the growing demand for electricity and natural gas.

This report presents the net statewide economic impacts of Focus on Energy for the 2015–2018 quadrennium and describes the analytical approach used to calculate those impacts. The analysis entailed reviewing the results of the impact evaluations conducted for each program for program years 2015 through 2018, then projecting those impacts for the entire program portfolio through each program year's 25-year study period, as summarized in Table 3.

**Table 3. Study Period by Program Year**

| Program Year(s) | Timeframe Modeled |
|---|---|
| 2015 | 2015–2039 |
| 2016 | 2016–2040 |
| 2017 | 2017–2041 |
| 2018 | 2018–2042 |
| 2015–2018 | 2015–2042 |

Focus on Energy's portfolio of energy efficiency and renewable energy programs changed somewhat between 2016 (the last year of the previous study) and 2018 (the end of the quadrennium), adding a suite of programs and offerings that cater specifically to rural customers. As such, the scope of this study includes examining the statewide benefits generated by customers in rural and non-rural locales. *Appendix B: Focus on Energy Programs by Year* lists all programs Cadmus included in its analysis of net economic impacts.

## *Introduction to Investment and Energy Savings Impacts*

Programs offered by Focus on Energy affect the flow of money through the Wisconsin economy and regional economies in multiple ways:

1. ***Direct economic effects*** result from changes in demand that are attributable to Focus on Energy, such as program- and project-level investments or reduced demand for energy resources. For example, a participant may spend a combination of program incentives and personal funds on new home insulation, thus directing funds to the insulation industry.
2. ***Indirect economic effects*** are generated in supply chains when directly affected industries purchase factor inputs from supporting industries. For example, to meet increased local demand, the insulation industry purchases fiberglass from the fiberglass industry.
3. ***Induced economic effects*** occur when participating households that save money on energy bills and employees in the directly and indirectly affected industries spend that income on goods and services in the regional economy, some of which come from outside Wisconsin. For example, program participants save money on energy bills and instead spend that portion of their personal income on other goods and services.

In addition to the effects from first-year program and project expenditures, the investments made by Focus on Energy and program participants continue to generate positive net impacts in the Wisconsin economy over time. Persistent energy savings resulting from energy-efficient and renewable energy measures allow residential and nonresidential participants to spend less money on energy and more money on other products and services, many of which have more localized supply chains than those associated with energy. Local utilities can reduce the amount of fuel and power imported into the region, while regional supply for energy-efficient and renewable energy measures increases to meet demand within Wisconsin.

Participating utilities benefit from reducing their fuel and power purchases, transmission and distribution costs, emission allowance costs, and capacity costs. However, since participants purchase less energy after participating in Focus on Energy programs, participating utilities also forego revenues equal to reductions in energy sales. The dollar value of these reductions in sales represents a cost to the utilities that is also included in the customized REMI E3+ model.

Additionally, REMI's new E3+ model allowed Cadmus to quantify the economic impacts of emissions reductions, a feature that the PI$^{+}$ (Policy Insight) model, upon which the E3+ model is based, did not possess. When calculated as a byproduct of energy savings and used as an input in E3+, emissions reductions make Wisconsin a more attractive place to live, thereby increasing in-migration and stimulating additional economic activity through bolstering the labor force and consumption on regional goods and services.

## *Introduction to Economic Impacts Modeled*

Cadmus used a customized REMI E3+ model to estimate Focus on Energy's annual and cumulative statewide economic impacts on three key indicators: employment, economic benefits (value added), and disposable personal income. Each of these indicators is explained below.

1. ***Employment*** estimates the number of full- and part-time jobs by place of work. One individual who works two-part time jobs is counted in the regional economy as two jobs rather than two

halves of one full-time job.

The REMI E3+ model determines employment impacts from estimated changes in output (total production) and labor productivity (total production per job). For instance, estimated increases in employment can result from increased output or decreased labor productivity. Conversely, estimated decreases in employment can result from either decreased output or increased labor productivity.

2. ***Value added*** measures the net contribution of each private industry and of government to Wisconsin's gross state product. It describes the total net economic benefit to Wisconsin, including wages, profits (minus intermediate goods purchased), and taxes (minus subsidies). All value-added impacts in this analysis are presented as economic benefits and refer to marginal (net) impacts on Wisconsin's gross state product.

The REMI E3+ model determines the value added from estimated changes in industry demand and competitiveness. For instance, an increase in demand leads to an increase in value added, while a decrease in demand leads to a decrease in value added.

3. ***Disposable personal income*** represents the change in money available to Wisconsin consumers for purchasing goods and services, saving money, and paying taxes. Personal income is incorporated into value added, along with profits and taxes, but is presented separately to demonstrate impacts specific to Wisconsin households.

The REMI E3+ model calculates personal income as total income received from all sources, including wages and salaries, benefits, proprietor (owner) income, rental income, investment income, and transfer payments from public entities (such as Social Security payments). Estimated increases or decreases in personal income result from changes in any of these sources.

## *Study Findings*

Cadmus estimated the net economic impacts generated from Focus on Energy's portfolio of energy efficiency and renewable energy programs during the 2015–2018 quadrennium, separately and in aggregate. Aggregate impacts were estimated with a REMI E3+ model comprising inputs from all four program years. Because of industry interactions, price responses, labor migration, and other dynamic factors in the REMI E3+ model, quadrennial impacts of program and project activity are not exactly equal to the sum of the impacts from each program year considered separately. Table 4 summarizes net economic impacts attributable to each program year and to the 2015–2018 quadrennium in aggregate.

**Table 4. Summary of Cumulative Economic Impacts by Program Year(s)[1]**

| Economic Impact | Program Year(s) | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | Quadrennium |
| Employment (jobs) | 5,520 | 5,270 | 5,250 | 5,350 | 20,870 |
| Economic Benefit (millions of 2018 dollars) | $569 | $542 | $551 | $524 | $2,200 |
| Disposable Personal Income (millions of 2018 dollars) | $458 | $392 | $407 | $334 | $1,566 |

[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Economic impacts fluctuate by program year due to annual differences in program spending and total lifecycle energy savings, the latter of which affects ongoing participant bill reductions and utility avoided costs. Lifecycle electric savings increased slightly year to year (Table 17), but lifecycle natural gas savings decreased more (Table 18), resulting in a net decrease in lifecycle energy savings (as measured by MMBtu, or million British thermal units). Annual program spending averaged $96 million from CY2015 through CY2017 but increased by more than $20 million in CY2018 with the conclusion of Focus on Energy's suite of two-year rural programs (Table 15). This additional spending, while increasing investment in the regional economy, required additional investment from ratepayers, which comes at the expense of consumption of other goods and services within the Wisconsin economy.

The results presented here also differ in magnitude from those in the study of Focus on Energy's 2015–2016 program period.[1] There are three primary drivers for these differences:

4. The REMI E3+ model updated economic assumptions and added functionality to accommodate emissions reductions, relative to its PI+ model.
5. CY2016 lifecycle energy savings and ratepayer spending increased dramatically once the 2016 evaluation report was completed.
6. Cadmus, in coordination with the Evaluation Working Group (EWG), updated assumptions concerning how utilities would recover the costs incurred through net revenue effects.

Overall, the combination of these changes contributed to greater economic impacts, whether measured by job growth, economic benefits, or disposable personal income. These changes are described in further detail in *Appendix C: Changes in Methodology/Assumptions*.

As described in the detailed findings below, energy efficiency and renewable energy investments made through Focus on Energy programs lead to immediate and long-term benefits that accrue while measures remain installed and operational. This analysis addresses program activities during the 2015–2018 quadrennium, so economic impacts from 2019 onward reflect only the long-term effects from

[1] Cadmus. "Focus on Energy Economic Impacts 2015–2016" January 2018. Available online: https://www.focusonenergy.com/sites/default/files/WI%20FOE%202015%20to%202016%20Econ%20Impact%20Report-%20Final.pdf

measures installed from 2015 through 2018. The economic impacts of all measures installed during the prior quadrennium (2011–2014) and current quadrennium (2019–2022) are excluded from this study.

## Detailed Portfolio Impacts

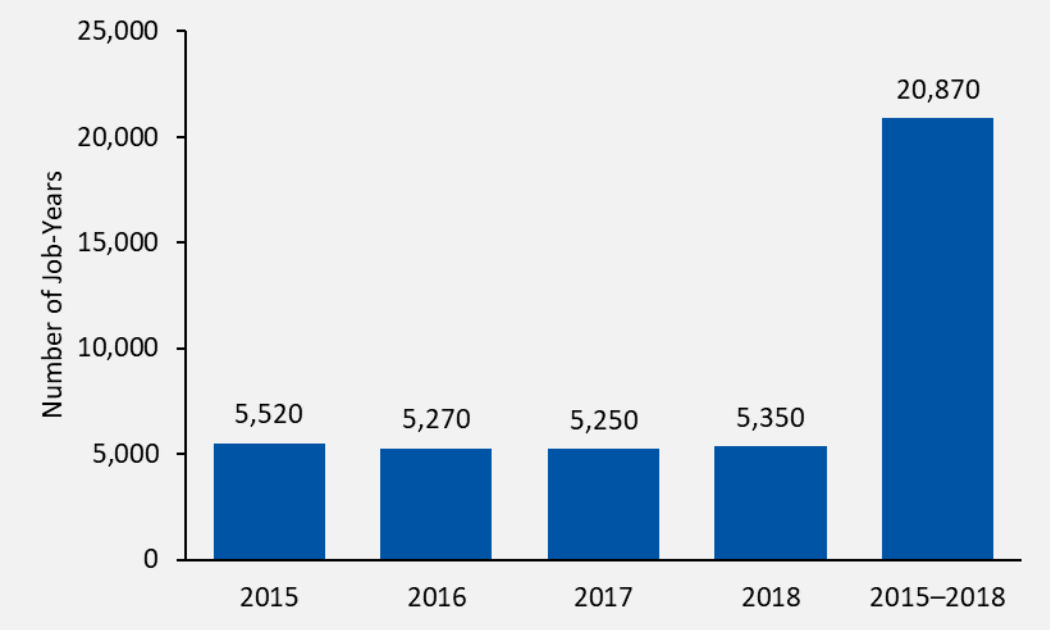
The subsections below provide detailed discussions of the 2015–2018 portfolio impacts according to three indicators of net statewide economic activity: employment, economic benefit (value added), and disposable personal income.

### *Employment*

Focus on Energy activities generate positive net effects on statewide employment. Trade Allies affected by increased business activity from Focus on Energy tend to hire more staff. Some of these new employees may have been unemployed previously or may have migrated to Wisconsin to gain employment: both cases represent a scenario in which Focus on Energy generates job growth in Wisconsin. Equipment installers within the state of Wisconsin will also be likely to hire additional employees to meet increased demand for energy-efficient and renewable energy projects. These newly hired employees will in turn spend their new wages in the Wisconsin economy, leading to additional induced economic impacts. Energy savings, and resulting bill savings, also lead to additional spending within the Wisconsin economy by businesses and residential customers that would not have occurred absent the energy savings.

Figure 1 illustrates Focus on Energy's cumulative net impacts on job growth annually and combined during the 2015–2018 quadrennium, measured relative to a hypothetical baseline scenario in which Focus on Energy programs did not operate. Study findings suggest each program year of activity will create 5,250 jobs or more through 2042 and nearly 21,000 jobs in aggregate.

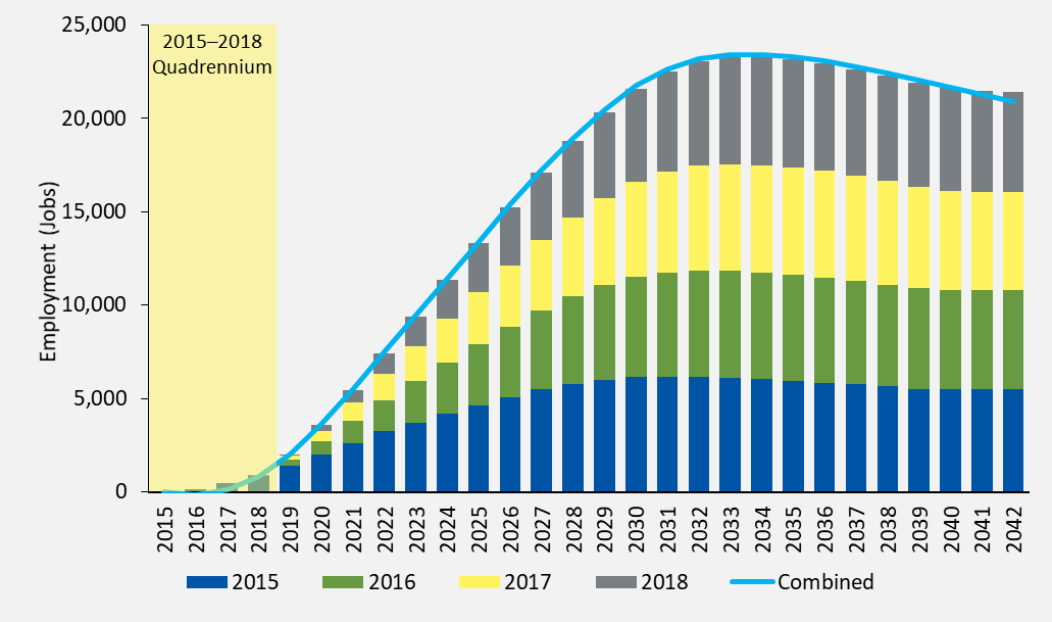
**Figure 1. Cumulative Net Employment Impacts by Program Year[1]**




[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Figure 2 illustrates how the cumulative net employment impacts by program year in Figure 2 accumulate over time. Cumulative quadrennial impacts equal the sum of cumulative program year impacts. These impacts peak roughly 15 years after the 2015–2018 quadrennium, at more than 23,400 jobs added. However, as energy efficiency measures reach the end of their effective useful lives (EULs), the long-term benefits created by Focus on Energy wear off, and the regional economy slowly returns to its pre-program equilibrium. Each additional program year of Focus on Energy activity not only increases peak job growth but also delays the wearing-off of employment impacts.

**Figure 3. Cumulative Net Employment Impacts Over Time**




## Portfolio Components Impacting Net Employment Growth

Table 5 shows the cumulative effects of program spending and emissions reductions on job growth by program year(s). Analysis findings suggest program spending during the 2015–2018 quadrennium will add roughly 18,600 jobs cumulatively, while emissions reductions persisting through 2042 will add another 2,250 jobs—a 12% increase in cumulative net employment impacts.

**Table 5. Program Spending and Emissions Reductions Effects on Job Growth by Program Year**

| Employment (jobs)[1] | Program Year(s) | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | Quadrennium |
| Program Spending | 4,950 | 4,740 | 4,690 | 4,800 | 18,610 |
| Emissions Reductions | 570 | 530 | 550 | 550 | 2,250 |
| **Cumulative** | **5,520** | **5,270** | **5,250** | **5,350** | **20,870** |

[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Similarly, Table 6 shows Focus on Energy's effects on job growth grouped by the locales in which projects where completed (rural areas versus non-rural areas). Analysis findings suggest energy efficiency and renewable energy projects completed in non-rural areas will add 74% more jobs through 2042 (13,200 jobs) than projects completed in rural areas (7,580 jobs). However, relative to spending, rural projects will add to the Wisconsin economy roughly as many jobs (48.9 jobs per $1 million spent) as non-rural projects (47.8 jobs per $1 million spent). Rural projects generated marginally more lifecycle energy savings per dollar spent, thus achieving ongoing positive impacts from participant bill reductions and utility avoided costs more cost-effectively.

**Table 6. Rural and Non-Rural Project Effects on Job Growth by Customer/Project Location**

| Economic Impact | Customer/Project Location | | |
|---|---|---|---|
| | Non-Rural | Rural | Total |
| Employment (jobs)[1] | 13,200 | 7,580 | 20,870 |
| Job-years per $1 Million Spent | 47.7 | 48.8 | 48.3 |

[1] Customer-specific impacts do not sum to total impacts due to rounding and because of dynamic factors in the REMI model.

### Net Employment Growth by Market Sector

The primary drivers of job growth in the first year and cumulatively over the study period are the direct, indirect, and induced effects of program investment, project spending, and ongoing energy savings. As economic activity related to Focus on Energy increases, so does Wisconsin's labor workforce.

Four of Wisconsin's five biggest sectors are projected to experience the largest cumulative job growth, ranked as follows:

1. Retail trade (3,810 jobs)
2. Health care and social assistance (3,170 jobs)
3. Manufacturing (2,760 jobs)
4. State and local government (2,280 jobs)
5. Other services (except public administration) (2,200 jobs)

Five other sectors are projected to add more than 1,000 jobs to the Wisconsin economy through 2042:

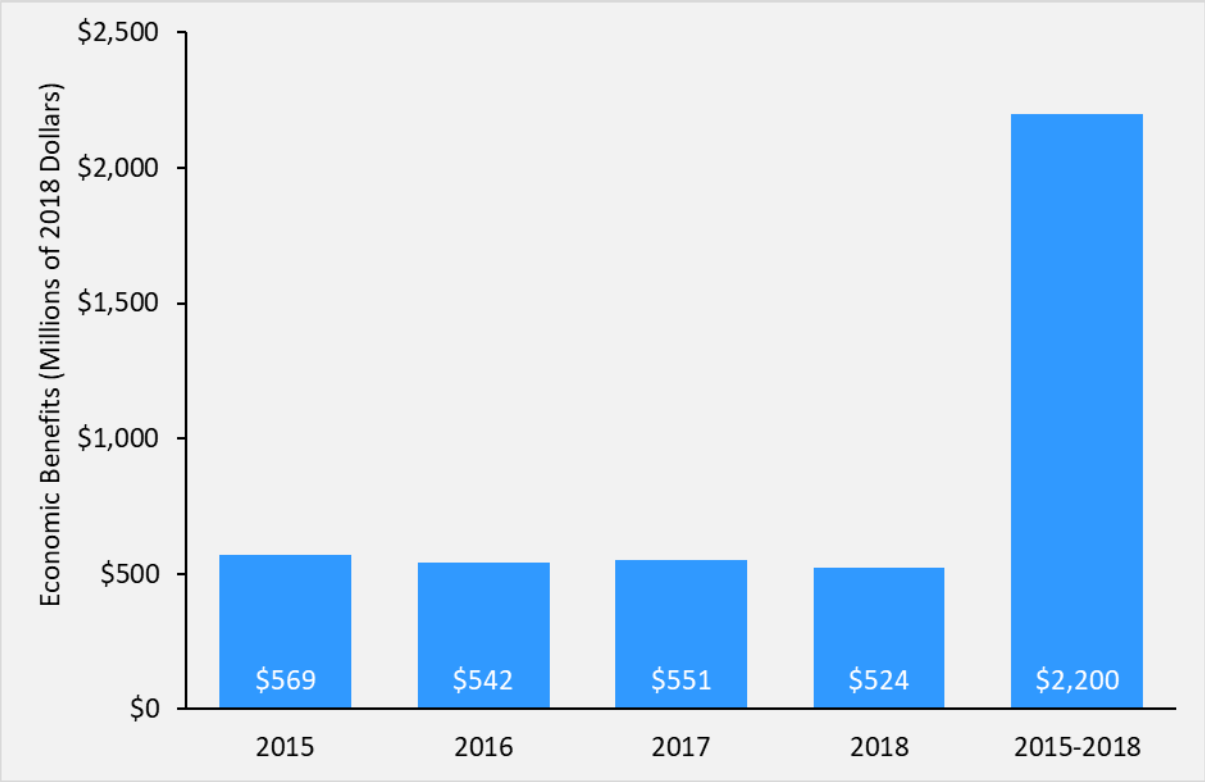
6. Accommodation and food services (2,110 jobs)
7. Professional, scientific, and technical services (1,750 jobs)
8. Administrative, support, waste management, and remediation services (1,010 jobs)
9. Real estate and rental and leasing (1,010 jobs)
10. Wholesale trade (1,000 jobs)

## *Economic Benefits*

Focus on Energy programs generate new demand for energy efficiency and renewable energy technologies and services and bring funds back into the Wisconsin economy that would normally be spent on out-of-state energy and fuel imports. Higher demand results in positive impacts on statewide wages, profits, and taxes, which collectively contribute economic benefits to Wisconsin's gross state product.

Figure 2 illustrates Focus on Energy's cumulative net impacts on economic benefits annually and combined during the 2015–2018 quadrennium. Model findings suggest, cumulatively through 2042, each program year will generate more than $520 million in net economic benefits, and the 2015–2018 quadrennium program portfolio will generate $2.2 billion in net economic benefits.

**Figure 2. Cumulative Net Economic Benefits[1]**




[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

## Portfolio Components Impacting Net Economic Benefits

Table 7 shows cumulative net economic benefits, which describe marginal impacts on Wisconsin's gross state product, created by Focus on Energy during the 2015–2018 quadrennium broken down by program spending and emissions reductions. Model findings suggest Focus on Energy investments in energy efficiency and renewable energy will generate nearly $2 billion in net economic benefit through 2042. Meanwhile, emissions reductions from energy savings will create roughly another $200 million in value added, increasing cumulative net economic benefits by 12%.

**Table 7. Cumulative Net Economic Benefits by Portfolio Component and Program Year**

| Economic Benefit (millions of 2018 dollars) | Program Year(s) | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | Quadrennium |
| Program Spending | $517 | $493 | $498 | $471 | $1,988 |
| Emissions Reductions | $52 | $49 | $53 | $53 | $212 |
| **Cumulative** | **$569** | **$542** | **$551** | **$524** | **$2,200** |

[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Figure 3 illustrates economic benefit impacts created by Focus on Energy program spending and emissions reductions both annually and combined during the 2015–2018 quadrennium, measured against a hypothetical baseline scenario in which Focus on Energy programs did not operate.

**Figure 3. Cumulative Net Economic Benefits by Portfolio Component and Program Year[1]**


[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

## Economic Benefit Effects on Annual Portfolio Cost-Effectiveness

In its annual evaluation reports, Cadmus has used the modified total resource cost (TRC) test to measure the net costs of Focus on Energy as a resource option. Results from the modified TRC test represent the balance between costs from direct utility and participant expenditures and benefits from avoided environmental externalities and energy and capacity costs that accrue over time. Although the modified TRC test incorporates a relatively expansive scope of benefits and costs, Cadmus also considered cumulative economic benefits to develop additional TRC tests for each year's program portfolio and for the 2015–2018 quadrennium. For all program years, the modified TRC benefit/cost ratio was higher when considering the economic benefits attributable to Focus on Energy.

Because this study establishes updated net economic benefits for the 2015–2018 quadrennium, the results in the following tables no longer align with the cost-effectiveness analyses that correspond with each program year's annual evaluation report.[2] All benefits and costs unrelated to the net economic benefits herein remain the same, but Cadmus revised net economic benefits to reflect the results of this study. These updates improved total TRC benefits, TRC benefits minus costs, and TRC benefit/cost ratios

[2] Cadmus also applied updated net economic benefits to the CY2019 evaluation report cost-effectiveness results, which had incorporated net economic benefits from the previous study. See *Appendix D: Revised CY2019 Cost-Effectiveness Results* for updated figures.

annually and in total. Incorporating cumulative net economic benefits improves the TRC benefit/cost ratio for the 2015–2018 quadrennium from 3.62 to 5.85.

Table 8 lists the results of the modified TRC tests with and without economic benefits for CY2015. Net economic benefits attributable to Focus on Energy program activity in CY2015 increase total TRC benefits minus costs from $597 million to $1.17 billion and the TRC benefit/cost ratio from 3.51 to 5.91.

**Table 8. CY2015 Cost-Effectiveness with and without Economic Benefits**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $8,492,929 | $8,492,929 |
| Delivery Costs | $26,707,516 | $26,707,516 |
| Incremental Measure Costs | $202,095,636 | $202,095,636 |
| **Total Non-Incentive Costs** | **$237,296,082** | **$237,296,082** |
| Electric Benefits | $454,672,669 | $454,672,669 |
| Natural Gas Benefits | $268,732,764 | $268,732,764 |
| Emissions Benefits | $110,581,131 | $110,581,131 |
| Net Economic Benefits | $0 | $569,286,657 |
| **Total TRC Benefits** | **$833,986,564** | **$1,403,272,221** |
| **TRC Benefits Minus Costs** | **$596,690,482** | **$1,165,977,139** |
| **TRC Benefit/Cost Ratio** | **3.51** | **5.91** |

Table 9 lists the results of the modified TRC tests with and without economic benefits for CY2016. Net economic benefits attributable to Focus on Energy program activity in CY2016 increase total TRC benefits minus costs from $524 million to $1.07 billion and the TRC benefit/cost ratio from 3.00 to 5.07.

**Table 9. CY2016 Cost-Effectiveness with and without Economic Benefits**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $7,934,445 | $7,934,445 |
| Delivery Costs | $25,869,078 | $25,869,078 |
| Incremental Measure Costs | $228,494,405 | $228,494,405 |
| **Total Non-Incentive Costs** | **$262,297,928** | **$262,297,928** |
| Electric Benefits | $460,910,375 | $460,910,375 |
| Natural Gas Benefits | $221,481,558 | $221,481,558 |
| Emissions Benefits | $104,003,542 | $104,003,542 |
| Net Economic Benefits | $0 | $542,174,724 |
| **Total TRC Benefits** | **$786,395,475** | **$1,328,570,199** |
| **TRC Benefits Minus Costs** | **$524,097,547** | **$1,066,272,271** |
| **TRC Benefit/Cost Ratio** | **3.00** | **5.07** |

Table 10 lists the results of the modified TRC tests with and without economic benefits for CY2017. Net economic benefits attributable to Focus on Energy program activity in CY2017 increase total TRC benefits minus costs from $574 million to $1.12 billion and the TRC benefit/cost ratio from 4.07 to 7.01.

**Table 10. CY 2017 Cost-Effectiveness with and without Economic Benefits**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $8,841,889 | $8,841,889 |
| Delivery Costs | $27,981,653 | $27,981,653 |
| Incremental Measure Costs | $150,204,217 | $150,204,217 |
| **Total Non-Incentive Costs** | **$187,027,759** | **$187,027,759** |
| Electric Benefits | $507,115,958 | $507,115,958 |
| Natural Gas Benefits | $154,045,069 | $154,045,069 |
| Emissions Benefits | $99,892,397 | $99,892,397 |
| Net Economic Benefits | $0 | $550,853,424 |
| **Total TRC Benefits** | **$761,053,424** | **$1,311,906,848** |
| **TRC Benefits Minus Costs** | **$574,025,665** | **$1,124,879,089** |
| **TRC Benefit/Cost Ratio** | **4.07** | **7.01** |

Table 11 lists the results of the modified TRC tests with and without economic benefits for CY2018. Net economic benefits attributable to Focus on Energy program activity in CY2018 increase total TRC benefits minus costs from $617 million to $1.14 billion and the TRC benefit/cost ratio from 3.66 to 5.93.

**Table 11. CY 2018 Cost-Effectiveness with and without Economic Benefits[1]**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $3,438,377 | $3,438,377 |
| Delivery Costs | $47,240,843 | $47,240,843 |
| Incremental Measure Costs | $180,868,708 | $180,868,708 |
| **Total Non-Incentive Costs** | **$231,547,927** | **$231,547,927** |
| Electric Benefits | $528,640,783 | $528,640,783 |
| Natural Gas Benefits | $209,803,790 | $209,803,790 |
| Emissions Benefits | $109,701,374 | $109,701,374 |
| Net Economic Benefits | $0 | $523,938,334 |
| **Total TRC Benefits** | **$848,145,948** | **$1,372,084,281** |
| **TRC Benefits Minus Costs** | **$616,598,020** | **$1,140,536,354** |
| **TRC Benefit/Cost Ratio** | **3.66** | **5.93** |

[1] Cadmus applied updated net economic benefits to the CY2019 evaluation report cost-effectiveness results, which had incorporated net economic benefits from the previous study of the 2015–2016 program period. See *Appendix D: Revised CY2019 Cost-Effectiveness Results* for updated figures.

Table 12 lists the results of the modified TRC tests with and without economic benefits for the entire 2015–2018 quadrennium. Net economic benefits attributable to Focus on Energy quadrennial activity in

increase total TRC benefits minus costs from $2.6 billion to roughly $4.8 billion and improve the 2015–2018 quadrennium TRC benefit/cost ratio from 3.62 to 5.85.

**Table 12. 2015–2018 Quadrennium Cost-Effectiveness with and without Economic Benefits[1]**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $28,707,640 | $28,707,640 |
| Delivery Costs | $127,799,090 | $127,799,090 |
| Incremental Measure Costs | $833,130,165 | $833,130,165 |
| **Total Non-Incentive Costs** | **$989,636,895** | **$989,636,895** |
| Electric Benefits | $2,212,781,472 | $2,212,781,472 |
| Natural Gas Benefits | $899,222,034 | $899,222,034 |
| Emissions Benefits | $474,103,341 | $474,103,341 |
| Net Economic Benefits | $0 | $2,200,373,372 |
| **Total TRC Benefits** | **$3,586,106,847** | **$5,786,480,219** |
| **TRC Benefits Minus Costs** | **$2,596,469,952** | **$4,796,843,324** |
| **TRC Benefit/Cost Ratio** | **3.62** | **5.85** |

[1] Some program benefits and costs were applied to the 2015–2018 quadrennium rather than a specific program year. Because of this, quadrennial benefits and costs will differ slightly from the sum of program year benefits and costs.

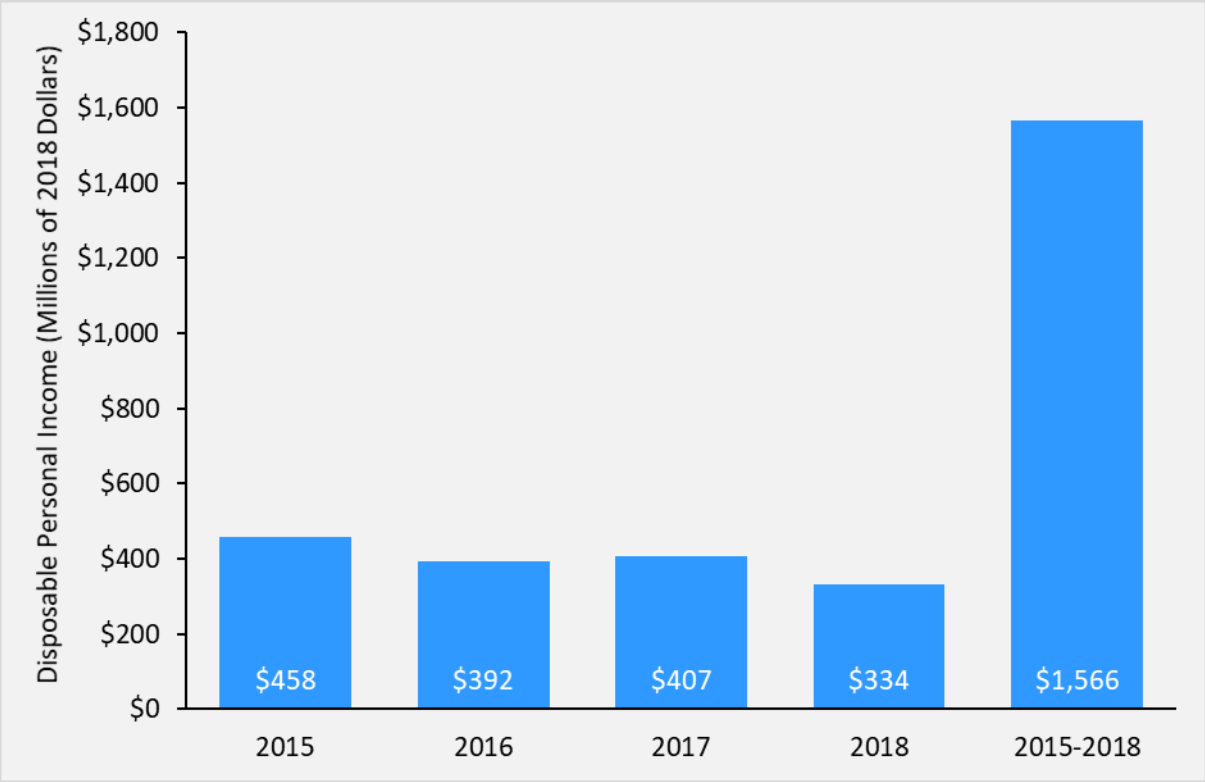
As shown above, incorporating net economic benefits from Focus on Energy activity into the TRC ratio, annually and in aggregate, consistently increases net benefits and improves cost-effectiveness outcomes.

### *Disposable Personal Income*

Employees of directly and indirectly affected industries and program participants who save money on energy through bill reductions benefit from increases in disposable personal income, which can be saved or re-spent on good and services in the Wisconsin economy at their discretion.

Figure 4 illustrates Focus on Energy's cumulative net impacts on disposable personal income annually and combined during the 2015–2018 quadrennium, measured relative to a hypothetical baseline scenario in which Focus on Energy programs did not operate. Model findings suggest investments will generate cumulative net disposable personal income impacts in excess of $330 million per program year of activity and $1.5 billion in aggregate through 2042.

**Figure 4. Cumulative Net Disposable Personal Income Impacts[1]**




[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

## Portfolio Components Impacting Net Disposable Personal Income

Table 13 shows increases in net disposable personal income broken down by program spending and emissions reductions for each program year(s). Model findings suggest program spending during the 2015–2018 quadrennium will generate more than $1.35 billion in new disposable personal income through 2042. Meanwhile, emissions reductions will add roughly another $210 million in disposable personal income, increasing cumulative net disposable personal income by 16%.

**Table 13. Disposable Personal Income Effects by Portfolio Component and Program Year**

| Disposable Personal Income (millions of 2018 dollars) | Program Year(s) | | | | |
|---|---|---|---|---|---|
| | 2015 | 2016 | 2017 | 2018 | Quadrennium |
| Program Spending | $407 | $343 | $355 | $281 | $1,353 |
| Emissions Reductions | $51 | $49 | $53 | $52 | $213 |
| **Cumulative** | **$458** | **$392** | **$407** | **$334** | **$1,566** |

[1] Program year impacts do not sum to 2015–2018 quadrennium impacts due to rounding and because of dynamic factors in the REMI model.

Because of the strong correlation between statewide employment and personal income, program year and future year personal income increases accrue over time in much the same manner as employment.

## *Analytical Approach*

In January 2018, Cadmus completed a Focus on Energy economic impact analysis to determine the statewide economic impacts of program activities during program years 2015 and 2016 and the resulting energy savings expected to accrue through 2040. This analysis follows the prior analysis with a few changes. Since the previous analysis, federal organizations that track and report on economic production and growth have released updated economic data and forecasts. These data contribute to the foundation of REMI models; therefore, the REMI model used in this analysis is based on more recent economic production and growth data than the model used in the 2018 study.

Moreover, Cadmus updated its REMI model from PI$^+$ to E3+, which was released in 2019. E3+ is built on PI$^+$ with additional functionality for energy analysis, for example it accepts changes in emissions (whether in the form of reductions or increases) as an input. This change (and other changes) in methodology are further described in *Appendix C: Changes in Methodology/Assumptions*.

The subsections below describe the REMI E3+ modeling software; the approach used to determine net economic impacts attributable to Focus on Energy program investments, project spending, and ongoing energy savings; and the model inputs used in the REMI E3+ model framework.

### Description of Software and Modeling Approach

Studies that assess the net economic impacts of energy efficiency and renewable resource programs typically use one of two types of modeling analysis.

1. The first type uses an input-output (IO) matrix to assess interactions between industries under static economic conditions, which is suitable for determining the approximate impacts of program-related cash flows that lead to ripple effects throughout the economy. However, an IO assessment does not incorporate future economic changes—such as labor migration, price changes, and general economic equilibrium—that affect the economic impacts of ongoing energy savings.
2. The second type of analysis incorporates dynamic changes in those variables and is thus a better option for assessing the near-term and long-term impacts of energy efficiency and renewable resource programs like those offered by Focus on Energy.

The REMI E3+ model used for this analysis incorporates features of both types of economic analysis, as described below.

#### *About the REMI E3+ Model*

REMI E3+ is a dynamic economic forecasting model and incorporates an IO matrix, general equilibrium, econometrics, and economic geography:

3. The **IO matrix** is at the core of how the REMI E3+ model captures industry-to-industry interactions within a particular region, in this case the state of Wisconsin.

For example, buying home insulation directs funds to the insulation industry. REMI E3+ includes a set of spending multipliers that account for how the insulation industry interacts with other industries, such as the fiberglass industry.

4. **General equilibrium** captures the long-term stabilization of the economic system as supply and demand become balanced.

For example, as investments in energy-efficient equipment increase, general equilibrium is established as contractors hire more employees to install and maintain the new energy-efficient equipment in the region. Additionally, commercial and industrial program participants have lower long-term energy costs, improving their competitiveness relative to neighboring states and allowing them to capture a greater share of the regional market.

5. **Econometrics** estimates responses to economic changes and the speed at which they occur.

For example, as Focus on Energy program participants demand less energy because they are using more efficient equipment, utilities increase energy rates to maintain revenue and profits. In this case, the econometric factor of "price elasticity of energy demand" describes how utilities change prices to account for reductions in demand.

6. **Economic geography** represents spatial characteristics of the economy, such as productivity and competitiveness, arising from industry clustering and labor market access.

For example, as investments in energy-efficient equipment increase, clusters of specialized labor and firms related to energy efficiency and renewable energy will develop in Wisconsin. In other words, Focus on Energy helps develop the energy efficiency and renewable energy industries in Wisconsin.

Unlike standard IO models, the REMI E3+ model accounts for the expected annual changes in the statewide economy over the entire study period. The economic production and growth data underpinning the model are based on real historical and forecasted conditions. As a result, the REMI E3+ model accounts for near-term conditions that affect calculated investment impacts and spending completed during the program operational period, and the model considers long-term conditions that affect calculated impacts from ongoing energy savings.

## Modeling Approach

Cadmus used a customized REMI E3+ model for the state of Wisconsin to determine the net effects on employment, economic benefits, and disposable personal income resulting from Focus on Energy programs during the 2015–2018 quadrennium, both by program year and in aggregate.

All findings described in this report represent net economic impacts, which means net spending change has not changed in Wisconsin as a result of Focus on Energy program activities. For example, the increase in consumer spending on energy-efficient appliances is balanced by decreases in spending on other goods and services. Additionally, investments in Focus on Energy programs must be offset by funding through ratepayer bill payments. The result is that total statewide spending remains constant,

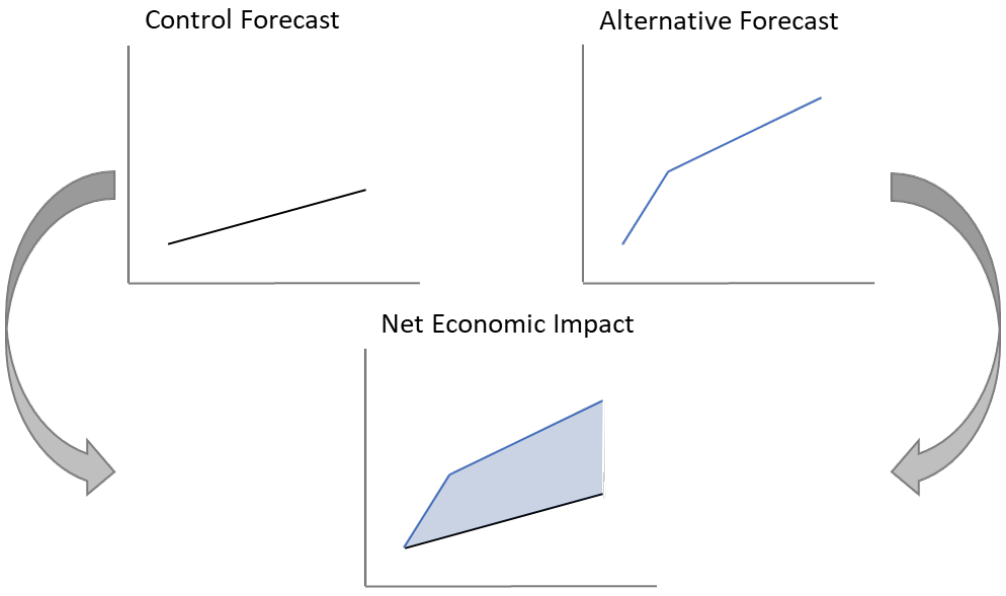
and calculated economic impacts represent the difference between an economy with Focus on Energy and one without Focus on Energy.

Cadmus used the REMI E3+ model's standard regional control to determine net changes in employment and other economic variables resulting from program activities. For this study, the model's standard regional control scenario details the impacts of economic activities that would have occurred without Focus on Energy program investments, project spending, and resulting energy savings and emissions reductions. These economic activities primarily consist of program participants' fuel and power purchases if they had not received incentives from Focus on Energy to purchase energy-efficient or renewable energy technologies.

The REMI E3+ model calculates a control forecast based on the standard regional control and an alternative forecast derived from model inputs describing all Focus on Energy program-related cash flows between Wisconsin stakeholder groups. The model integrates economic data collected by various federal government agencies. Employment and wage data are from the Bureau of Economic Analysis, Bureau of Labor Statistics, and County Business Patterns database. Information on fuel wholesale and retail costs is from the U.S. Energy Information Administration (EIA). Data from the U.S. Census Bureau form the basis for model assumptions of population growth and migration within and between regions.[3]

As Figure 5 illustrates, the REMI E3+ model compares impacts from the control forecast to impacts from the alternative forecast to determine net economic impacts.

**Figure 5. Determining Net Economic Impacts with REMI E3+**

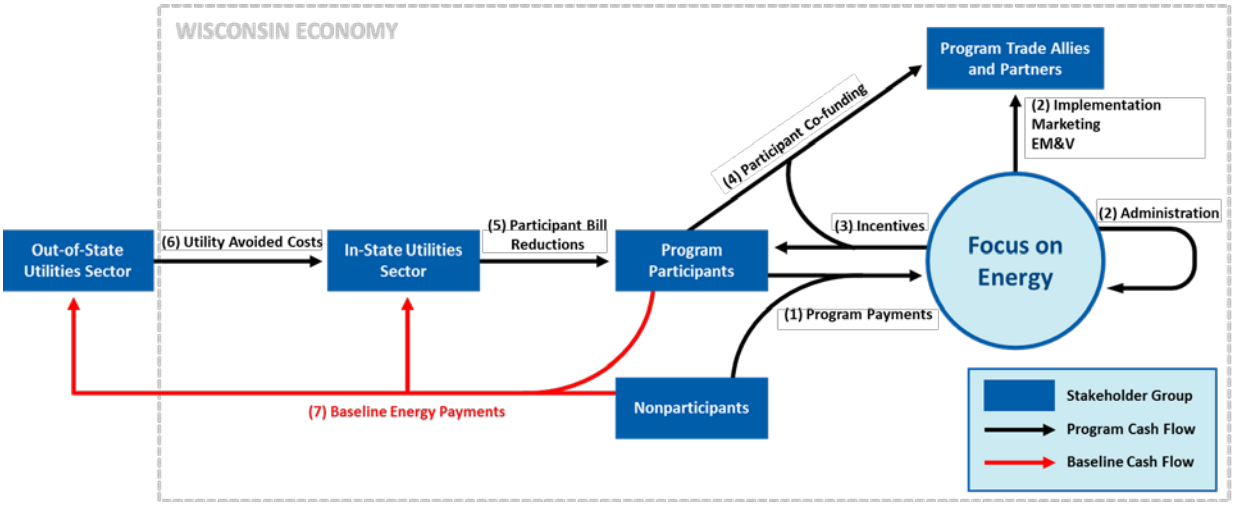



[3] For a more detailed breakdown of the data sources and estimate procedures included in the REMI E3+ model forecasts, please reference REMI's user documentation online: https://www.remi.com/wp-content/uploads/2019/11/Model-Equations.pdf

The net economic impacts calculated by REMI E3+ represent the difference between the Focus on Energy program-related economic activities (alternative forecast) and the economic activities that would have occurred if the money invested in Focus on Energy had instead been spent on fuel and power purchases (control forecast).

For each year in this analysis, Cadmus customized REMI E3+ to model program-related cash flows among relevant stakeholder groups. As shown in Figure 6, these cash flows affect the Wisconsin economy in multiple ways—program payments, administration, implementation, marketing, evaluation, measurement, and verification (EM&V), incentives, participant co-funding, participant bill reductions, utility avoided costs, and baseline energy payments—all of which are described after the figure.

**Figure 6. Program and Baseline Scenario Cash Flows**




These are the ways in which each cash flow affects the Wisconsin economy:

1. **Program payments.** Funding for Focus on Energy originates from participating utilities' revenues, which are collected from Wisconsin ratepayers through a charge embedded in their utility bills.

In aggregate, program payments equal program spending, such that every dollar spent to administer Focus on Energy programs is offset by a dollar collected from ratepayers. Cadmus modeled program payments from residential customers as increases in electricity and natural gas prices and modeled program payments from business customers as increases in the amount spent on fuel.

2. **Administration, implementation, marketing, and EM&V.** Focus on Energy funds are spent on program administration activities and technical and customer support, marketing, and EM&V services provided by program Trade Allies and partners.

Program spending on administration, technical and customer support, marketing, and EM&V was modeled as either wage increases or direct spending in specific industry sectors. Programs' different delivery mechanisms, incentive structures, and offered measures contributed to which industry sector received spending on a program-by-program basis.

3. **Incentives.** Program funds are also spent on direct financial and service-based incentives that encourage investments in energy-saving technologies and behaviors.

Since incentives offset a portion of the cost of high-efficiency measures, Cadmus generally modeled incentive payments as direct spending to affected industry sectors using the same program-specific categories as program spending.

4. **Participant co-funding.** In addition to receiving incentives from Focus on Energy programs, participants provide their own co-funding to complete payments for project goods and services.

Cadmus modeled participant co-funding as positive direct spending to the industry supplying a program's goods and services. The amount participants spent was offset with a negative consumption reallocation to reflect the forgone consumption of other goods and services resulting from program participation.

5. **Participant bill reductions.** Participants save energy as long as the installed measures remain operational, thus benefitting from energy bill reductions, while utilities forego those revenues.

For the residential programs' participants, Cadmus modeled energy bill reductions as a positive consumption reallocation, which marks an increase in household consumption on other goods and services (the REMI E3+ model accounts for Wisconsin-specific spending profiles by demographic group). To calculate future-year bill reductions, Cadmus used forecasted energy rates and savings by fuel type. Forecasted rates came from East North Central census region data from the EIA's *2019 Annual Energy Outlook*.[4] Future dollar values were also discounted to model base-year values using the consumer price index for the Illinois-Indiana-Wisconsin region from the U.S. Bureau of Labor Statistics (BLS).[5]

6. **Utility avoided costs.** As a result of decreased demand for energy resources, Wisconsin utilities benefit from avoided fuel and capacity costs.

When utilities generate less energy in reaction to decreased demand, there is a corresponding reduction in fuel purchases, transmission and distribution on the energy grid, the need to increase capacity, and air pollutants. Focus on Energy provided the avoided capacity and fuel prices used to calculate the avoided utility costs.

Cadmus modeled avoided costs as a positive impact to the utility industry by partially offsetting reductions in utility energy sales, which are negative utility industry impacts equal to the bill reductions described above. To account for the avoided costs and revenue losses from bill reductions, Cadmus

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[4] U.S. Energy Information Administration. "Annual Energy Outlook 2019." Table: Energy Prices by Sector and Source. Accessed October 2019. https://www.eia.gov/outlooks/aeo/data/browser/#/?id=3-AEO2019&sourcekey=0

[5] U.S. Bureau of Labor Statistics. "CPI for All Urban Consumers (CPI-U)." Accessed October 2019. https://data.bls.gov/cgi-bin/surveymost?cu

modeled a reduction in utility industry sales equal to the difference between participants' bill reductions and the avoided utility costs.

Utilities may seek to recover lost revenues through their rates, which could result in changes that, all else equal, could increase future rates for all Wisconsin ratepayers. This could increase the future cost of energy for ratepayers who did not participate in Focus on Energy programs and reduce the net bill savings of participating ratepayers (and ratepayers who implemented cost-effective energy efficiency measures without participating). The REMI E3+ model is not designed to assess the potential distributional effects of these rate changes on regional economic activity. Therefore, such potential distributional impacts are not included in this study.

7. **Baseline energy payments.** In the absence of Focus on Energy, Wisconsin ratepayers spend money on energy resources that otherwise would have been saved through the programs. Baseline energy payments were accounted for in the models' control forecasts, and therefore did not require alternative forecast model inputs from Cadmus.

Energy savings that generate participant bill reductions and utility avoided costs also generate emissions reductions, not shown in Figure 6. With E3+, Cadmus can account for emission reductions as a non-cash flow input that affects Wisconsin's "attractiveness," leading to in-migration and additional stimulus of economic activity.

Table 14 summarizes the positive and negative model inputs by relevant stakeholder group.

**Table 14. Summary of Positive and Negative Model Inputs by Cash Flow**

| Cash Flow | Positive Impact(s) | Negative Impact(s) |
|---|---|---|
| Program payments | N/A | Reduces consumption and investments in other sectors in regional economy |
| Program spending | Funds program administration, implementation, marketing, and EM&V | N/A |
| Incentives | Reduces up-front cost of project or measure for participant | N/A |
| Participant co-funding | Increases consumption on goods/services in sectors specific to Focus on Energy activity | Reduces consumption and investments on other goods/services by participants |
| Participant bill reductions | Increases disposable income for personal savings and consumer spending (residential); Reduces costs of production (nonresidential) | Reduces utility revenue |
| Utility avoided costs | Reduces energy, generation, transmission, and distribution costs for in-state utilities | Decreases infrastructure investments and energy imports from out of state |

## *Model Input Data*

Economic impacts derive from Focus on Energy program investments, project spending, and resulting energy savings. This section presents the key REMI E3+ model inputs and describes the evaluation of the impact of various measures. All monetary inputs are presented in fixed 2017 dollars.[6] Because of

[6] The REMI E3+ model accepted inputs in fixed 2017 dollars and generated outputs in fixed 2018 dollars.

methodological differences including but not limited to updated assumptions and naturally occurring changes to data, model inputs for program years 2015 and 2016 may look slightly different than they did for the study concerning the 2015–2016 period. See *Appendix C: Changes in Methodology/Assumptions* for more information on changes between the previous and current studies.

## Program Spending

Table 15 shows total Focus on Energy program spending by program year and category. Cadmus used Baker Tilly annual expense reports to calculate incentives and Statewide Energy Efficiency and Renewable Administration (SEERA) annual expense reports to determine EM&V spending.[7] Per a decision made jointly by the Evaluation Working Group, the team assigned to rural ratepayers 40% of all non-incentive costs, which consist of administration, implementation, EM&V, and the Program Administrator's final bonus.

**Table 15. Program Spending by Year (Fixed 2017$)**

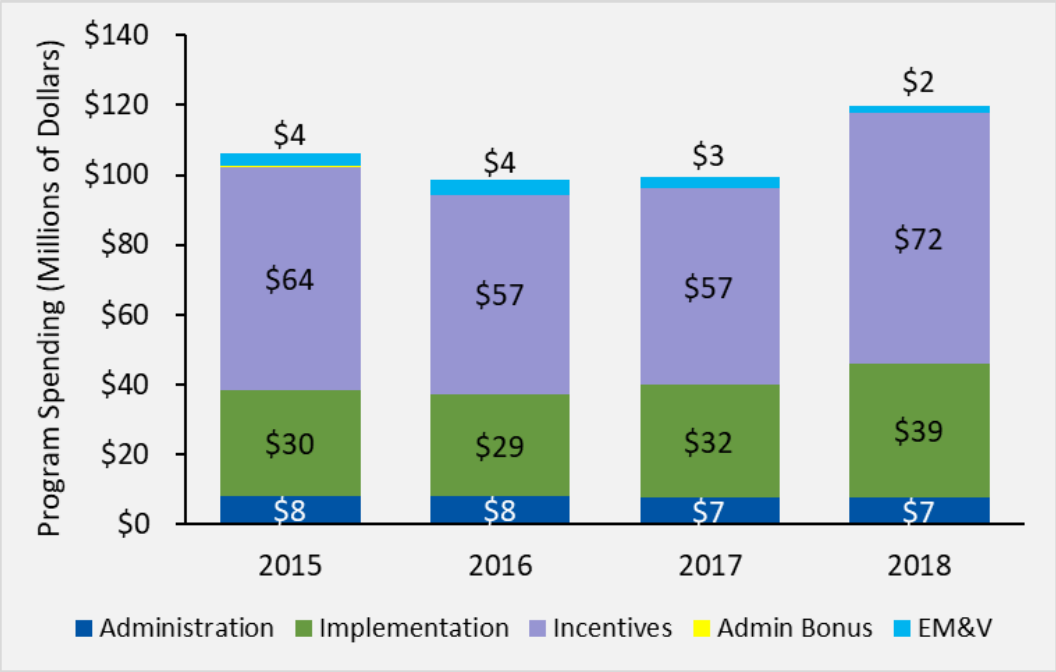
| Program Year | Administration | Implementation | Incentives | Admin Bonus[1] | EM&V |
|---|---|---|---|---|---|
| 2015 | $7,795,144 | $30,421,308 | $64,028,100 | $192,900 | $3,606,477 |
| 2016 | $7,804,587 | $29,279,388 | $57,247,441 | $0 | $4,345,271 |
| 2017 | $7,431,103 | $32,362,898 | $56,574,661 | $0 | $3,149,688 |
| 2018 | $7,397,583 | $38,719,688 | $71,724,753 | $0 | $2,032,153 |
| **Total** | **$30,428,417** | **$130,783,282** | **$249,574,955** | **$192,900** | **$13,133,589** |

[1] Cadmus assumed 50% of the Program Administrator's final bonus ($375,000) for the 2011–2014 quadrennium accrued outside of study region (Wisconsin).

Figure 7 illustrates the spending patterns in Table 15. Incentives comprised nearly 60% of all program spending, followed by implementation (31%) and administration (7%).

[7] Baker Tilly currently serves as the Focus on Energy Compliance Agent. SEERA is the legal entity (non-profit) formed by Energy Utilities to fulfill their obligations under Wisconsin Statute § 196.374(2)(a). SEERA creates and funds statewide energy efficiency and renewable energy programs.

**Figure 7. Program Spending by Category and Program Year (Fixed 2017$)**




## Participant Co-Funding

In addition to receiving incentives, program participants provided their own co-funding to complete payments for energy efficiency and renewable energy projects. For this study, Cadmus updated incremental cost estimates, which affect participant co-funding values, to better reflect how co-funding is incorporated into cost-effectiveness analyses in the annual Focus on Energy evaluation reports.

As shown in Table 16, annual participant co-funding by nonresidential participants during the 2015–2018 quadrennium were twice as large as payments by residential participants.

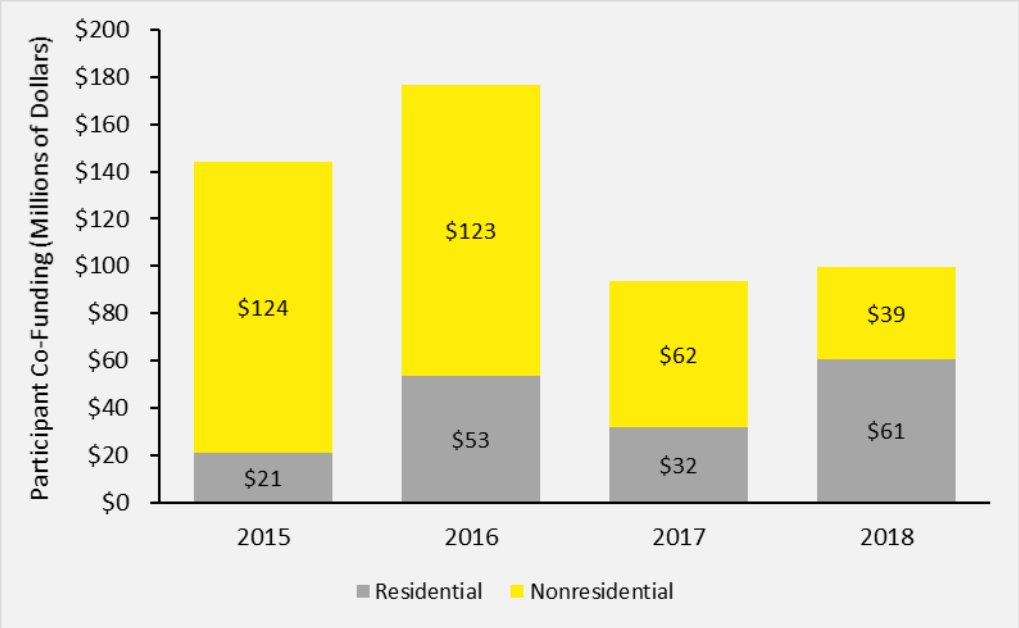
**Table 16. Participant Co-Funding by Program Year and Customer/Project Location (Fixed 2017$)**

| Program Year | Residential | Nonresidential | Total |
|---|---|---|---|
| 2015 | $20,803,442 | $123,598,458 | $144,401,900 |
| 2016 | $53,395,920 | $123,204,373 | $176,600,293 |
| 2017 | $31,802,431 | $61,725,833 | $93,528,264 |
| 2018 | $60,608,932 | $39,046,421 | $99,655,353 |
| **Total** | **$166,610,725** | **$347,575,085** | **$514,185,810** |

Figure 8 illustrates the co-funding patterns shown in Table 16. Participant co-funding payments track with incremental costs (described in *Economic Benefit Effects on Annual Portfolio Cost-Effectiveness*), which shrank in CY2017 and CY2018. Incentive spending remained stable throughout the 2015–2018 quadrennium except in CY2018, when the additional suite of rural programs concluded. In CY2017, the Program Administrator trued up its incremental costs for LEDs, a measure category that accounts for nearly 43% of first-year energy savings during the 2015–2018 quadrennium. Because LEDs comprise

such a large portion of Focus on Energy activity, adjustments to ensure LED incremental costs were more accurate made a large impact on participant co-funding estimates from CY2016 to CY2017. Any difference attributable to changes in day-to-day program administration and implementation would be negligible.

**Figure 8. Participant Co-Funding by Program Year and Market Segment (Fixed 2017$)**




## Electric Energy Savings

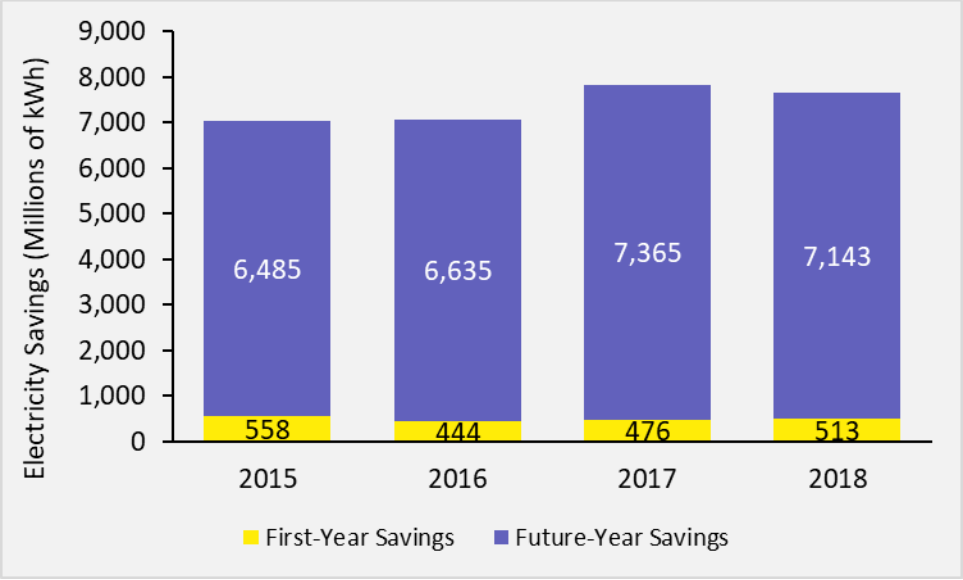
For each program year and the 2015–2018 quadrennium, Cadmus collected net verified electric savings from annual evaluation data. Table 17 presents the first-year, future-year, and lifecycle electric savings by program year and market segment. The sum of first-year savings and future-year savings (all energy savings from the second year onward) equals lifecycle savings. The first year of savings is broken out to illustrate how a single year of program savings produces significantly more savings in future years throughout measures' effective useful lifetimes. Cadmus revised electric energy savings estimates to accommodate updated program data and adjustments made *ex post*. Due to revisions to and rounding of values in the program data, energy savings below may not exactly match the values presented in each of the annual evaluation reports. Any margin of error is insubstantial in its influence on the cumulative net economic impacts outlined herein.

**Table 17. Electric Savings (kWh) by Program Year and Market Segment**

| Year | Segment | First-Year Savings | Future-Year Savings | Lifecycle Savings |
|---|---|---|---|---|
| 2015 | Residential | 206,529,181 | 1,660,904,602 | 1,867,433,783 |
| | Nonresidential | 351,707,463 | 4,823,798,386 | 5,175,505,849 |
| | **Total** | **558,236,544** | **6,484,703,088** | **7,042,939,632** |
| 2016 | Residential | 131,482,671 | 2,190,957,075 | 2,322,439,746 |
| | Nonresidential | 312,460,570 | 4,443,841,107 | 4,756,301,677 |
| | **Total** | **443,943,241** | **6,634,798,182** | **7,078,741,423** |
| 2017 | Residential | 114,932,709 | 2,054,853,402 | 2,169,786,111 |
| | Nonresidential | 360,748,366 | 5,310,631,194 | 5,671,379,560 |
| | **Total** | **475,681,075** | **7,365,484,596** | **7,841,165,671** |
| 2018 | Residential | 161,606,999 | 2,507,420,900 | 2,669,027,899 |
| | Nonresidential | 351,464,201 | 4,635,734,936 | 4,987,199,137 |
| | **Total** | **513,071,200** | **7,143,155,836** | **7,656,227,036** |
| 2015–2018 | Residential | 614,551,561 | 8,414,135,978 | 9,028,687,539 |
| | Nonresidential | 1,376,380,600 | 19,214,005,624 | 20,590,386,224 |
| | **Total** | **1,990,932,161** | **27,628,141,602** | **29,619,073,763** |

Figure 9 illustrates electric energy savings patterns by program year and market segment. Lifecycle electric energy savings in CY2017 and CY2018 increased by 10% over CY2015 and CY2016 because EULs for energy efficiency measures improved, which increased future-year savings.

**Figure 9. First-Year and Future Electric Savings (kWh) by Program Year and Market Segment**




## Natural Gas Energy Savings

For each program year and the 2015–2018 quadrennium, Cadmus organized net verified natural gas savings from annual evaluation data. Table 18 presents the first-year, future-year, and lifecycle natural gas savings by program year and market segment. The sum of first-year savings and future-year savings

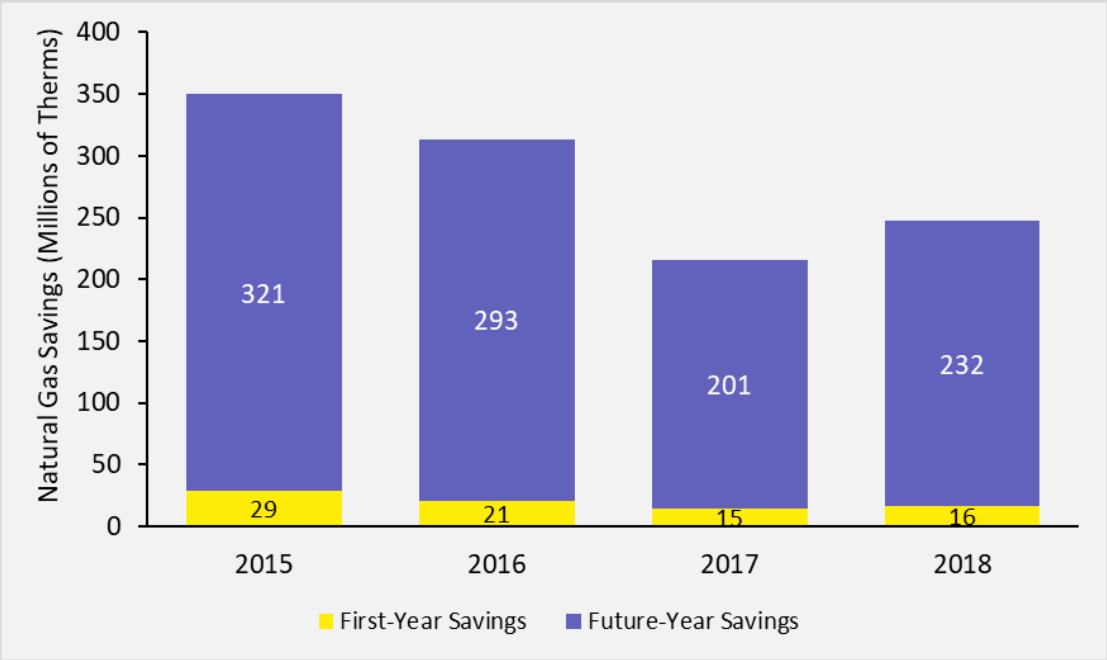
(all energy savings from the second year onward) equals lifecycle savings. The first year of savings is broken out to illustrate how a single year of program savings produces significantly more savings in future years throughout measures' effective useful lifetimes. As with electric energy savings, Cadmus revised natural gas energy savings estimates to accommodate updated program data and adjustments made *ex post*. Due to revisions to and rounding of values in the program data, energy savings below may not exactly match the values presented in each of the annual evaluation reports. Any margin of error is insubstantial in its influence on the cumulative net economic impacts outlined herein.

**Table 18. Natural Gas Savings (therms) by Program Year and Market Segment**

| Year | Segment | First-Year Savings | Future-Year Savings | Lifecycle Savings |
|---|---|---|---|---|
| 2015 | Residential | 2,226,601 | 41,341,279 | 43,567,880 |
| | Nonresidential | 26,698,157 | 279,444,318 | 306,142,475 |
| | **Total** | **28,924,758** | **320,785,596** | **349,710,354** |
| 2016 | Residential | 1,993,080 | 31,551,374 | 33,544,454 |
| | Nonresidential | 18,848,352 | 261,187,034 | 280,035,386 |
| | **Total** | **20,781,433** | **292,798,406** | **313,579,839** |
| 2017 | Residential | 2,237,935 | 33,680,512 | 35,918,447 |
| | Nonresidential | 12,334,829 | 167,580,964 | 179,795,793 |
| | **Total** | **14,572,764** | **201,141,476** | **215,714,240** |
| 2018 | Residential | 3,566,430 | 49,479,466 | 53,045,896 |
| | Nonresidential | 12,648,147 | 182,092,468 | 194,740,615 |
| | **Total** | **16,214,577** | **231,571,935** | **247,786,512** |
| 2015–2018 | Residential | 9,964,047 | 156,112,630 | 166,076,677 |
| | Nonresidential | 70,529,485 | 8890,184,784 | 960,714,269 |
| | **Total** | **80,493,532** | **1,046,297,413** | **1,126,790,945** |

Figure 10 illustrates natural gas energy savings patterns by year and market segment. Lifecycle natural gas energy savings in CY2017 and CY2018 decreased by 30% relative to CY2015 and CY2016.

**Figure 10. First-Year and Future Natural Gas Savings (Therms) by Program Year**




## Electric Bill Reductions

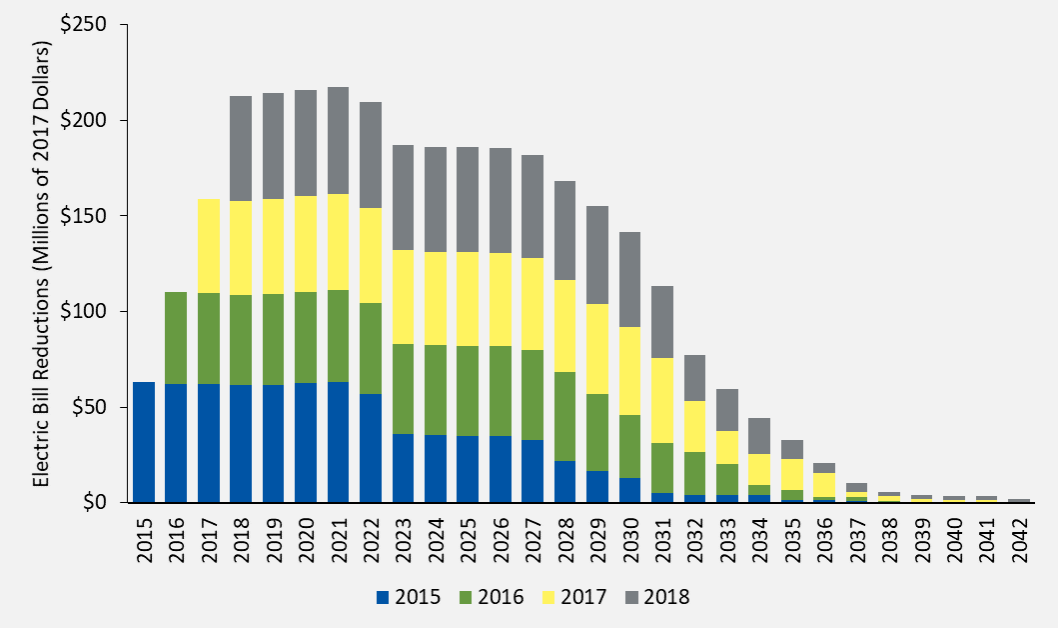
For each program year and the 2015–2018 quadrennium, Cadmus used net verified electric savings and EIA retail rate data to determine annual electric bill reductions. Table 19 presents the first-year, future-year, and lifecycle electric bill reductions attributable to each program year. Because EIA retail rate forecasts have changed over time, so have projected bill reductions.

**Table 19. Electric Bill Reductions by Program Year (Fixed 2017$)**

| Program Year | First-Year Reductions | Future-Year Reductions | Lifecycle Reductions |
|---|---|---|---|
| 2015 | $63,195,586 | $676,343,387 | $739,538,973 |
| 2016 | $47,910,989 | $720,298,624 | $768,209,614 |
| 2017 | $49,609,544 | $776,437,318 | $826,046,862 |
| 2018 | $55,022,576 | $781,876,078 | $836,898,655 |
| **Total** | **$215,738,696** | **$2,954,955,407** | **$3,170,694,103** |

Figure 11 illustrates annual electric bill reductions attributable to Focus on Energy projects completed during each program year. Electric bill reductions are projected to reach an annual peak of $217 million in 2021. Afterwards, bill reductions will accrue at a lesser magnitude as measures installed during Focus on Energy's 2015–2018 operational period reach their maximum EUL.

**Figure 11. Annual Electric Bill Reductions by Program Year (Fixed 2017$)**




This analysis addresses program activities during the 2015–2018 quadrennium, so economic impacts from 2019 onward reflect persistence of measures installed in 2015 through 2018. The full effects of Focus on Energy will be higher in future years after taking program activities from the current 2019–2022 quadrennium into account. Similarly, economic impacts reported here do not include the impacts from persistent energy savings driven by measures installed prior to 2015.

## Natural Gas Bill Reductions

For each program year and the 2015–2018 quadrennium, Cadmus used net verified natural gas savings and EIA retail rate data to determine annual natural gas bill reductions. Table 20 presents the first-year, future-year, and lifecycle natural gas bill reductions attributable to each program year. Because EIA retail rate forecasts have changed over time, so have projected bill reductions.

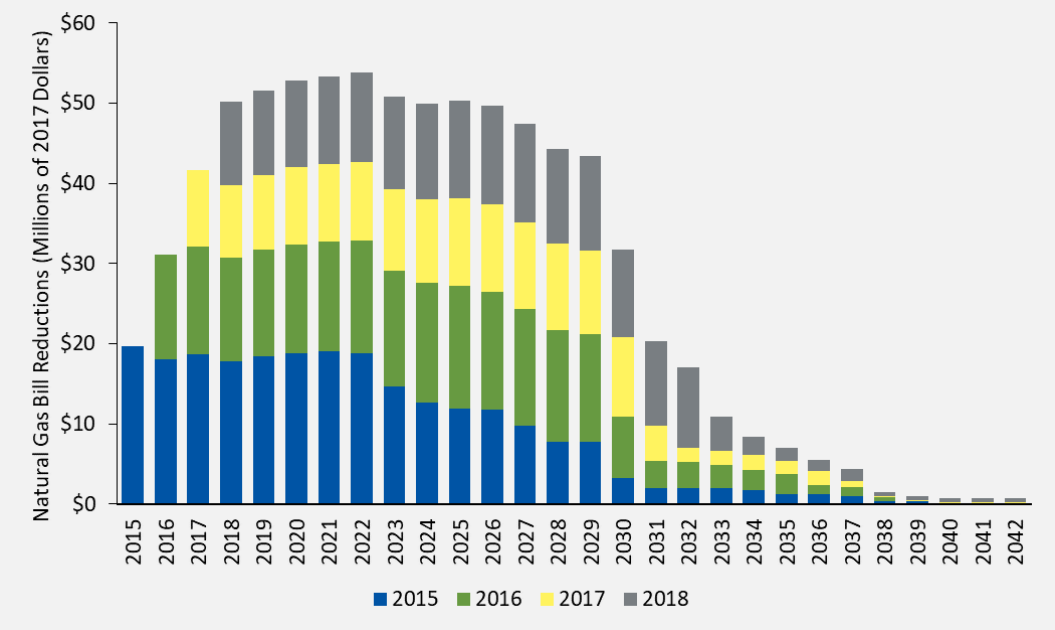
**Table 20. Natural Gas Bill Reductions (Fixed 2017$)**

| Program Year | First-Year Reductions | Future-Year Reductions | Lifecycle Reductions |
|---|---|---|---|
| 2015 | $19,740,356 | $221,437,952 | $241,178,308 |
| 2016 | $13,072,434 | $207,458,772 | $220,531,206 |
| 2017 | $9,632,306 | $146,510,675 | $156,142,981 |
| 2018 | $10,437,759 | $172,149,081 | $182,586,839 |
| **Total** | **$52,882,854** | **$747,556,479** | **$800,439,333** |

Figure 12 illustrates annual natural gas bill reductions attributable to Focus on Energy projects completed during the 2015–2018 quadrennium. Natural gas bill reductions are projected to continue increasing annually beyond the programs' operational period, reaching an annual peak of nearly $54 million in 2022, then persisting at a lesser magnitude thereafter. The projected annual reductions in

natural gas bills are less than for electric bills mostly because of differences in retail prices, which are generally higher for electricity.

**Figure 12. Annual Natural Gas Bill Reductions Over Time (Fixed 2017$)**




As with electric bill reductions, the full effects of Focus on Energy will be higher in future years after taking program activities from the current 2019–2022 quadrennium into account. Similarly, economic impacts reported here do not include impacts from persistent energy savings driven by measures installed prior to 2015.

## Net Revenue Effects

As a result of Focus on Energy participants' reduced energy usage, participating utilities benefit by spending less on fuel and other variable costs. Because participants also purchase less energy, participating utilities experience a reduction in energy sales, which may cause utilities to collect less revenue than forecasted. Cadmus calculated differences between utility avoided costs and lost utility revenues to determine net revenue effects.

Focus on Energy investments stimulate economic activity that invariably requires energy to carry out. For example, increased demand for heating, ventilation, and cooling (HVAC) appliances will stimulate further production in related industries; firms that ramp up production processes will consume energy. This additional consumption organically helps offset reduced energy sales for utilities caused by program-based energy savings. In coordination with the Evaluation Working Group (EWG), Cadmus developed assumptions to address this naturally occurring take-back effect, as described in *Appendix C: Changes in Methodology/Assumptions*.

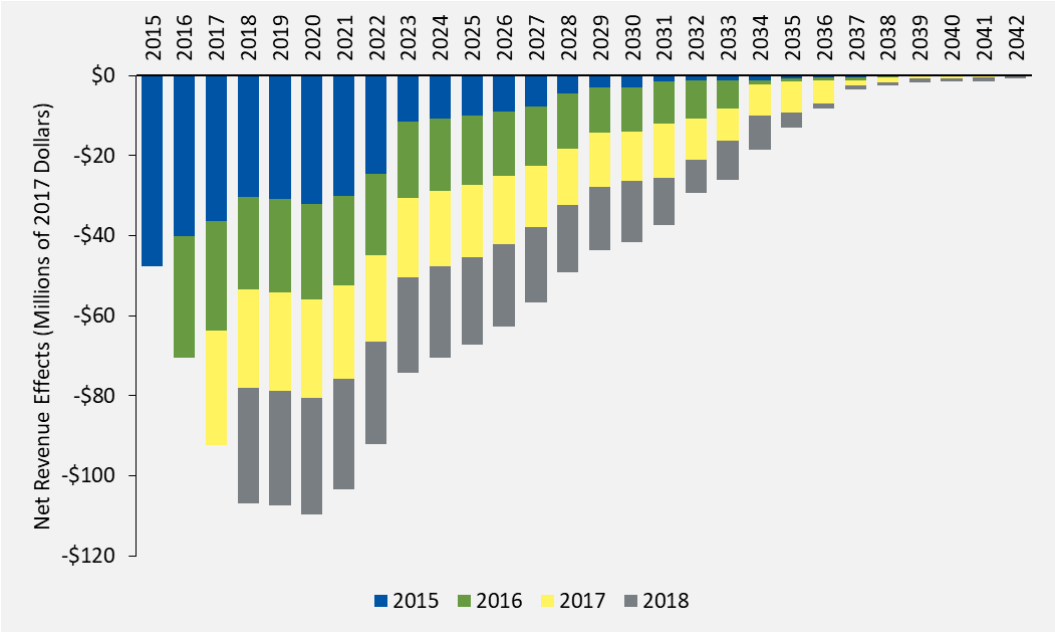
Table 21 presents the first-year, future-year, and lifecycle utility net revenue effects attributable to each program year.

**Table 21. Utility Net Revenue Effects by Program Year (Fixed 2017$)**

| Program Year | First-Year Effects | Future-Year Effects | Lifecycle Effects |
|---|---|---|---|
| 2015 | -$47,710,846 | -$289,790,456 | -$337,501,302 |
| 2016 | -$30,409,598 | -$292,743,053 | -$323,152,651 |
| 2017 | -$28,857,025 | -$305,530,453 | -$334,387,478 |
| 2018 | -$28,746,087 | -$315,209,660 | -$343,955,747 |
| **Total** | **-$135,723,556** | **-$1,203,273,623** | **-$1,338,997,179** |

Figure 13 illustrates annual electric utility net revenue effects that will accumulate from the installation of energy-saving measures during the 2015–2018 quadrennium. Negative utility net revenue effects are estimated to peak at nearly -$110 million in 2020. Then, like bill reductions, net revenue effects will taper off as energy savings decrease over time when installed energy-saving measures reach their maximum EULs.

**Figure 13. Annual Net Revenue Effects Over Time (Fixed 2017$)**




## Environmental Benefits

In previous studies, Cadmus quantified the benefits to utilities of displaced emissions of nitrous oxides ($NO_X$) and sulfur dioxide ($SO_2$), which are emissions regulated under the federal Clean Air Act. Cap and trade markets assign these emissions a monetary value that in turn has a measurable effect on the Wisconsin economy. As such, Cadmus included emissions benefits for $NO_X$ and $SO_2$ in its economic impact analysis of Focus on Energy's 2015–2016 period of activity.

In this study, Cadmus, by upgrading from REMI PI$^+$ to REMI E3+, could calculate cumulative emissions reductions (as a function of lifecycle energy savings) and use them as an input to REMI E3+. These inputs act like other policy variables in the model: just as changes in spending alter cash flows within the

regional economy, emissions reductions positively affect air quality, which makes Wisconsin a more attractive place to live and in turn stimulates additional economic activity.

To quantify emissions reductions, Cadmus required lifecycle net energy savings and emissions factors, or the rates at which pollutants are emitted per unit of energy. The product of the emissions factor and the net lifecycle energy savings establishes the total weight of air pollutants displaced by the program.

Table 22 shows fuel- and pollutant-specific emissions factors used to estimate emissions reductions. In addition to $NO_X$ and $SO_2$, REMI E3+ accepts inputs for fine particulate matter ($PM_{2.5}$) as well.

**Table 22. Emissions Factors by Pollutant and Fuel Type**

| Service Fuel Type | $NO_X$ | $SO_2$ | $PM_{2.5}$ |
|---|---|---|---|
| Electric emissions factor (tons/MWh)[1] | 7.8 E-04 | 1.6 E-03 | 8.0 E-05 |
| Natural gas emissions factor (tons/therm)[2] | 4.7 E-06 | 3.0 E-08 | 3.8 E-08 |

[1] Cadmus derived electric emissions factors using data from the U.S. Environmental Protection Agency's (EPA) AVERT (AVoided Emissions and geneRation Tool): https://www.epa.gov/statelocalenergy/avoided-emissions-and-generation-tool-avert.

[2] Cadmus derived natural gas emissions factors using data from the EPA's *AP-42: Compilation of Air Emissions Factors*: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

Cadmus did not model $CO_2$ emissions benefits for two reasons:

8. There are no carbon trading markets to provide a defined monetary value for $CO_2$ emissions reductions, which makes it difficult to monetize and model $CO_2$ emissions as a change to the Wisconsin economy; and
9. REMI E3+ does not include a policy variable (similar to those for $NO_X$, $SO_2$, and $PM_{2.5}$) to model $CO_2$ emissions changes.

Cadmus did include $CO_2$ emissions benefits in the cost-effectiveness tests described previously. For purposes of the Focus on Energy cost-effectiveness testing, the PSC has monetized the societal benefits of displaced $CO_2$ emissions at $15 per ton.[8]

Table 23 shows cumulative emissions reductions by pollutant and program year. Emissions reductions were modeled as negative changes to total pollutants.

[8] Public Service Commission of Wisconsin. June 6, 2018. *Quadrennial Planning Process III – Final Decision*. *PSC Docket 5-FE-101, PSC REF#: 343909.* http://apps.psc.wi.gov/vs2015/ERF_view/viewdoc.aspx?docid=343909

**Table 23. Lifecycle Emissions Reductions by Pollutant and Program Year**

| Program Year | $NO_X$ Emission Reductions | $SO_2$ Emission Reductions | $PM_{2.5}$ Emission Reductions |
|---|---|---|---|
| 2015 | -7,136 | -11,352 | -696 |
| 2016 | -6,995 | -11,408 | -685 |
| 2017 | -7,129 | -12,633 | -709 |
| 2018 | -7,136 | -12,336 | -706 |
| **2015–2018** | **-28,396** | **-47,729** | **-2,796** |

# Appendix A: Rural and Non-Rural Project Impacts

This appendix summarizes two scenarios using differing assumptions about how Focus on Energy spending accrues to rural and non-rural participants/projects. Cadmus used the primary scenario ("60-40 split") to estimate the net economic impacts described in the *Study Findings* section. Limitations with spending data prevented Cadmus from discerning exactly how all program funds were spent on rural and non-rural customers. To address this uncertainty, Cadmus tested the sensitivity of its spending assumptions as they pertained to rural and non-rural participants and ratepayers.

In December 2016, the PSC directed Focus on Energy to improve its service to customers in rural areas by offering them enhanced programs during CY2017 and CY2018 (Docket 5-FE-102). In recognition of this interest in Focus of Energy's impacts on rural areas, Cadmus conducted additional analysis to identify statewide economic impacts generated by energy efficiency and renewable energy projects completed in rural and non-rural areas. For consistency, rural areas were defined as those in the 582 zip codes eligible to participate in Focus on Energy's 2017-2018 rural programs, while non-rural areas were defined as all other zip codes within the state.

Because Focus on Energy tracked participants' zip codes in SPECTRUM, Cadmus could classify every measure or project—and, thus, the energy savings generated by those measures and projects—as rural or non-rural. This allowed Cadmus to assess the statewide net economic impacts generated because of rural and non-rural customer participation. While it can be intuited that energy efficiency and renewable energy projects create greater impacts in areas closer to where projects were completed, this study did not examine where net economic impacts accrue. Accordingly, it is assumed that all net employment and economic benefit impacts accrue broadly to the Wisconsin economy.

## *Primary Scenario: 60-40 Split*

Focus on Energy expenses related to administration, implementation, and EM&V for the 2015–2018 quadrennium were tracked at the program and portfolio level. Because spending tracking occurred at a high level, Cadmus could not confidently discern the relative proportion of program spending devoted to projects completed in rural areas versus non-rural areas.

However, in SPECTRUM, Focus on Energy tracks incentives for every measure installed and project completed. This level of granularity allowed Cadmus to calculate exact amounts of incentive spending on rural and non-rural participants. During the 2015–2018 quadrennium, Focus on Energy spent 33% of incentives on rural participants and 67% of incentives on non-rural participants. Accordingly, Cadmus could make the simple assumption that all other funds were spent similarly; that is, 33% of administration, implementation, and EM&V spending accrued to rural projects, while 67% accrued to non-rural projects.

The PSC's directive to increase programming in rural areas reflects a desire to reach underserved populations in ways that core Focus on Energy programs previously could not. In light of this, Cadmus, in coordination with Focus on Energy, the PSC, and APTIM, determined that program spending being

proportional to incentives (33% of all spending) may not accurately reflect the difficulty or obstacles associated with recruiting rural customers. In other words, non-rural customers might be slightly easier (and less costly) to recruit, while rural customers might be slightly harder (and more costly) to recruit.

Under guidance from these stakeholders, Cadmus assumed this added difficulty in recruiting rural customers would require Focus on Energy to spend closer to 40% of non-incentive funds on rural customers. Stakeholders recognized that it is possible that Focus on Energy spends more than 40% of non-incentive funds to recruit rural customers, but lack of granular data prevented an exact estimate.

Table A-24 shows how projects completed in rural and non-rural areas are projected to generate statewide net economic impacts through 2042. Non-rural customers comprised a larger portion of participants and thus will generate larger absolute impacts, including more than 13,000 jobs and $1.3 billion in economic benefit. Rural customer participation will create more than 7,500 jobs and $850 million in economic benefit throughout Wisconsin.

**Table A-24. Cumulative Net Economic Impacts by Customer/Project Location: "60-40" Scenario**

| Economic Impact | Customer/Project Location | | |
|---|---|---|---|
| | Non-Rural | Rural | Total[1] |
| Employment (jobs) | 13,200 | 7,580 | 20,870 |
| Economic Benefit (millions of 2018 dollars) | $1,330 | $856 | $2,200 |

[1] Customer-specific impacts do not sum to total impacts due to rounding and because of dynamic factors in the REMI model.

Because rural and non-rural customers were not equally represented in terms of participation and total spending, Cadmus calculated net economic benefit relative to spending for each customer group, as shown in Table A-25. Relative to spending, energy efficiency and renewable energy projects completed in rural areas generated 2% more job growth and 15% more economic benefits for the Wisconsin economy than those in non-rural areas.

**Table A-25. Normalized Net Economic Impacts by Customer/Project Location: "60-40" Scenario**

| Economic Impact | Customer/Project Location | | |
|---|---|---|---|
| | Non-Rural | Rural | Total |
| Job-years per $1 Million Spent | 47.7 | 48.8 | 48.3 |
| Economic Benefit per Dollar Spent (2018$) | $4.81 | $5.52 | $5.10 |

[1] Customer-specific impacts do not sum to total impacts due to rounding and because of dynamic factors in the REMI model.

These results match those presented in Table 6 in the *Study Findings* section.

## *Alternate Scenario: 67-33 Split*

To test the sensitivity of the assumptions outlined above, Cadmus also modeled a scenario in which non-incentive spending matched incentive spending, such that utilities spent 33% of all Focus on Energy

funds on rural customers. This assumption shifts roughly $13.2 million[9] in non-incentive spending—3.1% of total spending during the 2015–2018 quadrennium—from rural participants to non-rural participants.

Table A-26 shows the net economic benefits for projects in rural and non-rural areas normalized for spending according to this alternate scenario. Under this assumption, Focus on Energy activity in rural areas is projected to generate 16% more job growth and 33% more economic benefits through 2042.

**Table A-26. Normalized Net Economic Impacts by Customer/Project Location: "67-33" Scenario**

| Economic Impact | Customer/Project Location | | |
|---|---|---|---|
| | Non-Rural | Rural | Total[1] |
| Job-years per $1 Million Spent | 45.7 | 53.1 | 48.3 |
| Economic Benefit per Dollar Spent (2018$) | $4.58 | $6.07 | $5.10 |

[1] Customer-specific impacts do not sum to total impacts due to rounding and because of dynamic factors in the REMI model.

As described in Study Findings, rural customer participation generated net economic impacts for Wisconsin slightly more efficiently than non-rural customer participation. Under this simplified scenario, in which rural customers cost proportionally as much to recruit as non-rural customers, rural program activity generates net economic impacts even more efficiently.

Ultimately, regardless of spending assumptions, energy efficiency and renewable energy projects cultivate substantial positive impacts for the Wisconsin economy, regardless of customer locale.

[9] Fixed 2017 dollars.

# Appendix B: Focus on Energy Programs by Year

Table B-27 lists the programs included in the macroeconomic analysis by year. Cadmus marked program years for which programs generated non-zero energy savings. For example, although the Connected Device Kit Program was active from 2017 through 2018, only program year 2018 is marked below. Non-program initiatives that incurred administrative expenses but did not generate energy savings (such as digital customer engagement, education and training, and rural program design) are not listed here.

**Table B-27. Residential and Business Programs by Program Year**

| Program Name | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|
| Agriculture, Schools and Government | X | X | X | X |
| Appliance Recycling | X | | X | X |
| Assisted Home Performance (HPwES) | X | X | | |
| Business Incentives | X | X | X | X |
| Chains and Franchises | X | X | | |
| Communication Provider's Incentive | | | X | X |
| Community Small Business Offering (Small Business Program) | | | X | X |
| Connected Device Kit Program | | | | X |
| Design Assistance - Business | X | X | X | X |
| Design Assistance - Residential | X | X | X | X |
| Enhanced Rewards (Residential Rewards) | X | | | |
| Home Performance Flood Relief (HPwES) | | | | X |
| Home Performance with ENERGY STAR® (HPwES) | X | | X | X |
| Large Energy Customers | X | X | X | X |
| Low-E Storm Windows Pilot | | | X | |
| Manufactured Home Efficiency Pilot | | X | | |
| Midstream Commercial & Industrial Lighting | | | | X |
| Midstream Commercial Kitchen Pilot | | | X | X |
| Multi Family Direct Install | X | X | X | |
| Multi Family Energy Savings | X | X | X | X |
| Multi Family New Construction | | | X | X |
| Networked Lighting Control Pilot | | | X | |
| New Homes | X | X | X | X |
| RECIP - ASG | X | X | X | X |
| RECIP - BIP | X | X | X | X |
| RECIP - LEU | X | X | X | X |
| Renewable Rewards - Business | X | X | X | X |
| Renewable Rewards - Residential | X | X | X | X |
| Residential Lighting and Appliance | X | X | X | X |
| Residential Rewards | X | X | | |
| Rural Broadband Home Performance (HPwES) | | | | X |
| Seasonal Savings | | X | X | X |
| Simple Energy Efficiency (SEE; formerly $E^3$) | X | X | X | X |
| Small Business Program | X | X | X | X |
| Smart Thermostat Pilot | | X | | |
| Strategic Energy Management | | X | X | X |

# Appendix C: Changes in Methodology/Assumptions

The current study remains largely consistent with the previous study of the 2015–2016 program period. However, Cadmus, in coordination with members of the Evaluation Working Group (EWG), updated certain assumptions and calculations to better reflect changes to the regional economy caused by Focus on Energy.

## Macroeconomic Modeling Software

Cadmus upgraded to REMI's E3+ model, which had not been released during the previous study. It shares the same structure as REMI's PI$^{+}$ model, which Cadmus used previously, but allows Cadmus to use emissions reductions as an input that causes changes to regional air quality, similar to how Focus on Energy expenditures cause changes to regional cash flows. Emissions reductions make Wisconsin more attractive, increasing in-migration and stimulating additional economic activity.

The quantification of emissions reductions in E3+ increases cumulative value added by 11%, as shown in Table 5.

## Project Spending

Cadmus updated how Focus on Energy funds are allocated to industries in REMI to more accurately reflect how investments in energy efficiency and renewable energy affect the Wisconsin economy. Cadmus also accounted for the final bonus awarded to the Program Administrator in CY2015 for performance during the 2011–2014 quadrennium ($375,000, less than 0.1% of all spending).

## Incentives

Cadmus used Baker Tilly accounting reports to inform incentive spending. Previously, Cadmus used SPECTRUM data. Cadmus made this decision to reconcile a small discrepancy totaling roughly $4 million, or less than 2% of all program spending, during the 2015–2018 quadrennium.

## Incremental Costs

To calculate the incremental costs of completing energy efficiency and renewable energy projects, Cadmus adopted the methodology used for Focus on Energy's portfolio cost-effectiveness analysis during the 2015–2018 quadrennium. Incremental costs influence participant co-funding payments.

## Retail Rates

Cadmus calculated nonresidential retail rates as a blend of commercial and industrial prices based on historical energy sales by sector, courtesy of the EIA. Previously, only commercial prices were used. Retail rates affect participant bill reductions and utility net revenue effects.

## Recovery of Net Revenue Effects

When Focus on Energy participants save energy, utilities achieve avoided costs of generation and distribution but lose energy sales. The decrease in revenue commonly exceeds avoided costs, resulting

in a revenue requirement shortfall. Because utilities must meet revenue requirements established by the PSC, one way that utilities might recover these additional costs is through increasing retail rates.

The magnitude of these additional costs can be difficult to ascertain. When Focus on Energy invests in energy efficiency and renewable energy and participants achieve bill reductions, additional economic activity is stimulated. This activity requires energy consumption, which increases energy sales and thus helps utilities meet their required revenue. Moreover, because utilities use five years of operational history to develop their plans, there can be a lag between utilities observing and recovering this revenue shortfall.

In prior studies, the economic model could not quantify the energy-related impacts of stimulated economic activity. However, REMI's E3+ model includes new functionality designed to estimate energy consumption resulting from economic activity. The model suggests that stimulation of the economy by Focus on Energy investments results in additional energy consumption that acts to offset the revenue gap. In addition, because of Focus on Energy's long history in Wisconsin, the EIA retail rate forecast used in the analysis may already factor in energy efficiency programming, which could also account for cost recovery efforts to an unknown extent. Ultimately, the dynamic relationship of these interrelated variables is complicated.

Previous studies that did not have access to the recent advancements in REMI's macroeconomic modeling software adopted a conservative approach that assumed revenues from energy sales would be reduced and subsequently recovered by utilities in direct proportion to Focus on Energy-produced energy savings (100% recovery). This oversimplified approach likely resulted in underestimating the total net economic impacts generated by Focus on Energy. Relaxing this assumption (which the REMI E3+ model indicates is more realistic) results in increased consumer spending on goods and services in multiple industries throughout Wisconsin, stimulating more economic activity and increasing statewide economic benefits and ratepayers' disposable personal incomes compared to previous studies.

The opposite extreme—assuming utilities recover 0% of their revenue shortfall due to Focus on Energy-induced savings—is equally unrealistic. Accordingly, Cadmus and the EWG settled upon a moderate approach that delivers 50% of the simplified estimates of energy sales decreases directly back to utilities through a model input.

Table C-28 shows how cumulative net economic impacts change when Cadmus adjusts the magnitude of the revenue shortfall recovered by utilities. In the most realistic scenario, where actual revenue shortfall lands between 0% and 100% of net revenue effects, economic impacts increase by roughly 4,000 jobs (23%), $450 million of economic benefits (42%), and $1 billion of disposable personal income (195%) from the assumption used in previous analyses.

**Table C-28. Sensitivity of Economic Indicators to Simplified Revenue Shortfall Variable**

| Revenue Shortfall / Recovery | 100% [1] | 50% | 0% |
|---|---|---|---|
| Employment (jobs) | 16,960 | 20,870 | 24,820 |
| Economic Benefits (millions of 2018 dollars) | $1,553 million | $2,200 million | $2,854 million |
| Disposable Personal Income (millions of 2018 dollars) | $531 million | $1,566 million | $2,609 million |

[1] This approach was used for the 2015–2016 program period study.

# Appendix D: Revised CY2019 Cost-Effectiveness Results

This appendix summarizes how CY2019 cost-effectiveness results, documented in the CY2019 Annual Evaluation Report, are impacted by updating the modified TRC calculation to use the net economic benefits reported in this study. Because the 2019–2020 program period is in progress and its economic impacts have yet to be evaluated, Cadmus used CY2018 net economic benefits in its modified TRC test results.

Table D-29 lists the results of the modified TRC tests with and without economic benefits for CY2019. Net economic benefits attributable to Focus on Energy program activity increase total TRC benefits by $524 million to $1.13 billion and the TRC benefit/cost ratio from 2.58 to 4.80. Similarly, Societal Test (SCT) results increase to 5.27.

**Table D-29. CY2019 Cost-Effectiveness with and without Economic Benefits**

| Test Component | Without Economic Benefits | With Economic Benefits |
|---|---|---|
| Administrative Costs | $4,938,358 | $4,938,358 |
| Delivery Costs | $33,090,816 | $33,090,816 |
| Incremental Measure Costs | $197,512,151 | $197,512,151 |
| **Total Non-Incentive Costs** | **$235,541,325** | **$235,541,325** |
| Electric Benefits | $340,572,540 | $340,572,540 |
| Natural Gas Benefits | $147,319,948 | $147,319,948 |
| Emissions Benefits | $118,803,890 | $118,803,890 |
| Net Economic Benefits | $0 | $523,938,334 |
| **Total TRC Benefits** | **$606,696,377** | **$1,130,634,711** |
| **TRC Benefits Minus Costs** | **$371,155,053** | **$895,093,387** |
| **TRC Benefit/Cost Ratio** | **2.58** | **4.80** |