Evergy

2019 DSM Potential Study

Final Report

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Eureka Facts supported ICF in conducting the appliance saturation survey.

Introduction

Evergy engaged ICF to conduct this demand side management (DSM) potential study. It assessed technical, economic and achievable potential in the residential, commercial, and industrial sectors within Evergy's service areas in Missouri, Evergy Missouri Metro and Evergy Missouri West. The study covers energy efficiency, demand response, demand-side rates, and combined heat and power.

ICF assessed five achievable potential scenarios including Realistic Achievable Potential (RAP), RAP-, RAP+, Missouri Energy Efficiency Investment Act (MEEIA), and Maximum Achievable Potential (MAP) for energy efficiency, demand response and demand side rates. ICF modeled additional stand-alone scenarios for demand response and demand side rates.

As part of the study, ICF conducted an appliance saturation analysis to collect a variety of appliance and end-use data from customers across multiple service territories in Missouri and Kansas, including residential, commercial, and industrial accounts. It included a web and mail survey of residential customers and a computer-assisted telephone interviewing (CATI) survey of business customers. The results of this analysis were used in the market characterization and baseline electricity load analysis in the study.

This study will be used to satisfy the demand-side analysis requirements of the Missouri resource planning regulations at 4 CSR 240-22, particularly Chapter 22.050. In addition, the study also takes into consideration the requirements of demand-side programs under the MEEIA regulations at 4 CSR 240-20.092, 20.093, and 20.094.

Report Organization

This report includes five volumes:

- Volume 1: Executive Summary
- Volume 2: Appliance Saturation Analysis
- Volume 3: Potential Study
- Volume 4: Program Descriptions
- Volume 5: Appendices

This document is Volume 5: Appendices.

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A. Measure Assumptions

This section is comprised of six files that detail the energy efficiency measure assumptions used in ICF's Demand Side Resource Potential Model (DSRPM) models: one for each sector and service area combination. The assumptions include inputs that provide the base and efficient measure characterizations, such as savings, costs, measure life, and technical feasibility for each measure in a program, for each sector of the two service areas.

1. Residential Measure Assumptions

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Metro Residential Measure Assumptions

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West Commercial Measure Assumptions

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Metro Industrial Measure Assumptions

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West Industrial Measure Assumptions

B. Benchmarking Analysis

1. Summary

Program performance benchmarking was used to help estimate energy efficiency potential in all achievable scenarios, except RAP- and MAP. This Appendix documents the benchmarking data used for this purpose.

- **Data sources**: Actual net program MWh savings and program costs for program years 2014 to 2018 were pulled from ESource between March and July of 2020. Program administrator sales (MWh) data was pulled from US Energy Information Administration (EIA) Form 861 for 2018. Program data was pulled for program administrators operating in the following ten states in the central U.S.:
    - Arkansas
    - Illinois
    - Indiana
    - Iowa
    - Kentucky
    - Michigan
    - Minnesota
    - Missouri
    - Oklahoma
    - Tennessee
- **Savings/sales**: Calculated as average weather-normalized 2014 to 2018 net MWh savings divided by sector MWh sales for 2018.
- **$/kWh**: Calculated as average 2014 to 2018 program costs divided by average net MWh savings.
- **Benchmarking class**: The sample of program administrators against which Evergy's program performance was benchmarked.

2. Portfolio benchmarking

Total energy savings level in the study were benchmarked against the following energy efficiency program portfolios.

Table B-1 Benchmarking Data from EIA: Savings as Percentage of Sales

IOU	Incremental MWh savings as a % of MWh sales in 2018
Northern States Power Co	0.0%
Kentucky Power Co	0.1%
Empire District Electric Co	0.2%
Southwestern Electric Power Co	0.3%
Kentucky Utilities Co	0.4%
Duke Energy Kentucky	0.5%
Louisville Gas & Electric Co	0.6%
Oklahoma Gas & Electric Co	0.6%
ALLETE, Inc.	0.7%
Duke Energy Indiana, LLC	0.8%
Public Service Co of Oklahoma	0.8%
Indiana Michigan Power Co	0.9%
Northern Indiana Pub Serv Co	1.0%
Southern Indiana Gas & Elec Co	1.0%
Union Electric Co - (MO)	1.0%
Upper Peninsula Power Company	1.0%
Ameren Illinois Company	1.0%
Entergy Arkansas LLC	1.1%
Interstate Power and Light Co	1.2%
Indianapolis Power & Light Co	1.3%
Consumers Energy Co	1.4%
Otter Tail Power Co	1.5%
DTE Electric Company	1.5%
MidAmerican Energy Co	1.5%
Northern States Power Co - Minnesota	1.8%
Commonwealth Edison Co	2.4%

Source: U.S. EIA, 2018

3. Existing Evergy programs

Benchmarking data for the following programs, which are similar to programs Evergy had implemented at the time of the study, was used to inform the forecast.

3.1 Home performance programs

Table B-2 Home Performance Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
AEP - Southwestern Electric Power Co. AR	0.655%	$0.54
Ameren Illinois	0.040%	$0.90
Ameren Missouri	0.007%	$0.54
ComEd	0.011%	$0.89
Consumers Energy Company	0.018%	$2.11
DTE Energy	0.003%	$2.98
Entergy Arkansas	0.001%	$1.19
Indiana Michigan Power	0.002%	$3.36
Xcel Energy - Minnesota	0.002%	$0.99

Table B-3 Home Performance Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in benchmarking class)	9	
	Savings/sales	$/kWh
Minimum	0.001%	$0.50
25th percentile	0.002%	$0.89
Median (50th percentile)	0.007%	$0.99
75th percentile	0.018%	$2.11
90th percentile	0.163%	$3.05
Maximum	0.655%	$3.36
KCP&L-MO historical performance (2016-18 average)	0.06%	$1.64
Percentile within benchmarking class	0.88	0.69
KCP&L-GMO historical performance	0.05%	$2.01
Percentile within benchmarking class	0.88	0.74

3.2 Residential behavioral/Home energy report programs

Table B-4 Behavioral Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
Ameren Illinois	0.3%	$0.04
ComEd	1.2%	$0.06
Consumers Energy Company	0.5%	$0.10
DTE Energy	0.5%	$0.06
Entergy Arkansas	0.2%	$0.11
Indiana Michigan Power	0.4%	$0.05
Indianapolis Power & Light	0.4%	$0.10
MidAmerican Energy - IL	0.6%	$0.04
Otter Tail Power Company	0.8%	$0.13
Xcel Energy - Minnesota	0.2%	$0.12

Table B-5 Behavioral Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	10	
	Savings/sales	$/kWh
Minimum	0.2%	$0.04
25th percentile	0.4%	$0.05
Median (50th percentile)	0.4%	$0.08
75th percentile	0.6%	$0.11
90th percentile	0.9%	$0.12
Maximum	1.2%	$0.13
KCP&L-MO historical performance (2016-18 average)	0.6%	$0.03
Percentile within benchmarking class	0.78	NA
KCP&L-GMO historical performance (2016-18 average)	0.5%	$0.05
Percentile within benchmarking class	0.68	0.23

3.3 C&I prescriptive programs

Table B-6 C&I Prescriptive Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
AEP - PSO - OK	0.5%	$0.19
AEP - Southwestern Electric Power Co. AR	1.0%	$0.23
Alliant Energy - Minnesota	0.3%	$0.19
Ameren Illinois	0.3%	$0.16
Ameren Missouri	0.2%	$0.11
ComEd	0.7%	$0.17
Consumers Energy Company	1.0%	$0.16
DTE Energy	0.5%	$0.06
Entergy Arkansas	0.2%	$0.09
Indiana Michigan Power	0.1%	$0.11
Indianapolis Power & Light	0.2%	$0.12
MidAmerican Energy - IL	0.4%	$0.35
Minnesota Power	0.8%	$0.05
NIPSCO	0.1%	$0.16
Oklahoma Gas & Electric - AR	1.2%	$0.25
Oklahoma Gas & Electric - OK	0.2%	$0.08
Otter Tail Power Company	1.5%	$0.14
Xcel Energy - Minnesota	0.7%	$0.11

Table B-7 C&I Prescriptive Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	18	
	Savings/sales	$/kWh
Minimum	0.1%	$0.05
25th percentile	0.2%	$0.11
Median (50th percentile)	0.5%	$0.15
75th percentile	0.8%	$0.18
90th percentile	1.1%	$0.24
Maximum	1.5%	$0.35
KCP&L-MO historical performance (2016-18 average)	0.6%	$0.18
Percentile within benchmarking class	0.60	0.74
KCP&L-GMO historical performance (2016-18 average)	0.5%	$0.19
Percentile within benchmarking class	0.52	0.76

3.4 C&I custom programs

Table B-8 C&I Custom Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
AEP - Southwestern Electric Power Co. AR	0.8%	$0.23
Alliant Energy - Minnesota	0.9%	$0.13
Ameren Illinois	0.3%	$0.13
Ameren Missouri	0.5%	$0.09
ComEd	0.1%	$0.25
DTE Energy	0.4%	$0.11
Entergy Arkansas	1.5%	$0.22
Indiana Michigan Power	0.3%	$0.09
Indianapolis Power & Light	0.1%	$0.15
NIPSCO	0.0%	$0.17
Oklahoma Gas & Electric - OK	0.4%	$0.34
Otter Tail Power Company	0.2%	$0.12
Xcel Energy - Minnesota	0.5%	$0.17

Table B-9 C&I Custom Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	14	
	Savings/sales	$/kWh
Minimum	0.05%	$0.09
25th percentile	0.19%	$0.12
Median (50th percentile)	0.35%	$0.15
75th percentile	0.55%	$0.22
90th percentile	0.86%	$0.25
Maximum	1.51%	$0.34
KCP&L-MO historical performance (2016-18 average)	0.10%	$0.19
Percentile within benchmarking class	0.16	0.70
KCP&L-GMO historical performance (2016-18 average)	0.11%	$0.19
Percentile within benchmarking class	0.17	0.74

3.5 Small business programs

Table B-10 Small Business Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
AEP - Southwestern Electric Power Co. AR	0.4%	$0.25
Alliant Energy – Minnesota	0.1%	$0.31
Ameren Illinois	0.1%	$0.22
ComEd	0.1%	$2.33
Entergy Arkansas	0.2%	$0.24
Indiana Michigan Power	0.0%	$0.25
Indianapolis Power & Light	0.1%	$0.27
NIPSCO	0.0%	$0.23
Xcel Energy – Minnesota	0.3%	$0.24

Table B-11 Small Business Programs - Summary Statistics of Benchmarking Clas

Statistic	Value	
n (number of program administrators in sample)	10	
	Savings/sales	$/kWh
Minimum	0.02%	$0.22
25th percentile	0.06%	$0.24
Median (50th percentile)	0.11%	$0.25
75th percentile	0.23%	$0.27
90th percentile	0.32%	$0.71
Maximum	0.35%	$2.33
KCP&L-MO historical performance (2016-18 average)	0.02%	$0.40
Percentile within benchmarking class	NA	0.88
KCP&L-GMO historical performance (2016-18 average)	0.02%	$0.44
Percentile within benchmarking class	NA	0.88

4. Other programs

Benchmarking data for the following programs was used to inform the forecast; however, Evergy had not implemented similar programs at the time of the study. These programs were added to the MEEIA scenario.

4.1 Multifamily programs

Table B-12 Multifamily Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
Ameren Illinois	0.08%	$0.39
ComEd	0.07%	$0.32
Consumers Energy Company	0.07%	$1.15
DTE Energy	0.03%	$0.47
Entergy Arkansas	0.07%	$0.32
Indianapolis Power & Light	0.05%	$0.19
Oklahoma Gas & Electric – AR	0.78%	$0.17
Xcel Energy – Minnesota	0.03%	$1.01

Table B-13 Multifamily Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	8	
	Savings/sales	$/kWh
Minimum	0.03%	$0.20
25th percentile	0.04%	$0.29
Median (50th percentile)	0.07%	$0.36
75th percentile	0.07%	$0.61
90th percentile	0.29%	$1.05
Maximum	0.78%	$1.15

4.2 Appliance recycling programs

Table B-14 Appliance Recycling Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
Alliant Energy - Minnesota	0.15%	$0.44
Ameren Illinois	0.03%	$1.40
Ameren Missouri	0.10%	$0.60
ComEd	0.09%	$1.76
Consumers Energy Company	0.27%	$0.69
DTE Energy	0.21%	$0.72
Indiana Michigan Power	0.04%	$0.34
Indianapolis Power & Light	0.02%	$0.31
NIPSCO	0.02%	$0.57
Otter Tail Power Company	0.08%	$1.09
Xcel Energy - Minnesota	0.05%	$0.01

Table B-15 Appliance Recycling Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	12	
	Savings/sales	$/kWh
Minimum	0.02%	$0.30
25th percentile	0.04%	$0.50
Median (50th percentile)	0.08%	$0.60
75th percentile	0.17%	$0.90
90th percentile	0.26%	$1.40
Maximum	1.07%	$1.80

4.3 C&I midstream lighting programs

Due to a lack of programs in the U.S. Central region, benchmarking data for this program type was also sourced from California, Maryland and Massachusetts.

Table B-16 C&I Midstream Lighting Programs - Benchmarking Class

Program administrator	Savings/sales	$/kWh
Southern California Edison	0.1%	$0.08
Eversource Massachusetts	0.2%	$0.07
Baltimore Gas & Electric	0.3%	$0.07
Commonwealth Edison	0.3%	$0.07
Delmarva Power	0.3%	$0.17
Entergy Arkansas	0.4%	$0.03
Pepco	0.7%	$0.13

Table B-17 C&I Midstream Lighting Programs - Summary Statistics of Benchmarking Class

Statistic	Value	
n (number of program administrators in sample)	7	
	Savings/sales	$/kWh
Minimum	0.1%	$0.03
25th percentile	0.2%	$0.07
Median (50th percentile)	0.3%	$0.07
75th percentile	0.4%	$0.10
90th percentile	0.6%	$0.15
Maximum	0.7%	$0.17

C. Economic Calculation Assumptions

1. Avoided costs

Table C-1 Avoided Capacity Costs - Nominal

Year/Month	Avoided Capacity Cost ($/kW-year)	Year/Month	Avoided Capacity Cost ($/kW-year)
2023		2033	
2024		2034	
2025		2035	
2026		2036	
2027		2037	
2028		2038	
2029		2039	
2030		2040	
2031		2041	
2032		2042	

Table C-2 Avoided Energy Costs ($/kWh) - West - Nominal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023												
2024												
2025												
2026												
2027												
2028												
2029												
2030												
2031												
2032												
2033												
2034												
2035												
2036												
2037												
2038												
2039												
2040												
2041												
2042												

Table C-3 Avoided Energy Costs ($/kWh) - Metro - Nominal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023												
2024												
2025												
2026												
2027												
2028												
2029												
2030												
2031												
2032												
2033												
2034												
2035												
2036												
2037												
2038												
2039												
2040												
2041												
2042												

Table C-4 Avoided Gas Costs ($/Therm) - Nominal

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2023												
2024												
2025												
2026												
2027												
2028												
2029												
2030												
2031												
2032												
2033												
2034												
2035												
2036												
2037												
2038												
2039												
2040												
2041												
2042												

2. Loss factors and discount rates

Table C-5 Loss Factors - Energy and Capacity

Territory	Sector	Energy Loss Factor	Capacity Loss Factor
Metro	**Residential**	8.783%	10.344%
Metro	**Commercial**	8.111%	9.552%
Metro	**Industrial**	4.422%	5.207%
West	**Residential**	6.569%	8.169%
West	**Commercial**	5.940%	7.388%
West	**Industrial**	5.037%	6.264%

Table C-6 Discount Rates - Real

Territory	WACC	Participant Cost Test Discount Rate
Metro	6.730%	10.000%
West	6.731%	10.000%

D. Annual Program Outputs

1. Incremental program potential results

The incremental potential savings file below shows the following data in tabs, for each sector:

- Annualized incremental energy savings at the meter and at generator (MWh)
- Annualized incremental demand savings at the meter and at generator (MW)
- Nominal annual incentives costs ($, 000s)
- Nominal annual non-incentive costs ($,000s)
- Cost effectiveness tests - TRC, PAC, RIM, PCT and SCT (benefit-cost ratio)
- Levelized energy cost ($/kWh)
- Levelized demand cost ($/kW)

Evergy Combined Tables (Inc).xlsx

2. Cumulative program potential results

The cumulative potential savings file below shows the following data in tabs, for each sector:

- Annual cumulative energy savings at the meter and at generator (MWh)
- Annual cumulative demand savings at the meter and at generator (MW)
- Nominal annual incentives costs ($, 000s)
- Nominal annual non-incentive costs ($,000s)
- Cost effectiveness tests - TRC, PAC, RIM, PCT and SCT (benefit-cost ratio)
- Levelized energy cost ($/kWh)
- Levelized demand cost ($/kW)

Evergy Combined Tables (Cum).xlsx

3. Stand-alone demand response and demand side resource results

DR-DSR Stand-Alone Results (Cum).xlsx

E. Sensitivity and Uncertainty Analysis Results

1. Metro Residential

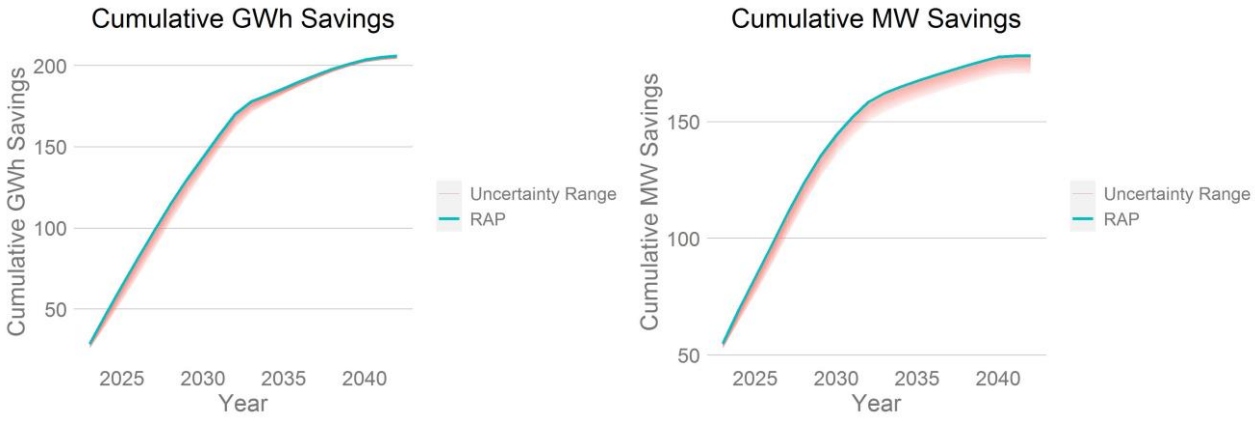

Figure E-1 Metro Residential - uncertainty range of energy and demand

Figure E-2 Metro Residential - incremental energy savings distribution

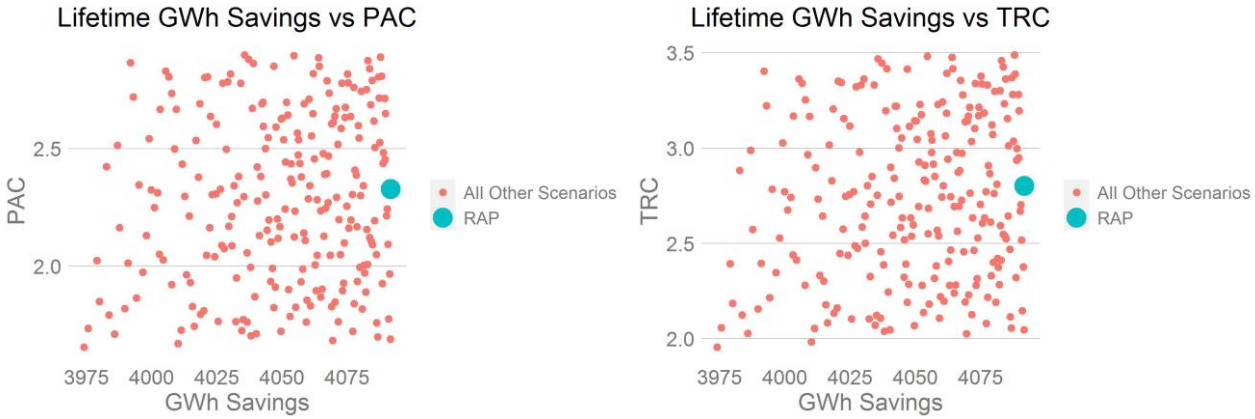

Figure E-3 Metro Residential - cost-effectiveness distribution

2. Metro Commercial

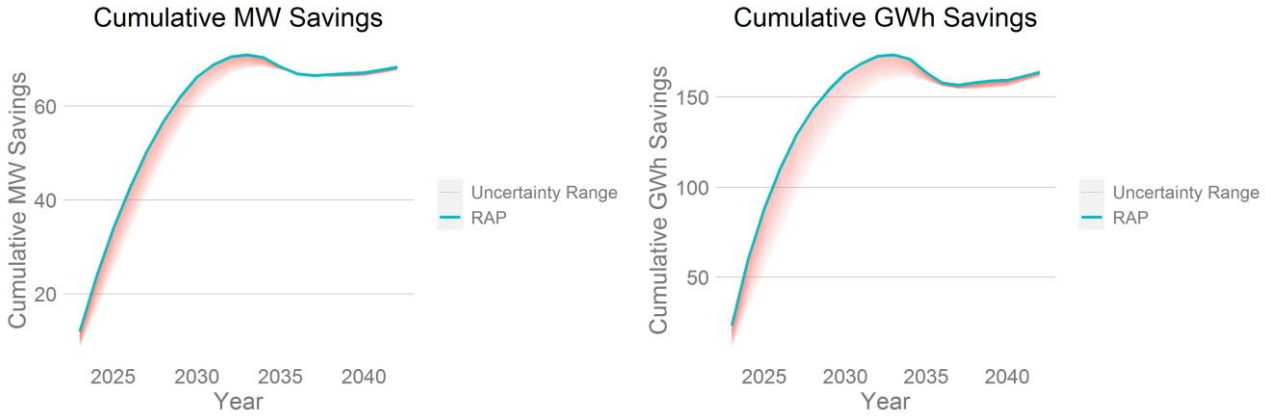

Figure E-4 Metro Commercial - uncertainty range of energy and demand

Figure E-5 Metro Commercial - incremental energy savings distribution

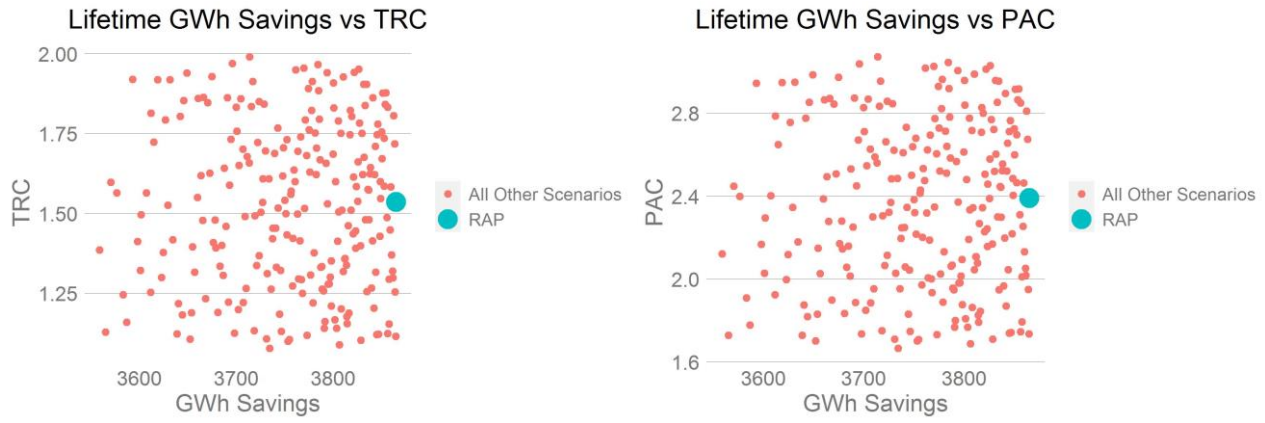

Figure E-6 Metro Commercial - cost-effectiveness distribution

3. Metro Industrial

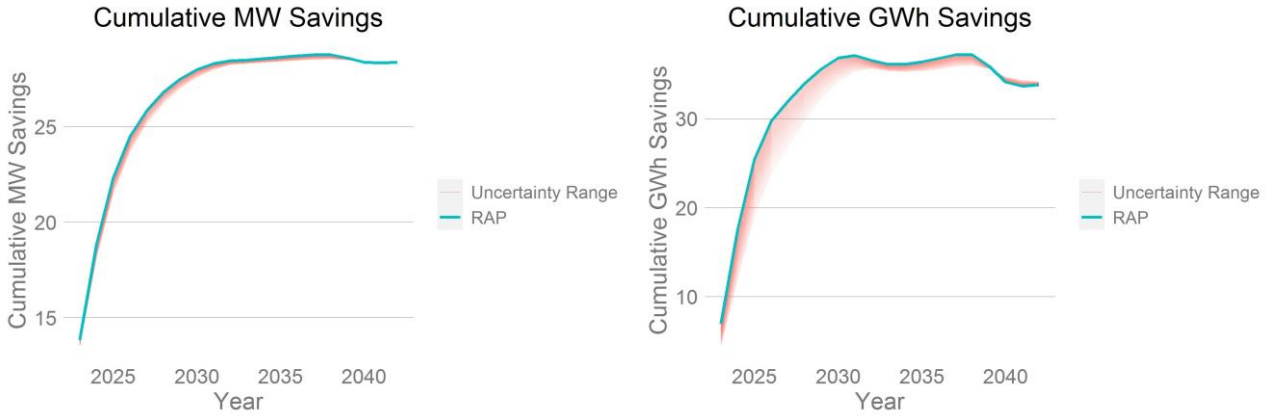

Figure E-7 Metro Industrial - uncertainty range of energy and demand

Figure E-8 Metro Industrial - incremental energy savings distribution

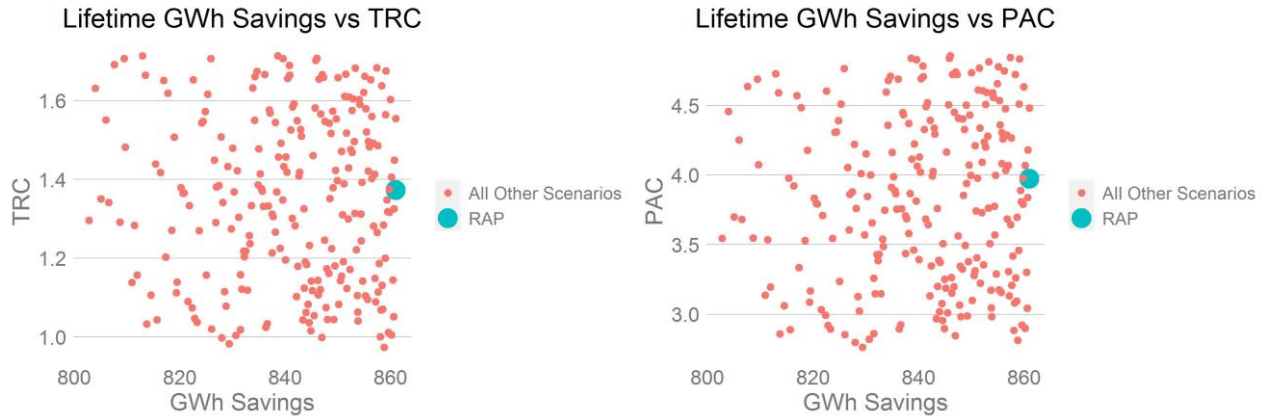

Figure E-9 Metro Industrial - cost-effectiveness distribution

4. West Residential

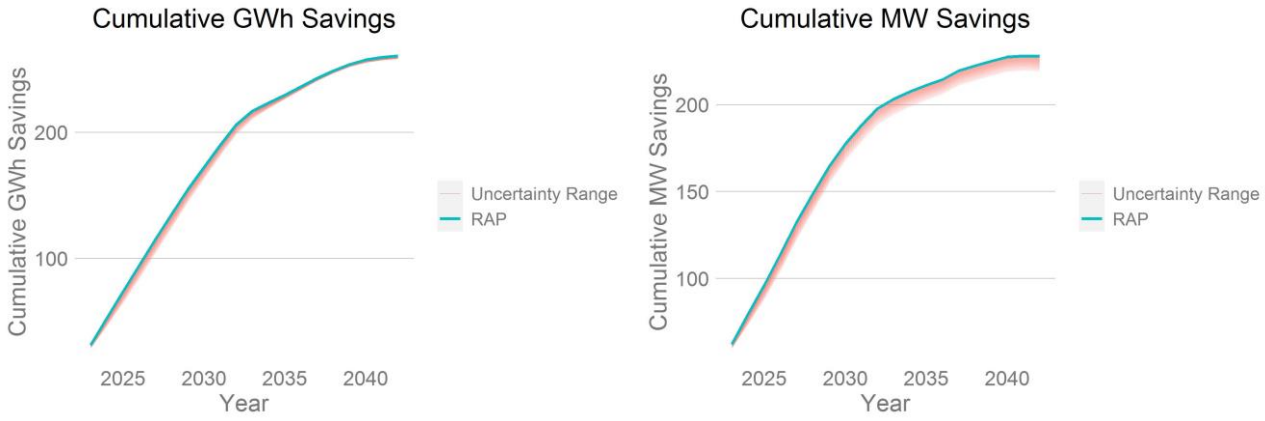

Figure E-10 West Residential - uncertainty range of energy and demand

Figure E-11 West Residential - incremental energy savings distribution

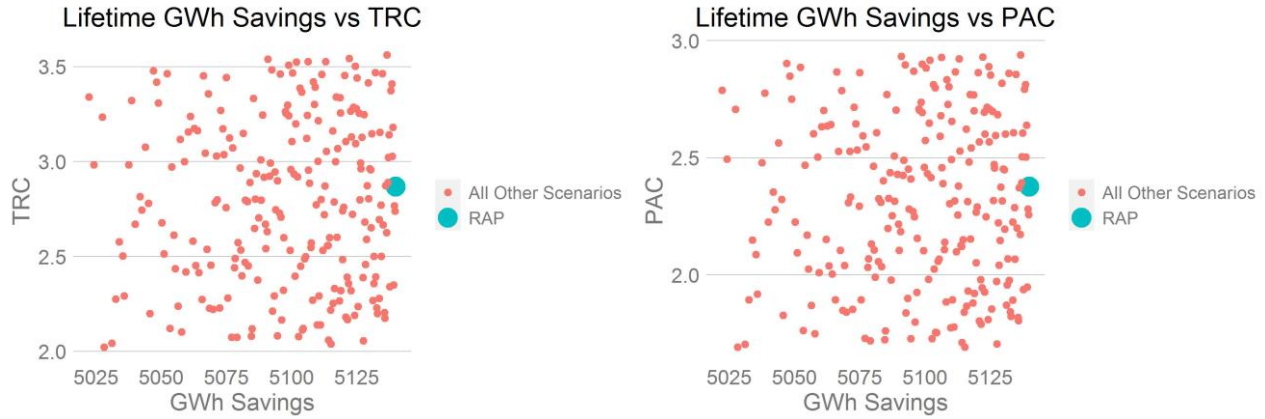

Figure E-12 West Residential - cost-effectiveness distribution

5. West Commercial

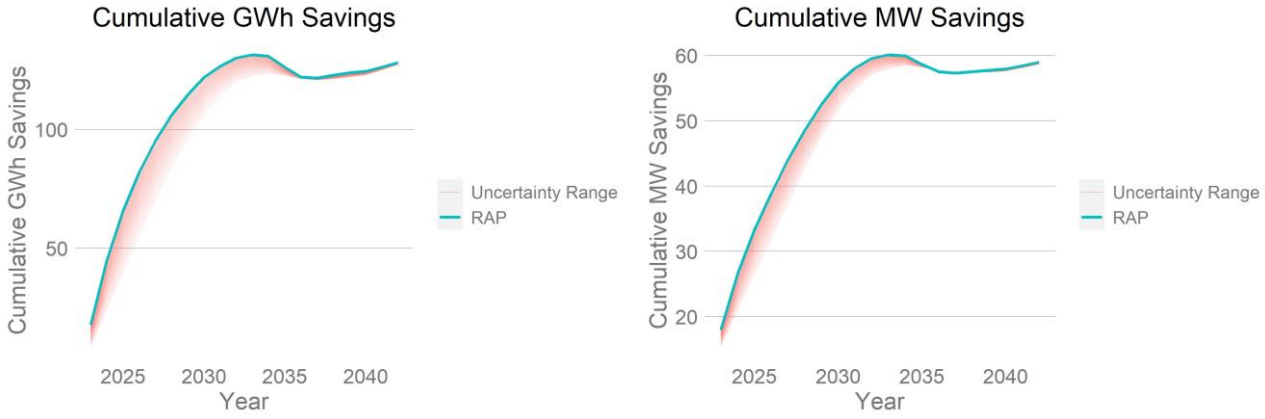

Figure E-13 West Commercial - uncertainty range of energy and demand

Figure E-14 West Commercial - incremental energy savings distribution

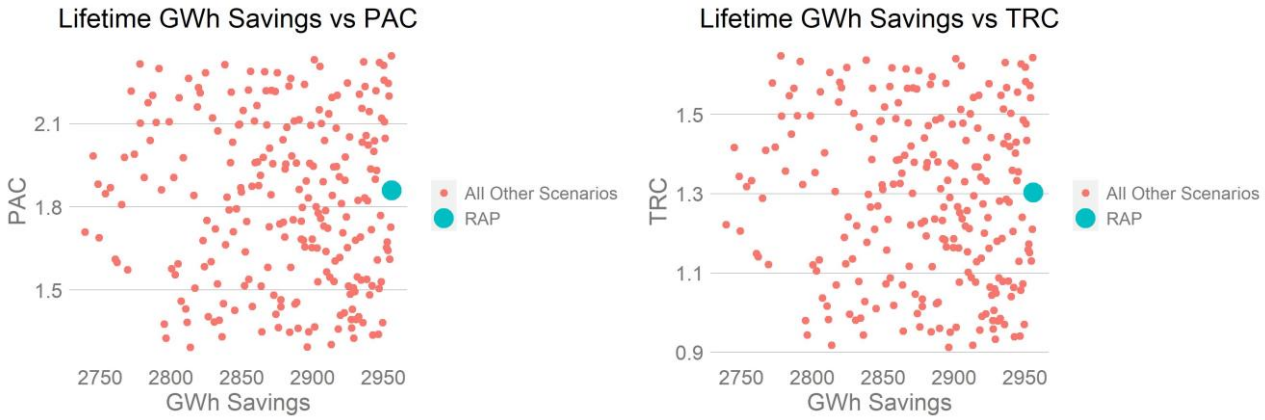

Figure E-15 West Commercial - cost-effectiveness distribution

6. West Industrial

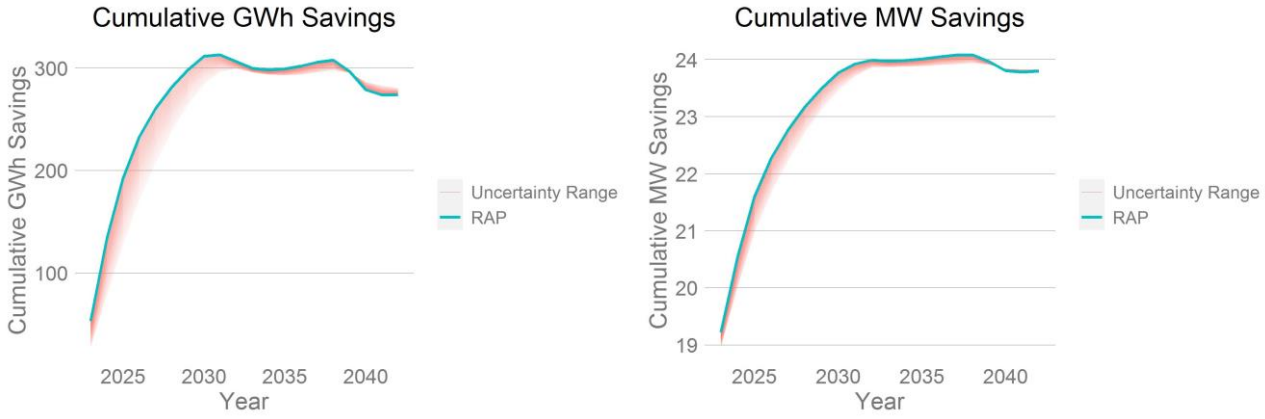

Figure E-16 West Industrial - uncertainty range of energy and demand

Figure E-17 West Industrial - incremental energy savings distribution

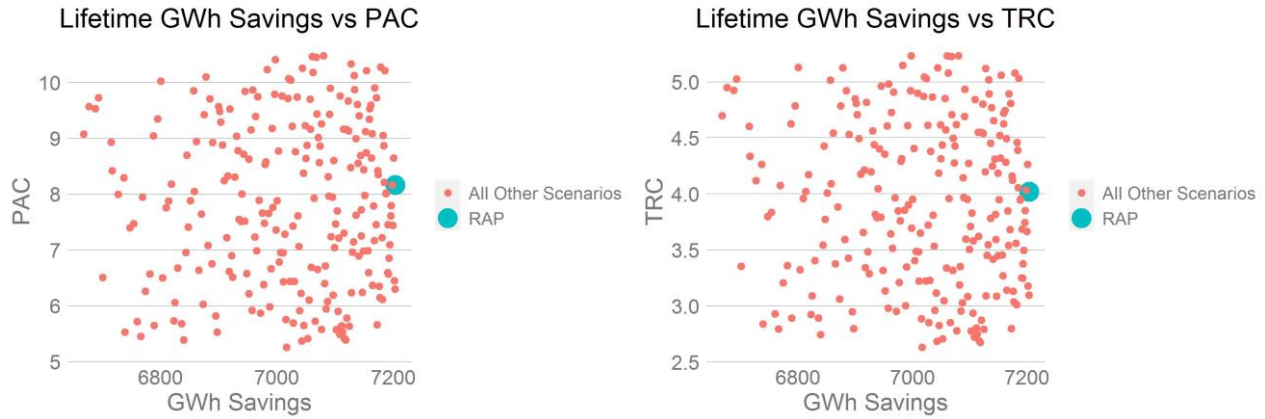

Figure E-18 West Industrial - cost-effectiveness distribution