CADMUS

Focus on Energy 2019–2022 Quadrennium Economic Impacts

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Table of Acronyms

Acronym	Term
CY	Calendar year (corresponds with program year)
E3+	Energy, Environment, and Economy
EIA	U.S. Energy Information Administration
EM&V	Evaluation, measurement, and verification
EUL	Effective useful life
EWG	Evaluation Work Group
GWh	Gigawatt per hour (1 million kWh)
IO	Input-output (matrix)
kWh	Kilowatt-hour
MThm	Thousand therms
MWh	Megawatt per hour (1,000 kWh)
PSC	Public Service Commission of Wisconsin
SPECTRUM	Statewide Program for Energy Customer Tracking, Resource Utilization, and Data Management
T&D	Transmission and Distribution
TRC (modified TRC)	Total Resource Cost test (Modified Total Resource Cost test)
TRM	Technical reference manual
REMI	Regional Economic Models, Inc.

Glossary of Terms

Term	Definition
Customer funding	Payments by Wisconsin customers that fund Focus on Energy offerings.
Direct spending	Focus on Energy program funds spent on administration, implementation, marketing, EM&V services, and incentives.
Disposable personal income	After-tax money available to Wisconsin consumers to spend and/or save at their discretion.
Economic benefits (Value added)	Contributions of private industries and government to Wisconsin's gross state product. Describes the total wealth created regionally, including wages, profits, and taxes.
Employment	The number of jobs that last a year. Full-time and part-time jobs are counted equally.
Incentives	Focus on Energy program funds that encourage participation and investment in energy-saving technologies and behaviors.
Net economic impacts	The difference between economic impacts created by Focus on Energy and a hypothetical ("baseline") scenario where Focus on Energy does not exist and equal funds are spent on other goods and services.
Participant utility bill savings	The estimated decrease in participant spending on utility bills resulting from Focus on Energy offerings. Utility bill savings by participants result in revenue losses for utilities.
Participant co-funding	Participant payments to complete Focus on Energy projects. The combination of incentives and participant co-funding represents the full cost of energy efficiency and renewable energy projects.
Revenue requirements	Mandates for utilities to generate certain amounts of revenue. Because Focus on Energy creates energy savings that reduce utilities revenues, utilities may increase energy prices in order to meet revenue requirements.
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

Cadmus estimated the net economic impacts of Focus on Energy's 2019–2022 energy efficiency and renewable energy portfolio using the Energy, Environment, and Economy (E3+) macroeconomic modeling software from Regional Economic Models, Inc. (REMI).

The analysis includes all energy efficiency and renewable energy investments made through Focus on Energy in each of the calendar years (CY) from 2019 to 2022 (CY 2019, CY 2020, CY 2021, and CY 2022, respectively) and the long-term impacts of those investments persisting through CY 2046. The resulting net economic impacts represent the difference between the Wisconsin economy with and without investment in Focus on Energy. In the latter (baseline) case, Wisconsin customers do not fund Focus on Energy, and therefore, no energy-saving projects occur.

While this analysis focuses specifically on the net economic impacts attributable to Focus on Energy investments made in CY 2019 through CY 2022, these investments build upon the ongoing economic impacts created by program activities from previous years. Likewise, current and future Focus on Energy investments will generate economic impacts that will add to the benefits from prior years, ensuring stable, ongoing economic benefits.

This section provides a brief summary of the overall net economic impacts, providing a topline view of key numbers and figures.

Focus on Energy achieves positive net economic impacts because it increases in-state spending. Focus on Energy not only increases spending on industries related to energy efficiency and renewable energy but also results in participants saving money on their utility bills. Money that would have been spent on fuel imports (electric and natural gas) is instead spent locally on goods and services, boosting Wisconsin's regional industries and statewide economy.[1] Moreover, emissions reductions generated by energy savings make Wisconsin a more attractive place to live, thus increasing in-migration and stimulating additional economic activity.

Table ES-1 summarizes the net economic impacts attributable to the CY 2019, CY 2020, CY 2021, and CY 2022 program years and to the 2019–2022 quadrennium in aggregate. Cadmus used changes in employment, economic benefit (value added), and disposable personal income as its key indicators of changes in economic activity for this analysis.[2] Focus on Energy investments and activity during the 2019–2022 quadrennium is projected to add more than 20,600 jobs, $2.3 billion in economic benefits, and $2.2 billion in disposable personal income to the Wisconsin economy through CY 2046.

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[1] Per the U.S. Energy Information Administration (EIA) State Profile for Wisconsin, Wisconsin consumes more electricity than it generates, and it imports all its natural gas. Accessed December 16, 2021. https://www.eia.gov/state/analysis.php?sid=WI.

[2] Definitions for these key indicators can be found in *Analysis Findings.*

Table ES-1. Cumulative Net Economic Impacts through CY 2046

Key Economic Indicator	CY 2019	CY 2020	CY 2021	CY 2022	Quadrennium[1]
Employment (jobs)	5,905	5,236	5,278	4,255	20,606
Economic Benefit (millions of dollars)[2]	$628	$563	$587	$445	$2,261
Disposable Personal Income (millions of dollars)[2]	$622	$555	$605	$398	$2,181

[1] Program year impacts do not sum to quadrennium impacts because of dynamic factors in the REMI model.

[2] Fixed 2022 U.S. dollars.

Table ES-2 shows economic impacts normalized by Focus on Energy spending. Direct spending includes costs of administration and implementation; incentives paid to participants; costs of evaluation, measurement, and verification; and bonuses paid to Focus on Energy's administrator in CY 2019 for performance in the previous 2015–2018 quadrennium. Every $1 million spent on Focus on Energy increases statewide employment by 49 jobs, and every dollar spent generates an additional $5.35 of economic benefit and $5.16 of disposable personal income through CY 2046.

Table ES-2. Cumulative Net Economic Impacts, Normalized for Direct Spending

Key Economic Indicator	Normalized Impacts				
	CY 2019	CY 2020	CY 2021	CY 2022	Quadrennium
Employment per $1MM spent	49	50	56	41	49
Economic Benefit[1] per dollar spent[2]	$5.23	$5.37	$6.20	$4.31	$5.35
Disposable Personal Income[1] per dollar spent	$5.18	$5.29	$6.38	$3.86	$5.16

[1] Fixed 2022 U.S. dollars.

[2] The ratio of economic benefits per dollar spent is distinct from the benefit/cost ratio used to measure portfolio cost-effectiveness, which is discussed in further detail in *Impact of Economic Benefits on Cost-Effectiveness*.

Focus on Energy investments in energy efficiency and renewable energy during the 2019–2022 quadrennium will cumulatively add more than $2.3 billion in economic benefits to the Wisconsin economy through CY 2046. On average, Focus on Energy's quadrennial investments are projected to generate nearly $90 million of economic benefits per year for the next 25 years.[3]

Nearly all of Wisconsin's industries will experience employment gains as a result of Focus on Energy investments. The largest increases in cumulative net employment are projected to occur in the manufacturing, retail, and healthcare sectors. Increased purchases of energy-efficient and renewable energy technologies through Focus on Energy impacted specialized fields in the short term, and the benefits of participant utility bill savings and emissions reductions will impact Wisconsin's largest sectors over the long term. Eight sectors are projected to create at least 1,000 net jobs through CY 2046 (at least 40 net jobs per year) because of Focus on Energy investments during the 2019-2022 quadrennium:

- Manufacturing (3,440 jobs added through CY 2046)
- Retail (3,200 jobs added through CY 2046)

[3] These benefits will occur whilst economic benefits from the past years' program investments, not modeled as part of this study, are also occurring.

- Health care and social assistance (2,960 jobs added through CY 2046)
- State and local government (1,920 jobs added through CY 2046)
- Accommodation and food services (1,820 jobs added through CY 2046)
- Other services, except public administration (1,640 jobs added through CY 2046)
- Professional, scientific, and technical services (1,490 jobs added through CY 2046)
- Real estate and rental and leasing (1,020 jobs added through CY 2046)

Focus on Energy increases disposable personal income by $909 per Wisconsin household through CY 2046. Cumulative disposable personal income gains of $2.2 billion—nearly $87 million annually on average for the next 25 years—will benefit Wisconsin households (both for program participants and nonparticipants alike). Additionally, the 2019–2022 quadrennium will save an estimated $3.9 billion on participants' utility bills through CY 2046.

Introduction

The purpose of this macroeconomic impact analysis is to quantify the net economic impacts created by ratepayer investment in Wisconsin Focus on Energy within the state economy. 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 customers of 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 Focus on Energy's offerings.

The Public Service Commission of Wisconsin (PSC) provides oversight of Focus on Energy. The PSC contracted with Cadmus to verify Focus on Energy's energy savings, including environmental and non-energy benefits, and evaluate its Quadrennium III (2019–2022) achievements. As part of this evaluation, Cadmus quantified net economic impacts attributable to Focus on Energy during the 2019-2022 quadrennium. Statewide impacts include employment, economic benefits (value added), and disposable personal income.

Focus on Energy provides information, technical support, and financial incentives to eligible Wisconsin residents and businesses to complete energy-saving 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.

As with previous studies, Cadmus used the Energy, Environment, and Economy (E3+) macroeconomic modeling software from Regional Economic Models, Inc. (REMI) [4] to assess Focus on Energy's economic impacts. Cadmus calculates net economic impacts as the difference between the economic impacts created by Focus on Energy and a baseline scenario in which Focus on Energy does not exist.

This analysis covers Focus on Energy projects completed during the quadrennium (CY 2019, CY2020, CY 2021, or CY 2022) and their persisting impacts. For modeling purposes, Cadmus set the persistence to end after 25 years, corresponding to the high end of project effective useful life (EUL) seen in Focus on Energy's portfolio. As such, the CY 2019 analysis period runs through CY 2043, the CY 2020 period runs through CY 2044, the CY 2021 period runs through CY 2045, and CY 2022 and quadrennium analyses run through CY 2046 (Table 3).

Table 3. Study Period by Program Year

Program Year(s)	Timeframe Modeled
2019	2019–2043
2020	2020–2044
2021	2021–2045
2022	2022–2046
2019–2022	2019–2046

[4] Please visit Remi's website for more information on E3+: https://www.remi.com/.

How Focus on Energy Improves Wisconsin's Economy

Changes in spending, captured in the form of changes in consumption and investment within various sectors and industries, produce ripple effects throughout a regional economy, affecting supply chains and household spending. Changes in consumption and investment affect consumer demand, which impacts employment and compensation in industries both directly and indirectly related to the changes in spending. Money continues to cycle through the regional economy—individuals continue to spend and save and businesses continue to invest and meet increases in demand—until the ripple effects caused by the initial changes in spending disappear.

Although changes in direct spending by utilities and participants modeled for this report occur only during CY 2019, CY 2020, CY 2021, and CY 2022, the energy efficiency and renewable energy projects completed during the 2019–2022 quadrennium generate long-term economic impacts. Most notably, persisting energy bill savings allow 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, renewable energy measures and services increases to meet demand within Wisconsin.

Participating utilities benefit from reducing their fuel and power purchases, transmission and distribution (T&D) costs, and capacity costs. However, because participating households and businesses purchase less energy after participating in Focus on Energy offerings, utilities also forego revenues from energy sales. To meet revenue requirements, Cadmus assumes in its models that utilities will recoup a portion of lost revenues by increasing the retail rates they will charge in future years.

Additional functionality of REMI's E3+ model includes the net economic impacts of emissions reductions. 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 of regional goods and services.

Key Changes

The biggest difference between the current economic impact analysis (for the 2019–2022 quadrennium) and the previous economic impact analysis (for the 2015–2018 quadrennium) is updated assumptions for avoided costs of energy. Periodically, as needed, the PSC and the Evaluation Work Group (EWG) update methodology, data, and assumptions related to the calculation of utility-avoided costs.

In CY 2020, the PSC updated the avoided costs of electricity ($/kWh) and natural gas ($/therm), reducing their values by roughly 30% to 33%, respectively.[5] Because avoided costs act as a benefit to utilities by helping offset revenue losses, the decrease in avoided costs reduces net economic benefits. In CY 2020, the PSC also began to incorporate transmission and distribution (T&D) avoided costs. The inclusion of T&D costs increases avoided costs/benefit estimations for utilities (and, thus, net economic benefits).

[5] Internal communication from the PSC to Cadmus

These changes are explained in the *Changes to Electric Avoided Cost Assumptions* and *Changes to Natural Gas Avoided Cost Assumptions* sections, and the effects of the changes are explained in the *Impact of Updated Electric Avoided Costs* and *Impacts of Updated Natural Gas Avoided Costs* sections.

Analysis Findings

Consistent with previous analyses, Cadmus reports the net economic impacts of Focus on Energy according to three key indicators:

- ***Employment*** counts the change in the number of full- and part-time jobs lasting a year. Full-time and part-time jobs are counted at equal weight.[6]
- ***Economic benefits (value added)*** measure the changes in contributions of each private industry and of government to Wisconsin's gross state product. It describes the total wealth created in Wisconsin, including wages, profits, and taxes. Throughout this report, economic benefits are presented in fixed 2022 U.S. dollars.
- ***Disposable personal income*** represents the change in after-tax money available to Wisconsin consumers to spend and save at their discretion. REMI accounts for all income sources, including wages and salaries, benefits, proprietor (owner) income, rental income, investment income, and transfer payments from public entities such as Social Security. Like economic benefits, disposable personal income is presented in fixed 2022 U.S. dollars.

During the CY 2019, CY 2020, CY 2021, and CY 2022 program years, net economic impacts decreased because customers spent money (above what they would have spent in the baseline scenario, absent Focus on Energy) to fund Focus on Energy offerings and help pay for their energy efficiency and renewable energy projects.[7] However, following the program years in which initial investments are made, each Focus on Energy project generates positive net economic impacts for decades. The net economic impacts presented in this report capture the cumulative net economic impacts generated during the lifecycle of all Focus on Energy projects completed in CY 2019, CY 2020, CY 2021, and CY 2022, which can last up to 25 years.

Summary of Net Economic Impacts

Table 4 summarizes net economic impacts attributable to each program year. Through CY 2046, the Focus on Energy 2019–2022 quadrennium will add more than 20,600 jobs, almost $2.3 billion in economic benefits, and more than $2.1 billion in disposable personal income to the Wisconsin economy.

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[6] This is not the same as number of employed individuals, some of whom may have more than one job. "Equal weight" is explained on pg. 4 of the PDF from REMI: https://www.remi.com/wp-content/uploads/2017/10/Data_Sources_and_Estimation_Procedures-4.pdf

[7] In reality, prior years' investments are creating net positive economic impacts that offset the net decrease observed when modeling is constrained to the CY 2019-2022 program years.

Table 4. Cumulative Net Economic Impacts

Key Economic Indicator	CY 2019	CY 2020	CY 2021	CY 2022	Quadrennium[1]
Employment (jobs)	5,905	5,236	5,278	4,255	20,606
Economic Benefit (millions of dollars)[2]	$628	$563	$587	$445	$2,261
Disposable Personal Income (millions of dollars)[2]	$622	$555	$605	$398	$2,181

[1] Program year impacts do not perfectly sum to biennium impacts because of dynamic factors in the REMI model.
[2] Fixed 2022 U.S. dollars.

When normalized for spending on administration, implementation, incentives, and evaluation, measurement, and verification (EM&V) services, Focus on Energy is projected to generate roughly 49 jobs per $1 million of direct spending and returns on investment of more than $5 of economic benefits and disposable personal income per dollar of direct spending.

Table 5. Cumulative Net Economic Impacts, Normalized for Direct Spending

Key Economic Indicator	Normalized Impacts				
	CY 2019	CY 2020	CY 2021	CY 2022	Quadrennium
Employment per $1 million spent	49	50	56	41	49
Economic Benefit[1] per dollar spent	$5.23	$5.37	$6.20	$4.31	$5.35
Disposable Personal Income[1] per dollar spent	$5.18	$5.29	$6.38	$3.86	$5.16

[1] Fixed 2022 U.S. dollars.

Interpreting Results

The following sections show net economic impacts attributable exclusively to the Focus on Energy 2019–2022 quadrennium. While this analysis focuses specifically on CY 2019, CY 2020, CY 2021, and CY 2022, these investments build upon the ongoing economic impacts created by program activities from previous years. Likewise, current and future Focus on Energy investments will generate economic impacts that will add to the benefits from prior years, ensuring more economic benefits for longer.

For example, in 2024, CY 2019, CY 2020, CY 2021, and CY 2022 investments are projected to add roughly 500, 430, 320, and 130 jobs, respectively (Figure 1 in the *Employment* section); combined, they will add approximately 1,400 jobs. However, as noted, this study omits ongoing impacts created in previous program years. The 2015–2018 quadrennial investments, like the 2019–2020 biennial investments, will create ongoing future impacts for up to 25 years. They are projected to add nearly 2,000 jobs in CY 2024, bringing the total employment impact in CY 2024 of the last eight Focus on Energy program years to 3,400 jobs added.[8] Each previous and future program year of Focus on Energy activity would contribute similarly additive employment effects, underscoring the importance of sustained investment by Focus on Energy in energy efficiency and renewable energy.

[8] Cadmus. July 3, 2020. *Focus on Energy 2015–2018 Quadrennium Economic Impact Analysis*. https://www.focusonenergy.com/sites/default/files/inline-files/Evaluation_Report-Economic_Impacts_2015-2018.pdf.

Employment

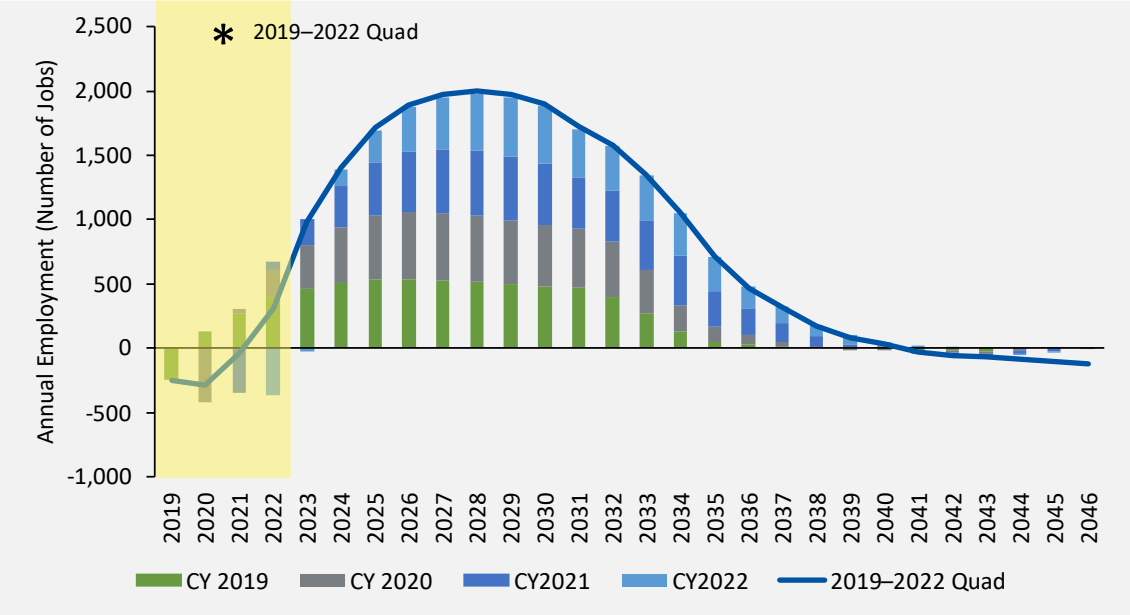
Focus on Energy's energy efficiency and renewable energy offerings, and the investments that fund them, increase employment statewide. Trade Allies and equipment installers who participate in Focus on Energy benefit from increased business activity and may hire more staff. New employees may have been unemployed or moved to Wisconsin seeking employment, both scenarios representing increases in employment and the labor force. In turn, newly hired employees spend their wages locally on goods and services, stimulating the Wisconsin economy. Ongoing energy savings from energy efficiency result in long-term utility bill savings that spur additional spending on local goods and services by participating businesses and residential customers, which would not have occurred in the baseline scenario absent the Focus on Energy program.

Like other forms of investment, the completion of Focus on Energy projects requires initial investments from utilities and participants that redirect spending toward energy efficiency and away from typical patterns of consumption in order to cultivate long-lasting benefits. As such, the Wisconsin economy incurs a nominal loss of jobs upfront with each individual year of Focus on Energy investment to ensure nearly two decades of employment growth thereafter.

Figure 1 shows changes in annual employment by program year.[9] As energy savings accumulate, annual employment growth increases rapidly and peaks at 2,000 annual jobs in CY 2028. Employment impacts begin to taper off in CY 2039 as energy-efficient measures reach the end of their EULs, representing the Wisconsin economy returning to its baseline equilibrium in the absence of Focus on Energy.

[9] The employment impacts in Figure 1 are presented as a table in *Annual Net Employment Impacts*.

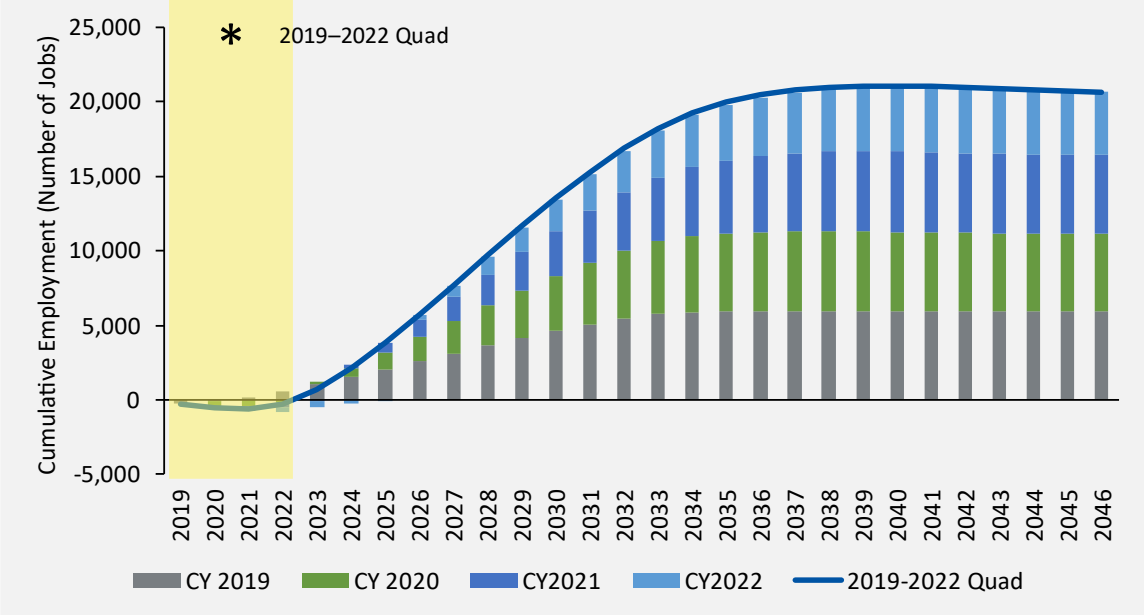
Figure 1. Annual Jobs Added by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Similarly, Figure 2 shows how annual employment changes in Figure 1 accumulate over time.

Figure 2. Cumulative Jobs Added by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Cumulative employment gains realized by Focus on Energy CY 2019, CY 2020, CY 2021, and CY 2022 investments will reach their peak of nearly 21,100 jobs in CY 2040. Afterward, employment contracts

slightly as the effects of initial direct spending and ongoing energy savings wear off. By the end of the analysis window in CY 2046, Focus on Energy will have added roughly 20,600 jobs in total. The following five industries show the greatest employment increases:

- Manufacturing (3,440 jobs added through CY 2046)
- Retail (3,200 jobs added through CY 2046)
- Health care and social assistance (2,960 jobs added through CY 2046)
- State and local government (1,920 jobs added through CY 2046)
- Accommodation and food services (1,820 jobs added through CY 2046)

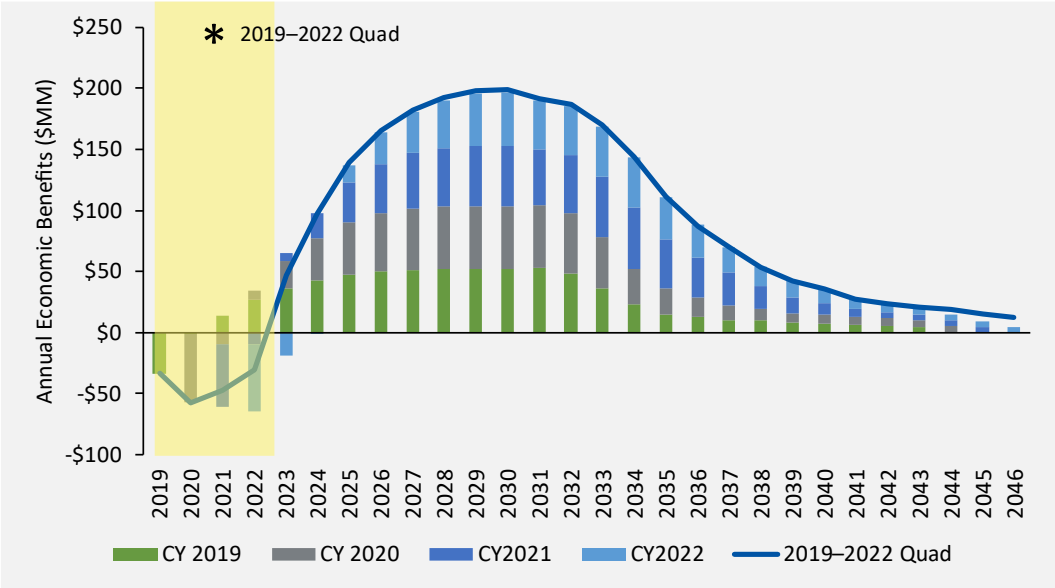
Economic Benefits

Focus on Energy offerings not only stimulate demand for energy efficiency and renewable energy technologies and services but also redirect money spent on fuel imports from out-of-state back into the Wisconsin economy.[10] This results in additional positive impacts on statewide wages, profits, and taxes, which boost economic benefits in the form of value added to Wisconsin's gross state product.

Figure 3 shows economic benefits by year. Because the initial costs of Focus on Energy outweigh the immediate benefits, annual economic benefits dip during the initial program years. However, they rapidly increase to a peak of $200 million in 2030, then taper off as the Wisconsin economy returns to its baseline equilibrium. Additionally, the ongoing positive economic benefits created by previous program years of Focus on Energy investments (such as the 2015–2018 quadrennium) offset the economic costs of funding the 2019-2022 quadrennium—a pattern that continues indefinitely, for as long as Focus on Energy is funded and administered.

[10] Per the U.S. EIA, Wisconsin consumes almost six times as much energy as it produces: https://www.eia.gov/state/?sid=WI.

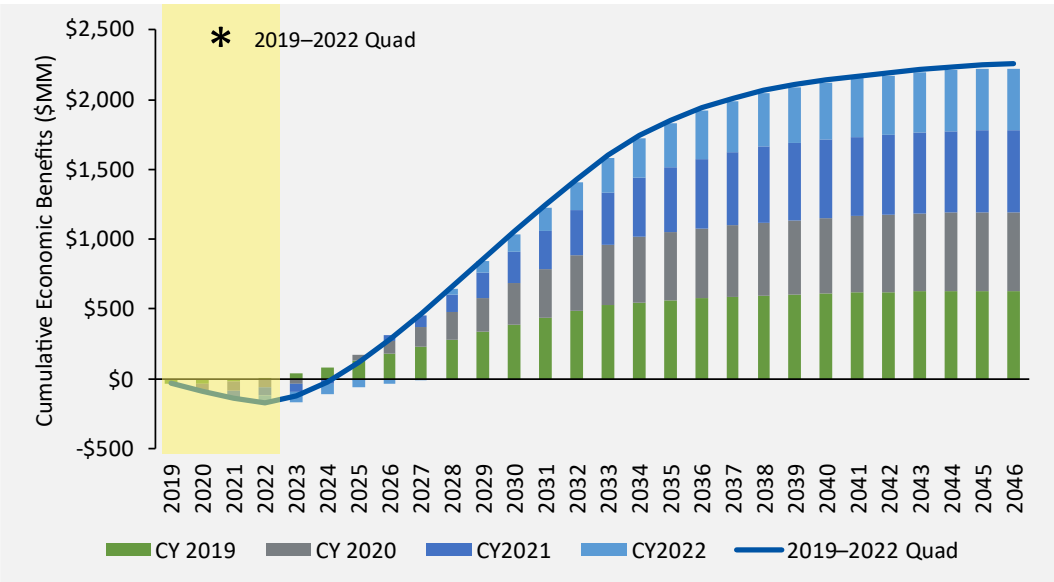
Figure 3. Annual Economic Benefits by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Similarly, Figure 4 shows how the annual economic benefits in Figure 3 accumulate over time. Cumulative economic benefits generated by Focus on Energy in CY 2019, CY 2020, CY 2021, and CY 2022 investments will reach their peak of more than $2.2 billion at the end of analysis window in CY 2046.

Figure 4. Cumulative Economic Benefits by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Impact of Economic Benefits on Cost-Effectiveness

The PSC currently considers the modified Total Resource Cost test to be the primary test in assessing the cost-effectiveness of individual offerings and the entire Focus on Energy portfolio.[11] The test's purpose is to determine if the total costs incurred by residents, businesses, and Focus on Energy in delivering energy efficiency and renewable energy offerings are outweighed by the total benefits they receive. The modified TRC accounts for benefits in the form of avoided utility and environmental costs from avoided energy consumption. Economic benefits are not among the component benefits accounted for by the modified TRC.

In addition to the modified TRC test, Cadmus calculates an expanded TRC test that incorporates economic benefits. This section shows how modified TRC test results change when the economic benefits derived from this analysis are included. Economic impact analyses are intended to create estimates of the magnitude of economic benefits, not develop exact dollar values for economic benefits. However, because cost-effectiveness is calculated using exact dollar values, and to remain consistent with prior economic impact analyses, Cadmus provides dollar values for economic benefits in the tables below. Rounding these estimates (to the closest $1 million, for example) would have a very small effect on total TRC benefits and the TRC benefit/cost ratios.

Table 6 lists the results of the modified and expanded TRC tests for CY 2019. Economic benefits attributable to Focus on Energy activity in CY 2019 increase total TRC benefits from $600 million to $1.2 billion and the benefit/cost ratio from 2.58 to 5.24.

Table 6. CY2019 TRC Test Results

Test Component	Modified TRC (without economic benefits)	Expanded TRC (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 TRC Costs	**$235,541,325**	**$235,541,325**
Electric Benefits	$340,572,539	$340,572,539
Natural Gas Benefits	$147,319,948	$147,319,948
Emissions Benefits	$118,803,890	$118,803,890
T&D Benefits	$0	$0
Economic Benefits	$0	$627,508,937
Total TRC Benefits	**$606,696,377**	**$1,234,205,314**
TRC Benefits Minus Costs	**$371,155,052**	**$998,663,989**
TRC Benefit/Cost Ratio	**2.58**	**5.24**

[11] The use of the modified TRC test as the primary cost-effectiveness test is directed by the PSC. Public Service Commission of Wisconsin. November 14, 2022. *Quadrennial Planning Process IV – Final Decision*. PSC Docket 5-FE-104, PSC REF#: 453081. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=453081.

Table 7 lists the results of the modified and expanded TRC tests for CY2020. Economic benefits attributable to Focus on Energy activity in CY 2020 increase total TRC benefits from $700 million to $1.25 billion and the benefit/cost ratio from 2.43 to 4.41.

Table 7. CY 2020 TRC Test Results

Test Component	Modified TRC (without economic benefits)	Expanded TRC (with economic benefits)
Administrative Costs	$2,788,738	$2,788,738
Delivery Costs	$30,544,175	$30,544,175
Incremental Measure Costs	$251,020,645	$251,020,645
Total TRC Costs	**$284,353,558**	**$284,353,558**
Electric Benefits	$393,460,787	$393,460,787
Natural Gas Benefits	$126,950,324	$126,950,324
Emissions Benefits	$116,464,956	$116,464,956
T&D Benefits	$54,665,398	$54,665,398
Economic Benefits	$0	$563,333,358
Total TRC Benefits	**$691,541,465**	**$1,254,874,823**
TRC Benefits Minus Costs	**$407,187,907**	**$970,521,265**
TRC Benefit/Cost Ratio	**2.43**	**4.41**

Table 8 lists the results of the modified and expanded TRC tests for CY 2021. Economic benefits attributable to Focus on Energy activity in CY 2021 increase total TRC benefits from $670 million to $1.25 billion and the benefit/cost ratio from 2.35 to 4.42.

Table 8. CY 2021 TRC Test Results

Test Component	Modified TRC (without economic benefits)	Expanded TRC (with economic benefits)
Administrative Costs	$2,704,508	$2,704,508
Delivery Costs	$28,670,313	$28,670,313
Incremental Measure Costs	$251,844,994	$251,844,994
Total TRC Costs	**$283,219,815**	**$283,219,815**
Electric Benefits	$364,603,856	$364,603,856
Natural Gas Benefits	$133,749,777	$133,749,777
Emissions Benefits	$109,885,997	$109,885,997
T&D Benefits	$57,004,279	$57,004,279
Economic Benefits	$0	$587,246,590
Total TRC Benefits	**$665,243,908**	**$1,252,490,498**
TRC Benefits Minus Costs	**$382,024,093**	**$969,270,683**
TRC Benefit/Cost Ratio	**2.35**	**4.42**

Table 9 lists the results of the modified and expanded TRC tests for CY 2022. Economic benefits attributable to Focus on Energy activity in CY 2022 increase total TRC benefits from $600 million to $1 billion and the benefit/cost ratio from 2.36 to 4.15.

Table 9. CY 2022 TRC Test Results

Test Component	Modified TRC (without economic benefits)	Expanded TRC (with economic benefits)
Administrative Costs	$2,797,178	$2,797,178
Delivery Costs	$33,130,161	$33,130,161
Incremental Measure Costs	$212,686,651	$212,686,651
Total TRC Costs	**$248,613,990**	**$248,613,990**
Electric Benefits	$336,014,587	$336,014,587
Natural Gas Benefits	$103,807,046	$103,807,046
Emissions Benefits	$93,649,181	$93,649,181
T&D Benefits	$52,382,582	$52,382,582
Economic Benefits	$0	$444,835,241
Total TRC Benefits	**$585,853,396**	**$1,030,688,637**
TRC Benefits Minus Costs	**$337,239,405**	**$782,074,647**
TRC Benefit/Cost Ratio	**2.36**	**4.15**

Table 10 lists the results of the modified and expanded TRC tests for the quadrennium. Economic benefits attributable to Focus on Energy quadrennium activity increase total TRC benefits from $2.5 billion to roughly $4.8 billion and improve the benefit/cost ratio from 2.42 to 4.54.

Table 10. 2019–2022 Quadrennium TRC Test Results

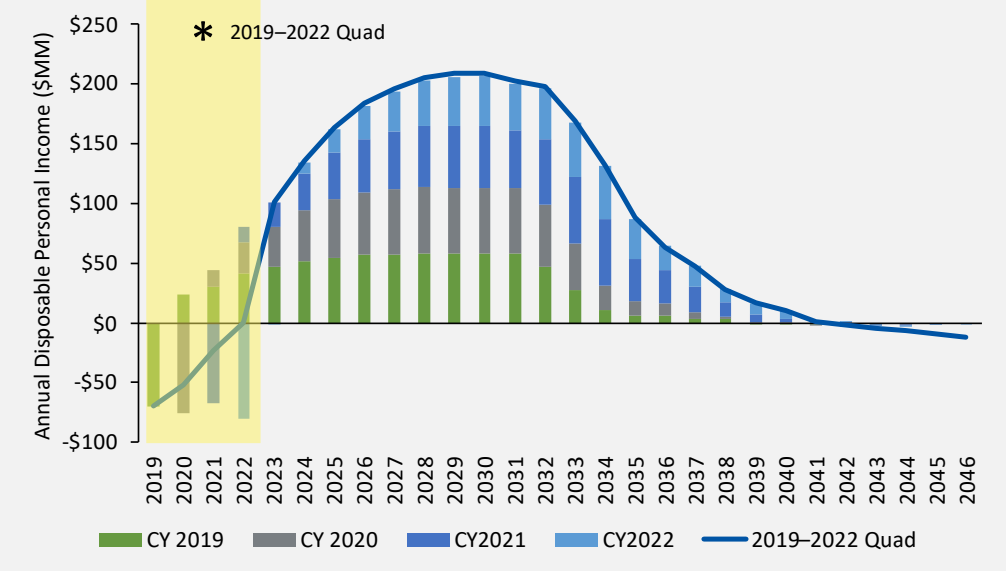
Test Component	Modified TRC (without economic benefits)	Expanded TRC (with economic benefits)
Administrative Costs	$13,228,782	$13,228,782
Delivery Costs	$125,435,465	$125,435,465
Incremental Measure Costs	$913,064,441	$913,064,441
Total TRC Costs	**$1,051,728,688**	**$1,051,728,688**
Electric Benefits	$1,434,651,769	$1,434,651,769
Natural Gas Benefits	$511,827,095	$511,827,095
Emissions Benefits	$438,804,024	$438,804,024
T&D Benefits	$164,052,259	$164,052,259
Economic Benefits	$0	$2,222,924,126
Total TRC Benefits	**$2,549,335,146**	**$4,772,259,272**
TRC Benefits Minus Costs	**$1,497,606,457**	**$3,720,530,584**
TRC Benefit/Cost Ratio	**2.42**	**4.54**

Disposable Personal Income

Direct spending that funds Focus on Energy and the utility bill savings generated by energy efficiency and renewable energy projects increase labor demand. In turn, the regional economy sees increases in employment and compensation, generating more disposable personal income that can be saved or spent at the individual's discretion on goods and services in Wisconsin's sectors and industries, stimulating further regional economic activity. These changes to disposable personal income accrue to both participants and non-participants alike.

Figure 5 illustrates how disposable personal income changes over time. Synchronously with economic benefits (Figure 3), disposable personal income dips during the quadrennium program years as initial costs of funding Focus on Energy outweigh the immediate benefits generated by energy efficiency and renewable energy projects. Disposable personal income rapidly increases then peaks at $209 million in both CY 2029 and CY 2030, afterward tapering off as the Wisconsin economy slowly returns to its baseline equilibrium. Like economic benefits, the ongoing positive disposable personal income impacts created in previous program years (such as the 2015–2018 quadrennium) offset the small declines during the quadrennium program years.

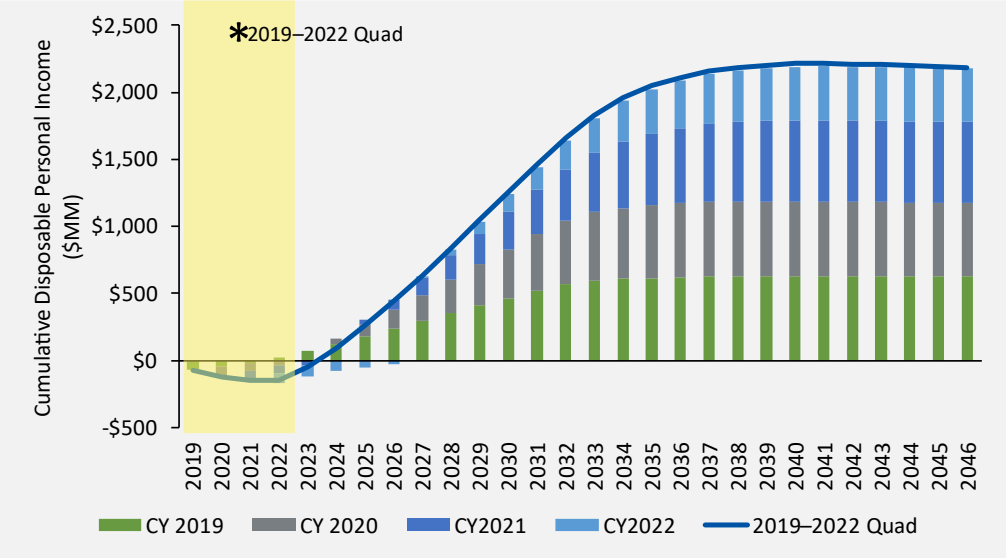
Figure 5. Annual Disposable Personal Income Gains by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Similarly, Figure 6 shows how disposable personal income in Figure 5 accumulates over time. Cumulative disposable personal income created by Focus on Energy CY 2019 through CY 2022 investments will peak at roughly $2.22 billion in CY 2041.

Figure 6. Cumulative Disposable Personal Income Gains by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Household Disposable Personal Income Impacts

The U.S. Census Bureau estimates there are more than 2.4 million occupied households in the state of Wisconsin.[12] With cumulative disposable personal gains nearing $2.2 billion, it can be estimated that Focus on Energy will create an average of $909 in additional disposable personal income per household through CY 2046.

[12] U.S. Census Bureau QuickFacts, Wisconsin: https://www.census.gov/quickfacts/WI.

Analytical Approach

This section describes the REMI E3+ modeling software, the approach used to determine net economic impacts attributable to Focus on Energy, and the model inputs used in the REMI E3+ model framework.

REMI E3+ Modeling Software

Studies that assess the net economic impacts of energy efficiency and renewable energy programming and investment typically use one of two types of modeling analysis:

- 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.
- The second type of analysis incorporates dynamic changes in those variables and is 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.

REMI E3+ features both types of economic analysis, incorporating an IO matrix, general equilibrium, econometrics, and economic geography:

- **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.
- **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.
- **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 energy-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.

- **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 analysis 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's operational period, and the model considers long-term conditions that affect calculated impacts from ongoing energy savings.

Modeling Approach

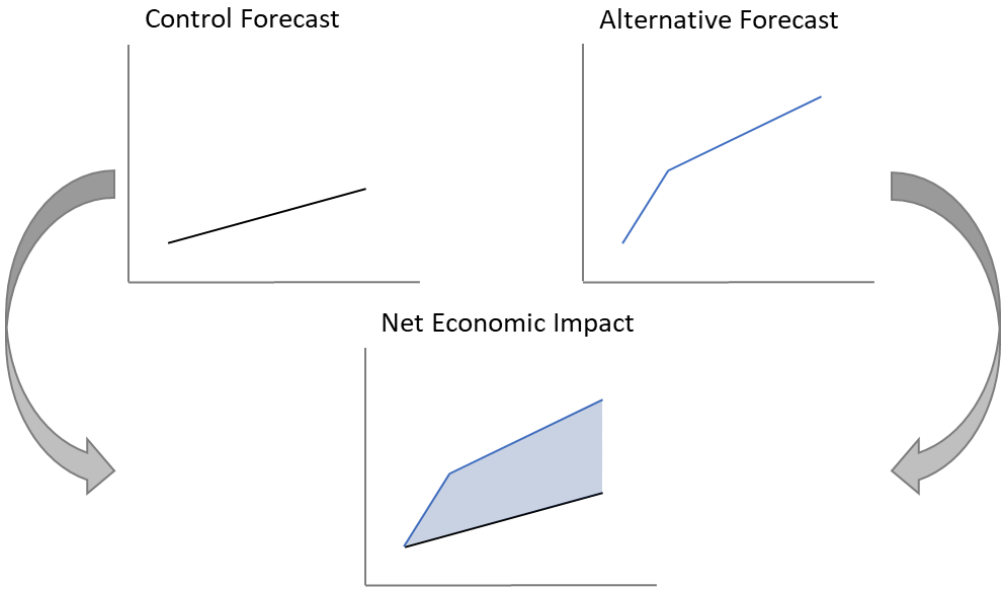
Cadmus used a customized REMI E3+ model for the state of Wisconsin to determine the net impacts on economic benefits (value added), employment, and disposable personal income resulting from Focus on Energy investments in energy efficiency and renewable energy programming during the quadrennium, both by program year and in aggregate.

Most critically, spending in one sector of the Wisconsin economy must be offset by spending elsewhere, such that money is neither created nor destroyed. For example, increased consumer spending on energy-efficient appliances (in order to participate in Focus on Energy) is offset by decreased spending on other goods and services that would have occurred in the absence of Focus on Energy. Additionally, investments in Focus on Energy must be funded by customers through added rates to their utility bill payments. As a result, total statewide spending remains constant, and modeled results represent the difference between an economy with and without Focus on Energy (net economic impacts).

Cadmus used the REMI E3+ model's standard regional control as the baseline scenario (control forecast) against which the economic impacts created by Focus on Energy (alternative forecast) can be compared. The standard regional control captures the impacts of economic activity that would have occurred without Focus on Energy investments in energy efficiency and renewable energy, project spending by customers, and the resulting energy savings and emissions reductions. This baseline economic activity is comprised primarily of participants' consumption of fuel and power had they not received incentives from Focus on Energy to purchase energy-efficient or renewable energy technologies or services.

As Figure 7 illustrates, the REMI E3+ model compares the differences in impacts from the control and alternative forecasts to estimate the net economic impacts created by Focus on Energy.

Figure 7. Determining Net Economic Impacts with REMI E3+

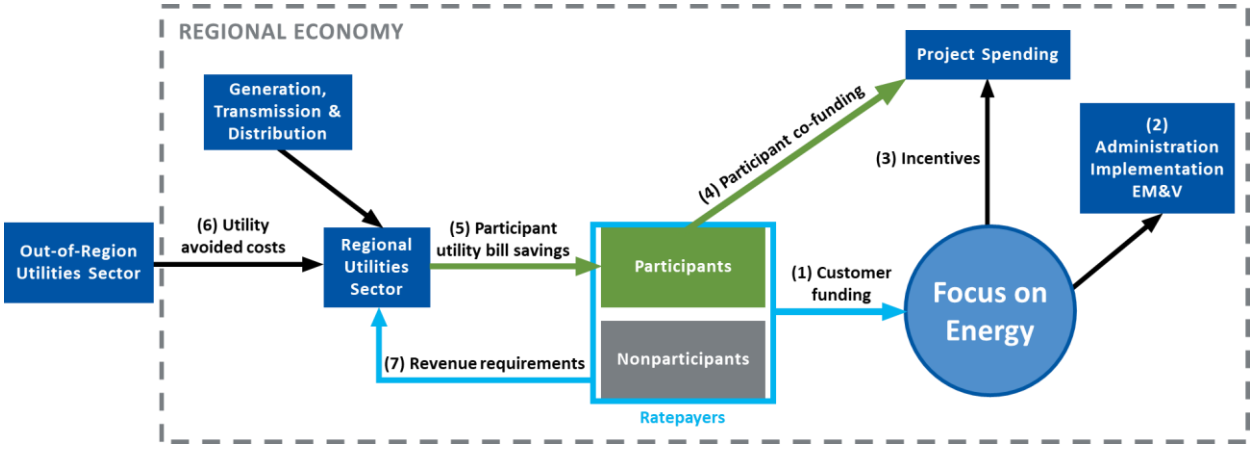


The REMI E3+ model calculates the control forecast based on the standard regional control and the alternative forecast based on user-customized model inputs (which, for this analysis, reflect economic activity related to Focus on Energy). The model integrates economic data collected by various federal 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. EIA. Data from the U.S. Census Bureau form the basis for model assumptions of population growth and migration within and between regions.[13]

For each program year of the biennium and in aggregate, Cadmus customized REMI E3+ inputs to model Focus on Energy-related cash flows among relevant stakeholder groups, as shown in Figure 8.

[13] 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.

Figure 8. Economic Cash Flows Attributable to Focus on Energy



These cash flows—consisting of customer funding; spending on administration, implementation, and EM&V; incentives; participant co-funding; participant utility bill savings; utility avoided costs; and revenue requirements—affect the Wisconsin economy as follows:

(1) Customer funding. Funding for Focus on Energy originates from participating utilities' revenues, which are collected from Wisconsin customers through a charge embedded in their utility bills.

(2) Administration, implementation, and EM&V (direct spending). Focus on Energy funds are spent on program administration activities, technical and customer support, marketing, and EM&V services provided by program trade allies and partners.

(3) Incentives. Focus on Energy funds are also spent on direct financial and service-based incentives that encourage investments in energy-saving technologies and behaviors.

- For accounting purposes, customer funding equals direct spending plus incentives**.** In other words, utility expenditures on Focus on Energy are offset dollar-for-dollar by customer funding.

(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.

- Because participants choose to invest in energy efficiency or renewable energy (project spending, Figure 8), Cadmus assumes that participants would have spent these funds elsewhere in Wisconsin's economy. Accordingly, participant co-funding is offset by an equal-and-opposite decrease in customer spending in other industries.[14]

(5) Participant utility bill savings. Participants save energy for as long as energy-efficient and renewable energy measures remain installed and operational, as informed by EULs deemed by the Wisconsin technical reference manual (TRM). Those energy savings translate to participant utility bill savings.

[14] Assigned automatically by REMI.

- Every dollar saved by participants results in a dollar of lost revenues by utilities.

(6) Utility avoided costs. Due to decreased demand for energy resources, Wisconsin utilities benefit from avoided fuel costs, calculated as a function of energy savings.

(7) Revenue requirements. Utilities may seek to recover lost revenues (caused by participant utility bill savings) by increasing future retail rates paid by Wisconsin customers. When utilities increase rates, energy costs increase for all customers, resulting in higher utility bill payments and, thus, higher future revenues that help recover lost revenues. Cadmus assumes utilities pay a small return on investment to shareholders and reinvest the remaining recovered lost revenues in utility infrastructure.

Lastly, energy savings that generate participant utility bill savings and utility avoided costs also generate emissions reductions, which are not shown in Figure 8. With REMI's E3+ model, Cadmus can account for emission reductions as a non-cash flow input that affects Wisconsin's "attractiveness," leading to in-migration and additional economic stimulus, including higher labor force participation and employment and increased retail and real estate activity.

Table 11 summarizes model inputs according to their positive and negative impacts on relevant stakeholder groups.

Table 11. Summary of Positive and Negative Model Impacts by Cash Flow

Cash Flow	Positive Impacts	Negative Impacts
Customer funding	N/A	Reduces consumption and investments in other sectors of the regional economy
Direct 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 of goods and services in sectors specific to Focus on Energy activity	Reduces consumption and investments in other goods/services by participants
Participant utility bill savings	Increases residential disposable income for savings and spending; Reduces commercial costs of production	Reduces utility revenue
Utility avoided costs	Reduces generation and T&D costs for in-state utilities	N/A
Revenue requirements	Partially offsets utility revenue losses, which utilities reinvest in infrastructure	Partially increases future bill rates charged to customers on their utility bills
Emissions reductions[1]	Increases the attractiveness of Wisconsin, which stimulates more economic activity	N/A

[1] Not shown in Figure 8.

Model Input Data

This section describes evaluated spending and monetized energy savings data for energy efficiency and renewable energy projects completed through Focus on Energy, which Cadmus translated into REMI E3+ model inputs. All monetary inputs are presented in fixed 2022 U.S. dollars.[15]

For more information about the bolded terminology used in this section, refer to *Modeling Approach*.

First-Year Spending

First-year spending consists of direct spending by utilities on Focus on Energy offerings (including administrative costs and incentives) and project co-funding by participants.

Direct Spending

Direct spending on Focus on Energy offerings includes administration, implementation, and EM&V costs and incentives and is funded by customers in participating utility service territories.

As shown in Table 12, direct spending totaled roughly $423 million during the 2019–2022 quadrennium. Cadmus sourced direct spending data from Baker Tilly and Statewide Energy Efficiency and Renewable Administration annual expense reports.[16]

Table 12. Focus on Energy Direct Spending by Category

Program Year	Direct Spending Categories ($1000s)				
	Administration	Implementation	Incentives	EM&V	Total
CY 2019	$3,730[1]	$39,393	$74,457	$2,417	**$119,996**
CY 2020	$7,360	$30,017	$62,377	$5,167	**$104,920**
CY 2021	$2,970	$32,911	$55,293	$3,614	**$94,787**
CY2022	$2,983	$32,029	$65,838	$2,296	**$103,146**
Quadrennium	**$17,043**	**$134,350**	**$257,964**	**$13,493**	**$422,850**

[1] Includes the program administrator's final bonus ($400,000) for the 2015–2018 quadrennium. Cadmus assumed 50% of the final bonus accrued outside of the analysis region (Wisconsin).

Participant Co-Funding

While some participants benefit from free direct-to-customer offerings, such as appliance recycling and mail-order packs of energy-efficient measures, many Focus on Energy participants pay the cost of their energy efficiency and renewable energy projects that are not covered by utility incentives. Participant

[15] Calculated using the U.S. Bureau of Labor Statistics consumer price index for the Illinois-Indiana-Wisconsin region: https://data.bls.gov/cgi-bin/dsrv.

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

co-funding represents customer spending on energy efficiency and renewable energy that would have otherwise been spent elsewhere in the Wisconsin economy.[17]

Table 13 shows participant co-funding by program year and customer segment. Co-funding exceeded $555 million for the quadrennium, with commercial and industry co-funding comprising more than 62% of all co-funding.

Table 13. Participant Co-Funding by Customer Segment

Program Year	Participant Co-Funding ($1000s)[1]		
	Residential	C&I	Total
CY 2019	$40,259	$98,253	**$138,512**
CY 2020	$50,940	$141,620	**$192,560**
CY 2021	$58,939	$81,850	**$140,788**
CY 2022	$60,185	$23,835	**$84,021**
Quadrennium	**$210,322**	**$345,559**	**$555,881**

[1] Totals may not sum due to rounding.

Energy Savings

The main benefit of Focus on Energy is participant energy savings. As the evaluation contractor for Focus on Energy, Cadmus calculates gross reported, gross verified, and net verified energy savings. For evaluation purposes, Cadmus uses net verified gross savings to calculate participant utility bill savings and utility avoided costs. These data are extracted from SPECTRUM, Focus on Energy's database.

Figure 9 illustrates first-year and future electric net verified savings by program year. Lifecycle savings, which represent the sum of first-year and future savings, vary based on the EULs of energy efficiency and renewable energy measures installed in each customer segment by program year. Residential participation generated 37% of first-year net verified energy savings (661 GWh) and 37% of lifecycle net verified energy savings (9,656 GWh).

[17] In SPECTRUM, participant co-funding is represented by net verified incremental costs. Net verified energy savings account for various market and behavioral forces for which adjustments are made to gross verified energy savings. The ratio between net and gross verified savings (net-to-gross) is then applied incremental costs so that energy savings and incremental costs are scaled proportionally.

Figure 9. First-Year and Future Electric Net Verified Energy Savings (GWh)

Figure 10 illustrates net verified demand reduction by program year. Residential participation generated 37% of net verified demand reduction (88.6 MW).

Figure 10. Electric Net Verified Demand Reduction (MW)

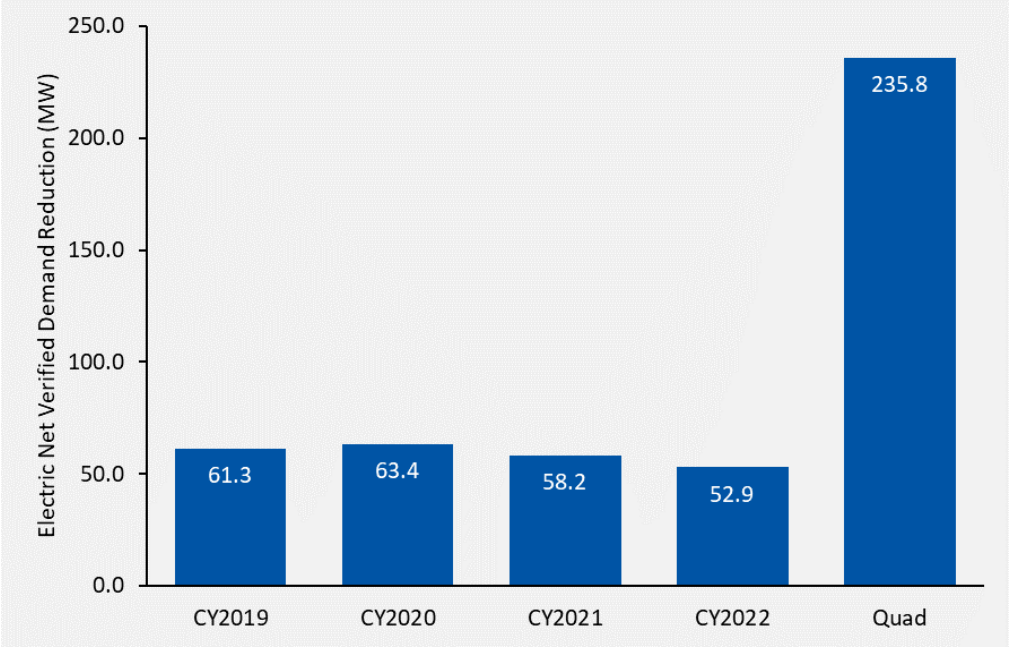
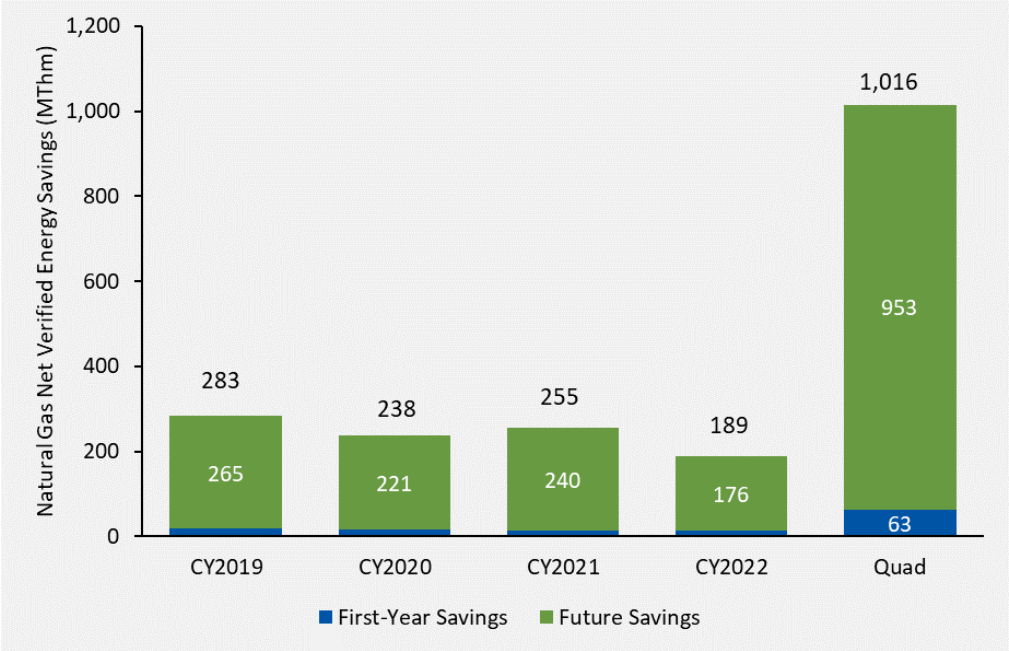


Figure 11 illustrates first-year and future natural gas net verified energy savings by program year. Residential participation generated 40% of first-year net verified energy savings (25,126 MThm) and 38% of lifecycle net verified energy savings (363,977 MThm).

Figure 11. First-Year and Future Natural Gas Net Verified Energy Savings (MThm)



Participant Bill Savings

Customers benefit from participating in Focus on Energy by saving energy, which helps them save money on their utility bills. Cadmus used net verified savings and retail rate data and projections to calculate bill savings for participants,[18] which recur annually until energy efficiency and renewable energy projects reach the end of their EULs, as deemed by the TRM.

Electric Bill Savings

Table 14 presents first-year and lifecycle electric bill savings attributable to each Focus on Energy program year. The quadrennium totaled over $205 million of first-year electric bill savings and will produce roughly $2.9 billion of lifecycle electric bill savings through CY 2046.

Table 14. Participant Electric Bill Savings

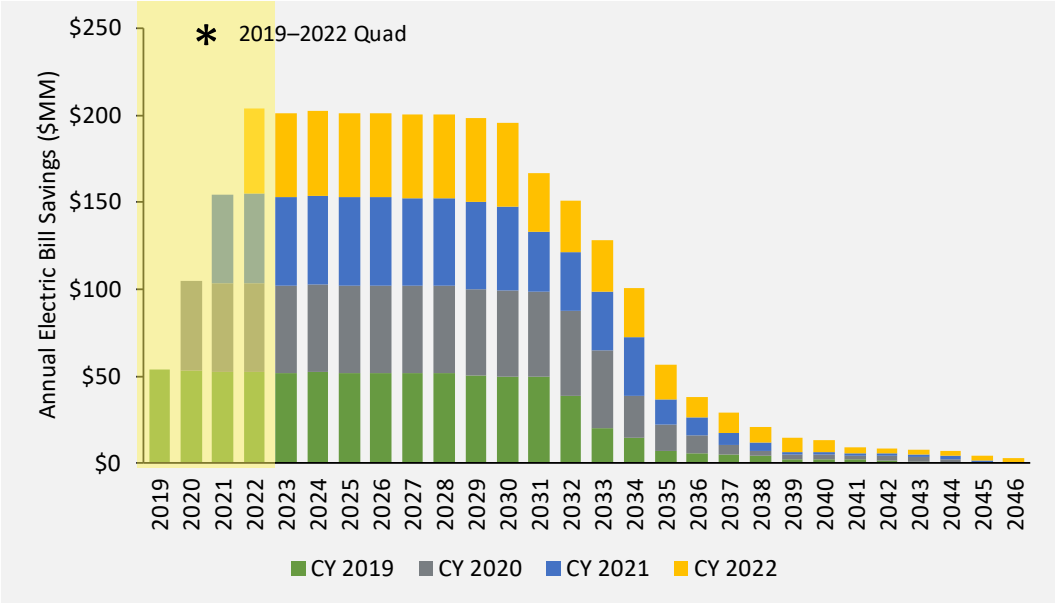
Program Year	Participant Electric Bill Savings ($1000s)[1]	
	First-Year	Lifecycle
CY 2019	$53,746	$777,368
CY 2020	$51,409	$768,076
CY 2021	$51,380	$689,894
CY 2022	$48,911	$639,635
Quadrennium	**$205,446**	**$2,874,974**

[1] Totals may not sum due to rounding.

[18] U.S. EIA Annual Energy Outlook 2021: https://www.eia.gov/outlooks/aeo/data/browser/.

Figure 12 illustrates the ongoing annual electric bill savings attributable to each Focus on Energy program year. Electric bill savings peak at roughly $50 million annually per program year ($200 million annually for the quadrennium), begin to taper off about 12 years after energy efficiency and renewable energy projects are originally completed and fall below $10 million annually by 2041.

Figure 12. Participant Annual Electric Utility Bill Savings by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Natural Gas Bill Savings

Table 15 shows the first-year and lifecycle natural gas bill savings attributable to each Focus on Energy program year. Because of the COVID-19 pandemic and accompanying economic uncertainty, fewer energy projects were completed in CY 2020. With business and industry savings experiencing a slowdown in CY 2021 and CY 2022, the first-year savings were driven by residential projects. Despite the larger first-year savings for CY 2021 and CY 2022, the lifecycle savings are smaller and decrease compared to CY 2019. In sum, the quadrennium created nearly $49 million in first-year natural gas bill savings and will create more than $1 billion in lifecycle natural gas bill savings through CY 2046.

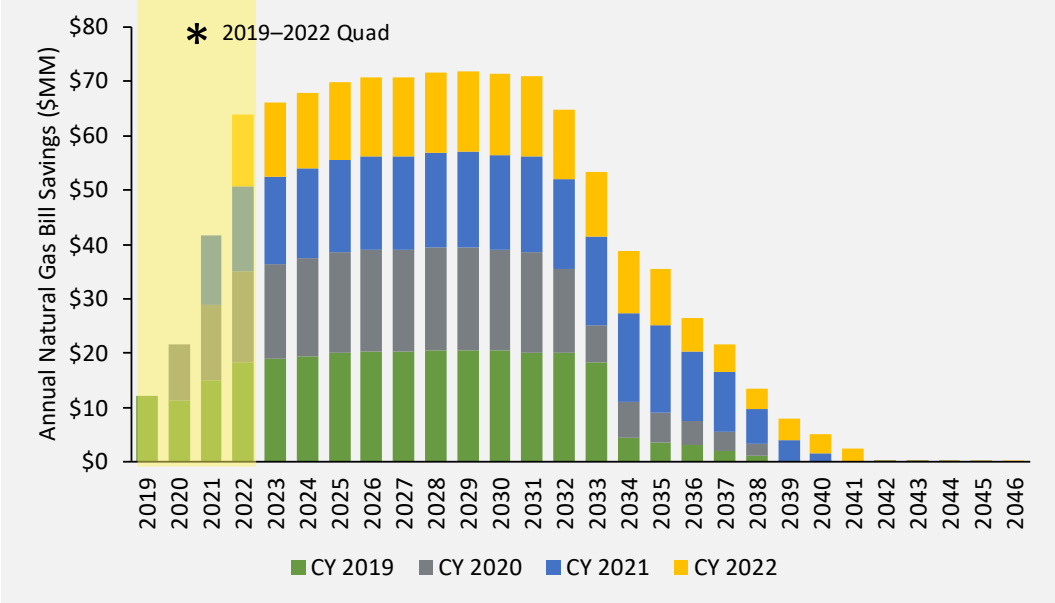
Table 15. Participant Natural Gas Bill Savings

Program Year	Participant Natural Gas Bill Savings ($1000s)[1]	
	First-Year	Lifecycle
CY 2019	$12,149	$290,652.08
CY 2020	$10,437	$251,763.60
CY 2021	$12,855	$283,047.16
CY 2022	$13,207	$215,449.54
Quadrennium	**$48,648**	**$1,040,912**

[1] Totals may not sum due to rounding.

Figure 13 illustrates the ongoing annual natural gas bill savings attributable to each program year of Focus on Energy investments and activity. Natural gas bill savings peak at roughly $18 million annually for the quadrennium in CY 2028, taper off after CY 2033 and cease completely by CY 2042.

Figure 13. Participant Annual Natural Gas Bill Savings by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Utility Avoided Costs

Most of the energy that Wisconsin utilities sell to customers is purchased from out of state. When participants conserve energy through Focus on Energy, utilities benefit from avoiding the cost of purchasing energy. Ahead of the CY 2020 program year, the PSC made the decision to account for the electric T&D avoided cost benefits attributable to Focus on Energy programs.[19] For this analysis, Cadmus included T&D avoided cost benefits retroactively for CY 2019.

Cadmus used net verified energy savings (kWh) and net verified demand savings (kW), along with data provided by the PSC, to calculate avoided costs of energy and T&D, which recur annually until energy efficiency and renewable energy projects reach the end of their EULs, as deemed by the TRM.

Electric Avoided Costs

Table 16 presents first-year and lifecycle electric avoided costs attributable to each Focus on Energy program year. Energy savings generated roughly $76 million of first-year electric avoided costs and nearly $1.1 billion of lifecycle electric avoided costs through CY 2046.

[19] Public Service Commission of Wisconsin. March 10, 2021. *Quadrennial Planning Process Final Decision.* https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=406591

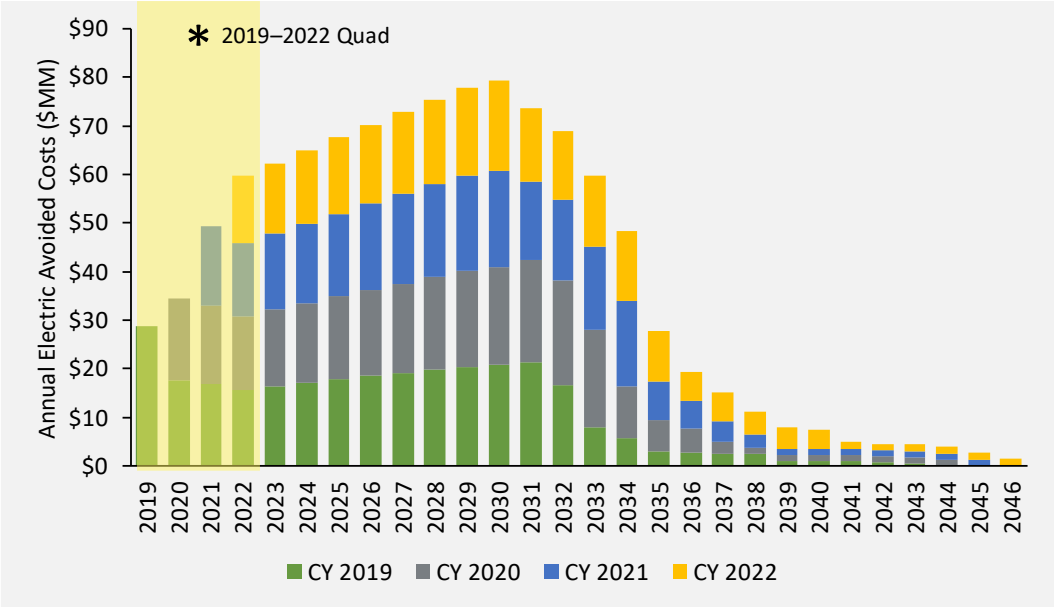
Table 16. Utility Electric Avoided Costs

Program Year	Utility Electric Avoided Costs ($1000s)[1]	
	First-Year	Lifecycle
CY 2019	$28,734	$296,369
CY 2020	$16,835	$288,576
CY 2021	$16,203	$271,109
CY 2022	$13,806	$248,320
Quadrennium	**$75,577**	**$1,104,374**

[1] Totals may not sum due to rounding.

Figure 14 illustrates the ongoing annual electric avoided costs attributable to each Focus on Energy program year. Electric avoided costs peak at roughly $79 million in CY 2030, at which point they taper off, eventually falling to $2 million annually in CY 2046.

Figure 14. Utility Annual Electric Avoided Costs by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Changes to Electric Avoided Cost Assumptions

Periodically, as needed, the PSC, with guidance from the Focus on Energy EWG, updates the methodology, data, and assumptions related to the calculation of avoided costs. In CY 2020, the PSC updated the avoided cost of the generation of electricity, forecasted from CY 2020 through CY 2050. The new values from CY 2020 were applied to CY 2019 due to CY 2019 having occurred prior to this forecast update. The PSC also included T&D avoided cost benefits ahead of the CY 2020 program year.[20] For this analysis, Cadmus applied T&D avoided costs to CY 2019 as well.

[20] Public Service Commission of Wisconsin. March 10, 2021. *Quadrennial Planning Process III – Final Decision*. PSC Docket 5-FE-101, PSC REF#: 406591. https://apps.psc.wi.gov/ERF/ERFview/viewdoc.aspx?docid=406591.

Table 17 compares the forecasted avoided costs of energy per megawatt-hour of electricity between the previous 2015–2018 quadrennium and the current 2019–2022 quadrennium.

Table 17. Avoided Costs of Electricity ($/MWh) by Quadrennial Forecast

Year	2015–2018 Quad	2019–2022 Quad
2019	$29.145	$30.929[1]
2020	$35.252	$30.929
2021	$41.359	$30.929
2022	$47.467	$30.928
2023	$49.753	$32.294
2024	$52.040	$33.659
2025	$54.327	$35.025
2026	$56.614	$36.390
2027	$58.900	$37.756
2028	$60.863	$39.133
2029	$62.825	$40.511
2030	$64.787	$41.889
2031	$66.749	$43.266
2032	$68.712	$44.644
2033	$68.712	$46.022
2034	$68.712	$47.400
2035	$68.712	$48.777
2036	$68.712	$50.155
2037	$68.712	$51.533
2038	$68.712	$52.910
2039	$68.712	$54.288
2040	$68.712	$55.666
2041	$68.712	$57.043
2042	$68.712	$58.421
2043	$68.712	$59.799
2044	$68.712	$61.176
2045	$68.712	$62.554
2046	$68.712	$63.932

[1] Because the current forecast begins in CY 2020, Cadmus used the avoided cost of electricity in CY 2020 for CY 2019.

The difference between previously and currently forecasted avoided costs of electricity grows as large as 23.5 cents per kWh (in CY 2031) and approximately amounts to a 30% decrease in avoided costs overall. The effects of changes to electric avoided cost assumptions are described in further detail in *Impact of Updated Electric Avoided Costs*. Table 18 shows the forecasted avoided costs of T&D per kilowatt.

Table 18. Avoided Costs of T&D ($/kW-yr)

Year	2019–2022 Quad
2019	$66.28
2020	$66.34
2021	$66.40
2022	$66.47
2023	$66.54
2024	$66.61
2025	$66.69
2026	$66.76
2027	$66.85
2028	$66.93
2029	$67.02
2030	$67.11
2031	$67.21
2032	$67.31
2033	$67.41
2034	$67.51
2035	$67.62
2036	$67.73
2037	$67.85
2038	$67.97
2039	$68.09
2040	$68.21
2041	$68.34
2042	$68.47
2043	$68.61
2044	$68.74
2045	$68.88
2046	$69.03

Natural Gas Avoided Costs

Table 19 presents first-year and lifecycle natural gas utility avoided costs attributable to each Focus on Energy program year. Energy savings generated roughly $42 million of first-year natural gas avoided costs and will generate nearly $613 million of lifecycle natural gas avoided costs through CY 2046.

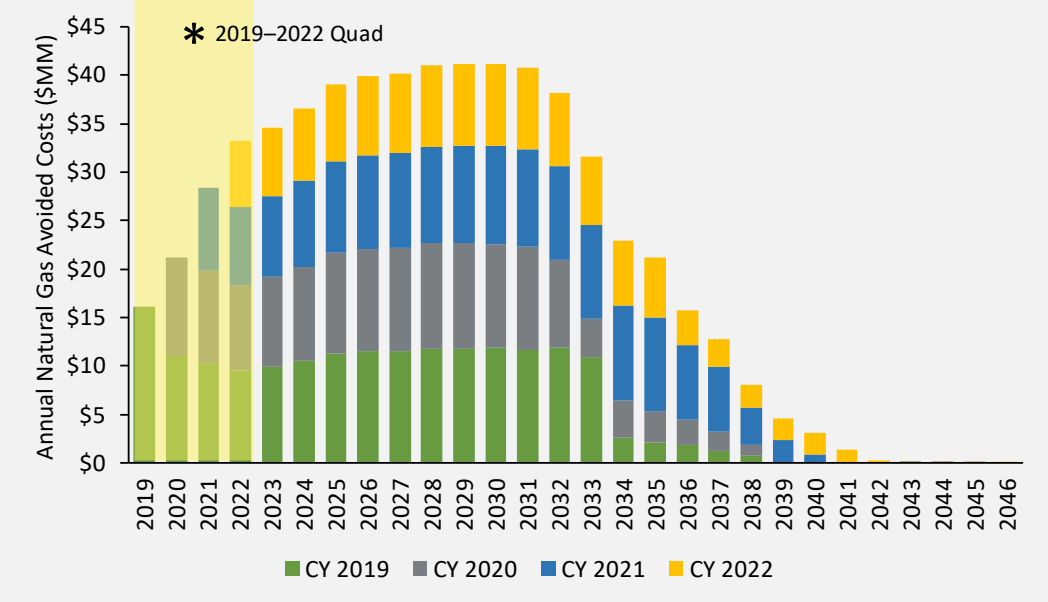
Table 19. Utility Natural Gas Avoided Costs

Program Year	Utility Natural Gas Avoided Costs ($1000s)	
	First-Year	Lifecycle
CY 2019	$16,140	$180,801
CY 2020	$10,128	$148,015
CY 2021	$8,660	$163,168
CY 2022	$6,756	$121,158
Quadrennium	**$41,684**	**$613,143**

[1] Totals may not sum due to rounding.

Figure 15 illustrates the ongoing annual natural gas avoided costs attributable to each Focus on Energy program year. Natural gas avoided costs peak at roughly $41 million in CY 2029, taper off after CY 2033, and cease almost completely by CY 2041.

Figure 15. Annual Utility Natural Gas Avoided Costs by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Changes to Natural Gas Avoided Cost Assumptions

In CY 2020, the PSC also updated the avoided cost of natural gas generation, forecasted through CY 2050.

Table 20 compares the forecasted avoided costs per therm of natural gas between the previous 2015–2018 quadrennium and the current 2019-2022 quadrennium.

Table 20. Avoided Costs of Natural Gas ($/therm) by Quadrennial Forecast

Year	2015–2018 Quad	2019–2022 Quad	Year	2015–2018 Quad	2019–2022 Quad
2019	$0.778	$0.538[1]	2033	$1.100	$0.688
2020	$0.731	$0.538	2034	$1.125	$0.695
2021	$0.779	$0.524	2035	$1.157	$0.702
2022	$0.805	$0.524	2036	$1.200	$0.715
2023	$0.828	$0.546	2037	$1.207	$0.719
2024	$0.855	$0.577	2038	$1.213	$0.721
2025	$0.874	$0.617	2039	$1.240	$0.724
2026	$0.895	$0.629	2040	$1.278	$0.735
2027	$0.917	$0.633	2041	$1.278	$0.732
2028	$0.935	$0.647	2042	$1.278	$0.740
2029	$0.965	$0.650	2043	$1.278	$0.750
2030	$1.008	$0.657	2044	$1.278	$0.764
2031	$1.030	$0.654	2045	$1.278	$0.777
2032	$1.062	$0.677	2046	$1.278	$0.785

[1] Because the current forecast begins in CY 2020, Cadmus used the avoided cost of natural gas in CY 2020 for CY 2019.

The difference between previously and currently forecasted avoided costs of natural gas grows as large as 54.3 cents per therm (in CY 2040) and approximately amounts to a 33% decrease in avoided costs overall. The effects of changes to natural gas avoided cost assumptions are described in further detail in *Impacts of Updated Natural Gas Avoided Costs*.

Net Revenue Effects

Net revenue effects describe the competing impacts of energy savings. Utilities benefit by spending less on fuel and other variable costs associated with energy and T&D (avoided costs). However, participants consuming less energy means utilities sell less energy, resulting in participant bill savings but also less utility revenue. In most cases, including for Wisconsin utilities, the costs of lost revenue exceed the benefits of avoided costs, which may cause utilities to collect less revenue than forecasted.

Net revenue effects are calculated as the difference between revenue losses and avoided costs. In Wisconsin, utilities charge more to deliver energy to customers (retail rates) than what they pay to purchase energy from out-of-state and to transmit and distribute electricity (avoided costs). Thus, when participants save energy, the loss in revenue from each unit of energy saved exceeds its avoided cost, which results in negative net revenue effects that exert downward pressure on net economic impacts.

As described in the *Modeling Approach* section, utilities may seek to recover lost revenues on a lagged schedule by increasing retail rates in future years to fulfill revenue requirements. In coordination with the EWG, Cadmus developed an approach to address this effect. For this analysis, it is assumed that half of revenues lost to energy savings annually will be recovered by utilities in the following year.

Electric Net Revenue Effects

Table 21 presents the first-year and lifecycle electric net revenue effects attributable to each Focus on Energy program year. Lifecycle net revenue effects of electric energy savings sum to roughly -$1.8 billion through 2046.

Table 21. Utility Electric Net Revenue Effects

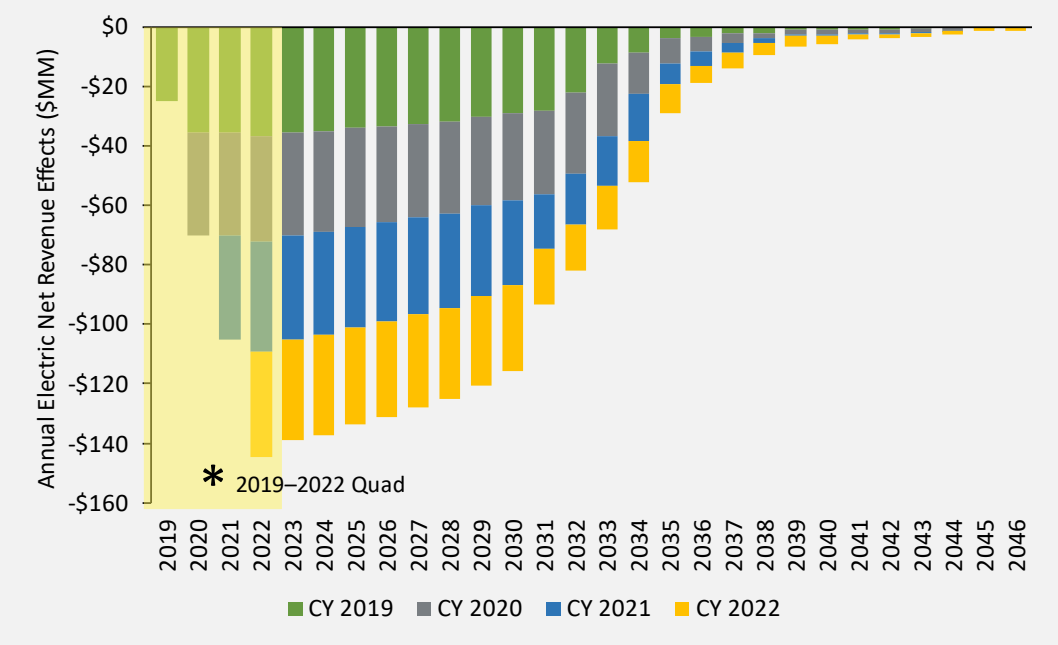
Program Year	Electric Net Revenue Effects ($1000s)[1]	
	First-Year	Lifecycle
CY 2019	-$25,012	-$480,999
CY 2020	-$34,574	-$479,500
CY 2021	-$35,177	-$418,786
CY 2022	-$35,105	-$391,315
Quadrennium	**-$129,869**	**-$1,770,600**

[1] Totals may not sum due to rounding.

Figure 16 illustrates the annual utility electric net revenue effects that accumulate from energy savings generated by Focus on Energy participants. Electric net revenue effects are expected to reach an annual peak of nearly -$144 million in CY 2022, taper off slowly through CY 2030, and then fade quickly until CY 2039, consistent with annual participant bill savings and utility avoided costs. The inclusion of T&D avoided cost benefits reduces peak annual electric net revenue effects by -$52 million.[21]

[21] Annual Net Revenue Effect = Annual Avoided Costs—Annual Bill Savings. T&D avoided cost benefits are treated the same as Annual Bill Savings and are subtracted from annual avoided costs. Thus, the net revenue effect gets more negative (i.e. reduces).

Figure 16. Annual Utility Electric Net Revenue Effects by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Impact of Updated Electric Avoided Costs

Electric avoided costs are lower for the 2019–2022 quadrennium analysis than for the 2015–2018 quadrennium (detailed in *Changes to Electric Avoided Cost Assumptions*), resulting in utilities recovering a larger amount of lost revenues from customers in future years (detailed in *Net Revenue Effects*) and leading to smaller economic benefits.

Cadmus estimated the impacts using the previous and current studies' electric avoided costs, as shown in Table 22. Changes to electric avoided costs—consisting of lower avoided costs of electricity and the inclusion of T&D avoided costs—curtail projected employment growth by roughly 6,000 jobs, economic benefits by $980 million, and disposable personal income gains by $800 million through CY 2046.

Table 22. Effects of Updated Electric Avoided Costs on Cumulative Net Economic Impacts[1]

Net Economic Impact Category	Current Avoided Costs	Previous Avoided Costs	Difference[2]
Employment (jobs)	20,606	26,567	–5,961 (–22%)
Economic Benefit (millions of dollars)[3]	$2,261	$3,245	–$984 (–30%)
Disposable Personal Income (millions of dollars)[3]	$2,181	$2,976	–$795 (–27%)

[1] Values reflect net economic impacts for quadrennium in aggregate.

[2] Differences in net economic impacts account only for changes to electric avoided costs. For changes to natural gas avoided costs, see *Impacts of Updated Natural Gas Avoided Costs*.

[3] Fixed 2022 U.S. dollars.

Natural Gas Net Revenue Effects

Table 23 presents the first-year and lifecycle natural gas net revenue effects attributable to each Focus on Energy program year. Lifecycle net revenue effects of natural gas energy savings sum to nearly –$428 million through CY 2046. CY 2019 saw positive natural gas net revenue effects, unlike electric net revenue effects, because the total annual avoided costs were greater than annual bill savings. Otherwise, the behavior exhibited in the first year of the other project years (and subsequent forecasted years) matches electric net revenue effects.

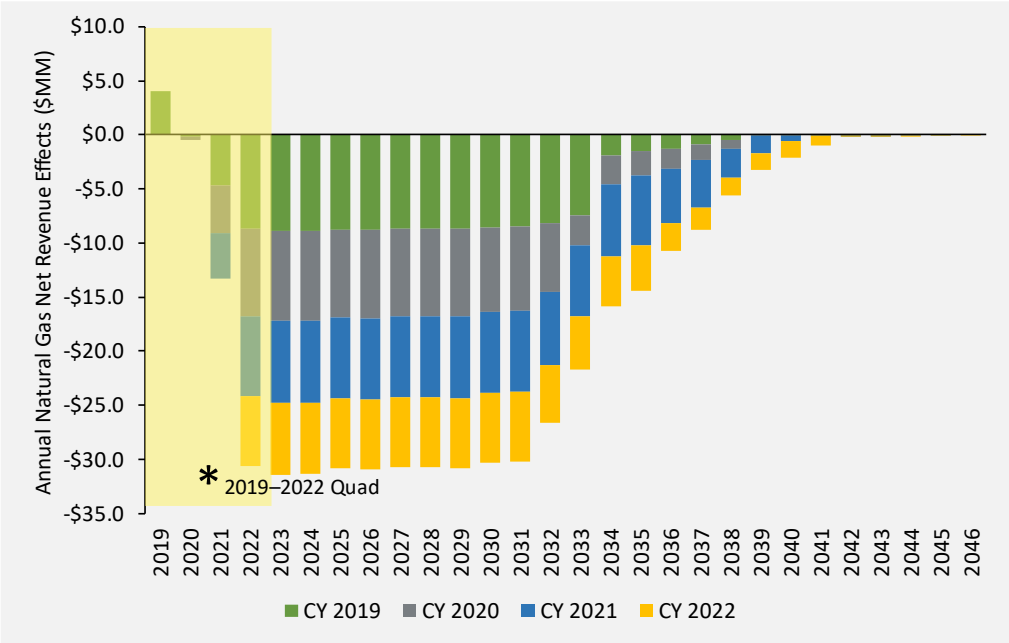
Table 23. Utility Natural Gas Net Revenue Effects

Program Year	Natural Gas Net Revenue Effects ($1000s)[1]	
	First-Year	Lifecycle
CY 2019	$3,991	-$109,850.69
CY 2020	-$308	-$103,748.56
CY 2021	-$4,196	-$119,878.77
CY 2022	-$6,451	-$94,291.16
Quadrennium	**-$6,964**	**-$427,769**

[1] Totals may not sum due to rounding.

Figure 17 illustrates the annual utility natural gas net revenue effects that accumulate from energy savings generated by Focus on Energy participants. Natural gas net revenue effects are expected to reach an annual peak of -$31 million in CY 2023, taper off slowly through CY 2031, and then fade until CY 2041, consistent with annual participant bill savings and utility avoided costs.

Figure 17. Annual Utility Natural Gas Net Revenue Effects by Program Year



Note: Asterisk, along with yellow shading, indicates the quadrennium (or first four years) of the analysis period.

Impacts of Updated Natural Gas Avoided Costs

Natural gas avoided costs are lower for the 2019–2022 quadrennium analysis than for the 2015–2018 quadrennium (detailed in *Changes to Natural Gas Avoided Cost Assumptions*), resulting in utilities recovering a larger amount of lost revenues from customers in future years (detailed in *Net Revenue Effects*) and leading to smaller economic benefits.

Cadmus estimated the impacts using the previous and current studies' natural gas avoided costs, as shown in Table 24. Changes to natural gas avoided cost assumptions suppress projected employment growth by roughly 2,400 jobs, economic benefits by $420 million, and disposable personal income gains by $330 million through CY 2046.

Table 24. Effects of Updated Natural Gas Avoided Costs on Cumulative Net Economic Impacts[1]

Net Economic Impact Category	Current Avoided Costs	Previous Avoided Costs	Difference[2]
Employment (jobs)	20,606	22,958	–2,351 (–10%)
Economic Benefit (millions of dollars[3])	$2,261	$2,679	–$418 (–16%)
Disposable Personal Income (millions of dollars)[3]	$2,181	$2,511	–$330 (–13%)

[1] Values reflect net economic impacts for quadrennium in aggregate.

[2] Differences in net economic impacts account only for changes to natural gas avoided costs. For changes to electric avoided costs, see *Impact of Updated Electric Avoided Costs*.

[3] Fixed 2022 U.S. dollars.

Emissions Reductions

To quantify emissions reductions, Cadmus used emissions factors that depict the rates at which a unit of energy emits pollutants. [22,23] Table 25 shows emission reduction factors specific to each fuel type and pollutant, including nitrogen oxides (NO_X), sulfur dioxide (SO_2), and fine particulate matter ($PM_{2.5}$).

Table 25. Emissions Factors by Pollutant and Fuel Type

Fuel Type	Emission Factors (Tons/Unit)		
	NO_X	SO_2	$PM_{2.5}$
Electricity (tons/MWh)	7.8 E-04	1.6 E-03	8.0 E-05
Natural gas (tons/therm)	4.7 E-06	3.0 E-08	3.8 E-08

The product of the emissions factors and the net lifecycle energy savings establishes the total weight (in tons) of emissions reduced by energy saved through Focus on Energy projects. Table 26 shows cumulative emissions reductions for each pollutant and program year.

Table 26. Lifecycle Emissions Reductions (Tons) by Pollutant

Program Year	Lifecycle Emissions Reductions (Tons)[1]		
	NO_X	SO_2	$PM_{2.5}$
CY 2019	-6,780	-11,261	-666
CY 2020	-6,473	-11,061	-639
CY 2021	-6,173	-10,278	-607
CY 2022	-5,316	-9,148	-526
Quadrennium	**–24,742**	**–41,748**	**–2,438**

[1] Totals may not sum due to rounding.

[22] Electric emissions derived from U.S. Environmental Protection Agency's AVoided Emissions and geneRation Tool (AVERT): https://www.epa.gov/statelocalenergy/avoided-emissions-and-generation-tool-avert.

[23] Natural gas emissions factors derived from EPA's AP-42: Compilation of Air Emissions Factors: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors.

Appendix A. Annual Net Employment Impacts

Table A-1 summarizes the annual net employment impacts (jobs added) attributable to each program year of the 2019–2022 quadrennium. Program year impacts do not sum to quadrennium impacts because of dynamic factors in the REMI model.

Table A-1. Annual Jobs Added by Program Year

CY Year	CY 2019	CY 2020	CY 2021	CY 2022	Quadrennium
2019	-249	n/a	n/a	n/a	-249
2020	135	-419	n/a	n/a	-285
2021	270	39	-350	n/a	-42
2022	397	214	60	-363	309
2023	465	341	195	-29	981
2024	508	436	321	126	1404
2025	533	498	413	254	1714
2026	535	524	468	347	1892
2027	526	527	495	407	1973
2028	516	520	505	442	1999
2029	496	501	497	453	1970
2030	481	477	476	450	1902
2031	469	459	401	377	1724
2032	398	428	396	351	1583
2033	266	338	394	346	1353
2034	129	201	390	330	1053
2035	52	119	274	263	711
2036	31	72	206	173	470
2037	12	32	147	131	321
2038	8	5	80	86	175
2039	-8	-7	32	66	83
2040	-10	-9	1	51	32
2041	-14	-13	-19	17	-31
2042	-19	-14	-24	1	-56
2043	-24	-16	-27	-4	-70
2044	n/a	-18	-27	-6	-82
2045	n/a	n/a	-26	-6	-104
2046	n/a	n/a	n/a	-9	-126
Total	**5,905**	**5,236**	**5,278**	**4,255**	**20,606**