

Focus on Energy
Calendar Year 2014 Evaluation Report
Appendices

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focus on energy
Partnering with Wisconsin utilities

Appendix A.

Key Achievements and Figures for State of Wisconsin and Focus on Energy

Program Participants

2014 Residential: 65,795

- **2014 Upstream Participants:** 923,044

2014 Non-Residential: 6,273

2014 Total Participants: 72,068

2011-2014 Residential: 260,097

- **2011-2014 Upstream Purchases:** 4,022,606

2011- 2014 Non-Residential: 35,610

2011- 2014 Total Participants: 295,707

Total Electric and Natural Gas Energy Use [2014]

Electric Sales to Wisconsin Retail Customers megawatt hours (MWh): 68,820,090

Wisconsin Aggregated Electric Utilities Noncoincident Peak Demand megawatts (MW): 13,464

Natural Gas Consumption (Therms): 3,020,000,000

Total Gross Verified Lifecycle Savings

2014 Energy Savings (MWh): 8,187,284

2014 Demand Reduction (MW): 106

2014 Natural Gas Savings (Therms): 357,805,563

2011 - 2014 Energy Savings (MWh): 28,922,668

2011 -2014 Demand Reduction (MW): 403

2011 - 2014 Natural Gas Savings (Therms): 1,275,590,549

Total Net Verified Annual Savings

2014 Energy Savings (MWh): 557,684

2014 Demand Reduction (MW): 77

2014 Natural Gas Savings (Therms): 18,320,964

2011 - 2014 Energy Savings (MWh): 1,920,361

2011 - 2014 Demand Reduction (MW): 276

2011 - 2014 Natural Gas Savings (Therms): 63,585,621

Population Numbers

Statewide Census Population: 5,757,564

Wisconsin Residential Electric Accounts: 2,609,168

Wisconsin Residential Gas Accounts: 1,681,001

Wisconsin Nonresidential Electric Accounts: 346,468

Wisconsin Nonresidential Gas Accounts: 172,238

CY 2014	Residential	Nonresidential	Total
Administrative Costs	**$4,589,801**	**$4,147,941**	**$8,737,742**
Delivery Costs	**$10,466,793**	**$16,937,770**	**$27,404,563**
Incremental Measure Costs	**$56,554,521**	**$134,463,692**	**$191,018,213**
Total Non-Incentive Costs	$71,611,115	$155,549,403	$227,160,519
Electric Benefits	**$108,611,640**	**$242,461,759**	**$351,073,399**
Gas Benefits	**$46,971,540**	**$184,838,874**	**$231,810,414**
Emissions Benefits	**$50,514,063**	**$123,033,140**	**$173,547,203**
Total TRC Benefits	$206,097,243	$550,333,772	$756,431,015
TRC Benefits Minus Costs	**$134,486,128**	**$394,784,369**	**$529,270,497**
TRC Ratio[1]	**2.88**	**3.54**	**3.33**

[1] The TRC ratio equals total TRC benefits divided by non-incentive costs.

CY 2011-2014	Residential	Nonresidential	Total
Administrative Costs	**$16,267,768**	**$16,119,568**	**$32,387,336**
Delivery Costs	**$37,097,763**	**$65,822,911**	**$102,920,674**
Incremental Measure Costs	**$204,203,260**	**$491,939,445**	**$696,142,704**
Total Non-Incentive Costs	$257,568,791	$573,881,924	$831,450,715
Electric Benefits	**$340,478,379**	**$852,316,757**	**$1,192,795,137**
Gas Benefits	**$183,486,847**	**$571,180,385**	**$754,667,232**
Emissions Benefits	**$165,297,474**	**$428,327,147**	**$593,624,621**
Total TRC Benefits	$689,262,700	$1,851,824,290	$2,541,086,990
TRC Benefits Minus Costs	**$431,693,909**	**$1,277,942,366**	**$1,709,636,275**
TRC Ratio[1]	**2.68**	**3.23**	**3.06**

[1] The TRC ratio equals total TRC benefits divided by non-incentive costs.

Appendix B. Glossary of Terms and List of Acronyms

Glossary of Terms

Term	Definition
Attribution	The establishment of a causal relationship between action(s) taken by a group or Program and an outcome. Being attributable to a program means that a program is directly responsible for the savings, and the savings would not have been achieved in the absence of a program.
Avoided Costs	Costs to the utility avoided by the implementation of an energy-efficiency measure, program, or practice.
Administrative Cost	Administrative costs include all costs related to the portfolio-wide management of Focus on Energy programs, including contract management, financial management, application and incentive processing, quality assurance, data collection and reporting, and utility coordination.
Baseline	Conditions (including energy consumption) that would have occurred without implementation of the subject measure or project.
Benefit-Cost Ratio	Mathematical relationship between the benefits and costs associated with the implementation of energy-efficiency measures, programs, practices, or emissions reductions.
Claimed Savings	The energy savings the Program Administrator or Implementer reports before they are verified by the Evaluation Team. (These are also called "*ex ante* savings," "reported savings," or "tracked savings.")
Cost-Effectiveness	Indicator of relative performance or economic attractiveness associated with the implementation of energy-efficiency measures, programs, practices, or emissions reductions.
Custom Savings	Savings for nonprescriptive measures that are calculated by a program implementer or administrator at the time of project completion. The result reflects the savings for the specific project based on pre-installation and post-installation energy use.
Deemed Savings	An estimate of energy, demand, or gas savings for a single unit of an installed energy-efficient measure. Deemed savings are typically developed from data sources and analytical methods that are: (1) widely considered acceptable for the measure and (2) applicable to the situation.
Ex Ante **Savings**	The energy savings the Program Administrator or Implementer reports before they are verified by the Evaluation Team. (These are also called "*ex ante* savings," "reported savings," or "tracked savings.")
Ex Post **Evaluation**	An assessment of the impact(s) of an activity after completion.

Term	Definition
Estimated Savings	Savings estimates an evaluator reports after a completed energy-impact evaluation.
Freeriders	Participants who would have adopted the energy-efficient measure without the program.
Gross Savings	The unadjusted program reported change in energy consumption and/or demand that results from program-related actions taken by participants in an efficiency program.
Interactive Effects	The influence in energy use between one technology application and the energy required to operate another application.
Locational Marginal Price (LMP)	The marginal cost to serve a unit of energy at a specific location at the time of delivery.
Life-Cycle Savings	Energy savings—expressed either as verified gross or verified net—generated in the current program cycle. Savings incorporate annual savings and each measure's estimated useful life.
Lifetime Savings	Energy savings—expressed as either verified gross or verified net—produced as a result of measures installed in the current program cycle and in the previous program cycle(s), provided the reporting period is within the measure's useful life. Savings incorporate annual savings and each measure's estimated useful life.
Market Effects	Changes in marketplace practices, services, and promotional efforts that induce businesses and consumers to buy energy-saving products and services without direct program assistance. Evaluators generally consider these effects a result of program impacts on the market.
Measure Life	The life of an energy consuming measure, including its equipment life and savings persistence.
Net Savings	Savings directly attributable to program efforts, i.e., net of what would have occurred in the program's absence. Savings "net" of what would have occurred in the program's absence. (These are the observed impacts attributable to the program.) Evaluators typically calculate the savings by applying the net-to-gross ratio to the gross verified savings.
Net-to-Gross Ratio (NTG)	The ratio of the verified net savings attributed to the program after evaluation to the verified gross savings.
Non-Energy Benefits (NEBs)	An array of valued attributes derived from energy-efficient measures in addition to energy savings, such as increased property value or reduced water usage.
Participant Spillover	Participants who, after an initial program experience, go on to adopt more energy-saving products or practices without program assistance.
Precision	The degree to which repeated measurements under unchanged conditions produce the same results.

Term	Definition
Realization Rate	Ratio of gross savings to verified gross savings.
Reported Savings	Energy savings the Program Administrator or Implementer reports before they are verified by the Evaluation Team. Also referred to as tracked savings or claimed savings.
Standard Error	A measure of the variability in a data sample. In other words, how far a typical data point is from the mean of a sample.
Tracked Savings	Energy savings the Program Administrator or Implementer reports before they are verified by the Evaluation Team. These are also called reported savings or claimed savings.
Unclaimed Rewards	Incentives set aside for customers who fail to submit the paperwork to claim program incentives.
Verified Gross Savings	Energy savings verified by an independent evaluation team based on inspections and reviews of the number and types of implemented energy-efficiency measures and the engineering calculations used to estimate the energy saved. Verified gross savings reflect the total calculated savings without considering the influence of freeriders or spillover.
Verified Net Savings	Energy savings that evaluators can confidently attribute to program efforts. For verified net savings, the evaluation team makes adjustments for outside influences, such as freeridership and spillover.

List of Acronyms

Acronym	Term
CB&I	Chicago Bridge & Iron Company
CFL	Compact Fluorescent Lamp
CY	Calendar Year
EIA	Energy Information Administration
EM&V	Evaluation, Measurement, and Verification
EUL	Expected Useful Life
HVAC	Heating, Ventilation, and Air Conditioning
KBtu/h	Thousand British Thermal Units per Hour
kW	Kilowatt
kWh	Kilowatt Hour
LED	Light-Emitting Diode
LMP	Locational Marginal Pricing
MISO	Midcontinent Independent Transmission System Operator, Inc.
MMBtu	Million British Thermal Units
MThm	Megatherm
MWh	Megawatt Hour
NTG	Net-to-Gross
PSC	Public Service Commission of Wisconsin
QA/QC	Quality Assurance/Quality Control
SEERA	Statewide Energy Efficiency and Renewable Administration
SMP	Standard Market Practice
SPECTRUM	Statewide Program for Energy Customer Tracking, Resource Utilization, and Data Management
TRC	Total Resource Cost (test)
TRM	Technical Reference Manual
VFD	Variable-Frequency Drive (also known as Variable-Speed Drive)

Appendix C. CY 2014 Program Descriptions

The section below provides detailed descriptions of the Focus on Energy residential and nonresidential programs included in the CY 2014 evaluation.

Descriptions of Residential Programs

The Evaluation Team assessed ten residential programs during the CY 2014 evaluation, which are described here.

Multifamily Energy Savings Program and Multifamily Direct Install Program

Program Dates: Launched April 1, 2012.

Program Purpose: The Multifamily Energy Savings Program and Multifamily Direct Install Program provide information, financial incentives, and implementation assistance for energy-efficiency projects to owners and managers of multifamily buildings and condominiums of four or more units. The Multifamily Direct Install Program provides installation of free energy-saving measures.

Target Audience: The target audiences are condominium and apartment associations, universities, and multifamily building owners and managers.

Program Implementer: Franklin Energy Services, LLC, is the Implementer for both Programs.

Process and Associated Measures: The Multifamily Energy Savings Program and Multifamily Direct Install Program are similar to the discontinued Apartment and Condo Efficiency Services Program. The current Programs launched in April 2012 and feature several design changes to achieve the following objectives:

- Lower non-incentive costs by recruiting Trade Allies to assist with market outreach;
- Use the direct-install path to guide participants to prescriptive and custom tracks;
- Reduce the number of audits that do not result in follow-up installations;
- Increase the amount of savings per building by introducing the custom track with increasing incentive amounts based on the savings achieved in the project.
- Prescriptive rebates for eligible measures; and
- Incentives for multi-tiered and performance-based custom projects.

The Multifamily Direct Install Program offers free direct-installations of CFLs, pipe insulation, faucet aerators, and low-flow showerheads, as well as a walk-through assessment of the building.

The Programs' Implementer markets both Programs to building owners and managers, as well as Trade Allies and contractors who work with these customers, through regionally based Energy Advisors. The Programs' Implementer also processes customer applications, manages Program data, and educates Trade Allies in an effort to help cost-effectively promote the Programs.

To address market saturation in the densely populated portions of the state, the Programs are targeting previously underserved markets including northwestern and southwestern Wisconsin and are collaborating with the Large Energy Users Program to provide energy savings to university campuses.

Appliance Recycling Program

Program Dates: Launched March 1, 2012.

Program Purpose: The Appliance Recycling Program encourages households and multifamily building owners to turn in working refrigerators and freezers for recycling. By offering free pick-up and providing financial incentives, the Program is designed to encourage customers to discontinue using secondary refrigerators and freezers, relinquish refrigerators and freezers previously in use as primary units when they are replaced, and prevent the continued use of old refrigerators and freezers through resale or giving the unit away.

Target Audience: The target audience is Wisconsin residential electric customers. The Appliance Recycling Program allows participation for residential customers in multifamily residences or for multifamily building owners and managers who are upgrading multiple units. However, participation skews strongly to single-family residential customers.

Program Implementer: The Appliance Recycling Program Implementer is JACO Environmental.

Process and Associated Measures: Participants received a $40 rebate for recycling working refrigerators or freezers in CY 2014. The units must be between 10 and 30 cubic feet. Customers interested in the Appliance Recycling Program are directed to call a designated toll-free number operated by the Implementer or visit the Focus on Energy website to schedule a time to have their old, working refrigerator or freezer picked up from their home. Implementer representatives verify customer eligibility and arrange a pick-up time, typically within two weeks of the request. A maximum of two pieces of equipment per customer address, per calendar year are eligible ($80 maximum incentive per customer). This maximum does not apply to multifamily buildings that are participating in the Program.

After the appliances are picked up, they are delivered to a recycling facility. Focus on Energy staff can conduct unannounced site visits at the recycling center and ride-along to collection sites to ensure that the Implementer is following program rules and specifications.

Residential Lighting and Appliance Program

Program Dates: Launched January 1, 2012.

Program Purpose: The Residential Lighting and Appliance Program is a retail-based promotion that provides upstream incentives, price markdowns, and coupon promotions for efficient lighting and other qualifying products. In upstream programs, the higher cost of the measure is paid directly to the distributor or manufacturer by the Program, so that customers receive an instant discount at the point of sale.

Focus on Energy has offered an upstream residential lighting program since 2006. In CY 2012, the Program Administrator renamed it the Lighting and Appliance Program, because it combined both lighting and efficient showerheads. In CY 2013, Focus on Energy added high-efficiency clothes washers. In CY 2014, incentives for efficient showerheads and high-efficiency clothes washers were discontinued.

Target Audience: The Residential Lighting and Appliance Program's target audience is residential customers. As an upstream program, it is difficult to limit participation to any single sector or population or to require that participants be customers of participating Focus on Energy utilities.

Program Implementer: The Residential Lighting and Appliance Program Implementer is CLEAResult.

Process and Associated Measures: The Residential Lighting and Appliance Program partners with nation, regional, and local retail stores to discount products including ENERGY STAR®-qualified lighting technologies. The markdowns vary by product and store and change throughout the year. The Program increases brand awareness through Focus on Energy signage on marked-down products and through events at participating stores.

Home Performance with ENERGY STAR Program

Program Dates: Launched January 1, 2012.

Program Purpose: The Home Performance with ENERGY STAR Program gives homeowners the opportunity to increase the energy efficiency of their home through the installation of energy-efficiency measures (air sealing and insulation). The Program provides participants with incentives for installing eligible measures as well as the direct-installation of free energy-saving measures during a home energy assessment.

Target Audience: The target audience is homeowners, landlords, and renters of single-family (one- to three-unit) dwellings.

Program Implementer: The Home Performance with ENERGY STAR Program Implementer is Conservation Services Group (CSG).

Process and Associated Measures: The Home Performance with ENERGY STAR Program is contractor-oriented and can work in one of two ways—one company performs all aspects of work, or one company acts as the general contractor but subcontracts out certain portions such as the energy assessment and/or the retrofit work. In both scenarios, the company, referred to as the Trade Ally, is responsible for managing the customer relationship, completing the full project, communicating with the Program Implementer, and ensuring that all program requirements are met. To qualify for the reward, the improvements must reduce the home's energy use by 10 percent or greater.

The Home Performance with ENERGY STAR Program provides instant discounts of 33%, up to $1,250, towards a home's air sealing and insulation improvements (attic, exterior wall, sill box, and interior foundation). Free direct-install measures such as CFLs, LEDs, faucet aerators, and low-flow showerheads

are installed during the home energy assessment. Participants pay market rate for the assessment, a cost that is determined by each Trade Ally.

Assisted Home Performance with ENERGY STAR Program

Program Dates: Launched April 1, 2012.

Program Purpose: The Assisted Home Performance with ENERGY STAR Program provides income-eligible residents with the opportunity to increase the energy efficiency, durability, and comfort of their homes.

Target Audience: The target audience is income-eligible owner-occupants of one- to three-unit homes. A household is considered income-eligible if its gross income falls between 60% and 80% of the state median income (SMI). Multi-family units are also eligible to participate as long as the household meets Program criteria.

Program Implementer: The Assisted Home Performance with ENERGY STAR Program Implementer is Conservation Services Group (CSG). Ineligible customers are directed to the Home Performance with ENERGY STAR Program.

Process and Associated Measures: A free home-energy assessment is provided by an Assisted Home Performance Program Trade Ally to identify energy-efficiency opportunities, and eligible customers can receive enhanced incentives that cover up to 75% of the cost of the improvement measures, up to $2,000. To qualify for the reward, the improvements must reduce the home's energy use by 10 percent or greater.

To be eligible to participate in the Assisted Home Performance with ENERGY STAR Program, customers submit an Income Eligibility Application; the Implementer notifies customers of their eligibility. Eligible customers then schedule a free energy assessment (an abbreviated version of the Home Performance with ENERGY STAR assessment) with a Trade Ally and receive a list of recommended upgrades. After the retrofit work is completed, customers receive the Program incentive in the form of an instant reward deducted from the Trade Ally's invoice.

The associated measures are air sealing, attic insulation, exterior wall insulation, foundation insulation, sill box insulation, along with free direct-installation measures such as CFLs, LEDs, faucet aerators, and low-flow showerheads.

New Homes Program

Program Dates: Launched July 1, 2012.

Program Purpose: Focus on Energy's New Homes Program provides information, implementation assistance, and incentives for builders of new single-family (one- to three-unit) homes in Wisconsin that meet energy-efficiency requirements.

Target Audience: The target audience is builders of new, single-family homes.

Program Implementer: The New Homes Program Implementer is the Wisconsin Energy Conservation Corporation (WECC).

Process and Associated Measures: The New Homes Program provides education and motivation leading to the construction of new homes that are at least 10% more efficient than homes built to the Wisconsin Uniform Dwelling Code (UDC). The Program offers incentives at four levels for homes that exceed the UDC's efficiency standards.

Higher tiers of efficiency require technology packages, which are home efficiency measures that are not covered in the building codes. These technology packages include ENERGY STAR-qualified light bulbs, ENERGY STAR-qualified light fixtures, energy efficient windows, R5 exterior insulation, rim and band joist insulation, residential water heaters, residential HVAC, and renewable energy systems (solar photovoltaic [PV], solar thermal, and geothermal).

Residential Rewards Program

Program Dates: Launched January 1, 2012. The Residential Rewards renewable component launched July 1, 2012.

Program Purpose: The Residential Rewards Program encourages single-family residential customers of participating utilities to install energy-efficient space heating equipment as well as renewable energy technologies and attic insulation.

Target Audience: The Residential Rewards Program's target market is residential customers in one- to three-unit homes.

Program Implementer: The Residential Rewards Program Implementer is CLEAResult.

Process and Associated Measures: The Program provides incentives for the purchase of high-efficiency or renewable space heating equipment and attic insulation. Customers must select this equipment from a prequalified list. The Residential Rewards Implementer markets the Program directly to homeowners, but the primary outreach method is through Trade Allies marketing the Program to their customers.

The qualifying measures include attic insulation; high-efficiency furnaces, and boilers; and renewables including solar electric (PV) and ground source heat pumps.

Enhanced Rewards Program

Program Dates: Launched January 1, 2012.

Program Purpose: The Enhanced Rewards Program provides incentives for the purchase of high-efficiency home heating equipment to income-eligible residents.

Target Audience: The Enhanced Rewards Program's target audience is income-eligible owner-occupants of existing single-family residential buildings. A household is considered eligible if gross income falls between 60% and 80% of the SMI. The eligible-income level targets customers who are unlikely to be

able to participate in the Focus on Energy Residential Rewards Program and who do not qualify for Home Energy Plus, Wisconsin's weatherization program.

Program Implementer: The Enhanced Rewards Program Implementer is CLEAResult.

Process and Associated Measures: The Enhanced Rewards Program provides financial incentives to customers of participating gas and electric utilities who purchased and installed new energy-efficient heating equipment. The primary outreach method to these customers is through Trade Allies that are familiar with the Program offerings. Customers are required to submit an income-eligibility application and are notified of their eligibility within 24 hours. Incentives are available only for pre-qualified energy-efficient furnaces and boilers. Ineligible customers are directed to the Wisconsin Home Energy Plus or the Focus on Energy Residential Rewards Program.

Express Energy Efficiency Program

Program Dates: Launched April 1, 2012.

Program Purpose: The Express Energy Efficiency Program provides direct installation of free energy-saving measures to participating customers and helps to promote other Focus on Energy programs. The Express Energy Efficiency Program is offered in a selection of targeted communities for a limited time before moving on to new locations. Over the three-year period from 2012 to 2014, the Express Energy Efficiency Program will be offered in most metropolitan areas.

Target Audience: The target audience is the owners and renters of residential dwellings with one to three units.

Program Implementer: The Express Energy Efficiency Program Implementer is Conservation Services Group (CSG).

Process and Associated Measures: The Program offers direct-installation of energy-efficiency measures including CFLs and LEDs (limit 12—10 CFLs and 2 LEDs), faucet aerators, low-flow showerheads, water heater pipe wrap insulation (up to 6 feet), and temperature turn-downs on water heaters at no cost to the customer. Installers also provide literature and information on other Focus on Energy programs.

Descriptions of Nonresidential Programs

The Evaluation Team assessed five nonresidential programs during the CY 2014 evaluation.

Business Incentive Program

Program Dates: Launched April 1, 2012

Program Purpose: The Business Incentive Program encourages energy efficiency by offering incentives for prescriptive and custom measures to nonresidential customers with electric demand between 100 and 1,000 kW.

Target Audience: The Business Incentive Program targets nonresidential segments including agribusinesses (including farms and greenhouses), commercial spaces (including hotels and independent retailers, food sales, and food service establishments), small- to medium-sized industrial facilities, educational institutions (including K-12 schools, technical colleges, and University of Wisconsin two-year colleges), and municipal and county government facilities.

Program Implementer: The Program Implementer is Franklin Energy Services, LLC.

Process and Associated Measures: The Business Incentive Program relies on Trade Allies to drive energy-savings. The Implementer staff encourage Trade Allies to recruit eligible customers, identify energy-saving opportunities, and lead customers through the incentive application process. Prescriptive incentives are available for many technologies including lighting, HVAC, commercial refrigeration, variable frequency drives, renewable energy systems, and food service equipment. Customers may also receive custom incentives for more complex energy-efficiency projects.

Chain Stores and Franchises Program

Program Dates: Launched April 1, 2012.

Program Purpose: The Chain Stores & Franchises Program is designed to motivate decision-makers at chain stores and franchise operations to make energy-efficiency upgrades at multiple locations.

Target Audience: The target audience is chain stores and franchise operations in retail, food service (restaurants), and food sales (grocery and convenience stores). To be eligible for the Program, a minimum of five locations in Wisconsin is required.

Program Implementer: The Program Implementer is Franklin Energy Services, LLC.

Process and Associated Measures: The Program Implementer staff assigns a dedicated Account Manager for specific chains and franchises. The Account Manager, or Energy Advisor, works with the customer to identify opportunities to improve energy efficiency. The Energy Advisor provides customer service and technical knowledge, helps develop business cases to support projects, and may assist with marketing and messaging related to energy-efficiency actions. All Focus on Energy nonresidential measures and combined measures are associated with this Program. Customers may also propose

additional energy-efficiency projects through the custom incentive option. Customers may bundle up to 10 sites into one application. Other services include a direct install option, through which Implementer staff install a limited set of measures at no cost to the customer.

Large Energy Users Program

Program Dates: Launched April 1, 2012.

Program Purpose: The Large Energy Users Program encourages the installation of energy-efficient technologies by offering incentives and services for large industrial, commercial, and institutional customers. These offerings include financial incentives for prescriptive and custom energy-efficient technologies, no-cost access to energy experts, training and tools to identify and evaluate energy-efficiency opportunities, resources to develop and benchmark energy management practices, and engineering reviews of proposed projects. Prescriptive incentives are available for many technologies including lighting, HVAC, commercial refrigeration, variable frequency drives, and food service equipment.

Target Audience: The Program is designed for large industrial, commercial, and institutional business customers of participating Wisconsin electric and natural gas utilities that had a system-wide energy utility bill of at least $60,000 in one month of the preceding year and had energy use at one contiguous facility of:

- Over 1,000 kW of electric demand in a single month in the past year; or
- Over 100,000 therms of natural gas consumption in a single month in the past year.

Program Implementer: The Program Implementer is Leidos (formerly known as SAIC).

Process and Associated Measures: The Program Energy Advisors work directly with large industrial, commercial, and institutional business customers to identify and analyze opportunities for improving energy efficiency in their facilities and processes. They provide technical expertise as well as on-going education about large-scale energy-efficiency measures and best practices. In addition, they help customers develop energy teams and energy management plans, establish energy baselines and key performance indicators for facilities and end-uses, and design custom incentive projects or hybrid projects with custom and prescriptive incentives.

All nonresidential measures and combined measures are associated with this program. Customers may also propose additional energy-efficiency projects through the custom incentive option.

Small Business Program

Program Dates: Launched July 1, 2012.

Program Purpose: The Small Business Program is designed to encourage small business owners to install easy and affordable energy-efficiency upgrades. It provides free on-site energy assessments to help small business customers identify energy-efficiency improvements and includes an energy-efficiency

package of free, direct-installed measures. A package of additional measures is offered at a discounted price.

Target Audience: The Small Business Program targets independently-owned and operated for-profit business customers, as well as not-for-profit organizations with average monthly electric demand of less than 100 kW. Typical customers are independent grocers, convenience stores, gas stations, retail shops, locally-owned restaurants, small hotels and motels, day care centers, doctor's offices, churches, and community action agencies.

Program Implementer: The Program Implementer is Staples & Associates, Inc.

Process and Associated Measures: Any small business owner can schedule an assessment, or Trade Allies who have received program-specific training may recruit participants in their local communities. Trade Allies must be registered with the program in order to submit applications. The Program Implementer and qualified Trade Allies conduct 30- to 45-minute energy assessments at customer facilities to identify energy-efficiency opportunities. After discussing the findings, owners can choose from a variety of stand-alone measures or measure packages, listed in Table C-1.

Table C-1. Small Business Program Measure Packages

Silver Package, Starting at $75
CFLs or screw-in LEDs to replace incandescent bulbs (maximum of 25 LEDs)
Vending machine controllers (unlimited)
LED "Open" sign (one, replacing a neon sign)
Faucet aerators (unlimited)
Water-saving showerheads (unlimited)
Hot water heater pipe wrap
Gold Package, Starting at $175
LED exit signs
Wall box occupancy sensors
LED lamps (maximum of 50)
High performance T8 fixtures or tLEDs
Platinum Package, starting at $295
Additional LED exist signs and occupancy sensors
LED lamps (maximum of 125)
LED fixture replacements

*Customers can also purchase "A La Carte Measures" separate from these packages

Design Assistance Program

Program Dates: Launched January 1, 2013.

Program Purpose: The Design Assistance Program helps building owners and design teams analyze the benefits and costs of incorporating various energy-saving technologies into the design of their new construction, or substantial renovation projects.

Target Audience: The Design Assistance Program targets building owners and design teams engaged in the design and completion of new buildings or substantial remodeling projects. The Program offers building analysis support and incentives for building owners and design teams as they implement building renovations or new construction.

Program Implementer: The Program Implementer is Weidt Group, Inc.

Process and Associated Measures: While customers can independently request to participate in the Design Assistance Program, the Program Implementer also develops relationships with key design firms to drive customer interest. The Program Implementer provides customers with modeling and analysis of how various energy-saving technologies can be incorporated into the building's design. The program also provides custom incentives for whole building design efficiency measures based on the incremental decrease in energy savings over a code-based design.

Appendix D. Summary of Savings by Sector and County

The following section includes twelve maps that represent the results of the 2014 evaluation. There are three county-level maps (per capita lifetime bill savings, 2014 participation rates, and per capita incentives paid in 2014) for three primary sectors (residential, industrial, and commercial) and three maps by county with upstream lighting per capita lifetime bill savings, 2014 participation rates, and per capita incentives paid in 2014. The commercial maps include commercial, schools, government, and agricultural entities.

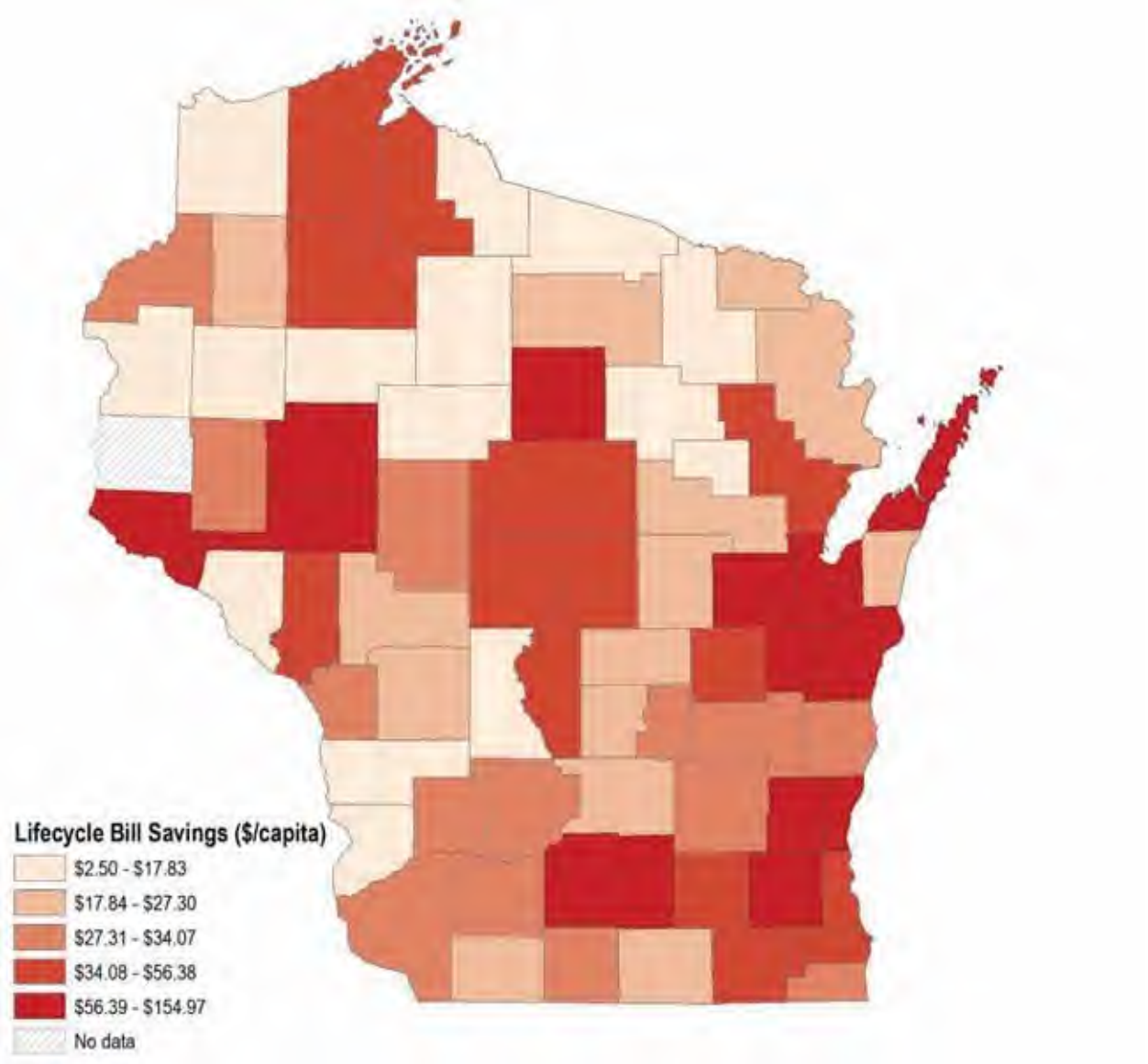
Similar to the 2011, 2012, and 2013 evaluation reports, the bill savings are defined as evaluated life-cycle verified gross energy savings that have been multiplied by the average retail rate of delivered energy in 2014 and normalized on a per-capita basis. The incentive dollars are also reported on a per-capita basis.

The per-capita residential numbers are based on the number of households reported in the most current U.S. Census, the American Community Survey (2012).[1] The per-capita county numbers for commercial and industrial are based on the county-level total number of active businesses in the 2010 evaluation report. The participation rates are the county-level participation normalized by the county- and sector-level populations.

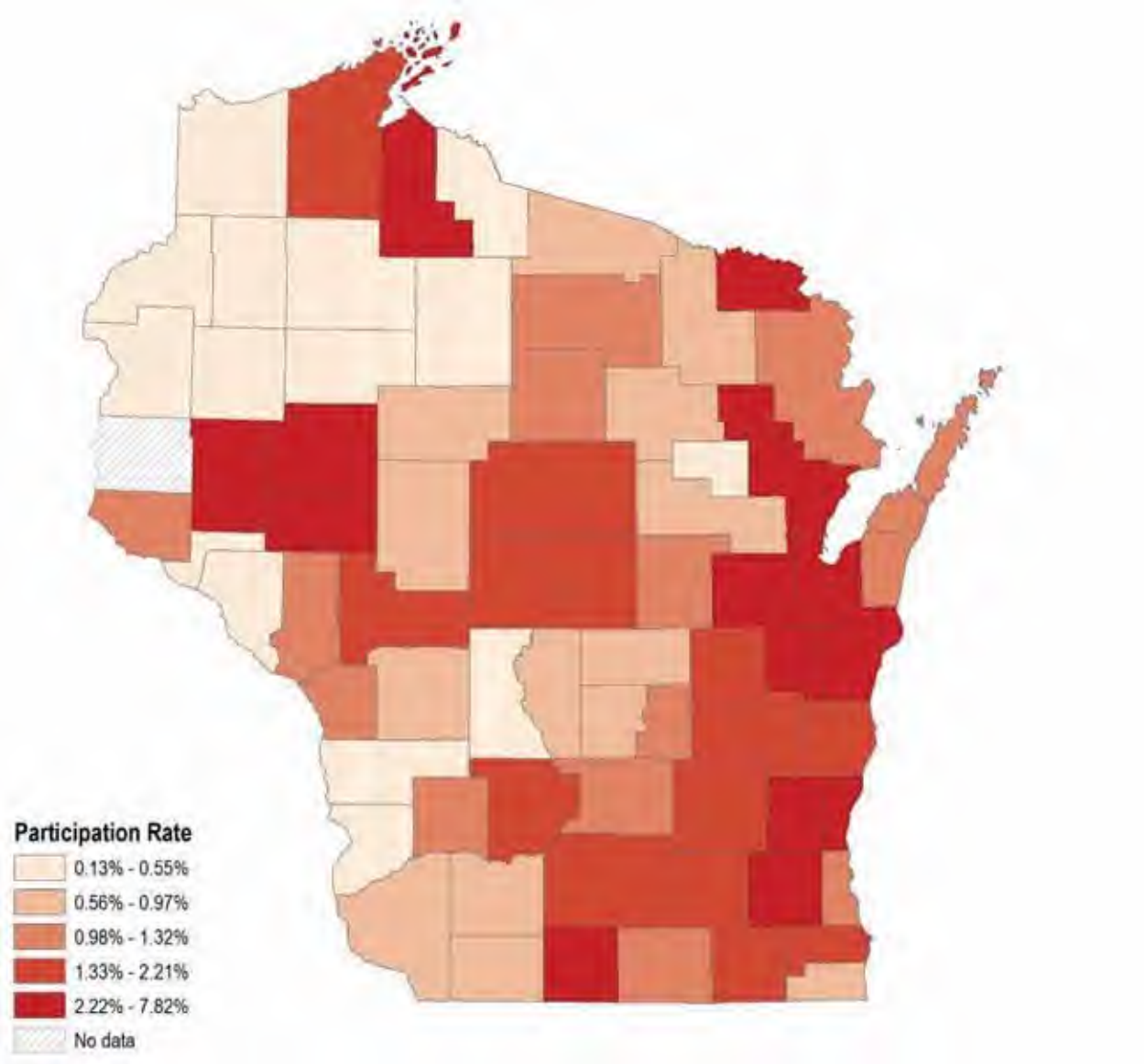
[1] U.S. Census. The American Community Survey. 2012. Available online: http://www.census.gov/acs/www/data_documentation/2012_release/

Residential

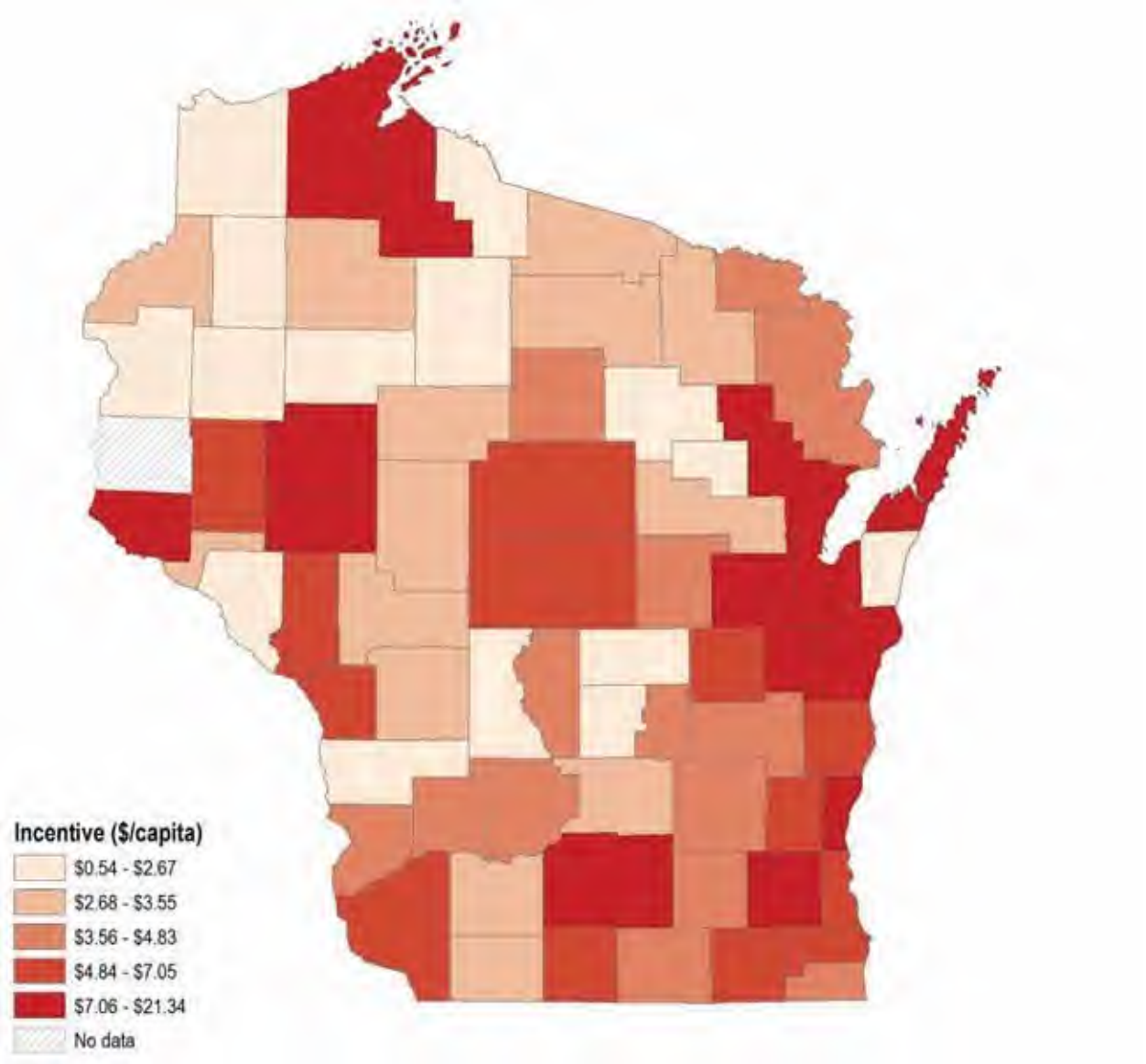
Residential Per-Capita Energy Bill Savings by County



Residential Participation Rate by County

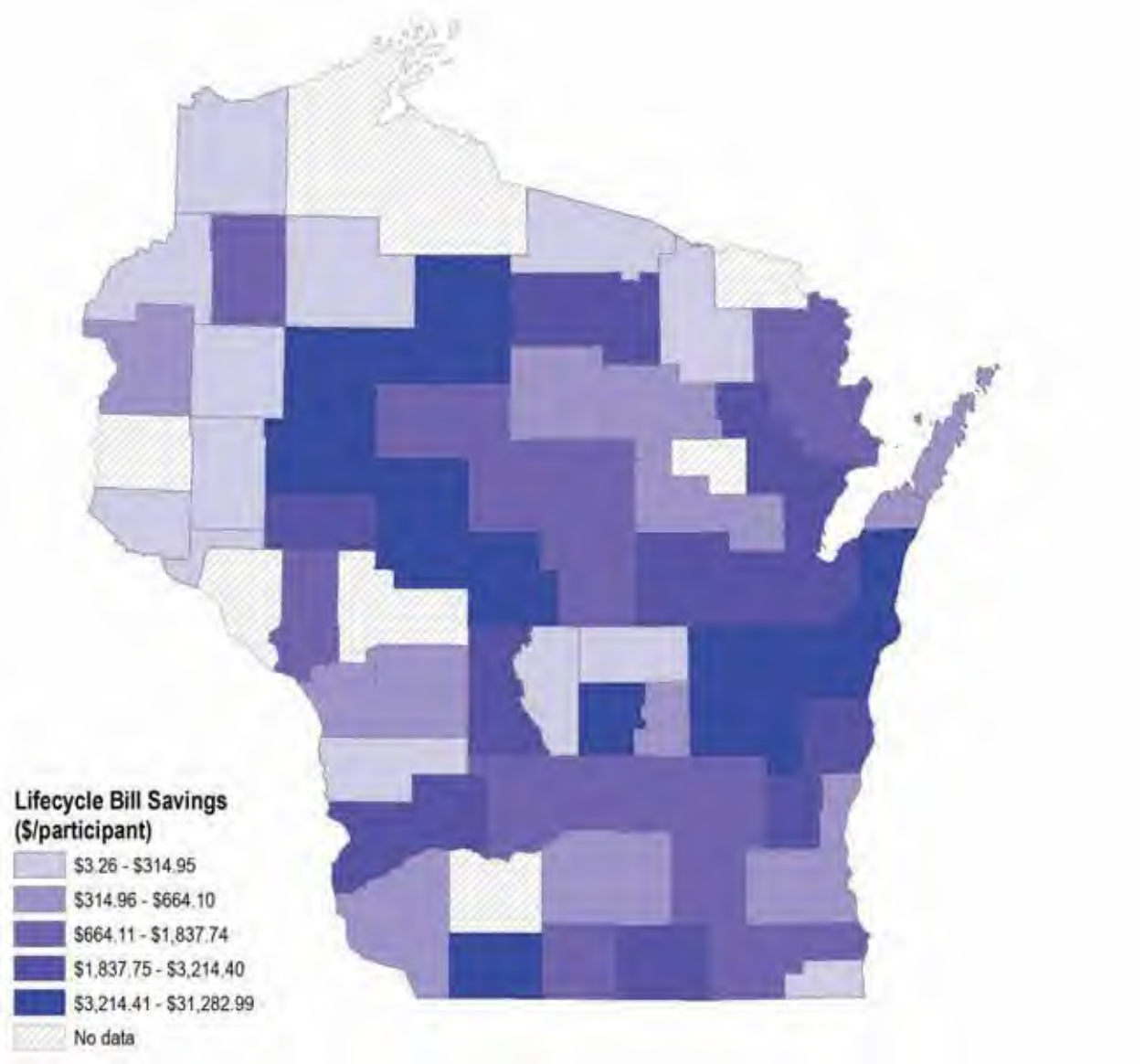


Residential Per-Capita Incentive Dollars Awarded by County

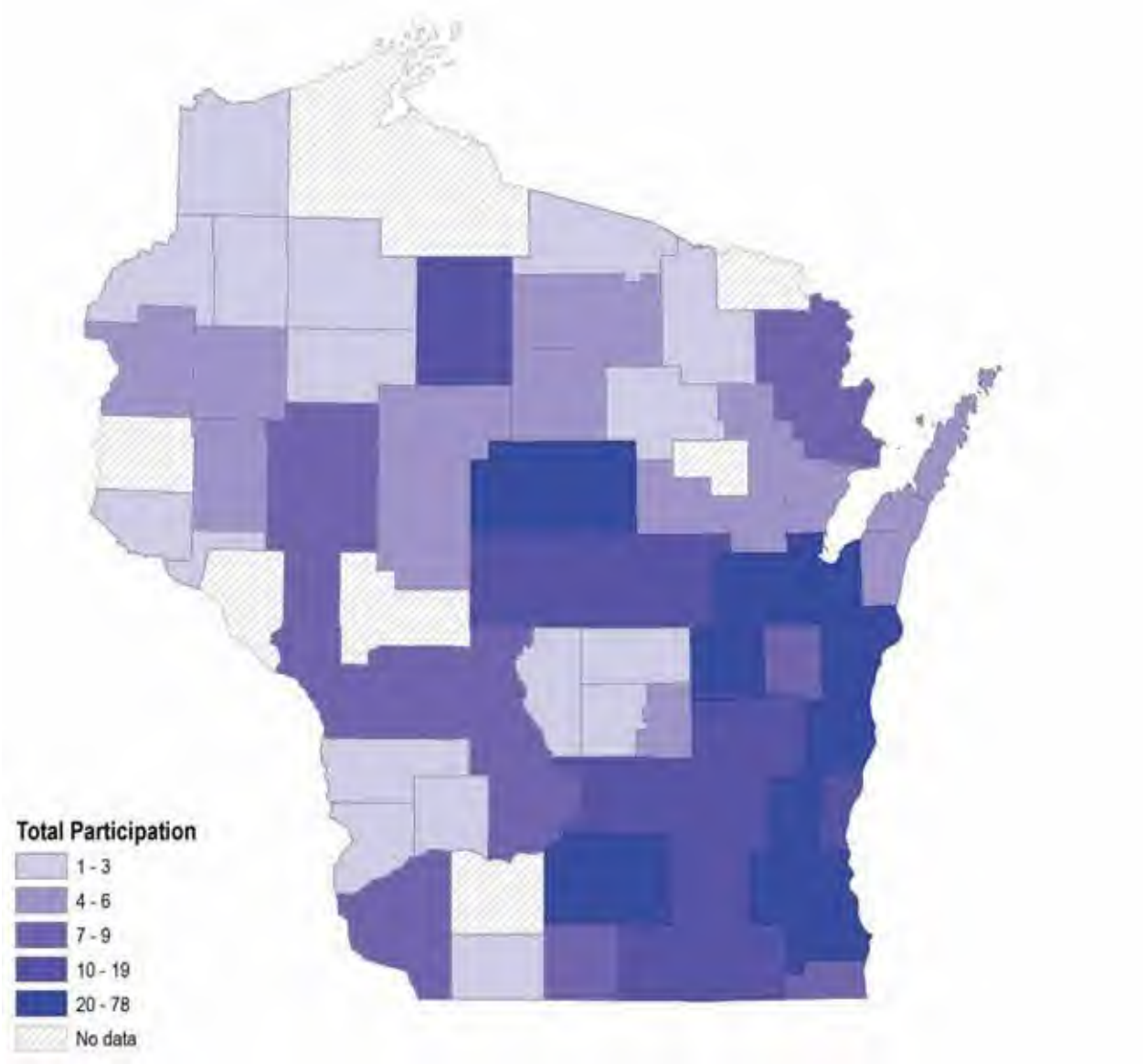


Industrial

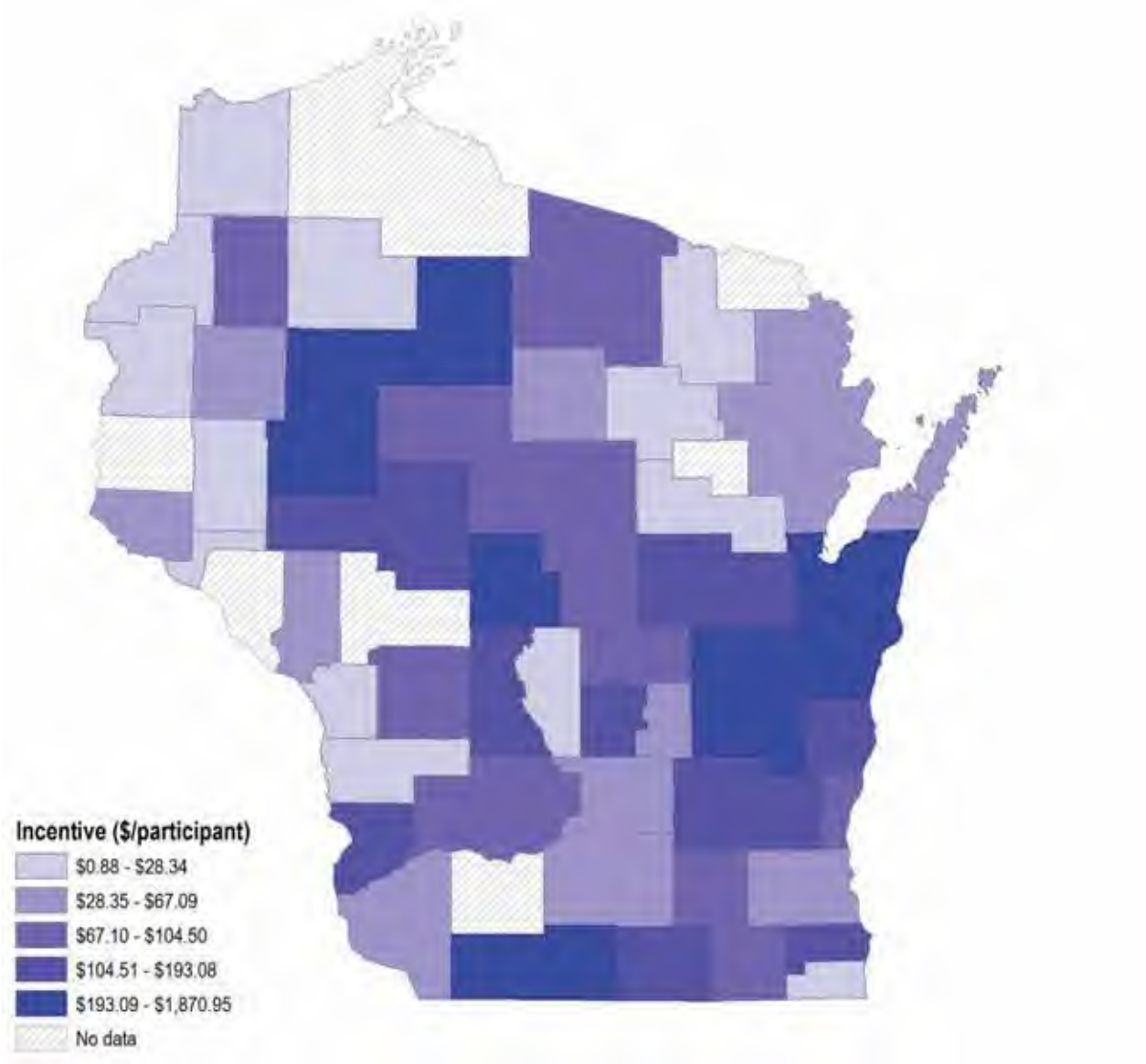
Industrial Per-Capita Energy Bill Savings by County



Industrial Participation Rate by County

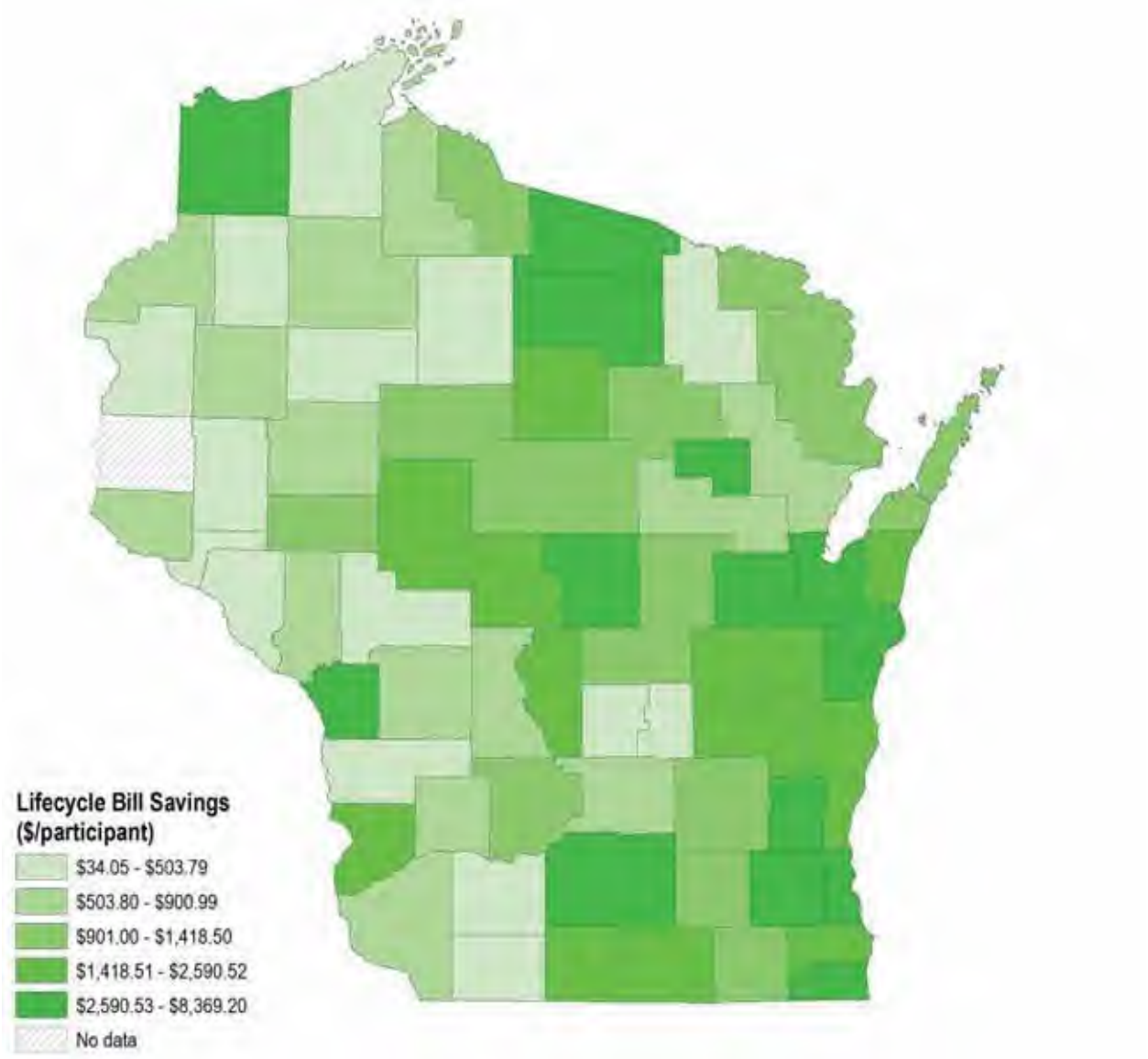


Industrial Per-Capita Incentive Dollars Awarded by County

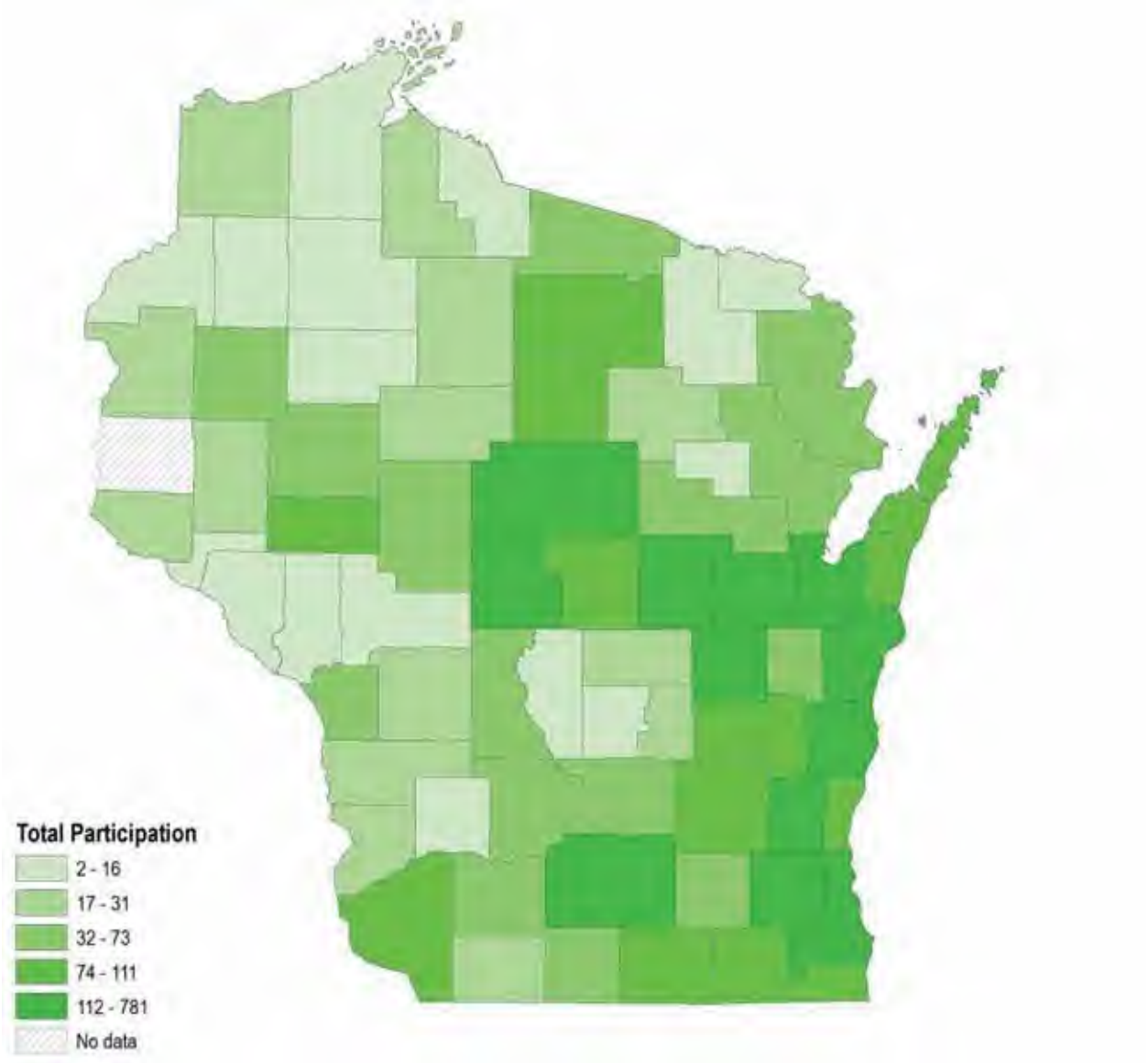


Commercial

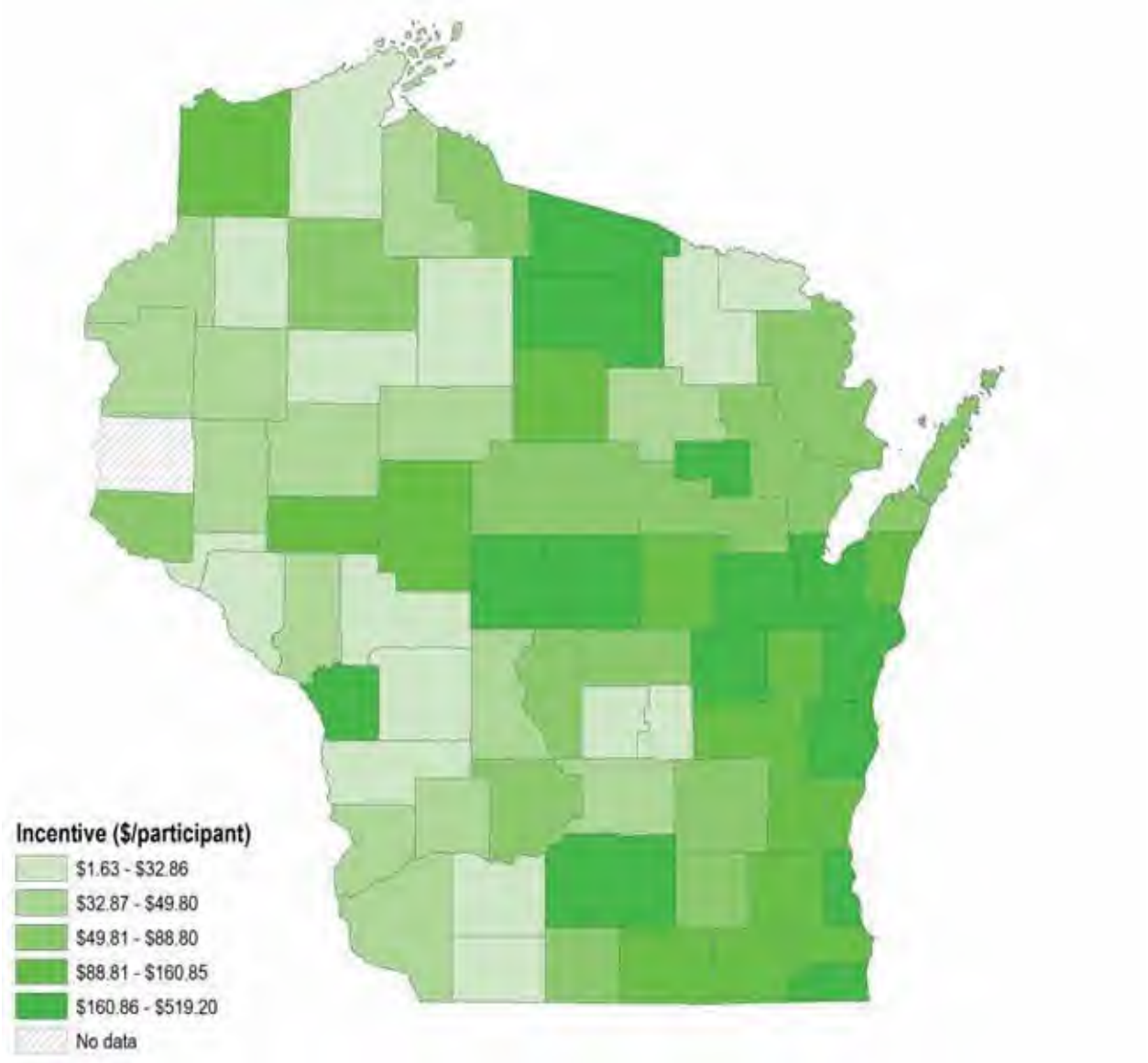
Commercial Per-Capita Energy Bill Savings by County



Commercial Participation Rate by County

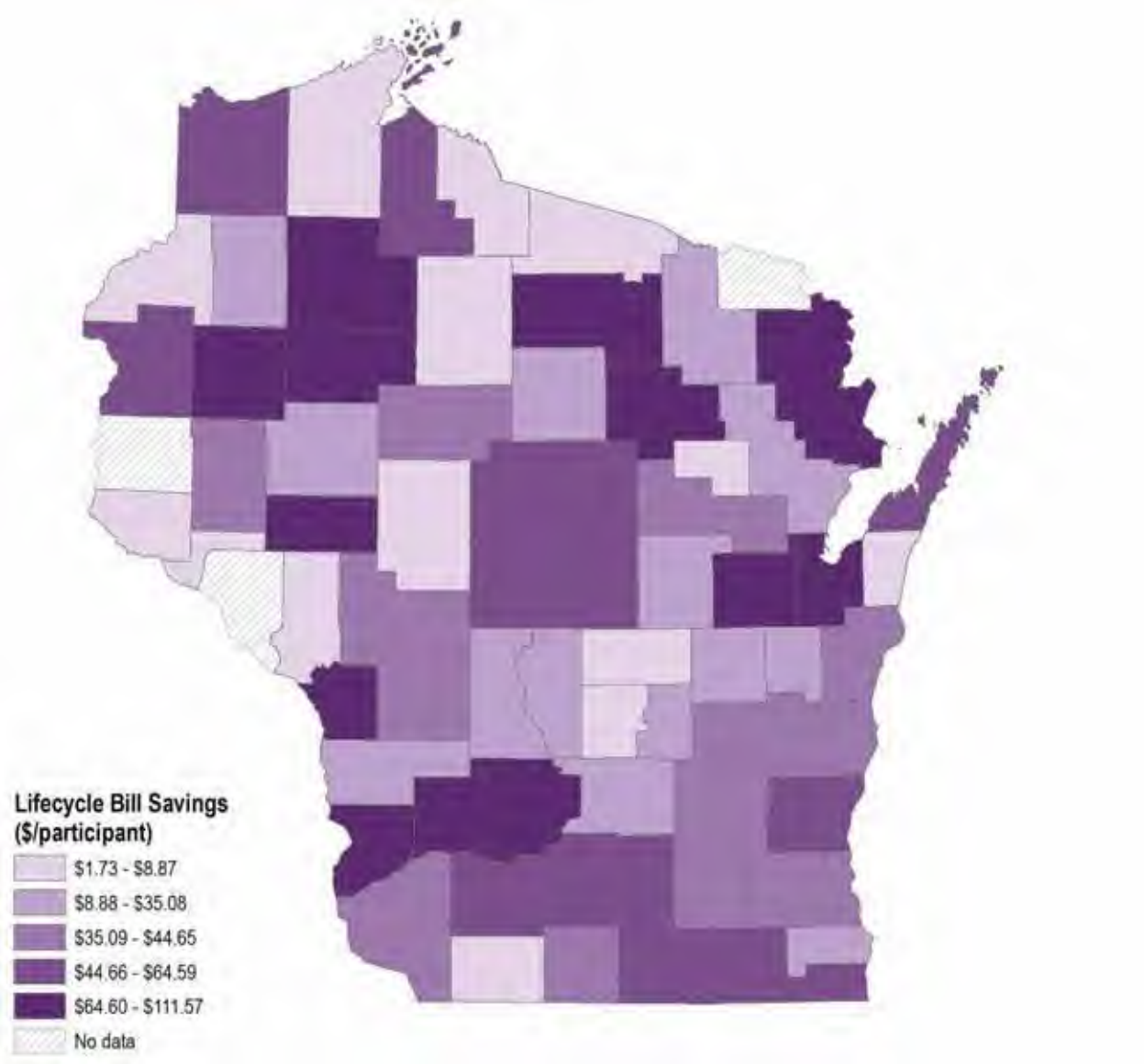


Commercial Per-Capita Incentive Dollars Awarded by County

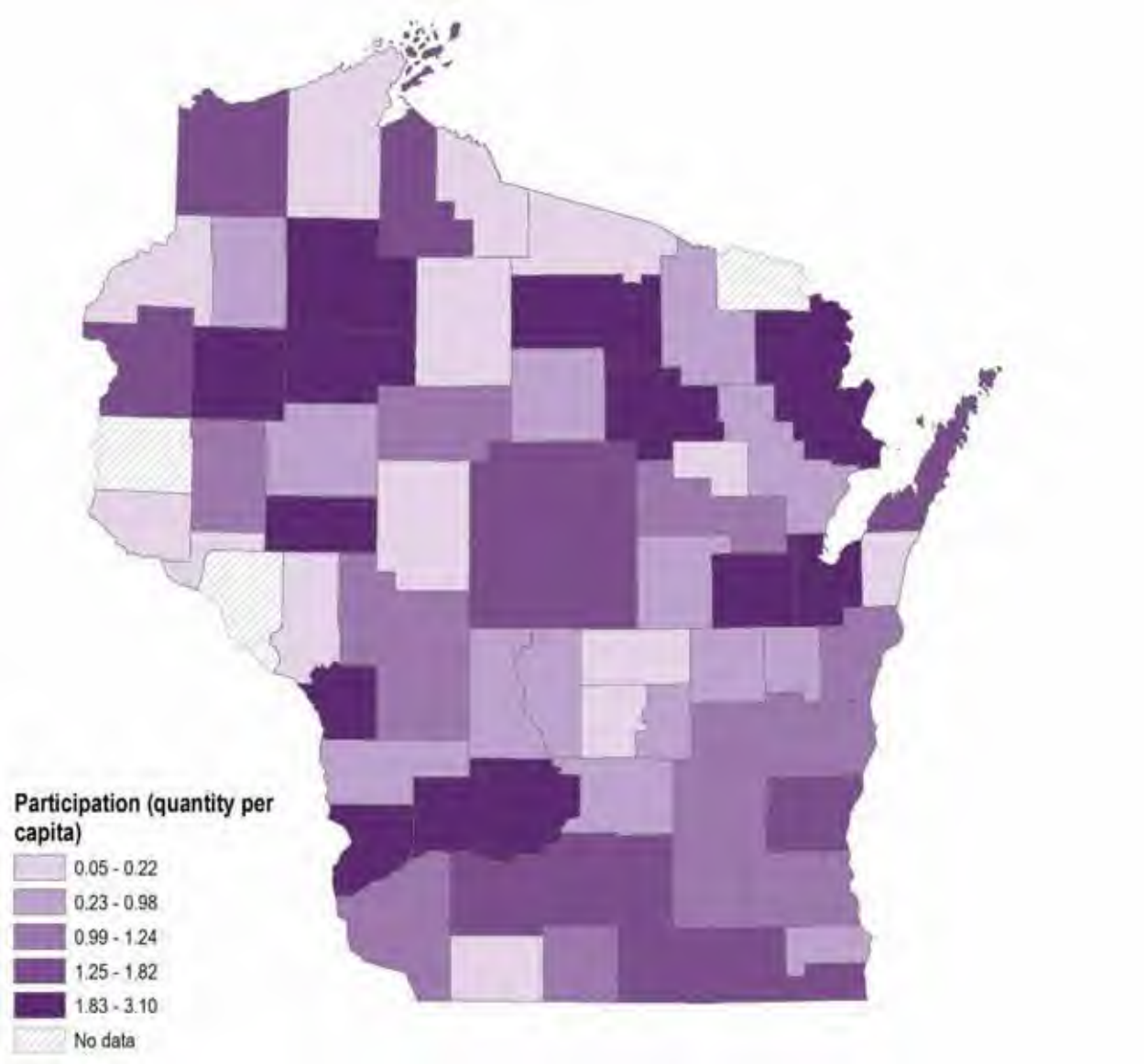


Upstream Lighting

Upstream Lighting Per-Capita Energy Bill Savings by County



Upstream Lighting Participation Rate by County



Upstream Lighting Per-Capita Incentive Dollars Awarded by County

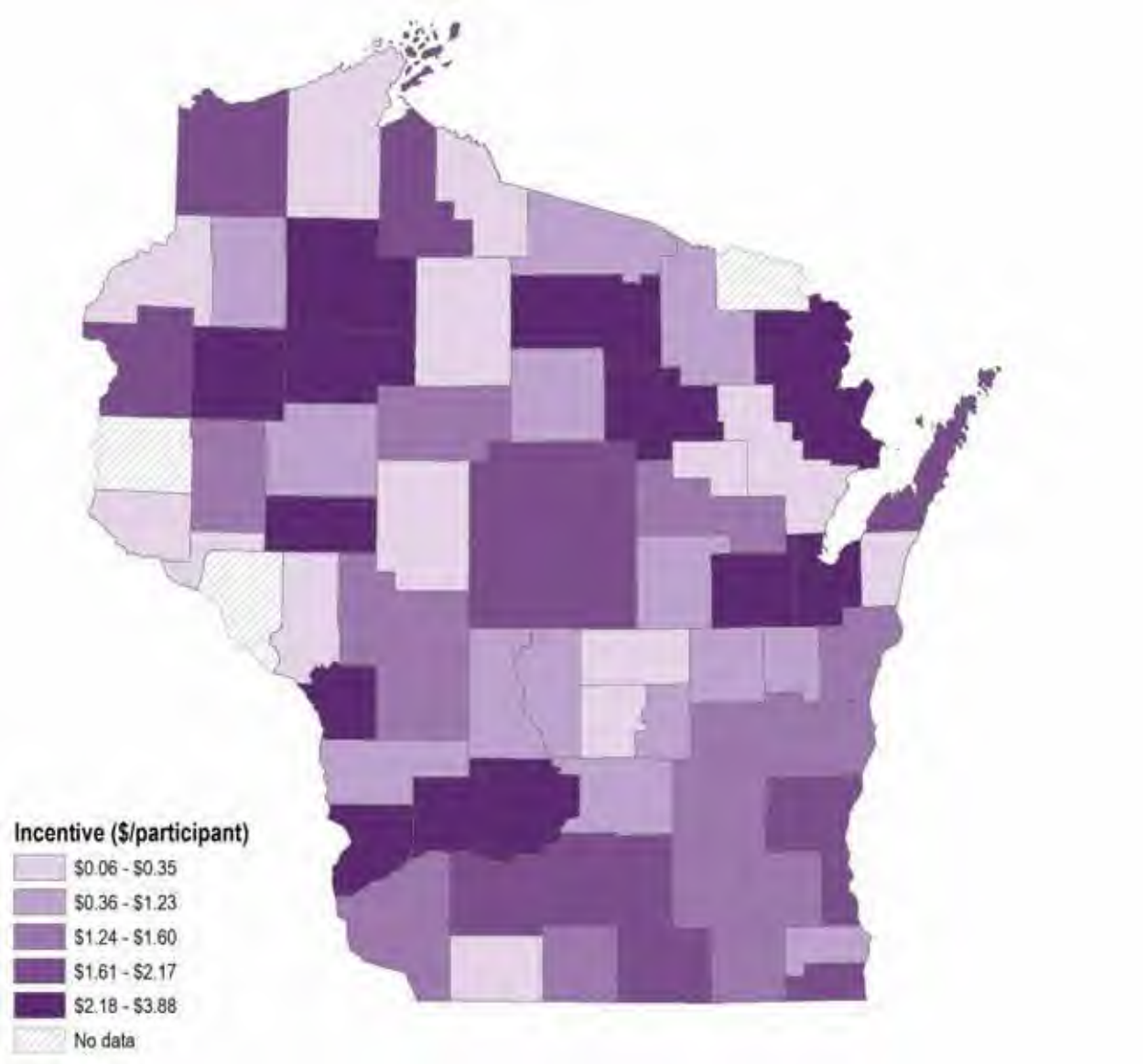


Table D-1. Savings and Participation by County and Segment

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Adams	Commercial	$1,879.13	1.5%	$56.73
Ashland	Commercial	$508.16	3.5%	$46.23
Barron	Commercial	$557.43	1.2%	$43.15
Bayfield	Commercial	$376.82	0.9%	$21.83
Brown	Commercial	$3,514.35	6.2%	$247.88
Buffalo	Commercial	$34.05	0.2%	$1.63
Burnett	Commercial	$529.34	1.3%	$33.06
Calumet	Commercial	$1,458.56	5.2%	$100.07
Chippewa	Commercial	$613.99	1.1%	$37.19
Clark	Commercial	$1,827.81	2.2%	$116.81
Columbia	Commercial	$757.04	1.3%	$44.17
Crawford	Commercial	$2,145.94	1.1%	$44.18
Dane	Commercial	$6,738.50	3.0%	$215.85
Dodge	Commercial	$1,418.50	2.0%	$88.80
Door	Commercial	$1,146.22	4.6%	$74.70
Douglas	Commercial	$2,856.14	2.4%	$154.03
Dunn	Commercial	$503.79	1.1%	$38.87
Eau Claire	Commercial	$1,176.85	2.6%	$95.40
Florence	Commercial	$1,065.03	0.8%	$26.54
Fond Du Lac	Commercial	$2,184.90	2.8%	$147.75
Forest	Commercial	$413.37	1.4%	$32.86
Grant	Commercial	$627.04	1.9%	$49.80
Green	Commercial	$2,199.67	1.5%	$86.50
Green Lake	Commercial	$272.19	1.0%	$13.13
Iowa	Commercial	$206.01	1.2%	$9.59
Iron	Commercial	$1,022.04	4.6%	$57.07
Jackson	Commercial	$235.03	0.7%	$13.18
Jefferson	Commercial	$1,036.91	2.3%	$55.33
Juneau	Commercial	$563.88	2.2%	$32.96
Kenosha	Commercial	$8,369.20	3.3%	$294.65
Kewaunee	Commercial	$1,558.56	4.9%	$99.98
La Crosse	Commercial	$4,091.11	2.3%	$259.13
Lafayette	Commercial	$316.90	1.0%	$18.71
Langlade	Commercial	$932.14	2.4%	$43.05
Lincoln	Commercial	$1,488.47	6.2%	$129.50
Manitowoc	Commercial	$2,991.85	5.5%	$214.87
Marathon	Commercial	$1,033.79	2.7%	$69.17
Marinette	Commercial	$1,193.22	3.0%	$71.50
Marquette	Commercial	$295.08	1.0%	$17.69
Menominee	Commercial	$3,702.24	8.3%	$519.20

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Milwaukee	Commercial	$5,116.47	5.4%	$253.88
Monroe	Commercial	$624.29	0.9%	$27.08
Oconto	Commercial	$864.31	2.3%	$57.49
Oneida	Commercial	$3,671.28	6.5%	$174.46
Outagamie	Commercial	$4,408.18	5.9%	$257.71
Ozaukee	Commercial	$1,815.27	4.3%	$95.50
Pepin	Commercial	$111.25	0.6%	$18.81
Pierce	Commercial	$778.00	1.0%	$78.16
Polk	Commercial	$408.41	0.6%	$35.19
Portage	Commercial	$3,958.48	4.6%	$228.21
Price	Commercial	$248.68	2.3%	$20.16
Racine	Commercial	$2,332.36	4.0%	$132.82
Richland	Commercial	$649.80	0.7%	$35.34
Rock	Commercial	$1,967.73	1.8%	$91.70
Rusk	Commercial	$213.36	0.7%	$8.64
Sauk	Commercial	$969.76	1.7%	$60.38
Sawyer	Commercial	$705.37	1.4%	$70.74
Shawano	Commercial	$900.99	2.4%	$67.70
Sheboygan	Commercial	$2,473.32	4.6%	$188.93
Taylor	Commercial	$1,089.72	0.9%	$44.52
Trempealeau	Commercial	$614.03	0.6%	$40.41
Vernon	Commercial	$289.69	0.7%	$32.71
Vilas	Commercial	$4,053.66	8.9%	$260.01
Walworth	Commercial	$1,397.73	2.7%	$92.62
Washburn	Commercial	$272.81	1.3%	$18.31
Washington	Commercial	$4,342.50	3.5%	$142.76
Waukesha	Commercial	$3,032.63	4.0%	$160.85
Waupaca	Commercial	$1,144.29	4.6%	$90.64
Waushara	Commercial	$1,069.27	2.3%	$58.44
Winnebago	Commercial	$2,511.81	4.6%	$190.10
Wood	Commercial	$2,590.52	5.5%	$188.49
Pepin	Industrial	$7.03	0.9%	$0.88
Forest	Industrial	$163.77	0.6%	$7.41
Rusk	Industrial	$7,512.58	1.8%	$307.74
Adams	Industrial	$97.43	0.5%	$5.48
Marquette	Industrial	$4,456.16	1.5%	$164.36
Lafayette	Industrial	$12,062.84	1.0%	$242.96
Richland	Industrial	$2,151.58	1.4%	$88.80
Crawford	Industrial	$2,942.47	1.4%	$144.33
Price	Industrial	$25,179.76	4.2%	$1,215.45
Taylor	Industrial	$717.82	1.6%	$79.88

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Burnett	Industrial	$245.28	0.4%	$24.90
Waushara	Industrial	$164.97	1.1%	$69.28
Kewaunee	Industrial	$31,282.99	2.0%	$1,870.95
Juneau	Industrial	$2,693.62	2.2%	$161.99
Langlade	Industrial	$502.82	0.9%	$13.59
Washburn	Industrial	$1,837.74	0.6%	$76.56
Vernon	Industrial	$102.95	0.3%	$6.43
Trempealeau	Industrial	$1,466.33	1.8%	$63.41
Sawyer	Industrial	$3.26	0.3%	$1.84
Oconto	Industrial	$1,874.03	1.4%	$54.88
Lincoln	Industrial	$504.68	1.3%	$67.09
Clark	Industrial	$5,037.93	1.3%	$116.55
Pierce	Industrial	$29.47	0.2%	$30.57
Dunn	Industrial	$314.95	1.0%	$26.38
Calumet	Industrial	$6,402.65	1.8%	$361.91
Monroe	Industrial	$389.44	1.6%	$71.10
Shawano	Industrial	$468.43	1.1%	$19.15
Vilas	Industrial	$160.74	0.2%	$80.77
Green	Industrial	$1,214.51	1.3%	$409.14
Green Lake	Industrial	$519.25	0.9%	$38.83
Douglas	Industrial	$10.67	0.2%	$2.01
Marinette	Industrial	$1,428.04	1.3%	$58.43
Grant	Industrial	$441.53	1.0%	$37.31
Door	Industrial	$664.10	0.7%	$31.46
Polk	Industrial	$628.41	0.7%	$28.34
Barron	Industrial	$290.44	0.7%	$35.97
Waupaca	Industrial	$3,065.01	2.1%	$184.94
Oneida	Industrial	$2,485.93	0.5%	$104.50
Chippewa	Industrial	$6,203.15	1.1%	$495.07
Columbia	Industrial	$1,335.89	1.2%	$64.53
Portage	Industrial	$1,081.69	1.1%	$92.39
Sauk	Industrial	$800.24	0.9%	$77.58
Manitowoc	Industrial	$5,521.44	2.9%	$517.65
Wood	Industrial	$3,868.99	1.7%	$651.19
Jefferson	Industrial	$817.01	0.9%	$82.50
Dodge	Industrial	$1,118.77	1.5%	$193.08
Fond Du Lac	Industrial	$3,834.80	1.4%	$241.84
Eau Claire	Industrial	$2,165.50	0.6%	$154.34
Sheboygan	Industrial	$2,037.11	1.5%	$182.28
Walworth	Industrial	$895.71	0.8%	$87.64
La Crosse	Industrial	$362.57	0.5%	$26.93

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Ozaukee	Industrial	$521.16	0.6%	$100.91
Kenosha	Industrial	$176.72	0.5%	$11.27
Rock	Industrial	$3,214.40	0.7%	$148.28
Marathon	Industrial	$771.68	1.5%	$67.79
Washington	Industrial	$2,049.19	1.1%	$116.43
Winnebago	Industrial	$4,160.36	2.6%	$222.59
Racine	Industrial	$1,366.76	0.8%	$171.58
Outagamie	Industrial	$2,748.71	2.1%	$128.92
Brown	Industrial	$2,907.84	1.4%	$370.77
Dane	Industrial	$638.70	0.5%	$32.52
Waukesha	Industrial	$502.41	0.9%	$45.57
Milwaukee	Industrial	$642.90	0.6%	$46.84
Adams	Residential	$46.65	0.9%	$4.45
Ashland	Residential	$34.43	4.1%	$8.79
Barron	Residential	$10.80	0.4%	$1.13
Bayfield	Residential	$56.38	2.2%	$15.59
Brown	Residential	$64.21	5.5%	$12.02
Buffalo	Residential	$7.28	0.2%	$0.61
Burnett	Residential	$29.88	0.3%	$3.00
Calumet	Residential	$74.55	3.7%	$9.81
Chippewa	Residential	$91.61	5.9%	$12.66
Clark	Residential	$28.18	0.9%	$3.55
Columbia	Residential	$25.45	1.2%	$3.48
Crawford	Residential	$16.77	0.4%	$3.99
Dane	Residential	$90.25	2.0%	$10.14
Dodge	Residential	$30.85	1.8%	$3.77
Door	Residential	$154.97	1.1%	$21.34
Douglas	Residential	$4.29	0.3%	$1.01
Dunn	Residential	$30.87	2.3%	$5.11
Eau Claire	Residential	$117.82	7.8%	$20.49
Florence	Residential	$23.91	3.4%	$3.61
Fond Du Lac	Residential	$32.00	1.5%	$4.45
Forest	Residential	$13.80	0.7%	$2.93
Grant	Residential	$31.71	0.7%	$5.53
Green	Residential	$34.07	3.4%	$5.55
Green Lake	Residential	$28.69	1.3%	$3.74
Iowa	Residential	$27.90	0.8%	$3.50
Iron	Residential	$4.01	0.3%	$1.20
Jackson	Residential	$24.39	1.9%	$3.02
Jefferson	Residential	$40.65	2.0%	$4.69
Juneau	Residential	$12.03	0.3%	$1.51

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Kenosha	Residential	$30.87	0.9%	$3.88
Kewaunee	Residential	$18.62	1.1%	$2.67
La Crosse	Residential	$30.34	1.2%	$5.02
Lafayette	Residential	$18.72	0.9%	$3.45
Langlade	Residential	$13.24	0.6%	$2.23
Lincoln	Residential	$61.59	1.1%	$4.47
Manitowoc	Residential	$58.85	6.3%	$9.72
Marathon	Residential	$35.19	1.3%	$5.20
Marinette	Residential	$24.73	1.0%	$4.58
Marquette	Residential	$19.07	0.8%	$2.13
Menominee	Residential	$12.72	0.5%	$1.70
Milwaukee	Residential	$45.08	1.3%	$6.99
Monroe	Residential	$25.27	0.8%	$3.28
Oconto	Residential	$47.76	3.1%	$7.58
Oneida	Residential	$24.89	1.1%	$3.31
Outagamie	Residential	$70.12	4.4%	$10.46
Ozaukee	Residential	$75.66	2.3%	$9.39
Pepin	Residential	$96.21	0.3%	$2.67
Pierce	Residential	$89.57	1.1%	$7.61
Polk	Residential	$10.89	0.2%	$1.84
Portage	Residential	$42.56	1.6%	$6.50
Price	Residential	$11.09	0.3%	$1.57
Racine	Residential	$46.47	1.4%	$6.39
Richland	Residential	$29.72	1.0%	$4.83
Rock	Residential	$20.93	1.0%	$4.75
Rusk	Residential	$2.50	0.2%	$0.54
Sauk	Residential	$32.68	1.4%	$3.89
Sawyer	Residential	$52.51	0.2%	$3.48
Shawano	Residential	$21.60	0.7%	$2.87
Sheboygan	Residential	$32.72	1.5%	$5.13
Taylor	Residential	$14.35	0.7%	$2.96
Trempealeau	Residential	$34.42	1.1%	$6.33
Vernon	Residential	$9.75	0.3%	$2.04
Vilas	Residential	$17.83	1.0%	$2.84
Walworth	Residential	$34.12	1.6%	$4.92
Washburn	Residential	$23.64	0.1%	$1.42
Washington	Residential	$58.44	2.3%	$6.99
Waukesha	Residential	$75.87	2.7%	$9.37
Waupaca	Residential	$27.30	1.0%	$4.06
Waushara	Residential	$20.88	0.9%	$2.52
Winnebago	Residential	$53.71	2.1%	$7.05

County	Segment	Per-Capita Life-Cycle Bill Savings ($)	Participation Rate (%)	Per-Capita Incentive ($)
Wood	Residential	$34.21	1.7%	$4.91
Taylor	Residential	$46.65	0.9%	$4.45
Trempealeau	Residential	$34.43	4.1%	$8.79
Vernon	Residential	$10.80	0.4%	$1.13
Vilas	Residential	$56.38	2.2%	$15.59
Walworth	Residential	$64.21	5.5%	$12.02
Washburn	Residential	$7.28	0.2%	$0.61
Washington	Residential	$29.88	0.3%	$3.00
Waukesha	Residential	$74.55	3.7%	$9.81
Waupaca	Residential	$91.61	5.9%	$12.66
Waushara	Residential	$28.18	0.9%	$3.55
Winnebago	Residential	$25.45	1.2%	$3.48
Wood	Residential	$16.77	0.4%	$3.99

Table D- 2. Upstream Lighting Savings and Participation by County

County	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
Adams	$9.21	0.25	$0.38
Ashland	$64.59	1.82	$2.17
Barron	$70.81	1.94	$2.47
Bayfield	$1.73	0.05	$0.06
Brown	$85.17	2.37	$3.13
Buffalo			
Burnett	$5.91	0.15	$0.20
Calumet	$18.58	0.51	$0.65
Chippewa	$26.97	0.74	$0.92
Clark	$4.12	0.09	$0.22
Columbia	$33.28	0.93	$1.10
Crawford	$103.62	2.78	$3.49
Dane	$51.19	1.44	$1.78
Dodge	$42.41	1.17	$1.47
Door	$59.94	1.68	$2.13
Douglas	$52.15	1.41	$1.79
Dunn	$40.25	1.14	$1.34
Eau Claire	$75.33	2.09	$2.71
Florence			
Fond Du Lac	$40.19	1.10	$1.46
Forest	$21.45	0.57	$0.76
Grant	$41.58	1.12	$1.44

County	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
Green	$37.96	1.06	$1.27
Green Lake	$28.42	0.79	$0.93
Iowa	$50.61	1.42	$1.66
Iron	$4.51	0.11	$0.16
Jackson	$40.83	1.15	$1.36
Jefferson	$39.12	1.10	$1.38
Juneau	$10.33	0.28	$0.37
Kenosha	$52.00	1.45	$1.92
Kewaunee	$3.41	0.09	$0.12
La Crosse	$77.33	2.15	$2.81
Lafayette	$3.58	0.10	$0.13
Langlade	$89.15	2.42	$3.10
Lincoln	$26.94	0.75	$0.93
Manitowoc	$37.35	1.01	$1.32
Marathon	$58.91	1.65	$2.16
Marinette	$77.49	2.06	$2.73
Marquette	$4.27	0.12	$0.15
Menominee	$5.84	0.11	$0.21
Milwaukee	$44.65	1.24	$1.60
Monroe	$40.75	1.13	$1.35
Oconto	$9.27	0.24	$0.35
Oneida	$111.57	3.10	$3.88
Outagamie	$73.37	2.05	$2.59
Ozaukee	$48.52	1.35	$1.65
Pepin	$1.90	0.05	$0.07
Pierce	$2.92	0.08	$0.12
Polk	$54.85	1.54	$1.92
Portage	$61.54	1.71	$2.16
Price	$7.72	0.19	$0.28
Racine	$35.08	0.98	$1.23
Richland	$66.01	1.85	$2.21
Rock	$53.94	1.49	$1.88
Rusk	$79.92	2.27	$2.65
Sauk	$83.90	2.35	$2.92
Sawyer	$83.00	2.35	$2.60
Shawano	$39.90	1.09	$1.44
Sheboygan	$43.76	1.22	$1.56
Taylor	$42.49	1.19	$1.39

County	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
Trempealeau	$3.38	0.08	$0.12
Vernon	$29.30	0.83	$1.01
Vilas	$8.87	0.22	$0.59
Walworth	$47.44	1.32	$1.60
Washburn	$12.43	0.33	$0.46
Washington	$58.37	1.62	$2.07
Waukesha	$39.32	1.09	$1.38
Waupaca	$24.36	0.69	$0.85
Waushara	$5.80	0.15	$0.21
Winnebago	$31.49	0.86	$1.11
Wood	$55.93	1.53	$2.00

Appendix E. Summary of Savings by Political District

The maps in this appendix summarize the evaluation findings by assembly district and senate district in the residential, commercial, and industrial sectors.

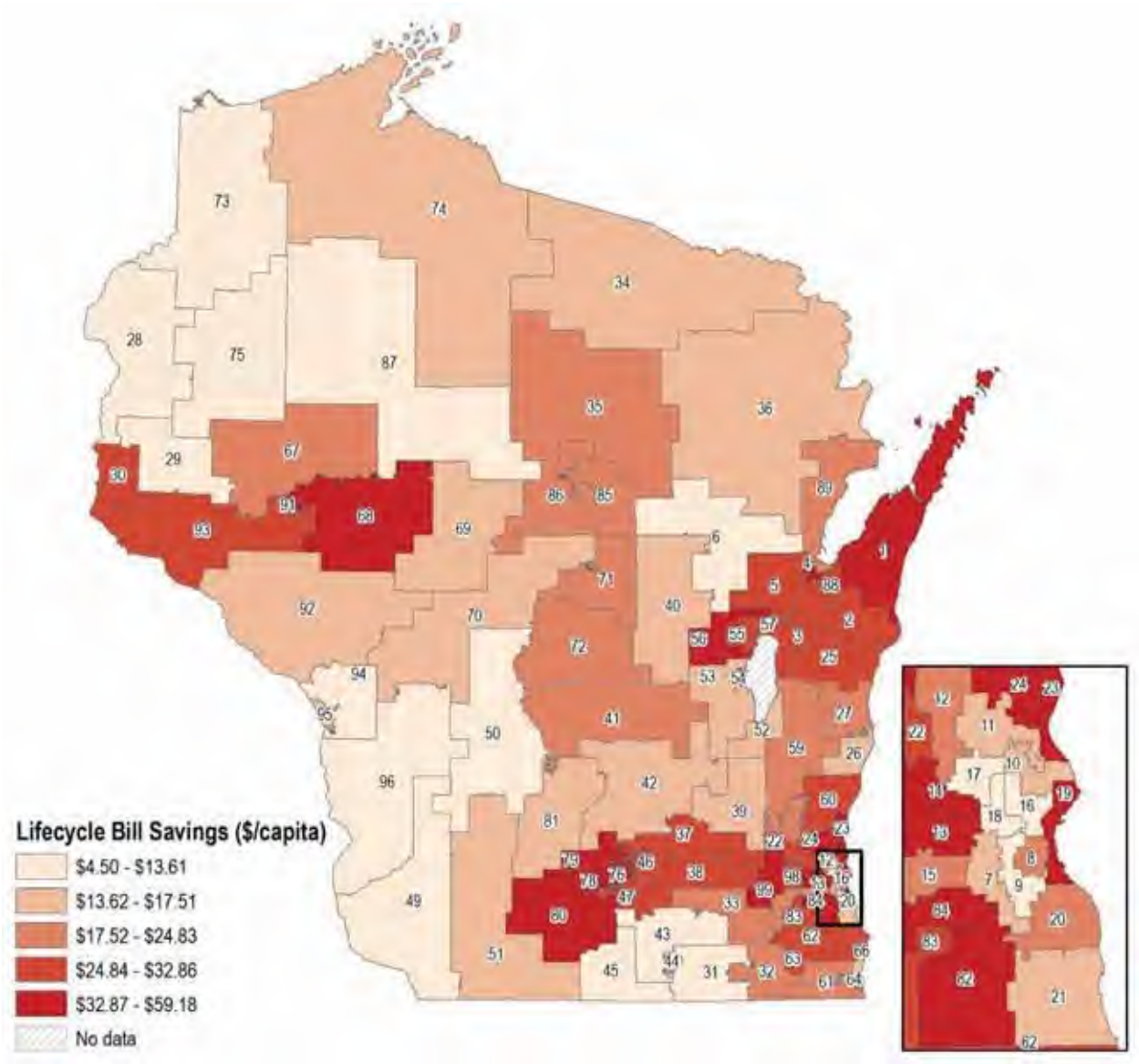
2014 Savings by Segment, by Assembly District

The following section includes twenty four maps based on the results of the 2014 evaluation: three assembly district and three senate district maps (total lifetime bill savings, total 2014 participation, and total incentive paid in 2014) each for three primary segments (residential, industrial, and commercial), as well as six maps with upstream lighting per-capita lifetime bill savings, 2014 participation rates, and per-capita incentives paid in 2014 by assembly and senate districts. Commercial maps include commercial businesses, schools, government, and agricultural entities.

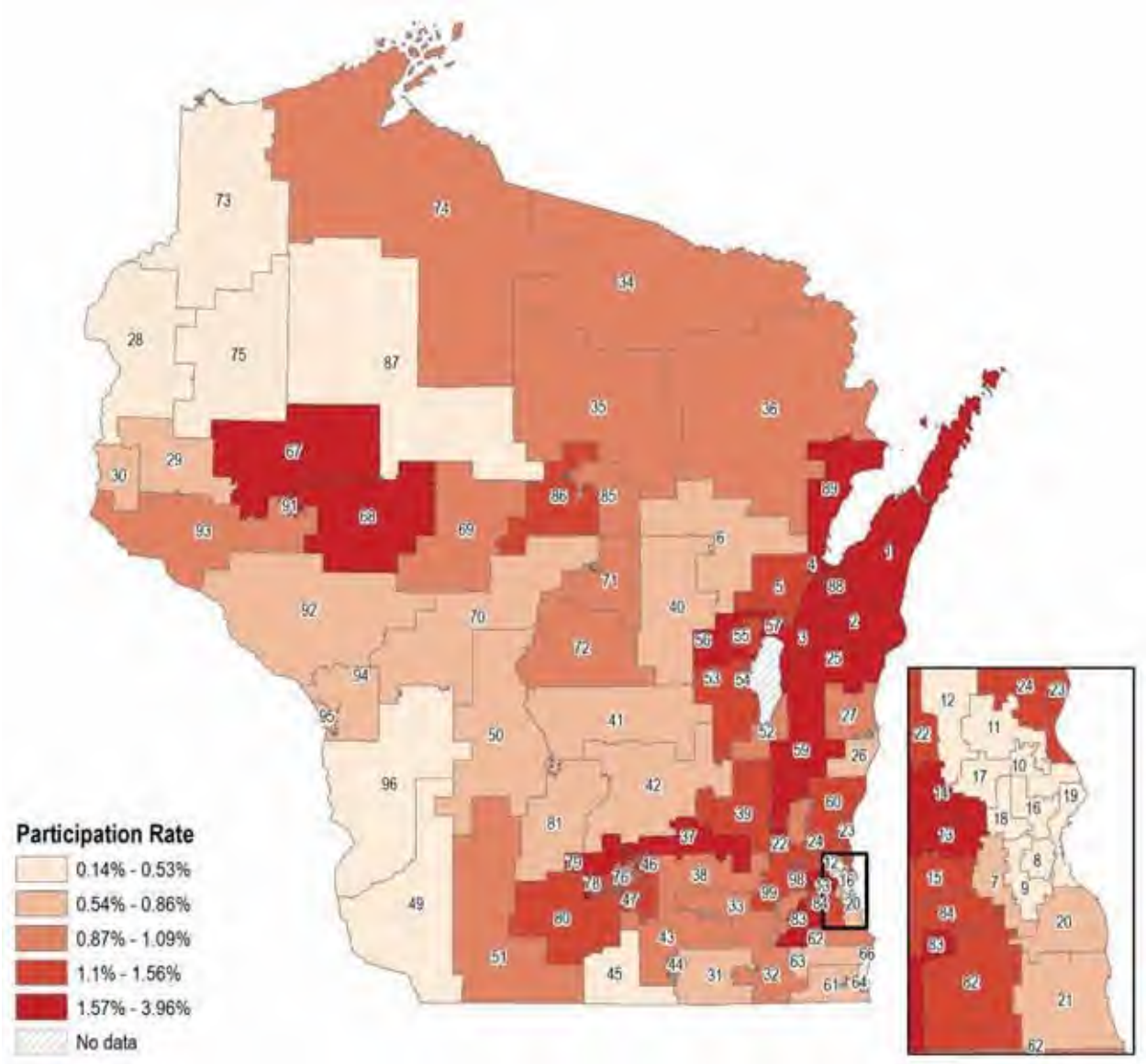
Similar to the 2011, 2012, and 2013 evaluation reports, the bill savings are defined as evaluated life-cycle verified gross energy savings multiplied by the retail rate of delivered energy in 2014. The participation is defined as total participation within each assembly/senate district. The incentives are defined as total incentives within each assembly/senate district.

Residential

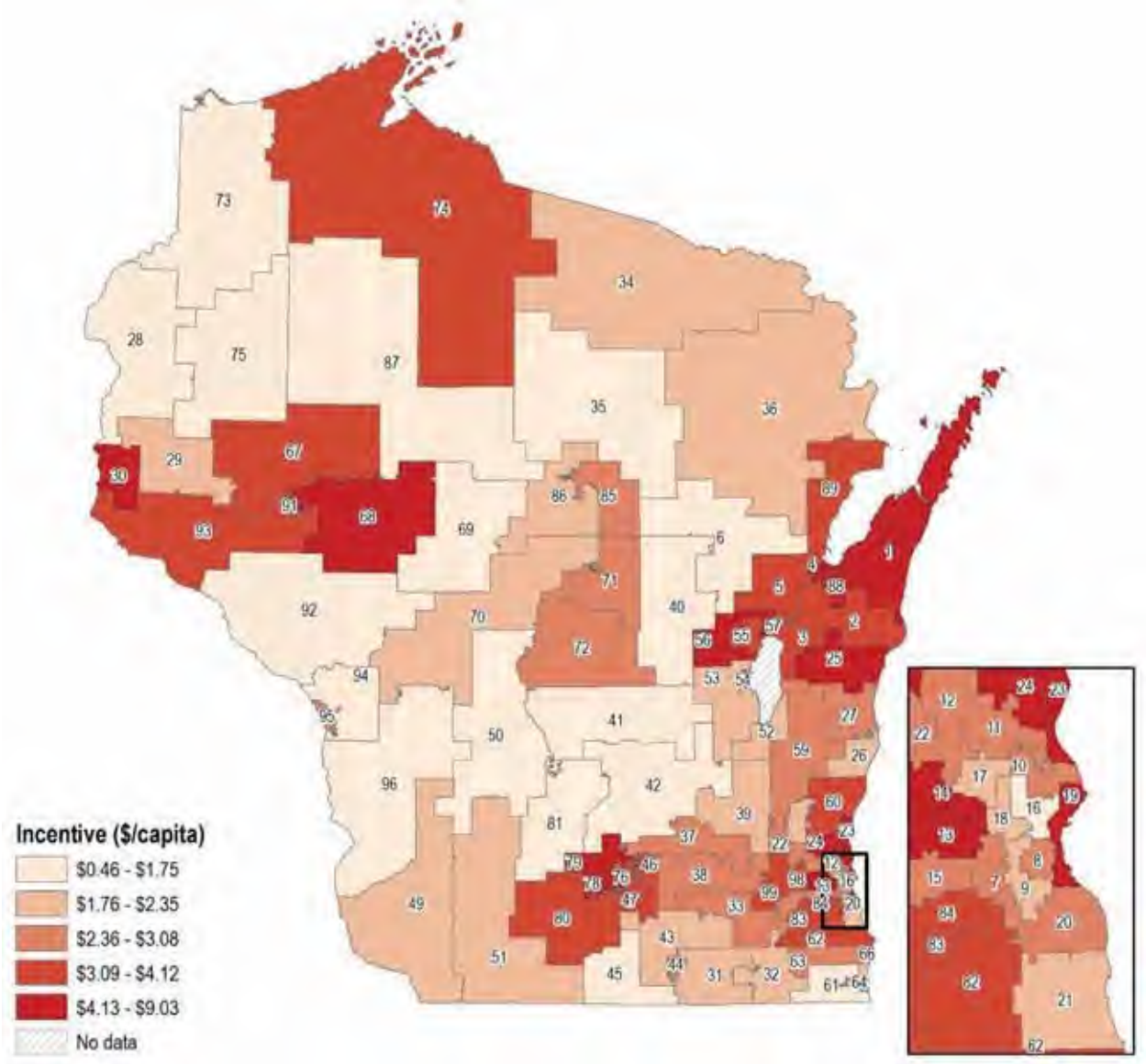
Residential Energy Bill Savings by Assembly District



Residential Participation by Assembly District

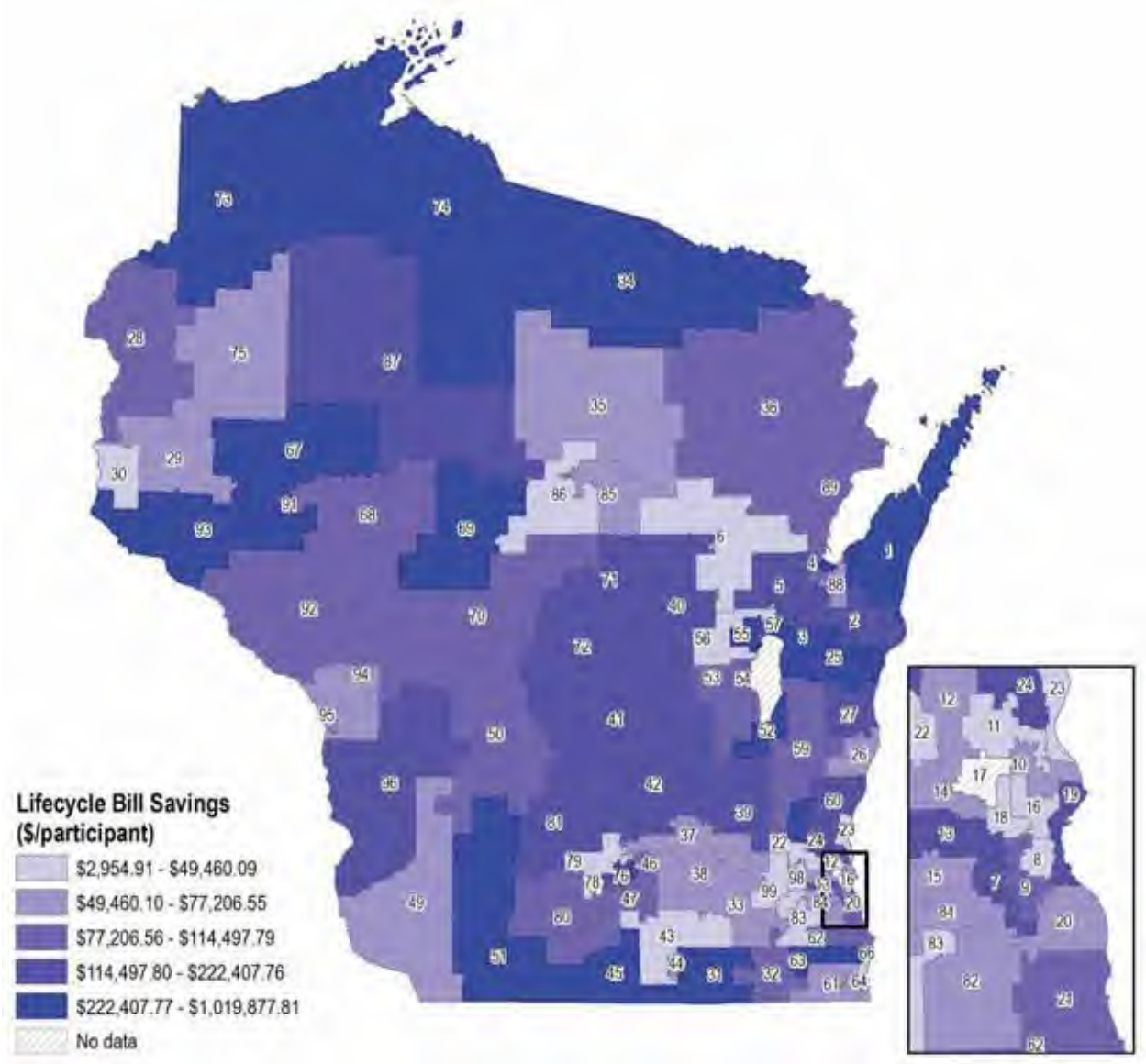


Residential Incentive Dollars Awarded by Assembly District

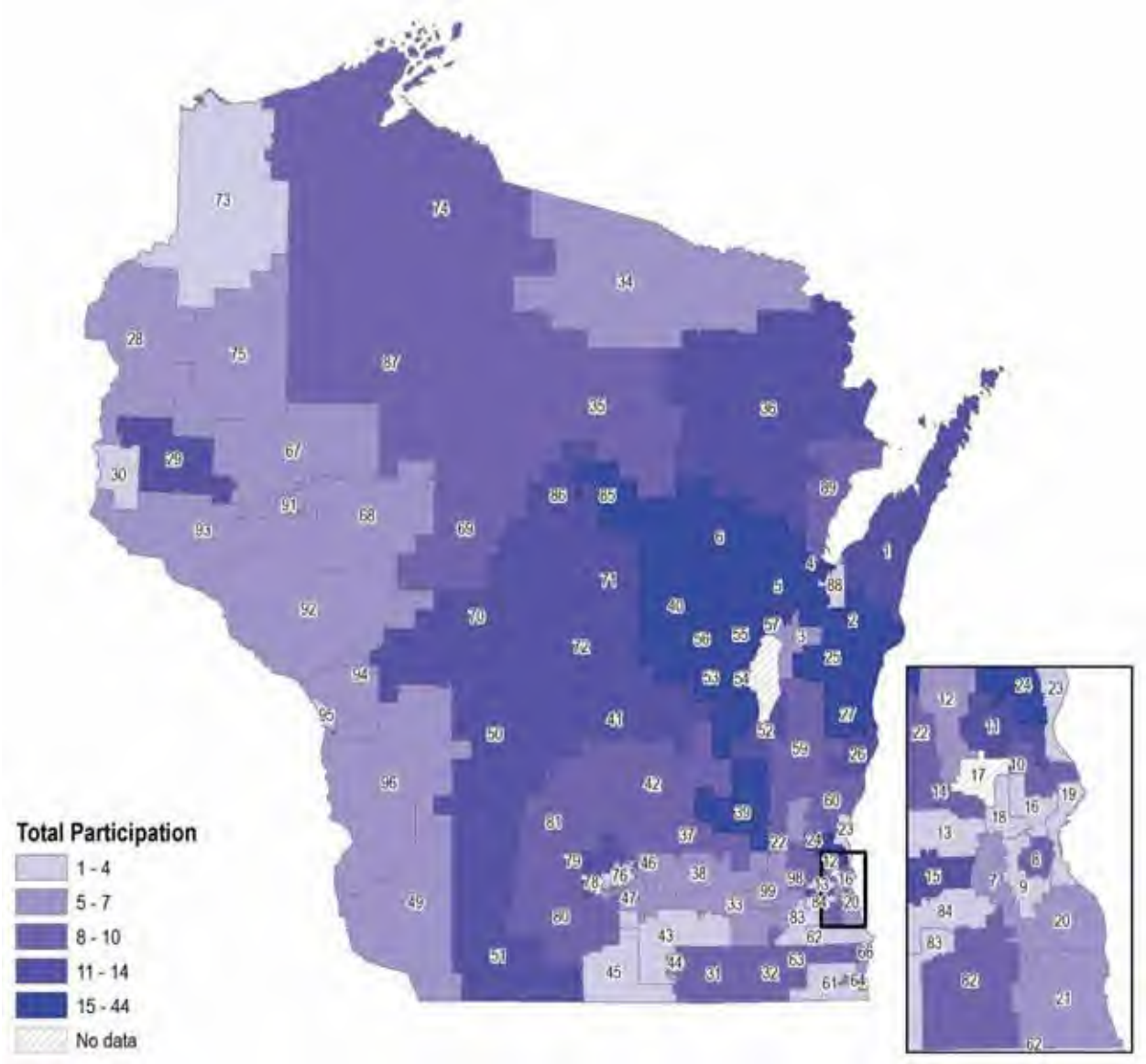


Industrial

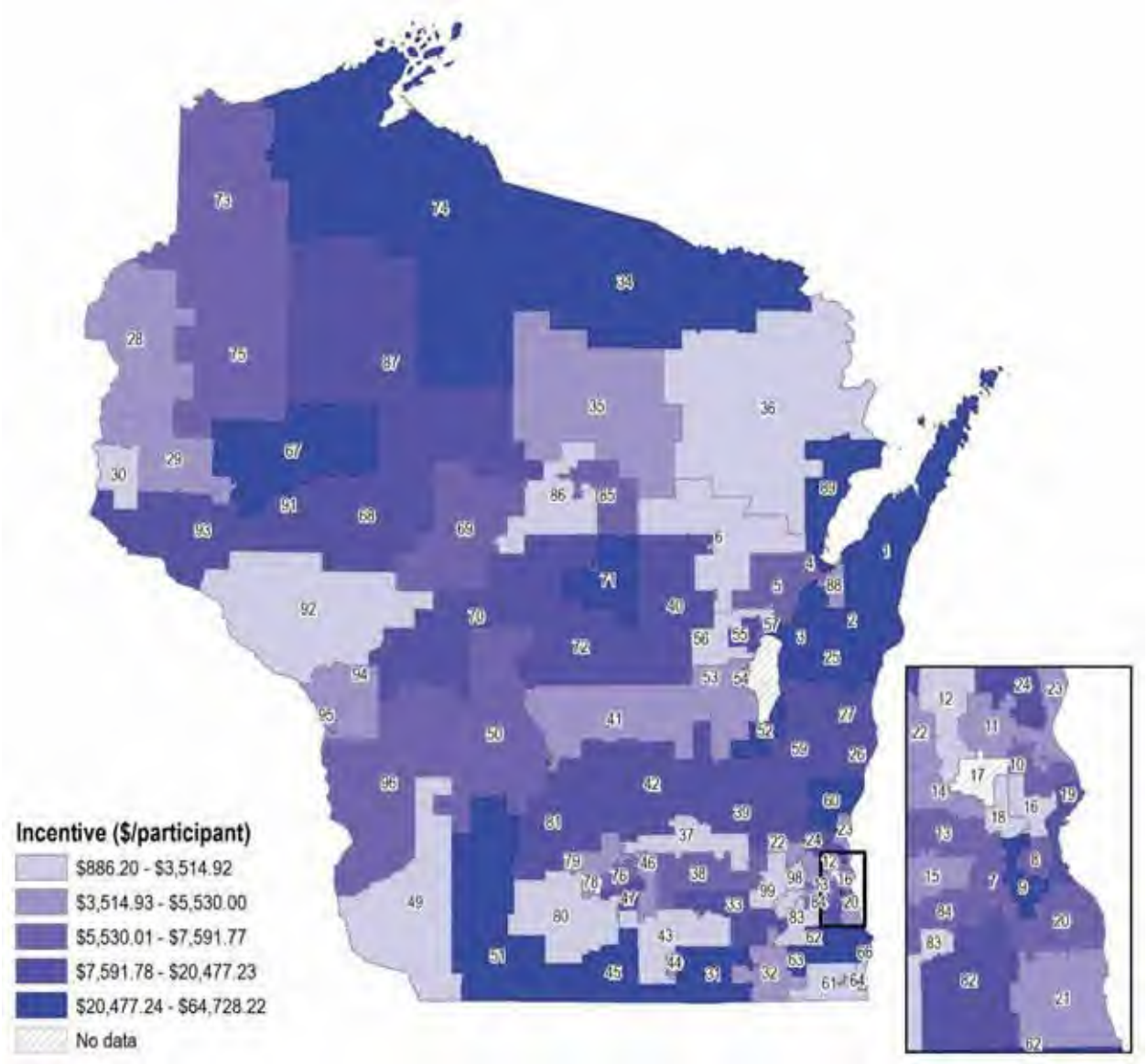
Industrial Energy Bill Savings by Assembly District



Industrial Participation by Assembly District

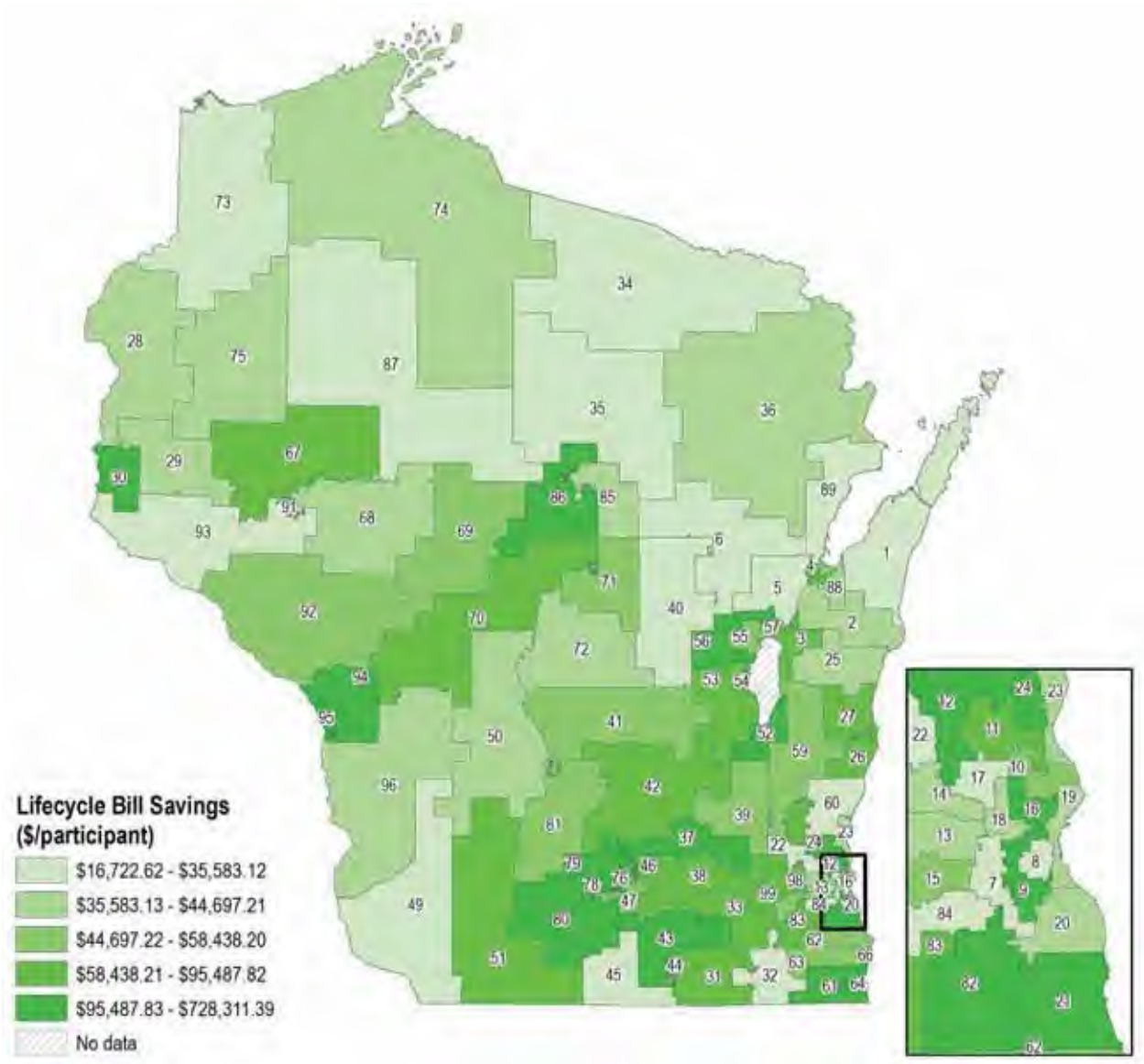


Industrial Incentive Dollars Awarded by Assembly District

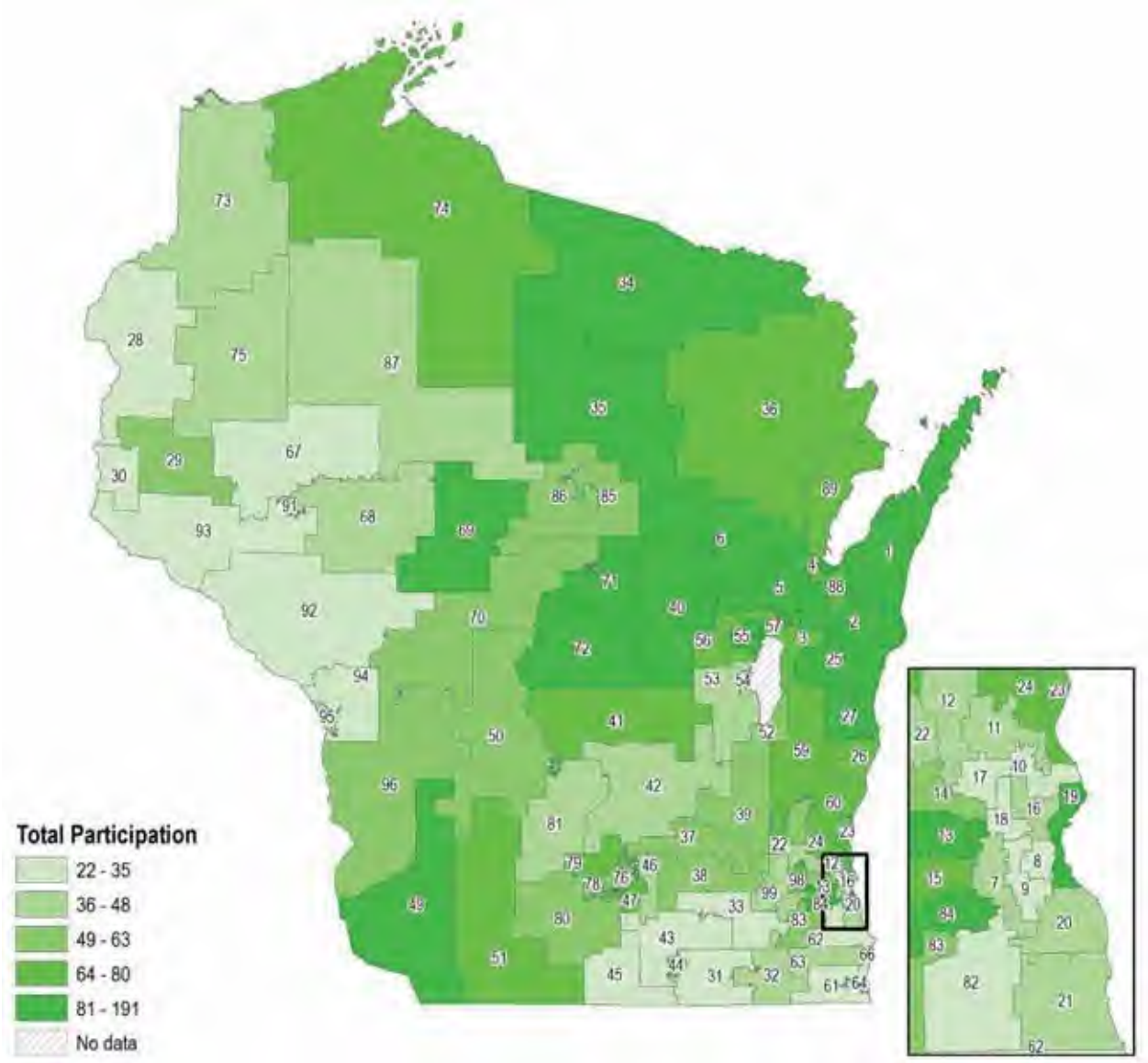


Commercial

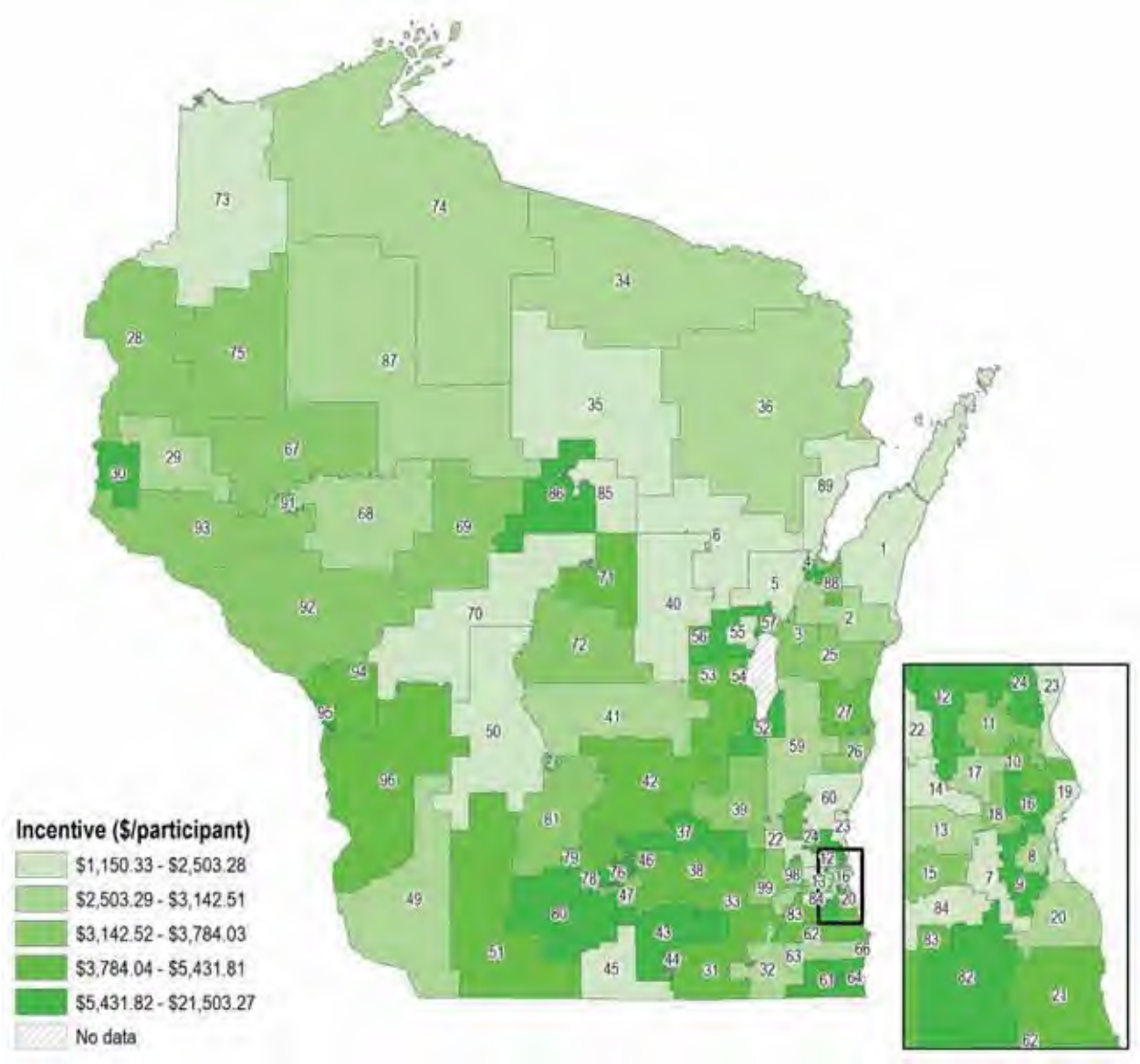
Commercial Energy Bill Savings by Assembly District



Commercial Participation by Assembly District

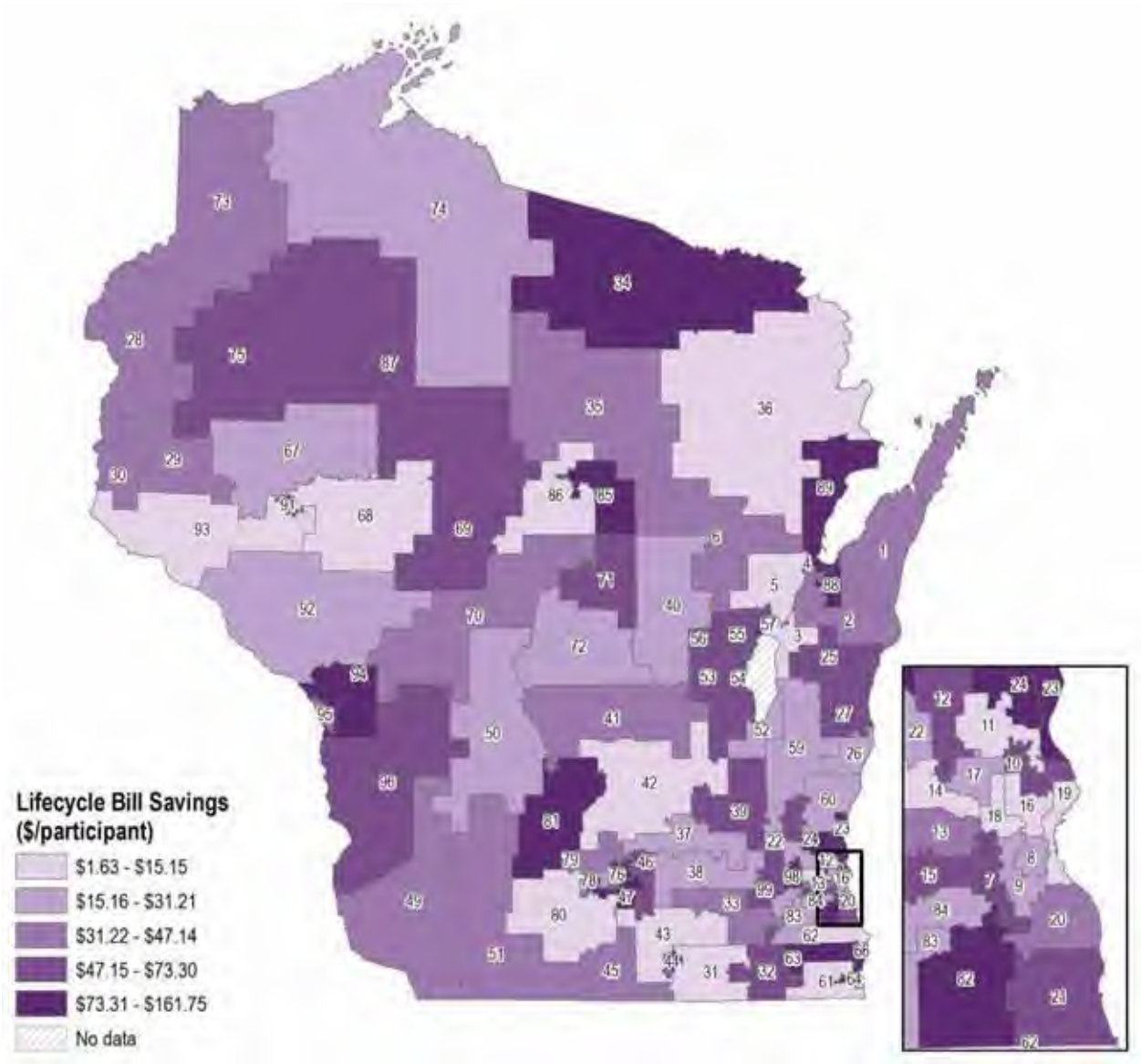


Commercial Incentive Dollars Awarded by Assembly District

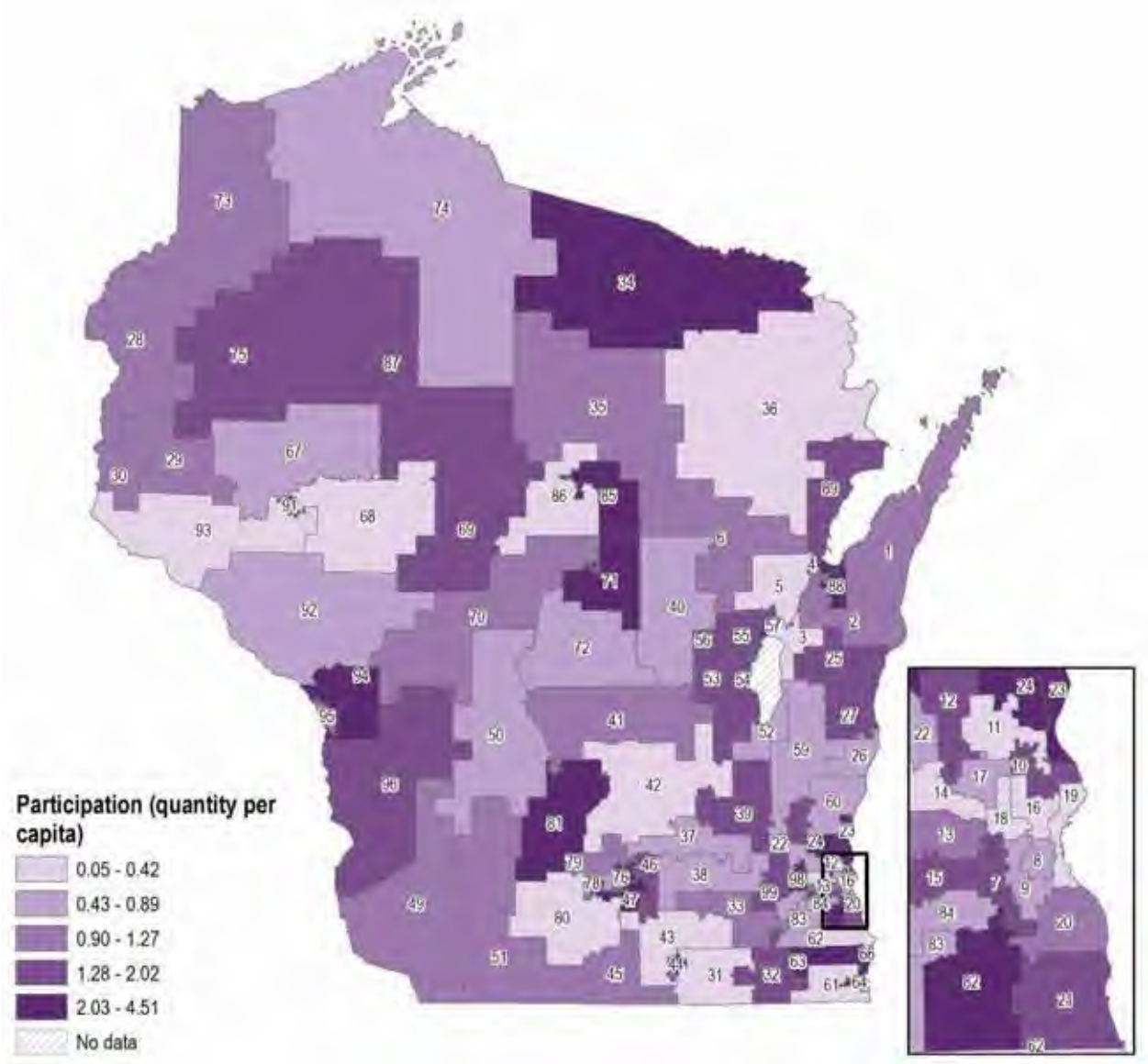


Lighting

Lighting Energy Bill Savings by Assembly District



Lighting Participation by Assembly District



Lighting Incentive Dollars Awarded by Assembly District

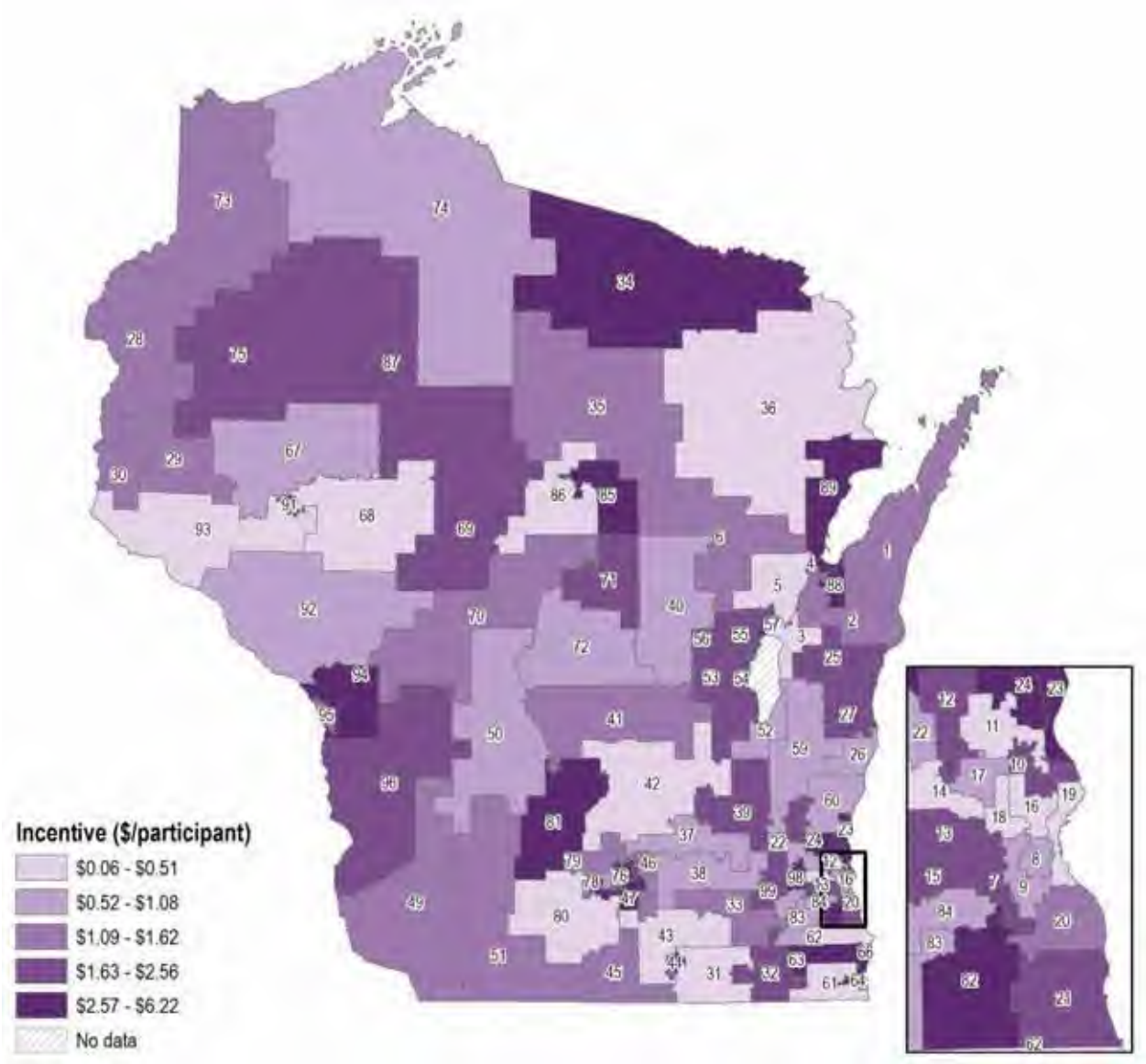


Table E-1. Residential Savings and Participation by Assembly District

Assembly District	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
1	Residential	$52.51	1.6%	$6.43
2	Residential	$31.73	2.2%	$3.93
3	Residential	$32.86	1.8%	$3.85
4	Residential	$34.69	4.0%	$6.64
5	Residential	$31.69	1.5%	$3.75
6	Residential	$13.61	0.7%	$1.56
7	Residential	$17.30	0.8%	$2.59
8	Residential	$20.37	0.1%	$2.90
9	Residential	$7.76	0.4%	$1.97
10	Residential	$16.14	0.4%	$2.95
11	Residential	$15.91	0.4%	$2.54
12	Residential	$19.18	0.5%	$2.40
13	Residential	$32.95	1.8%	$4.26
14	Residential	$42.29	2.3%	$5.63
15	Residential	$24.83	1.3%	$2.94
16	Residential	$5.25	0.2%	$1.24
17	Residential	$8.61	0.5%	$2.33
18	Residential	$8.63	0.3%	$1.97
19	Residential	$36.03	0.4%	$4.62
20	Residential	$19.07	0.8%	$2.57
21	Residential	$15.70	0.8%	$1.87
22	Residential	$29.45	1.4%	$2.97
23	Residential	$33.32	1.4%	$4.35
24	Residential	$46.51	1.3%	$4.95
25	Residential	$28.90	3.1%	$4.23
26	Residential	$14.15	0.9%	$2.31
27	Residential	$20.66	1.1%	$2.37
28	Residential	$5.43	0.1%	$0.96
29	Residential	$12.30	0.8%	$2.35
30	Residential	$28.54	0.8%	$5.60
31	Residential	$12.17	0.7%	$1.89
32	Residential	$17.55	0.9%	$2.30
33	Residential	$19.43	0.9%	$2.36
34	Residential	$15.75	1.0%	$1.78
35	Residential	$21.15	0.9%	$1.72
36	Residential	$17.51	0.9%	$2.01
37	Residential	$26.80	1.7%	$2.57

Assembly District	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
38	Residential	$26.35	1.1%	$3.02
39	Residential	$17.11	1.2%	$2.01
40	Residential	$15.20	0.7%	$1.65
41	Residential	$17.58	0.7%	$1.70
42	Residential	$15.56	0.8%	$1.42
43	Residential	$12.81	0.9%	$1.83
44	Residential	$9.52	0.6%	$2.57
45	Residential	$8.44	0.5%	$1.11
46	Residential	$28.98	1.3%	$3.40
47	Residential	$32.74	1.1%	$3.42
48	Residential	$42.37	1.0%	$3.87
49	Residential	$12.72	0.4%	$2.09
50	Residential	$12.14	0.7%	$1.44
51	Residential	$14.12	1.0%	$1.92
52	Residential	$16.72	1.0%	$2.09
53	Residential	$16.80	1.1%	$1.96
54	Residential	$31.26	1.3%	$3.45
55	Residential	$29.57	1.2%	$3.27
56	Residential	$35.51	2.6%	$4.68
57	Residential	$29.79	2.7%	$5.15
58	Residential	$23.18	1.0%	$2.25
59	Residential	$21.96	1.6%	$2.37
60	Residential	$31.43	1.1%	$3.26
61	Residential	$18.70	0.6%	$1.75
62	Residential	$25.89	1.0%	$3.18
63	Residential	$28.08	0.8%	$3.08
64	Residential	$16.31	0.5%	$1.90
65	Residential	$7.26	0.4%	$1.29
66	Residential	$9.03	0.4%	$1.59
67	Residential	$24.39	1.7%	$3.68
68	Residential	$40.02	2.3%	$5.61
69	Residential	$14.82	0.9%	$1.69
70	Residential	$16.73	0.8%	$1.86
71	Residential	$21.01	1.0%	$2.81
72	Residential	$19.61	1.1%	$2.44
73	Residential	$7.28	0.1%	$0.68
74	Residential	$15.47	1.0%	$3.30
75	Residential	$4.50	0.2%	$0.46

Assembly District	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
76	Residential	$59.18	0.5%	$4.60
77	Residential	$43.92	1.2%	$7.12
78	Residential	$37.10	1.1%	$4.54
79	Residential	$58.42	1.8%	$5.50
80	Residential	$34.31	1.3%	$3.28
81	Residential	$15.00	0.7%	$1.68
82	Residential	$42.88	1.2%	$4.12
83	Residential	$31.96	2.0%	$3.55
84	Residential	$39.31	1.4%	$3.86
85	Residential	$20.36	1.0%	$2.58
86	Residential	$19.13	1.2%	$2.32
87	Residential	$10.54	0.3%	$1.08
88	Residential	$27.86	2.2%	$4.40
89	Residential	$23.44	2.2%	$3.88
90	Residential	$20.48	2.1%	$4.57
91	Residential	$48.71	3.9%	$9.03
92	Residential	$14.99	0.6%	$1.75
93	Residential	$28.38	1.1%	$3.18
94	Residential	$11.70	0.6%	$1.73
95	Residential	$15.09	0.6%	$2.42
96	Residential	$7.07	0.3%	$1.14
97	Residential	$21.97	1.0%	$2.70
98	Residential	$30.06	1.1%	$3.51
99	Residential	$36.37	1.6%	$3.83

Table E-2. Nonresidential Savings and Participation by Assembly District and Segment

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
1	Commercial	$30,806.36	191	$1,953.52
2	Commercial	$40,599.95	112	$3,142.51
3	Commercial	$73,725.29	71	$3,545.53
4	Commercial	$88,942.30	80	$5,948.60
5	Commercial	$29,642.08	110	$1,909.94
6	Commercial	$34,239.37	93	$2,047.84
7	Commercial	$18,346.15	37	$1,611.37
8	Commercial	$27,955.35	31	$2,801.05
9	Commercial	$117,561.38	33	$12,856.93
10	Commercial	$54,881.93	31	$4,992.61
11	Commercial	$67,081.56	38	$3,382.14
12	Commercial	$140,331.78	38	$7,057.86
13	Commercial	$37,800.34	102	$2,612.40
14	Commercial	$44,094.25	63	$2,503.28
15	Commercial	$52,929.73	80	$3,369.58
16	Commercial	$625,367.30	47	$12,522.41
17	Commercial	$27,606.58	22	$2,911.34
18	Commercial	$40,096.15	32	$3,580.42
19	Commercial	$35,843.05	183	$2,458.57
20	Commercial	$38,991.60	39	$2,814.83
21	Commercial	$103,032.42	39	$4,981.60
22	Commercial	$34,777.40	48	$1,980.30
23	Commercial	$35,752.46	65	$1,997.26
24	Commercial	$728,311.39	75	$19,795.54
25	Commercial	$43,957.71	124	$3,430.75
26	Commercial	$63,650.43	77	$3,154.92
27	Commercial	$67,358.03	91	$5,431.81
28	Commercial	$40,771.17	30	$3,719.44
29	Commercial	$38,370.47	53	$3,094.57
30	Commercial	$107,189.77	28	$8,377.68
31	Commercial	$76,570.64	34	$4,674.60
32	Commercial	$32,535.52	48	$2,602.88
33	Commercial	$90,983.80	35	$4,660.78
34	Commercial	$31,386.71	138	$2,504.09
35	Commercial	$26,392.78	121	$2,019.89
36	Commercial	$36,566.71	76	$2,526.68
37	Commercial	$187,480.28	51	$11,853.69
38	Commercial	$82,496.46	56	$4,013.31

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
39	Commercial	$45,723.67	49	$3,211.75
40	Commercial	$33,707.90	125	$2,346.99
41	Commercial	$55,755.83	78	$3,129.50
42	Commercial	$78,982.40	39	$4,114.23
43	Commercial	$113,882.64	34	$5,743.45
44	Commercial	$36,327.68	40	$2,749.45
45	Commercial	$16,722.62	26	$2,021.16
46	Commercial	$65,447.83	38	$3,888.61
47	Commercial	$50,562.86	66	$3,659.30
48	Commercial	$95,487.82	60	$6,160.55
49	Commercial	$33,645.61	85	$2,555.89
50	Commercial	$38,356.58	58	$2,320.09
51	Commercial	$80,621.64	68	$3,941.02
52	Commercial	$123,062.13	59	$7,979.38
53	Commercial	$63,786.71	46	$5,279.00
54	Commercial	$44,884.64	56	$3,226.60
55	Commercial	$54,313.26	94	$2,443.25
56	Commercial	$121,159.27	77	$6,328.66
57	Commercial	$58,438.20	89	$6,195.36
58	Commercial	$83,545.38	57	$5,155.91
59	Commercial	$50,227.25	74	$2,784.36
60	Commercial	$33,864.84	65	$1,899.54
61	Commercial	$391,588.91	34	$14,636.56
62	Commercial	$47,803.05	31	$4,476.68
63	Commercial	$45,299.94	48	$2,906.97
64	Commercial	$154,974.85	32	$7,269.66
65	Commercial	$30,505.62	27	$1,945.50
66	Commercial	$52,430.58	67	$2,811.85
67	Commercial	$65,030.90	22	$3,641.02
68	Commercial	$37,784.30	47	$2,944.20
69	Commercial	$47,377.81	153	$3,496.50
70	Commercial	$63,897.13	56	$2,283.36
71	Commercial	$58,298.45	100	$4,665.06
72	Commercial	$44,697.21	84	$3,678.92
73	Commercial	$29,503.72	42	$2,234.27
74	Commercial	$42,341.88	78	$2,797.47
75	Commercial	$41,297.80	45	$3,519.14
76	Commercial	$48,705.28	53	$3,194.03
77	Commercial	$147,088.93	51	$10,349.72

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
78	Commercial	$44,848.59	55	$2,805.19
79	Commercial	$130,285.99	64	$4,936.41
80	Commercial	$140,017.22	55	$5,518.99
81	Commercial	$51,982.54	47	$3,256.30
82	Commercial	$410,426.57	26	$16,025.26
83	Commercial	$90,292.53	49	$4,943.01
84	Commercial	$19,523.66	99	$1,150.33
85	Commercial	$40,508.41	53	$2,083.60
86	Commercial	$113,606.59	62	$7,602.01
87	Commercial	$35,583.12	37	$2,545.55
88	Commercial	$41,280.90	67	$4,399.44
89	Commercial	$31,811.80	65	$2,094.41
90	Commercial	$53,458.96	84	$3,784.03
91	Commercial	$75,964.48	60	$4,438.68
92	Commercial	$52,206.39	29	$3,668.93
93	Commercial	$29,038.88	35	$3,325.32
94	Commercial	$116,912.35	32	$5,352.16
95	Commercial	$308,012.45	38	$21,503.27
96	Commercial	$44,559.93	50	$3,922.12
97	Commercial	$47,825.25	37	$2,717.83
98	Commercial	$94,643.68	71	$4,662.70
99	Commercial	$71,346.91	37	$3,241.03
Unknown	Commercial	$4,640,464.47	10	$2,690.43
1	Industrial	$747,267.12	13	$44,811.98
2	Industrial	$200,001.80	21	$21,729.33
3	Industrial	$1,019,759.39	6	$44,698.25
4	Industrial	$112,760.55	17	$7,102.19
5	Industrial	$119,535.07	21	$6,506.28
6	Industrial	$29,641.83	16	$2,455.07
7	Industrial	$159,392.28	6	$6,988.88
8	Industrial	$35,872.64	8	$5,776.98
9	Industrial	$109,497.68	1	$22,215.00
10	Industrial	$52,110.46	8	$5,730.37
11	Industrial	$39,142.25	14	$4,249.89
12	Industrial	$53,110.95	7	$2,467.45
13	Industrial	$177,687.43	3	$6,291.48
14	Industrial	$49,979.03	8	$4,751.79
15	Industrial	$76,219.41	12	$3,864.62
16	Industrial	$2,954.91	1	$2,016.80

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
18	Industrial	$29,039.78	1	$936.00
19	Industrial	$134,826.43	2	$11,312.75
20	Industrial	$62,565.41	7	$6,288.97
21	Industrial	$88,448.39	7	$3,792.14
22	Industrial	$41,695.18	10	$4,964.65
23	Industrial	$11,130.77	2	$3,600.00
24	Industrial	$193,491.02	26	$15,088.80
25	Industrial	$255,046.59	22	$24,846.13
26	Industrial	$69,309.60	13	$9,184.87
27	Industrial	$164,268.55	16	$11,248.78
28	Industrial	$82,456.59	6	$3,653.48
29	Industrial	$60,694.86	12	$4,349.25
30	Industrial	$37,336.11	1	$1,325.00
31	Industrial	$334,422.80	10	$57,317.88
32	Industrial	$84,070.68	8	$4,464.38
33	Industrial	$50,105.15	6	$8,067.12
34	Industrial	$399,935.24	5	$24,687.18
35	Industrial	$49,609.09	8	$4,342.17
36	Industrial	$109,149.62	11	$3,403.86
37	Industrial	$61,132.72	9	$2,337.71
38	Industrial	$57,347.58	6	$6,267.40
39	Industrial	$222,407.76	16	$17,710.25
40	Industrial	$156,450.86	15	$8,164.97
41	Industrial	$121,778.47	11	$5,512.19
42	Industrial	$156,692.25	10	$8,420.45
43	Industrial	$29,594.51	2	$2,130.00
44	Industrial	$24,538.67	4	$3,027.50
45	Industrial	$985,936.72	4	$40,447.31
46	Industrial	$89,917.95	6	$5,207.09
47	Industrial	$92,132.94	5	$7,631.06
48	Industrial	$560,627.43	2	$7,591.77
49	Industrial	$50,321.01	5	$3,306.17
50	Industrial	$112,787.07	14	$7,567.67
51	Industrial	$782,974.46	11	$44,057.52
52	Industrial	$356,048.05	13	$22,470.29
53	Industrial	$95,452.83	17	$4,987.69
54	Industrial	$91,813.31	9	$4,276.49
55	Industrial	$257,882.15	44	$14,478.40
56	Industrial	$33,721.12	17	$2,744.61

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
57	Industrial	$118,338.19	19	$6,487.12
58	Industrial	$239,817.06	6	$16,385.41
59	Industrial	$80,426.74	8	$10,445.78
60	Industrial	$181,447.44	8	$22,549.22
61	Industrial	$63,110.62	3	$2,783.33
62	Industrial	$108,972.55	4	$56,570.68
63	Industrial	$1,019,877.81	9	$39,222.97
64	Industrial	$20,781.04	7	$1,441.43
66	Industrial	$41,797.06	1	$4,795.00
67	Industrial	$108,884.44	7	$7,375.86
68	Industrial	$789,022.86	6	$64,728.22
69	Industrial	$78,352.29	7	$15,315.68
70	Industrial	$301,831.11	8	$7,201.04
71	Industrial	$90,962.29	11	$11,266.33
72	Industrial	$145,351.35	11	$41,150.85
73	Industrial	$200,890.30	11	$20,477.23
74	Industrial	$256,897.49	2	$7,418.47
75	Industrial	$596,760.30	10	$28,806.20
76	Industrial	$56,145.58	7	$6,814.85
77	Industrial	$49,191.66	4	$4,929.17
79	Industrial	$152,529.71	3	$6,094.73
80	Industrial	$49,460.09	11	$4,241.12
81	Industrial	$79,181.88	9	$3,417.26
82	Industrial	$164,585.34	9	$12,151.40
83	Industrial	$68,898.78	9	$9,051.54
84	Industrial	$4,189.55	4	$1,391.99
85	Industrial	$67,751.84	3	$6,233.33
86	Industrial	$73,632.72	20	$6,462.14
87	Industrial	$40,803.97	12	$2,625.21
88	Industrial	$181,911.15	8	$9,158.27
89	Industrial	$68,220.36	3	$3,890.00
90	Industrial	$114,497.79	10	$20,984.42
91	Industrial	$256,075.02	17	$37,206.67
92	Industrial	$350,638.34	5	$23,876.21
93	Industrial	$81,276.80	7	$3,514.92
94	Industrial	$325,342.89	6	$8,930.41
95	Industrial	$59,188.02	5	$5,530.00
96	Industrial	$77,206.55	4	$4,317.50
97	Industrial	$144,836.12	5	$7,338.02

Assembly District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
98	Industrial	$33,642.40	6	$2,948.01
99	Industrial	$23,844.41	10	$1,891.37
Unknown	Industrial	$12,842.40	5	$886.20

Table E-3. Upstream Lighting Savings and Participation by Assembly District

Assembly District	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
1	$38.79	1.1	$1.38
2	$33.96	0.9	$1.19
3	$3.02	0.1	$0.11
4	$33.61	0.9	$1.23
5	$4.40	0.1	$0.19
6	$36.63	1.0	$1.32
7	$47.32	1.3	$1.68
8	$27.38	0.8	$0.97
9	$25.35	0.7	$0.81
10	$73.30	2.0	$2.44
11	$3.29	0.1	$0.15
12	$54.10	1.5	$1.89
13	$41.37	1.1	$1.64
14	$5.84	0.2	$0.23
15	$51.38	1.4	$1.82
16	$2.16	0.1	$0.08
17	$31.21	0.9	$1.00
18	$6.76	0.2	$0.23
19	$3.13	0.1	$0.10
20	$34.21	1.0	$1.18
21	$55.52	1.6	$1.93
22	$16.41	0.4	$0.59
23	$77.85	2.2	$2.66
24	$104.53	2.9	$3.78
25	$54.26	1.5	$1.92
26	$21.66	0.6	$0.80
27	$66.60	1.9	$2.34
28	$44.67	1.2	$1.57
29	$40.60	1.1	$1.35
30	$45.54	1.2	$1.57
31	$7.30	0.2	$0.27
32	$58.68	1.6	$2.00
33	$34.13	1.0	$1.19
34	$73.60	2.0	$2.66
35	$46.46	1.3	$1.61
36	$10.85	0.3	$0.40
37	$18.78	0.5	$0.66

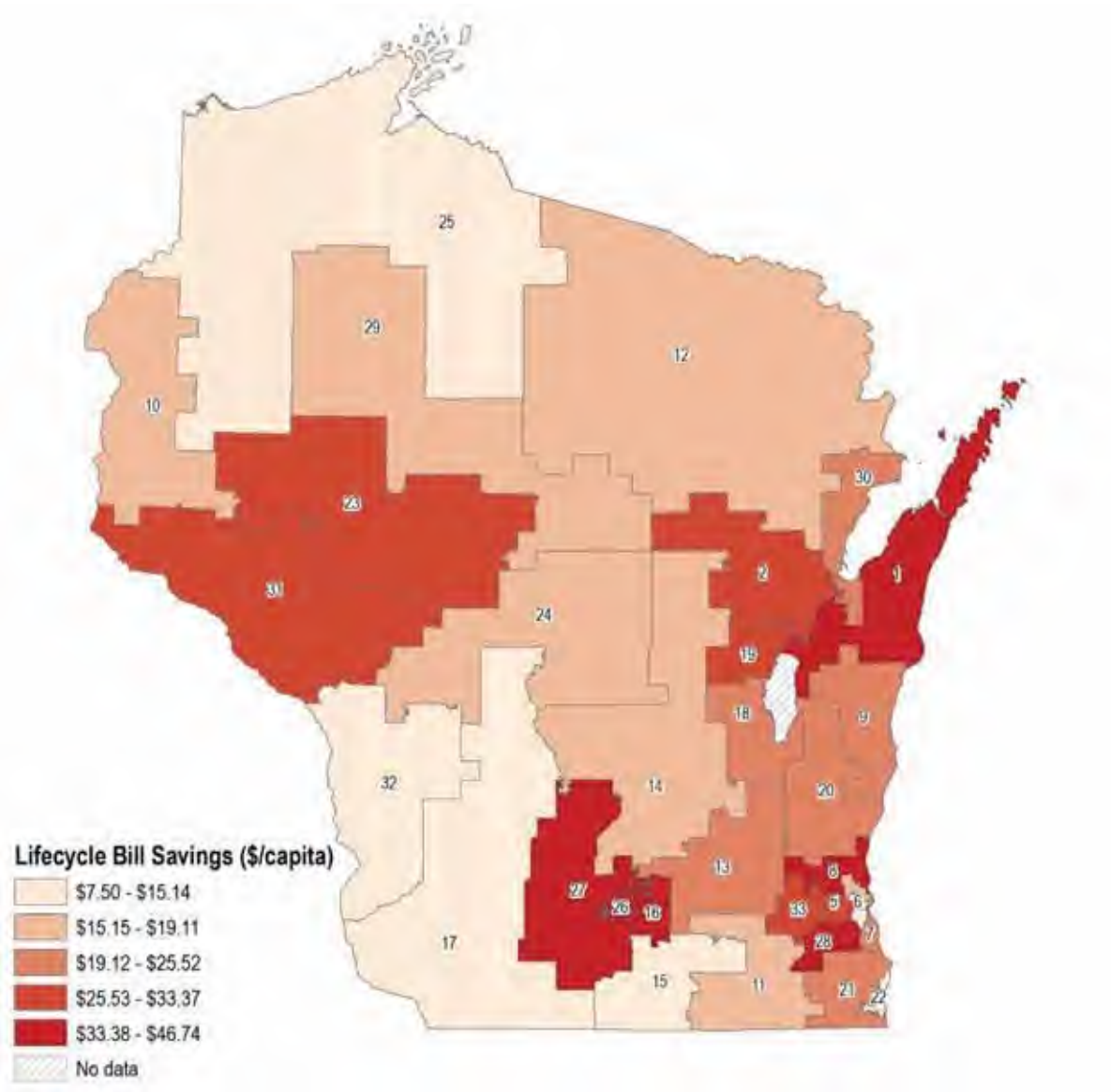
Assembly District	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
38	$21.22	0.6	$0.75
39	$53.01	1.5	$1.84
40	$21.23	0.6	$0.74
41	$39.96	1.1	$1.34
42	$1.63	0.0	$0.06
43	$15.15	0.4	$0.51
44	$78.18	2.2	$2.73
45	$42.44	1.1	$1.45
46	$47.68	1.3	$1.54
47	$81.07	2.3	$2.79
48	$93.39	2.6	$3.28
49	$41.58	1.1	$1.44
50	$24.64	0.7	$0.85
51	$44.31	1.2	$1.47
52	$23.95	0.7	$0.91
53	$56.65	1.6	$2.00
54	$34.77	1.0	$1.35
55	$52.65	1.5	$1.97
56	$68.76	1.9	$2.51
57	$82.21	2.3	$2.67
58	$52.99	1.5	$1.95
59	$21.92	0.6	$0.73
60	$21.71	0.6	$0.73
61	$3.04	0.1	$0.11
62	$11.34	0.3	$0.40
63	$78.15	2.2	$2.79
64	$81.03	2.3	$3.00
65	$7.31	0.2	$0.26
66	$9.14	0.3	$0.22
67	$27.21	0.7	$0.93
68	$4.83	0.1	$0.20
69	$55.07	1.5	$2.04
70	$36.07	1.0	$1.19
71	$73.02	2.0	$2.56
72	$29.16	0.8	$1.01
73	$47.14	1.3	$1.62
74	$27.07	0.8	$0.92
75	$66.04	1.8	$2.30

Assembly District	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
76	$5.75	0.2	$0.20
77	$30.74	0.9	$1.08
78	$124.60	3.5	$4.53
79	$36.81	1.0	$1.24
80	$2.74	0.1	$0.17
81	$83.58	2.3	$2.88
82	$135.59	3.7	$5.01
83	$15.66	0.4	$0.56
84	$25.84	0.7	$1.02
85	$89.87	2.5	$3.31
86	$11.11	0.3	$0.40
87	$64.59	1.8	$2.08
88	$150.08	4.2	$5.15
89	$74.18	2.0	$2.61
90	$161.75	4.5	$6.22
91	$78.67	2.2	$2.84
92	$21.24	0.6	$0.71
93	$2.65	0.1	$0.12
94	$144.16	4.0	$5.24
95	$38.32	1.1	$1.39
96	$54.68	1.5	$1.86
97	$18.46	0.5	$0.60
98	$105.25	2.9	$3.75
99	$57.21	1.6	$2.03

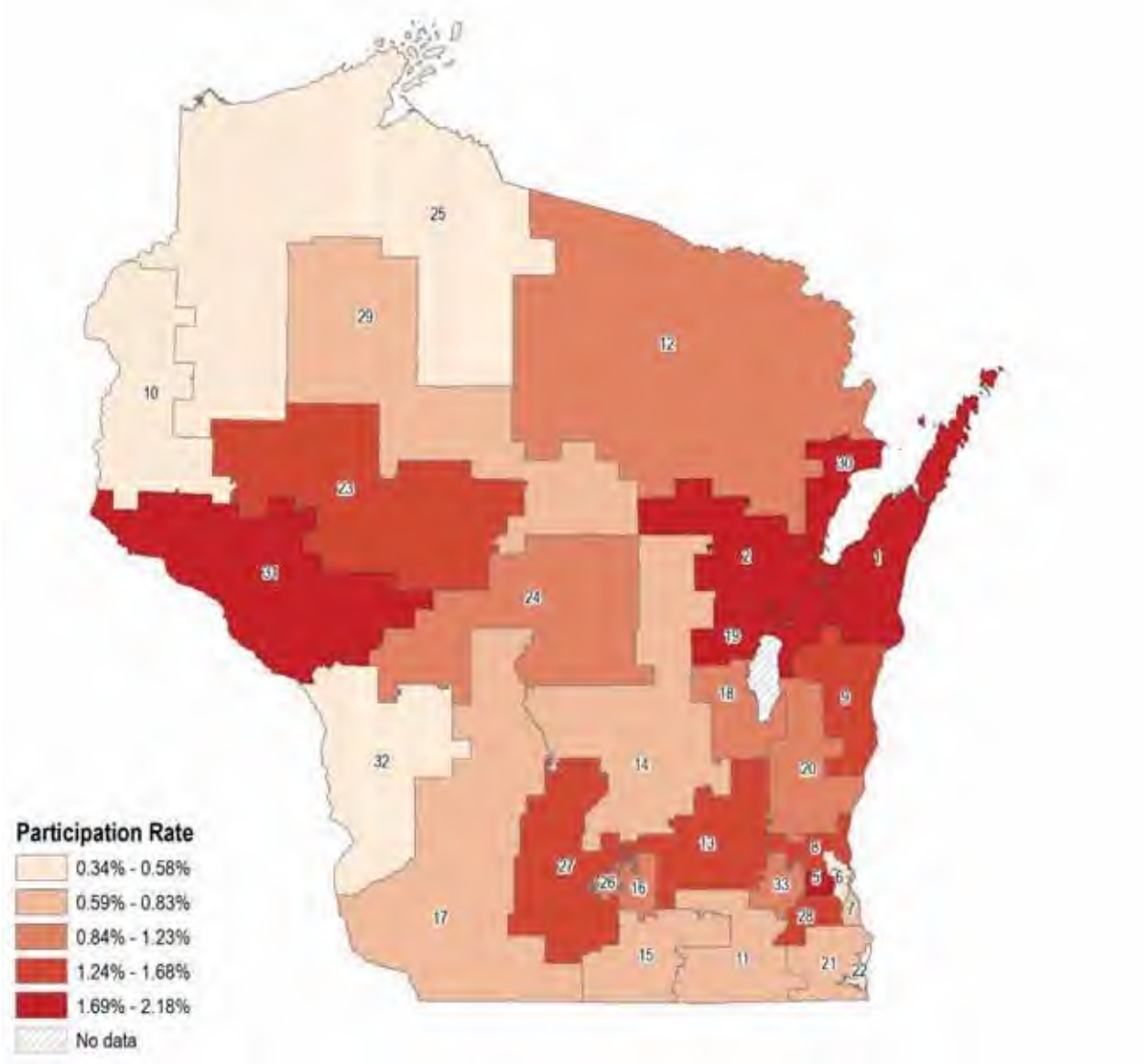
2014 Savings by Segment, by Senate District

Residential

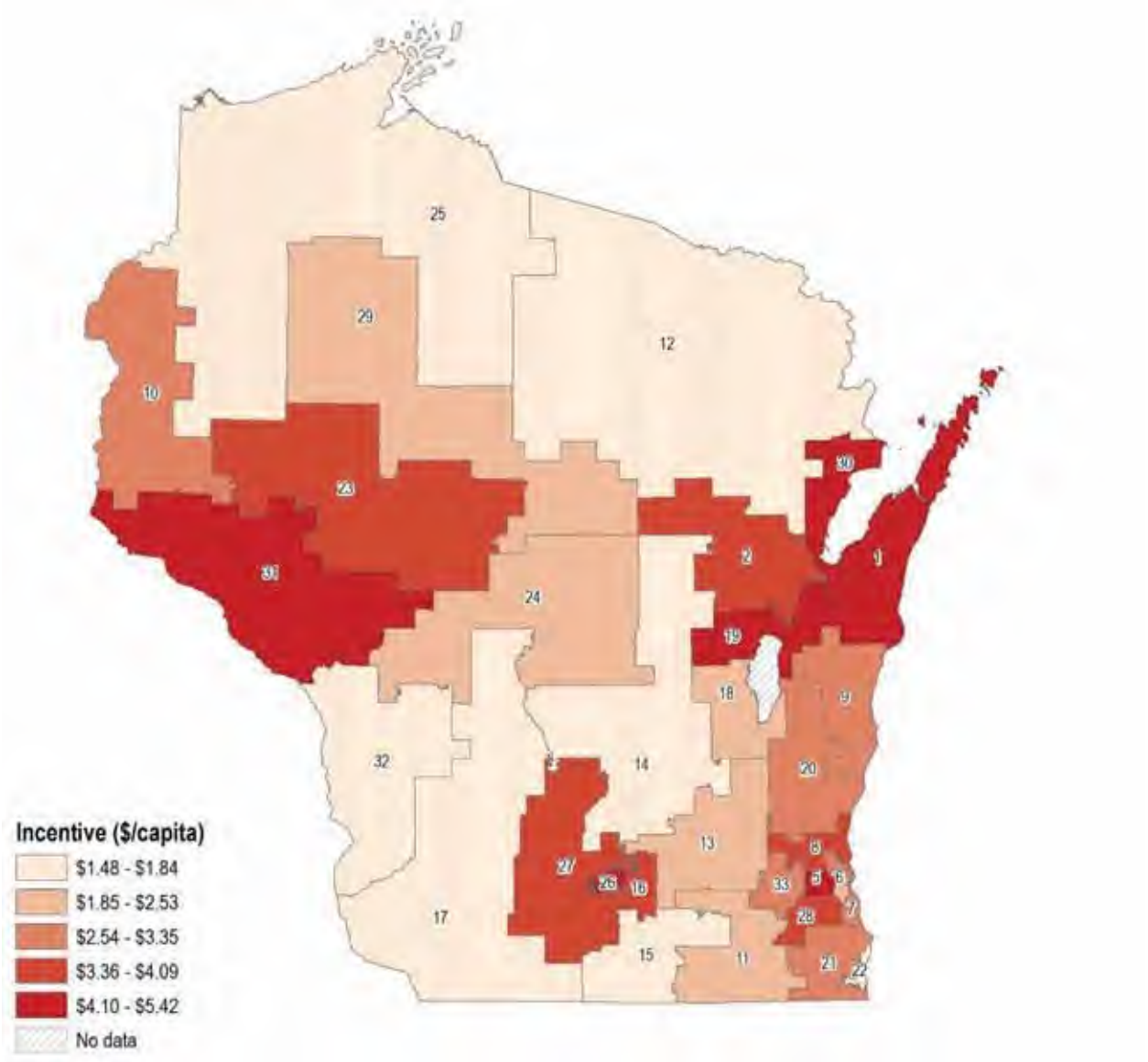
Residential Energy Bill Savings by Senate District



Residential Participation by Senate Districts

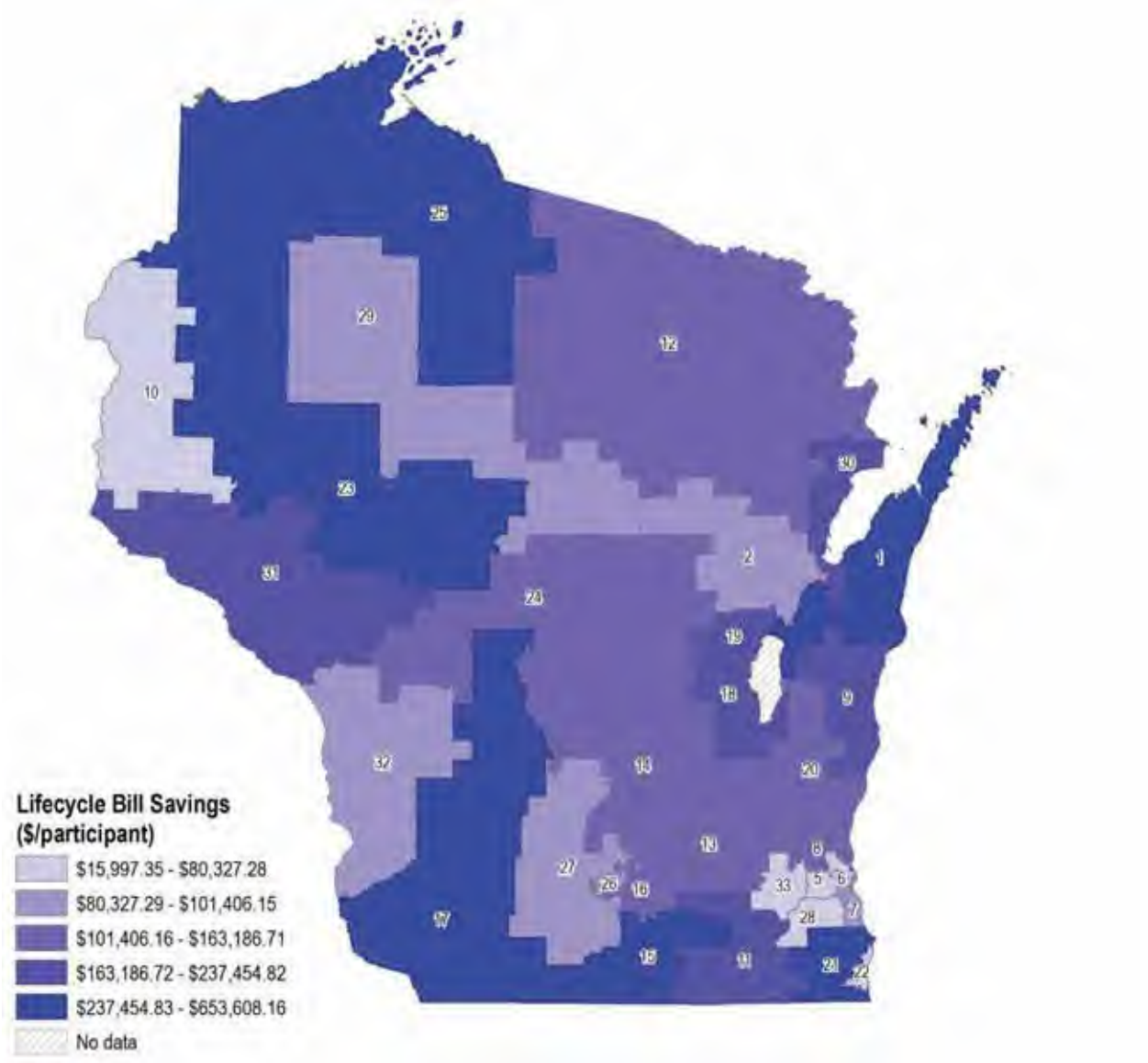


Residential Incentive Dollars Awarded by Senate District

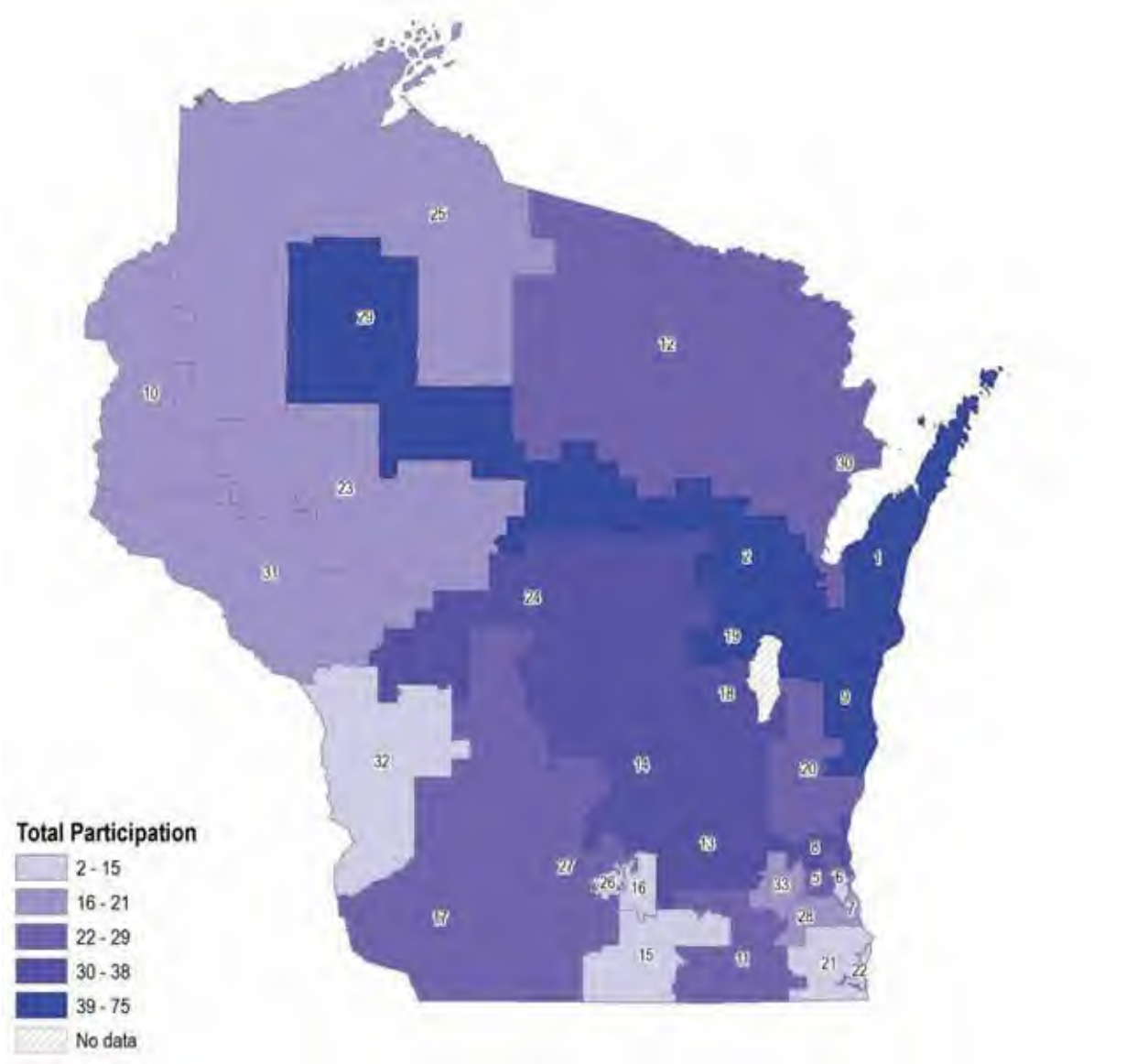


Industrial

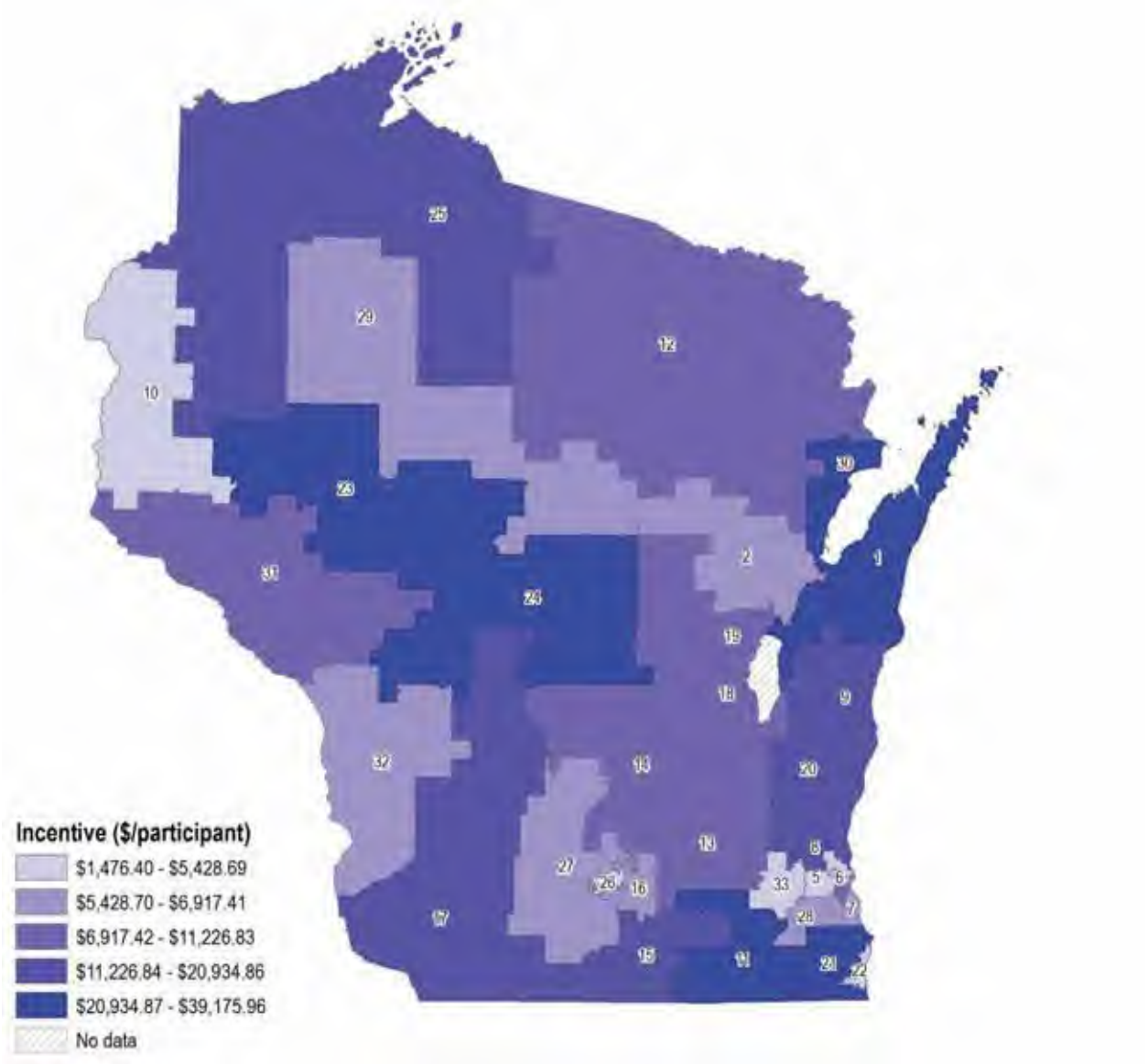
Industrial Energy Bill Savings by Senate District



Industrial Participation by Senate District

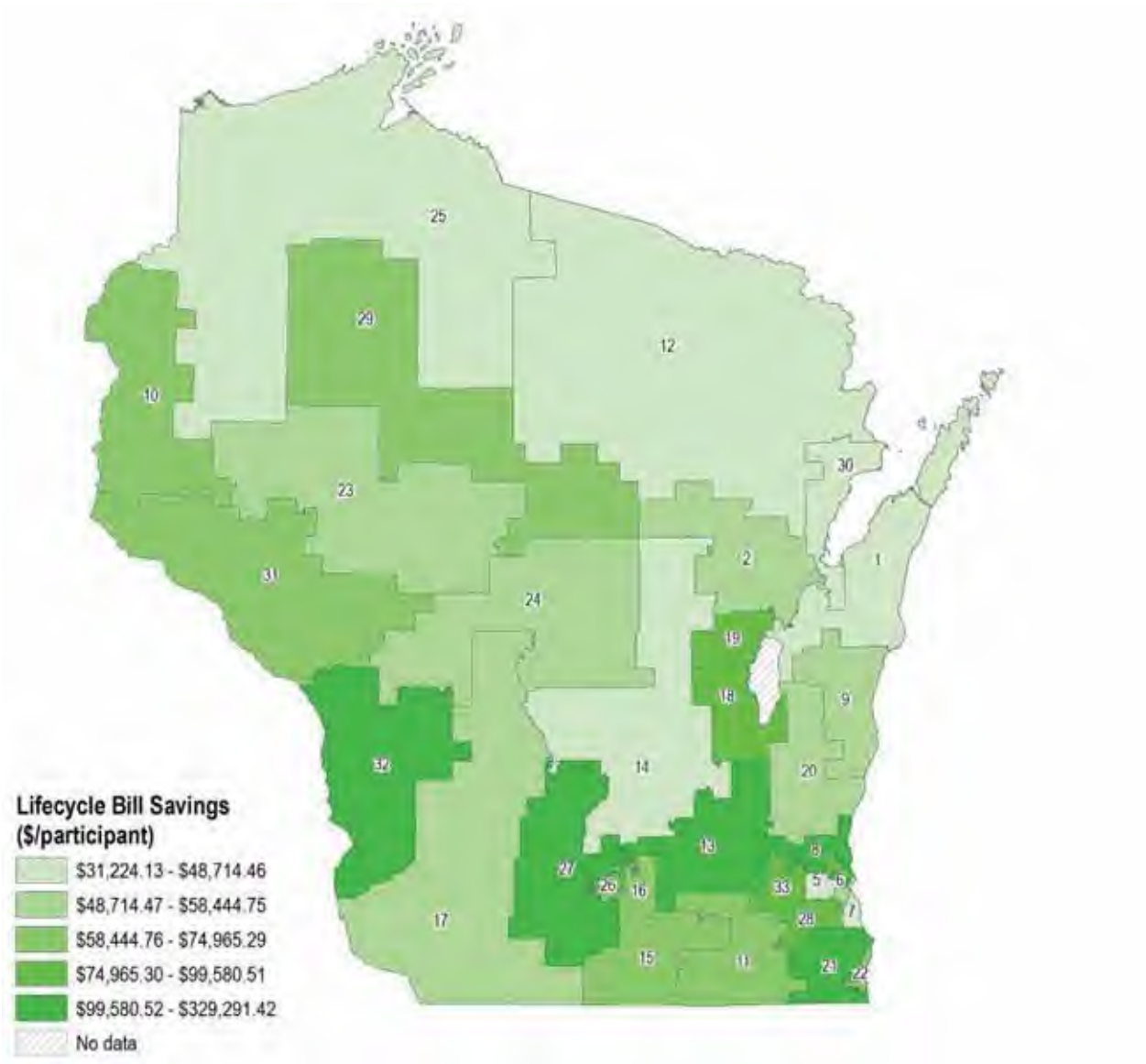


Industrial Incentive Dollars Awarded by Senate District

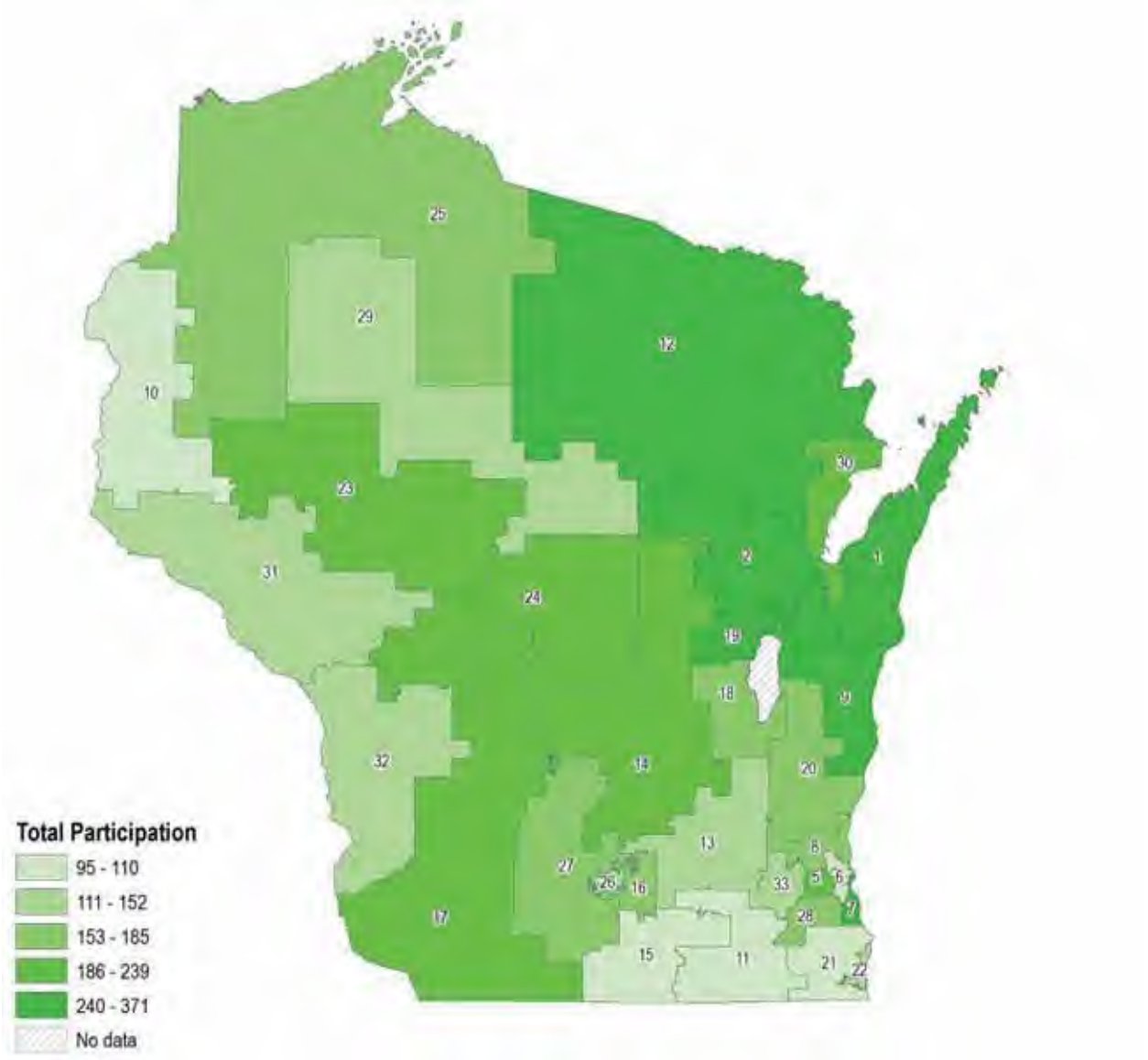


Commercial

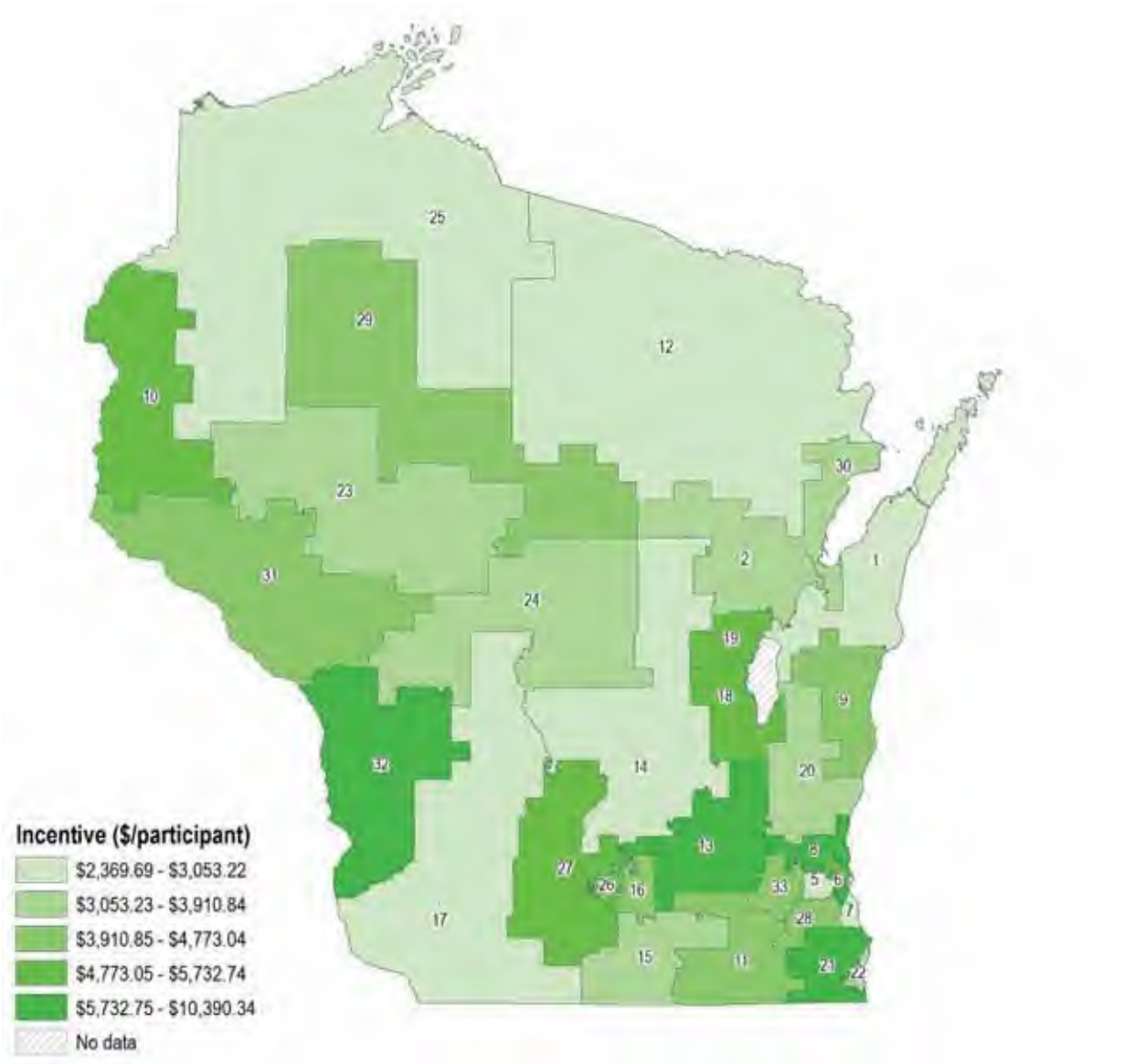
Commercial Energy Bill Savings by Senate District



Commercial Participation by Senate District

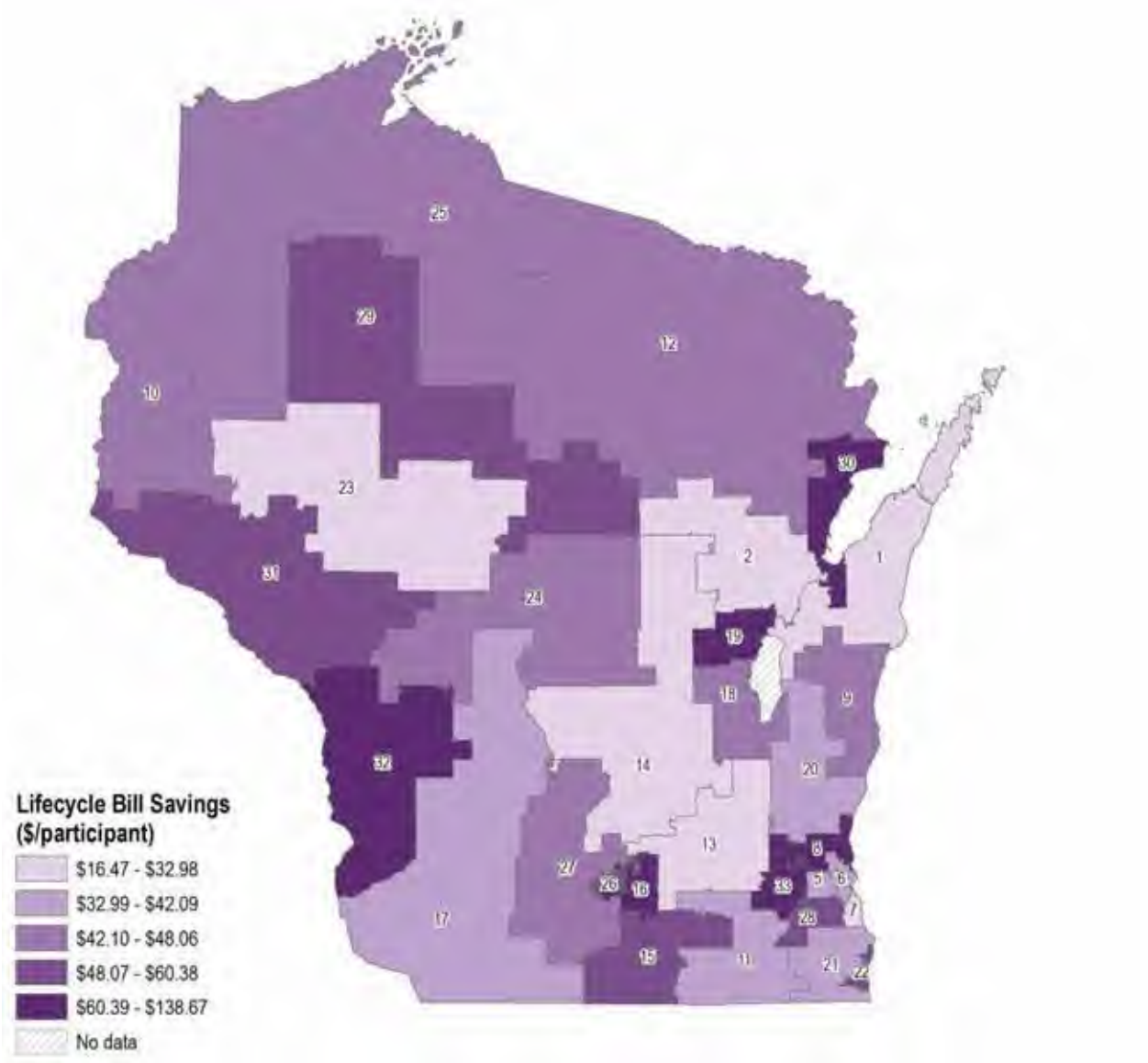


Commercial Incentive Dollars Awarded by Senate District

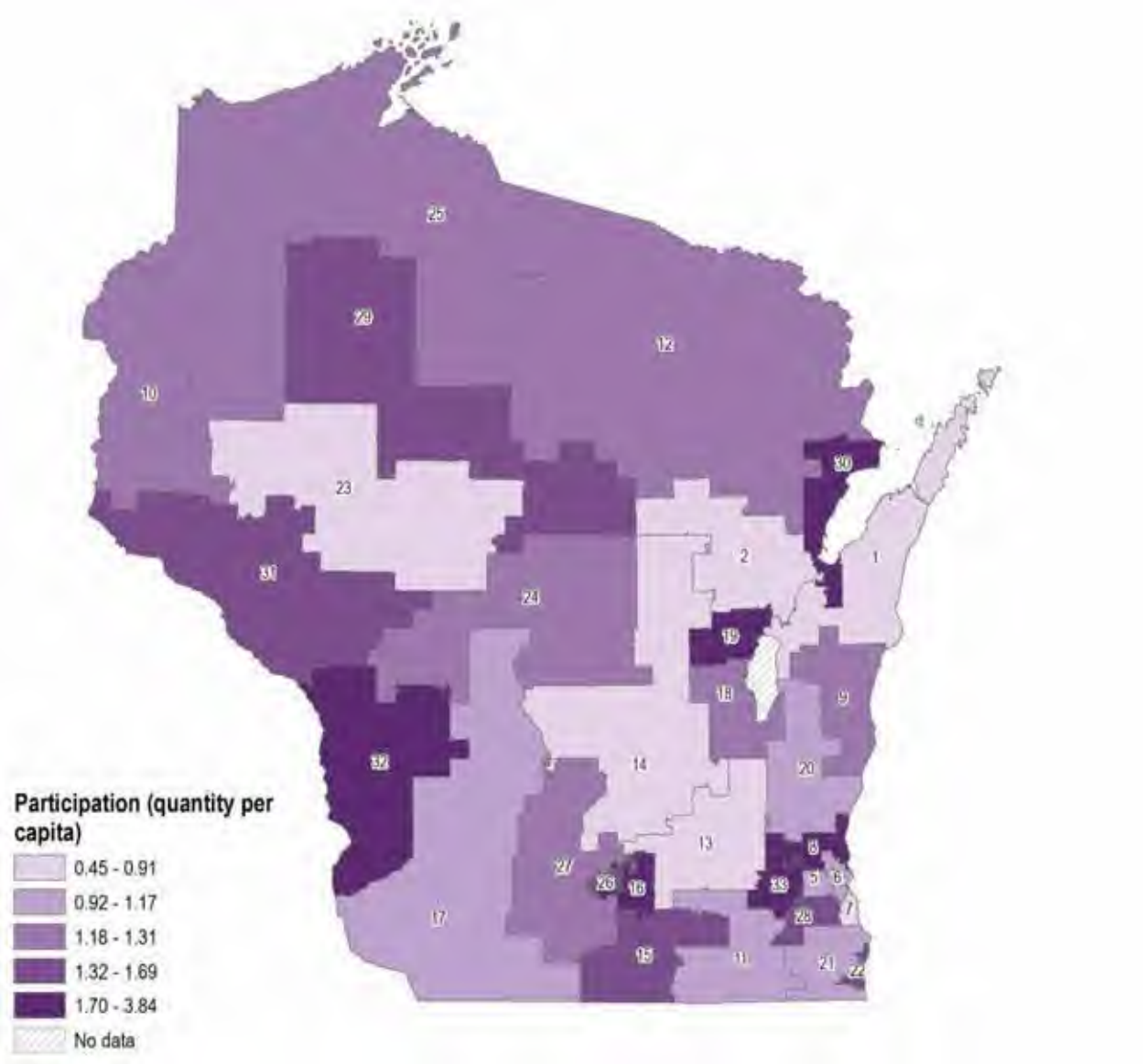


Upstream Lighting

Upstream Lighting Energy Bill Savings by Senate District



Upstream Lighting Participation by Senate District



Upstream Lighting Incentive Dollars Awarded by Senate District

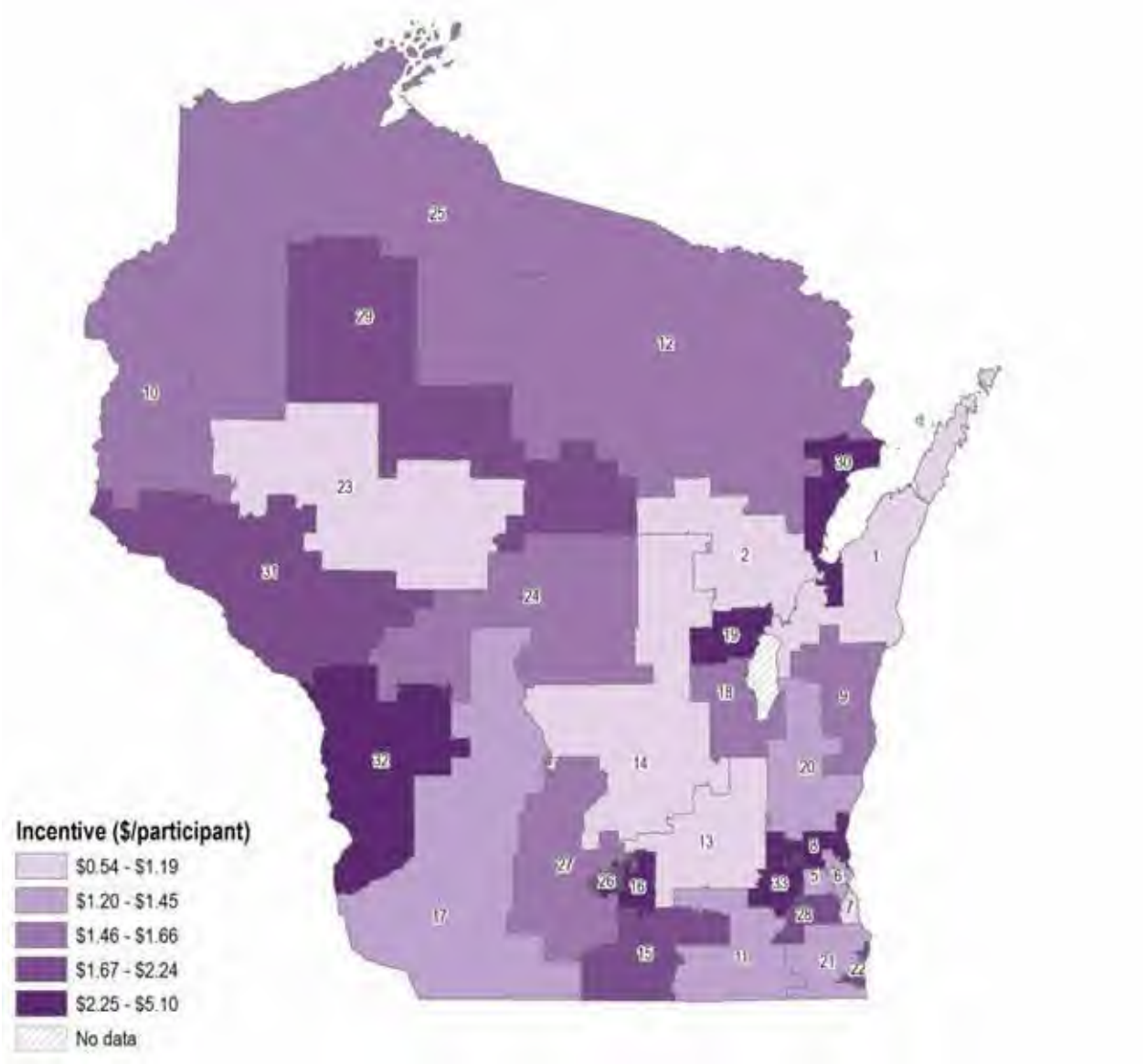


Table E-4. Residential Savings and Participation by Senate District

Senate District	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
1	Residential	$39.01	1.9%	$4.73
2	Residential	$26.66	2.1%	$3.98
3	Residential	$15.14	0.5%	$2.49
4	Residential	$17.08	0.4%	$2.63
5	Residential	$33.37	1.8%	$4.28
6	Residential	$7.50	0.3%	$1.85
7	Residential	$23.61	0.7%	$3.02
8	Residential	$36.41	1.4%	$4.09
9	Residential	$21.22	1.7%	$2.97
10	Residential	$15.41	0.6%	$2.97
11	Residential	$16.39	0.8%	$2.19
12	Residential	$18.14	1.0%	$1.84
13	Residential	$23.43	1.3%	$2.53
14	Residential	$16.11	0.7%	$1.59
15	Residential	$10.26	0.7%	$1.84
16	Residential	$34.70	1.1%	$3.56
17	Residential	$12.99	0.7%	$1.81
18	Residential	$21.59	1.1%	$2.50
19	Residential	$31.62	2.1%	$4.37
20	Residential	$25.52	1.2%	$2.63
21	Residential	$24.21	0.8%	$2.67
22	Residential	$10.86	0.5%	$1.59
23	Residential	$26.38	1.6%	$3.65
24	Residential	$19.11	1.0%	$2.37
25	Residential	$9.08	0.4%	$1.48
26	Residential	$46.74	1.0%	$5.42
27	Residential	$35.92	1.2%	$3.49
28	Residential	$38.05	1.5%	$3.84
29	Residential	$16.68	0.8%	$1.99
30	Residential	$23.93	2.2%	$4.28
31	Residential	$30.68	1.8%	$4.65
32	Residential	$11.28	0.5%	$1.76
33	Residential	$29.48	1.2%	$3.35

Table E-5. Nonresidential Savings and Participation by Senate District and Segment[1]

Senate District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
1	Commercial	$42,225.62	371	$2,632.93
2	Commercial	$48,777.97	278	$3,152.63
3	Commercial	$55,927.31	97	$5,883.83
4	Commercial	$94,881.65	101	$5,460.31
5	Commercial	$45,856.33	237	$2,927.16
6	Commercial	$329,291.42	95	$8,075.54
7	Commercial	$47,074.77	257	$2,933.77
8	Commercial	$320,309.18	183	$9,341.76
9	Commercial	$58,444.75	282	$4,122.82
10	Commercial	$60,173.88	104	$4,905.48
11	Commercial	$66,814.00	110	$4,063.66
12	Commercial	$31,224.13	330	$2,369.69
13	Commercial	$109,478.37	150	$6,577.73
14	Commercial	$48,714.46	239	$2,920.21
15	Commercial	$59,380.46	97	$3,688.72
16	Commercial	$72,663.12	159	$4,773.04
17	Commercial	$52,053.35	203	$3,053.22
18	Commercial	$81,464.06	156	$5,732.74
19	Commercial	$79,819.96	246	$5,155.93
20	Commercial	$57,730.36	185	$3,369.73
21	Commercial	$155,690.96	109	$7,118.85
22	Commercial	$74,965.29	124	$3,818.96
23	Commercial	$48,856.76	214	$3,520.77
24	Commercial	$56,981.17	231	$3,910.84
25	Commercial	$40,252.98	159	$2,958.51
26	Commercial	$82,563.08	152	$5,601.35
27	Commercial	$115,515.19	160	$4,828.25
28	Commercial	$99,580.51	171	$4,518.99
29	Commercial	$72,966.18	144	$4,694.03
30	Commercial	$45,931.72	203	$3,688.46
31	Commercial	$59,068.46	120	$4,075.88
32	Commercial	$155,032.15	114	$10,390.34
33	Commercial	$79,493.37	140	$3,939.50
Unknown	Commercial	$4,640,464.47	10.00	$2,690.43
1	Industrial	$500,826.66	40	$32,676.53
2	Industrial	$90,767.32	54	$5,493.52
3	Industrial	$96,630.89	14	$7,883.15
4	Industrial	$46,091.44	29	$4,228.05

Senate District	Segment	Per-Participant Life-Cycle Bill Savings ($)	Participant Count	Per-Participant Incentive ($)
5	Industrial	$80,327.28	23	$4,489.75
6	Industrial	$15,997.35	2	$1,476.40
7	Industrial	$82,921.84	16	$5,824.58
8	Industrial	$143,946.84	38	$11,819.88
9	Industrial	$186,537.69	49	$17,265.28
10	Industrial	$66,337.58	19	$3,970.36
11	Industrial	$179,892.68	24	$27,387.35
12	Industrial	$149,883.11	24	$8,150.65
13	Industrial	$143,638.84	31	$11,032.51
14	Industrial	$145,923.57	36	$7,425.36
15	Industrial	$410,109.06	10	$17,815.92
16	Industrial	$163,186.71	13	$6,506.26
17	Industrial	$360,115.28	29	$20,934.86
18	Industrial	$191,287.64	37	$11,226.83
19	Industrial	$188,913.32	75	$10,759.51
20	Industrial	$160,631.63	22	$16,466.93
21	Industrial	$653,608.16	15	$39,175.96
22	Industrial	$63,297.03	15	$4,434.40
23	Industrial	$366,535.81	21	$26,342.26
24	Industrial	$150,288.86	32	$25,057.45
25	Industrial	$361,811.42	19	$18,452.78
26	Industrial	$93,479.40	7	$5,428.69
27	Industrial	$101,406.15	27	$6,917.41
28	Industrial	$52,506.42	16	$6,608.24
29	Industrial	$87,630.54	39	$6,000.29
30	Industrial	$196,652.22	29	$29,449.23
31	Industrial	$237,454.82	18	$10,976.00
32	Industrial	$94,924.78	14	$5,829.29
33	Industrial	$24,024.31	21	$1,953.94
Unknown	Industrial	$166,328.89	2	$500.00

[1]Participant count provided instead of customer participation rate (%) for Senate Districts as nonresidential business counts for senate districts have not been updated since 2011 redistricting.

Table E-6. Upstream Lighting Savings and Participation by Senate District

Senate District	Per-Capita Life-Cycle Bill Savings ($)	Per-Capita Quantity	Per-Capita Incentive ($)
1	$32.98	0.9	$1.16
2	$27.26	0.8	$1.00
3	$34.83	1.0	$1.20
4	$38.88	1.1	$1.34
5	$36.38	1.0	$1.37
6	$16.47	0.4	$0.54
7	$30.59	0.9	$1.06
8	$77.00	2.1	$2.75
9	$45.27	1.2	$1.61
10	$43.57	1.2	$1.49
11	$42.09	1.2	$1.45
12	$46.38	1.3	$1.65
13	$28.91	0.8	$1.01
14	$27.07	0.8	$0.92
15	$50.61	1.4	$1.75
16	$72.91	2.0	$2.49

Appendix F. Summary of Savings by Segment and Utility Territory

The following section includes eighteen maps based on the results of the 2014 evaluation: three electric utility and three gas utility maps (per-capita lifetime bill savings, total 2014 participation, and per-capita incentive paid in 2014) each for three primary segments (residential, industrial, and commercial). Commercial maps include businesses, schools, government, and agricultural entities.

Similar to the 2011, 2012, and 2013 evaluation reports, the bill savings are defined as evaluated life-cycle verified gross energy savings that have been multiplied by the retail rate of delivered energy in 2014 and normalized on a per-capita basis. The incentive dollars and participation rates are also reported on a per-capita basis.

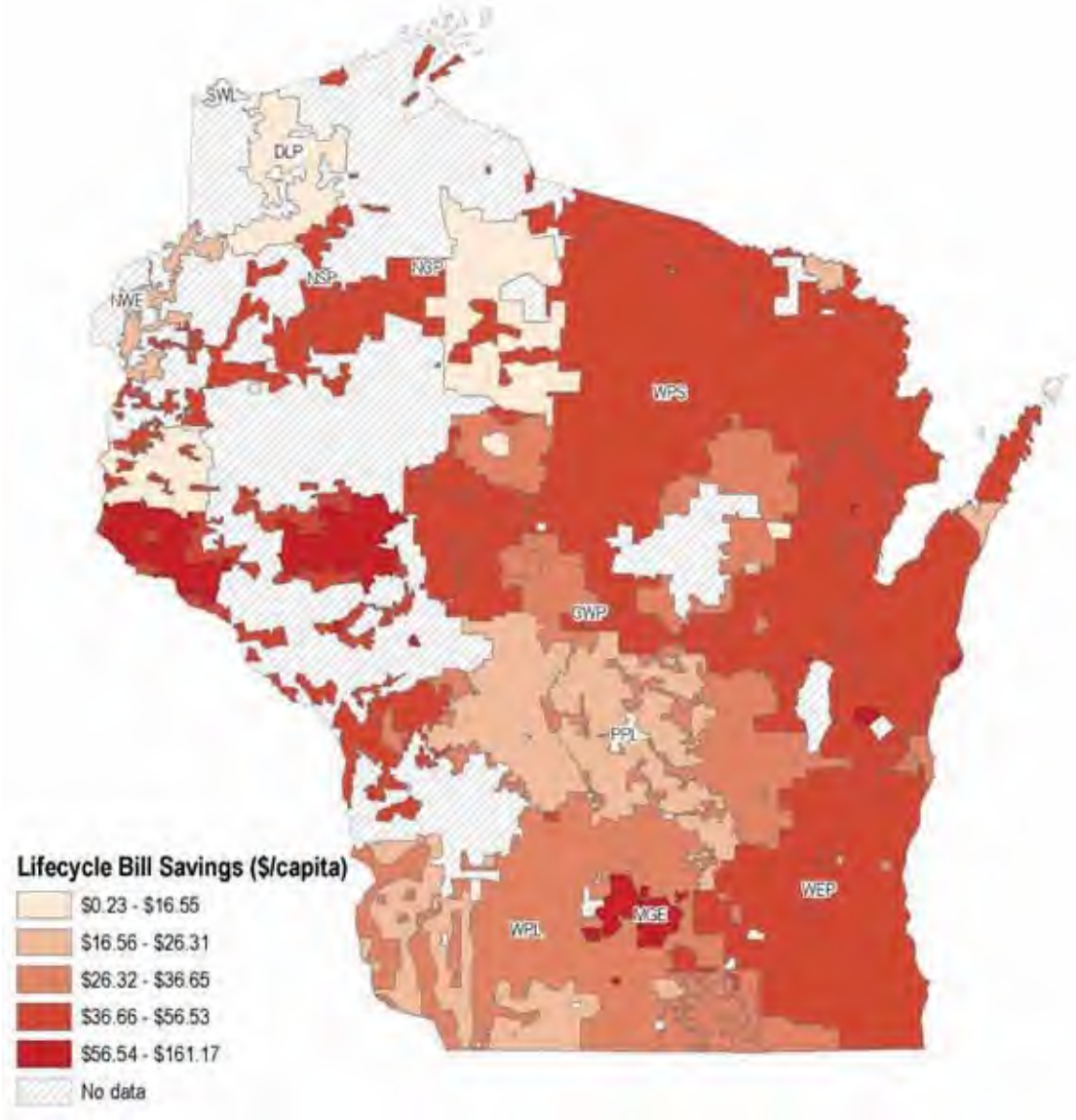
The counts of eligible customers by segment from different sources are inconsistent due to varying definitions of those segments. The electric utility maps use counts of customers by segment from the EIA-861 report (2013),[2] which is based upon data provided by utilities. The differences in how utilities and Focus on Energy define each segment results in noticeably high participation rates for the industrial and commercial segments in this appendix.

Please note that due to the large number of electric cooperatives and municipal utilities, the Evaluation Team chose to include only larger utility-level labels for the following group of maps. Further, some cooperatives and municipal utilities do not participate in Focus on Energy, as such there may be some gaps in the map areas.

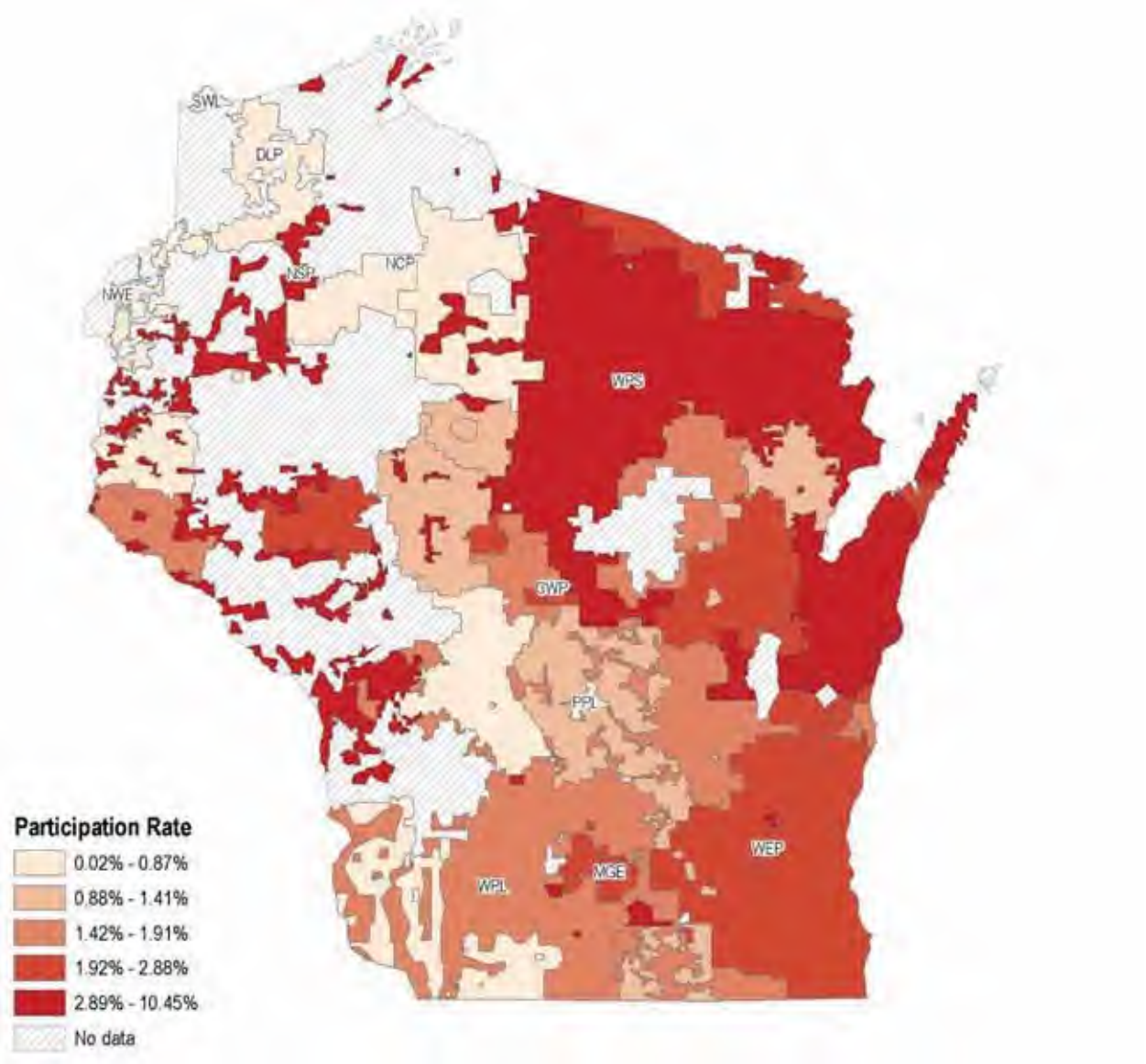
[2] U.S. Energy Information Administration, U.S. Department of Energy. "Electricity." Release date for 2013: February 19, 2015. Available online: http://www.eia.gov/electricity/data/eia861/index.html

Residential–Electric Territory

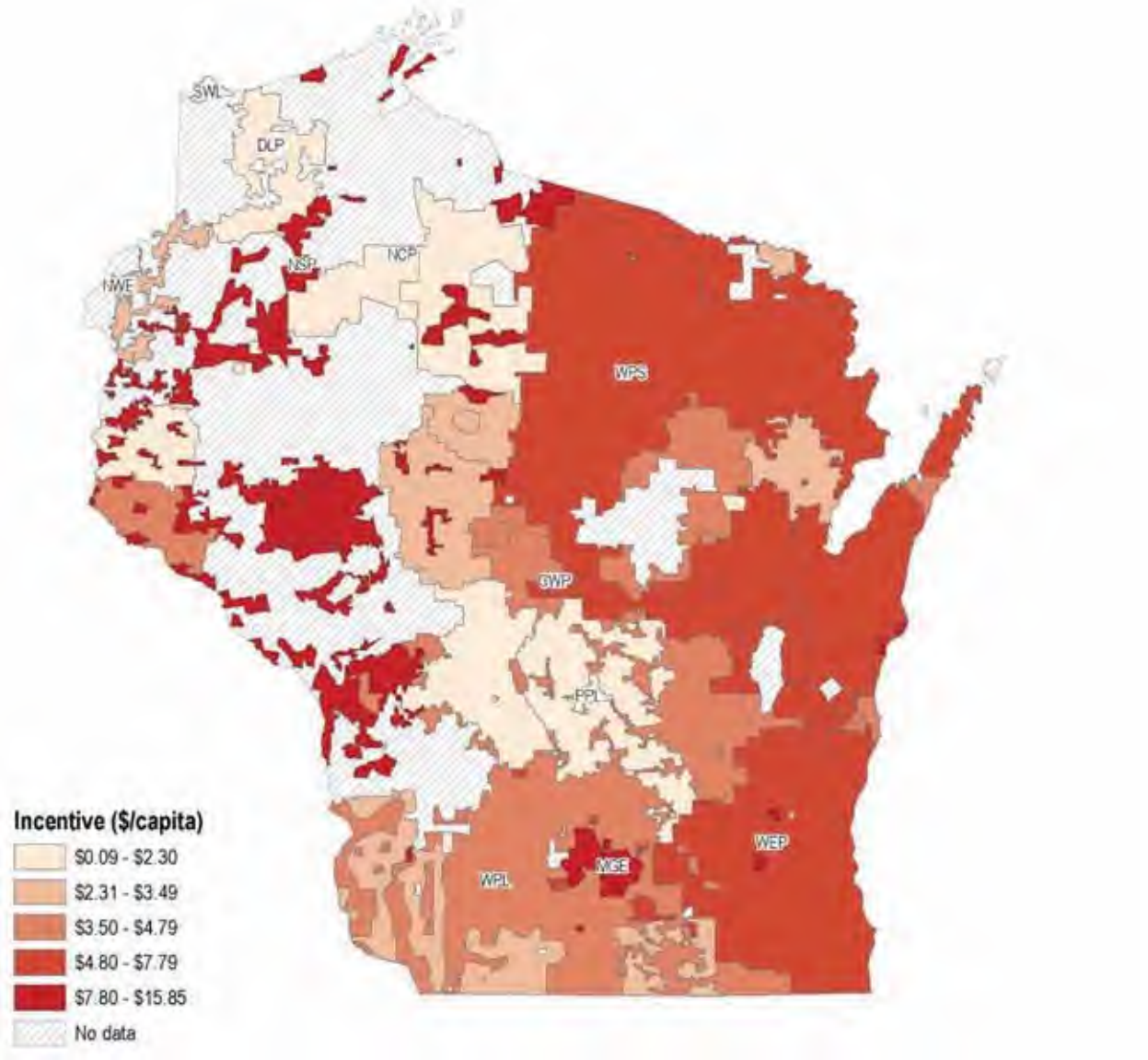
Residential Per-Capita Energy Bill Savings by Electric Territory



Residential Participation Rate by Electric Territory

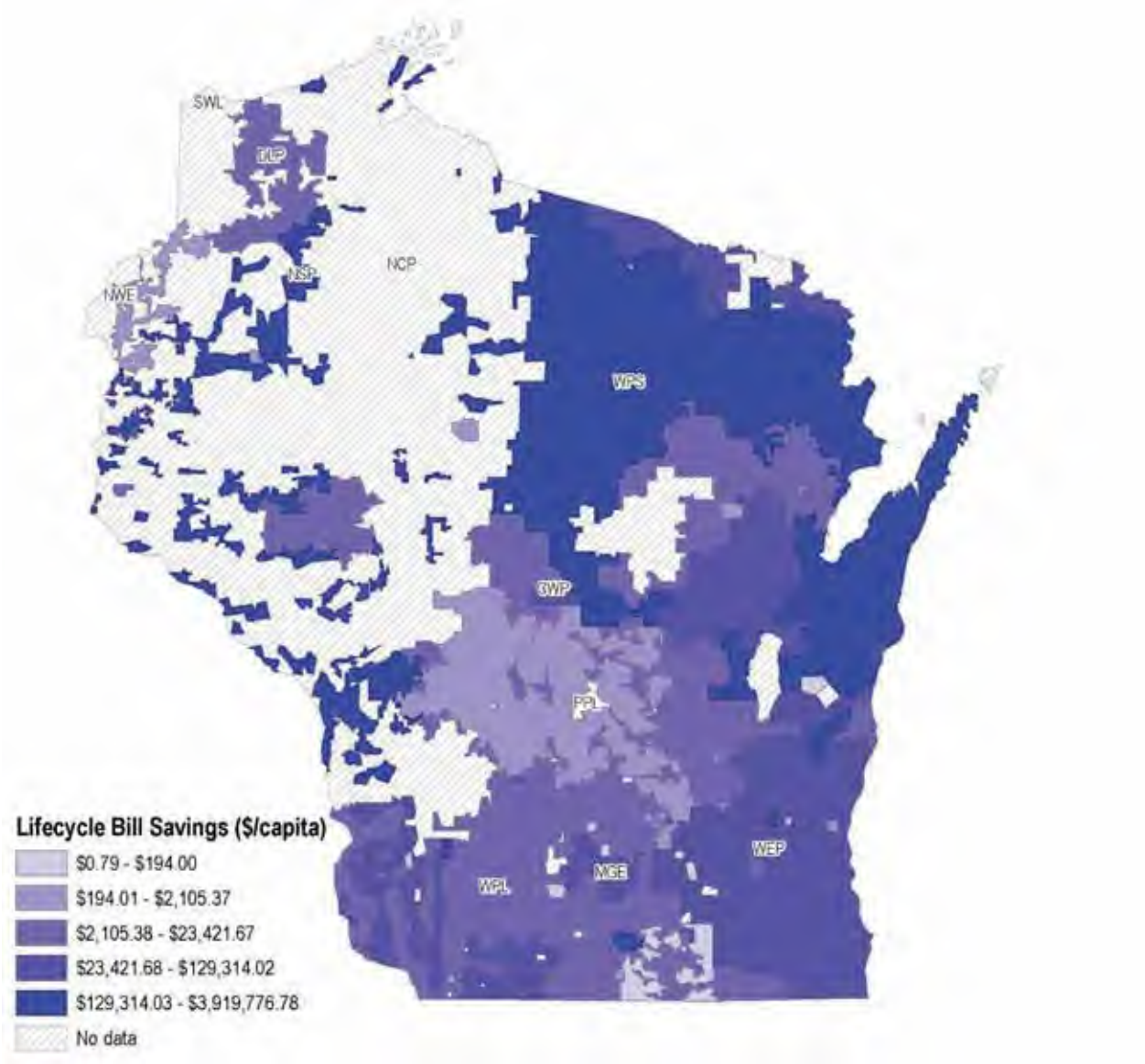


Residential Per-Capita Incentive Dollars Awarded by Electric Territory

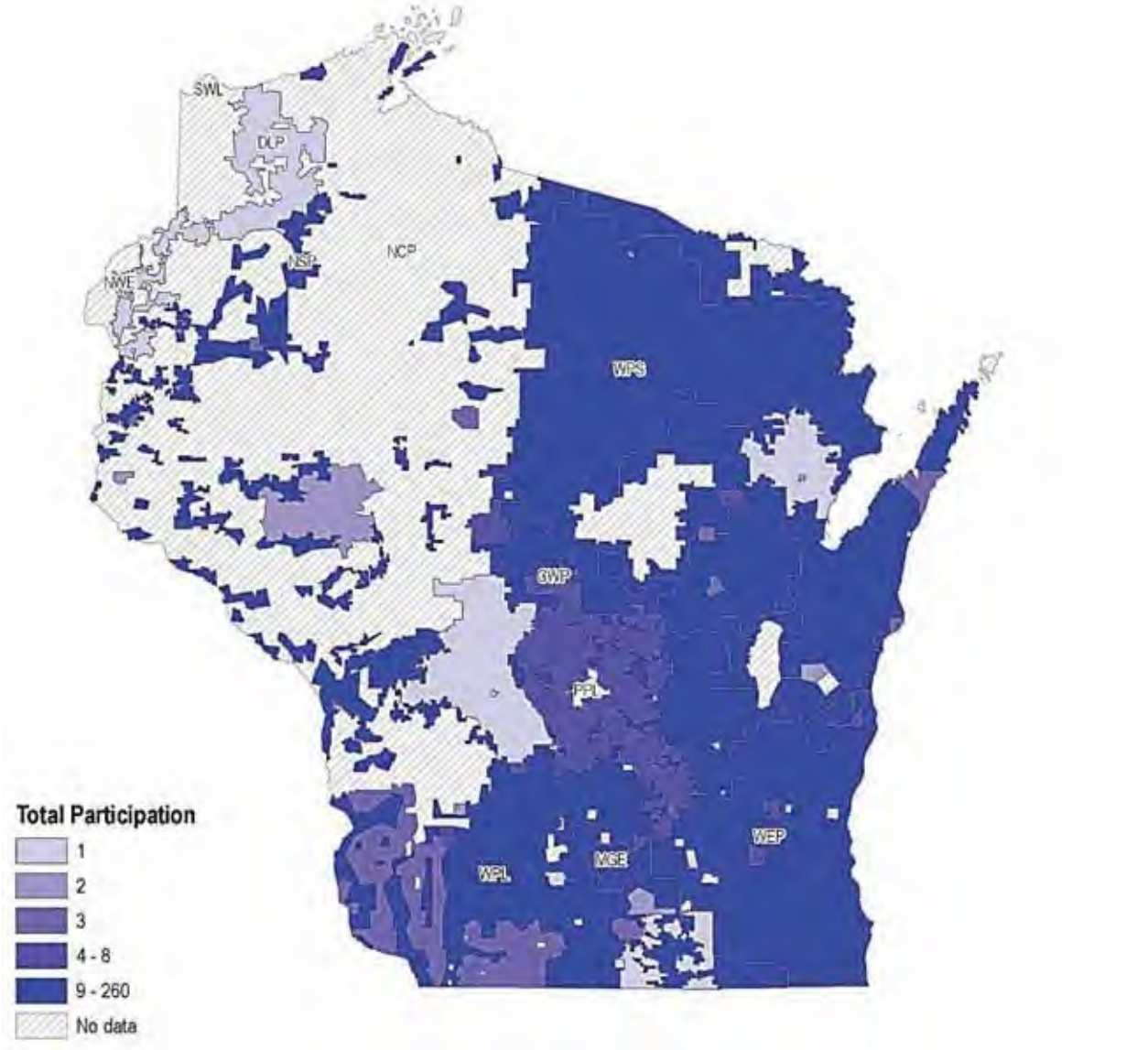


Industrial––Electric Territory

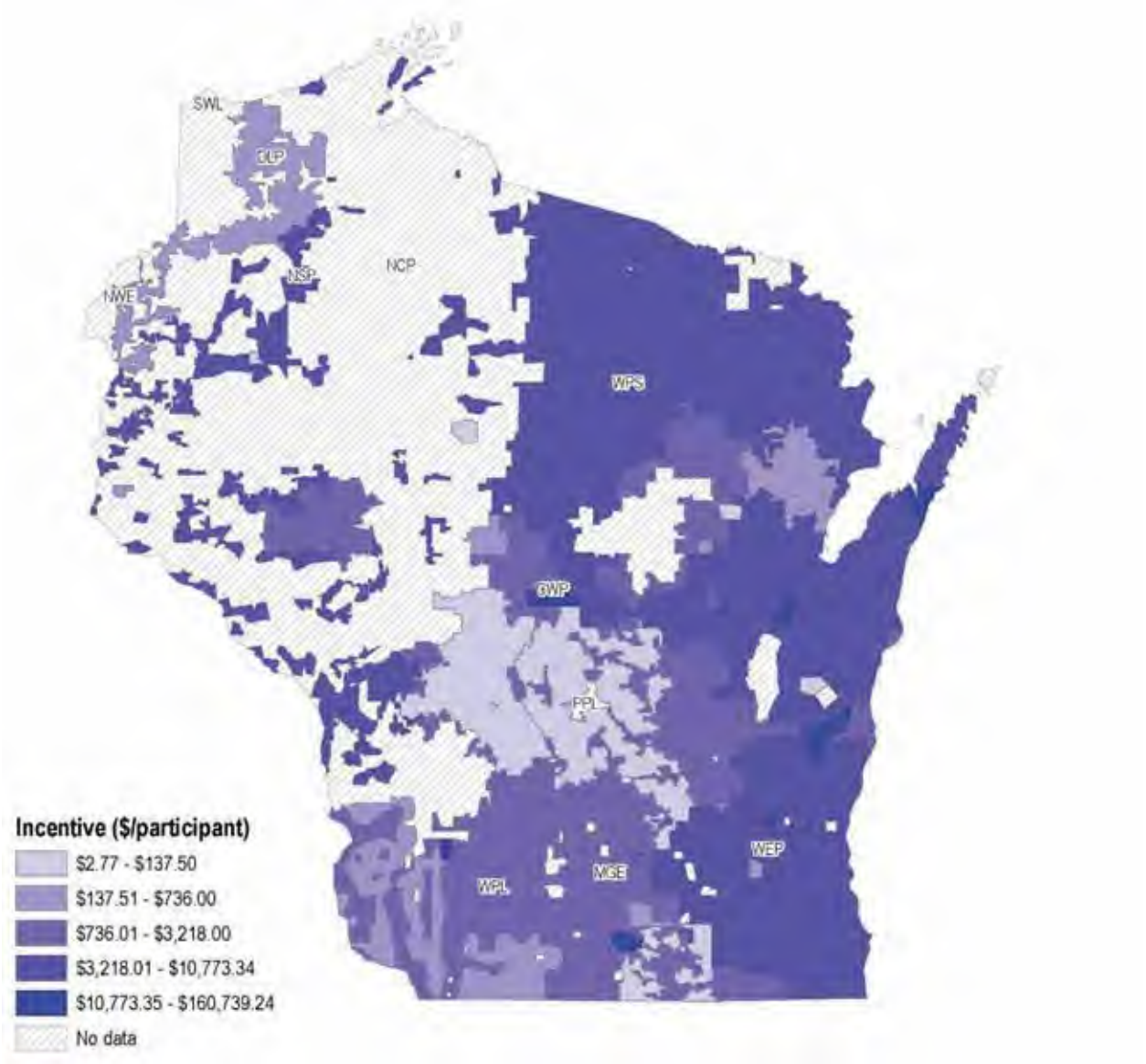
Industrial Per-Capita Energy Bill Savings by Electric Territory



Industrial Participation Rate by Electric Territory

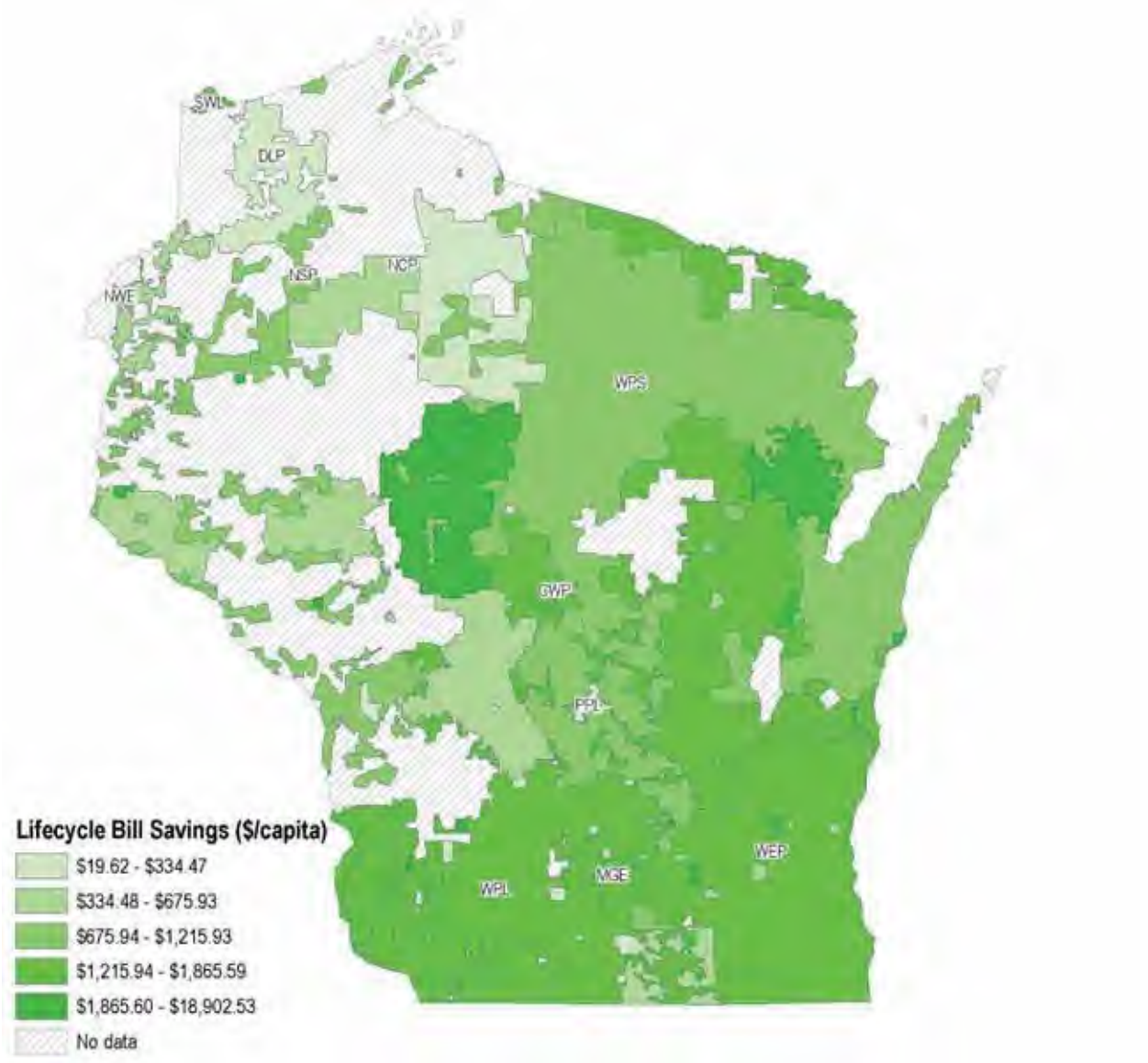


Industrial Per-Capita Incentive Dollars Awarded by Electric Territory

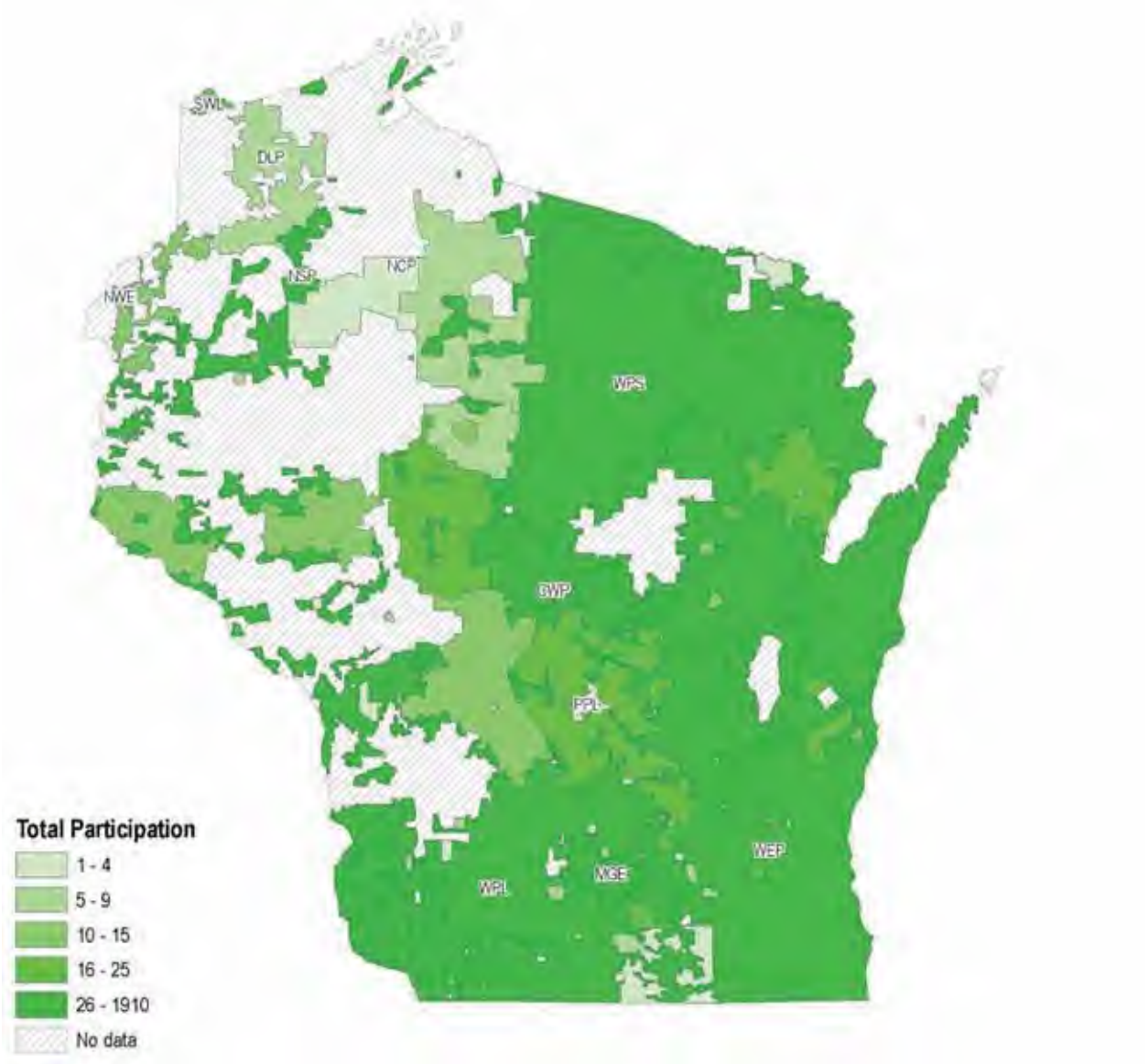


Commercial–Electric Territory

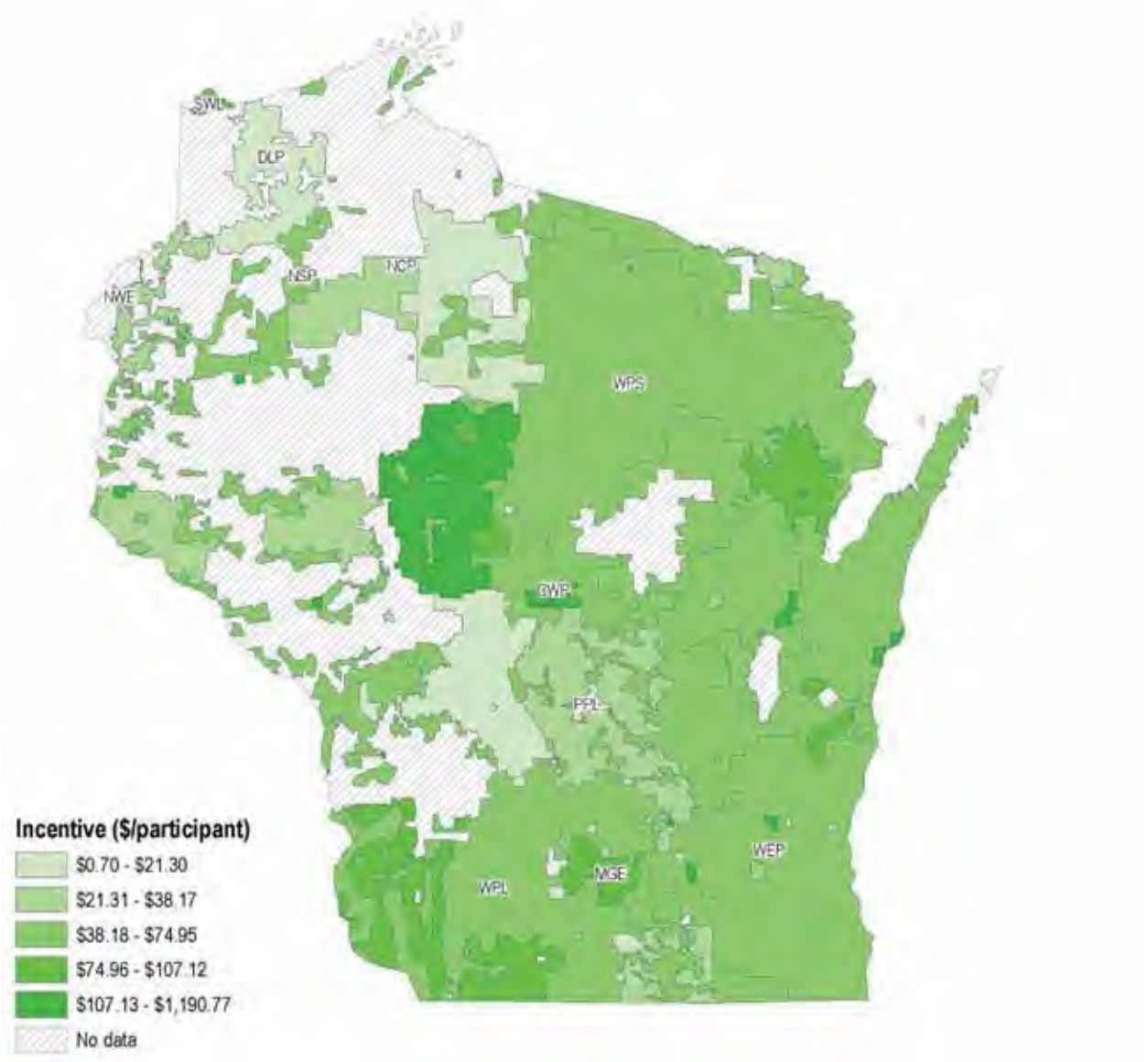
Commercial Per-Capita Energy Bill Savings by Electric Territory



Commercial Participation Rate by Electric Territory

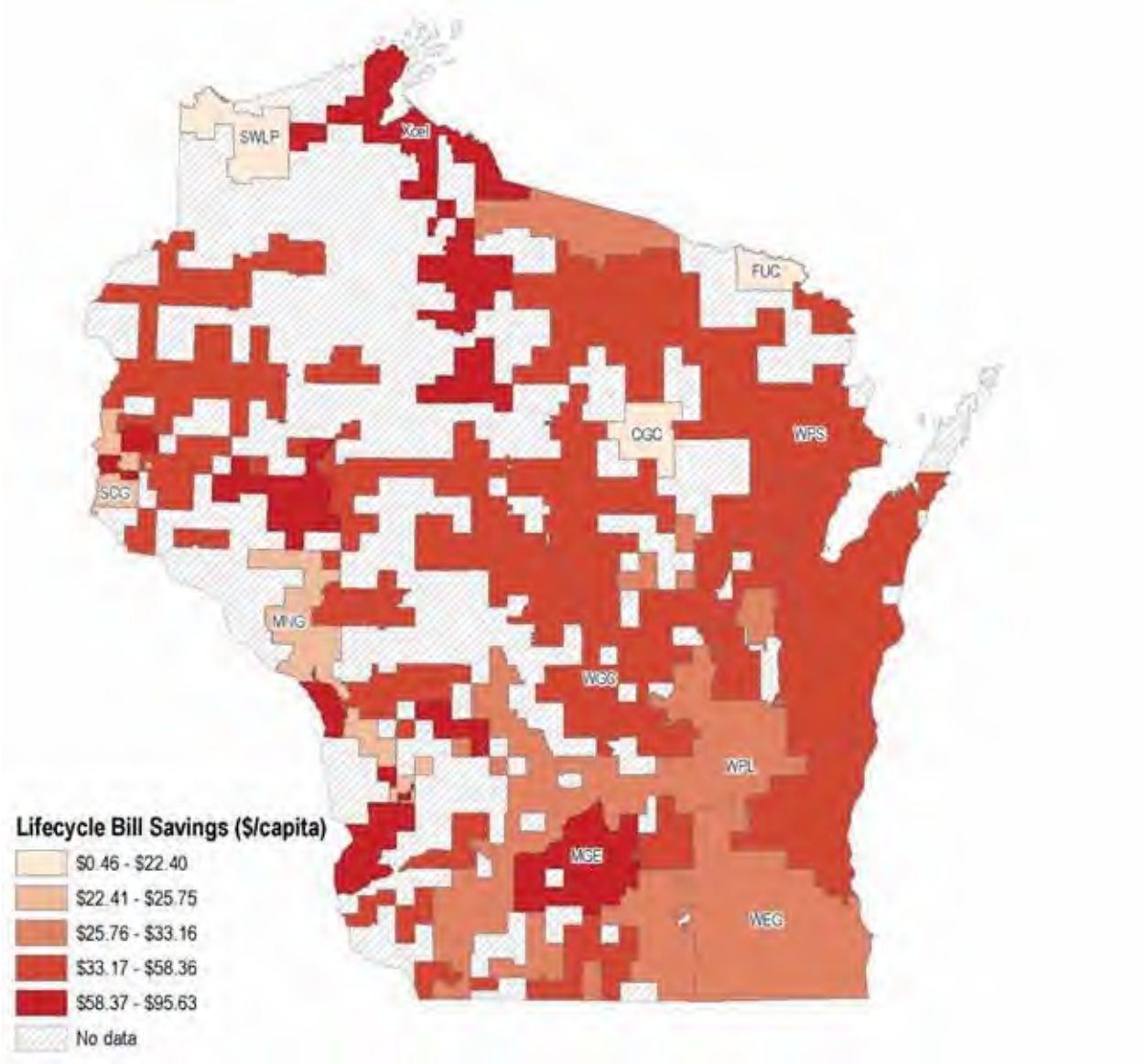


Commercial Per-Capita Incentive Dollars Awarded by Electric Territory

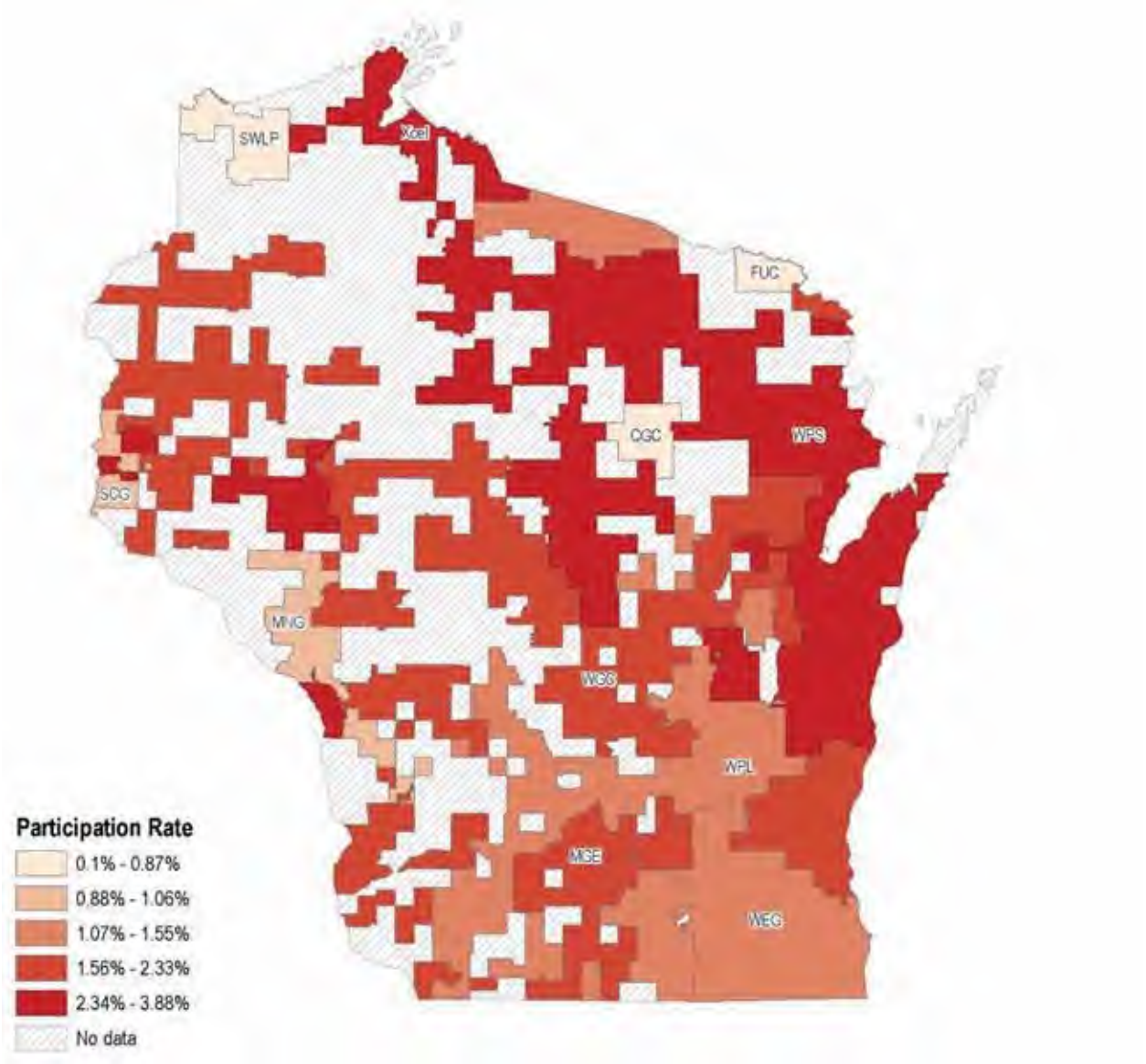


Residential–Gas Territory

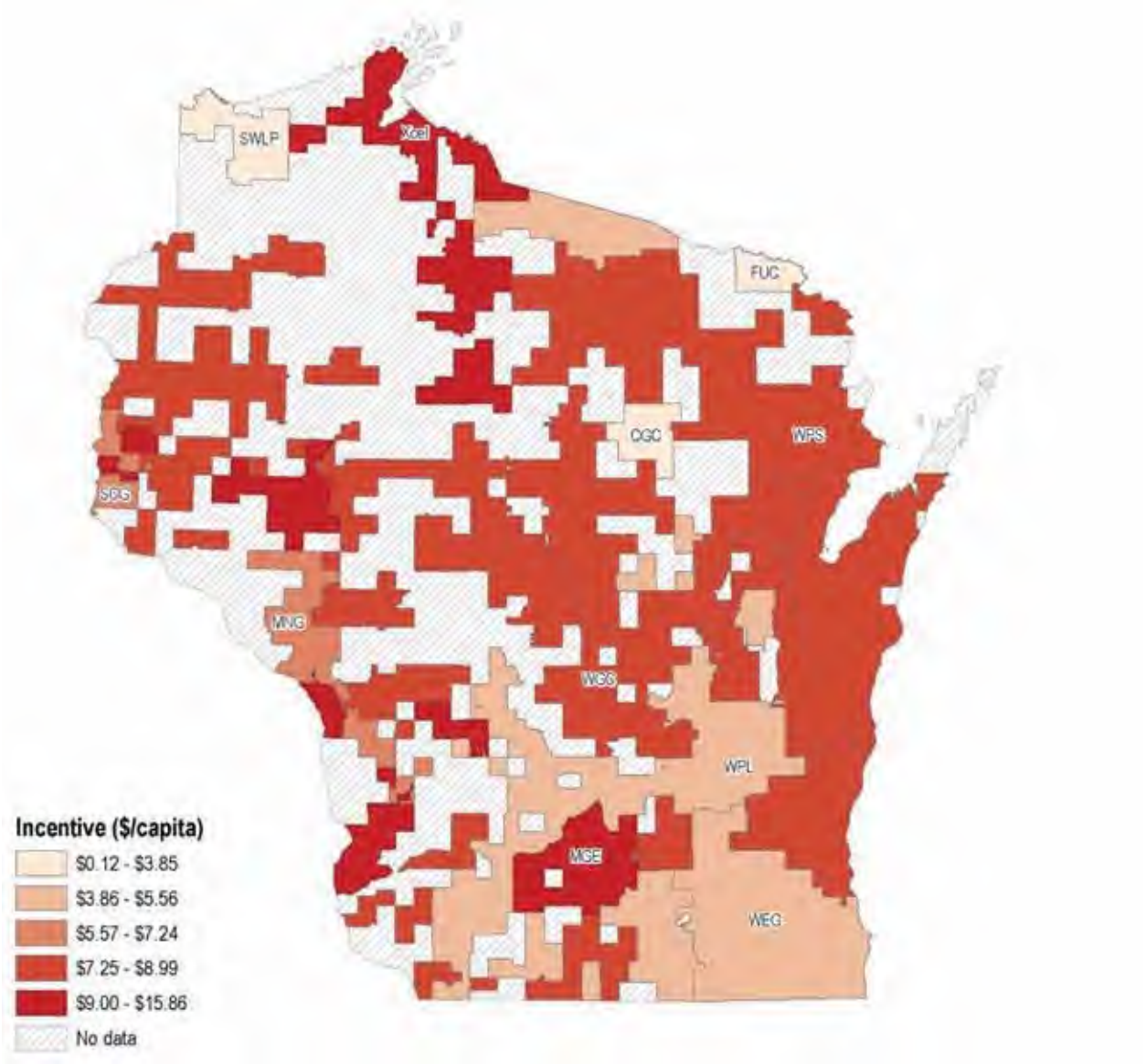
Residential Per-Capita Energy Bill Savings by Gas Territory



Residential Participation Rate by Gas Territory

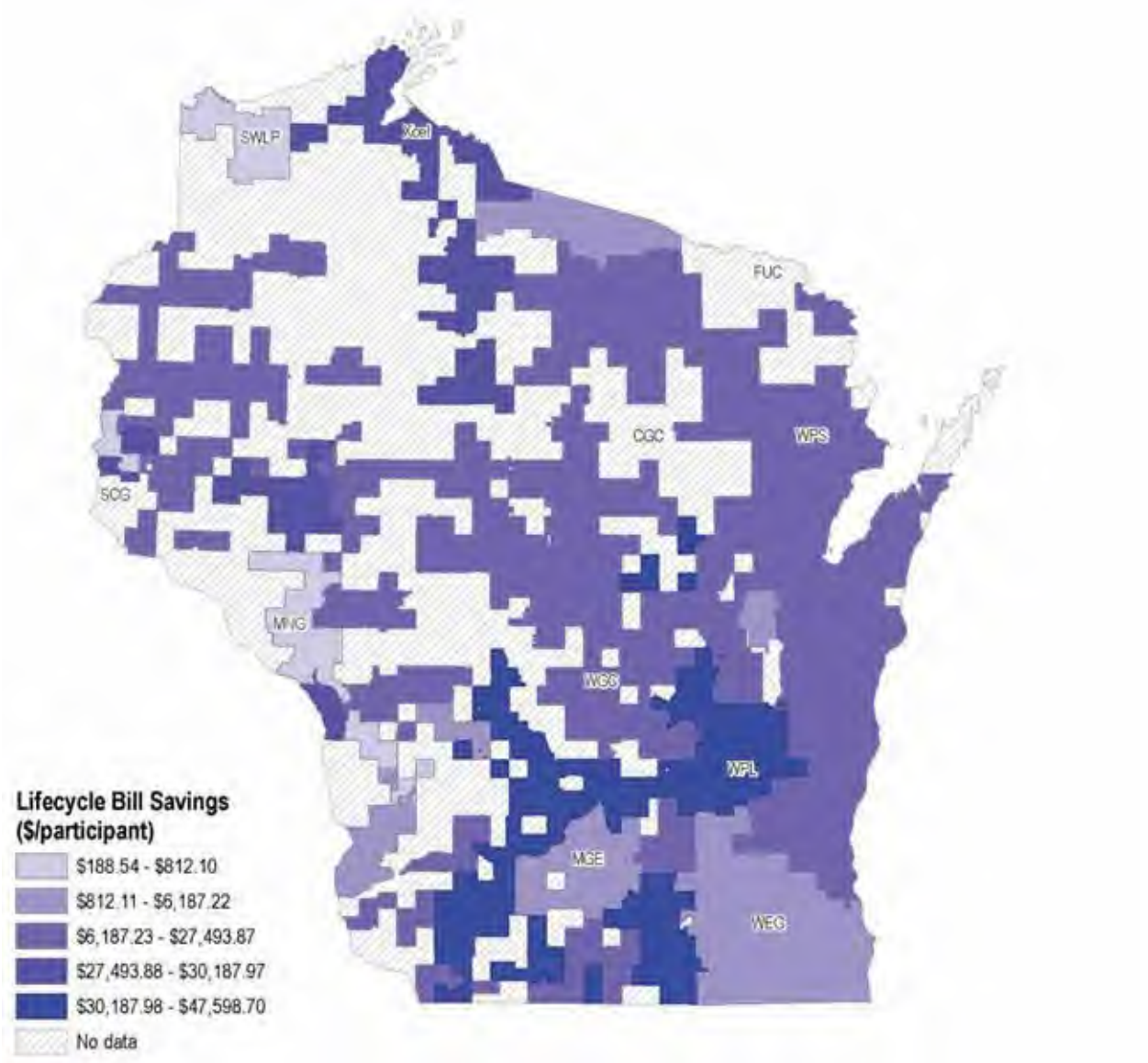


Residential Per-Capita Incentive Dollars Awarded by Gas Territory

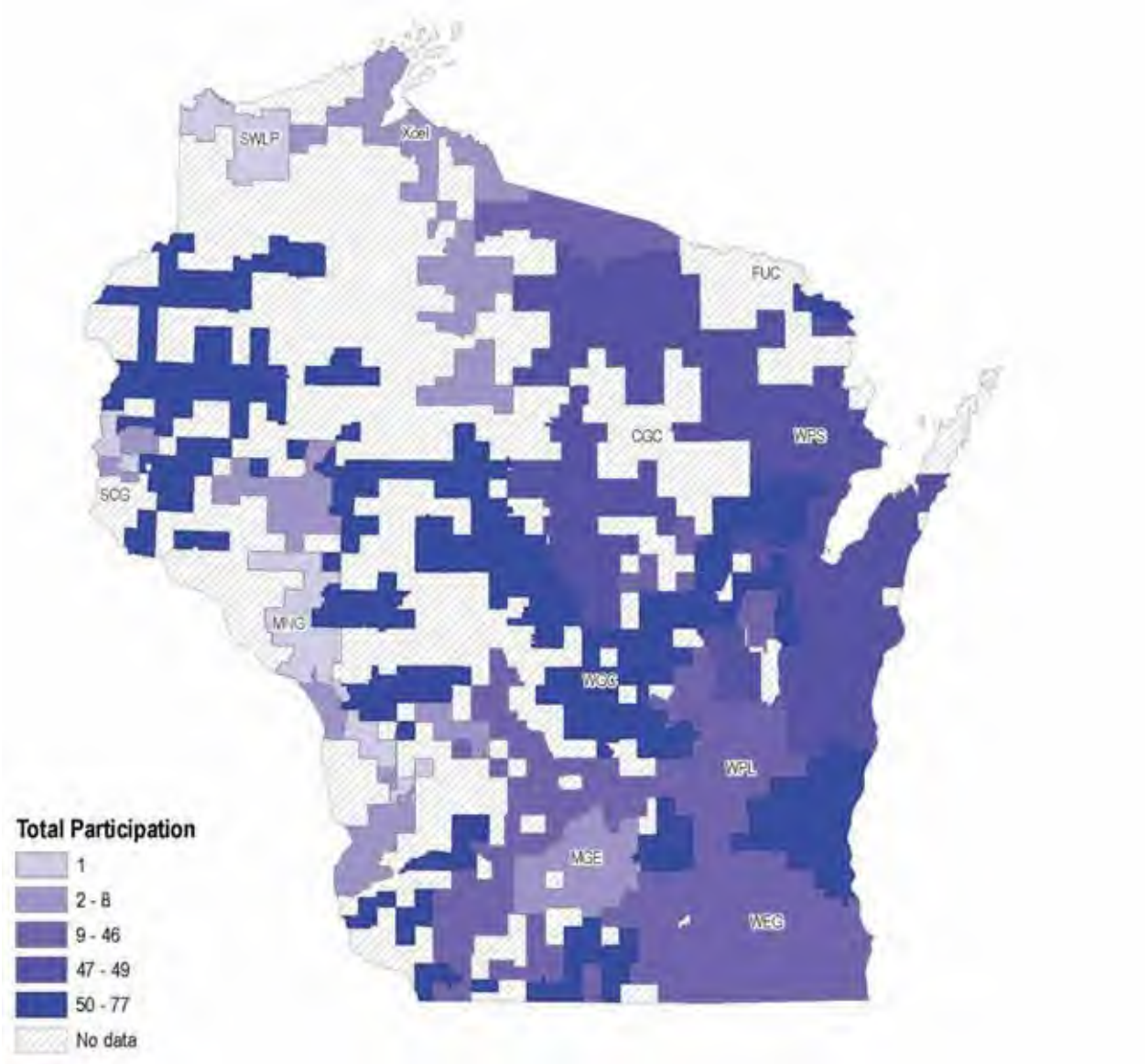


Industrial–Gas Territory

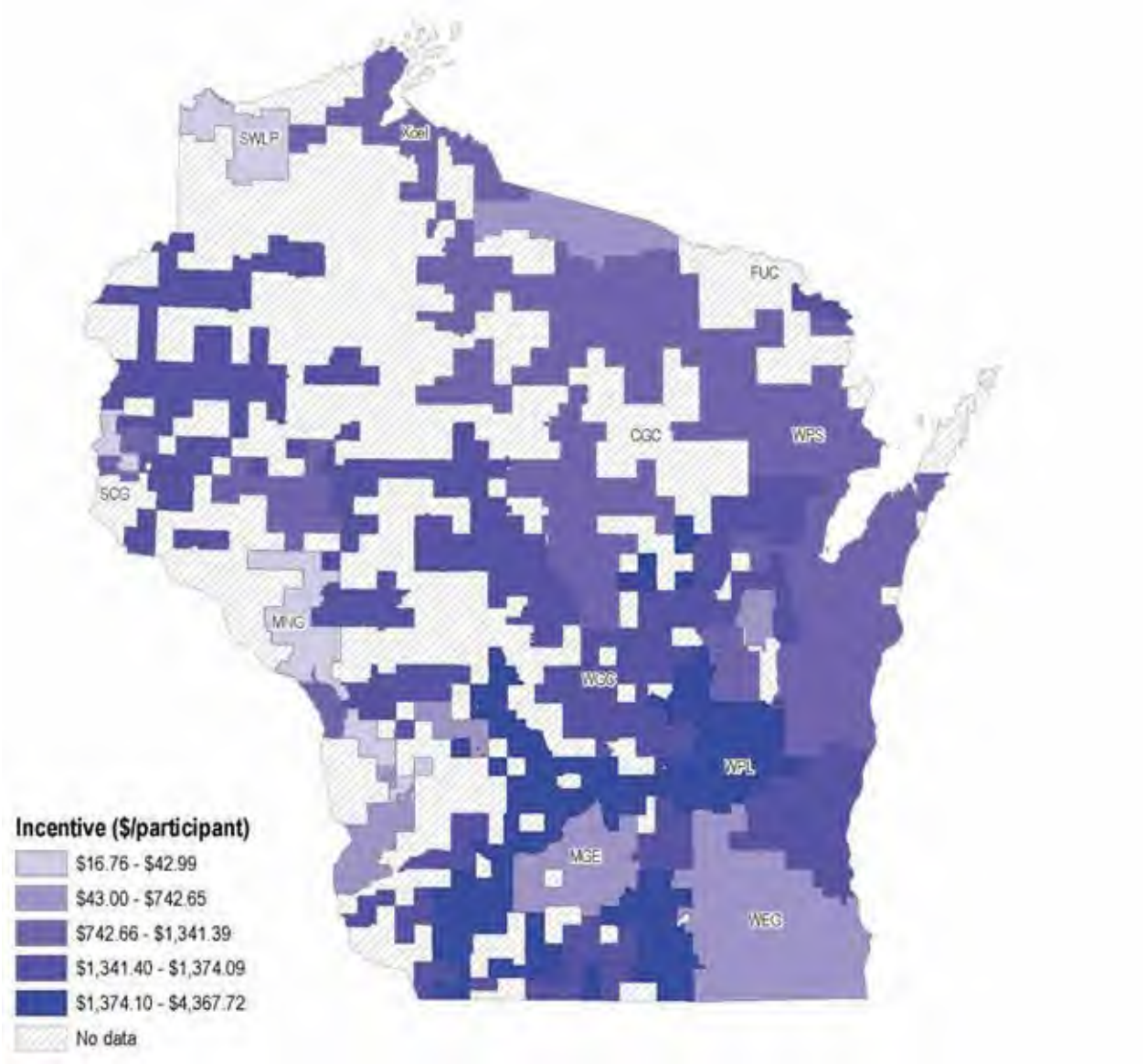
Industrial Per-Capita Energy Bill Savings by Gas Territory



Industrial Participation Rate by Gas Territory

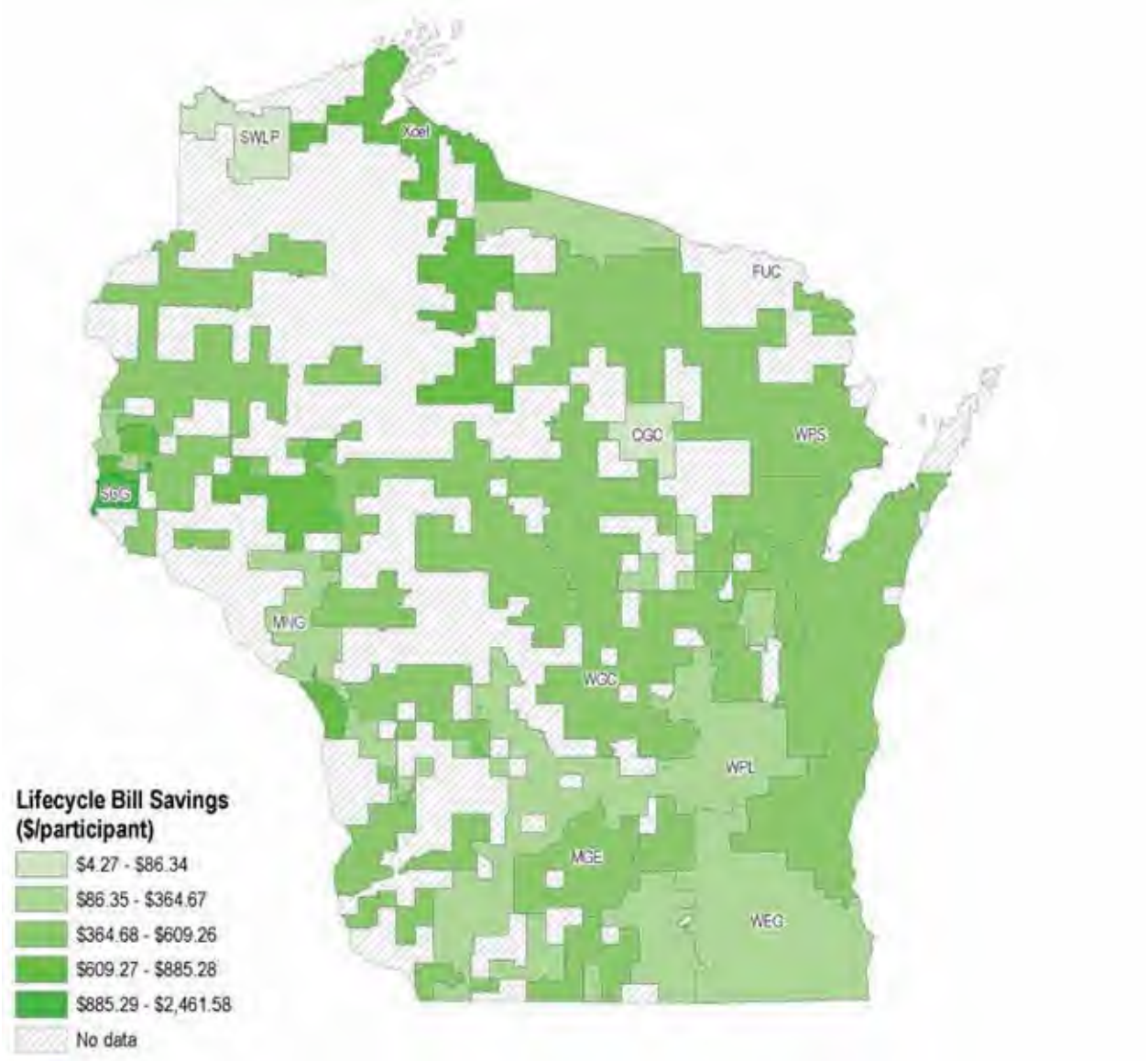


Industrial Per-Capita Incentive Dollars Awarded by Gas Territory

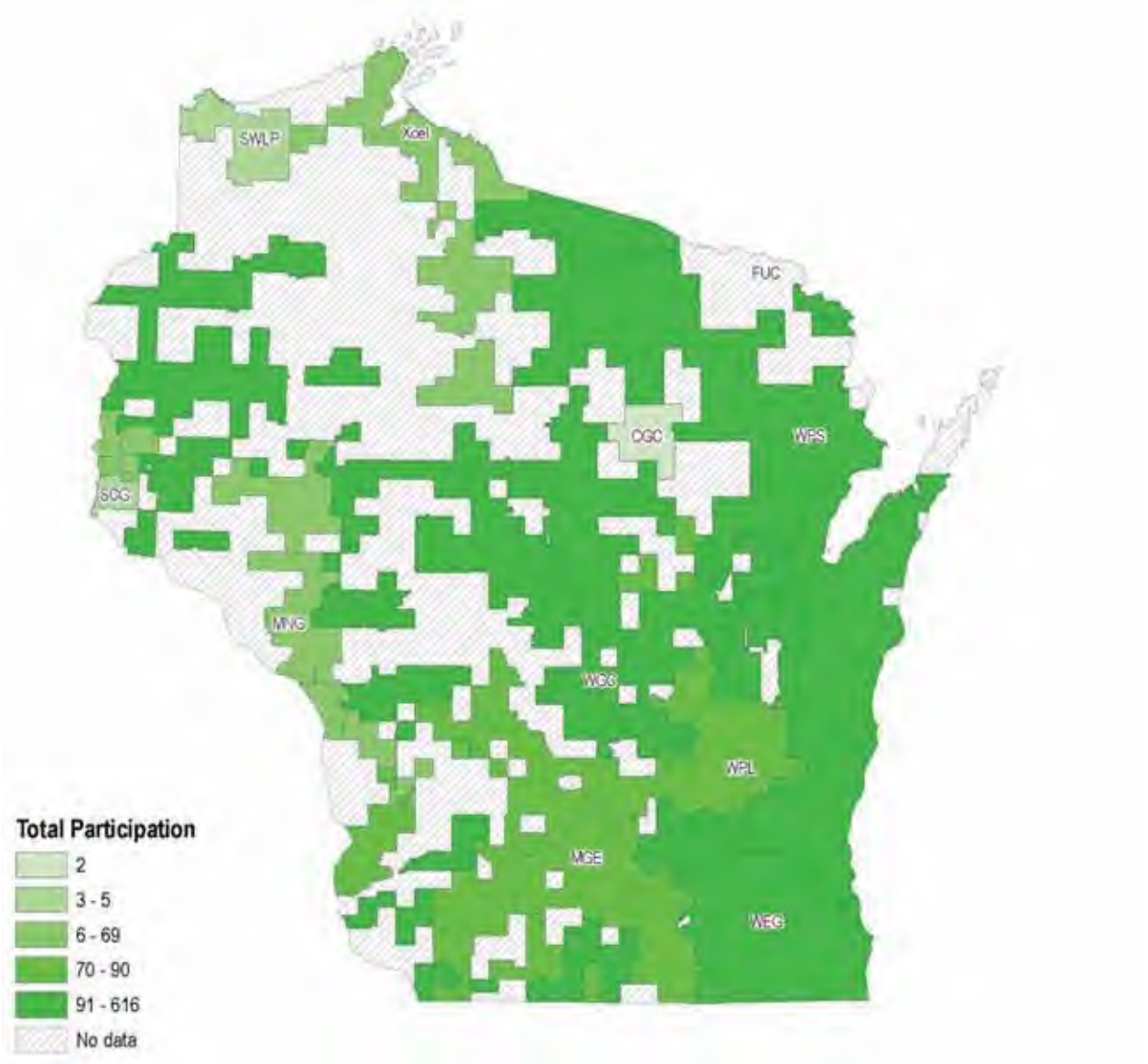


Commercial–Gas Territory

Commercial Per-Capita Energy Bill Savings by Gas Territory



Commercial Participation Rate by Gas Territory



Commercial Per-Capita Incentive Dollars Awarded by Gas Territory

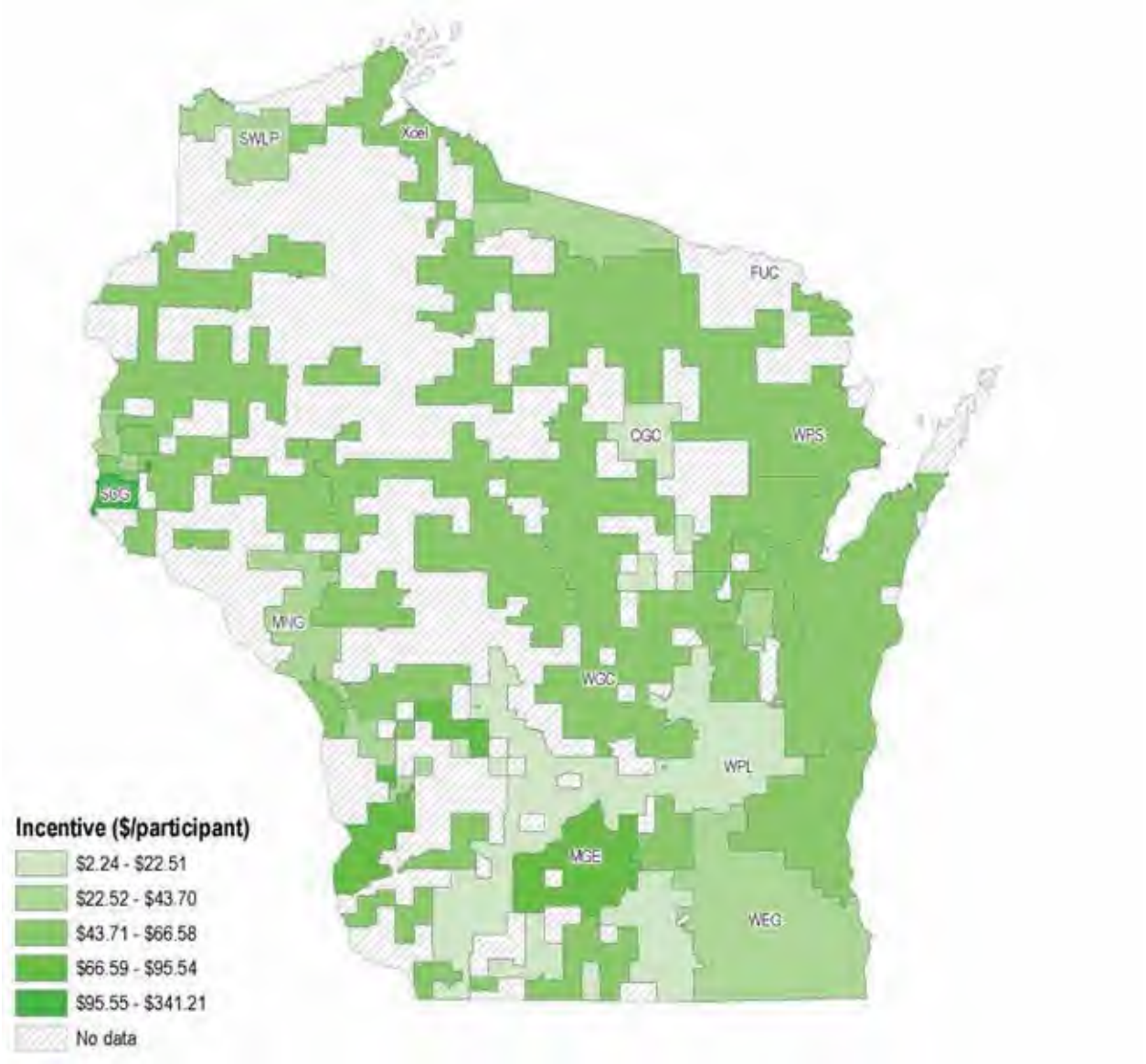


Table F-1. Savings and Participation by Electric Utility Territory and Segment

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
City Gas Company - 32	Gas	Residential	$22	1%	$4
Florence Utility Commission - 59	Gas	Residential	$0	0%	$0
Madison Gas and Electric Company - 93	Gas	Residential	$96	2%	$12
Midwest Natural Gas Incorporated - 103	Gas	Residential	$23	1%	$6
Northern States Power Company (Xcel Energy-Wis) - 116	Gas	Residential	$71	4%	$16
St Croix Valley Natural Gas Company Inc. - 154	Gas	Residential	$26	1%	$7
Superior Water Light and Power Co. - 162	Gas	Residential	$11	0%	$2
Wisconsin Electric Power Company (WE Energies) - 187	Gas	Residential	$28	1%	$5
Wisconsin Gas LLC (WE Energies) - 190	Gas	Residential	$58	2%	$9
Wisconsin Power and Light (Alliant) - 191	Gas	Residential	$33	2%	$6
Wisconsin Public Service Corporation - 192	Gas	Residential	$45	3%	$9
Adams-Columbia Electric Cooperative - 3	Electric	Residential	$21	1%	$2
Algoma Utility Commission - 5	Electric	Residential	$34	3%	$4
Bangor Municipal Utility - 9	Electric	Residential	$29	2%	$4
Barron Light and Water Utility - 11	Electric	Residential	$0	0%	$0
Black River Falls Municipal Elec & Water - 17	Electric	Residential	$79	7%	$9
Boscobel Municipal Utilities - 20	Electric	Residential	$21	1%	$10
Brodhead Water and Light Commission - 21	Electric	Residential	$15	2%	$4
Cedarburg Light and Water Utility - 25	Electric	Residential	$37	2%	$7
Clark Electric Cooperative - 33	Electric	Residential	$38	1%	$3
Clintonville Water & Electric Utility - 35	Electric	Residential	$22	1%	$5
Columbus Water and Light Department - 36	Electric	Residential	$26	1%	$3
Consolidated Water Power Company - 37	Electric	Residential	$18	2%	$2
Cuba City Electric & Water Utility - 39	Electric	Residential	$24	1%	$3
Dahlberg Light and Power Company - 42	Electric	Residential	$8	0%	$1
Eagle River Light and Water Commission - 45	Electric	Residential	$6	1%	$0
Eau Claire Electric Cooperative - 47	Electric	Residential	$115	3%	$9
Elkhorn Light and Water - 48	Electric	Residential	$16	1%	$3
Evansville Water & Light Department - 56	Electric	Residential	$21	2%	$3
Florence Utility Commission - 59	Electric	Residential	$26	4%	$3

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Hartford City of Utilities - 70	Electric	Residential	$51	7%	$10
Hustisford Utilities - 75	Electric	Residential	$27	2%	$3
Jefferson Water and Electric Department - 77	Electric	Residential	$14	1%	$4
Juneau Utility Commission - 82	Electric	Residential	$24	2%	$4
Kaukauna Utilities - 83	Electric	Residential	$45	3%	$7
Lake Mills Light and Water Department - 90	Electric	Residential	$31	1%	$4
Lodi Mun Light and Water Utility - 91	Electric	Residential	$35	2%	$5
Madison Gas and Electric Company - 93	Electric	Residential	$92	3%	$11
Manitowoc Public Utilities - 94	Electric	Residential	$57	8%	$10
Marshfield Utilities - 95	Electric	Residential	$26	3%	$4
Medford Electric Utility - 98	Electric	Residential	$8	1%	$3
Menasha Electric & Water Utilities - 100	Electric	Residential	$59	2%	$8
Mount Horeb Electric Utility - 106	Electric	Residential	$62	3%	$8
Muscoda Light and Water Utility - 107	Electric	Residential	$7	1%	$1
New Glarus Light and Water Works - 109	Electric	Residential	$61	8%	$11
New Holstein Public Utility - 110	Electric	Residential	$74	4%	$6
New London Electric & Water Utility - 112	Electric	Residential	$31	1%	$5
New Richmond Municipal Electric Utility - 113	Electric	Residential	$49	2%	$13
North Central Power Company Inc. - 115	Electric	Residential	$37	0%	$2
Northern States Power Company (Xcel Energy-Wis) - 116	Electric	Residential	$52	3%	$9
Northwestern Wisconsin Electric Co. - 117	Electric	Residential	$25	0%	$3
Oakdale Electric Cooperative - 118	Electric	Residential	$20	1%	$2
Oconomowoc City of Utilities - 119	Electric	Residential	$50	2%	$9
Oconto Electric Cooperative - 120	Electric	Residential	$38	1%	$3
Oconto Falls Water And Light Commission - 121	Electric	Residential	$67	5%	$6
Pierce-Pepin Electric Cooperative - 125	Electric	Residential	$73	2%	$4
Pioneer Power and Light Company - 126	Electric	Residential	$9	1%	$1
Plymouth Utilities - 127	Electric	Residential	$50	2%	$5
Prairie Du Sac Municipal Electric & Water - 130	Electric	Residential	$21	1%	$3
Price Electric Cooperative - 131	Electric	Residential	$17	1%	$1
Reedsburg Utility Commission - 135	Electric	Residential	$45	4%	$6

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Rice Lake Municipal Water & Electric Utility - 136	Electric	Residential	$6	1%	$2
Richland Center Electric Utility - 137	Electric	Residential	$18	1%	$4
River Falls Municipal Utilities - 139	Electric	Residential	$161	2%	$15
Rock Energy Cooperative - 141	Electric	Residential	$28	1%	$3
Scenic Rivers Energy Cooperative - 1848	Electric	Residential	$23	1%	$2
Shawano Municipal Utilities - 148	Electric	Residential	$12	1%	$2
Sheboygan Falls Utilities - 149	Electric	Residential	$31	2%	$5
Slinger Utilities - 151	Electric	Residential	$20	2%	$3
St Croix Electric Cooperative - 153	Electric	Residential	$1	0%	$1
Stoughton Electric Utility - 157	Electric	Residential	$43	4%	$8
Sturgeon Bay Utilities - 160	Electric	Residential	$26	2%	$4
Sun Prairie Water & Light Commission - 161	Electric	Residential	$74	2%	$8
Superior Water Light and Power Co. - 162	Electric	Residential	$4	0%	$1
Taylor Electric Cooperative - 164	Electric	Residential	$28	1%	$3
Two Rivers Water & Light Utility - 169	Electric	Residential	$71	10%	$13
Waterloo Water and Light Commission - 177	Electric	Residential	$27	1%	$5
Waunakee Water and Light Commission - 178	Electric	Residential	$98	3%	$11
Waupun Public Utilities - 179	Electric	Residential	$31	1%	$4
Westby (City of) Municipal Electric & Water Utility - 180	Electric	Residential	$8	1%	$1
Westfield Milling & Electric Light Company - 181	Electric	Residential	$-	0%	$-
Whitehall Municipal Electric Utility - 182	Electric	Residential	$150	6%	$16
Wisconsin Electric Power Company (WE Energies) - 187	Electric	Residential	$51	2%	$7
Wisconsin Power and Light (Alliant) - 191	Electric	Residential	$34	2%	$4
Wisconsin Public Service Corporation - 192	Electric	Residential	$49	3%	$7
Wisconsin Rapids Waterworks & Light - 194	Electric	Residential	$41	3%	$7
City Gas Company - 32	Gas	Commercial	$4	0%	$4
Florence Utility Commission - 59	Gas	Commercial	$-	0%	$-
Madison Gas and Electric Company - 93	Gas	Commercial	$555	1%	$555
Midwest Natural Gas Incorporated - 103	Gas	Commercial	$365	1%	$365

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Northern States Power Company (Xcel Energy-Wis) - 116	Gas	Commercial	$644	1%	$644
St Croix Valley Natural Gas Company Inc. - 154	Gas	Commercial	$2,462	1%	$2,462
Superior Water Light and Power Co. - 162	Gas	Commercial	$86	0%	$86
Wisconsin Electric Power Company (WE Energies) - 187	Gas	Commercial	$294	1%	$294
Wisconsin Gas LLC (WE Energies) - 190	Gas	Commercial	$591	1%	$591
Wisconsin Power and Light (Alliant) - 191	Gas	Commercial	$271	0%	$271
Wisconsin Public Service Corporation - 192	Gas	Commercial	$609	1%	$609
Adams-Columbia Electric Cooperative - 3	Electric	Commercial	$1,104	1%	$1,104
Algoma Utility Commission - 5	Electric	Commercial	$255	2%	$255
Bangor Municipal Utility - 9	Electric	Commercial	$65	0%	$65
Barron Light and Water Utility - 11	Electric	Commercial	$1,976	3%	$1,976
Black River Falls Municipal Elec & Water - 17	Electric	Commercial	$590	2%	$590
Boscobel Municipal Utilities - 20	Electric	Commercial	$2,106	2%	$2,106
Brodhead Water and Light Commission - 21	Electric	Commercial	$20	0%	$20
Cedarburg Light and Water Utility - 25	Electric	Commercial	$546	2%	$546
Clark Electric Cooperative - 33	Electric	Commercial	$3,559	26%	$3,559
Clintonville Water & Electric Utility - 35	Electric	Commercial	$706	3%	$706
Columbus Water and Light Department - 36	Electric	Commercial	$4,803	2%	$4,803
Consolidated Water Power Company - 37	Electric	Commercial	$276	6%	$276
Cuba City Electric & Water Utility - 39	Electric	Commercial	$1,766	4%	$1,766
Dahlberg Light and Power Company - 42	Electric	Commercial	$72	1%	$72
Eagle River Light and Water Commission - 45	Electric	Commercial	$953	6%	$953
Eau Claire Electric Cooperative - 47	Electric	Commercial	$481	2%	$481
Elkhorn Light and Water - 48	Electric	Commercial	$847	2%	$847
Evansville Water & Light Department - 56	Electric	Commercial	$234	2%	$234
Florence Utility Commission - 59	Electric	Commercial	$1,323	1%	$1,323
Hartford City of Utilities - 70	Electric	Commercial	$2,889	2%	$2,889
Hustisford Utilities - 75	Electric	Commercial	$284	2%	$284
Jefferson Water and Electric Department - 77	Electric	Commercial	$497	1%	$497
Juneau Utility Commission - 82	Electric	Commercial	$952	1%	$952

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Kaukauna Utilities - 83	Electric	Commercial	$2,374	5%	$2,374
Lake Mills Light and Water Department - 90	Electric	Commercial	$6,233	2%	$6,233
Lodi Mun Light and Water Utility - 91	Electric	Commercial	$63	1%	$63
Madison Gas and Electric Company - 93	Electric	Commercial	$1,677	1%	$1,677
Manitowoc Public Utilities - 94	Electric	Commercial	$1,651	4%	$1,651
Marshfield Utilities - 95	Electric	Commercial	$1,005	4%	$1,005
Medford Electric Utility - 98	Electric	Commercial	$2,797	2%	$2,797
Menasha Electric & Water Utilities - 100	Electric	Commercial	$961	3%	$961
Mount Horeb Electric Utility - 106	Electric	Commercial	$295	2%	$295
Muscoda Light and Water Utility - 107	Electric	Commercial	$108	1%	$108
New Glarus Light and Water Works - 109	Electric	Commercial	$296	3%	$296
New Holstein Public Utility - 110	Electric	Commercial	$1,329	6%	$1,329
New London Electric & Water Utility - 112	Electric	Commercial	$452	2%	$452
New Richmond Municipal Electric Utility - 113	Electric	Commercial	$255	2%	$255
North Central Power Company Inc. - 115	Electric	Commercial	$521	1%	$521
Northern States Power Company (Xcel Energy-Wis) - 116	Electric	Commercial	$849	1%	$849
Northwestern Wisconsin Electric Co. - 117	Electric	Commercial	$399	1%	$399
Oakdale Electric Cooperative - 118	Electric	Commercial	$377	1%	$377
Oconomowoc City of Utilities - 119	Electric	Commercial	$597	2%	$597
Oconto Electric Cooperative - 120	Electric	Commercial	$1,981	6%	$1,981
Oconto Falls Water And Light Commission - 121	Electric	Commercial	$1,704	3%	$1,704
Pierce-Pepin Electric Cooperative - 125	Electric	Commercial	$671	3%	$671
Pioneer Power and Light Company - 126	Electric	Commercial	$324	2%	$324
Plymouth Utilities - 127	Electric	Commercial	$1,866	2%	$1,866
Prairie Du Sac Municipal Electric & Water - 130	Electric	Commercial	$1,506	3%	$1,506
Price Electric Cooperative - 131	Electric	Commercial	$123	2%	$123
Reedsburg Utility Commission - 135	Electric	Commercial	$334	2%	$334
Rice Lake Municipal Water & Electric Utility - 136	Electric	Commercial	$712	2%	$712
Richland Center Electric Utility - 137	Electric	Commercial	$2,168	2%	$2,168
River Falls Municipal Utilities - 139	Electric	Commercial	$2,762	2%	$2,762
Rock Energy Cooperative - 141	Electric	Commercial	$676	1%	$676

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Scenic Rivers Energy Cooperative - 1848	Electric	Commercial	$1,256	5%	$1,256
Shawano Municipal Utilities - 148	Electric	Commercial	$796	2%	$796
Sheboygan Falls Utilities - 149	Electric	Commercial	$1,270	3%	$1,270
Slinger Utilities - 151	Electric	Commercial	$371	2%	$371
St Croix Electric Cooperative - 153	Electric	Commercial	$-	0%	$-
Stoughton Electric Utility - 157	Electric	Commercial	$858	2%	$858
Sturgeon Bay Utilities - 160	Electric	Commercial	$731	3%	$731
Sun Prairie Water & Light Commission - 161	Electric	Commercial	$1,216	1%	$1,216
Superior Water Light and Power Co. - 162	Electric	Commercial	$1,725	1%	$1,725
Taylor Electric Cooperative - 164	Electric	Commercial	$18,903	3%	$18,903
Two Rivers Water & Light Utility - 169	Electric	Commercial	$1,979	5%	$1,979
Waterloo Water and Light Commission - 177	Electric	Commercial	$335	1%	$335
Waunakee Water and Light Commission - 178	Electric	Commercial	$413	2%	$413
Waupun Public Utilities - 179	Electric	Commercial	$1,108	2%	$1,108
Westby (City of) Municipal Electric & Water Utility - 180	Electric	Commercial	$1,446	1%	$1,446
Westfield Milling & Electric Light Company - 181	Electric	Commercial	$546	2%	$546
Whitehall Municipal Electric Utility - 182	Electric	Commercial	$2,812	2%	$2,812
Wisconsin Electric Power Company (WE Energies) - 187	Electric	Commercial	$1,652	2%	$1,652
Wisconsin Power and Light (Alliant) - 191	Electric	Commercial	$1,238	1%	$1,238
Wisconsin Public Service Corporation - 192	Electric	Commercial	$1,101	2%	$1,101
Wisconsin Rapids Waterworks & Light - 194	Electric	Commercial	$1,415	3%	$1,415
City Gas Company - 32	Gas	Industrial	$-	0%	$-
Florence Utility Commission - 59	Gas	Industrial	$-	0%	$-
Madison Gas and Electric Company - 93	Gas	Industrial	$5,489	12%	$5,489
Midwest Natural Gas Incorporated - 103	Gas	Industrial	$189	1%	$189
Northern States Power Company (Xcel Energy-Wis) - 116	Gas	Industrial	$30,188	4%	$30,188
St Croix Valley Natural Gas Company Inc. - 154	Gas	Industrial	$-	0%	$-
Superior Water Light and Power Co. - 162	Gas	Industrial	$812	1%	$812

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Wisconsin Electric Power Company (WE Energies) - 187	Gas	Industrial	$6,187	3%	$6,187
Wisconsin Gas LLC (WE Energies) - 190	Gas	Industrial	$27,494	5%	$27,494
Wisconsin Power and Light (Alliant) - 191	Gas	Industrial	$47,599	14%	$47,599
Wisconsin Public Service Corporation - 192	Gas	Industrial	$14,676	4%	$14,676
Adams-Columbia Electric Cooperative - 3	Electric	Industrial	$1,123	0%	$1,123
Algoma Utility Commission - 5	Electric	Industrial	$36,835	33%	$36,835
Bangor Municipal Utility - 9	Electric	Industrial	$-	0%	$-
Barron Light and Water Utility - 11	Electric	Industrial	$-	0%	$-
Black River Falls Municipal Elec & Water - 17	Electric	Industrial	$-	0%	$-
Boscobel Municipal Utilities - 20	Electric	Industrial	$1	0%	$1
Brodhead Water and Light Commission - 21	Electric	Industrial	$289	50%	$289
Cedarburg Light and Water Utility - 25	Electric	Industrial	$480	50%	$480
Clark Electric Cooperative - 33	Electric	Industrial	$-	0%	$-
Clintonville Water & Electric Utility - 35	Electric	Industrial	$5,620	30%	$5,620
Columbus Water and Light Department - 36	Electric	Industrial	$96,604	300%	$96,604
Consolidated Water Power Company - 37	Electric	Industrial	$828,768	100%	$828,768
Cuba City Electric & Water Utility - 39	Electric	Industrial	$2	1%	$2
Dahlberg Light and Power Company - 42	Electric	Industrial	$13,361	3%	$13,361
Eagle River Light and Water Commission - 45	Electric	Industrial	$-	0%	$-
Eau Claire Electric Cooperative - 47	Electric	Industrial	$20,026	25%	$20,026
Elkhorn Light and Water - 48	Electric	Industrial	$20	2%	$20
Evansville Water & Light Department - 56	Electric	Industrial	$3,919,777	300%	$3,919,777
Florence Utility Commission - 59	Electric	Industrial	$-	0%	$-
Hartford City of Utilities - 70	Electric	Industrial	$250,237	71%	$250,237
Hustisford Utilities - 75	Electric	Industrial	$-	0%	$-
Jefferson Water and Electric Department - 77	Electric	Industrial	$-	0%	$-
Juneau Utility Commission - 82	Electric	Industrial	$-	0%	$-
Kaukauna Utilities - 83	Electric	Industrial	$511,939	180%	$511,939
Lake Mills Light and Water Department - 90	Electric	Industrial	$3	0%	$3
Lodi Mun Light and Water Utility - 91	Electric	Industrial	$2	0%	$2
Madison Gas and Electric Company - 93	Electric	Industrial	$64,470	44%	$64,470

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Manitowoc Public Utilities - 94	Electric	Industrial	$60,638	23%	$60,638
Marshfield Utilities - 95	Electric	Industrial	$8,179	10%	$8,179
Medford Electric Utility - 98	Electric	Industrial	$1,583	4%	$1,583
Menasha Electric & Water Utilities - 100	Electric	Industrial	$199,022	110%	$199,022
Mount Horeb Electric Utility - 106	Electric	Industrial	$1	0%	$1
Muscoda Light and Water Utility - 107	Electric	Industrial	$2,642,900	200%	$2,642,900
New Glarus Light and Water Works - 109	Electric	Industrial	$-	0%	$-
New Holstein Public Utility - 110	Electric	Industrial	$58	0%	$58
New London Electric & Water Utility - 112	Electric	Industrial	$36,097	60%	$36,097
New Richmond Municipal Electric Utility - 113	Electric	Industrial	$111,699	300%	$111,699
North Central Power Company Inc. - 115	Electric	Industrial	$-	0%	$-
Northern States Power Company (Xcel Energy-Wis) - 116	Electric	Industrial	$181,897	64%	$181,897
Northwestern Wisconsin Electric Co. - 117	Electric	Industrial	$2,105	4%	$2,105
Oakdale Electric Cooperative - 118	Electric	Industrial	$357	4%	$357
Oconomowoc City of Utilities - 119	Electric	Industrial	$13,266	80%	$13,266
Oconto Electric Cooperative - 120	Electric	Industrial	$19,952	7%	$19,952
Oconto Falls Water And Light Commission - 121	Electric	Industrial	$273	1%	$273
Pierce-Pepin Electric Cooperative - 125	Electric	Industrial	$-	0%	$-
Pioneer Power and Light Company - 126	Electric	Industrial	$-	0%	$-
Plymouth Utilities - 127	Electric	Industrial	$213,172	113%	$213,172
Prairie Du Sac Municipal Electric & Water - 130	Electric	Industrial	$287	100%	$287
Price Electric Cooperative - 131	Electric	Industrial	$-	0%	$-
Reedsburg Utility Commission - 135	Electric	Industrial	$30,166	75%	$30,166
Rice Lake Municipal Water & Electric Utility - 136	Electric	Industrial	$289	2%	$289
Richland Center Electric Utility - 137	Electric	Industrial	$23,422	50%	$23,422
River Falls Municipal Utilities - 139	Electric	Industrial	$18,803	100%	$18,803
Rock Energy Cooperative - 141	Electric	Industrial	$194	1%	$194
Scenic Rivers Energy Cooperative - 1848	Electric	Industrial	$41,938	50%	$41,938
Shawano Municipal Utilities - 148	Electric	Industrial	$1,179	3%	$1,179
Sheboygan Falls Utilities - 149	Electric	Industrial	$5,491	7%	$5,491
Slinger Utilities - 151	Electric	Industrial	$1	0%	$1
St Croix Electric Cooperative - 153	Electric	Industrial	$-	0%	$-

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Stoughton Electric Utility - 157	Electric	Industrial	$7,973	67%	$7,973
Sturgeon Bay Utilities - 160	Electric	Industrial	$469,697	300%	$469,697
Sun Prairie Water & Light Commission - 161	Electric	Industrial	$129,314	150%	$129,314
Superior Water Light and Power Co. - 162	Electric	Industrial	$-	0%	$-
Taylor Electric Cooperative - 164	Electric	Industrial	$-	0%	$-
Two Rivers Water & Light Utility - 169	Electric	Industrial	$133,858	300%	$133,858
Waterloo Water and Light Commission - 177	Electric	Industrial	$1	0%	$1
Waunakee Water and Light Commission - 178	Electric	Industrial	$168	33%	$168
Waupun Public Utilities - 179	Electric	Industrial	$612	50%	$612
Westby (City of) Municipal Electric & Water Utility - 180	Electric	Industrial	$-	0%	$-
Westfield Milling & Electric Light Company - 181	Electric	Industrial	$-	0%	$-
Whitehall Municipal Electric Utility - 182	Electric	Industrial	$-	0%	$-
Wisconsin Electric Power Company (WE Energies) - 187	Electric	Industrial	$61,585	38%	$61,585
Wisconsin Power and Light (Alliant) - 191	Electric	Industrial	$18,397	11%	$18,397
Wisconsin Public Service Corporation - 192	Electric	Industrial	$140,468	63%	$140,468
Wisconsin Rapids Waterworks & Light - 194	Electric	Industrial	$75,562	160%	$75,562
City Gas Company - 32	Gas	Industrial			
Florence Utility Commission - 59	Gas	Industrial			
Madison Gas and Electric Company - 93	Gas	Industrial	$5,489	12%	$449
Midwest Natural Gas Incorporated - 103	Gas	Industrial	$189	1%	$43
Northern States Power Company (Xcel Energy-Wis) - 116	Gas	Industrial	$30,188	4%	$1,128
St Croix Valley Natural Gas Company Inc. - 154	Gas	Industrial			
Superior Water Light and Power Co. - 162	Gas	Industrial	$812	1%	$17
Wisconsin Electric Power Company (WE Energies) - 187	Gas	Industrial	$6,187	3%	$743
Wisconsin Gas LLC (WE Energies) - 190	Gas	Industrial	$27,494	5%	$1,374
Wisconsin Power and Light (Alliant) - 191	Gas	Industrial	$47,599	14%	$4,368
Wisconsin Public Service Corporation - 192	Gas	Industrial	$14,676	4%	$1,341

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Adams-Columbia Electric Cooperative - 3	Electric	Industrial	$1,123	0%	$42
Algoma Utility Commission - 5	Electric	Industrial	$36,835	33%	$2,242
Bangor Municipal Utility - 9	Electric	Industrial			
Barron Light and Water Utility - 11	Electric	Industrial			
Black River Falls Municipal Elec & Water - 17	Electric	Industrial			
Boscobel Municipal Utilities - 20	Electric	Industrial	$1	0%	$-
Brodhead Water and Light Commission - 21	Electric	Industrial	$289	50%	$-
Cedarburg Light and Water Utility - 25	Electric	Industrial	$480	50%	$-
Clark Electric Cooperative - 33	Electric	Industrial			
Clintonville Water & Electric Utility - 35	Electric	Industrial	$5,620	30%	$345
Columbus Water and Light Department - 36	Electric	Industrial	$96,604	300%	$5,026
Consolidated Water Power Company - 37	Electric	Industrial	$828,768	100%	$44,507
Cuba City Electric & Water Utility - 39	Electric	Industrial	$2	1%	$-
Dahlberg Light and Power Company - 42	Electric	Industrial	$13,361	3%	$360
Eagle River Light and Water Commission - 45	Electric	Industrial			
Eau Claire Electric Cooperative - 47	Electric	Industrial	$20,026	25%	$1,377
Elkhorn Light and Water - 48	Electric	Industrial	$20	2%	$-
Evansville Water & Light Department - 56	Electric	Industrial	$3,919,777	300%	$160,739
Florence Utility Commission - 59	Electric	Industrial			
Hartford City of Utilities - 70	Electric	Industrial	$250,237	71%	$10,978
Hustisford Utilities - 75	Electric	Industrial			
Jefferson Water and Electric Department - 77	Electric	Industrial			
Juneau Utility Commission - 82	Electric	Industrial			
Kaukauna Utilities - 83	Electric	Industrial	$511,939	180%	$26,539
Lake Mills Light and Water Department - 90	Electric	Industrial	$3	0%	$-
Lodi Mun Light and Water Utility - 91	Electric	Industrial	$2	0%	$-
Madison Gas and Electric Company - 93	Electric	Industrial	$64,470	44%	$2,548
Manitowoc Public Utilities - 94	Electric	Industrial	$60,638	23%	$5,875
Marshfield Utilities - 95	Electric	Industrial	$8,179	10%	$441
Medford Electric Utility - 98	Electric	Industrial	$1,583	4%	$105
Menasha Electric & Water Utilities - 100	Electric	Industrial	$199,022	110%	$10,592
Mount Horeb Electric Utility - 106	Electric	Industrial	$1	0%	$-
Muscoda Light and Water Utility - 107	Electric	Industrial	$2,642,900	200%	$105,441

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
New Glarus Light and Water Works - 109	Electric	Industrial			
New Holstein Public Utility - 110	Electric	Industrial	$58	0%	$3
New London Electric & Water Utility - 112	Electric	Industrial	$36,097	60%	$1,362
New Richmond Municipal Electric Utility - 113	Electric	Industrial	$111,699	300%	$9,959
North Central Power Company Inc. - 115	Electric	Industrial			
Northern States Power Company (Xcel Energy-Wis) - 116	Electric	Industrial	$181,897	64%	$10,773
Northwestern Wisconsin Electric Co. - 117	Electric	Industrial	$2,105	4%	$229
Oakdale Electric Cooperative - 118	Electric	Industrial	$357	4%	$25
Oconomowoc City of Utilities - 119	Electric	Industrial	$13,266	80%	$736
Oconto Electric Cooperative - 120	Electric	Industrial	$19,952	7%	$671
Oconto Falls Water And Light Commission - 121	Electric	Industrial	$273	1%	$20
Pierce-Pepin Electric Cooperative - 125	Electric	Industrial			
Pioneer Power and Light Company - 126	Electric	Industrial			
Plymouth Utilities - 127	Electric	Industrial	$213,172	113%	$14,541
Prairie Du Sac Municipal Electric & Water - 130	Electric	Industrial	$287	100%	$-
Price Electric Cooperative - 131	Electric	Industrial			
Reedsburg Utility Commission - 135	Electric	Industrial	$30,166	75%	$2,649
Rice Lake Municipal Water & Electric Utility - 136	Electric	Industrial	$289	2%	$14
Richland Center Electric Utility - 137	Electric	Industrial	$23,422	50%	$2,738
River Falls Municipal Utilities - 139	Electric	Industrial	$18,803	100%	$663
Rock Energy Cooperative - 141	Electric	Industrial	$194	1%	$19
Scenic Rivers Energy Cooperative - 1848	Electric	Industrial	$41,938	50%	$726
Shawano Municipal Utilities - 148	Electric	Industrial	$1,179	3%	$38
Sheboygan Falls Utilities - 149	Electric	Industrial	$5,491	7%	$1,027
Slinger Utilities - 151	Electric	Industrial	$1	0%	$-
St Croix Electric Cooperative - 153	Electric	Industrial			
Stoughton Electric Utility - 157	Electric	Industrial	$7,973	67%	$400
Sturgeon Bay Utilities - 160	Electric	Industrial	$469,697	300%	$20,570
Sun Prairie Water & Light Commission - 161	Electric	Industrial	$129,314	150%	$7,511
Superior Water Light and Power Co. - 162	Electric	Industrial			
Taylor Electric Cooperative - 164	Electric	Industrial			

Territory	Utility Type	Segment	Per-Capita Life-Cycle Bill Savings ($)	Customer Participation Rate (%)	Per-Capita Incentive ($)
Two Rivers Water & Light Utility - 169	Electric	Industrial	$133,858	300%	$3,218
Waterloo Water and Light Commission - 177	Electric	Industrial	$1	0%	$-
Waunakee Water and Light Commission - 178	Electric	Industrial	$168	33%	$-
Waupun Public Utilities - 179	Electric	Industrial	$612	50%	$138
Westby (City of) Municipal Electric & Water Utility - 180	Electric	Industrial			
Westfield Milling & Electric Light Company - 181	Electric	Industrial			
Whitehall Municipal Electric Utility - 182	Electric	Industrial			
Wisconsin Electric Power Company (WE Energies) - 187	Electric	Industrial	$61,585	38%	$4,033
Wisconsin Power and Light (Alliant) - 191	Electric	Industrial	$18,397	11%	$1,482
Wisconsin Public Service Corporation - 192	Electric	Industrial	$140,468	63%	$9,345
Wisconsin Rapids Waterworks & Light - 194	Electric	Industrial	$75,562	160%	$40,850

Appendix G. CY 2014 Statewide Total Energy Efficiency Savings and Participation

Table G-1 presents CY 2014 Focus on Energy, Northern States Power, We Energies, Wisconsin Power and Light, as well as Wisconsin Public Service Energy Efficiency program savings and participation. Utilities may run voluntary programs, with authorization from the Wisconsin PSC, using additional funds to the funding they contribute to Focus on Energy. Northern States Power, We Energies, and Wisconsin Public Service complemented Focus on Energy programs in CY 2014 by adding bonus incentives.

Table G-1. CY 2014 Wisconsin Total Energy Efficiency Gross Annual Savings and Participation

Program	Participation	kW	kWh	Therms
Focus on Energy[1]	991,944	93,856	735,876,317	25,578,678
Northern States Power[2]	1,722	TBD	TBD	TBD
We Energies[3]	99	0	0	43,377
Wisconsin Power and Light[4]	TBD	TBD	TBD	TBD
Wisconsin Public Service[5]	0	0	0	0

[1] Includes estimated Residential Lighting and Appliance Program participation.

[2] See Docket 4220-GF-123 for additional details. Savings for the Community Conservation Program designed to complement Focus on Energy programs by adding bonus incentives for both residential and business customers throughout the service territory are forthcoming. Gross annual savings have not yet been calculated for the CY 2014 Program.

[3] We Energies' Residential Assistance Natural Gas Program. See Docket 6630-GF-136 for additional details.

[4] Wisconsin Power and Light's Alliant Energy Advisor Program. See Docket 6680-GF-133 for additional details. Gross annual savings have not yet been calculated for the CY 2014 Program; savings values are forthcoming.

[5] Wisconsin Public Service's Territory Wide and Focus on Energy Bonus Programs. See Docket 6690-UR 119 for additional details. Does not include Focus on Energy Bonus Program Savings as they are reported by Focus on Energy. Besides the Focus on Energy bonus programs, Wisconsin Public Service offered no other voluntary programs in 2014.

Appendix H. Detailed Findings

This section contains detailed first-year annual gross savings and life-cycle savings for the nonresidential and residential segments as well as savings organized by program and measure category.

Overview of Savings

Table H-1 lists first-year annual savings: gross claimed, gross verified, and verified net. In CY 2014, on an annual gross claimed basis prior to verification, Focus on Energy achieved a total of 735,876,317 kWh savings and 25,578,678 therm savings.

Table H-1. CY 2014 First-Year Annual Savings by Segment[1]

		Nonresidential	Residential	Total
Gross	kWh	405,762,654	330,113,663	735,876,317
	kW	59,428	34,427	93,856
	Therms	20,900,613	4,678,066	25,578,678
Verified Gross	kWh	426,323,541	331,055,834	757,379,375
	kW	62,146	43,538	105,684
	Therms	20,159,448	4,265,593	24,425,040
Verified Net	kWh	318,522,062	239,161,899	557,683,961
	kW	46,334	30,508	76,842
	Therms	15,242,822	3,078,143	18,320,964

[1] Totals may not match the sum of nonresidential and residential savings due to rounding.

Table H-2 lists the first-year annual savings for CY 2014, CY 2013, CY 2012, and CY 2011. The annual verified net electric, peak demand, and natural gas savings have increased from CY 2011 to CY 2014.

Table H-2. First-Year Annual Verified Net Savings by Segment—CY 2011, CY 2012, CY 2013, and CY 2014[1]

Calendar Year	Unit	Residential	Nonresidential	Total
2011	kWh	61,368,714	207,596,331	268,965,045
	kW	12,763	34,558	47,320
	Therms	2,088,348	9,163,081	11,251,429
2012	kWh	126,367,389	334,417,343	460,784,732
	kW	18,299	48,518	66,817
	Therms	3,273,440	13,203,348	16,476,788
2013	kWh	297,880,259	321,538,168	619,418,427
	kW	35,793	51,816	87,608
	Therms	3,412,565	14,064,701	17,477,267
2014	kWh	318,522,062	239,161,899	557,683,961
	kW	46,334	30,508	76,842
	Therms	15,242,822	3,078,143	18,320,964
Total	**kWh**	**804,138,424**	**1,102,713,741**	**1,906,852,165**
	kW	**113,189**	**165,400**	**278,587**
	Therms	**24,017,175**	**39,509,273**	**63,526,448**

[1] Includes renewable energy measures. Totals may not match the sum of nonresidential and residential savings due to rounding.

Table H-3 presents the verified gross life-cycle savings achieved by Focus on Energy in CY 2011, CY 2012, CY 2013, and CY 2014. Life-cycle savings represent the savings the measures installed during CY 2014 will achieve during their useful lifetimes. Certain effective useful lifetimes (EULs) were carried forward from the 2011 and CY 2012 evaluations and verified in program tracking records. The Evaluation Team adjusted certain measure specific EULs to reflect the CY 2014 evaluation findings.

Table H-3. CY 2011, CY 2012, CY 2013, and CY 2014 Verified Gross Life-Cycle Savings by Segment [1]

Calendar Year	Unit	Residential	Nonresidential	Total
2011	kWh	885,561,963	4,374,342,776	5,259,904,739
	kW	19,327	57,747	77,074
	Therms	60,435,758	185,735,647	246,171,405
2012	kWh	1,578,656,352	5,390,366,110	6,969,022,462
	kW	28,697	65,522	94,219
	Therms	80,249,406	273,269,275	353,518,681
2013	kWh	2,965,153,969	5,628,502,360	8,593,656,329
	kW	47,762	78,381	126,143
	Therms	90,424,987	227,669,922	318,094,910
2014	kWh	2,696,994,975	5,490,288,656	8,187,283,631
	kW	43,538	62,146	105,684
	Therms	94,541,074	263,264,489	357,805,563
Total	**kWh**	**8,126,367,259**	**20,883,499,902**	**29,009,867,161**
	kW	**139,324**	**263,796**	**403,120**
	Therms	**325,651,225**	**949,939,333**	**1,275,590,559**

[1] Includes renewable energy measures. Totals may not match the sum of nonresidential and residential savings due to rounding.

Summary of Savings by Program

Table H-4 summarizes the first-year annual savings by program.

Table H-4. Summary of First-Year Annual Savings by Program, CY 20141

Program Name	Gross			Verified Gross			Verified Net		
	kWh	kW	therms	kWh	kW	therms	kWh	kW	therms
Residential Programs									
Multifamily Direct Install	2,504,195	224	155,516	2,428,022	217	150,429	2,428,022	217	150,429
Multifamily Energy Savings	9,023,306	1,012	426,323	9,023,306	1,012	426,323	7,211,812	781	367,453
Appliance Recycling	21,599,340	2,865	-	17,897,745	2,374	-	9,483,162	1,258	-
Residential Lighting and Appliance	267,271,017	21,024	19,282	272,050,680	30,510	20,229	198,241,011	22,141	5,553
Home Performance with ENERGY STAR	1,450,062	487	559,390	1,963,987	660	233,795	1,911,523	635	223,664
Assisted Home Performance with ENERGY STAR	439,262	151	182,856	431,706	150	182,610	431,706	150	182,610
New Homes	3,843,213	1,233	875,717	3,843,213	1,233	875,717	2,563,247	811	564,984
Residential Rewards	11,998,259	5,366	1,749,481	11,997,388	5,366	1,749,481	5,471,628	2,499	956,441
Renewable Rewards (Residential)	2,356,711	686	1,348	2,356,711	686	1,348	2,356,711	686	1,348
Renewable Rewards (Nonresidential)	183,862	74	-	183,862	74	-	183,862	74	-
Enhanced Rewards	756,380	334	264,495	756,380	334	264,495	756,380	334	264,495
Express Energy Efficiency	8,688,056	971	443,658	8,122,835	922	361,167	8,122,835	922	361,167
Residential Total	**330,113,663**	**34,427**	**4,678,066**	**331,055,834**	**43,538**	**4,265,593**	**239,161,899**	**30,508**	**3,078,143**
Nonresidential Programs									
Business Incentive	144,754,497	20,972	7,179,610	143,217,468	22,332	6,616,652	103,932,594	16,228	5,152,387
Chain Stores and Franchises	46,127,984	6,540	459,340	44,744,926	6,540	476,975	27,088,731	3,953	287,153
Large Energy Users	121,537,211	15,364	12,069,530	145,735,249	18,871	11,909,020	112,931,861	14,726	8,869,045
Small Business	40,626,815	7,905	38,350	40,626,815	7,905	38,350	30,104,585	5,786	32,614
Design Assistance (Business)	18,206,991	4,007	508,751	17,383,288	2,033	475,465	9,949,346	1,163	272,133
Design Assistance (Residential)	883,799	106	77,703	838,027	54	72,619	479,646	31	41,564
Renewable Energy Competitive Incentive	7,749,555	1,479	471,528	7,901,966	1,357	474,565	8,159,495	1,391	492,124
Training	25,875,803	3,055	95,802	25,875,803	3,055	95,802	25,875,803	3,055	95,802
Nonresidential Total	**405,762,654**	**59,428**	**20,900,613**	**426,323,541**	**62,146**	**20,159,448**	**318,522,062**	**46,334**	**15,242,822**
Total All Programs	*735,876,317*	*93,856*	*25,578,678*	*757,379,375*	*105,684*	*24,425,040*	*557,683,961*	*76,842*	*18,320,964*

Summary of Savings by Measure

Table H-5 summarizes CY 2014 residential savings by measure category.

Table H-5. Summary of First-Year Annual Savings by Measure Category, Residential Sector 1

Measure Category	Verified Gross						Incentive Dollars	Incentive Dollars %
	kWh	kWh %	kW	kW %	Therms	Therms %		
Boilers & Burners - Boiler	0	0.00%	0	0.00%	279,683	6.56%	$490,063	1.97%
Boilers & Burners - Controls	0	0.00%	0	0.00%	2,377	0.06%	$300	0.00%
Boilers & Burners - Tune-up / Repair / Commissioning	0	0.00%	0	0.00%	10,455	0.25%	$7,649	0.03%
Boilers & Burners - Variable Speed Drive	16,018	0.00%	0	0.00%	0	0.00%	$303	0.00%
Building Shell - Air Sealing	3,393	0.00%	0	0.00%	8,722	0.20%	$11,174	0.05%
Building Shell - Insulation	51,549	0.02%	695	1.60%	24,170	0.57%	$31,442	0.13%
Building Shell - Window	5,017	0.00%	5	0.01%	3,898	0.09%	$4,956	0.02%
Domestic Hot Water - Aeration	1,154,404	0.35%	95	0.22%	193,810	4.54%	$130,474	0.53%
Domestic Hot Water - Controls	56,153	0.02%	0	0.00%	28,811	0.68%	$0	0.00%
Domestic Hot Water - Insulation	91,742	0.03%	0	0.00%	7,387	0.17%	$15,218	0.06%
Domestic Hot Water - Other	244,098	0.07%	28	0.06%	13,813	0.32%	$27,377	0.11%
Domestic Hot Water - Pre-Rinse Sprayer	0	0.00%	0	0.00%	42	0.00%	$0	0.00%
Domestic Hot Water - Showerhead	1,677,148	0.51%	131	0.30%	306,007	7.17%	$154,519	0.62%
Domestic Hot Water - Water Heater	292,383	0.09%	28	0.06%	7,304	0.17%	$49,891	0.20%
HVAC - Controls	55,591	0.02%	0	0.00%	7,840	0.18%	$13,982	0.06%
HVAC - Energy Recovery	-2,514	0.00%	2	0.01%	1,418	0.03%	$675	0.00%
HVAC - Furnace	10,611,642	3.21%	4,245	9.75%	1,686,838	39.55%	$5,197,375	20.94%
HVAC - Other	1,991,435	0.60%	1,424	3.27%	231,707	5.43%	$1,052,350	4.24%

Measure Category	Verified Gross						Incentive Dollars	Incentive Dollars %
	kWh	kWh %	kW	kW %	Therms	Therms %		
HVAC - Rooftop Unit / Split System AC	13,376	0.00%	43	0.10%	0	0.00%	$20,800	0.08%
HVAC - Steam Trap	0	0.00%	0	0.00%	140,110	3.28%	$9,475	0.04%
Laundry - Clothes Washer	691,965	0.21%	193	0.44%	21,851	0.51%	$184,300	0.74%
Lighting - Controls	542,246	0.16%	0	0.00%	0	0.00%	$43,871	0.18%
Lighting - Delamping	39,780	0.01%	5	0.01%	0	0.00%	$192	0.00%
Lighting - Fluorescent, Compact (CFL)	281,830,706	85.13%	31,578	72.53%	0	0.00%	$9,311,900	37.52%
Lighting - Fluorescent, Linear	486,995	0.15%	59	0.13%	0	0.00%	$62,391	0.25%
Lighting - Light Emitting Diode (LED)	4,359,429	1.32%	502	1.15%	0	0.00%	$606,571	2.44%
Lighting - Other	745,276	0.23%	65	0.15%	0	0.00%	$83,550	0.34%
Motors & Drives - Motor	85,500	0.03%	34	0.08%	0	0.00%	$21,375	0.09%
New Construction - Whole Building	3,431,629	1.04%	1,158	2.66%	875,004	20.51%	$1,159,375	4.67%
Other - Bonus	0	0.00%	0	0.00%	0	0.00%	$239,004	0.96%
Other - Other	1,486,879	0.45%	2	0.00%	410,259	9.62%	$4,295,685	17.31%
Refrigeration - Other	17,895,973	5.41%	2,374	5.45%	0	0.00%	$799,770	3.22%
Renewable Energy - Geothermal	1,104,390	0.33%	71	0.16%	2,061	0.05%	$106,600	0.43%
Renewable Energy - Photovoltaics	1,847,767	0.56%	765	1.76%	0	0.00%	$618,172	2.49%
Vending & Plug Loads - Dishwasher, Residential	84,784	0.03%	16	0.04%	2,027	0.05%	$33,650	0.14%
Vending & Plug Loads - Refrigerator / Freezer - Residential	161,082	0.05%	20	0.05%	0	0.00%	$35,325	0.14%

Table H-6 lists CY 2014 nonresidential savings by measure category.

Table H-6. Summary of First year Annual Savings by Measure Category, Nonresidential Sector 1

Measure Category	Verified Gross						Incentive Dollars	Incentive Dollars %
	kWh	kWh %	kW	kW %	Therms	Therms %		
Agriculture	5,135,838	1.20%	680	1.09%	54,724	0.27%	$331,070	1.00%
Boilers & Burners	5,805,474	1.36%	184	0.30%	2,759,514	13.69%	$1,898,187	5.74%
Building Shell	793,981	0.19%	874	1.40%	726,838	3.61%	$381,506	1.15%
Compressed Air, Vacuum Pumps	44,782,067	10.50%	6,025	9.67%	592,767	2.94%	$1,692,312	5.12%
Domestic Hot Water	2,672,268	0.63%	447	0.72%	32,947	0.16%	$118,907	0.36%
Food Service	1,157,973	0.27%	172	0.28%	118,540	0.59%	$164,363	0.50%
HVAC	42,491,664	9.97%	6,668	10.70%	6,006,894	29.80%	$4,736,579	14.33%
Industrial Ovens and Furnaces	-16,590	0.00%	7	0.01%	386,931	1.92%	$266,038	0.80%
Information Technology	2,335,550	0.55%	131	0.21%	0	0.00%	$92,052	0.28%
Laundry	-2,509	0.00%	-10	-0.02%	145,796	0.72%	$142,035	0.43%
Lighting	166,485,382	39.05%	27,231	43.71%	0	0.00%	$11,299,827	34.19%
Motors & Drives	128,315	0.03%	8	0.01%	0	0.00%	$6,114	0.02%
New Construction	15,777,915	3.70%	2,245	3.60%	548,084	2.72%	$1,753,098	5.30%
Other	1,236,057	0.29%	-19	-0.03%	117,647	0.58%	$901,589	2.73%
Pools	518,574	0.12%	40	0.06%	15,168	0.08%	$19,768	0.06%
Process	47,525,760	11.15%	6,413	10.29%	7,983,192	39.60%	$4,689,408	14.19%
Refrigeration	29,280,208	6.87%	3,510	5.63%	100,039	0.50%	$1,342,908	4.06%
Renewable Energy	32,785,453	7.69%	4,514	7.25%	474,565	2.35%	$3,116,322	9.43%
Training & Special	25,875,803	6.07%	3,055	4.90%	95,802	0.48%	$35,845	0.11%
Vending & Plug Loads	504,418	0.12%	0	0.00%	0	0.00%	$7,111	0.02%
Waste Water Treatment	1,049,940	0.25%	129	0.21%	0	0.00%	$57,204	0.17%

Appendix I. Cost-Effectiveness and Emissions Methodology and Analysis

In the current quadrennial cycle the Program Administrator has, with Public Service Commission of Wisconsin (PSC) approval, elected to use a cost-effectiveness calculator for program planning purposes. Consistency between planning and evaluation approaches is critical for an effective understanding of program performance relative to expectations.

As part of the 2014 evaluation activities, the Evaluation Team has used the same calculator as the Program Administrator to review the cost-effectiveness of the Focus on Energy programs. This appendix presents the findings of the benefit-cost analysis for Focus on Energy's 2014 program year.

Total Resource Cost Test

The benefit-cost test, also known as a cost-effectiveness test, is used to compare the benefits of a demand-side management program with the costs of the program. The primary benefit/cost test used to measure Focus on Energy's cost-effectiveness is a modification of the total resource cost (TRC) test,[3] one of several tests used for evaluating the cost-effectiveness of energy efficiency and commonly administered in the energy industry. The goal of a TRC test is to determine if energy efficiency is cost-effective overall by measuring the net benefits of an energy efficiency program (and renewable program) as a resource compared to the total program costs, both to the participants and to Focus on Energy.

The modified TRC test used for this evaluation is typically applied to define what specific elements of the program are cost-effective from a regulatory perspective and measures the overall impacts on the state of Wisconsin. The test counts the avoided costs of supplying the displaced energy against the program implementation and participant costs. Its purpose here is to determine whether the costs incurred by residents, businesses, and Focus on Energy for operating a program are outweighed by the benefits they receive.

In simple terms, the TRC B/C test is the ratio of program benefits to program costs. A value greater than one means a program or portfolio of programs is cost-effective (net benefits are positive), whereas a value less than one is not cost-effective (net benefits are negative). From a TRC perspective, a conservation measure or practice "fails" if net benefits are negative, meaning the costs of achieving the savings outweigh the value of the savings achieved.

[3] The use of the modified TRC test as the primary cost-effectiveness test is directed by PSC Order, docket 5-GF-191 (PSC REF#:141173), November 9, 2010.

The equation used for the TRC is:

$$TRC\,\frac{B}{C} = \frac{[Value\ of\ Net\ Saved\ Energy\ (Avoided\ Costs) + Value\ of\ Net\ Avoided\ Emissions]}{[Program\ Adminstrative\ Costs\ +\ (Incremental\ Measure\ Cost\ *\ NTG\ Ratio)]}$$

Where:

$$Value\ of\ Energy\ Saved = Net\ Energy\ Savings\ \times\ Utility\ Avoided\ Cost$$

Energy Avoided Costs

The source for electric energy avoided costs in this 2014 evaluation comes from the annualized forecast avoided cost model developed by Cadmus. This forecast relied on the Midwest Independent Transmission System Operator, Inc. (MISO), forecast of Locational Margin Price (LMP) for the years 2016, 2021, and 2026. The PSC established the electric energy avoided costs on June 18, 2012, in PSC Order, docket 5-GF-191 (PSC REF#:166932). The gas avoided costs are based on market prices for commodity and transportation, and were developed in the Benefit/Cost Analysis CY 2009 Evaluation Report.[4]

The forecast model decreases the verified gross energy savings by the conventional attribution factor of net-to-gross to derive net savings. The net savings are then increased by the line loss factor of 8% to account for avoided distribution losses. Table I-1 shows the assumptions for the four-year (CY 2011–CY 2014) avoided cost used for the cost-effectiveness tests.

Table I-1. Avoided Cost Comparison Between Years[1]

Avoided Cost	CY 2011–CY 2014	CY 2014	CY 2013	CY 2012	CY 2011
Electric Energy ($/kWh)	0.0379-0.0561	0.0448 to 0.0561	0.0414 to 0.0561	0.0379 to 0.0561	0.041
Electric Capacity ($/kW year)	114.3	114.3	114.3	114.3	114.3
Gas ($/therms)	1.005	1.005	1.005	1.005	1.005
Avoided Cost Inflation	0%	0%	0%	0%	0%
Real Discount Rate	2%	2%	2%	2%	2%
Line Loss	8%	8%	8%	8%	8%

[1]The value listed here for electric energy of $0.041 per kWh and in the CY 2011 Evaluation Report represents a single value. In modeling the cost-effectiveness, the Evaluation Team used a time series of values. Similarly, the CY 2012and CY 2013 cost-effectiveness analyses used a time series that grows from 0.0379 to 0.0561 over 15 years in the forecast model.

[4] PA Consulting group and KEMA, Inc. *Focus on Energy Benefit/Cost Analysis CY 2009 Evaluation Report.* Submitted to Public Service Commission of Wisconsin. Final: November 24, 2009. http://www.focusonenergy.com/files/Document_Management_System/Evaluation/bcanalysiscy09_evaluationreport.pdf

Emissions Benefits

Emissions benefits are the only other benefit included in the TRC B/C calculation. Determining the emissions benefits requires three key parameters—life-cycle net energy savings, emissions factors, and the dollar value of the displaced emissions.

Emissions factors are simply the rate at which the criteria pollutants are emitted per unit of energy and are most often expressed in tons of pollutant per energy unit (electric is in tons/MWH, and gas is in tons/MThm). The product of the emissions factor and the net energy savings is the total weight of air pollutant offset or avoided by the program. The product of the total tonnage of pollutant saved and the dollar value of the reduced emissions per ton is therefore the avoided emissions benefit, as shown in this equation.

$$Value\ of\ Avoided\ Emissions = [Net\ Saved\ Energy\ x\ Emissions\ Factor\ x\ Value\ of\ Emissions\ Allowance]$$

The gas emissions factors have remained constant since the 2011 evaluation report, while the electric emissions factors remain unchanged since the 2012 evaluation report. Table I-2 lists the emissions factors and allowance prices.

Table I-2. Emissions Factors and Allowance Price

Service Fuel Type	CO_2	NO_X	SO_2
Electric Emissions Factor (Tons/MWh)	0.83000	0.0012	0.0008
Gas Emissions Factor (Tons/MThm)	5.85	N/A	N/A
Allowance Price ($/Ton)	$30	$4.10	$1.08

The Evaluation Team obtained the 2011 nitrogen oxides (NO_x) and sulfur dioxides (SO_2) emissions allowance prices from the U.S. Energy Information Administration, and adjusted these values based on the 2012 Quarterly State of the Market Report for PJM.[5,6] Due to the continued decline in and uncertainty surrounding forecasted NO_x and SO_2 allowance prices, the forecasted values remained constant at 2012 values. The Evaluation Team used the CO_2 emissions price in the PSC's Order,

[5] U.S. Energy Information Administration. Today in Energy: "Emissions allowance prices for SO_2 and NO_x remained low in 2011." Accessed online April 2015: http://www.eia.gov/todayinenergy/detail.cfm?id=4830

[6] Monitoring Analytics, LLC. "2012 Quarterly State of the Market Report for PJM: January through June." Accessed online May 2015: http://www.monitoringanalytics.com/reports/PJM_State_of_the_Market/2012/2012q2-som-pjm-sec7.pdf

docket 5-GF-191 (PSC REF#:158228), which states, "A levelized carbon value of $30 per ton shall be used in the benefit/cost modeling of energy-efficiency programs."

Table I-3 lists the emissions benefits for all programs by nonresidential or residential segment by year.

Table I-3. Total Program Emissions Benefits by Segment

Program Year	Nonresidential	Residential	Total
2014 Emissions Benefits	$123,033,140	$50,514,063	$173,547,203
2013 Emissions Benefits	$111,096,441	$64,154,495	$175,250,937
2012 Emissions Benefits	$110,122,130	$30,961,768	$141,083,899
2011 Emissions Benefits	$84,075,436	$19,667,147	$103,742,582

Program Costs

The 2014 program costs were provided to the Evaluation Team from Focus on Energy's contract fiscal agent, the accounting firm Wipfli. The program costs represent all costs associated with running the efficiency programs (including administration and delivery costs). Note that incentive costs are not included as program costs because they are deemed transfer payments, which is consistent with industry guidelines defining the TRC test.

Incremental Costs

The gross incremental costs are the additional costs incurred by participants as a result of purchasing efficient equipment over and above a baseline non-qualified product. Gross incremental cost values used in this evaluation were derived from two sources—the incremental cost study conducted by the Program Administrator, implementers, and Evaluation Team; and the Focus on Energy Benefit-Cost Analysis CY09 Evaluation Report (with the exception of renewable-based measures).

All new CY2014 program measures used incremental measure costs from approved work papers when available or were mapped to program planning measures and received incremental cost estimates from these sources. The Evaluation Team applied the CY2011 incremental cost logic to all CY2012 legacy and carryover-based program measures.

Similar to the 2011, 2012, and 2013 evaluation effort, the Evaluation Team assigned actual project cost values from the program tracking databases to the renewable energy projects.

The gross incremental costs, similar to the energy savings values used in the cost-effectiveness tests, required the application of attribution factors to account for freeridership. The Evaluation Team derived the values, namely the net-to-gross ratios, for attribution factors for all legacy and carryover program measures from the 2010 evaluation and applied them to the 2014 evaluation on a measure-by-measure basis.

Cost-Effectiveness Results by Program

The following tables provide the cost-effectiveness analysis results by program and overall for CY 2014 and 2012 to 2014.

Table I-4 provides the sector-level and overall results with renewables combined of the cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-4. CY 2014 Overall with Renewables Combined Cost-Effectiveness Analysis

	Residential	Nonresidential	Total
Incentive Costs	$25,041,460	$32,973,509	$58,014,968
Admin Costs	$4,589,801	$4,147,941	$8,737,742
Delivery Costs	$10,466,793	$16,937,770	$27,404,563
Incremental Measure Costs	$56,554,521	$134,463,692	$191,018,213
Total Non-Incentive Costs	**$71,611,115**	**$155,549,403**	**$227,160,519**
Electric Benefits	$108,611,640	$242,461,759	$351,073,399
Gas Benefits	$46,971,540	$184,838,874	$231,810,414
Emissions Benefits	$50,514,063	$123,033,140	$173,547,203
Total TRC Benefits	**$206,097,243**	**$550,333,772**	**$756,431,015**
TRC Benefits Minus Costs	**$134,486,128**	**$394,784,369**	**$529,270,497**
TRC Ratio	**2.88**	**3.54**	**3.33**

Table I-5 provides the sector-level and overall results of the cost-effectiveness analysis with renewables reported separately. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-5. CY 2014 Overall with Renewables Separate Cost-Effectiveness Analysis

	Residential	Nonresidential	Renewables	Total
Incentive Costs	$23,383,498	$30,790,377	$3,841,093	$58,014,968
Admin Costs	$4,285,917	$3,873,311	$578,514	$8,737,742
Delivery Costs	$9,773,801	$15,816,343	$1,814,419	$27,404,563
Incremental Measure Costs	$49,294,078	$115,525,774	$26,198,361	$191,018,213
Total Non-Incentive Costs	**$63,353,795**	**$135,215,429**	**$28,591,295**	**$227,160,519**
Electric Benefits	$104,762,965	$221,000,346	$25,310,088	$351,073,399
Gas Benefits	$46,942,967	$177,333,863	$7,533,584	$231,810,414
Emissions Benefits	$49,370,860	$113,691,016	$10,485,327	$173,547,203
Total TRC Benefits	**$201,076,791**	**$512,025,225**	**$43,328,999**	**$756,431,015**
TRC Benefits Minus Costs	**$137,722,996**	**$376,809,796**	**$14,737,704**	**$529,270,497**
TRC Ratio	**3.17**	**3.79**	**1.52**	**3.33**

Table I-6 provides the residential program cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-6. CY 2014 Residential Programs Cost-Effectiveness Analysis

	Appliance Recycling	Assisted Home Performance	Express Energy Efficiency	Enhanced Rewards	Home Performance Program	Multifamily Energy Savings	Multifamily Direct Install	New Homes Program	Residential Lighting and Appliance	Residential Rewards
Incentive Costs	$799,950	$1,187,733	$1,723,468	$1,387,350	$2,572,207	$1,335,915	$553,845	$1,215,834	$8,310,005	$5,845,614
Admin Costs	$679,847	$122,696	$352,529	$260,742	$326,550	$291,372	$95,747	$220,459	$959,866	$1,159,803
Delivery Costs	$1,550,355	$279,802	$803,923	$594,608	$744,680	$664,457.81	$218,346	$502,745	$2,188,922	$2,644,866.88
Incremental Measure Costs	$0	$1,265,998	$962,686	$2,427,555	$4,980,467	$2,207,574	$238,705	$3,832,948	$13,358,531	$27,280,057
Total Non-Incentive Costs	**$2,230,202**	**$1,668,497**	**$2,119,137**	**$3,282,905**	**$6,051,697**	**$3,163,404**	**$552,798**	**$4,556,152**	**$16,507,319**	**$31,084,726**
Electric Benefits	$4,449,947	$347,113	$3,640,922	$1,399,752	$1,486,996	$3,372,331	$1,533,605	$4,859,525	$74,269,646	$13,251,804
Gas Benefits	$0	$3,457,184	$3,546,604	$4,703,077	$4,226,390	$3,279,644	$1,427,851	$12,340,334	$56,252	$13,934,204
Emissions Benefits	$1,730,172	$782,230	$2,105,911	$1,190,638	$1,440,993	$1,920,579	$885,065	$3,588,948	$30,987,046	$5,882,481
Total TRC Benefits	**$6,180,119**	**$4,586,527**	**$9,293,436**	**$7,293,466**	**$7,154,379**	**$8,572,555**	**$3,846,521**	**$20,788,807**	**$105,312,944**	**$33,068,489**
TRC Benefits Minus Costs	**$3,949,918**	**$2,918,030**	**$7,174,299**	**$4,010,561**	**$1,102,682**	**$5,409,150**	**$3,293,722**	**$16,232,655**	**$88,805,625**	**$1,983,763**
TRC Ratio	**2.77**	**2.75**	**4.39**	**2.22**	**1.18**	**2.71**	**6.96**	**4.56**	**6.38**	**1.06**

Table I-7 provides nonresidential program cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-7. CY 2014 Nonresidential Programs Cost-Effectiveness Analysis

	Business Incentive Program	Chain Stores and Franchises Program	Large Energy Users Program	Small Business Program	Design Assistance	Renewable Energy Competitive Incentive
Incentive Costs	$10,874,746	$2,849,236	$10,432,140	$5,036,879	$1,987,963	$1,902,083
Admin Costs	$1,480,170	$309,294	$1,144,854	$486,201	$516,746	$42,466
Delivery Costs	$6,044,152	$1,262,974	$4,668,614	$1,985,361	$2,110,087	$173,406
Incremental Measure Costs	$49,390,438	$13,873,291	$50,749,554	$4,400,725	$5,035,120	$11,014,565
Total Non-Incentive Costs	**$56,914,759**	**$15,445,559**	**$56,563,022**	**$6,872,288**	**$7,661,953**	**$11,230,437**
Electric Benefits	$74,462,581	$19,353,466	$86,055,217	$24,092,810	$10,958,249	$8,768,100
Gas Benefits	$61,744,041	$3,418,493	$105,802,274	$304,240	$5,004,162	$7,505,011
Emissions Benefits	$38,177,046	$7,831,579	$51,602,791	$8,373,220	$5,116,485	$4,427,677
Total TRC Benefits	**$174,383,668**	**$30,603,538**	**$243,460,282**	**$32,770,269**	**$21,078,897**	**$20,700,788**
TRC Benefits Minus Costs	**$117,468,909**	**$15,157,979**	**$186,897,260**	**$25,897,982**	**$13,416,944**	**$9,470,351**
TRC Ratio	**3.06**	**1.98**	**4.30**	**4.77**	**2.75**	**1.84**

Table I-8 provides the sector-level and overall results with renewables combined of the cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-8. CY 2011-2014 Overall with Renewables Combined Cost-Effectiveness Analysis

	Mass Market	Targeted Market	Total
Incentive Costs	$85,328,123	$133,074,000	$218,402,123
Admin Costs	$16,267,768	$16,119,568	$32,387,336
Delivery Costs	$37,097,763	$65,822,911	$102,920,674
Incremental Measure Costs	$204,203,260	$491,939,445	$696,142,704
Total Non-Incentive Costs	**$257,568,791**	**$573,881,924**	**$831,450,715**
Electric Benefits	$340,478,379	$852,316,757	$1,192,795,137
Gas Benefits	$183,486,847	$571,180,385	$754,667,232
Emissions Benefits	$165,297,474	$428,327,147	$593,624,621
Total TRC Benefits	**$689,262,700**	**$1,851,824,290**	**$2,541,086,990**
TRC Benefits Minus Costs	**$431,693,909**	**$1,277,942,366**	**$1,709,636,275**
TRC Ratio	**2.68**	**3.23**	**3.06**

Table I-9 provides the sector-level and overall results of the cost-effectiveness analysis with renewables reported separately. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-9. CY 2011-2014 Overall with Renewables Separate Cost-Effectiveness Analysis

	Mass Market	Targeted Market	Renewables	Total
Incentive Costs	$78,348,236	$118,647,560	$21,406,327	$218,402,123
Admin Costs	$15,323,002	$15,227,815	$1,836,519	$32,387,335
Delivery Costs	$34,796,338	$61,952,426	$6,171,910	$102,920,675
Incremental Measure Costs	$184,978,858	$390,741,515	$125,399,708	$696,120,300
Total Non-Incentive Costs	**$235,098,198**	**$467,921,756**	**$133,408,138**	**$831,428,311**
Electric Benefits	$331,617,777	$783,761,211	$76,312,180	$1,191,691,169
Gas Benefits	$183,058,384	$558,995,723	$12,613,694	$754,667,801
Emissions Benefits	$162,563,259	$400,742,718	$30,322,295	$593,628,272
Total TRC Benefits	**$677,239,420**	**$1,743,499,653**	**$119,248,169**	**$2,539,987,242**
TRC Benefits Minus Costs	**$442,141,222**	**$1,275,577,897**	**($14,159,969)**	**$1,708,558,931**
TRC Ratio	**2.88**	**3.73**	**0.89**	**3.05**

Table I-10 provides the combined CY 2012-2014 residential new program and carryover program cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-10. CY 2012-2014 Residential Programs Cost-Effectiveness Analysis

	Appliance Recycling	Assisted Home Performance	Express Energy Efficiency	Enhanced Rewards	Home Performance Program	Multifamily Energy Savings	Multifamily Direct Install	New Homes Program	Residential Lighting and Appliance	Residential Rewards	Mass Market Legacy
Incentive Costs	$2,377,130	$2,693,832	$4,766,455	$5,024,974	$8,091,402	$3,432,920	$1,412,775	$3,459,018	$23,522,228	$16,234,349	$2,229,925
Admin Costs	$1,910,220	$368,467	$1,035,265	$913,578	$1,149,847	$936,219	$305,409	$818,889	$2,815,423	$3,030,271	$264,799
Delivery Costs	$4,356,153	$840,269	$2,360,866	$2,083,366	$2,622,165	$2,134,998	$696,468	$1,867,431	$6,420,419	$6,910,368	$603,860
Incremental Measure Costs	$382,852	$2,705,200	$3,202,081	$6,970,757	$14,118,153	$8,056,030	$1,872,250	$12,477,394	$43,943,301	$63,343,210	$8,981,610
Total Non-Incentive Costs	$6,649,225	$3,913,936	$6,598,213	$9,967,702	$17,890,165	$11,127,247	$2,874,126	$15,163,714	$53,179,143	$73,283,849	$9,850,269
Electric Benefits	$12,101,410	$964,087	$9,370,631	$2,991,375	$3,322,255	$11,286,398	$4,593,482	$12,883,556	$206,605,750	$36,107,618	$9,900,438
Gas Benefits	$0	$7,510,638	$15,212,663	$9,122,315	$10,316,902	$10,528,518	$5,633,140	$33,205,802	$403,257	$43,684,978	$11,765,520
Emissions Benefits	$4,600,250	$1,614,631	$6,654,216	$2,302,514	$3,216,149	$6,109,109	$3,071,913	$9,526,646	$86,941,974	$16,984,028	$5,395,946
Total TRC Benefits	**$16,701,659**	**$10,089,356**	**$31,237,510**	**$14,416,204**	**$16,855,306**	**$27,924,025**	**$13,298,535**	**$55,616,004**	**$293,950,980**	**$96,776,623**	**$27,061,904**
TRC Benefits Minus Costs	**$10,052,435**	**$6,175,420**	**$24,639,297**	**$4,448,502**	**($1,034,859)**	**$16,796,779**	**$10,424,409**	**$40,452,290**	**$240,771,837**	**$23,492,773**	**$17,211,635**
TRC Ratio	**2.51**	**2.58**	**4.73**	**1.45**	**0.94**	**2.51**	**4.63**	**3.67**	**5.53**	**1.32**	**2.75**

Table I-11 provides the combined CY 2012-2014 nonresidential new program and carryover program cost-effectiveness analysis. Incentive costs are provided below but are not included in the TRC calculation. The TRC ratio equals the total TRC benefits divided by total non-incentive costs.

Table I-11. CY 2012-2014 Nonresidential Programs Cost-Effectiveness Analysis

	Business Incentive Program	Chain Stores and Franchises Program	Large Energy Users Program	Small Business Program	Design Assistance	Renewable Energy Competitive Incentive	Retro-commissioning	Targeted Market Legacy
Incentive Costs	$30,435,935	$8,151,871	$24,203,978	$18,309,591	$2,235,051	$2,837,827	$279,846	$14,239,295
Admin Costs	$4,110,739	$1,010,849	$2,539,842	$1,820,008	$748,961	$75,113	$209,169	$985,964
Delivery Costs	$16,785,860	$4,127,719	$10,364,934	$7,431,853	$3,058,320.86	$306,716	$854,125.60	$4,026,102
Incremental Measure Costs	$134,307,210	$41,293,327	$89,871,315	$29,519,097	$5,182,315	$13,885,453	$576,024	$94,696,681
Total Non-Incentive Costs	**$155,203,809**	**$46,431,896**	**$102,776,091**	**$38,770,959**	**$8,989,597**	**$14,267,282**	**$1,639,319**	**$99,708,747**
Electric Benefits	$225,143,900	$77,932,465	$200,514,242	$59,570,894	$11,908,035	$9,428,226	$758,087	$96,970,129
Gas Benefits	$132,110,889	$13,406,708	$234,432,841	$1,560,383	$5,160,044	$8,055,147	$1,268,550	$75,649,163
Emissions Benefits	$106,063,976	$32,442,919	$118,444,850	$21,451,337	$5,508,470	$4,653,224	$561,316	$48,943,479
Total TRC Benefits	**$463,318,765**	**$123,782,092**	**$553,391,933**	**$82,582,614**	**$22,576,549**	**$22,136,597**	**$2,587,952**	**$221,562,771**
TRC Benefits Minus Costs	**$308,114,957**	**$77,350,197**	**$450,615,842**	**$43,811,655**	**$13,586,951**	**$7,869,315**	**$948,633**	**$121,854,024**
TRC Ratio	**2.99**	**2.67**	**5.38**	**2.13**	**2.51**	**1.55**	**1.58**	**2.22**

Cost-Effectiveness Results for Renewables

Table I-12 lists the CY 2014, CY 2013, CY 2012, and CY 2011 cost-effectiveness results, with renewables separate and with renewables included.

Table I-12. Cost-Effectiveness Results for Focus on Energy Portfolio

Calendar Year	Residential	Nonresidential	Renewables	Total
CY 2014: With Renewables	2.88	3.54	N/A	3.33
CY 2014: Renewables Separate	3.17	3.79	1.52	3.33
CY 2013: With Renewables	3.22	3.51	N/A	3.41
CY 2013: Renewables Separate	3.27	3.80	0.97	3.41
CY 2012: With Renewables	2.41	3.07	N/A	2.89
CY 2012: Renewables Separate	2.69	3.83	0.82	2.89
CY 2011: With Renewables	1.84	2.71	N/A	2.46
CY 2011: Renewables Separate	2.26	3.41	0.52	2.46

As shown, the TRC for renewables increased over the course of the quadrennium. The key driver of this change was that average savings per project increased while average cost per project decreased.

Between 2013 and 2014 the main contributor to this change was an increase in savings from biogas projects, which tend to be highly cost-effective. Biogas projects accounted for 84% of the 2014 savings from renewable measures and drove the increase in renewables cost-effectiveness.

A smaller driver of this increase was solar photovoltaic projects; these projects also became more cost-effective over time.

Appendix J. Summary of Confidence and Precision

Focus on Energy gives significant consideration to evaluation design in order to ensure its programs achieve the most accurate and reliable results possible under the available evaluation budget. The Evaluation uses statistical confidence and precision standards as a key driver in determining the scale and scope of the evaluation design for each program.

This appendix presents the Evaluation Team's data collection activities over the course of the quadrennial period of CY 2011 through CY 2014 to demonstrate that the Team conducted a rigorous evaluation of the programs' reported savings. While the evaluation report described several approaches for calculating savings values, methodologies for some of those approaches have changed. For example, the Evaluation Team first used a deemed hours-of-use value to calculate verified gross savings for efficient measures, but updated those hours-of-use values after completing a residential metering study. As another example, the Evaluation Team has changed its approach to calculating net savings, transitioning toward a data-driven standard market practice approach beginning in CY 2013. Such changes impact the meaning of confidence and precision, making calculated confidence and precision for each evaluation year not directly comparable to previous reports, and likely not comparable to future reports.

This appendix documents areas of potential error in each program and provides a discussion of ways to calculate confidence and precision in future evaluations. Each program's evaluation activities and any sources of error are discussed qualitatively.

Introduction to Statistical Uncertainty

Statistical uncertainty is inherent in all activities for which a sample is used to estimate a property of a population. Using a sample is preferred for a number of practical reasons, most notable to save the cost and time of studying an entire population, the physical difficulty of checking all members of a population, and the adequacy of sample results. The statistical properties of a sample allow for making inferences about the population, with the strength of an estimate related to the amount of uncertainty or error around the estimate. In statistical analysis, the results should produce an estimate with a low amount of uncertainty under time and budgetary constraints.

Statistical uncertainty is comprised of two parts: the confidence in an estimate and the amount of precision for the estimate at a certain level of confidence. Confidence is set at a specified level, such as 90%, 95%, or 99%. The precision of an estimate indicates a range of values where the actual population parameter will fall in at the given confidence level.

The general precision equation is:

$$\text{Precision} = \text{Critical t-statistic} * \sqrt{\frac{\text{Variance}}{\text{Sample size}}}$$

Where:

Critical t-statistic	=	Critical t-statistic at a chosen confidence level
Variance	=	A quantifiable error (the sum of the squared deviations of each individual data point to its mean)
Sample size	=	Number of units (people, homes, businesses) in sample

The only factor that can be controlled is the sample size; precision is improved at a rate proportional to the square root of the sample size. For example, quadrupling the sample size will double the precision.

Together, confidence and precision create a confidence interval around the estimate, which is the estimate plus or minus its precision. For example, if an estimate of 24 has a precision of plus or minus five at 90% confidence, then there is 90% confidence the true value of the estimate falls between 19 and 29. A small confidence interval indicates that the true population estimate is very similar to that calculated using the sample.

For the Focus on Energy evaluation, the general standard for uncertainty is to achieve evaluation results with 90% confidence and ±10% precision over the quadrennial period, and evaluation activities are defined and prioritized to align with this standard. This standard is in line with nationwide best practices for the evaluation of energy-efficiency programs, as documented in the U.S. EPA's National Action Plan for Energy Efficiency and elsewhere.[7]

Sources of Uncertainty

Uncertainty in this evaluation, or the amount of error surrounding a measured or calculated value, came from a variety of sources that included (but was not limited to):

- *Sampling error.* Error that comes from using a sample of a population instead of a census. This type of error is minimized by using a rigorous and robust sampling plan.
- *Modeling error.* Error that comes from statistical modeling. Broadly, this error is equal to the sum of the squared difference between the predicted and observed values of the model dependent variable. Standard statistical practices minimize this type of error.
- *Systematic error.* Systematic error comes from biases in measurement, whether in the form of responses to survey questions or instrumentation error of metering equipment. Systematic error includes both non-response bias and self-report bias.
  - *Non-response bias* refers to situations when there is a non-random difference between survey respondents and non-respondents.
  - *Self-report bias* occurs when survey respondents adjust their responses to be more (as they perceive) socially-desirable.

[7] U.S. EPA National Action Plan for Energy Efficiency. http://www.epa.gov/cleanenergy/energy-programs/suca/resources.html

Systematic error can be minimized with well-designed survey instruments and by ensuring that a sample is representative of the population of interest.

- *Random error.* Random error occurs by chance and is entirely attributable to using a sample rather than a census. This error is minimized by using appropriately sample sizes.

Findings that contain error from the sources listed here may nevertheless be more robust than a figure with no specific source of uncertainty if the underlying measurement methods are more detailed or reliable. For example, a deemed per-unit savings value has no uncertainty because it is an assumed value, while a value estimated based on Wisconsin-specific measurement such as surveys or site visits would typically contain sampling error and other sources of uncertainty. However, the measurement-based value is considered more robust since it is based on detailed and reliable research specific to Wisconsin.

Sources of Information

This section summarizes the sources of information used to calculate savings during the CY 2011 through CY 2014 quadrennium. Almost all sources of information have some degree of variance, and in some cases, the amount of variance may be unknown. Some calculations require the use of weighted averages, evaluation observations, or rely on self-reports. The information sources are described below, along with the variance or assumptions for each data source.

Surveys

Surveys capture information directly from a program participant that may contain both process and impact evaluation components. For the impact evaluations, the Team used surveys to assess the in-service and retention rates for various measures as a portion of gross savings. The Team captured additional information to calculate self-report freeridership and spillover, allowing for the calculation of NTGR for programs that had non-SMP measures.

Site Visits

To most accurately assess actions taken through a program, site visits can be used to capture key data, such as:

- The location of installed equipment
- Verification of proper installment
- The nameplate information of installed measures
- Customer operation procedures or usage patterns
- Any other measure-specific data that may be beneficial to the analysis

Some site visits require metering in order to calculate the run time or power draw from the new measure. The Evaluation Team used all of these types of data to verify impact savings and assess customer uptake of efficiency measures.

Implementer Data

In some cases, the Evaluation Team drew on data collected by Program Implementers. The most substantial example of this approach was part of the CY 2013 evaluation, when the Evaluation Team reviewed data from residential audits that were performed as part of the Home Performance with ENERGY STAR Program and Assisted Home Performance with ENERGY STAR Program. The Program Implementer reported efficiency levels from the residential audits, and recorded observations of existing units prior to any program upgrades or changes. The Evaluation Team used the Program Implementer data to supplement the panel study data, particularly for any measures without sufficient panel study responses needed to formulate the market baseline.

Audits (Engineer Desk Reviews)

The Evaluation Team conducted engineering reviews using the best available data and calculated the energy consumptions of varying efficiency levels for each measure. The Team used measure-specific algorithms from an agreed-upon source, such as the published Wisconsin Technical Resource Manual (TRM), as a guide to consumption calculations. Using the efficiency levels of the equipment, in conjunction with information about the sector, the Evaluation Team calculated energy savings specific to each measure.

Deemed Values

The team, in collaboration with program staff and the PSC, calculated deemed *ex ante* savings values for many measures in advance of their use in the program. Because these values, by their nature, do not have the quantifiable uncertainty outlined above, the Evaluation Team assumed no uncertainty around those values in calculating verified gross savings.

Standard Market Practice and Self-Report

While the Team primarily used SMP to determine net savings, the information can be used in future savings planning. For CY 2013 and CY 2014, the Evaluation Team altered its approaches to represent recent market effects and changes in Wisconsin. Specifically, for several program measures, the Team leveraged the results of a baseline study and other program and secondary data in order to estimate the average efficiencies of equivalent products being sold to nonparticipating individuals or businesses (known as the "standard market practice").

The Team calculated net savings achieved by the programs as the difference in the annual consumption of equipment installed through the programs relative to the SMP. The specific combination of SMP and self-report used this year vary from previous and future evaluations, which in turn reduces the probability of replication (and impacts the confidence and precision).

The Evaluation Team typically gathered SMP data through three methods: (1) site visits, during which evaluators confirmed what was actually installed, (2) a panel study, where evaluators assessed what contractors are selling, and (3) self-report surveys, typically gathered over the phone with a sample of a particular program's participants.

Areas of Uncertainty by Program

Each Focus on Energy program had various levels uncertainty around gross verified savings, which is discussed below along with methods that could be used to calculate confidence and precision in future evaluations. Each program write-up includes a table that outlines the areas of uncertainty for each evaluation activity that led to an update or change of verified gross energy savings. If the evaluation activities did not lead to updated verified gross energy savings, the program write-up contains a forward-looking discussion of ways to calculate confidence.

Multifamily Energy Savings Program and Multifamily Direct Install Program

In the Multifamily Energy Savings Program, boilers comprised 38% and lighting comprised 29% of programmatic savings. The remaining 33% of programmatic savings came from a wide array of measures including steam traps, insulation, HVAC, and domestic hot water measures.

Eighty one percent of Multifamily Direct Install Program energy savings came from showerheads and faucet aerators. CFLs comprised 18% of energy savings. The remaining 1% came from pipe insulation, LED exit signs, and pre-rinse sprayers.

For the 2013 impact evaluation of the Multifamily Energy Savings and Multifamily Direct Install programs, the Team conducted a metering study to update lighting hours-of-use, coincidence factors, and in-service rates. Table J-1 details the multifamily metering study.

Table J-1. Multifamily Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Lighting	Metering of multifamily homes	72	Site	Hours-of-use
				Coincidence factor
				In-service rates

Through metering multifamily homes, the Evaluation Team was able to conduct statistical modeling to update the hours-of-use parameter and determine the modeling error. However, the coincidence factor estimate does not have modeling error.

The Team used deemed values for all other verified gross savings estimates, and passed all claimed energy savings through as verified gross savings. Since the Evaluation Team did not adjust claimed energy savings, which were derived from deemed values, there is no uncertainty around these energy savings.

In future evaluations, the Team will continue to research the assumptions underlying these energy-saving parameters and deemed values. This new research may include surveys of program participants and/or metering studies.

Appliance Recycling Program

In the Appliance Recycling Program, refrigerators comprised 74% of energy savings and freezers made up the other 26% of savings. There were two main 2013 evaluation activities that influenced gross verified savings—participant surveys and modeling of appliance meter data. For appliance modeling, the Team used two data sources—Wisconsin-specific metering data and secondary data from another Midwestern utility. Table J-2 lists the evaluation activities that led to updated inputs values in energy-savings calculations.

Table J-2. Appliance Recycling Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Refrigerator	Participant surveys	70	Surveys	Partial use
	Modeling of Wisconsin-specific metering data	20	Appliances	Annual kWh
	Modeling of secondary metering data	195	Appliances	Annual kWh
Freezer	Participant surveys	60	Surveys	Partial use
	Modeling of Wisconsin-specific metering data	8	Appliances	Annual kWh
	Modeling of secondary metering data	56	Appliances	Annual kWh

Participant surveys informed and were used to update the partial use parameter. Potential areas of uncertainty from participant surveys include both sampling and systematic error. Sampling error is minimized by randomization, and is inherent whenever a representative sample is used instead of census. Systematic error of partial use could come from recall error or non-response bias.

The Team used a standard statistical model, using Wisconsin-specific and secondary appliance datasets, to inform the annual kWh estimates. The metering data came from a sample of appliances in Wisconsin and another Midwestern utility territory. The Evaluation Team included secondary source data to improve the precision of the overall model and provide a more robust estimate of energy savings. Sources of uncertainty for the annual kWh parameter come from both sampling and modeling error.

To reduce these sources of error in the future, the Evaluation Team will continue to ensure that participant surveys have a large enough sample to meet 90/10 confidence and precision. Additionally, the Team will use knowledge from past survey efforts to optimize future survey sampling efforts, such as by adjusting the coefficient of variation (CV), an input into sample size calculation.[8]

[8] Typically, the Evaluation Team assumes a 0.5 coefficient of variation if there is no prior knowledge of the study population. As the Team gains greater understanding of this population, the assumption can be adjusted.

Residential Lighting and Appliance Program

For the 2013 Residential Lighting and Appliance Program, the Team conducted four evaluation activities that were used to update verified gross savings for lighting:

- Metering of single-family homes
- Metering of multifamily homes
- In-store intercept surveys
- Telephone surveys

These four activities comprised almost 700 data points that contributed to updated inputs into energy-savings calculations (Table J-3).

Table J-3. Residential Lighting and Appliance Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Lighting	Metering of single-family homes	69	Sites	Hours-of-use
				Coincidence factor
				In-service rate
	Metering of multifamily homes	72	Sites	Hours-of-use
				Coincidence factor
				In-service rate
	In-store intercept surveys	293	Customers	Commercial split
				In-service rate
	Telephone surveys	494	Surveys/households	Commercial split
				In-service rate

Using data from metering single-family and multifamily homes, the Evaluation Team updated hours-of-use parameter through statistical modeling (so it contains modeling error and some sampling error). The updated coincidence factor value, similar to the hours-of-use estimate, also contains sampling error, but not modeling error. The Evaluation Team calculated an in-service rate of efficient lighting during the metering process; the main source of uncertainty in the in-service rate calculation is from sampling error.

In-store intercept surveys informed the commercial split of program-subsidized bulbs, or the percentage of residential program bulbs purchased for commercial operations and the in-service rate of those bulbs. The sources of uncertainty for in-store intercept surveys are systematic error and sampling error. Systematic error, in this context, arises from self-report bias and potential interviewer effects. The commercial split and in-service rates that come from in-store intercept surveys could also contain sampling error, since the sample cannot be randomly selected.

In future evaluations, the Team will continue to improve methods for reducing the various sources of error, such as by using samples that are representative of the population of interest.

Home Performance with ENERGY STAR Program

The 2013 evaluation of the Home Performance with ENERGY STAR Program consisted of a statistical billing analysis of both gas and electric customers. The energy savings calculated through the billing analysis informed the program realization rate that was applied to the verified gross savings. These results were also applied in the 2014 evaluation. Table J-4 summarizes the evaluation activities that were used to update the verified gross savings.

Table J-4. Home Performance with ENERGY STAR Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Whole House (all measures)	Gas billing analysis	265	Households	Realization rate
	Electric billing analysis	184		

The main source of uncertainty from the gas and electric billing analyses is modeling error, which can be reduced by using larger sample sizes and proper model specification. While the Evaluation Team cannot control sample sizes in future evaluations, the Team will ensure that the most up-to-date model specifications for billing analysis are used and tested. The Team will also properly account for data errors by using clustered robust standard errors.

Assisted Home Performance with ENERGY STAR Program

In the Assisted Home Performance with ENERGY STAR Program, project completion (air sealing and insulation) made up 95% of program savings. The remaining 5% of program savings is distributed across direct-install measures, with no measure making up more than 1.6% of total program savings.

For the impact evaluation of the Assisted Home Performance with ENERGY STAR Program, the Team used deemed values to calculate energy savings. The Team passed all claimed energy savings through as verified gross savings, as the program had a limited number of participants and a short evaluation timeframe. Since the Evaluation Team did not adjust claimed energy savings, and energy savings were derived from deemed values, there is no uncertainty around these energy savings.

In the 2015 evaluation, the Team plans to conduct a statistical billing analysis to measure energy savings attributable to the program. Billing analysis will provide robust estimates of energy savings from the Assisted Home Performance with ENERGY STAR Program by measuring the difference between weather-normalized energy consumption of program participants before and after participation. The Evaluation Team will ensure that all future evaluations meet 90/10 confidence and precision.

New Homes Program

In the New Homes Program, gas certification level two (between 20% and 30% improvement above code) made up 52% of program savings. Gas certification level one (up to 20% better than code) made up 32% of program savings, followed by gas certification level three (between 30% and 40% above code), which made up 11.5% of program savings). The remaining 4.5% of program savings is distributed

across the other gas certification levels and renewables measures, with no one particular measure type/ certification level achieving more than 1% of total program savings.

For the impact evaluation of the New Homes Program, the Team used deemed values to calculate energy savings, and passed all claimed energy savings through as verified gross savings. Since the Evaluation Team did not adjust claimed energy savings, and energy savings were derived from deemed values, there is no uncertainty around these energy savings.

In the 2015 evaluation, the Team plans to conduct a statistical billing analysis to compare program-built homes to non-program homes. Billing analysis will provide robust estimates of energy savings by comparing weather-normalized energy use between participant and non-participant homes. The Evaluation Team will ensure that all evaluated parameters meet 90/10 confidence and precision.

Residential Rewards Program

In the Residential Rewards Program, furnace and furnace/AC combination offerings made up 90% of programmatic savings. The remaining 10% of program savings came from boilers, water heaters, renewable energy, and heat pumps.

For the 2013 impact evaluation of the Residential Rewards Program, the Team metered 110 furnaces with ECMs. Table J-5 summarizes the evaluation activities used to update inputs for furnace energy-savings calculations.

Table J-5. Residential Rewards Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Furnaces with ECMs	Metering	110	Sites	Airflow
				Static pressure
				Supply and return temperature
				Fan current/power
				Thermostat temperature

Metering contains uncertainty due to sampling error and any systematic error introduced by the meter itself. The Team reduced both sources of uncertainty by using randomized sampling procedures and by properly using and calibrating the metering equipment.

In future evaluations, the Team will continue to improve methods of reducing the various sources of error, and will research and update additional measures offered through the program

Enhanced Rewards Program

The Evaluation Team used deemed values to calculate Enhanced Rewards Program energy savings. The Team passed all claimed energy savings through as verified gross savings. Since the Evaluation Team did not adjust claimed energy savings, and energy savings were derived from deemed values, there is no uncertainty around these energy savings.

To determine Enhanced Rewards Program savings, the Team used results from the 2013 Residential Rewards Program furnace metering study. Table J-6 summarizes the evaluation activities that led to updated inputs into furnace energy-savings calculations.

Table J-6. Enhanced Rewards Evaluation Activity

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Furnaces with ECMs	Metering	67	Sites	Airflow
				Static pressure
				Supply and return temperature
				Fan current/power
				Thermostat temperature

Metering contains uncertainty due to sampling error and any systematic error introduced by the meter itself. The Team reduced both sources of uncertainty by using randomized sampling procedures and by properly using and calibrating the metering equipment.

In future evaluations, the Team will continue to improve methods of reducing the various sources of error, and will research and update additional measures offered through the Enhanced Rewards Program.

Express Energy Efficiency Program

For the 2013 evaluation of the Express Energy Efficiency Program, the Team used site visits to collect the in-service rates of measures installed through the program, which were then used to adjust verified gross savings. Table J-7 lists the measures for which site visits informed an in-service rate.

Table J-7. Express Energy Efficiency Evaluation Activity

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Lighting	Site visits	72	Sites	In-service rate
Faucet Aerators - Bathroom				
Faucet Aerators - Kitchen				
Showerheads				
Pipe Wrap				
DHW Temperature Turndown				

The main sources of uncertainty for site visits are sampling error and selection bias. As previously mentioned, there is always some amount of error associated with using a sample rather than a population census. Additionally, there is a possibility that households that allow a site visit are systematically different from the program population as a whole. Site visits, however, tend to reduce the opportunity for recall error and self-report biases associated with surveys, and can be expected to

provide more reliable estimates of in-service rates, even with smaller sample sizes. Thus, site visits are the best evaluation method to gather this type of information.

While a population census would theoretically provide the most accurate information, this is cost prohibitive given the size of the Express Energy Efficiency Program. The Evaluation Team makes every effort to select samples that are representative of the overall program population, through robust and thoughtful sampling plans and standard statistical practices such as randomization, stratification, and weighting.

Chain Stores and Franchises Program

For the evaluation of the Chain Stores and Franchises Program, the Team used site visits to verify many input parameters to TRM energy-savings algorithms (used to calculate verified gross savings) in 2012 and 2013. No site visits were conducted in 2014. Table J-8 summarizes the input parameters verified during site visits by measure group. All other input parameters, not listed in Table J-8, were deemed and do not have uncertainty by definition.

Table J-8. Chain Stores and Franchises Evaluation Activities

Measure/ Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
HVAC	Site visits	1	Sites	Mega Btu hours
				Thermal efficiency
Lighting	Site visits	17	Sites	Fixture count
				Lamp watts
				Lamps per fixture
				Ballast factor
Refrigeration	Site visits	18	Sites	Quantity
				Motor type
				Fan type

In addition to the measure groups listed in Table J-9, the Evaluation Team conducted one site visit to verify input parameters for LED, reach-in refrigerator lighting, such as fixture count, lamp wattages, and lamps per fixture.

The main sources of uncertainty for site visits are sampling error and selection bias. As previously mentioned, there is always some amount of error associated with using a sample rather than a population census. Additionally, there is a possibility that Focus on Energy participants who allow a site visit are systematically different from the program population as a whole. Site visits, however, tend to reduce the opportunity for biases associated with other verification methods, such as surveys, and can provide more reliable determinations of input parameters, even with smaller sample sizes. Site visits are the best evaluation method to gather this type of information.

Business Incentive Program

To evaluate the Business Incentive Program, the Team conducted site visits, equipment metering, and desk reviews in 2012-2014. The information gained from these activities, summarized in Table J-9, was used to update input parameters to TRM energy-saving algorithms. All other input parameters, not listed in Table J-9, were deemed and do not have uncertainty by definition.

Table J-9. Business Incentive Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Boilers and Burners	Site visits	19	Sites	Mega Btu hours
				Thermal efficiency
				Boiler horsepower
				Combustion efficiency
				Steam pressure
				Trap orifice diameter
				Discharge rate
				Pump horsepower
				Equipment kilowatts
				Equipment efficiency
	Option C: Billing Analysis	67	Projects	
Air Compressors	Site visits	36	Sites	Compressor horsepower
				Compressor kilowatts
				Compressor CFM
				Air demand
				Dryer CFM
				Motor efficiency
				Line pressure reduction
				Leak air loss
				Leak orifice size
				Hours-of-use
	Metering	5	Meters	Hours-of-use
				Load profile

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
HVAC	Site visits	26	Sites	Capacity (tons and Btu/hr)
				SEER
				AFUE
				COP
				EER
				Combustion efficiency
				Steam pressure
				Trap orifice diameter
				Discharge rate
				Fan diameter
				Fan horsepower
				Fan kilowatts
HVAC Controls	Site visits	11	Sites	Fan horsepower
				Fan kilowatts
	Metering	3	Loggers	Occupied hours
				Space temperature
				PTAC amps
				PTAC hours of use
HVAC VFD	Site visits	37	Sites	Fan horsepower
				Full load kilowatts
				Pump curve
	Metering	58	Loggers	Load
				Hours-of-use
Lighting	Site visits	50	Sites	Lamp watts
				Lamps per fixture
				Fixture count
				Controlled load per sensor
				Quantity of sensors
				Ballast factors
	Metering	28	Loggers	Hours-of-use
Lighting Controls	Site visits	3	Sites	Controlled load per sensor
				Quantity of sensors
Refrigeration	Site visits	7	Sites	Fan type
				Quantity

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Guest Room Energy Management Systems	Site visits and Spot Measurements	12	Thermostats	Cooling Capacity (Btu/hr)
				Heating Capacity (kW or Btu/hr
				EER Rating
				Heating Efficiency (%)
				Unoccupied (Default) Heating and Cooling Temperature Setpoints for Winter and Summer
				Fan Size (hp)
				Line voltage
				AC Current
				True RMS poly-phase power (kW)
				Power factor
	Metering	12	Thermostats	Room Temperature
				Supply current
Custom Process	Site Visits	8	Measures	Equipment specification verification; various variables depending on measure type
	Metering	3	Loggers	Various variables depending on measure type
	Desk reviews	8	Sites	Various variables depending on measure type

In addition to site visits for the measures listed in Table J-10, the Evaluation Team conducted site visits to verify inputs for boiler retrofits, LED freezer lighting, and livestock waterers. The input parameters for these measures include MBtu/h, thermal efficiency, fixture count, lamp watts, lamps per fixture, and equipment kilowatts.

The error associated with both site visits and metering was explained in previous sections: error from site visits includes sampling error and selection bias, while error from metering includes sampling error and systematic error. Additionally, the small site visit and metering sample sizes increased the amount of error when generalizing to the program population.

Large Energy Users Program

For the evaluation of the Large Energy Users Program, the Team used site visits and metering to update inputs to energy-savings algorithms throughout the quadrennial period. Table J-10 summarizes evaluation activities by measure group and indicates which variables were updated.

Table J-10. Large Energy Users Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Boilers and Burners	Site visits	3	Sites	Mega Btu hours
				Boiler horsepower
	Option C: Billing Analysis	7	Projects	
Air Compressor	Site visits	2	Sites	Compressor horsepower
				Compressor kilowatts
				CFM
				Air demand
				Load profile
				Hours-of-use
				Leak air loss
				Leak orifice size
Compressed Air Vacuum Pumps	Site visits	5	Sites	Horsepower
				Kilowatts
				CFM
				Air demand
				Motor efficiency
				Line pressure reduction
				Leak air loss
				Leak orifice size
				Hours-of-use
	Metering	1	Logger	Hours-of-use
				Load profile
HVAC	Site visits	10	Sites	Combustion efficiency
				Steam pressure
				Trap orifice diameter
				Discharge rate
	Metering	3	Loggers	Hours-of-use
				Load

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Lighting	Site visits	33	Sites	Fixture count
				Lamp watts
				Lamps per fixture
				Ballast factor
	Metering	3	Loggers	Hours-of-use
Custom Process	Site Visits	11	Measures	Equipment specification verification; various variables depending on measure type
	Metering	5	Loggers	Various variables depending on measure type
	Desk reviews	4	Sites	Various variables depending on measure type

The error associated with both site visits and metering was explained in previous sections: error from site visits includes sampling error and selection bias, error from metering includes sampling error and systematic error. The small site visit and metering sample sizes increased the amount of error (as compared to that associated with larger sample sizes) when generalizing to the program population, but these sample sizes were determined based on a portfolio-wide prioritization of evaluation activities to achieve overall confidence and precision in quadrennium evaluation results.

Agricultural Custom Program

The Evaluation Team conducted site visits and metering to evaluate the 2011 Agricultural Custom Program. After 2011, Focus on Energy rolled the Agricultural Custom Program offerings into the Business Incentive and Large Energy User programs. Table J-11 summarizes the evaluation activities used to update inputs to energy-savings algorithms. All other input parameters, not listed in Table J-11, were deemed and do not have uncertainty by definition.

Table J-11. Agricultural Custom Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Fan	Site visits	6	Sites	Horsepower
				Diameter
				Kilowatts
	Metering	1	Logger	Amps
				Kilowatts

The error associated with site visits and metering was explained in previous sections; error from site visits includes sampling error and selection bias, error from metering includes sampling error and systematic error. The small site visit and metering sample sizes increased the amount of error (as compared to that associated with larger sample sizes) when generalizing to the program population, but

these sample sizes were determined based on a portfolio-wide prioritization of evaluation activities to achieve overall confidence and precision in quadrennium evaluation results.

Commercial Custom Program

The Evaluation Team conducted metering for the 2011 evaluation of the Commercial Custom Program. After 2011, Focus on Energy rolled the Commercial Custom Program offerings into the Business Incentive, Chain Stores and Franchises, and Large Energy User programs. Table J-12 presents the evaluation activity that was used to update energy-savings inputs. All other input parameters, not listed in Table J-12, were deemed and do not have uncertainty by definition.

Table J-12. Commercial Custom Evaluation Activity

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Chiller	Metering	1	Logger	Hours-of-use

As stated in previous sections, the error associated with metering includes both sampling error and systematic error. There is also additional uncertainty from using data collected from only one logger.

Industrial Custom Program

The Evaluation Team conducted site visits for the 2011 evaluation of the Industrial Custom Program. After 2011, Focus on Energy rolled the Industrial Custom Program offerings into the Large Energy User Program. Table J-13 summarizes the updated parameters from the site visit, by measure group. All other input parameters, not listed in Table J-13, were deemed and do not have uncertainty by definition.

Table J-13. Industrial Custom Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Fan	Site visit	1	Site	Horsepower
				Full load kilowatts
				Load factor
				Hours-of-use
				Heating system capacity
				Heating system efficiency
				Cooling degree days
				Heating degree days
Filtration				Horsepower
				Full load kilowatts
				Load factor
				Hours-of-use
				Heating system capacity
				Heating system efficiency
				Cooling degree days
				Heating degree days

The error associated with site visits was explained in previous sections and includes sampling error and selection bias. Additionally, the small number of site visits (one) increased the amount of error when generalizing to the program population.

Retrocommissioning Program

In 2013, the Evaluation Team conducted site visits to update Retrocommissioning Program energy savings. Since this program is project specific, there was not a set of standard variables to update. Table J-14 summarizes both measure groups, the evaluation activities, and the amount of data collected. In 2014, Focus on Energy rolled Retrocommissioning Program offerings into Business Incentive and Large Energy User programs.

Table J-14. Retrocommissioning Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Core Retrocommissioning, HVAC	Engineering assessment and on-site data collection	5	Sites	Project-specific parameters
Retrocommissioning, Express Building Tune Up				

The error associated with site visits was explained in previous sections, and includes sampling error and selection bias. Additionally, the small number of site visits increased the amount of error when generalizing to the program population.

Renewable Energy Competitive Incentive Program

The Evaluation Team conducted site visits in 2013 that included taking meter readings for the Renewable Energy Competitive Incentive Program. Table J-15 summarizes both measure groups, the evaluation activities, the amount of data collected, and the variable applied.

Table J-15. Renewable Energy Competitive Incentive Evaluation Activities

Measure/Measure Group	Evaluation Activity	Quantity of Data Collected	Unit of Measurement	Variable Applied
Solar PV	Site visits with on-site meter reading	10	Sites	kWh
Wind	Site visit with on-site meter reading	1	Sites	kWh

The error associated with both site visits and metering was explained in previous sections: error from site visits includes sampling error and selection bias; error from metering includes sampling error and systematic error. Additionally, the small site visit and metering sample sizes increased the amount of error when generalizing to the program population.

Appendix K. Measure Analyses and Methodology

The CY 2014 evaluation included detailed analysis for a limited number of measures in the Residential and Nonresidential segments. This appendix describes the CY 2014 analyses, including the methodologies followed and the results applied to the CY 2014 program evaluations.

Residential Measures

Appliance Recycling

The Evaluation Team conducted surveys with 70 Appliance Recycling Program (ARP) participants to estimate an updated part-use factor. Part-use is an adjustment factor used to convert the annual unit energy consumption (UEC) of a refrigerator or freezer into an average per-unit gross savings value. The part-use adjustment accounts for the fact that not all recycled appliances would have operated year-round had they not been decommissioned through the Program.

As appliance recycling programs mature, the characteristics of the recycled appliances tend to change over time. For example, a newly launched appliance recycling program is more likely to collect many older unwanted appliances that may not be in use prior to recycling, which would result in a low part-use factor. As the program matures, it clears the backlog of unwanted appliances, typically resulting in an increase in part-use factor over time and resulting in higher savings.

Therefore, in order to accurately reflect the Appliance Recycling Program's current part-use factor, the Evaluation Team conducted a survey with CY 2014 participants.

In order to estimate part-use, the Evaluation Team followed the methodology, based on current industry standards, as documented in detail in Chapter 7 of DOE's Uniform Methods Project report.[9] First, the Evaluation Team asked participants a series of questions about how they used their appliance prior to recycling. The responses to these questions contributed to the estimate of "historic" part-use factor or the average portion of the year during which a participating appliance was plugged in and running prior to recycling. Next, participants were asked how they would have used the appliance if they had not recycled it through the Program. This information allowed the Evaluation Team to estimate a prospective part-use factor, using a weighted average of historically observed part-use factors and the participants' likely action in the absence of the Program.

[9] National Renewable Energy Laboratory. "The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures." April 2013.

Table K-1 shows the results of CY 2014 analysis.

Table K-1. Part-Use Factor Data

Use Prior to Recycling	Likely Use Independent of Recycling	Refrigerator		Freezer	
		Part-Use Factor	Percentage of Participants	Part-Use Factor	Percentage of Participants
Primary	Kept (as primary unit)	1.00	1%		
	Kept (as secondary unit)	0.71	17%		
	Discarded	0.88	33%		
Secondary	Kept	0.71	20%	0.79	44%
	Discarded	0.88	29%	0.79	56%
Overall		**0.82**	**100%**	**0.79**	**100%**

The CY 2014 part-use factor was 0.82 for refrigerators and 0.79 for freezers. There was no statistically significant change between the CY 2013 and CY 2014 results, but nominally the CY 2014 part-use factor for refrigerators is 4% higher than the CY 2013 value.

Table K-2 shows the CY 2014 part-use results compared to prior years' results. Although the differences are not large, the trend over time indicates that the part-use factor for refrigerators may be increasing.

Table K-2. Part-Use Factor Yearly Trends

Appliance	Part-Use Factor		
	CY 2012	CY 2013	CY 2014
Refrigerators	0.67	0.78	0.82
Freezers	0.81	0.80	0.79

An increasing part-use factor is expected over the first several years of program implementation because new appliance recycling programs tend to clear out a backlog of unwanted and seldom-used appliances that may have been sitting in customer homes for many years. The increase in part-use factor will result in increased per-unit gross energy savings.

Showerheads

The Evaluation Team conducted 100 surveys with participants from three Focus on Energy programs: Home Performance with ENERGY STAR, Assisted Home Performance with ENERGY STAR, and Express Energy Efficiency. The samples per program were weighted by the contribution of savings that each program represents, with the Express Energy Efficiency Program contributing the majority of the savings.

The primary goal of the survey was to determine the rate at which program showerheads were installed, and remained installed, up to the date of the survey. Using both sets of data, the Evaluation Team

calculated a residential direct-install, in-service rate (ISR) for energy efficient showerheads for CY 2014. The results of the survey and site visits combined are shown in Table K-3.

Table K-3. In-Service Rate

Program	Showerheads Received	Showerheads Persisted	Overall In-Service Rate
Home Performance, Assisted Home Performance, and Express Energy Efficiency	208	187	90%

Table K-4 shows the historic ISRs applied to showerhead savings for the three programs. The findings from the surveys are consistent with the previous ISRs applied.

Table K-4. Historical In-Service Rates

Program	Historic Showerhead In-Service Rate Applied	
	2012	2013
Home Performance with ENERGY STAR	93%	100%[1]
Assisted Home Performance with ENRGY STAR	93%	93%
Express Energy Efficiency	93%	87%

[1] In CY 2013, the Evaluation Team conducted a billing analysis that generated a realization rate for all program measures including showerheads. As billing analyses capture the effects of installation, no installation adjustments were applied in CY 2013 (ISR = 100%). The results of the CY 2013 billing analysis were applied in CY 2014, and again, the Evaluation Team did not apply an installation adjustment for showerheads for this Program.

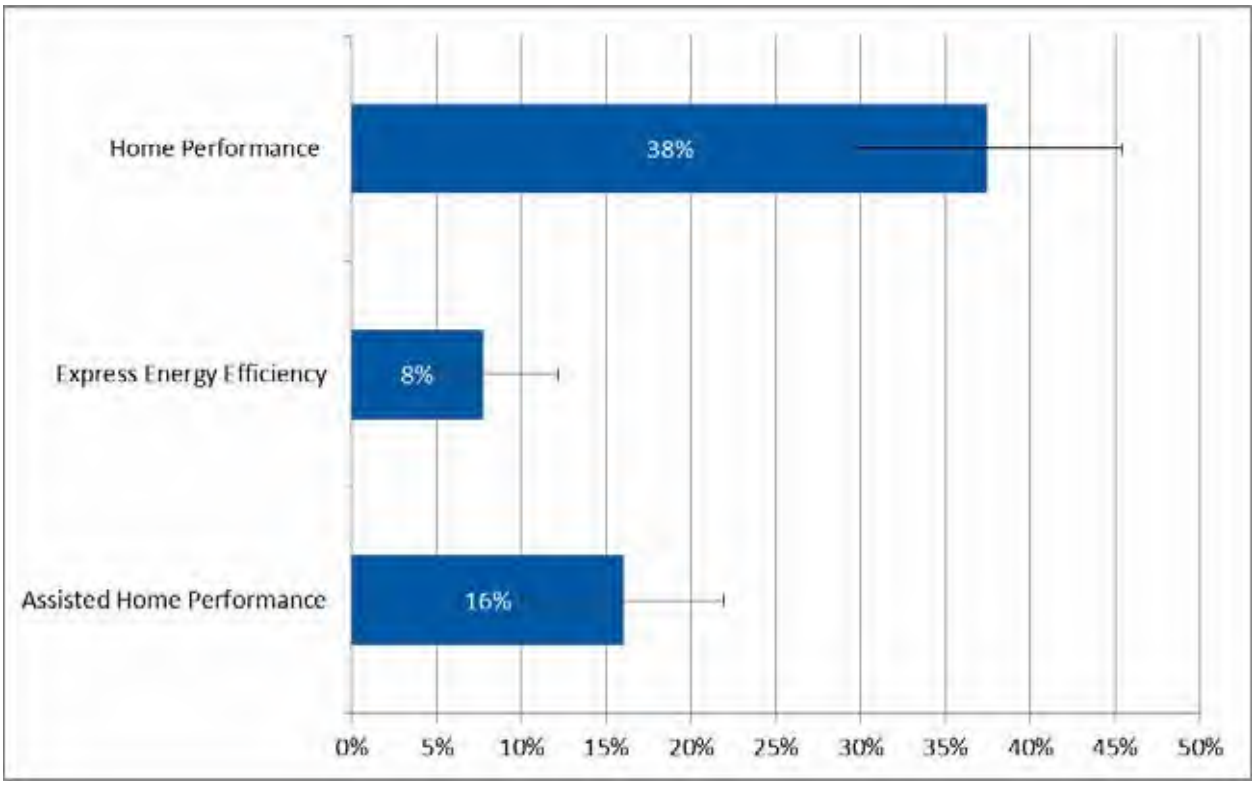
Process Survey Results

Of all survey respondents, 96% of showerheads were ultimately installed, and 95% of those showerheads remained installed at the time of the survey.[10] Of the five respondents who never installed all or some of their showerheads, one participant reported simply not having had the time to install it. Three participants reported that they were waiting for plumbing and construction work to be completed before installation. The most common reason for removal was a dislike of the flow of the water (all five respondents). One respondent removed the showerhead because they did not like the look of it.

Although the sample sizes per program were too small to generate program-specific findings, the installation rate for the Home Performance Program appeared lower than the other programs. The Evaluation Team attributed this difference to a higher reported percentage of showerheads left behind for the participant to install. In fact, 38% of all showerheads distributed to the surveyed Home Performance Program population were left behind (see Figure K-1) compared to 16% and 8% in the Express Energy Efficiency and Assisted Home Performance programs, respectively (p= 0.02).

[10] These values differ from the ISR of 90% because the ISR also includes adjustments based on site visit results.

Figure K-1. Percentage of Showerheads Left Behind by Contractors



Across all three programs, 30% of the showerheads left behind are never installed by the residents. The Home Performance Program could significantly improve this percentage by ensuring that contractors install showerheads while on the site.

Nonresidential Measures

Variable-Frequency Drives

This study focused on the variable frequency drive (VFD) heating ventilation and air conditioning (HVAC) fan measure offered by the Wisconsin Focus on Energy Business Incentive Program (BIP) and Large Energy User (LEU) Program. This study was designed to evaluate the deemed load profile from the State of Wisconsin Technical Reference Manual (TRM) used to estimate savings for the VFD HVAC fan measure.[11] The study objective was to develop a Wisconsin-specific load profile for VFD HVAC fans and to possibly update assumptions used in the TRM.

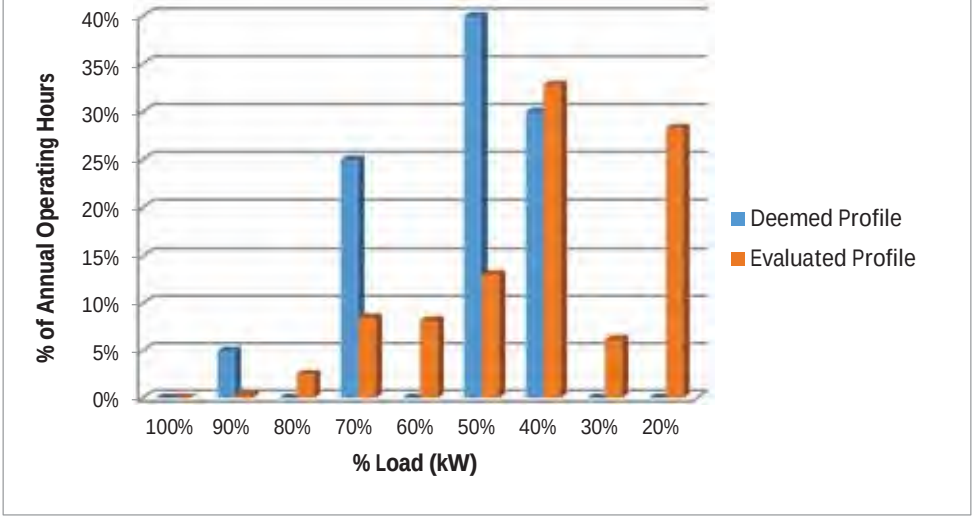
This 2014 study was based on the findings of the CY 2013 Impact Evaluation of the BIP and the LEU Program. For that evaluation, the Evaluation Team compiled the deemed load profiles used to estimate savings and the actual load profiles determined from evaluation activities into an Excel database for all

[11] The 2014 study focuses on the VFD HVAC fan measure, not the VFD chilled water, VFD process fan, or VFD process pump measures.

sampled VFD projects. (These two programs offer VFD measures for HVAC fans, chilled water pumps, process fans, and process pumps.) The Evaluation Team then compared deemed profiles to the evaluated profiles for each measure to assess the validity of the work paper assumptions from the Program Implementers and the Wisconsin TRM.

From the load profile analysis conducted for the 2013 evaluation, the Evaluation Team determined that in general the deemed load profiles used by the programs for VFD chilled water pumps, process fans, and process pumps were ; however, the deemed profile used for VFD HVAC fan projects differed from preliminary estimates determined through metering.[12] Figure K-2 illustrates findings for the VFD HVAC Fan measure in CY 2013.

Figure K-2. Deemed vs. Evaluated Load Profile for Evaluated 2013 VFD HVAC Fan Measures



The default load profile used for the HVAC fan measure assumes an average load of approximately 54%. The actual average load was approximately 40%, as determined from metering, trend logs from building automation systems, and on-site data collection. Table K-5 shows the deemed and evaluated average run hours per year, average load, and effective full load hours (EFLH) for the VFD HVAC projects evaluated in 2013.

Table K-5. CY 2013 VFD HVAC Fan Load Profile Comparison: Deemed vs. Evaluated

VFD Application	Deemed			Evaluated			Change in EFLH
	Run Hours	Load	EFLH	Run Hours	Load	EFLH	
VFD, HVAC Fan	5,224	54.0%	2,821	4,437	40.4%	1,791	(1,030)

EFLH = equivalent full load hours

[12] 12 AHU VFD fans metered in 2013.

For the CY 2014 evaluation activities, the Evaluation Team assessed fan system load profiles through on-site inspections and post-installation power metering using a combination of data logging equipment, watt-hour transducers, and appropriately rated current transducers. This methodology is designed to be consistent with the draft U.S. Department of Energy (DOE) Uniform Methods Project (UMP) chapter on Adjustable Speed Motors (more specific details on metering equipment are provided in the Measurement and Verification Methodology section).

Sampling Methodology

At the time of the representative sampling in October 2014, 103 total VFD HVAC projects had been completed between January 2014 and October 2014. The study's primary research objective was to estimate savings per horsepower. VFD HVAC annualized savings have variability for numerous reasons so the Evaluation Team chose a coefficient of variation (CV) of 0.5, which is conservative and based on past experience metering similar projects. In an effort to achieve a confidence level of 90% with 10% precision for the evaluation cycle, the Evaluation Team desired a total sample of 68 VFD HVAC systems. Of these, however, 12 had been inspected during Focus on Energy evaluations in prior years, resulting in a sample size of 56 VFD systems from the CY 2014 participating projects.

The Evaluation Team stratified the sample by fan system type and allocated sample points based on each fan system type's overall contribution to program savings. Supply, return, exhaust, and circulation fan systems qualify for the VFD HVAC fan incentive offered by the BIP. The three most common fan system types are supply, return, and exhaust. Circulation fan projects are less common but account for a disproportionally larger share of aggregate measure-level savings. Table K-6 presents the frequency of fan system types, the corresponding contribution to program savings for CY 2014, and the desired sample size for each.

Table K-6. CY 2014 VFD HVAC Fan Project Summary (as of August 2014)

Fan System Type	Frequency of Fan System Type (%)	Contribution to Aggregated Measure-level Savings (%)	Desired Sample Points (N=56)	Sampled VFD HVAC Projects (N=56)
Supply	68%	75%	42	32
Return	16%	7%	3	11
Exhaust	13%	5%	3	4
Circulation/Other	3%	14%	8	9

As a standard protocol for this evaluation, field inspectors were instructed to try to avoid metering both the supply and return fans affiliated with a single air handling unit. The Evaluation Team elected to install multiple data loggers at some of the sites, depending on the diversity of fan motor sizes. The study achieved its quota of 56 VFD logging installations through 26 on-site inspections. The Evaluation Team intended to install loggers on each fan type equivalent to the number of desired sample points (see Table K-6, under the column headed Desired Sample Points). The sites recruited for the study and fan systems available for metering produced fewer sampled supply fans and more return fans than

desired. The Evaluation Team was unable to schedule a site visit for some of the sampled sites and in some cases the field staff was limited by time constraints, so it chose to install a second meter on a return fan, rather than locate an additional supply fan.

Measurement & Verification Methodology

The general approach for determining VFD energy savings relied upon post-installation meter data and performance curves specific to the fan on which the VFD was installed or a default performance curve if a specific fan curve could not be identified. This method is consistent with International Performance Measurement and Verification Protocol (IPMVP) Option A (Isolation Retrofit, Key Parameter Measurement).[13] The method incorporates kW metering of the VFD installed on the fan for 12 consecutive months so as to trend fan operations and energy consumption for a complete annual weather cycle—summer, winter, and both shoulder seasons.

The basis for the savings calculation was that the post-installation power trend, combined with the site's system specifications, allows the derivation of a post-installation air flow trend. The baseline flow trend is assumed to be constant speed at full load (less approximately 2% for drive losses). The Evaluation Team used hourly typical meteorological year 3 (TMY3) weather data to extrapolate individual savings values to an annual profile, which was summed to annual savings. This approach was designed in accordance with the DOE UMP chapter for evaluating adjustable speed drive motors.

On-Site Data Collection

During the on-site inspections, each field engineer interviewed the facility engineer and asked questions about the fan operation, fan speed, range of fan speeds, minimum and maximum fan speeds, and fan speed related to operating schedules, weather and facility conditions.

All interviews and data collection activities were facilitated through the use of a custom survey instrument developed specifically for this study. The instrument included all necessary data fields to verify equipment specifications and to compare with program records. Data fields were also provided to collect baseline and post-installation fan system operations. The Evaluation Team gathered information from equipment nameplates or as-built drawings while on the site, which included, as applicable, motor make and model, motor size (hp), motor efficiency, motor speed (rpm), motor type, fan type, and VFD make and model.

The Evaluation Team also collected the specific VFD drive's operating parameters using the user-interface control panel (if present). This information included current operating frequency (Hz) or percentage speed, cumulative kWh and associated time interval, motor power (W) and amperage (A), and outdoor conditions during that time of day.

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[13] U.S. Department of Energy. *International Performance Measurement and Verification Protocol (IPMVP) Option A (Isolation Retrofit, Key Parameter Measurement).* Accessed online March 2015: http://www.evo-world.org/index.php?lang=en

Spot Measurements

The Evaluation Team collected one-time spot measurements of line voltage, AC current (amps), true power (kW), and power factor on all legs of the circuit supplying power to the VFD. The Evaluation Team took spot measurements using an Amprobe ClampmeterACD-41PQ 1000A Power Quality Clamp Meter. If possible, on at least two legs of the circuit, these measurements were recorded while the VFD was set to a series of at least three levels of speed, including one at 100% speed or in bypass mode. These spot measurements confirmed the accuracy of the data loggers and the operation of the system at full speed (peak power). The peak power reading represents the baseline power estimate for all constant volume fan systems.

True RMS Power (kW) Trend Logging

The Evaluation Team installed an Onset HOBO UX120-017 state data logging system coupled with a 3D-240 or 3D-480 WattNode system and appropriately rated current transducers (one for each phase of electrical service) to measure total energy consumption (watt-hour) on one-minute intervals in order to estimate true root mean square (RMS) power. It determined the appropriate current transformer (CT) rating based upon rated fan motor horsepower and the type of electrical service.

The Evaluation Team performed follow-up inspections in mid-February 2015 to obtain a mid-study readout and analysis of the data recorded since the original deployment in September 2014. At that time, it redeployed the metering equipment, which will remain in place through September/October 2015 to capture fan operations for a full 12-month weather cycle.

Although the mid-study readout includes only the fall and winter season, the Evaluation Team reviewed the results to determine if the findings were applicable to the VFD measures reported in CY 2014. The Evaluation Team found that the meter data also recorded peak heating conditions and fall (shoulder conditions); though including some summer-like warm days, the data for this time period are limited. The Evaluation Team applied the findings to CY 2014 VFD fan measures because actual meter data supersedes the reported engineering estimates that are primarily based on assumed operating hours and a load factor for 80%.

The Evaluation Team requires additional data and research, however, to update the VFD savings calculation tool. Additional research includes completion of the full 12-month VFD metering study and a baseline metering study (metering non-VFD systems) that began in February 2015.

The Evaluation Team will also study the load factor of HVAC fan VFDs. The current findings indicate VFD motors have an average load factor that is less than expected (80% is assumed). This important finding requires further investigation because savings are directly proportional to the load factor. The study will determine the applicability of the findings from the sampled systems (many in the education sector) to VFDs in other sectors.

CY 2014 Analysis and Findings: Baseline (Non-VFD)

The Evaluation Team reviewed the VFD calculation tool to understand the inputs and algorithms it uses to calculate savings.[14] To estimate savings for HVAC Fan VFDs, the tool requires these inputs:

- Motor horsepower from nameplate
- Motor efficiency (if not entered, lookups are provided)
- Annual operating hours
- Type of control of existing system (e.g., on/off constant volume, inlet guide vanes, discharge damper)

The Evaluation Team reviewed all calculation tool files from the metered sample and found nearly all fan motors (93%) previously had on/off control. The savings estimates for on/off control are relatively straightforward. The tool estimates baseline power with the equation:

$$Power = \frac{Nameplate\ Horsepower \times 0.746 \frac{kW}{HP} \times 0.8\ Load\ Factor}{Nameplate\ motor\ efficiency}$$

For each metered VFD, the Evaluation Team determined the baseline power by performing a spot power measurement of the motor at 100% speed. This type of spot measurement does not always provide the best estimate of baseline power, however, because duct static pressure can vary at constant speed due to changing characteristics of the duct system. For example, if a supply register is opened or closed, the change in airflow causes the duct pressure to change and in turn changes the load on the fan and consequently the load on the motor. The Evaluation Team compared spot measurements at 100% speed to the peak power reading from meter data to determine the most realistic baseline power estimate for each VFD fan motor.

The Evaluation Team estimated a load factor of only 56.3% for metered VFDs, lower than expected.[15] Some plausible explanations are:

- HVAC contractors tend to oversize fan motors for large custom-built air handlers because the actual system characteristics change and are difficult to calculate within ±10%. There is little incentive to properly size (e.g., using a safety factor of 20%) and there is a disincentive to select a motor that might not provide sufficient airflow.
- The nameplate horsepower was improperly documented. The Evaluation Team was unable to verify several of the motors with the lowest load factors (~35%) due to lack of accessibility. Actual nameplate horsepower ratings could be lower than reported.

[14] Two versions of the tool were used to estimate *ex ante* savings. For example: FOCUS_Calc_Workbook_Version_1.10.xlsx

[15] Load factor of motors in custom-built AHUs is generally 60% to 80%.

As stated, the savings calculation algorithm used for 93% of metered systems assumed constant baseline power. The remaining 7% of systems reported inlet guide vanes and discharge dampers, which use more complex algorithms to estimate the baseline power and result in a more conservative (lower) savings value. However, the Evaluation Team chose to assume that constant power adequately represents the baseline for all systems because variable flow systems were not verified and are oftentimes not functional.

CY 2014 Analysis and Findings: VFDs

For all systems, the Evaluation Team assumed the baseline power estimate was equivalent to the power at full speed. The savings algorithm used for each metered system was:

$$kWh\ savings = VFD\ runtime \frac{hrs}{year} \times (Baseline\ Power - Average\ VFD\ Power)$$

To determine total yearly run time of the VFD, the Evaluation Team multiplied run time hours (hours the fan was running) by the ratio of hours per year to total hours during the metering interval. The Evaluation Team reviewed the data collected and determined that the largest factor impacting the savings realization rate was the load factor, which changes the assumed energy consumption of the baseline condition and, consequently, the savings estimate.

Load profile and hours of operation also affected savings (see Table K-7 and Table K-8) but less than the load factor. Although it metered some cooling use, the Evaluation Team acknowledges not metering peak summer conditions, which could impact the savings estimates. Inclusion of data from additional months of metering would have only a relatively small effect on the results because:

- The greatest contributor to the updated savings estimate is the load factor observed.
- A large portion of the sample is the education sector, which has variable occupancy during the peak cooling periods. Savings attributable to peak cooling weather may negate savings due to low occupancy.
- Meter data includes a large portion of the winter and a full shoulder season.

To understand the differences between the assumptions used to estimate savings and the actual metered findings, the Evaluation Team reviewed the calculation tool operational run time estimates for VFDs. Table K-7 summarizes the assumptions used by the tool and also shows the savings at each fan speed. Toward the second half of CY 2014, the Evaluation Team updated the VFD tool, but these updates had only a minor impact on savings. For example, savings at a speed of 90% averaged 1.4% savings before the update and -0.3% after the update, resulting in an average of 1.0% savings at the highest VFD speed.

Table K-7. VFD Savings Calculation Tool Assumptions

	Average VFD Speed (% of 60 Hz)				
	40%	50%	70%	90%	100%
Power Percentage of Full Load $\left(\frac{Power\ at\ Speed}{Power\ at\ 100\%}\right)$	13.1%	20.6%	44.7%	80.3%	100%
Percentage of Fan Yearly Run Time	30%	40%	25%	5%	0%
Percentage of Savings	37%	45%	17%	1.0%	0%
Average Hours Reported (Total = 2,868)	845	1,137	735	151	0

The Evaluation Team metered VFD power, not VFD speed. To make a direct comparison, the Evaluation Team summarized run time hours and savings by the percentage of full load (see first row in Table K-8). The Evaluation Team summarized all meter data into bins of 10% increments by the percentage of full load. For example, if VFD peak power was 10 kW and the meter data indicated the VFD operated at 5 kW for the entire metering duration, a summary of the system would show 100% of yearly run time at 50% of full load.

Table K-8 shows the summary of results. The goal was to compare estimates from the calculation tool to metered results. Note there are slight differences in load percentage (e.g., 13.1% from the tool compared to 15% from analysis of meter data).

Table K-8. Metered VFD Data Summary

Metric	% of Full Load from Bin Analysis of Metered Power Data				
	15%	25%	45%	80%	100%
Comparison (Calculation Tool)	**13.1%**	**20.6%**	**44.7%**	**80.3%**	**100%**
% of Fan Yearly Run Time	7%	14%	32%	36%	12%
% of Savings	6%	17%	33.0%	44.1%	-0.2%
Average Hours Reported (total with fan on = 3,266)	214	456	1,045	1,175	376

Comparison of the assumptions and savings estimates used to calculate *ex ante* savings (Table K-7) to the metered values (Table K-8) shows some differences. Forty-four percent of the metered savings occurs when VFDs operate at an average load of 80% (compared to 90% of 60 Hz in Table K-7). Conversely, the calculation tool estimates only 1% of the total savings at this speed. Metered savings are relatively high because several of the largest VFDs were set to operate at a constant speed of 54 Hz (90%).

Figure K-3 shows the distribution of savings at 10% increments by percentage of full load, and Figure K-4 shows the distribution of runtime hours.

Figure K-3. Distribution of Savings by Percentage of Full Load

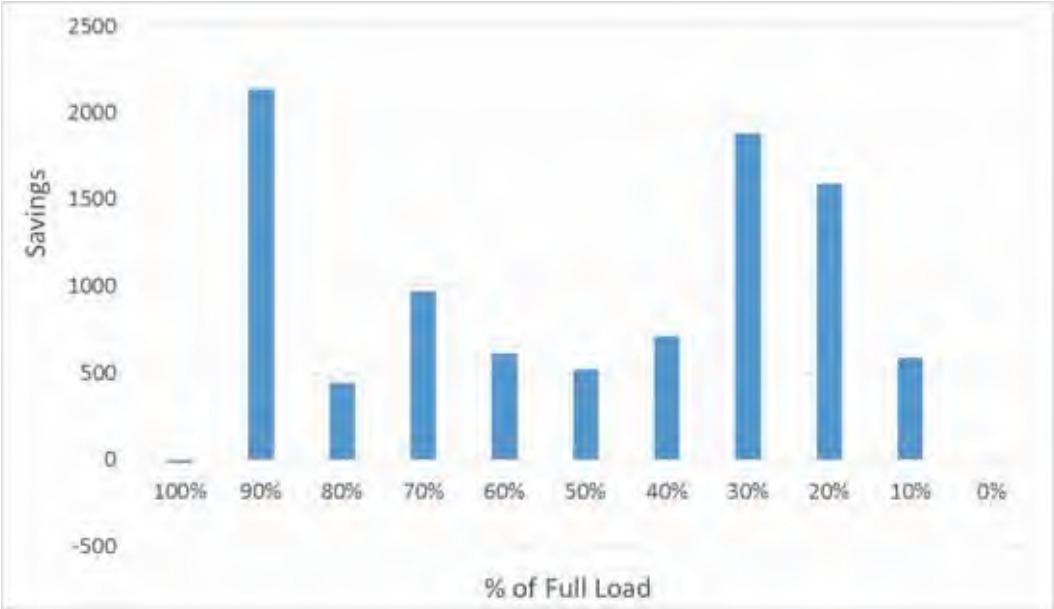


Figure K-4. Distribution of Run Time Metered

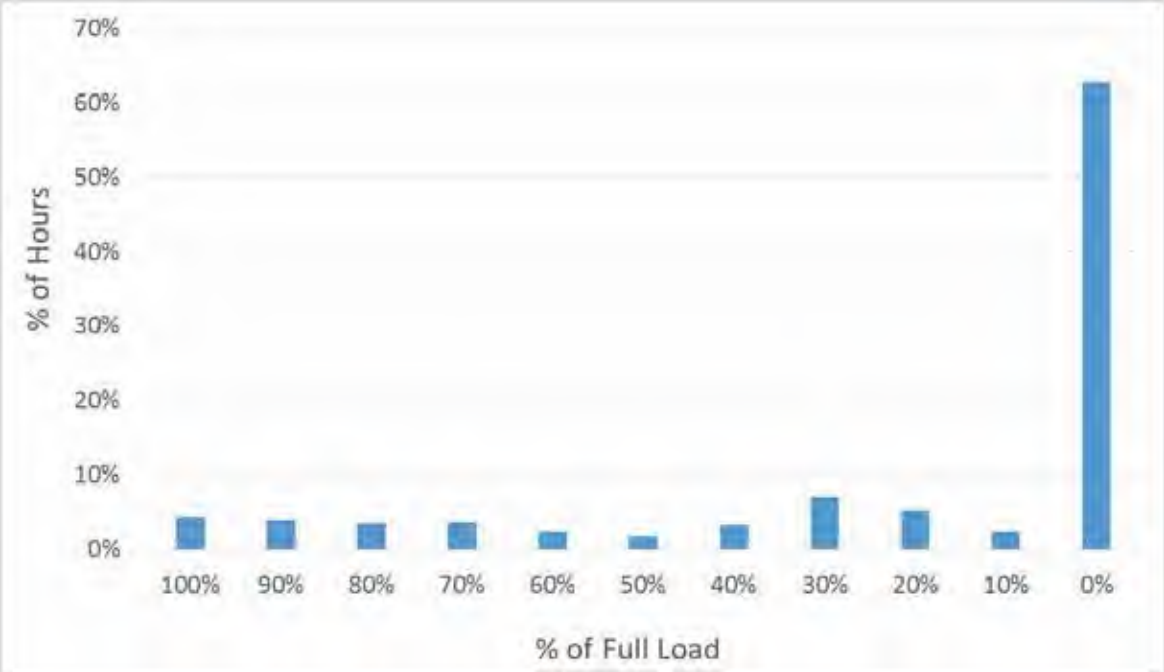


Table K-9 shows the reported (*ex ante*) and evaluated (*ex post*) results of the study. The Evaluation Team applied these results to the CY 2014 HVAC fan VFD measures.

Table K-9. Summary of Metered Results: Savings

Average System Size (hp)	Number of Systems Metered[1]	*Ex Ante* (kWh)	*Ex Post* (kWh)	Realization Rate
8.2	56	14,140	9,437	67%

[1] Six units were not included in sample because of insufficient meter data.

Conclusions and Recommendations

The evaluation offers the following conclusions and a recommendation.

Conclusion. The primary reason savings were less than *ex ante* was because the load factor of peak power observed (56.3%) was lower than the assumed load factor (80%). If the savings analysis used the load factor metered, the realization rate increases to 95%.

Conclusion. The run time hours reported were conservative compared to the metered run time hours. Many of the meters were installed on VFDs in schools, precluding the summer months when use may be reduced.

Conclusion. Although metered run time hours were higher than estimated, savings were still less than expected even after adjusting for the load factor. Savings are decremented because some large VFDs operated continuously at nearly full load.

Conclusion. Although the savings estimates are based on partial metering (September 2014 through February 2015), the *ex post* values represent the best savings estimates for CY 2014 HVAC VFD participation. Many of the CY 2014 participants were schools so the low average load factor might not represent a future program participant.

Recommendation. Due to the low load factor, the Program Implementer should consider a requirement to take spot power measurements of HVAC fans either at 100% speed or before VFD installation. These measurements will support a load factor of 80% or help determine a better value.

Note: The Evaluation Team expects to continue baseline research and will update the load factor, load profile, and savings profile after completion of the 12-month VFD metering study. In addition, the Evaluation Team will use meter data from another ongoing study that is currently metering 65 non-VFD, constant-volume large air handling unit (AHU) fan motors

Boilers

The boiler retrofit Option C study was intended to evaluate the assumptions in the Wisconsin TRM that were used to estimate savings for the suite of commercial boiler retrofit measures offered by the Wisconsin Focus on Energy Business Incentive Program (BIP) and Large Energy User (LEU) Program.[16]

[16] The study is named Option C because it used the whole-building billing analysis from the International Performance Measurement and Verification Protocol (IPMVP): Option C.

The Evaluation Team studied boilers to heighten the level of rigor applied to evaluating these measures. The evaluation plan was consistent with the methods recommended in the U.S. Department of Energy (DOE) Uniform Methods Project (UMP), Chapter 5: Residential Furnaces and Boilers Evaluation Protocol.[17]

During CY 2012 and CY 2013, the Evaluation Team conducted on-site verification and interviews, a less costly approach than gas sub-metering.

In CY 2014, the Evaluation Team used another common approach to evaluate natural gas-fired boiler measures—a whole-facility billing analysis from the International Performance Measurement and Verification Protocol (IPMVP): Option C. The possible end uses for natural gas in a conventional commercial facility (nonindustrial) are typically limited to domestic hot water and space heating, so disaggregation of whole-facility gas billing data is feasible.

The Evaluation Team obtained utility billing data from each participating customer's natural gas utility provider and did not conduct any on-site inspections or customer interviews for this study.

The BIP and the LEU Program offer incentives for these six measures:

- Boiler Plant Retrofit, Hybrid Plant, 1- 5 MMBh
- Boiler Plant Retrofit, Mid-Efficiency Plant, 1- 5 MMBh
- Boiler, Hot Water, Condensing, >=90% AFUE, 300-1000 MBh
- Boiler, Hot Water, Modulating, >=90% AFUE, <= 175 MBh
- Boiler, Hot Water, Modulating, >=90% AFUE, 175-300 MBh
- Boiler, Hot Water, Near Condensing, 300-1000 MBh

These measures are prescriptive[18] and apply only to boiler equipment used in a space-heating application. Boilers serving manufacturing or industrial processes are ineligible to receive an incentive from the BIP or LEU Program for these measures.

Methodology

Sampling Methodology

This study was designed to estimate the boiler retrofit category-level savings at the 90% confidence interval and a precision level of 10% (90/10) using a sample size of 60 projects. The minimum sample size required for this level of confidence and precision is 49, assuming a coefficient of variance (C_v) of 0.5. The actual evaluated C_v was 0.7; therefore, the Evaluation Team was able achieve 90/14 for the study by successfully evaluating a total 76 projects.[19] The Evaluation Team gathered billing data and

[17] A protocol specifically for commercial boilers has not been released at this time.

[18] Savings vary based on sector type, location, and boiler system capacity.

[19] In order to achieve 90/10 with a C_v of 0.7, the evaluation team would have had to successfully evaluate 132 projects, which exceeds the number of projects evaluated.

conducted analyses for 117 projects; however, the results from 41 of these projects were determined to be invalid (see Data Analysis section for common causes for study exclusion). The total therms evaluated represent 64% of the therms reported.

The 76 projects involved 165 boiler retrofits, a census of the retrofits completed from January 2012 through June 2013. The Evaluation Team selected this timeframe to ensure there would be at least 12 months of post-retrofit gas utility data available for each analysis. Table K-10 lists the number of projects evaluated, the number of measures implemented, and each measure's attributable savings.

Table K-10. Summary of Evaluated Measures

Measure	Projects Evaluated	Measures Implemented	Measure-Level Savings (therms)
Boiler Plant Retrofit, Hybrid Plant, 1- 5 MMBh	7	22	146,508
Boiler Plant Retrofit, Mid-Efficiency Plant, 1- 5 MMBh	6	10	42,427
Boiler, Hot Water, Condensing, >=90% AFUE, 300-1000 MBh	22	51	143,769
Boiler, Hot Water, Modulating, >=90% AFUE, <= 175 MBh	16	32	14,491
Boiler, Hot Water, Modulating, >=90% AFUE, 175-300 MBh	19	42	46,401
Boiler, Hot Water, Near Condensing, 300-1000 MBh	6	8	19,877
Total	**76**	**165**	**413,475**

Measurement and Verification Methodology

Each measure analysis commenced with a review of documentation obtained from SPECTRUM, the Wisconsin Focus on Energy database. Specific information included:

- Facility type and hours of operation
- Facility location
- New boiler manufacturer, model number, and type
- New boiler rated heating input capacity (Btu/hr)
- New boiler installation date

The Evaluation Team also searched the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) boiler database to determine boiler thermal efficiency or AFUE for each installed boiler. Manufacturer's specifications were used in cases where a particular model could not be found in the AHRI database.

For each site, the Evaluation Team collected up to three years of monthly natural gas billing data (at least 12 months of pre-retrofit and 12 months of post-retrofit data) and meter reading dates and energy use for each billing period.[20]

[20] On August 18, 2014 the Evaluation Team submitted requests for billing data to the seven utility companies serving customers in the study. All responded with utility data, although not for all requested sites.

Data Analysis

The following steps describe the regression analysis conducted on each site's utility billing data.

1. Determine the nearest and most appropriate weather station to the site (Table K-11):

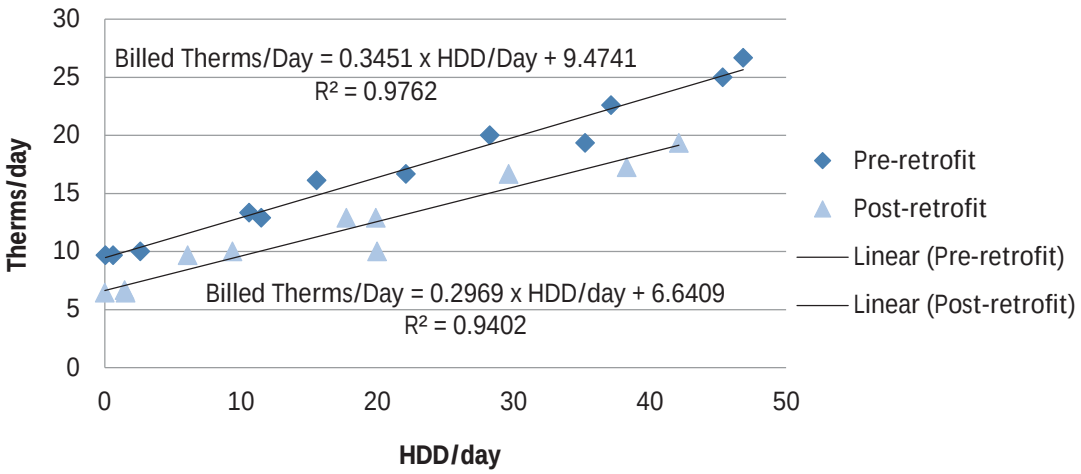
Table K-11. Weather Stations in the State of Wisconsin

TRM Location	Weather Station	WBAN
Milwaukee	General Mitchell International AP	14839
Green Bay	Austin Straubel International AP	14898
Wausau	Wausau Downtown Airport	14897
Madison	Dane Co Regional-Traux Field Airport	14837
La Cross	La Cross Municipal Airport	14920
Minocqua	Lakeland Noble F Lee Memorial Field	04865
Rice Lake	Rice Lake Regional – Carl's Field Airport	54909

2. Calculate the number of heating-degree days (HDDs) using a base temperature of 60°F applicable to each utility bill.
3. Use linear regression to determine a relationship between monthly average HDD per day and average daily gas usage.
4. Make adjustments to the HDD base temperature for the site by reviewing the site's sensitivity to outdoor temperature and regression fit statistics including R^2. Typical base temperatures for commercial properties range from 50°F to 65°F.

A graphical example of the regression analysis output is shown in Figure K-5.

Figure K-5. Graphical Example of Regression Analysis Output



Once the best fit is achieved, the post-retrofit regression relationship becomes the post-retrofit model. (The pre-retrofit regression can also be used as a model representing pre-retrofit facility conditions. This

model was not used for this analysis, however, since the measure baseline is assumed to be a new standard efficiency boiler.) The general form of the post-retrofit model was:

$$Billed\ Therms\ per\ Day = \beta_H \times HDD\ per\ Day + \alpha$$

Where:

- β_H = heating slope in therms per heating degree day
- α = non-heating usage in therms per day

The coefficients α and β_H are determined through linear regression. The number of billed therms per day is the collected billing data and the number of HDD per day is calculated from weather data. Each site's effective full load hours (EFLH) was estimated using:

$$EFLH = \frac{\beta_H H_0}{Capacity_{input-e}}$$

Where:

- H_0 = normal annual heating degree days, determined from TMY3 data for each weather station
- $Capacity_{input\text{-}e}$ = heating input of the installed boiler

Each site's gas savings was estimated using:

$$Savings = Capacity_{input-e} \times EFLH \times \left[\frac{AFUE_e}{AFUE_b} - 1\right]$$

Where:

- $AFUE_e$ = AFUE rating of the installed boiler
- $AFUE_b$ = AFUE rating of a baseline boiler, 80%

Utility billing analysis for energy savings is most successful when any changes at the site—apart from the energy efficiency measure—are minimal. Inconsistent building occupancy during the analysis period, changes to the building envelope and square footage, replacement or removal of other gas appliances, and other similar types of changes cannot be separated from the impact of the boiler efficiency upgrade through the utility bill analysis.

Additionally, because the analysis must calculate the EFLH, the boiler(s) should be the only major gas HVAC end-use at the site.

The Evaluation Team excluded some projects from the study due to insufficient data for an accurate and defensible analysis. Determination was on a case-by-case basis. Common examples of circumstances that compromise the validity of a utility bill analysis are:

- The utility provided less than 12 months of post-retrofit billing data.

- Gas bills are too high for the rebated boiler(s), which results in a calculation of impossibly high EFLH.
- Gas us is not weather-dependent. This results in poor-fit statistics during the linear regression process and indicates that the boiler equipment is either being used atypically or there are other dominating non-HVAC loads at the site.

Conclusions and Recommendations

Conclusion: Realization rates for the hybrid plant and near-condensing boiler retrofit measures were much lower than for the mid-efficiency plant, condensing, and modulating boiler retrofit measures. The Evaluation Team suspects this is because the majority of the evaluated hybrid plant and near-condensing boiler retrofits were at sites where multiple boilers were installed.

It is common in the industry for boilers in a central plant to be designed with 100% redundancy when sizing the equipment; this means one boiler can handle most, if not all, of the design load. However, this scenario can result in reduced run times and lower boiler oversize factors (BOF) and HDD values, two key inputs in the savings algorithm used by the BIP and LEU Program (see equations below).

Table K-12 shows the measure-level realization rates for the six measures.

Table K-12. Measure-Level Realization Rates

Measure Name	Average Realization Rate	Measures Implemented
Boiler Plant Retrofit, Hybrid Plant, 1- 5 MMBh	62.4%	22
Boiler Plant Retrofit, Mid-Efficiency Plant, 1- 5 MMBh	94.0%	10
Boiler, Hot Water, Condensing, >=90% AFUE, 300-1000 MBh	95.6%	51
Boiler, Hot Water, Modulating, >=90% AFUE, <= 175 MBh	86.5%	32
Boiler, Hot Water, Modulating, >=90% AFUE, 175-300 MBh	98.3%	42
Boiler, Hot Water, Near Condensing, >=85% AFUE, 300-1000 MBh	61.0%	8
Total Projects	**88.4%**	**165**

The common savings algorithm used for boiler retrofit measures in the Wisconsin TRM is:

$$Therms_{SAVED} = (C_q * BOF * HDD * 24 / \Delta T) * (TE_q / TE_b - 1) / 100$$

Where:

C_q = Input capacity of qualifying unit in MBh, from application

BOF = Boiler oversize factor (= 0.77)[21]

HDD = Heating degree days (= 7,616)

[21] The boiler oversize factor currently used in the Wisconsin TRM is based on the assumption that boiler equipment is oversized by approximately 30% above minimum design-rated capacity (Btu/hr). Mathematically, the BOF value is derived from 1/1.3 = 0.77.

24	=	Conversion factor, hours per day
ΔT	=	Design temperature difference (= 80°F)
TE_b	=	Thermal efficiency of baseline unit (= 80%)
TE_q	=	Thermal efficiency of qualifying unit, from application
100	=	Conversion factor from MBtus to therms

Recommendation: The Evaluation Team recommends a two-tiered approach to estimating project-level savings for all boiler retrofit measures. Tier 1 would apply to stand-alone, single-boiler retrofit projects (Quantity = 1 in SPECTRUM) using the existing overdesign assumption of 30% (BOF = 1/1.3 = 0.77). Tier 2 would apply to multiple-quantity boiler retrofit projects (Quantity > 1 in SPECTRUM) using an adjusted oversizing assumption of 60% (BOF = 1/1.6 = 0.63).

To validate suspicions about discrepancies in overdesign factors between single-quantity and multiple-quantity projects, the Evaluation Team stratified the sample into these two categories then calculated the weighted average realization rate for each stratum and measure using the TRM's overdesign assumption of 30%. For single-quantity projects, the weighted average realization rate was approximately 94%. For multiple-quantity boiler retrofit projects, the weighted average realization rate was approximately 77%.

The Evaluation Team then took the data from the multiple-boiler stratum and adjusted the claimed savings for each project by applying incremental overdesign correction factors of 40%, 50%, 60%, and 70% to see how this affected realization rates. The Evaluation Team determined that if the claimed savings for multiple-quantity boiler retrofit projects were adjusted using an overdesign factor of 60% rather than 30%, the weighted average realization rate would be 94%.

Table K-13 and Table K-14 show the weighted average realization rates for each measure using the current overdesign assumption of 30% for single-quantity and multiple-quantity boiler retrofit projects. Table K-14 also shows the weighted average realization rate using an over-design assumption of 60%.

Table K-13. Measure-Level and Aggregate Realization Rates for Single-Quantity Boiler Retrofit Projects

Measure Name	Total Single-Boiler Projects	Weighted Avg. RR w/ 30% (BOF=0.77)
Boiler Plant Retrofit, Hybrid Plant, 1- 5 MMBh	4	61%
Boiler Plant Retrofit, Mid-Efficiency Plant, 1- 5 MMBh	5	105%
Boiler, Hot Water, Condensing, >=90% AFUE, 300-1000 MBh	13	104%
Boiler, Hot Water, Modulating, >=90% AFUE, <= 175 MBh	13	85%
Boiler, Hot Water, Modulating, >=90% AFUE, 175-300 MBh	15	104%
Boiler, Hot Water, Near Condensing, >=85% AFUE, 300-1000 MBh	1	22%
Total Retrofits	**51**	
Weighted Average Aggregate Realization Rate		**94.3%**

Table K-14. Measure-Level and Aggregate Realization Rates for Multiple-Quantity Boiler Retrofit Projects

Measure Name	Total Multiple-Boiler Projects	Weighted Avg. Realization Rate	
		With 30% (BOF=0.77)	With 60% (BOF=0.63)
Boiler Plant Retrofit, Hybrid Plant, 1- 5 MMBh	3	65%	80%
Boiler Plant Retrofit, Mid-Efficiency Plant, 1- 5 MMBh	1	40%	50%
Boiler, Hot Water, Condensing, >=90% AFUE, 300-1000 MBh	9	83%	102%
Boiler, Hot Water, Modulating, >=90% AFUE, <= 175 MBh	3	91%	112%
Boiler, Hot Water, Modulating, >=90% AFUE, 175-300 MBh	4	79%	97%
Boiler, Hot Water, Near Condensing, >=85% AFUE, 300-1000 MBh	5	69%	85%
Total Retrofits	**25**		
Weighted Average Realization Rate		**76.5%**	**94.3%**

Guest Room Energy Management (GREM)

This study focused on the Guest Room Energy Management (GREM) thermostat measure offered by the Focus on Energy Business Incentive Program. GREM controls are typically installed on packaged terminal air conditioning (PTAC) or packaged terminal heat pump (PTHP) units serving individual hotel guest rooms. They can also be installed on water-source heat pumps (WSHP) or fan coils.

GREM controls are retrofit thermostat products capable of monitoring occupancy status using an integrated, passive infrared sensor or remote ceiling-mounted sensor. These sensors are designed to search for an occupant via motion-detection or operation of the guest room door. When the thermostat senses the room is occupied, the guest has control over the thermostat and room temperature. When the system senses that the room is unoccupied, it sets the HVAC system to a default energy conservation mode consisting primarily of setpoint temperature setbacks.

As part of the CY 2014 impact evaluation, the Evaluation Team conducted metering and trend data analysis at two hotel sites to provide recommendations for updating the GREM savings algorithm.

Study Purpose and TRM Inputs

A GREM work paper defines the savings algorithms and methodology used by program implementers to estimate savings. This study was intended to evaluate the validity of the 30% energy reduction factor used to estimate claimed savings. The GREM work paper does not cite sources for this savings factor but it is believed to originate from a technical briefing published by a GREM thermostat product representative or manufacturer.

A secondary goal of this study was to evaluate the measure-specific values for heating degree day (HDD), cooling degree day (CDD), heating correction factor, and design temperature difference used in the savings algorithm. This algorithm is:

$$kWh = \left[\left(\frac{DL \times OLF \times HDD \times 24 \times HCF}{\Delta Th \times 3{,}413}\right) + \left(\frac{DL \times OLF \times CDD \times 24}{\Delta Tc \times 12{,}000} \times \frac{12}{EER}\right)\right] \times GREM\ savings\ factor$$

Where:

- *DL* = design load in Btu/hr
- *HDD* = number of heating degree days, deemed 7,501
- *CDD* = number of cooling degree days, deemed 582
- ΔT_h = design temperature difference for heating, deemed 76°F
- ΔT_c = design temperature difference for cooling, deemed 17°F
- *HCF* = Heating Correction Factor, deemed 0.75
- *OLF* = oversized factor for design load, deemed 85%
- *EER* = Energy Efficiency Ratio for air conditioner
- *12,000* = conversion factor, Btu per ton
- *12* = conversion factor based on the definition of EER, converts EER to kW/ton
- *GREM savings factor* = percentage reduction in energy consumption due to use of GREM controls, deemed 30%
- *24* = number of hours in a day
- *3,413* = conversion factor, Btu per kWh[22]

The Team reviewed several key inputs in the algorithm to affirm the values and to compare, when possible, to values in the TRM. These include:

- HDD
- CDD
- Design temperature difference for heating (ΔT_H)
- Design temperature difference for cooling (ΔT_C)
- Heating correction factor (HCF)
- Oversized factor for design load (OLF)
- Energy savings factor of 30%

The GREM savings algorithm uses heating hours (based on HDD and design temperature difference) with a heating correction factor and over-sized factor. The focus of the study was the GREM savings factor, which is unaffected by these parameters. By setting these parameters constant, the Team was able to focus only on the difference between occupied room energy consumption and un-occupied energy consumption – which represents the GREM savings factor. The Team metered HVAC systems for several months which shows the difference in energy consumption during occupied and unoccupied modes. This time period, however, is too short to determine or validate the other parameters in the algorithm; a full 12-month study is necessary. The Team did, however, review the parameters to determine whether

[22] Standard TRM conversion factor is 3,412 Btu per kWh.

they align with the values and methods used in the TRM. The following list describes the parameters in the GREM algorithm:

- **Design load (DL):** The actual design load is determined from equipment tags from a representative sample of the PTAC or PTHP units serving each guest room type.
- **Cooling and heating degree days (CDD and HDD):** The GREM work paper uses measure-specific values of 582 CDD to estimate annual cooling energy consumption and 7,501 HDD to estimate annual heating energy consumption for the GREM thermostat measure (but cites no sources for either of these values). For all other cooling energy consumption algorithms, the TRM uses 535 CDD, which represents the population-weighted 30-year statewide average for Wisconsin. For all other heating energy consumption algorithms, the TRM uses 7,616 HDD, which represents the population-weighted 30-year statewide average for Wisconsin.
- **Design temperature difference for cooling (ΔT_c):** The ΔT_c represents the indoor design temperature minus the outdoor design temperature. The indoor design temperature for cooling is represented by the base temperature used to determine CDD, typically 65°F. The GREM thermostat measure uses a value of 17°F (but does not provide any cited sources or justification for using this modified value). For the majority of cooling measures in the TRM, the outdoor design temperature uses a population-weighted average for the state of Wisconsin of 87.3°F, a ΔT_c value of 22.3°F.
- **Design temperature difference for heating (ΔT_h):** The ΔT_h represents the design indoor temperature minus the outdoor design temperature. The indoor design temperature is analogous to the average desired indoor temperature. For heating it is typically 70°F. The GREM thermostat measure uses a design temperature difference of 76°F (but provides no cited sources or justification for using this modified value). The outdoor design temperature used for the majority of heating measures in the TRM is a population-weighted average for the state of Wisconsin of -15°F, which is calculated to a ΔT_h value of 80°F.
- **Heating correction factor (HCF):** The GREM work paper does not provide a methodology for determining the HCF, but the Evaluation Team assumed it is represented by the ratio of PTAC/PTHP unit heating capacity (Btu/hr) relative to the rated cooling capacity (Btu/hr). The work paper uses a stipulated value of 0.75. The Evaluation Team determined the HCF value by surveying the equipment installed at each hotel site; this value is strongly dependent on system type.
- **Oversized load factor (OLF):** The GREM work paper savings algorithm uses an OLF of 0.85, which is applied based on the assumption that "most heating and cooling units are oversized for their application."[23] (The work paper provides no cited sources or justification for using this factor.)

[23] *Wisconsin Focus on Energy Technical Resource Manual.* Prepared for the Public Service Commission of Wisconsin. Prepared by Cadmus. January 2015. Available online at: https://focusonenergy.com/sites/default/files/Focus%20on%20Energy_TRM_January2015.pdf

- **GREM savings factor:** The GREM energy savings factor currently deemed in the GREM work paper is 30%.

For the purpose of this study, the Evaluation Team evaluated the GREM energy savings factor by comparing trended equipment run times and duty cycles for periods of active room occupancy versus known vacancy.

Sampling Methodology

The study originally intended to evaluate three of the six GREM projects completed in CY 2014.[24] However, only two participants were willing to accommodate on-site inspections and allow the Evaluation Team to deploy data logging equipment in guest rooms. Table K-15 lists the population and sample details.

Table K-15. Population and Sample Details

Description	Quantity
Projects in Population	6
Projects in Sample	2
Number of Rooms Metered	12

These are brief summaries of the GREM thermostats installed and their capabilities for the two hotel sites in the study.

- **Hotel Site #1:** The Evaluation Team installed Telkonet EcoInsight GREM thermostat systems in each guest room. Each EcoInsight thermostat reports to a networked central monitoring and control station (EcoCommander). Parameters reported to and trended by the EcoCommander system include room space temperature, temperature setpoint, thermostat mode, duty cycle, and room occupancy status. The system continuously monitors these parameters and stores the data on a remote Telkonet server. The Evaluation Team obtained historic trend data for CY 2014 from Telkonet with formal approval of the customer.
- **Hotel Site #2:** The Evaluation Team installed Telkonet EcoWave wireless thermostats in all guest rooms. Each thermostat reports to a central EcoSource HVAC controller. Each EcoWave thermostat is capable of trending room-specific space temperature, temperature setpoint, thermostat mode, duty cycle, and room occupancy status on a 30-day rolling basis. This system was not networked; therefore, the Evaluation Team conducted the savings analysis for this particular project based on on-site metering only.

Evaluation Methodology

Approach

[24] Each project is a unique hotel site.

The Evaluation Team's measurement and verification plan for this study consisted of one-time electrical measurements and longer-term trends of room space temperature and AC current (amps) of PTAC units serving a representative sampling of guest rooms. This approach is in keeping with IPMVP Option A - Retrofit Isolation: Key Parameter Measurement.[25]

On-Site Data Collection

The Evaluation Team interviewed the hotel manager or owner and maintenance personnel to gather information on system control capabilities and various room types to determine how many guest rooms to meter. The Evaluation Team also gave the managers or owners a notification letter explaining the study and describing the data logging equipment to be deployed and asked them to pass along this information to their staff to avoid any situations where data logging equipment could mistakenly be removed from the guest room.

The Evaluation Team then inspected guest rooms and selected a representative sample of guest room types, inventoried heating and cooling equipment specifications, and deployed data logging equipment. The Evaluation Team gathered this information from each surveyed system:

- Manufacturer
- Model number
- Cooling capacity (Btu/hr) or tonnage
- Heating capacity (kW or Btu/hr)
- EER rating
- Heating efficiency (%)
- Unoccupied (default) heating and cooling temperature setpoints for winter and summer
- Fan size (hp)
- If the system had a fan-only mode of operation

The Evaluation Team used a custom survey instrument developed specifically for this study for all interviews and data collection activities. The instrument included all necessary data fields to document heating and cooling equipment specifications.

Table K-16 shows the distribution of PTAC systems by room type, average system cooling capacity, average system heating capacity, and average cooling efficiency (EER ratings). The Team summarized the systems observed in this way to compare to the values and assumptions used in the GREM measure work paper.

[25] U.S. Department of Energy. *International Performance Measurement & Verification Protocol.* Available online at: http://www.nrel.gov/docs/fy02osti/31505.pdf.

Table K-16. Guest Room Cooling and Heating Equipment Size Saturations by Room Type

Room Type	Avg. Cooling Capacity (Btu/hr)	Avg. Cooling EER Rating	Avg. Heating Capacity (Btu/hr)
System 1 (Typically in Single Queen)	8,440	10.1	11,023
System 2 (Typically in Double Queen)	7,920	10.8	10,344
System 3 (Typically in King)	6,200	11.5	8,097
System 4 (Typically in King Suite)	10,800	10.8	14,105
Total/Weighted Average	**9,285**	**10.6**	**10,753**

On average, the PTAC systems observed were similar to the values in the GREM measure work paper. To estimate measure-level savings the work paper uses a stipulated per-unit cooling capacity and efficiency rating (weighted average based on market share). Using the market share assumptions from column three of Table K-17, the weighted average cooling capacity is 9,750 Btu/hr and the weighted average EER rating is 9.6.

Table K-17. Capacity, Performance, and Market Share Assumptions Used in the GREM Measure Work Paper

HVAC Designation	Cooling Design Load (Btu/hr)	Avg. EER Rating	Market Share	Annual Energy Consumption (kWh)		
				Cooling	Heating	Total
System 1	9,000	9.7	80%	648	3,982	4,630
System 2	12,000	9.3	15%	896	5,309	6,206
System 3	15,000	9	5%	1,164	6,637	7,801
Weighted Avg.	**9,750**	**9.6**	**100%**	**711**	**4,314**	**5,025**

While on site, the Evaluation Team requested room-sold status for each guest room for the period during which data logging equipment was deployed.[26] Table K-18lists the average room-sold rates. The Evaluation Team also obtained the annual average for each of the 63 guest rooms from one of the hotel sites. Its annual average room-sold rate of 35% was close to the 38% occupancy of the metered sample.

Table K-18. Nightly Room Sold Rate by Room Type during Metering Period

Room Type	Room-Sold Rate	Rooms Surveyed

[26] Room-sold status refers to whether or not the room was booked.

Single Queen	29.6%	5
Double Queen	51.8%	5
King	29.8%	1
King Suite	22.8%	1
Average	**38.3%**	**12**

One-Time Electrical Measurements

The Evaluation Team collected one-time spot measurements of line voltage, AC current (amps), true power (kW), and power factor for each representative PTAC unit using an Amprobe Clampmeter while the unit was operating. The Evaluation Team analyzed meter data using these measurements to determine if the PTAC unit was operating in fan-only mode, cooling mode, and heating mode and then used the spot voltage and power factor measurements to derive the true power (kW) consumption of each unit.

Long-term Energy Monitoring (kWh)

These are descriptions of the measurements and metering equipment deployed:

- **Room temperature:** Hobo model U12-012 placed near guest room thermostat. Any data loggers placed in plain sight accompanied by a laminated notification card that described the device, the scope of the ongoing study, and instructions asking occupants to call the front desk with any questions or concerns before touching or removing the device from the room. Hotel management also provided with a laminated full-page reference sheet describing the study in further detail and giving contact information for the project manager.
- **Supply current at the PTAC:** Measured with a current transducer (Hobo model CTV-A/B) and stored in a data logger (Hobo U12-012).

The Evaluation Team deployed the monitoring equipment for approximately six weeks and set a uniform logging interval of once every three minutes for all temperature and supply current measurements.

Data Analysis

The Evaluation Team followed these seven steps in the data analysis for this study:

1. Exported temperature/relative humidity and load current data from Onset HoboWare into Excel. Used load current values from spot measurements to establish whether a PTAC unit was operating in fan-only, heating, or cooling code. Also cross-referenced load current data with trended room space temperature to verify the assumed operating mode. (For example, the Evaluation Team verified that room space temperature was increasing when it assumed it was operating in heating mode.)

2. Converted trended load current data into true RMS power (kW) using the equation below. Volts and power factor were determined from spot measurements acquired in the field:

$$kW = \frac{(Volts \times Amps \times Power\ Factor)}{1{,}000}$$

3. Used historic room-sold status to stratify trended power data into two categories—days when the room was sold or unsold. For this evaluation, defined a daily 24-hour cycle as 12:00 p.m. to 12:00 p.m. (noon), rather than the standard 12:00 a.m. to 12:00 a.m. (midnight) definition, in recognition of typical hotel occupancy patterns.
4. Developed daily average demand (kW) load profiles for each guest room. Plotted profiles to visually compare the average hourly kW consumption for a full 24-hour cycle when the guest room was sold or unsold, as shown in the example in Figure K-6 and Figure K-7 show temperature trends of a sold room compared to an unsold room.

Figure K-6. Average Hourly Energy Consumption of PTAC Unit Serving Guest Room in Heating Season

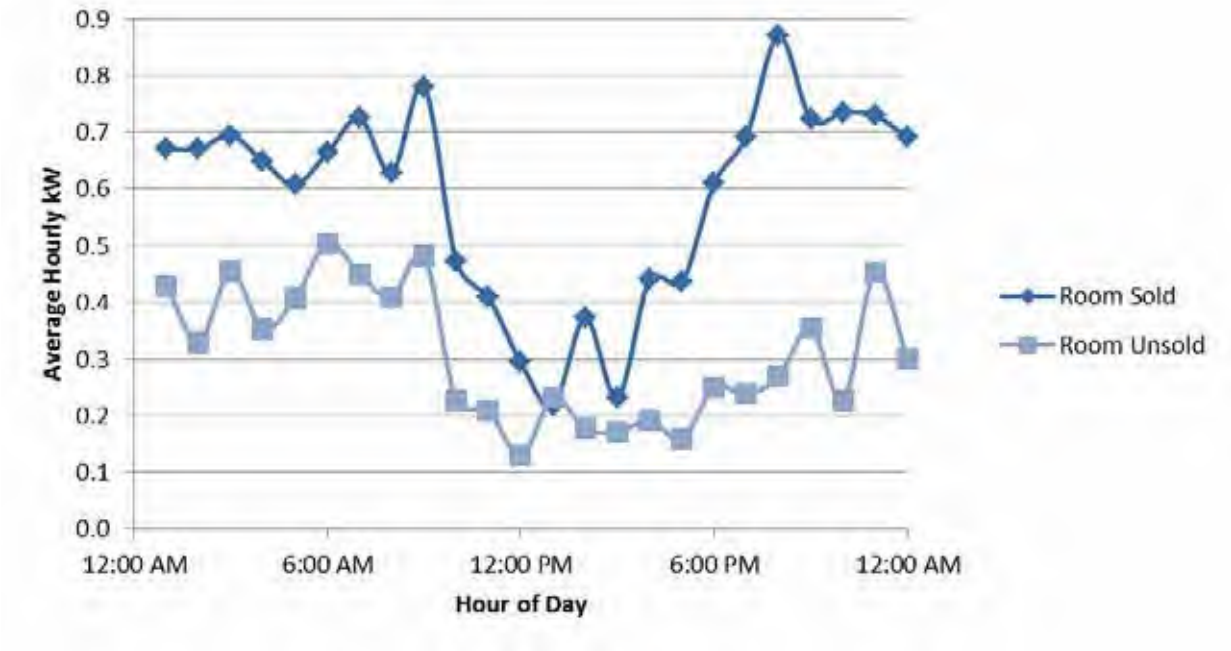
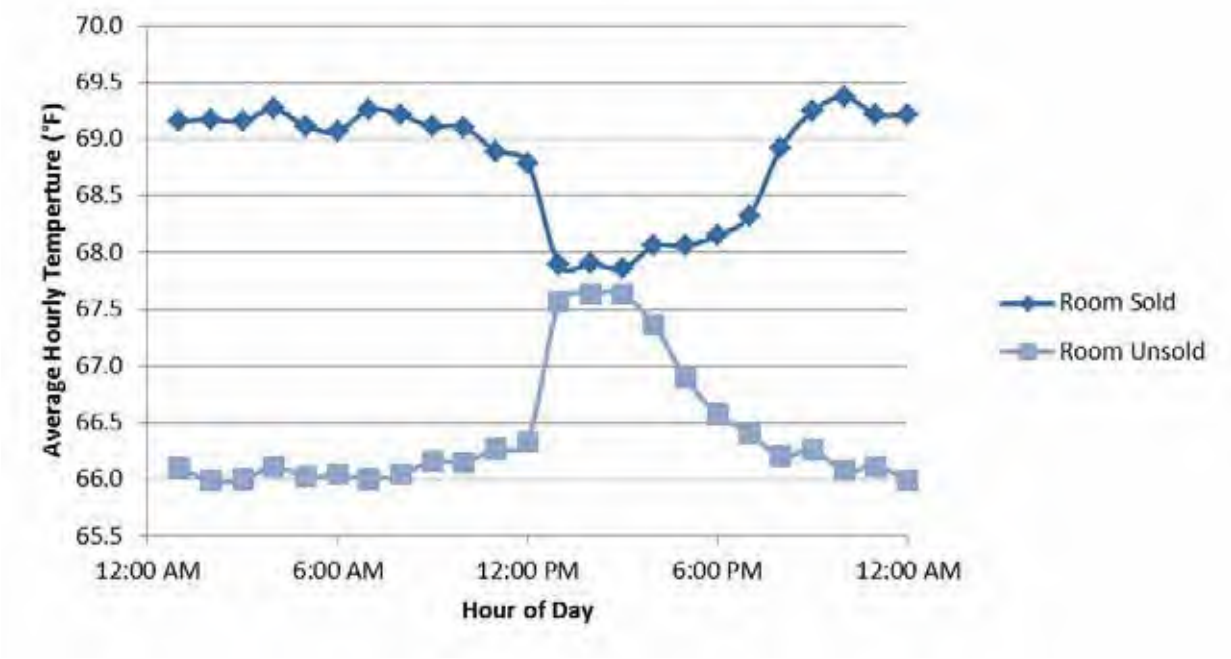


Figure K-7. Average Hourly Temperature of PTAC Unit Serving Guest Room in Heating Season



Energy savings are represented by the area between the two curves as well as the decrease in energy demand between the hours of 9:00 a.m. and 5:00 p.m. along the Room Sold curve. As shown in Figure K-7, the majority of the savings for this guest room occurs between the hours of midnight to 9:00 a. m. and from 5:00 p.m. to midnight on days when the room is unsold. Additional savings also appear to occur between the hours of 9:00 a.m. and 5:00 p.m. in sold guest rooms, which can be attributed to the occupancy sensor technology and corresponding temperature setbacks.

5. Calculated the daily average kWh savings for each room in the study (metered) for both sold and unsold days. Due to the timing of this study, the daily kWh savings values represented only the heating season; therefore, the Evaluation Team had to derive savings values for cooling savings by discounting the heating savings value by the relative ratio of load amps when the PTAC operated in cooling mode versus heating mode (approximately 25% on average).
6. Extrapolated the average daily heating and cooling mode savings values for sold and unsold rooms to the entire year to determine annual energy savings. Estimated annual consumption for each operating mode using the following parameters and assumptions:
   - Used actual room-sold rates for each guest room metered.
   - Established if PTACs units would be operating in heating mode or cooling mode based upon daily HDD and CDD values from the National Climatic Data Center for the geographic location of each hotel in the study.
   - Assumed room-sold cooling and heating savings values could be applied only to an eight-hour period during the day rather than to the 24-hour period used for unsold room savings.

7. Used the calculated annual energy savings for each guest room and solved for a room-specific GREM energy-savings factor using a modified version of the algorithm from the Wisconsin TRM (modified values shown in red font):

$$GREM\ savings\ factor = \frac{Annual\ kWh\ Savings}{\left[\left(\frac{DL \times OLF \times HDD \times 24 \times HCF}{\Delta Th \times 3{,}413}\right) + \left(\frac{DL \times OLF \times CDD \times 24}{\Delta Tc \times 12{,}000} \times \frac{12}{EER}\right)\right]}$$

Where:

- *Annual kWh Savings* = room specific annual savings
- *DL* = actual room-specific cooling capacity of the PTAC unit in Btu/hr
- *HDD* = number of heating degree days, deemed 7,501
- *CDD* = number of cooling degree days, deemed 582
- ΔT_h = design temperature difference for heating, deemed 76°F
- ΔT_c = design temperature difference for cooling, deemed 17°F
- *HCF* = Heating Correction Factor, deemed 0.75
- *OLF* = oversized factor for design load, deemed 85%
- *EER* = actual room-specific Energy Efficiency Ratio for PTAC unit
- *12,000* = conversion factor, Btu per ton
- *12* = conversion factor based on the definition of EER, converts EER to kW/ton
- *24* = number of hours in a day
- *3,413* = conversion factor, Btu per kWh

Findings

The results for all 12 rooms metered at both hotels are shown in Table K-19.

Table K-19. Evaluated Average Annual Savings (kWh) and GREM Savings Factors

Evaluated Avg. Annual Savings per Guest Room	Deemed Annual Savings per Guest Room	kWh Realization Rate	Evaluated Avg. GREM Savings Factor	Deemed GREM Savings Factor
1,568	1,507	104%	31%	30%

Savings are based on the difference between an occupied (sold) and unoccupied (unsold) room. The savings analysis presumes an occupied room adequately represents the baseline condition. A more

accurate baseline for a room or whole hotel with a GREM system is a comparable room or hotel with no GREM system installed.

The savings found from this study may be different for future program participants installing a GREM system if:

- **The hotel has high occupancy rates.** If a room is continuously occupied, the opportunity for savings decreases; there are no savings during occupied periods.
- **Snapback occurs.** Rooms gain and lose heat to the outside but also to the adjacent rooms. GREM system controls that prevent heat gained or lost directly to the outside produce quantifiable savings, but heat that is gained or lost to the adjacent rooms is more difficult to quantify. Theoretically, hotels with high occupancy have less potential savings per room because the thermal mass of adjacent rooms would have an average temperature that is higher (in the winter) than a hotel with low occupancy. This thermal mass would keep the room warmer for a longer period of time thus increasing heat loss in the winter (and conversely heat gain in the summer).
- **Hotel staff sets temperature back before GREM installation.** Some hotels have a mandatory protocol that requires staff members to reset the thermostat when they enter an unoccupied room. Although hotel staff readily admit the protocol is often neglected, following the protocol for any portion of the time would decrease the baseline power estimate and reduce potential savings.

Conclusions and Recommendations

Conclusion: The findings of this study (shown in Table K-19) indicate that the 30% savings factor is slightly underrepresenting savings. The Evaluation Team acknowledges that the limited size and scope of the study results in sampling and measurement uncertainty from seasonal variability in hotel occupancy, and this uncertainty exceeds the difference between the deemed (30%) and evaluated (31%) GREM savings factor. The Evaluation Team concludes that the deemed GREM savings factor is reasonable but that the research does not conclusively support a change to the GREM savings factor.

Recommendation: The Evaluation Team will continue to assess the applicability of the GREM savings factor by surveying program participants to determine the average hotel occupancy. Hotels with high occupancy may have lower potential savings. The Program Implementer should collect occupancy rates (whole hotel, monthly, or annually) for future GREM measure applicants.

Conclusion: The algorithm and inputs in the GREM savings calculation measure workbook differ slightly from TRM algorithms and inputs for similar measures. The values in the savings algorithm do not affect the estimate of the GREM savings factor but these values could be refined to align with values in the TRM.

Recommendation: The Program Implementer should submit a revised work paper that aligns with weather-related HVAC measures in the TRM so that it can be included in the Wisconsin TRM. Comments and recommendations for each parameter are:

Conclusion – Design Load & EER Ratings: The GREM work paper assumes a weighted average cooling design load of 9,750 Btu/hr and a 9.6 EER rating for guest room PTAC units. The verified weighted averages from this study were 9,285 Btu/hr and 10.8 EER, respectively.

Recommendation: The stipulated cooling capacity and efficiencies used in the GREM measure workbook seem reasonable, but any increase in the stipulated EER value in the future should be carefully considered as older equipment gets phased out and newer, more efficient equipment is installed. This parameter could be investigated further by researching product specifications available from manufacturers' websites, which typically include the heating and cooling capacities for each model offered.

Conclusion – Weather Related Savings Parameters: The Wisconsin TRM provides guidance on HDD, CDD, and design temperature, but the GREM savings calculation uses different inputs.

Recommendation: Update the algorithm for the GREM measure to ensure that parameter inputs match values provided by the TRM. Inputs for HDD and CDD should match the TRM population-weighted statewide average. Using a base temperature of 65°F and the TRM-defined population weighted statewide average design temperatures, the GREM heating and cooling design temperatures should be changed to 80°F and 20°F, respectively and should use the TRM HDD and CDD values (Table K-20).

Table K-20. Differences between TRM and Measure Specific Inputs

Parameter	Wisconsin TRM Value	GREM Algorithm Value
Cooling Degree Days (CDD)	565	582
Heating Degree Days (HDD)	7,616	7,501
Design Temperature Difference – Cooling (ΔT_c) in °F	80	76
Design Temperature Difference – Heating (ΔT_h) in °F	20	17

Conclusion – Heating Correction Factor (HCF): The average verified HCF from the equipment surveyed was dependent on equipment type and ranged from 94% to 184%, as shown in Table K-21. The GREM measure workbook currently assumes an HCF value of 75%. Currently, all available data indicates unitary HVAC systems eligible for the GREM measure are PTACs with electric auxiliary heat.

Table K-21. Verified HCF by System Type for Sample Population

System Type	Weighted Avg. HCF

Packaged Terminal Heat Pump (PTHP)	0.94
Packaged Terminal Heat Pump with Electric Auxiliary Heating	1.84
Packaged Terminal Air Conditioner with Electric Auxiliary Heating	1.33

Recommendation: Request nameplate specifications (heating and cooling Btu/hr, size of auxiliary heating in kW), or at a minimum make and model number, for the HVAC systems controlled by the GREM measure. Use these data to research product specifications from manufacturers' websites, which typically include the heating and cooling capacities for each model offered. Consider differences between heat pump reverse cycle heating and auxiliary resistance heat.

Custom Process

This study focused on Custom Process projects completed in CY 2014, placing a primary emphasis on any projects claiming significant natural gas savings. Custom Process is available through the Business Incentive Program and the Large Energy User Program and provides incentives for nonstandard technologies and projects. Incentive amounts are determined by the type of organization applying and its respective level of energy use. To be eligible for an incentive, both the Business Incentive Program and the Large Energy User Program require that the participant work with an Energy Advisor from Focus on Energy prior to purchasing equipment or proceeding with upgrades.

This study was proposed during the planning stages for the 2014 Targeted Markets Impact Evaluation because of changes to the measure mix in the two programs. Focus on Energy expected that the discontinuation of boiler tune-up incentives in 2014 would have a significant impact on the overall composition of projects contributing to program natural gas savings. To recapture these lost savings, Focus on Energy introduced a new measure offering, Process Exhaust Filtration, and pursued more Custom Process projects with large natural gas savings. In anticipation of these changes, the Evaluation Team recommended increasing the number of Custom Process projects to be evaluated in 2014.

Methodology

When the sample was generated in August 2014, a total of 39 Custom Process measures had natural gas savings. The Evaluation Team set a targeted sample size for the study of 28 measures and evaluated 31 unique measures from the Business Incentive Program and the Large Energy User Program. Table K-22 lists the population, sample, and associated energy savings (therms) by program. The next section, Sampling Methodology, discusses how the sample was selected and describes the number of projects by measure category.

Table K-22. Population and Sample Size by Program

Population – Measures (N)	*Ex Ante* Therm Savings (N)	Sample Size (n)	*Ex Ante* Therm Savings (n)
Business Incentive Program			
22	1,367,343	7	844,581
Large Energy User			
35	7,205,475	24	3,895,143

Total	**8,572,818**	**31**	**4,739,724**

Sampling Methodology

To develop a better understanding the scope of each measure in the population, the Evaluation Team conducted a detailed review of the project files. A team of engineers obtained and reviewed project documentation for each measure from SPECTRUM. The project files typically include application forms, engineering calculations, invoices, and e-mail correspondence between the Program Implementers, Energy Advisors, and customers.

The Evaluation Team assigned a measure category (one of eight) to each of the 39 measures. The sampling methodology involved a random selection, followed by modifications by the Evaluation Team to include the 16 largest natural gas savings projects from 2014, resulting in 31 measures. Table K-23 shows these 31 measures according to the eight measure categories, which represented approximately 97% of the aggregate therm savings for the total population of 39 measures.

Table K-23. Summary of Custom Process Projects Evaluated in 2014 by Designated Measure Category

Measure Category	Desk Audits	On-Site Inspection	Sample Projects	*Ex Ante* Therm Savings
Process Heat Recovery	2	5	7	1,942,942
Heat Exchanger Replacement/Improvement	1	4	5	261,381
Paper & Pulp Process Improvement	1	5	6	1,004,352
Process Exhaust Filtration	1	4	5	350,480
Industrial Steam Traps & Pipe Insulation	7	-	7	863,832
Reverse Osmosis Filtration	-	1	1	316,737
Total	**12**	**19**	**31**	**4,739,724**

Measurement & Verification (M&V) Methodology

For the impact evaluation, the Evaluation Team conducted 12 desk audits and performed 19 on-site inspections for projects with large savings and higher perceived uncertainty.

Desk Audits

Desk audits consisted of a detailed review of all relevant documentation available through SPECTRUM, including:

- Project applications
- Savings calculations performed by participants or third-party contractors (if applicable)
- Energy audits or feasibility studies
- Customer meter data
- Invoices for equipment and contracting services
- Any other documentation submitted to Focus on Energy

As part of the desk audits, the Evaluation Team conducted follow-up conversations with the customer to collect any necessary information not available in SPECTRUM.

The Evaluation Team prepared project-specific verification plans to facilitate data collection and ensure that project engineers collected the necessary data from customers to evaluate the savings. Each plan included a summary of the project, key parameters and assumptions used in program savings calculations, equipment specifications from project documentation to be verified, questions pertaining to eligibility, pre- and post-retrofit facility operations, and other critical inputs necessary to estimate project savings. The verification plans also included the savings algorithms used to determine Program gross savings.

Customers could provide responses by e-mail or over the phone and were generally accommodating to additional inquiries on desk audits. For three desk audit projects, the Evaluation Team did not receive responses from the customers, despite multiple inquiries, so it replaced these projects with alternates.

On-Site Inspections

The Evaluation Team conducted on-site inspections for 19 measures, which were selected by their complexity during a preliminary review of from SPECTRUM data and overall contribution to the gross savings among the sampled projects. These projects also received engineering desk audits.

During on-site inspections, the Evaluation Team gathered data for various savings input assumptions to confirm the accuracy of the estimation metrics, to identify any discrepancies between reported and verified savings, and to verify energy impacts of measures. As part of this study, the Evaluation Team identified and compiled key parameters for all evaluated measures and compared the actual or estimated values, determined from the on-site inspections and customer interviews, with the assumed values used to estimate savings.

Project engineers applied a variety of specific on-site data collection methods depending on the measure type, such as deploying temporary data-logging devices and performing spot power measurements when appropriate. If data loggers could not be safely deployed or the customer did not permit metering, project engineers reviewed daily operations and maintenance logs, gathered system setpoints and operating conditions from central energy management systems and facility personnel, and reviewed the historic trend data, if available.

Measurement

Because this study focused on natural gas savings, there were fewer opportunities to deploy stand-alone data logging equipment due to prohibitive costs and safety concerns. Project engineers performed temporary metering on industrial exhaust filtration and process pump applications for a minimum of four weeks and up to eight weeks. They installed true power meters using current transducers and watt-hour transducers on a single process exhaust filtration project and performed spot power measurements at two additional industrial exhaust filtration projects. The engineers deployed motor on/off loggers on five process pumps. The Evaluation Team analyzed the collected data to determine project-level realized annual energy (kWh) and demand savings (kW).

Site-Specific M&V Plan

The Evaluation Team developed a custom M&V plan for each on-site inspection. Typically, senior engineers developed the plans and reviewed them with the project engineers prior to the on-site inspection. A standard M&V plan consisted of:

- Directives on the appropriate data-logging equipment to use in the field, such as the correct amperage ratings for current transducers (including the quantity and type of watt-hour transducers) and power meters.
- Directives on the required personal protective equipment (PPE) to use in the field when working on energized or de-energized equipment.
- Recommendations on data logger sampling intervals and metering period.
- Directives on spot measurements to be obtained using power meters and infrared thermostats.
- Directives on acquiring spot readings from on-site temperature and pressure gauges.
- Directives on data to be gathered from on-site Energy Management Systems (EMS).
- Questions and data to collect pertaining to operating schedules and load profiles.

Table K-24 through Table K-27 show abbreviated sample data collection M&V plans for four of the most frequently evaluated measures from CY 2014.

Table K-24. Sample Data Collection Content and M&V Plan for Heat Recovery Project

	Typical Content in M&V Plan for Heat Recovery Project
Recommended M&V Equipment	• Camera, infrared thermometer gun, USB storage device
Parameters to be Verified	• Average production of steam boiler No. 6 (pph) • Average DA Tank steam usage (pph) • Steam pressure to DA Tank (psi) • Boiler burn hours • Demineralized water flow rate (gpm) • Inlet temperature of boiler feedwater (°F) • Outlet temperature from heat recovery (°F) • Annual operating hours of ancillary pumps
M&V Instructions	• Take pictures of the heat recovery equipment and any associated pumps. • Verify boiler's operating schedule (24/7/365 except for outages). Verify with trend data. If trend data is unavailable ask for EMS data. If EMS data is unavailable, ask site contact to verify and/or request billing data. • Collect inlet and outlet temperatures from heat exchanger using existing temperature gauges or IR heat gun.

	Typical Content in M&V Plan for Heat Recovery Project
	• Collect any available historic trend data on baseline conditions.
Equipment Specification Verification	• **Plate-and-Frame Heat Exchanger:** Collect manufacturer, model number, plate quantities and dimensions, and heat exchanger effectiveness. Take picture of equipment tags. • **Boiler:** Collect manufacturer, model number, rated heating output, efficiency, feedwater pump hp, and blower hp. Take picture of equipment tags. • **Pumps:** Collect manufacturer, model number, rated hp, rated gpm, motor/pump efficiency, volts/full load amps/phase, power factor, method of pump control.

Table K-25. Sample Data Collection Content and M&V Plan for Heat Exchanger Improvement Project

	Typical Content in M&V Plan for Heat Exchanger Improvement
Recommended M&V Equipment	Camera, infrared thermometer gun, USB storage device
Parameters to be Verified	• Mash volumetric flow rate (gpm) • Inlet and outlet mash temperatures (°F) at heat exchanger • Beer volumetric flow rate (gpm) • Inlet and outlet beer temperatures (°F) at heat exchanger • Number of plates added to heat exchanger and standard dimensions • Increase in total pressure drop through heat exchanger (psi) and corresponding increased pump hp required • Annual production hours
M&V Instructions	• Take pictures of the heat exchanger, associated pumps, cooling tower, boiler, and chiller. • Verify beer and mash flow rates through EMS. • Verify inlet and outlet temperatures through heat exchanger either through EMS, gauges mounted directly on inlet and outlet lines, or spot measurements using IR thermometer. • Determine annual hours of operation for the boiler, chiller, and cooling tower. How weather-dependent is chiller operation? At what outdoor air temperature does the chiller activate? • Determine increased pumping power required after increasing heat exchanger plate count. The increase in pressure drop through the HX would also be acceptable. • Collect any available production trend data. • Request utility bills.
Equipment Specification Verification	• **Plate-and-Frame Heat Exchanger:** Collect manufacturer, model number, plate quantities and dimensions, and heat exchanger effectiveness. • **Boiler:** Collect manufacturer, model number, rated heating output, efficiency, feedwater pump hp, and blower hp. • **Pumps:** Collect manufacturer, model number, rated hp, rated gpm, motor/pump efficiency, volts/full load amps/phase, and power factor. Also determine increased load on pump as it is VFD-controlled. • **Cooling Tower:** Collect manufacturer, model number, rated cooling capacity (BTU/hr or tons), kW/ton (if known), combined fan hp, total hours of operation. Also attempt to obtain any design specifications for the tower as it was a custom design. • **Chiller:** Collect manufacturer, model number, rated cooling capacity (BTU/hr or tons), COP/IPLV/NPLV, kW/ton, total hours of operation since date of installation, load profile.

Table K-26. Sample Data Collection Content and M&V Plan for Industrial Steam Traps

	Typical Content in M&V Plan for Industrial Steam Traps
Recommended M&V Equipment	Camera, USB storage device
Parameters to be Verified	• Operating pressure of steam (psig) and corresponding temperature (°F) • Steam boiler performance specifications • Quantity of steam traps that failed and differentiate between those that failed closed versus open • Document manufacturer, model number, type (thermostatic or mechanical) and orifice diameter for all replaced traps
EM&V Instructions	• Take pictures of steam boiler and representative sample of replaced traps. • Verify steam pressure and temperature is uniform throughout the distribution system. • Gather boiler equipment specifications. • Ask whether steam boiler has been regularly maintained or recently overhauled. If overhauled inquire about timing and scope.
Equipment Specification Verification	• **Boiler:** Collect manufacturer, model number, rated heating output, efficiency, feedwater pump hp, and blower hp. Take picture of equipment tags.

Table K-27. Sample Data Collection Content and M&V Plan for Industrial Exhaust Filtration

	Typical Content in M&V Plan for Industrial Exhaust Filtration
Recommended M&V Equipment	• Camera, (1) WattNode Pulse WNB-3Y-480-P kWh transducer, (3) 50-amp current transducers, (1) HOBO UX90 state logger, *Amprobe* Clampmeter
Parameters to be Verified	• Quantity of MAU units and performance specifications • Quantity of RTUs serving production area and performance specifications • Heating and cooling system temperature setpoints • Weekly or annual hours of production and facility operating schedule
M&V Instructions	• Take pictures of make-up air units, exhaust filtration systems, and deployed metering setup. • Determine when system was activated (new construction project). • Determine whether production/warehouse area is cooled during summer months in addition to being heated during winter months. • Has production increased since the original date of installation? • Verify MAUs are identical and loading is uniform between the two. • Verify filtration systems are integrated into the make-up air units and that no additional filtration circulators were installed as part of this project. • Deploy kWh metering kit (true RMS power) on VSD-controlled MAUs. • Perform spot power measurements or record Hz and amp values from the VSD across the entire spectrum of common fan operations.
Equipment Specification Verification	• **Makeup Air Units:** Collect manufacturer, model number, rated hp, rated CFM, motor efficiency, volts/full load amps/phase, power factor, method of fan control • **Rooftop Units:** Collect manufacturer, model number, rated cooling capacity (Btu/hr or tons), rated heating capacity (Btu/hr), cooling and heating system efficiencies

Gross Verified Savings Analysis

The Evaluation Team used data from project audits and on-site inspections to analyze each sampled measure, completing these using custom Excel-based calculation tools developed for each measure category. The Evaluation Team relied on historic trend data from customer control systems whenever possible as well as trend and instantaneous data from meters deployed during the on-site visit.

The Evaluation Team carefully reviewed the savings algorithms and assumptions used by the program, using engineering judgment and best practices from other statewide technical reference manuals.

Realization Rates by Measures Type

After determining verified savings for each measure, the Evaluation Team calculated realization rates at the measure-category level. Table K-28 shows the category-level natural gas energy (therm) savings.

Table K-28. Measure Category Realization Rates for CY 2014

Measure Category	*Ex Ante* Savings (Therms)	*Ex Post* Savings (Therms)	Realization Rate (Therms)
Process Heat Recovery	1,942,942	1,493,058	77%
Heat Exchanger Replacement/Improvement	261,381	411,405	157%
Paper & Pulp Process Improvement	1,004,352	970,706	97%
Process Exhaust Filtration	350,480	284,869	81%
Industrial Steam Traps & Pipe Insulation	863,832	778,413	90%
Reverse Osmosis Filtration	316,737	288,072	91%
Weighted Average	**4,739,724**	**4,226,523**	**89%**

Table K-29 shows the category-level natural gas energy (therm) savings by program for CY 2014.

Table K-29. Measure Category Realization Rates by Program for CY 2014

Measure Category	*Ex Ante* Savings (Therms)	*Ex Post* Savings (Therms)	Realization Rate (Therms)
Business Incentive Program			
Process Heat Recovery*	494,101	234,854	48%
Process Exhaust Filtration	350,480	284,869	81%
Total	**844,581**	**519,723**	**62%**
Large Energy User Program			
Heat Exchanger Replacement/Improvement	261,381	411,405	157%
Industrial Steam Traps & Pipe Insulation	863,832	778,413	90%
Paper & Pulp Process Improvement	1,004,352	970,706	97%
Process Heat Recovery	1,448,841	1,258,204	87%
Reverse Osmosis Filtration	316,737	288,072	91%
Total	**3,895,143**	**3,706,800**	**95%**

*This is the savings for one project only. The realization rate shown here was applied to the reported savings for this project only. This realization rate was removed from the realization rate applied to the Business Incentive program, however, because of the uncertainty in life cycle savings for this project. See explanation in Conclusions and Recommendations section.

Conclusions and Recommendations

- The low therm realization rate for the **process heat recovery** measure category (77% for the two programs combined) was heavily influenced by a single project (approximately 25% of this category's reported savings) in which the installed system was not fully using the available waste heat exchanger, achieving 47% of the reported savings. The Evaluation Team removed this project from the sample after confirming it was different from all other projects; it was not operating at full capacity but was expected to increase capacity in forthcoming years. Consequently, the realization rate applied to the program was not affected by this project but the Team maintained the verified realization rate for this project's reported lifetime savings.
- The high realization rate for the **heat exchanger replacement/improvement** measure category is primarily attributed to a single project, which represented 44% of this category's reported savings. The high savings resulted from forecasted fluid flow rates and rates of heat transfer through the expanded heat exchanger that exceeded program projections, realizing 245% of the reported savings.
- Confidence level for custom projects can be highly variable due to inconsistencies in data sources or collection methods for key parameters that heavily influence the calculated savings. As an example, fluid flow rates through a heat exchanger can be determined from EMS trend data, hand-written logs by facility personnel, temporary flow meters, spot measurements, industry standard or best practices, equipment specifications, or estimates made by plant personnel.
- The accuracy of calculated realized energy savings is influenced by customer project-related knowledge. This is particularly true for desk audit projects where project engineers will reach out to the designated site contact to verify key parameters and assumptions from the savings algorithms. In instances when the customer is unresponsive or not knowledgeable about the project, the project engineer has to assume that certain inputs/parameters in the original savings calculations developed by the Program were correct. For on-site audits where the customer provides limited access and/or time to the project engineer, estimates and assumptions are necessary if parameters cannot be verified by some other means.

The savings calculations in the sample were all custom-built spreadsheet analyses developed by the customer, consultant, Energy Advisor, or vendor. However, even though the savings are not deemed or prescriptive, the Evaluation Team recommends that the methodology used in custom calculations incorporate the algorithms from the most current Wisconsin TRM when available. As an example, the TRM includes sections on steam traps in an industrial or HVAC application as well as pipe insulation, but the savings algorithms were not used consistently for the **industrial steam trap & pipe insulation** projects evaluated in this study. The benefits of adding this as a requirement include consistency in calculation methodology for similar projects, increased simplicity for data collection (the M&V plan data collection will include the input parameters for the approved calculation methodology), reduced evaluation cycle time, and more consistent savings estimates.

Appendix L. Net Savings Analysis Methodologies

For the CY 2014 evaluation, the Evaluation Team applied net-to-gross adjustments based primarily on prior research. This appendix presents the two general approaches used to assess net savings—standard market practice and self-report net-to-gross (NTG). Additionally, this appendix describes the results of the CY 2014 analysis conducted for the Residential Lighting and Appliance Program, the Chain Stores and Franchises Program, and the Design Assistance Program.

Net Savings Overview

As described in earlier sections, the evaluation of a program involves reviewing the reported gross savings to ensure that the measures installed have remained installed and are working as intended. Any adjustments based on these findings are applied, and the result is the verified gross savings.

Net savings are the final savings, as reviewed by an independent evaluator, which are attributed to a program. Being attributable to a program means that a program is directly responsible for the savings, and the savings would not have been achieved in the absence of a program. In deriving this value, evaluators account for, and deduct, reported savings that are associated with freeriders (participants who would have undertaken the same action and achieved the same savings in the absence of a program) and account for, and add, spillover savings (savings that are the result of a program's influence but for which no incentive was paid and for which no program has recorded savings).

Net savings represent the total savings that are being achieved from the investment of ratepayer dollars into the Focus on Energy program. These net savings are the primary benefits that are factored into the benefit-cost analysis used for designing programs and ensuring that they are operating in a manner that returns a net positive benefit to ratepayers. These net savings are also used for tracking the progress toward the savings targets established by the Public Service Commission for Focus on Energy.

This appendix discusses the specific approaches used in deriving the net savings for the CY 2014 Focus on Energy programs. Of particular note, beginning in CY 2013, the Evaluation Team began the process of moving away from estimating net savings based exclusively upon the results of surveys to the standard market practice (SMP)—an approach that measures the impact of the programs on the average efficiencies of measures sold and installed in Wisconsin. It is Focus on Energy's long-term goal to use this approach as broadly as possible and to limit the use of self-reporting methodologies. The Evaluation Work Group (EWG) approved the use of this methodology and supports increasing its use.

The Evaluation Team applied the SMP methodology for nine residential measure categories and four nonresidential measure categories, which were selected because they had adequate baseline data. In some cases, the Evaluation Team applied blended the approaches by combining measure-level results from both the SMP and the self-report methods to determine savings-weighted average program NTG ratios. Table L-1 shows the net savings method(s) applied for each program for the CY 2014 evaluation.

Table L-1. CY 2014 Net Savings Methodology by Program

CY 2014 Programs	Net Savings Methodologies
Residential	
Multifamily Energy Savings	Standard Market Practice and Self-Report
Multifamily Direct Install	Stipulated NTG = 1.0
Appliance Recycling	Self-Report
Lighting and Appliance	Market Analysis
Home Performance with ENERGY STAR	Self-Report
Assisted Home Performance with ENERGY STAR	Stipulated NTG = 1.0
New Homes	Self-Report
Residential Rewards	Standard Market Practice and Self-Report
Enhanced Rewards	Stipulated NTG = 1.0
Express Energy Efficiency	Stipulated NTG = 1.0
Nonresidential	
Business Incentive	Standard Market Practice and Self-Report
Chain Stores and Franchises	Standard Market Practice and Self-Report
Large Energy Users	Standard Market Practice and Self-Report
Small Business	Standard Market Practice and Self-Report
Design Assistance	Self-Report
Renewable Energy Competitive Incentive	Stipulated NTG = 1.0

Although the rigor of the SMP approach has been discussed and reviewed at length by the Evaluation Team and the EWG, any systematic change in approach introduces or eliminates systematic biases that cannot always be quantified. As a result, NTG (or net savings divided by verified gross savings) ratios reported for the CY 2013 and CY 2014 programs may not be directly comparable to those reported for CY 2012 in cases where the SMP approach was applied. Additionally, this approach diverges from the methods used in the design of the programs at the beginning of the present quadrennium; therefore, changes in NTG ratios may not be solely because of the effectiveness of the program design or implementation.

Standard Market Practice Methodology

This section describes the SMP methodology. The Evaluation Team conducted the analysis during the CY 2013 evaluation and continued to apply the results in CY 2014.

Where adequate market baseline data were available, the Evaluation Team calculated net savings with a SMP methodology, using program data and data collected through the evaluation process to define the average market baseline and average program-installed energy consumption (kWh and/or therm) of each measure category. The Evaluation Team first accessed a representative sample of records showing existing efficiency levels of a particular equipment type outside of the Focus on Energy program. Market baselines include a range of varying efficiency levels (both inefficient and efficient levels) and represent the average efficiency being sold in Wisconsin during CY 2013. The SMP methodology calculates net

savings as the difference between the average market baseline and the average program-installed energy consumption, under the assumption that freeridership is captured in the baseline. To calculate the NTG ratio using the SMP method, the Evaluation Team compared the net savings determined through the SMP analysis to the verified gross savings.

The Evaluation Team then determined the baseline for each measure category based on these three main sources of sales and installation data:

- Baseline study, which included two distinct tasks:
  - CY 2013 panel study recording sales data
  - CY 2013 commercial site visits recording units installed within the past four years
- CY 2013 Home Performance with ENERGY STAR Program audit data

Table L-2 lists the measures selected in the SMP analysis for CY 2013 and their corresponding baseline data sources.[27]

Table L-2. Measures Assessed with Standard Market Practice Methodology

CY 2013 SMP Measures	Baseline Data Source
Residential (Mass Markets)	
Clothes Washer	Panel study
Dishwasher	Panel study
Refrigerator	Panel study
Efficient Showerhead	Panel study
Faucet Aerator	Panel study
Water Heater	National efficiency shares for water heaters (2010, DOE)
Boiler	Home audit data collected for Home Performance Program
Furnace	Home audit data collected for Home Performance Program
Water heater turndown	Home audit data collected for Home Performance Program
Nonresidential (Targeted Markets)	
Boiler	Commercial site visits
Efficient lighting	Commercial site visits; program data
Water Heater	Commercial site visits
Occupancy Sensors	Commercial site visits

Example of the SMP Methodology Used for High-Efficiency Showerheads

The following example illustrates how the Evaluation Team used the SMP method to calculate baseline and Program-installed kWh and therm consumption to determine net-of-freeridership savings for the high-efficiency showerheads sold through the Residential Lighting and Appliances Program in CY 2013.

[27] The Residential Lighting and Appliance Program used a similar but distinct method, which is described in the CY 2014 Program section of this appendix.

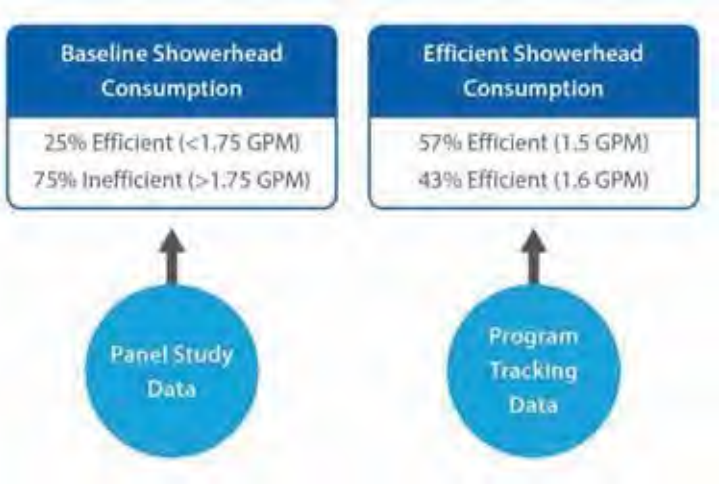
This example is generally representative of all SMP calculations, though some variations are described later in this appendix.

The efficiency level of a showerhead is determined by the gallons of water the unit produces per minute (gpm), commonly presented in discrete efficiency specifications (2.2, 1.75, 1.5, etc.). Efficient showerheads, as defined in Focus on Energy's programs, are rated with a gpm of less than 1.75. To define the market baseline efficiency for showerheads, the Evaluation Team used data collected through the evaluation panel study, which listed a sample of sales records of showerheads and their corresponding rated gpms. The panel study found that 25% of showerheads are efficient (<1.75 gpm) and 75% are inefficient (≥1.75 gpm). Therefore, the market baseline is a combination of 25% efficient and 75% inefficient showerheads. The Evaluation Team calculated a weighted average market baseline consumption based on the distribution of gpms among the products sold outside the program.

As Step 1 of the SMP method, the Evaluation Team computed the baseline consumption as the weighted average of this efficiency distribution, according to the consumption algorithms in the Wisconsin TRM. The Evaluation Team then calculated the Program-installed consumption values for efficient showerheads as a weighted average of showerheads based on the distribution of gpms in Program participation (57% 1.5 gpm, 43% 1.6 gpm).

Step 1 of the SMP method—computing the baseline and Program-installed consumption values—is shown in Figure L-1.

Figure L-1. SMP Method Step 1: Estimate Baseline and Program Energy Consumption



Step 2 of the SMP method—calculating net savings—involved adjusting for the influence of Focus on Energy's Program activity in Wisconsin. This Program-influence adjustment removes a portion of the efficient units from the baseline, thereby accounting for the fact that Focus on Energy has an effect on purchases of efficient equipment outside of Program participation. In other words, a portion of the sales and installation of efficient equipment that occurred in CY 2013 was induced by Focus on Energy activity

(such as energy education and awareness building), despite the purchasers not having participated in the Program.

The Evaluation Team used participant spillover to determine this Program-influence effect. Participant surveys asked respondents a series of questions about additional purchases they made that were influenced by Focus on Energy but for which they did not receive an incentive. The Evaluation Team combined responses from all Focus on Energy programs, weighted responses in each measure category to reflect program populations, and extrapolated these quantities to apply to the total population of Wisconsin.

For example, the Evaluation Team used participant surveys to estimate that a total of 76 efficient showerheads were purchased in Wisconsin in CY 2013 as a result of Focus on Energy but without receiving an incentive or discount. The Evaluation Team removed these 76 Program-influenced efficient showerheads to establish the market baseline *absent* any Program influence. To maintain the accuracy of the baseline, however, the Evaluation Team assumed that the total number of showerheads sold would have remained the same. Thus these Program-influenced efficient showerheads had to be replaced with 76 inefficient showerheads, which decreased the proportion of efficient showerheads in the baseline.

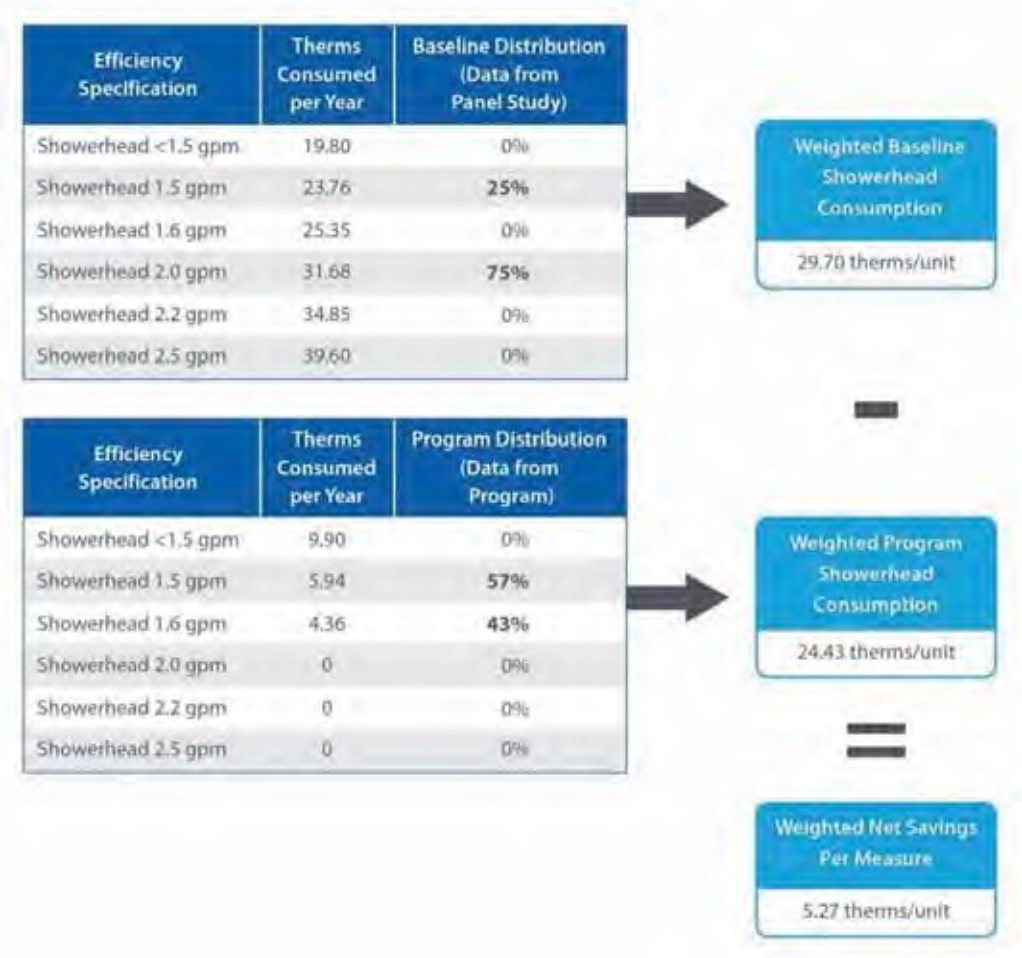
Step 2 of the SMP—adjusting the baseline to account for Program influence—is shown in Figure L-2.

Figure L-2. SMP Method Step 2: Adjust Baseline for Focus on Energy Program Influence



Step 3 of the SMP method was to determine per-unit, net-of-freeridership savings for each measure category. After adjusting the baseline to account for Program influence in Step 2, the Evaluation Team subtracted the weighted average Program-installed consumption from weighted-average adjusted market baseline consumption to determine average per-unit net-of-freeridership savings, as shown in Figure L-3.

Figure L-3. SMP Method Step 3: Compute Net-of-Freeridership Savings



Finally, the Evaluation Team calculated total Program net-of-freeridership savings for each measure category by multiplying average per-unit net-of-freeridership savings by the verified Program participation. Again, using the example of efficient showerheads and applying it to the Residential Lighting and Appliances Program, the Evaluation Team multiplied the per-unit savings for showerheads by the number of total units sold through the Program then multiplied 5.27 therms saved per unit by the 4,619 units sold to verified Program participants living in homes with natural gas water heaters. This calculation is illustrated in Figure L-4. The Evaluation Team applied the same process to homes with electric water heaters.

Figure L-4. SMP Method Step 4: Calculate Verified Total Program Net-of-Freeridership Savings



Following this step, spillover is added (for programs where the Evaluation Team determined spillover was occurring) for a final net savings value. The Evaluation Team calculated each program's overall program net-to-gross ratio by dividing the sum of each measure's net savings for by the sum of the verified gross savings. The result represents the program's overall net-to-gross ratio. This final metric is weighted by measure savings and includes a combination of SMP net savings values and self-report values.

Variations in Calculating SMP

All net savings calculated through the SMP method involved defining a market baseline using the best data available from the panel study, program, or baseline data. The savings calculations also involved creating a weighted efficient consumption value based on program participation. The Evaluation Team made adjustments to account for Focus on Energy's influence on the market baseline as well.

The Evaluation Team employed three slightly different variations to calculate net savings, depending on the characteristics and/or availability of data for a particular measure. These are listed here and discussed in the following sections:

- Variation 1: Market baselines defined by discrete efficiency levels
- Variation 2: Market baselines defined by continuous efficiency levels
- Variation 3: Market baselines defined by a binary saturation approach

Variation 1: Market baselines defined by discrete efficiency levels

Market baselines defined by discrete efficiency levels are for such measures as showerheads, faucet aerators, clothes washers, dishwashers, and commercial lighting. These measures have clear efficiency boundaries and sufficient data at the various efficiency levels. The showerhead example above fits into this category because the efficiency boundaries are defined as the standard GPM levels.

Baseline energy consumption values (kWh or therm) are calculated at each efficiency level and then weighted to produce a weighted baseline energy consumption value.

Variation 2: Market baselines defined by continuous efficiency levels

Market baselines defined by continuous efficiency levels are for boilers, furnaces, and water heaters. These measures have a wide, continuous range of different energy use levels, rather than a limited number of levels. For example, determining the baseline for gas furnaces by following the approach described above for efficient showerheads would have required defining energy consumption at each observed efficiency level (Annual Fuel Utilization Ratio ranging from 0.64 to over 0.97).

The Evaluation Team first calculated weighted average baseline and program-installed efficiency levels based on one of the three baseline data sources (Home Performance Program data in the case of gas furnaces). The Evaluation Team then computed the weighted average efficiency of all units in the baseline data and applied this value as the baseline efficiency to calculate the average baseline consumption. Similarly, the Evaluation Team used the weighted average efficiency of all units in the

program tracking database (program-installed average efficiency) to calculate the average program-installed energy consumption. The Evaluation Team also incorporated any Focus on Energy influence adjustments in the baseline.

Variation 2 differs from Variation 1 in that the weighting process takes place before calculating the consumption value. (In Variation 1, consumption value for each efficiency level is calculated, and then the baseline consumption is calculated as a weighted average.)

The Evaluation Team applied the same adjustments for applying single average net saving values to the program participant population.

Variation 3: Market baselines defined by a binary approach

For some measures, there are no efficiency levels to consider, and instead the measure is simply either installed or not installed. Measures in this category are occupancy sensors and water heater setpoint turn-down. For these measures, the Evaluation Team determined the market baseline as an average saturation (percentage installed) for each measure, then calculated the measure's saturation in the general population using the appropriate baseline data source. For example, for occupancy sensors, site visits to commercial facilities determined than 6.7% of facilities in the nonparticipant population had installed occupancy sensors. Finally, the Evaluation Team adjusted consumption to reflect differences in the measure's impact between nonparticipants and program participants.

For example, the Evaluation Team noted that the average wattage of lighting connected to an occupancy sensor differed between these populations: nonparticipants had an average of 284 connected watts, while participants had an average of 335 connected watts. Using these inputs, the Evaluation Team calculated an adjusted freeridership percentage of 5.68% following the equation:

$$FRadjusted = (CWn / CWp) * Sn$$

Where:

$FR_{adjusted}$	=	Adjusted free ridership rate
CW_n	=	Connected wattage (to occupancy sensor) among non-participants
CW_p	=	Connected wattage (to occupancy sensor) among participants
S_n	=	Saturation of occupancy sensor installation among non-participants

Self-Report Net-To-Gross Methodology

Two components constitute NTG—freeridership and spillover. True freeriders are customers who would have purchased a measure without a program's influence. Spillover is the amount of additional savings obtained by customers investing in additional, energy-efficient measures or activities due to their program participation.

This section presents the approaches and detailed results of residential and nonresidential NTG estimates derived from the use of self-reports, procured through participant surveys. These results were

applied to measure categories and programs for which adequate baseline data were unavailable. In some cases, the Evaluation Team applied a blended approach, combining measure level results from both the SMP and the self-report methods to determine weighted average program NTG ratios.

Survey Design

For programs where participating customer surveys were conducted in the CY 2013 evaluation plans, the Evaluation Team asked a series of freeridership and spillover questions in the participant survey.

These freeridership questions were designed to elicit, to the best of the respondent's ability, the impact of the particular program on the respondent's decision to purchase the high-efficiency equipment. Direct questions (such as "Would you have installed measure X without the program incentive?") tend to result in exaggerated "yes" responses. Participants often provide answers they believe surveyors seek, so a question becomes the equivalent of asking: "Would you have done the right thing on your own?" Effectively avoiding such bias involves asking a question in several different ways, then checking for consistent responses.

The Evaluation Team designed the survey questions to determine why customers installed a given measure and what influence the program had on their decisions. The survey sought to establish what decision-makers might have done in the program's absence, using a set of core freeridership questions to address that issue. Programs can have an effect on more than a customer's decision to purchase an energy-efficient measure. They can influence a customer to purchase an energy-efficient measure sooner than planned, to purchase a higher-efficiency measure than planned, or to purchase more units than planned without the program.

Basing freeridership estimates on a series of questions, rather than a single question, can help evaluators recognize and minimize response biases. Not all questions are weighted equally. For example, if a respondent would not have installed the measure(s) to the same level of efficiency without the program, they are automatically a 0% freerider. If they would not have installed the measure(s) within two years without the program, they are automatically a 0% freerider.

Other questions included in the freeridership analysis are assigned partial weights for responses that are indicative of a non-freerider. Using this method does not allow for a respondent to be estimated as a 100% freerider based on a single answer to a single question; a customer would have to provide consistent responses across the relevant questions in the freeridership analysis.

The Evaluation Team designed survey questions to determine why customers installed a specific measure and what influence the program had on their decisions. The survey sought to establish what decision-makers might have done in the program's absence, using questions addressing five core

freeridership dimensions for residential programs and six core freeridership dimensions for nonresidential programs:

- Would participants have installed measures without the program?
- Were participants planning on ordering or installing the measures before learning about the program?
- Would participants have installed the measures at the same efficiency levels without the program incentive?
- Would participants have installed the same quantity of measures without the program?
- In the program's absence, would participants have installed the measures at a different time?
- Was the purchase of the measures in the organization's most recent capital budget? (Nonresidential only)

The survey design included several skip patterns, allowing interviewers to confirm answers previously provided by respondents by asking the same question in a different format. Specific freeridership questions used for the programs are presented within their analysis sections in this appendix.

Freeridership Methodology

The Evaluation Team developed a score for all participants based on their responses to the freeridership questions. The Evaluation Team developed a probability matrix for assigning a single score to each participant, based on his or her objective responses to targeted survey questions.[28] Question response patterns existing in the probability matrix received freeridership scores, with confidence and precision estimates calculated on the distribution of these scores.

This matrix approach provides these key benefits:

- Derivation of a partial freeridership score, based on the likelihood of a respondent taking similar actions in the incentive's absence.
- Use of a rules-based approach for consistency among multiple respondents.
- Ability to change weightings in a "what if" exercise, testing the response set's stability.

The Evaluation Team's method offered a key advantage in introducing the concept of partial freeridership. Experience has shown program participants do not fall neatly into freerider and non-freerider categories. For example, the Evaluation Team assigned partial freeridership scores to participants who had plans to install a measure; though the program exerted some influence over their decisions, other market characteristics outside of the program also proved influential. Further, the Evaluation Team could assign partial credit to "don't know" and "refused" responses, rather than removing respondents entirely from the analysis.

[28] Khawaja, M. S. *The NAPEE Handbook on DSM Evaluation.* 2007 edition, page 5-1.

The Evaluation Team assessed freeridership at three levels:

- Each participant survey response was converted into a freeridership matrix terminology.
- Each participant's combination of responses received a score from the matrix.
- All participants were aggregated into an average freeridership score for the entire program category.

Convert Responses to Matrix Terminology

The study independently evaluated each survey question's response, assessing participants' freeridership levels for each question, with each survey response option converted into the following values:

- "Yes" (indicative of freeridership)
- "No" (indicative of non-freeridership)
- "Partial" (partially indicative of freeridership)

Participant Freeridership Scoring

Following conversion of survey responses into matrix terminology, a freeridership matrix was created for each program, allowing each participant's combined responses to be assigned a freeridership score. All combinations of survey question responses were considered in creating the matrix, with each combination receiving a freeridership score of 0% to 100%.

The Evaluation Team's process for determining freeridership score is as follows:

- Customers were categorized as 0% freeriders in these instances:
  - They had no plans to install the measure in absence of the program's incentives and would not have installed the measure within a year for Residential programs and within two years for Nonresidential programs.
  - They had specific plans to install the measure before learning about the program but would not have done so without program incentives.
  - In the absence of program incentives, the customer would not have purchased or installed equipment to the same level of efficiency.
- Customers were categorized as 100% freeriders if they would have installed the measure without the program or if they had installed the measure before learning about the program.
- Customers received a partial freeridership score (ranging from 12% to 75%) if they had plans to install the measure and their decision was influenced by the program. (This influence may have been installation timing, the number of measures installed, or the efficiency levels of measures installed.) For customers who were highly likely to install a measure and for whom the program had less influence over their decision, a higher freeridership percentage was applied.

Measure Category Freeridership Scoring

After assigning a freeridership score to every survey respondent, the Evaluation Team calculated a savings-weighted average freerider score for the measure category. For each program, respondents' freerider scores were individually weighted by estimated savings of equipment installed, using the following calculation:

$$\text{SavingsWeightedFreeridership} = \frac{\sum[\text{Respondent FR Score}] * [\text{Measure Energy Savings}]}{\sum[\text{All Respondents Measure Energy Savings}]}$$

Spillover Methodology

Spillover refers to additional savings generated by program participants through program participation but not captured by program records. Spillover occurs when participants choose to purchase energy-efficient measures or adopt energy-efficient practices due a program's influence but do not participate (or otherwise cannot participate) in the program.

The Evaluation Team measured spillover by asking a sample of participants purchasing and receiving an incentive for a particular measure if, due to the program, they installed another efficient measure or undertook another energy-efficiency activity. Respondents were asked to rate the program's (and incentive's) relative influence (either highly, somewhat, or not at all influential) on their decisions to pursue additional savings.

Participant Spillover Analysis

Calculating spillover savings used a top-down approach. Analysis began with a subset containing only survey respondents indicating they installed additional energy-saving measures after participating in the program. The Evaluation Team screened out any participants who received an incentive for these additional measures. Participants were also removed if they indicated the program had little influence on their decisions to purchase additional measures, thus retaining only participants rating the program as "highly influential."

The Evaluation Team applied evaluated and deemed savings values to the spillover measures that customers said they installed as a result of their program participation.

The spillover percentage per program category was calculated by dividing the sum of additional spillover savings reported by respondents for a given program category by total incentivized gross savings achieved by all respondents in the program category:

$$Spillover\ \% = \frac{\sum \text{Spillover Measure EnergySavings for All Survey Respondents}}{\sum \text{Program Measure Energy Savings for All Survey Respondents}}$$

Net-to-Gross Analysis

The Evaluation Team combined this spillover information with the program-level freeridership results to achieve the NTG ratio, using the following calculation:

$$\text{NTG} = 1 - \text{Freeridership} + \text{Spillover}$$

CY 2014 Program Analysis

For the CY 2014 evaluation, the Evaluation Team updated the net savings approach for several programs. The Team used more recent or new data sources for the Lighting and Appliance Program, the Chain Stores and Franchises Program, and the Design Assistance Program.

Lighting and Appliance Program

For the CY 2013 evaluation, the Evaluation Team developed an approach to estimate the spillover and market effects impacts of the upstream lighting offerings. The Evaluation Team's analysis assessed nonparticipant lighting and non-lighting spillover and market effects, all using a single method, which was not based on survey data. The approach differed from the standard SMP approach described above in that it reflects the particular market influences of an upstream program. This analysis compared the change in CFL bulb saturation levels in Wisconsin to sales of Program bulbs over the same time period to determine spillover.

Spillover for the Lighting and Appliances Program can be defined as energy savings caused by (but for which incentives are not offered) program activity during a program's implementation cycle. Spillover may occur from:

- Nonparticipants purchasing lighting products (for example, a customer indicating they purchased a non-incented specialty compact fluorescent lamp [CFL] after experiencing satisfaction with the performance of a three-pack of incented, standard CFLs).
- Nonparticipants purchasing non-lighting products (those purchasing additional energy-efficient measures because their actions were influenced by knowledge they received from the program).

For the CY 2014 evaluation, the Evaluation Team improved upon this analysis with more recent and applicable data sources for four variables to re-estimate spillover, resulting in a decrease of lighting spillover from 20% to 13% (more information on the initial methodology and inputs used to estimate spillover can be found in the CY 2013 evaluation report). The Evaluation Team updated the CFL spillover inputs and sources documented in Table L-3.

Table L-3. CY 2014 Updates to Spillover Inputs and Sources

Spillover Variable	CY 2013 Input	CY 2013 Source	CY 2014 Input	CY 2014 Source
Number of Sockets Per Household	51.40	2008 PA self-report survey (n=345)	51.50	2009 NMR/PA on-site visits (n=82)
Baseline Saturation	0.19	2008 PA self-report survey (n=345)	0.20	2009 NMR/PA on-site visits (n=82)
Storage CFLs	0.70	2007 PA self-report survey (n=345)	1.40	2009 NMR/PA on-site visits (n=82)
Energy Efficiency Proportion	0.44	CY 2012-CY 2013 SF and MF Lighting Audits	0.46	CY 2013 Retailer Inventory

For CY 2014, the Evaluation Team updated the source for several baseline saturation variables from the 2008 PA self-report survey to the 2009 NMR/PA Consulting on-site findings.[29] The source is more robust since the NMR/PA research presents more recent findings and provides on-site data compared to self-report.

The Evaluation Team also updated the source for the energy efficiency proportion variable (the proportion of energy efficient lighting products for sale) from the home lighting audits to the retailer inventory study.[30] In this case, data from the retailer inventory study was retrieved from collecting data from shelving stocks, which better represents the proportion of energy efficient lighting products for sale in the market than from data collected in homes.

Chain Stores and Franchises Program

As in 2013, the Chain Stores and Franchises Program's net savings was computed through a combination of self-report and the application of SMP values for commercial lighting and boilers and burners. However, in CY 2014, the Evaluation Team collected new self-report data from third-party market actors called National Rebate Administrators. The Team supplemented the self-report data with new freeridership scores determined from interviews with these actors.

In 2014, there were 27 companies that pursued projects through the Program by using a National Rebate Administrator. These organizations help national chains maximize their return on investment when making store upgrades or installing new equipment by "matching" them with various utility incentive programs around the country. National Rebate Administrators will often help national companies process incentive applications, advise them on program-qualifying equipment, and navigate eligibility guidelines.

Because they play a significant role in customer decision-making and work with companies representing a notable share of program savings (19% of total MMBtu in 2014), the Evaluation Team interviewed the three National Rebate Administrators operating in Wisconsin to help inform freeridership in CY 2014.

To measure freeridership, the Evaluation Team used the same scoring approach and a similar question battery used for participant self-report surveys, with some slight modifications. Because National Rebate Administrators dealt with multiple clients and projects, interviewers stressed that answers should reflect the majority of cases, or typical scenarios. Wherever possible, respondents distinguished between the frequency of one occurrence versus another (e.g., clients purchased and installed equipment prior to learning about the rebate about 5% of the time; 95% of the time they did not). The National Rebate Administrator interview guide is included in Appendix N.

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29 NMR/PA Consulting. *The Market for CFLs in Wisconsin.* 2009.

30 The Evaluation Team documented lighting inventories (not sales data) of one big box store from each chain in Focus on Energy's service territory (both participating and nonparticipating stores) to estimate lighting stocking practices. The Evaluation Team collected inventory data from seven participating and two nonparticipating big box store retail chains in Focus on Energy territory.

Figure L-5, on the next page, contains a high-level flow-chart of the freeridership scoring approach. Although the Evaluation Team used its typical decrement approach to scoring, final results relied also on verbatim comments and qualitative information, a key benefit of utilizing in-depth interviews as the data collection tool.

Freeridership was low (Table L-4). All three National Rebate Administrators that work with the Program reported that Focus on Energy was very influential in how their clients decide on facility upgrades. Occasionally, the interviewees reported that their clients will purchase install equipment prior to learning about the rebates, but this was rare.

Table L-4. National Rebate Administrator Respondent Freeridership Scores

Respondent	Freeridership Score
NRA #1	12%
NRA #2	5%
NRA #3	0%
Overall Savings-weighted NRA Freeridership Score	6%

After calculating a savings-weighted average freeridership score of 6% from the interviews, the Evaluation Team applied this freeridership ratio to the proportion of savings associated with National Rebate Administrator projects. For the remainder of the program savings, the Team applied the self-report freeridership score that was determined through the CY 2013 participant survey, after removing any respondents that were accounted for through the National Rebate Administrator interviews (the adjusted self-report survey freeridership value was 49%). For two measures categories, lighting and boilers and burners, the Evaluation Team incorporated the standard market practice values determined in 2013.

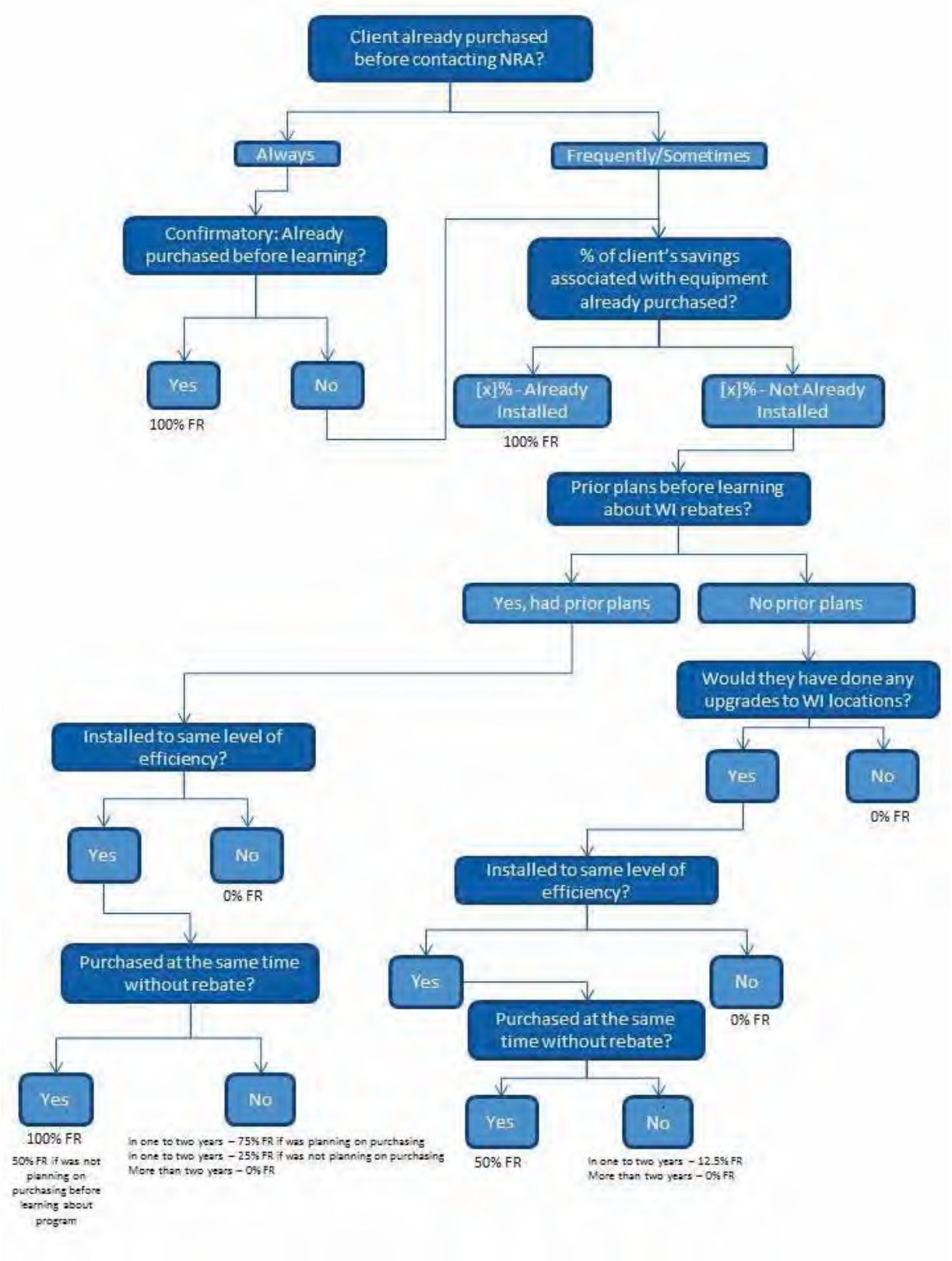
Overall, this approach resulted in a CY 2014 program-level freeridership score of 40%; in CY 2013, the program-level freeridership was 50%.

Because the survey was conducted in 2014, the Evaluation Team did not apply a retroactive adjustment to CY 2012 or CY 2013 net savings. However, since the program processed incentive applications through National Rebate Administrators throughout the quadrennium, freeridership in those years may have been lower than originally measured.

Design Assistance Program

The Evaluation Team used the self-report approach to determine the Program's freeridership level. The need for new data collected in CY 2014 was due to the program's small number of completed projects in CY 2013 (two projects). The small sample size did not provide enough confidence in the freeridership results to apply in CY 2014.

Figure L- 5. Freeridership Flow Chart (Chain Stores and Franchises)



The Evaluation Team interviewed 14 completed projects. Seven of the 14 interviews were completed in CY 2013, while they were still in-progress, which the Evaluation Team used to determine a preliminary freeridership ratio. For the CY 2014 evaluation, the Team re-evaluated those preliminary results, assigned verified savings, and combined with an additional seven respondents to generate a savings-weighted freeridership ratio for the program.

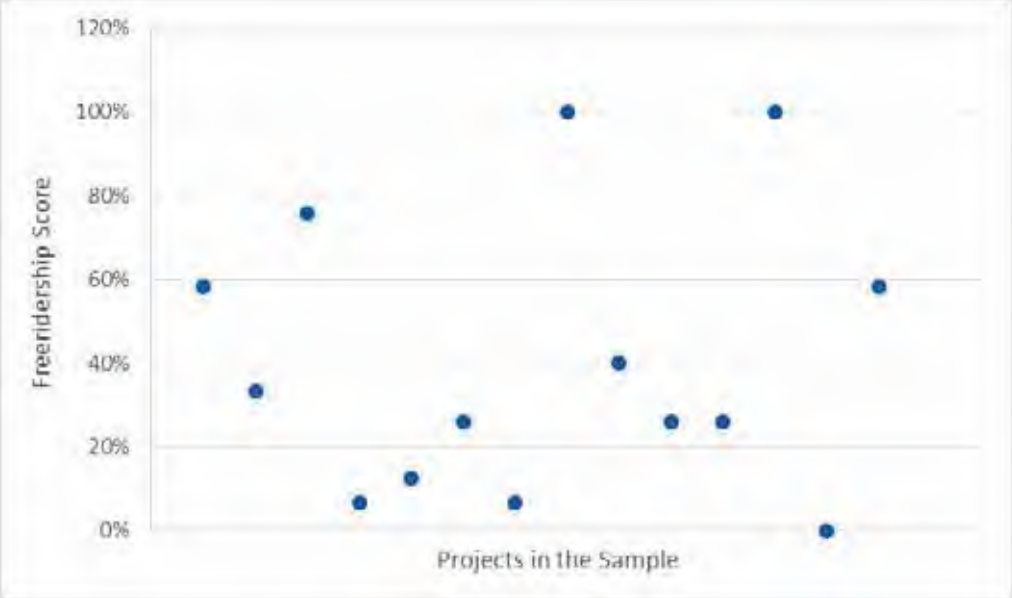
As in CY 2013, the Evaluation Team considered both the modeling assistance and incentives the Program offers when assessing the Program's net savings. Scoring was based on six questions: three questions that assessed the importance of the modeling assistance and three questions that assessed the participant's likelihood to install energy efficient equipment or features without the incentives and assistance from the program. Each response was given a pre-determined score, and responses to each of these two question batteries had the potential to aggregate to 100% freeridership. Respondents' final scores were determined by aggregating the scores associated with each of their responses. The maximum possible score for each question is listed in Table L-5.

Table L-5. Maximum Freeridership Scores for Each Question

Question	Maximum Possible FR Score	Associated Response
Modeling		
Focus on Energy paid for the cost of the energy modeling. Without this assistance, would your firm have conducted energy modeling to examine energy use during the building design phase?	33%	No
How important was the energy modeling when you decided which energy features to include in your new building? Were the recommendations…[read list]	33%	Not at all Important
If you had not received the energy modeling services and financial incentives for energy savings, do you think your building would have been more energy-efficient, less efficient, or just as efficient?	33%	More efficient or just as efficient
Likelihood of Completing the Same Project		
What is the likelihood that you would have included the same energy-efficient features and equipment in this building without incentives of [$XXX]? Would you say:	25%	Very likely
Just to confirm, did the incentives enable you to complete a different, or more energy efficient, project than you would have without the incentives?	25%	No
And if you didn't receive the Focus on Energy assistance and incentives, would you have installed the same equipment with the same level of energy efficiency?	50%	No

Freeridership ratios for assessed projects ranged from 6.7% to 100%. Using a savings-weighted average, the Evaluation team estimated that the Program had an overall average freeridership ratio of 43% in CY 2014, which is consistent with CY 2013 (44%). Figure L-6 illustrates the distribution of scores for each project evaluated (represented by the data points on the grid).

Figure L-6. Distribution of CY 2014 Freeridership Scores (n=14)



Two project participants were deemed 100% freeriders. These projects represented 7% of the combined electric and gas energy savings in the interview sample and 14% of the responses. These two respondents reported that they would have installed the same equipment with the same level of efficiency without the program's assistance.

Table L-6 shows the Program-level freeridership and spillover ratios applied for CY 2014. The freeridership ratio represents the weighted average of the CY 2014 project-level freeridership ratios.

Table L-6. Design Assistance Program Freeridership and Spillover

Adjustment	CY 2014	CY 2013– CY 2014
Freeridership Ratio (Weighted Average)	43%	43%
Spillover Ratio[1]	0%	0%
NTG Ratio	57%	57%

[1] The Evaluation Team did not assess spillover because interviews were completed with building owners. The Evaluation Team will evaluate Program spillover in CY 2015 by interviewing design teams.

CY 2013 Savings Adjustments

During the effort to roll up savings over the quadrennium for all Focus on Energy Programs, the Evaluation Team discovered several opportunities to retroactively enhance or correct savings calculated for CY 2013. Retroactive changes were made only to address cases where calculations were not as accurate as possible in CY 2013. In these instances, the Evaluation Team worked closely with the PSC, the Program Administrator, and the Program Implementers to identify and correct calculation errors, inputs, or methods and apply updated CY 2013 values to the quadrennium savings summaries in Volume I and Volume II.

Residential

Of the residential programs, the Evaluation Team updated CY 2013 net savings for the following programs:

- **Multifamily Energy Savings.** Net annual gas savings were updated to correct for a calculation error that was producing net savings by multiplying verified gross saving with the freeridership score (instead of the NTG ratio). This led the Evaluation Team to underreport the net gas savings for the Multifamily Energy Savings Program. This issue carried forward into the calculations for net life-cycle savings, for which the Evaluation Team also corrected. Net life-cycle savings were also updated to correct for a calculation error when multiplying the net savings by the EUL for the program spillover. The Evaluation Team updated the electric and gas savings to include program spillover resulting in increases to both savings types for CY 2013.
- **Home Performance with ENERGY STAR.** Net annual gas savings were updated to correct for an error in how adjustment measures were multiplied by the NTG ratio. The evaluation team updated the net annual savings which resulted in a very minor decrease to both annual net gas and electricity savings.
- **Lighting and Appliances.** Net life-cycle savings were updated to correct for a calculation error made in multiplying the net savings by the EUL to calculate life-cycle program spillover. The Evaluation Team updated the electric and gas net life-cycle savings to include the program spillover resulting in increases to both savings types.
- **Residential Rewards.** The Evaluation Team updated the EUL applied to program spillover, resulting in minor decreases in CY 2013 net life-cycle electric and gas savings. The EUL applied previously reflected the savings-weighted average EUL from all program measures; the Evaluation Team's adjustments instead followed the best practice of calculating the EUL based on the specific spillover measures reported in program surveys.

Table L-7 and Table L-8 present the adjustments to net annual and life-cycle savings.

Table L-7. CY 2013 Adjustments to Net Annual Savings

Program	2013 Reported Net Annual Savings		2013 Adjusted Net Annual Savings	
	kWh	Therms	kWh	Therms
Multifamily Energy Savings	6,075,125	261,427	No change	320,615
Home Performance with ENERGY STAR	1,826,240	259,921	1,828,881	259,905

Table L-8. CY 2013 Adjustments to Net Life-Cycle Savings

Program	2013 Reported Net Life-Cycle Savings		2013 Adjusted Net Life-Cycle Savings	
	kWh	Therms	kWh	Therms
Multifamily Energy Savings	76,198,302	4,341,204	81,492,395	5,102,281
Lighting and Appliances	1,311,736,960	122,907	1,759,291,947	321,506
Residential Rewards	129,329,294	19,710,654	129,087,763	19,674,329

Nonresidential

For the nonresidential programs, the Evaluation Team updated baseline values used in CY 2013 commercial lighting SMP calculations, and applied this adjustment retroactively to CY 2013 NTG ratios as well as current year results (CY 2014). The commercial lighting baseline adjustment pertained to T8 linear fluorescents and impacted the net savings for the Business Incentive Program, Large Energy Users Program, Chain Stores and Franchises Program, and the Small Business Program. This change was based upon discussions with the PSC and Program Implementers during the development of the Technical Resource Manual (TRM) in 2014, and brings the three documents (the CY2013 and CY2014 evaluation reports and the TRM) into alignment.

Specifically, in calculating the net-of-freeridership for the above programs, the Evaluation Team had compared the verified savings (delta watts) for the 1-lamp linear fluorescent measures for the Business incentive program to the *ex ante* claimed delta watts for 1,2,3,4,6,and 8-lamp measures for four different programs. In other words, the delta watts for 1-L linear fluorescent measures was initially used to incorrectly reflect the blended weighted-average delta watts across all linear fluorescent lamp measures, regardless of size. After identifying this error, the Evaluation Team corrected the calculation to reflect a true weighted-average that considered multiple-lamp fluorescents.

Table L-9 shows the original SMP value used for T8 measures, the updated SMP value, and revised 2013 NTG ratio.

Table L-9. Adjusted CY 2013 Commercial Lighting Net of Freeridership Values

Program	Original T8 SMP Value[1]	Adjusted T8 SMP Value[1]	Adjusted CY 2013 Program-Level NTGR
Business Incentive	17%	29%	73%
Large Energy Users	13%	88%	76%
Chain Stores and Franchises	24%	28%	50%
Small Business	26%	30%	73%

[1] Value represents savings net of freeridership. Spillover savings are added to arrive at a final NTG ratio.

Table L-10 and Table L-11 show the difference between the net annual and life-cycle savings reported in the CY 2013 evaluation report and the savings reported in the quadrennial report, reflecting the above adjustments to the program-level NTGRs.

Table L-10. CY 2013 Adjustments to Net Annual Savings

Program	2013 Reported Net Annual Savings		2013 Adjusted Net Annual Savings	
	kWh	Therms	kWh	Therms
Business Incentive	120,473,489	5,524,871	125,129,060	5,524,871
Large Energy Users	102,477,432	7,525,715	111,541,873	7,525,715
Chain Stores and Franchises	28,544,068	575,922	27,596,103	575,922
Small Business	66,033,437	111,766	66,767,916	111,766

Table L-11. CY 2013 Adjustments to Net Life-Cycle Savings

Program	2013 Reported Net Annual Savings		2013 Adjusted Net Annual Savings	
	kWh	Therms	kWh	Therms
Business Incentive	1,632,510,332	60,223,541	1,673,130,194	60,058,027
Large Energy Users	1,255,738,629	105,771,599	1,389,692,627	103,149,653
Chain Stores and Franchises	335,732,014	8,142,542	330,472,974	8,271,519
Small Business	560,465,686	1,106,531	595,091,181	1,196,454

Appendix M. State of Wisconsin Reporting Data (State-Level Reporting)

Legislative Report

This appendix is a compilation of frequently requested data, which are presented in one location for ease of use by interested parties. This appendix does not contain any unique information; all information below is already presented elsewhere in the evaluation report.

Table M-1. Calendar Year Renewable Measures Installed[1]

Calendar Year	Residential	Nonresidential	Total
CY 2011 [2]	N/A	N/A	N/A
CY 2012	164	1	165
CY 2013 [3]	307	22	329
CY 2014	449	60	509

[1]Includes solar photovoltaic, solar thermal, wind, and geothermal measures for the Multifamily Energy Savings Program, New Homes Program, Residential Rewards Program, Business Incentive Program, Large Energy Users Program, Renewable Rewards, and the Renewable Energy Competitive Incentive Program.

[2] In CY2011, there was no stand-alone renewables program offered for the nonresidential sector, as there was for the residential sector. Therefore, incentives for nonresidential renewables were offered through the agricultural, commercial, industrial, and schools and government programs. Focus on Energy temporarily suspended incentives for business renewable energy projects beginning July 1, 2011.

[3] Includes solar photovoltaic, solar thermal, and geothermal measures for the Residential Rewards Program, New Homes Program, and Large Energy Users Program.

Table M-2. Calendar Year Participants in Renewables Programs

Calendar Year	Residential	Nonresidential	Total
CY 2011	402 [1]	N/A [2]	402
CY 2012	164	1	165
CY 2013 [3]	-	21 [4]	21
CY 2014	438	54	492

[1] Residential Renewables Program.

[2] In CY2011, there was no stand-alone renewables program offered for the nonresidential sector, as there was for the residential sector. Therefore, incentives for nonresidential renewables were offered through the agricultural, commercial, industrial, and schools and government programs. Focus on Energy temporarily suspended incentives for business renewable energy projects beginning July 1, 2011.

[3] Includes solar photovoltaic, solar thermal, and geothermal measures for the Residential Rewards Program, New Homes Program, and Large Energy Users Program. In CY 2013, there were 21 participants who completed projects for the Renewable Energy Competitive Incentive Program.