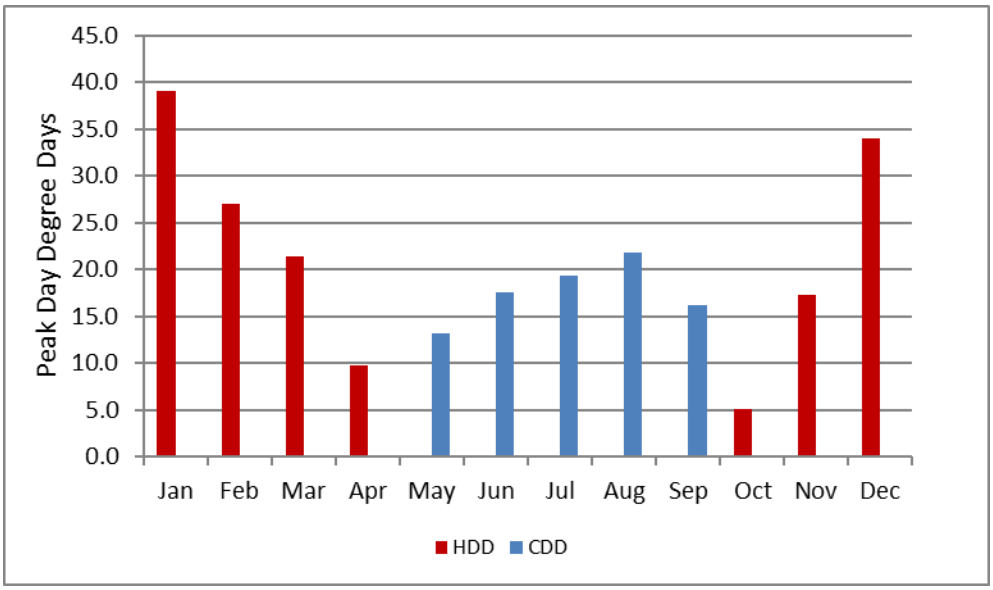
FIGURE 28: NORMAL PEAK-DAY HDD & CDD



5.2 ECONOMIC DATA

The class sales forecasts are based on *IHS Markit* June 2022 economic forecast for the Evansville Metropolitan Statistical Area (MSA) and Indiana. The primary economic drivers in the residential sector are household income and the number of new households. Household formation is stable and increasing consistently though the forecast period with 0.4% average annual growth. Real household income growth is modest, averaging 1.6% over the forecast period.

Commercial sales are driven by nonmanufacturing output, nonmanufacturing employment, and population. Non-manufacturing output is forecasted to grow at 1.4% per year through the forecast period with non-manufacturing employment growing 0.4% per year and population a little over 0.04% per year.

The industrial model relates sales to manufacturing output and employment. Manufacturing output is projected to increase more rapidly than non-manufacturing output, with output increasing 2.2% per year. While output increases, associated manufacturing employment is projected to decline at a 0.5% annual rate.

Table 5-1 through Table 5-3 shows economic forecasts applicable to each customer class.

TABLE 5-1: RESIDENTIAL ECONOMIC DRIVERS

Year	Population (Thou)		Households (Thou)		Household Income (Thou $)	
2022	313.8		131.0		125.7	
2023	313.9	0.0%	131.5	0.4%	127.5	1.4%
2024	314.0	0.0%	132.1	0.5%	129.9	1.9%
2025	314.3	0.1%	132.7	0.4%	132.0	1.6%
2026	314.5	0.1%	133.2	0.4%	134.5	2.0%
2027	314.6	0.0%	133.7	0.4%	137.4	2.1%
2028	314.7	0.0%	134.2	0.4%	140.2	2.0%
2029	314.9	0.1%	134.7	0.4%	142.4	1.6%
2030	315.3	0.1%	135.2	0.4%	144.5	1.5%
2031	315.7	0.1%	135.7	0.4%	146.8	1.6%
2032	315.9	0.1%	136.2	0.4%	149.0	1.5%
2033	316.1	0.0%	136.7	0.4%	151.1	1.4%
2034	316.2	0.0%	137.3	0.4%	153.1	1.3%
2035	316.2	0.0%	137.8	0.4%	155.2	1.4%
2036	316.1	0.0%	138.3	0.3%	157.4	1.4%
2037	316.0	0.0%	138.8	0.4%	159.6	1.5%
2038	316.2	0.0%	139.3	0.4%	161.8	1.4%
2039	316.3	0.1%	139.9	0.4%	164.0	1.4%
2040	316.4	0.0%	140.4	0.4%	166.4	1.5%
2041	316.4	0.0%	140.9	0.3%	168.8	1.4%
2042	316.3	0.0%	141.3	0.3%	171.3	1.5%
22-42		0.0%		0.4%		1.6%

TABLE 5-2: COMMERCIAL ECONOMIC DRIVERS

Year	Non-Manufacturing GDP (Mil $)		Non-Manufacturing Employment (Thou)		Population (Thou)	
2022	253,187		2,643.2		313.8	
2023	256,123	1.2%	2,664.3	0.8%	313.9	0.0%
2024	260,156	1.6%	2,664.7	0.0%	314.0	0.0%
2025	263,884	1.4%	2,667.2	0.1%	314.3	0.1%
2026	267,077	1.2%	2,676.6	0.4%	314.5	0.1%
2027	270,657	1.3%	2,688.4	0.4%	314.6	0.0%
2028	274,621	1.5%	2,699.7	0.4%	314.7	0.0%
2029	278,367	1.4%	2,710.8	0.4%	314.9	0.1%
2030	282,165	1.4%	2,722.5	0.4%	315.3	0.1%
2031	285,891	1.3%	2,731.5	0.3%	315.7	0.1%
2032	289,857	1.4%	2,739.5	0.3%	315.9	0.1%
2033	294,371	1.6%	2,750.1	0.4%	316.1	0.0%
2034	299,853	1.9%	2,763.5	0.5%	316.2	0.0%
2035	305,016	1.7%	2,774.8	0.4%	316.2	0.0%
2036	309,490	1.5%	2,784.5	0.4%	316.1	0.0%
2037	313,794	1.4%	2,794.2	0.3%	316.0	0.0%
2038	318,078	1.4%	2,803.1	0.3%	316.2	0.0%
2039	322,587	1.4%	2,812.0	0.3%	316.3	0.1%
2040	327,598	1.6%	2,822.6	0.4%	316.4	0.0%
2041	332,301	1.4%	2,829.6	0.2%	316.4	0.0%
2042	337,283	1.5%	2,836.0	0.2%	316.3	0.0%
22-42		1.4%		0.4%		0.04%

TABLE 5-3: INDUSTRIAL ECONOMIC DRIVERS

Year	Manufacturing GDP (Mil $)		Manufacturing Employment (Thou)	
2022	104,581		544.4	
2023	107,562	2.9%	550.6	1.1%
2024	109,532	1.8%	545.5	-0.9%
2025	110,981	1.3%	535.6	-1.8%
2026	113,113	1.9%	529.9	-1.1%
2027	115,724	2.3%	528.7	-0.2%
2028	118,245	2.2%	526.6	-0.4%
2029	120,744	2.1%	523.2	-0.7%
2030	123,055	1.9%	519.3	-0.7%
2031	125,631	2.1%	517.0	-0.5%
2032	128,328	2.1%	514.5	-0.5%
2033	131,222	2.3%	512.5	-0.4%
2034	134,229	2.3%	508.7	-0.7%
2035	137,326	2.3%	505.7	-0.6%
2036	140,855	2.6%	504.8	-0.2%
2037	144,496	2.6%	504.6	0.0%
2038	148,346	2.7%	504.2	-0.1%
2039	152,180	2.6%	502.7	-0.3%
2040	156,000	2.5%	500.6	-0.4%
2041	159,680	2.4%	497.5	-0.6%
2042	163,171	2.2%	494.8	-0.5%
22-42		2.2%		-0.5%

Historical electric prices (in real dollars) are derived from billed sales and revenue data. Historical prices are calculated as a 12-month moving average of the average rate (revenues divided by sales); prices are expressed in real dollars. Prices impact residential and commercial sales through imposed short-term price elasticities. Short-term price elasticities are small; residential and commercial price elasticities are set at -0.10. Price is not an input to the industrial sales model. Price projections are based on the Energy Information Administration's (EIA) Short-term Energy Outlook and Annual Energy Outlook. Over the forecast period, residential prices are flat in real dollars, commercial prices decline 0.2% annually.

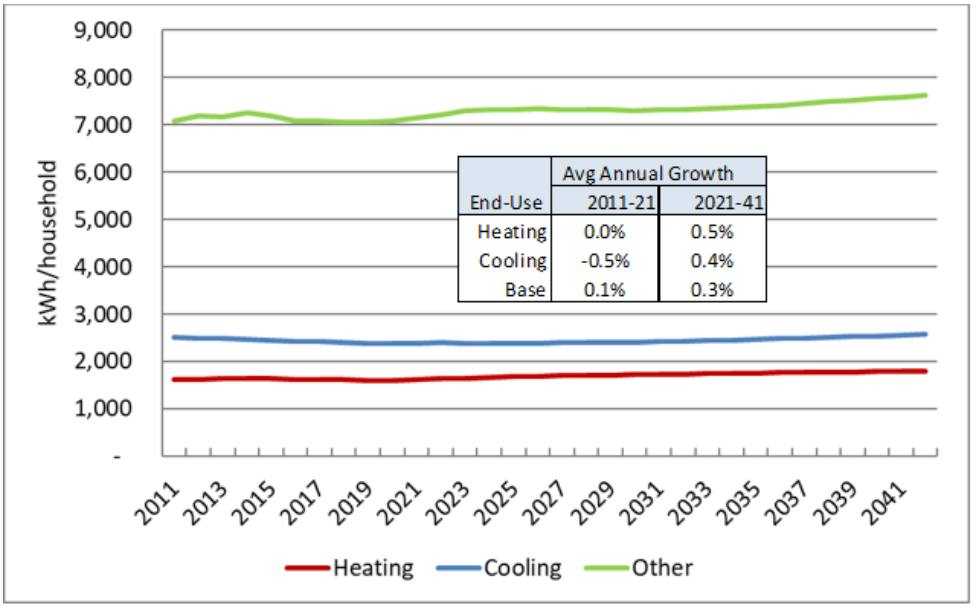
5.3 APPLIANCE SATURATION & EFFICIENCY TRENDS

Over the long-term, changes in end-use saturation and stock efficiency impact class sales, system energy, and peak demand. End-use energy intensities, expressed in kWh per household for the residential sector and kWh per square foot for the commercial sectors, are incorporated into the constructed forecast model variables. Energy intensities reflect both change in ownership (saturation) and average stock efficiency. In general, efficiency is improving faster than end-use saturation resulting in declining end-use energy use. Energy intensities are derived from Energy Information Administration's (EIA) 2022 Annual Energy Outlook and CEI South's appliance saturation surveys. The residential sector incorporates saturation and

efficiency trends for seventeen end-uses. The commercial sector captures end-use intensity projections for ten end-use classifications across ten building types.

Residential end-use intensities are used in constructing the model end-use variables. Figure 29 shows the resulting aggregated end-use intensity projections.

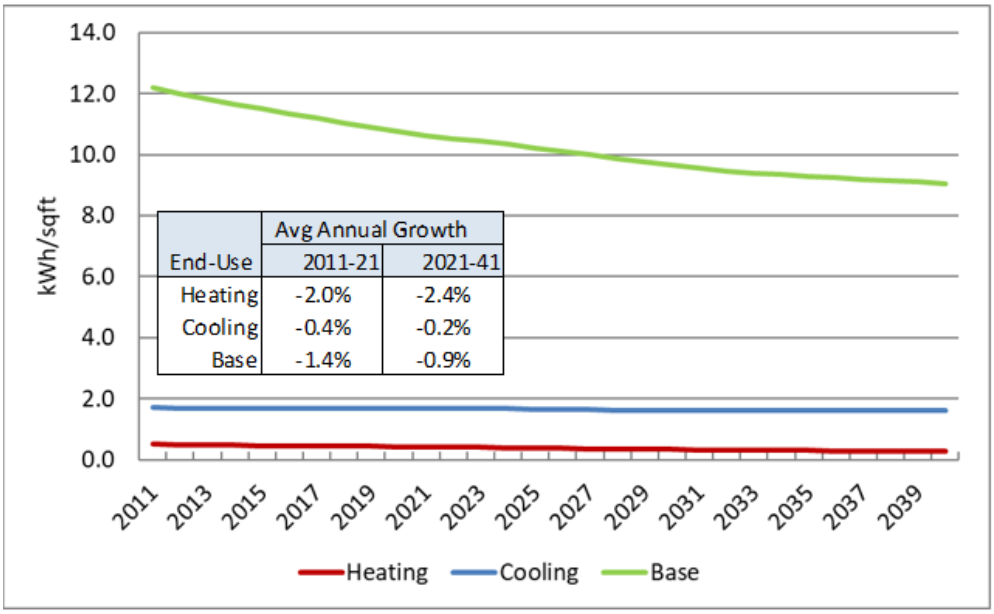
FIGURE 29: RESIDENTIAL END-USE ENERGY INTENSITIES



Heating intensity increases 0.5% annually through the forecast period, reflecting an increasing share in heat-pump saturation. Cooling intensity increases 0.5% annually through the forecast period as overall air conditioning efficiency improvements are offset by increased growth in heat-pump saturation. Total non-weather sensitive end-use intensity increases 0.3% annually.

Commercial end-use intensities (expressed in kWh per sqft) are based on the EIA's East South Central Census Division forecast; the starting intensity estimates are calibrated to CEI South commercial sales. As in the residential sector, end-use energy use has been declining as a result of new codes and standards and utility DSM programs. Figure 30 shows commercial end-use energy intensity forecasts for total heating, cooling, and non-weather sensitive loads.

FIGURE 30: COMMERCIAL END-USE ENERGY INTENSITY



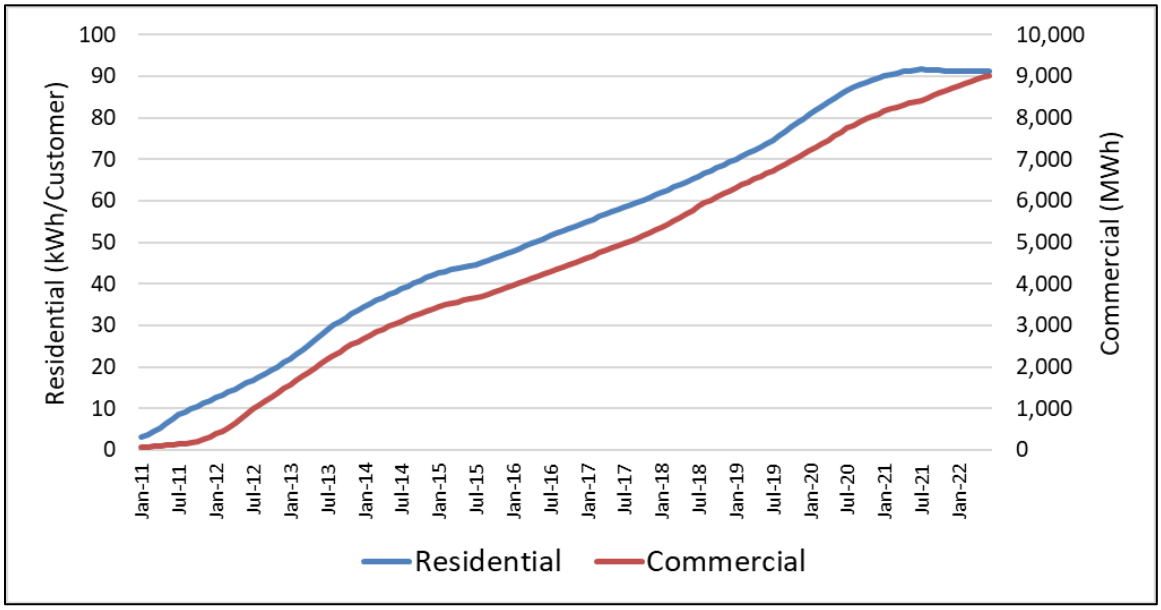
Commercial usage is dominated by non-weather sensitive (Base) end-uses, which over the forecast period are projected to decline 0.9% per year. Cooling intensity declines 0.2% annually through the forecast period. Heating intensity declines even stronger at 2.4% annual rate though commercial electric heating is relatively small.

5.4 HISTORICAL DSM SAVINGS

For more than ten years CEI South has promoted energy efficiency savings through utility sponsored programs. These programs have had a significant impact on electricity usage across nearly all customer classes. The DSM program savings are above and beyond naturally occurring savings, and impact of federal codes and standards.

The residential and commercial models incorporate historical DSM to account for historical program savings. The DSM variables help explain historical usage trends. In the forecast period DSM are held constant, as incremental program savings are modeled on a consistant and comparable basis as supply-side resources in the IRP modeling framework. The DSM variables are based on annual verified DSM savings that are converted to a monthly series. In the residential average use models, DSM is expressed as savings per customer. Figure 31 shows the cumulative DSM saving for the residential and commercial classes.

FIGURE 31: HISTORICAL DSM



5.5 COVID-19 IMPACT

By the spring of 2020, Indiana, like many others states across the country, issued a "Stay at Home" order in response to the COVID-19 virus. This had the impact of significantly reducing commercial and industrial usage as businesses shutdown and significantly increasing residential usage as work activity shifted from the office to the home. As these restrictions were lifted most businesses re-opened, although even today some portion of the workforce remains working from home. To capture the impact, the residential average use and non-residential rate class models include a COVID impact variable. This variable is constructed using Google Mobility Report data for the residential, workplace and retail place types for Vanderburgh County. Google Mobility Report data tracks daily cell phone locations by place type compared to a pre-COVID baseline. The residential place type active increased while the workplace and retail decreased, this data correlates well to the actual changes in electric sales.

APPENDIX A: MODEL STATISTICS

Residential Average Use Model

Variable	Coefficient	StdErr	T-Stat	P-Value
mStructRevRes.XHeat	1.42	0.026	53.902	0.00%
mStructRevRes.XCool	1.21	0.015	80.281	0.00%
mStructRevRes.XOther	0.95	0.013	71.961	0.00%
mBin.Jan	26.779	8.485	3.156	0.20%
mBin.Aug	49.469	9.532	5.19	0.00%
mBin.Sep	43.299	8.788	4.927	0.00%
mBin.Oct	3577.50%	8.177	4.375	0.00%
mBin.Jun14	-92.799	24.491	-3.789	0.02%
mBin.May16	63.925	24.594	2.599	1.04%
mDSMFcst.ResDSM_Const	-1.105	0.087	-12.658	0.00%
COVID.ResIdx	33.829	16.51	2.049	4.25%

Model Statistics	
Iterations	1
Adjusted Observations	138
Deg. of Freedom for Error	127
R-Squared	0.989
Adjusted R-Squared	0.988
AIC	6.443
BIC	6.676
Model Sum of Squares	6,668,954.77
Sum of Squared Errors	73,915.51
Mean Squared Error	582.01
Std. Error of Regression	24.12
Mean Abs. Dev. (MAD)	17.6
Mean Abs. % Err. (MAPE)	1.89%
Durbin-Watson Statistic	1.657

Residential Customer Model

Variable	Coefficient	StdErr	T-Stat	P-Value
Econ.HHs	980.543	0.366	2677.188	0.00%
mBin.Yr20Plus	2,878.09	100.746	28.568	0.00%

Model Statistics	
Iterations	1
Adjusted Observations	138
Deg. of Freedom for Error	136
R-Squared	0.967
Adjusted R-Squared	0.967
AIC	12.388
BIC	12.43
Model Sum of Squares	942,570,437.63
Sum of Squared Errors	32,157,085.58
Mean Squared Error	236449.16
Std. Error of Regression	486.26
Mean Abs. Dev. (MAD)	369.89
Mean Abs. % Err. (MAPE)	0.29%
Durbin-Watson Statistic	0.3

Commercial Sales Model

Variable	Coefficient	StdErr	T-Stat	P-Value
mStructRevCom.XHeat	18.623	1.888	9.866	0.00%
mStructRevCom.XCool	14.93	0.441	33.855	0.00%
mStructRevCom.XOther	1.18	0.013	88.658	0.00%
mBin.Feb	4587.139	1091.1	4.204	0.01%
mBin.Jun	-6175.569	1017.093	-6.072	0.00%
mBin.Oct	3995.709	1027.751	3.888	0.02%
mBin.Jun14	-857584.60%	3204.273	-2.676	0.84%
mBin.Jul19	-12961.405	3133.007	-4.137	0.01%
mDSMFcst.ComDSM_Const	-0.367	0.123	-2.981	0.34%
COVID.ComIdx	-9401.596	1900.935	-4.946	0.00%

Model Statistics	
Iterations	1
Adjusted Observations	138
Deg. of Freedom for Error	128
R-Squared	0.955
Adjusted R-Squared	0.952
AIC	16.124
BIC	16.336
Model Sum of Squares	25,518,480,761.69
Sum of Squared Errors	1,200,949,076.36
Mean Squared Error	9382414.66
Std. Error of Regression	3063.07
Mean Abs. Dev. (MAD)	2428.62
Mean Abs. % Err. (MAPE)	2.38%
Durbin-Watson Statistic	1.744

Industrial Sales Model

Variable	Coefficient	StdErr	T-Stat	P-Value
CONST	47659.506	24178.291	1.971	5.08%
mEcon.IndVar	102,632.85	24881.768	4.125	0.01%
mWthrRev.CDD65	66.28	7.912	8.377	0.00%
mBin.Feb	7311.369	4193.517	1.743	8.36%
mBin.Mar	-10732.371	4187.386	-2.563	1.15%
mBin.Nov	19035.26	4472.841	4.256	0.00%
mBin.Oct12	6537566.70%	13177.36	4.961	0.00%
mBin.Nov12	-55445.067	13733.821	-4.037	0.01%
COVID.ComIdx	-7356.898	6361.812	-1.156	24.96%

Model Statistics	
Iterations	1
Adjusted Observations	138
Deg. of Freedom for Error	129
R-Squared	0.552
Adjusted R-Squared	0.524
AIC	19.005
BIC	19.196
Model Sum of Squares	26,784,531,047.87
Sum of Squared Errors	21,728,430,928.25
Mean Squared Error	168437449.1
Std. Error of Regression	12978.35
Mean Abs. Dev. (MAD)	9272.65
Mean Abs. % Err. (MAPE)	5.89%
Durbin-Watson Statistic	2.089

Peak Model

Variable	Coefficient	StdErr	T-Stat	P-Value
mCPkEndUses.HeatVar	3.899	0.36	10.822	0.00%
mCPkEndUses.CoolVar	19.00	0.591	32.179	0.00%
mCPkEndUses.BaseVar	1.44	0.022	66.004	0.00%
mBin.May	-46.444	11.304	-4.109	0.01%
mBin.Oct	-24.704	12.117	-2.039	4.35%
mBin.Jan16	143.733	36.148	3.976	0.01%
mBin.Apr20	-9773.60%	36.14	-2.704	0.78%
mBin.Apr21	-109.766	36.192	-3.033	0.29%

Model Statistics	
Iterations	1
Adjusted Observations	137
Deg. of Freedom for Error	129
R-Squared	0.935
Adjusted R-Squared	0.931
AIC	7.214
BIC	7.384
Model Sum of Squares	2,378,330.01
Sum of Squared Errors	165,515.34
Mean Squared Error	1283.06
Std. Error of Regression	35.82
Mean Abs. Dev. (MAD)	27.74
Mean Abs. % Err. (MAPE)	3.57%
Durbin-Watson Statistic	1.674

APPENDIX B: RESIDENTIAL SAE MODELING FRAMEWORK

The traditional approach to forecasting monthly sales for a customer class is to develop an econometric model that relates monthly sales to weather, seasonal variables, and economic conditions. From a forecasting perspective, econometric models are well suited to identify historical trends and to project these trends into the future. In contrast, the strength of the end-use modeling approach is the ability to identify the end-use factors that drive energy use. By incorporating end-use structure into an econometric model, the statistically adjusted end-use (SAE) modeling framework exploits the strengths of both approaches.

There are several advantages to this approach.

- The equipment efficiency and saturation trends, dwelling square footage, and thermal shell integrity changes embodied in the long-run end-use forecasts are introduced explicitly into the short-term monthly sales forecast. This provides a strong bridge between the two forecasts.
- By explicitly introducing trends in equipment saturations, equipment efficiency, dwelling square footage, and thermal integrity levels, it is easier to explain changes in usage levels and changes in weather-sensitivity over time.
- Data for short-term models are often not sufficiently robust to support estimation of a full set of price, economic, and demographic effects. By bundling these factors with equipment-oriented drivers, a rich set of elasticities can be incorporated into the final model.

This section describes the SAE approach, the associated supporting SAE spreadsheets, and the *MetrixND* project files that are used in the implementation. The source for the SAE spreadsheets is the 2021 Annual Energy Outlook (AEO) database provided by the Energy Information Administration (EIA).

RESIDENTIAL STATISTICALLY ADJUSTED END-USE MODELING FRAMEWORK

The statistically adjusted end-use modeling framework begins by defining energy use ($USE_{y,m}$) in year (y) and month (m) as the sum of energy used by heating equipment ($Heat_{y,m}$), cooling equipment ($Cool_{y,m}$), and other equipment ($Other_{y,m}$). Formally,

$$\text{USE}_{y,m} = \text{Heat}_{y,m} + \text{Cool}_{y,m} + \text{Other}_{y,m} \quad (1)$$

Although monthly sales are measured for individual customers, the end-use components are not. Substituting estimates for the end-use elements gives the following econometric equation.

$$USE_m = a + b_1 \times XHeat_m + b_2 \times XCool_m + b_3 \times XOther_m + \varepsilon_m \quad (2)$$

$XHeat_m$, $XCool_m$, and $XOther_m$ are explanatory variables constructed from end-use information, dwelling data, weather data, and market data. As will be shown below, the equations used to construct these X-variables are simplified end-use models, and the X-variables are the estimated usage levels for each of the major end uses based on these models. The estimated model can then be thought of as a statistically adjusted end-use model, where the estimated slopes are the adjustment factors.

Constructing XHeat

As represented in the SAE spreadsheets, energy use by space heating systems depends on the following types of variables.

- Heating degree days
- Heating equipment saturation levels
- Heating equipment operating efficiencies
- Thermal integrity and footage of homes
- Average household size, household income, and energy prices

The heating variable is represented as the product of an annual equipment index and a monthly usage multiplier. That is,

$$XHeat_{y,m} = HeatIndex_{y,m} \times HeatUse_{y,m} \quad (3)$$

Where:

- $XHeat_{y,m}$ is estimated heating energy use in year (y) and month (m)
- $HeatIndex_{y,m}$ is the monthly index of heating equipment
- $HeatUse_{y,m}$ is the monthly usage multiplier

The heating equipment index is defined as a weighted average across equipment types of equipment saturation levels normalized by operating efficiency levels. Given a set of fixed weights, the index will change over time with changes in equipment saturations (*Sat*), operating efficiencies (*Eff*), building structural index (*StructuralIndex*), and energy prices. Formally, the equipment index is defined as:

$$HeatIndex_y = StructuralIndex_y \times \sum_{Type} Weight^{Type} \times \frac{\left(Sat_y^{Type} \Big/ Eff_y^{Type} \right)}{\left(Sat_{base\,yr}^{Type} \Big/ Eff_{base\,yr}^{Type} \right)} \quad (4)$$

The *StructuralIndex* is constructed by combining the EIA's building shell efficiency index trends with surface area estimates:

$$StructuralIndex_y = \frac{BuildingShellEfficiencyIndex_y \times SurfaceArea_y}{BuildingShellEfficiencyIndex_{base\ yr} \times SurfaceArea_{base\ yr}} \quad (5)$$

The *StructuralIndex* is defined on the *StructuralVars* tab of the SAE spreadsheets. Surface area is derived to account for roof and wall area of a standard dwelling based on the regional average square footage data obtained from EIA. The relationship between the square footage and surface area is constructed assuming an aspect ratio of 0.75 and an average of 25% two-story and 75% single-story. Given these assumptions, the approximate linear relationship for surface area is:

$$SurfaceArea_y = 892 + 1.44 \times Footage_y \quad (6)$$

For electric heating equipment, the SAE spreadsheets contain two equipment types: electric resistance furnaces/room units and electric space heating heat pumps. Examples of weights for these two equipment types for the U.S. are given in Table 0-1.

TABLE 0-1: ELECTRIC SPACE HEATING EQUIPMENT WEIGHTS

Equipment Type	Weight (kWh)
Electric Resistance Furnace/Room units	767
Electric Space Heating Heat Pump	127

Data for the equipment saturation and efficiency trends are presented on the *Shares* and *Efficiencies* tabs of the SAE spreadsheets. The efficiency for electric space heating heat pumps is given in terms of Heating Seasonal Performance Factor [BTU/Wh], and the efficiencies for electric furnaces and room units are estimated as 100%, which is equivalent to 3.41 BTU/Wh.

Heating system usage levels are impacted on a monthly basis by several factors, including weather, household size, income levels, prices, and billing days. The estimates for space heating equipment usage levels are computed as follows:

$$HeatUse_{y,m} = \left(\frac{HDD_{y,m}}{HDD_{base\ yr}}\right) \times \left(\frac{HHSize_y}{HHSize_{base\ yr,m}}\right)^{0.25} \times \left(\frac{Income_y}{Income_{base\ yr,m}}\right)^{0.15} \times \left(\frac{Elec\ Price_{y,m}}{Elec\ Price_{base\ yr,m}}\right)^{-0.1} \quad (7)$$

Where:

- *HDD* is the number of heating degree days in year (*y*) and month (*m*).
- *HHSize* is average household size in a year (*y*)
- *Income* is average real income per household in year (*y*)
- *ElecPrice* is the average real price of electricity in month (*m*) and year (*y*)

By construction, the $HeatUse_{y,m}$ variable has an annual sum that is close to 1.0 in the base year. The first term, which involves heating degree days, serve to allocate annual values to months of the year. The remaining terms average to 1.0 in the base year. In other years, the values will reflect changes in the economic drivers, as transformed through the end-use elasticity parameters. The price impacts captured by the Usage equation represent short-term price response.

Constructing XCool

The explanatory variable for cooling loads is constructed in a similar manner. The amount of energy used by cooling systems depends on the following types of variables.

- Cooling degree days
- Cooling equipment saturation levels
- Cooling equipment operating efficiencies
- Thermal integrity and footage of homes
- Average household size, household income, and energy prices

The cooling variable is represented as the product of an equipment-based index and monthly usage multiplier. That is,

$$XCool_{y,m} = CoolIndex_{y} \times CoolUse_{y,m} \quad (8)$$

Where

- $XCool_{y,m}$ is estimated cooling energy use in year (*y*) and month (*m*)
- $CoolIndex_{y}$ is an index of cooling equipment
- $CoolUse_{y,m}$ is the monthly usage multiplier

As with heating, the cooling equipment index is defined as a weighted average across equipment types of equipment saturation levels normalized by operating efficiency levels. Formally, the cooling equipment index is defined as:

$$CoolIndex_y = StructuralIndex_y \times \sum_{Type} Weight^{Type} \times \frac{\left({Sat_y^{Type}} / {Eff_y^{Type}} \right)}{\left({Sat_{base\ yr}^{Type}} / {Eff_{base\ yr}^{Type}} \right)} \quad (9)$$

For cooling equipment, the SAE spreadsheets contain three equipment types: central air conditioning, space cooling heat pump, and room air conditioning. Examples of weights for these three equipment types for the U.S. are given in Table 0-2.

TABLE 0-2: SPACE COOLING EQUIPMENT WEIGHTS

Equipment Type	Weight (kWh)
Central Air Conditioning	1,219
Space Cooling Heat Pump	240
Room Air Conditioning	177

The equipment saturation and efficiency trends data are presented on the *Shares* and *Efficiencies* tabs of the SAE spreadsheets. The efficiency for space cooling heat pumps and central air conditioning (A/C) units are given in terms of Seasonal Energy Efficiency Ratio [BTU/Wh], and room A/C units efficiencies are given in terms of Energy Efficiency Ratio [BTU/Wh].

Cooling system usage levels are impacted on a monthly basis by several factors, including weather, household size, income levels, and prices. The estimates of cooling equipment usage levels are computed as follows:

$$CoolUse_{y,m} = \left(\frac{CDD_{y,m}}{CDD_{base\ yr}} \right) \times \left(\frac{HHSize_y}{HHSize_{base\ yr,m}} \right)^{0.25} \times \left(\frac{Income_y}{Income_{base\ yr,m}} \right)^{0.15} \times \left(\frac{Elec\ Price_{y,m}}{Elec\ Price_{base\ yr,m}} \right)^{-0.1} \quad (10)$$

Where:

- *CDD* is the number of cooling degree days in year (*y*) and month (*m*).
- *HHSize* is average household size in a year (*y*)
- *Income* is average real income per household in year (*y*)
- *ElecPrice* is the average real price of electricity in month (*m*) and year (*y*)

By construction, the *CoolUse* variable has an annual sum that is close to 1.0 in the base year. The first term, which involves cooling degree days, serves to allocate annual values to months of

the year. The remaining terms average to 1.0 in the base year. In other years, the values will change to reflect changes in the economic driver changes.

Constructing XOther

Monthly estimates of non-weather sensitive sales can be derived in a similar fashion to space heating and cooling. Based on end-use concepts, other sales are driven by:

- Appliance and equipment saturation levels
- Appliance efficiency levels
- Average number of days in the billing cycle for each month
- Average household size, real income, and real prices

The explanatory variable for other uses is defined as follows:

$$XOther_{y,m} = OtherEqpIndex_{y,m} \times OtherUse_{y,m} \quad (11)$$

The first term on the right-hand side of this expression ($OtherEqpIndex_y$) embodies information about appliance saturation and efficiency levels and monthly usage multipliers. The second term (*OtherUse*) captures the impact of changes in prices, income, household size, and number of billing-days on appliance utilization.

End-use indices are constructed in the SAE models. A separate end-use index is constructed for each end-use equipment type using the following function form.

$$ApplianceIndex_{y,m} = Weight^{Type} \times \frac{\left(Sat_y^{Type} \Big/ \frac{1}{UEC_y^{Type}} \right)}{\left(Sat_{base\ yr}^{Type} \Big/ \frac{1}{UEC_{base\ yr}^{Type}} \right)} \times MoMult_m^{Type} \times \quad (12)$$

Where:

- *Weight* is the weight for each appliance type
- *Sat* represents the fraction of households, who own an appliance type
- $MoMult_m$ is a monthly multiplier for the appliance type in month (*m*)
- *Eff* is the average operating efficiency the appliance
- *UEC* is the unit energy consumption for appliances

This index combines information about trends in saturation levels and efficiency levels for the main appliance categories with monthly multipliers for lighting, water heating, and refrigeration.

The appliance saturation and efficiency trends data are presented on the *Shares* and *Efficiencies* tabs of the SAE spreadsheets.

Further monthly variation is introduced by multiplying by usage factors that cut across all end uses, constructed as follows:

$$ApplianceUse_{y,m} = \left(\frac{BDays_{y,m}}{30.5}\right) \times \left(\frac{HHSize_{y}}{HHSize_{base\ yr,m}}\right)^{0.26} \times \left(\frac{Income_{y}}{Income_{base\ yr,m}}\right)^{0.15} \times \left(\frac{Elec\ Price_{y,m}}{Elec\ Price_{base\ yr,m}}\right)^{-0.1} \quad (13)$$

The index for other uses is derived then by summing across the appliances:

$$OtherEqpIndex_{y,m} = \sum_{k} ApplianceIndex_{y,m} \times ApplianceUse_{y,m} \quad (14)$$

APPENDIX C: COMMERCIAL SAE MODELING FRAMEWORK

The traditional approach to forecasting monthly sales for a customer class is to develop an econometric model that relates monthly sales to weather, seasonal variables, and economic conditions. From a forecasting perspective, the strength of econometric models is that they are well suited to identifying historical trends and to projecting these trends into the future. In contrast, the strength of the end-use modeling approach is the ability to identify the end-use factors that are driving energy use. By incorporating end-use structure into an econometric model, the statistically adjusted end-use (SAE) modeling framework exploits the strengths of both approaches.

There are several advantages to this approach.

- The equipment efficiency trends and saturation changes embodied in the long-run end-use forecasts are introduced explicitly into the short-term monthly sales forecast. This provides a strong bridge between the two forecasts.
- By explicitly introducing trends in equipment saturations and equipment efficiency levels, it is easier to explain changes in usage levels and changes in weather-sensitivity over time.
- Data for short-term models are often not sufficiently robust to support estimation of a full set of price, economic, and demographic effects. By bundling these factors with equipment-oriented drivers, a rich set of elasticities can be built into the final model.

This document describes this approach, the associated supporting Commercial SAE spreadsheets, and *MetrixND* project files that are used in the implementation. The source for the commercial SAE spreadsheets is the 2021 Annual Energy Outlook (AEO) database provided by the Energy Information Administration (EIA).

COMMERCIAL STATISTICALLY ADJUSTED END-USE MODEL FRAMEWORK

The commercial statistically adjusted end-use model framework begins by defining energy use ($USE_{y,m}$) in year (y) and month (m) as the sum of energy used by heating equipment ($Heat_{y,m}$), cooling equipment ($Cool_{y,m}$) and other equipment ($Other_{y,m}$). Formally,

$$\mathrm{USE}_{y,m} = \mathrm{Heat}_{y,m} + \mathrm{Cool}_{y,m} + \mathrm{Other}_{y,m} \quad (1)$$

Although monthly sales are measured for individual customers, the end-use components are not. Substituting estimates for the end-use elements gives the following econometric equation.

$$\mathrm{USE}_{m} = a + b_1 \times \mathrm{XHeat}_{m} + b_2 \times \mathrm{XCool}_{m} + b_3 \times \mathrm{XOther}_{m} + \varepsilon_{m} \quad (2)$$

Here, $XHeat_m$, $XCool_m$, and $XOther_m$ are explanatory variables constructed from end-use information, weather data, and market data. As will be shown below, the equations used to construct these X-variables are simplified end-use models, and the X-variables are the estimated usage levels for each of the major end uses based on these models. The estimated model can then be thought of as a statistically adjusted end-use model, where the estimated slopes are the adjustment factors.

Constructing XHeat

As represented in the Commercial SAE spreadsheets, energy use by space heating systems depends on the following types of variables.

- Heating degree days,
- Heating equipment saturation levels,
- Heating equipment operating efficiencies,
- Commercial output, employment, population, and energy price.

The heating variable is represented as the product of an annual equipment index and a monthly usage multiplier. That is,

$$\text{XHeat}_{y,m} = \text{HeatIndex}_{y} \times \text{HeatUse}_{y,m} \quad (3)$$

Where:

- *$XHeat_{y,m}$ is estimated heating energy use in year (y) and month (m),*
- *$HeatInde_{xy}$ is the annual index of heating equipment, and*
- *$HeatUse_{y,m}$ is the monthly usage multiplier.*

The heating equipment index is composed of electric space heating equipment saturation levels normalized by operating efficiency levels. The index will change over time with changes in heating equipment saturations (*HeatShare*) and operating efficiencies (*Eff*). Formally, the equipment index is defined as:

$$HeatIndex_y = HeatSales_{base\ yr} \times \frac{\left(HeatShare_y / Eff_y\right)}{\left(HeatShare_{base\ yr} / Eff_{base\ yr}\right)} \quad (4)$$

The ratio on the right is equal to 1.0 in the base year. In other years, it will be greater than one if equipment saturation levels are above their base year level. This will be counteracted by higher efficiency levels, which will drive the index downward. Base year space heating sales are defined as follows.

$$HeatSales_{base\ yr} = \left(\frac{kWh}{Sqft}\right)_{Heating} \times \left(\frac{CommercialSales_{base\ yr}}{\sum_e kWh/Sqft_e}\right) \quad (5)$$

Here, base-year sales for space heating is the product of the average space heating intensity value and the ratio of total commercial sales in the base year over the sum of the end-use intensity values. In the Commercial SAE Spreadsheets, the space heating sales value is defined on the *BaseYrInput* tab. The resulting $HeatIndex_y$ value in the base year will be equal to the estimated annual heating sales in that year. Variations from this value in other years will be proportional to saturation and efficiency variations around their base values.

Heating system usage levels are impacted on a monthly basis by several factors, including weather, commercial level economic activity, prices and billing days. Using the COMMEND default elasticity parameters, the estimates for space heating equipment usage levels are computed as follows:

$$HeatUse_{y,m} = \left(\frac{HDD_{y,m}}{HDD_{base\ yr}}\right) \times \left(\frac{EconVar_{y,m}}{EconVar_{base\ yr,m}}\right) \times \left(\frac{Price_{y,m}}{Price_{base\ yr,m}}\right)^{-0.10} \quad (6)$$

Where:

- *HDD* is the number of heating degree days in month (m) and year (y).

- *EconVar* is the weighted commercial economic variable that blends Output, Employment, and Population in month (m), and year (y).
- *Price* is the average real price of electricity in month (m) and year (y).

By construction, the $HeatUse_{y,m}$ variable has an annual sum that is close to one in the base year. The first term, which involves heating degree days, serves to allocate annual values to months of the year. The remaining terms average to one in the base year. In other years, the values will reflect changes in commercial output and prices, as transformed through the end-use elasticity parameters. For example, if the real price of electricity goes up 10% relative to the base year value, the price term will contribute a multiplier of about .98 (computed as 1.10 to the -0.18 power).

Constructing XCool

The explanatory variable for cooling loads is constructed in a similar manner. The amount of energy used by cooling systems depends on the following types of variables.

- Cooling degree days,
- Cooling equipment saturation levels,
- Cooling equipment operating efficiencies,
- Commercial output, employment, population, and energy price.

The cooling variable is represented as the product of an equipment-based index and monthly usage multiplier. That is,

$$\text{XCool}_{y,m} = \text{CoolIndex}_{y} \times \text{CoolUse}_{y,m} \quad (7)$$

Where:

- $XCool_{y,m}$ is estimated cooling energy use in year (y) and month (m),
- $CoolIndex_y$ is an index of cooling equipment, and
- $CoolUse_{y,m}$ is the monthly usage multiplier.

As with heating, the cooling equipment index depends on equipment saturation levels (*CoolShare*) normalized by operating efficiency levels (*Eff*). Formally, the cooling equipment index is defined as:

$$CoolIndex_y = CoolSales_{base\ yr} \times \frac{\left(CoolShare_y / Eff_y\right)}{\left(CoolShare_{base\ yr} / Eff_{base\ yr}\right)} \quad (8)$$

Data values in 2004 are used as a base year for normalizing the index, and the ratio on the right is equal to 1.0 in the base year. In other years, it will be greater than one if equipment saturation levels are above their base year level. This will be counteracted by higher efficiency levels, which will drive the index downward. Estimates of base year cooling sales are defined as follows.

$$CoolSales_{base\ yr} = \left(\frac{kWh}{Sqft}\right)_{Cooling} \times \left(\frac{CommercialSales_{base\ yr}}{\Sigma_e {}^{kWh}/_{Sqft_e}}\right) \quad (9)$$

Here, base-year sales for space cooling is the product of the average space cooling intensity value and the ratio of total commercial sales in the base year over the sum of the end-use intensity values. In the Commercial SAE Spreadsheets, the space cooling sales value is defined on the *BaseYrInput* tab. The resulting *CoolIndex* value in the base year will be equal to the estimated annual cooling sales in that year. Variations from this value in other years will be proportional to saturation and efficiency variations around their base values.

Cooling system usage levels are impacted on a monthly basis by several factors, including weather, economic activity levels and prices. Using the COMMEND default parameters, the estimates of cooling equipment usage levels are computed as follows:

$$CoolUse_{y,m} = \left(\frac{CDD_{y,m}}{CDD_{base\ yr}}\right) \times \left(\frac{EconVar_{y,m}}{EconVar_{base\ yr,m}}\right) \times \left(\frac{Price_{y,m}}{Price_{base\ yr,m}}\right)^{-0.15} \quad (10)$$

Where:

- *HDD* is the number of heating degree days in month (m) and year (y).
- *EconVar* is the weighted commercial economic variable that blends Output, Employment, and Population in month (m), and year (y).
- *Price* is the average real price of electricity in month (m) and year (y).

By construction, the *CoolUse* variable has an annual sum that is close to one in the base year. The first term, which involves cooling degree days, serves to allocate annual values to months of the year. The remaining terms average to one in the base year. In other years, the values will change to reflect changes in commercial output and prices.

Constructing XOther

Monthly estimates of non-weather sensitive sales can be derived in a similar fashion to space heating and cooling. Based on end-use concepts, other sales are driven by:

- Equipment saturation levels,
- Equipment efficiency levels,
- Average number of days in the billing cycle for each month, and
- Real commercial output and real prices.

The explanatory variable for other uses is defined as follows:

$$\text{XOther}_{y,m} = \text{OtherIndex}_{y,m} \times \text{OtherUse}_{y,m} \quad (11)$$

The second term on the right-hand side of this expression embodies information about equipment saturation levels and efficiency levels. The equipment index for other uses is defined as follows:

$$OtherIndex_{y,m} = \sum_{Type} Weight_{base\ yr}^{Type} \times \left(\frac{Share_{y}^{Type} / Eff_{y}^{Type}}{Share_{base\ yr}^{Type} / Eff_{base\ yr}^{Type}} \right) \quad (12)$$

Where:

- *Weight* is the weight for each equipment type,
- *Share* represents the fraction of floor stock with an equipment type, and
- *Eff* is the average operating efficiency.

This index combines information about trends in saturation levels and efficiency levels for the main equipment categories. The weights are defined as follows.

$$Weight_{base\ yr}^{Type} = \left(\frac{kWh}{Sqft}\right)_{Type} \times \left(\frac{CommercialSales_{04}}{\sum_e {}^{kWh}/_{Sqft_e}} \right) \quad (13)$$

Further monthly variation is introduced by multiplying by usage factors that cut across all end-uses, constructed as follows:

$$OtherUse_{y,m} = \left(\frac{BDays_{y,m}}{30.5}\right) \times \left(\frac{EconVar_{y,m}}{EconVar_{base\ yr,m}}\right) \times \left(\frac{Price_{y.m}}{Price_{base\ yr,m}}\right)^{-0.15} \quad (14)$$

Attachment 4.2 CEI South Hourly System Load Data

Dt	Hour1	Hour2	Hour3	Hour4	Hour5	Hour6	Hour7	Hour8	Hour9	Hour10	Hour11	Hour12	Hour13	Hour14	Hour15	Hour16	Hour17	Hour18	Hour19	Hour20	Hour21	Hour22	Hour23	Hour24
1/1/2021	484.5	468.4	460.2	460.5	463	462.7	470	487.6	486.9	484.9	491.8	496.3	487.1	473.4	473.1	452.9	469	484.4	503.3	501.9	486.7	480.6	474.4	448.5
1/2/2021	439.3	440.2	427.3	428.5	430.1	433.3	447.3	463.5	482.3	502.6	519.6	517.6	519.4	502.9	498.8	487.4	495.6	507.3	539	529.2	515.7	508.8	486.9	467.4
1/3/2021	458.3	441.9	435.4	425.2	438.2	437.3	448.6	461.2	477.8	486.7	486	501.6	497.2	501.1	498.9	478.6	493.5	508.4	547.8	552.3	553.1	546.9	530.2	513.3
1/4/2021	510.8	496.7	505.1	504.8	512.6	526.2	562.5	604.5	617.1	603.4	595.4	569.3	555.9	540.3	543.2	526.2	537.8	551.6	569.4	575	579.9	565.7	535.4	516.6
1/5/2021	496.6	486	488	489.4	496.3	510.6	537.9	574.9	600.8	598.3	595.3	579.7	558.9	542.2	541.4	526.7	536	559.6	597.1	588.6	603.7	592	569.6	551.9
1/6/2021	530.3	535.1	529.7	534.2	536.1	544	571.6	617	627.5	621.8	623.5	596.1	583.2	575	569.6	569.8	563.8	584.9	607.9	603.6	602.7	592.7	580.2	552.2
1/7/2021	531.9	535	522	530.4	539	538.8	570.9	614.7	623.8	627.6	624.9	621.2	618.4	610	612.7	611.1	620	620.2	624.9	622.4	611	603.1	578.3	546.3
1/8/2021	529.1	517.1	512.7	514.6	507.8	513.1	542.4	591.7	608.3	607.5	620.1	614	613.4	611.3	608.3	610.6	604.1	604.9	614.1	607.8	594.8	589.2	568.5	545
1/9/2021	521.4	493.8	501.2	507.6	506.9	505.4	519.8	534.4	557.3	564.4	580.8	573.3	578.3	578.9	562.8	569.1	568.9	582.3	593.3	591.5	583.5	580.3	563	539.4
1/10/2021	525.8	505.8	505.8	499	497.3	499	504.7	503.1	508.4	526.8	541.1	546	548	551.4	537.8	550.9	548.5	576.1	589.1	587.8	579.7	575.9	543.9	520.9
1/11/2021	502.1	505.2	491	496.4	506.1	520.2	558.9	613.4	624	646.2	643.8	647	634.6	644.3	638.3	636.9	634.3	653.9	661.6	658.4	644.2	629.2	606.2	576.3
1/12/2021	569.7	553.3	547	555	557.9	573.3	616.8	647.4	665.5	653.5	633.4	620.1	595.9	583.1	564.2	551.3	552	574.4	611.5	617.4	611.9	600.1	587.7	555.7
1/13/2021	545.2	535.8	533.2	528.7	534.7	550.2	580.4	617.2	623	623.4	588.2	583.8	550.3	549.4	537.9	536.7	536.3	559.4	595.7	590.9	581.4	564.3	554.5	521
1/14/2021	506.8	502.7	504.4	507.2	502.9	522.7	543.6	594	608.5	593	588.5	555.5	559.6	550.4	534.9	522.7	524.8	538.8	568.8	553.5	544.6	539.7	526.1	504.1
1/15/2021	486.3	472.2	481.3	472.9	485.9	497.3	535	577	588.7	583.7	563.5	557.5	564.5	561	548.2	565	561.1	572.7	604.4	586.3	587.2	568.6	563.2	532.8
1/16/2021	512.9	504.7	496.9	497.5	492.1	503.6	502.8	515.4	516.4	529.4	530.7	529.9	547.3	538.4	529.6	534.1	527.1	537.2	548.6	545.2	540.9	516.6	509.7	486.8
1/17/2021	469.5	464.4	458.6	452.5	455.6	448.6	458.1	481	490.8	503.7	517.3	529.6	524.7	528.1	526.2	513.1	520.5	523.1	573.8	553.5	542.3	539.7	520.4	509.5
1/18/2021	486	478.6	483	477.3	474.6	488.1	517.9	544.5	551.9	565.5	562.1	547.6	546.9	522.4	515.9	509.1	515	529.2	554.7	559.6	547.6	528	512.1	481.8
1/19/2021	475	462.6	449	458.9	455.9	486.4	515.1	575.6	597.9	597.6	578.4	560.7	539.1	535.4	521.3	514.9	521.7	531.2	555.2	574.5	572.7	566.4	549.2	519.8
1/20/2021	504.5	499.7	500	497.3	502.9	527.8	558.1	617.1	625	616.7	600.8	582.3	566.7	554.4	551.3	551	542.4	570.3	610.7	597.4	585.3	579.8	555.1	528.3
1/21/2021	502.6	501.2	487.9	489.3	484.6	496.1	518.3	570.3	579	582.7	570.3	563.9	548	537.6	523.6	522	520.7	537	572.2	570.6	569.3	563.7	541.1	518.7
1/22/2021	501	495.4	495.7	488.6	494.1	509.3	538.8	580.5	597.6	596.6	586.6	572.4	560.7	548.7	541	532.5	532.3	544.2	583.1	587.3	595	583.2	566.6	546.9
1/23/2021	530.8	524.6	526.2	523.6	528.8	531.2	552.4	563	565	559.4	554.2	532.1	508.6	508.8	492.5	477.2	482	505.5	536.3	532.2	526.9	524	505.4	480
1/24/2021	466.4	465.2	452.1	448.5	444.8	451.1	454.5	472.1	481.4	501.8	515.9	516.9	526.9	505.1	513.9	498	504.4	513.3	544.9	536	525.5	513.5	490.8	473
1/25/2021	453.9	444.3	446.8	444.4	456.9	471.2	510.7	565.7	587.5	608.2	615.9	614.8	625.4	632.3	620.5	606.1	608.1	602.4	611.3	605.5	585.9	562.4	549.8	510.8
1/26/2021	488.1	483.2	479.4	470.7	477	487.1	507	557.5	569	569.9	565.6	566.7	570.4	575.6	566.9	563.4	571.3	580.7	596.6	596.5	595.9	588.6	557.8	535.7
1/27/2021	510.9	505.9	498.2	503	503.9	520.1	554.1	593.3	608.6	615.9	610	616.4	620.6	615.2	616.2	615.1	626.5	634	645.8	650.2	642.6	634.2	609.9	579.7
1/28/2021	558.2	561.9	554.2	551.4	562.7	575.7	606.3	658	664.7	652.1	653.1	626.8	627.5	606.3	596.3	581.8	583.7	598.5	630.8	648.6	648.6	642.4	626.6	604.8
1/29/2021	586.2	585.5	576.5	572	583.2	596.9	623.2	654	671.2	649.4	630.4	603.4	585.2	574.2	567.5	544.4	536	550	587.5	594.7	586	590.1	576.8	544.3
1/30/2021	525.2	516.1	509.9	503.9	505.3	513.8	514.2	520.6	522.4	537.7	546	542.1	535.2	536.2	528.9	531.2	538.3	541.3	551.7	558.1	550.7	536.8	521.5	493.8
1/31/2021	467.9	456.6	452.4	434.2	424.8	426.4	416.9	433.1	441.7	480.2	494.8	498.5	516.5	516.3	522.7	521.2	528.8	545.2	571.7	567	557.4	554.4	538.8	509.8
2/1/2021	494	489.7	491.2	494.8	495.5	510.9	555.8	608.4	623.8	624.6	633	636.1	630.3	629.3	623.8	612	605.7	625	639.9	643.2	632	632.8	614.3	573
2/2/2021	556.7	546.9	549.2	549.3	551.2	559.2	596.5	634.9	641.7	628.1	617.8	608.8	599.7	602.4	597.5	587.9	588	606.8	625.4	619.8	613.3	601	582.3	560.1
2/3/2021	543.6	530.5	543	539.7	549.5	566.9	591.3	636.4	644.1	626.1	592.8	584	570.6	560.9	542.2	544.8	543.5	555.6	578.1	589.8	602.1	596.4	587.1	565.6
2/4/2021	539.3	539.5	535.5	528.8	534.6	537.9	559.8	601.6	606.3	618.1	614.8	605.8	619.9	627.2	622.4	613.3	608.4	600.4	610.3	611.7	586.5	589.7	578.1	554.8
2/5/2021	534.6	528	522.6	533.9	536.8	548.2	574.6	622.7	627.1	628.4	647.8	641.2	650.5	618.2	563.5	539.5	531.4	536.6	575.2	583.5	566.5	561.9	543.8	527.6
2/6/2021	508.2	498.7	490.3	493.2	499.6	504.1	518.5	536.4	542.2	556.5	554.2	554.4	540.2	507.4	502.3	495.7	501.1	511	543.8	556	549.6	551.9	535.5	522.3
2/7/2021	514.1	505.6	500.3	508.8	517.5	524.8	552.7	568.5	587	594	590.6	579.1	591.2	578.4	575.1	568.8	557.4	579.9	617.8	625.7	615.9	627.1	599.5	585.8
2/8/2021	563.9	553.2	546.4	541.2	543.8	558	587	626.8	653	644.5	637.6	611.5	599.3	583.6	588.3	601	597.7	607.8	625.9	628.2	625	616.1	587.7	574.4
2/9/2021	549.9	542.5	532.8	533.5	538.5	540.9	568.9	614.4	636.2	647.6	652.6	667.5	657.5	657.9	654.4	647.3	640.3	642.5	662	665.6	664.6	649.6	626.1	599.3
2/10/2021	574.5	564.9	551.7	554.6	562.8	562.9	588.7	636.1	648	655.2	663.9	669.6	678.2	656.5	669.9	663	646.7	651.7	666	652.1	653.8	644.8	613.9	597.8
2/11/2021	580	588.8	572.8	588.4	579.2	586.6	607.1	631.4	658.6	657.3	659.3	663.7	653.9	654.4	640.9	643	640.4	636.6	652.6	661	646.5	643.4	619.7	598.4
2/12/2021	578.5	573.1	567.1	573.9	557.8	568.7	589.2	622.9	636.2	652.4	652.6	653.7	637.4	655.1	637.5	644.9	635.8	646.4	653.6	654	652.2	645.8	636.5	615.6
2/13/2021	600.6	587.2	589.1	589.4	592.4	592.8	594.4	612.1	623.4	648.9	651.7	658.5	656	663.9	654.5	651.6	646.2	660.4	669.8	675.3	667.1	670.6	657.4	638.2
2/14/2021	613.1	610.4	613	619.5	608.8	615.3	641.4	646.2	667.7	679	677.7	675.6	669.8	648.9	632.9	625	629.6	639.4	666.9	688.2	674	671	660.5	644.5
2/15/2021	631.5	621.7	624.6	626.2	637.3	642.4	678.5	707.8	718.9	736.6	741.6	736.1	743.1	734.1	712.8	708.5	681.5	673.6	691	697.1	680.7	661	642.1	619.7
2/16/2021	600.8	596	602	600.3	610.8	629.3	644.6	669.9	668.9	670.3	655.7	655.9	647.8	629.8	628	617.1	607.6	628.3	667.3	690.4	679.5	687.3	676.5	650.6
2/17/2021	639.7	635.6	626.3	626.3	631.4	649.4	665.3	695.2	706.6	718.5	703.9	687.6	680	658.5	652	655.3	654.3	652.9	670.4	680.9	656.1	658	639.2	613
2/18/2021	590.9	585.6	581.9	576.5	587.7	597.7	612	636.3	655.7	657.1	657.6	651.4	641.2	636.4	616.5	617.6	612.1	617.4	652.3	664.7	659.1	650.2	638	622.2
2/19/2021	599.5	602.2	600.3	607.4	610	628	650.6	683.4	691.1	679.4	659.8	642.2	628	618.2	611.5	596.9	598.1	601	632.7	657	661.5	658.3	650.3	634
2/20/2021	622.8	620.8	622.4	630	626.5	633	646.8	653.3	650.4	638.1	620.4	601.1	563.5	546.4	535.1	519.1	517.8	525.8	559.7	597.6	579.1	577.5	554.7	550.3
2/21/2021	543.2	536	528.6	528.4	521.9	533.2	540.3	547.9	548	566.8	553.9	531.6	523.3	519	512.4	503.3	509.4	521.7	549.8	563.4	550.1	536.4	506.7	485.7
2/22/2021	465.6	461.6	459.7	456.5	461.9	479.2	524.1	559.1	580	589.8	580.2	585.8	560.7	550.4	543	533.2	517.4	532.4	555.2	584.9	578.6	568.4	553.6	527.4
2/23/2021	506.1	498	493.1	497.9	499.3	512.3	541.7	563.5	585.3	574.2	544.1	536	524.5	513.3	507.8	498.1	498.4	489.1	519.2	539.2	550.2	537.1	518.2	508
2/24/2021	475	472.2	459.6	460.9	468.7	471	503	537.1	541.8	545.2	541.2	529.6	516.5	519.8	519.7	510.4	509.8	491.6	513.9	540.3	537.5	520.1	509.3	487.4
2/25/2021	462.4	465.9	457.7	463.5	470.1	495	530.7	561.9	565.7	566.4	542.5	536.3	526.1	506.4	504.6	503.6	496.4	508.9	527.2	547.2	549.4	553.9	528.7	503.6
2/26/2021	488.8	476	476.3	483.9	492	494.5	522.7	558.9	567.9	576	578.8	574.5	555.1	558.8	552.3	547.4	549.3	543.9	556.9	560.1	548.1	541	523.2	498.2
2/27/2021	464	457.5	447.9	438.4	443.6	437	444.2	454.6	460.3	456.4	453	454.6	450	448.1	437.1	439.2	436.2	446.5	472	470.1	465.8	461.9	439.2	422.2
2/28/2021	405.7	384.8	389.3	384.5	377.6	383.2	394.4	396.8	412	428.6	431.8	442.1	443.1	440.9	432.6	433.8	443.1	457.1	478.2	481.9	474.4	453.8	436.9	409.3
3/1/2021	404.2	406.8	407.6	407.6	424	445.4	481.7	529.5	564.1	575.2	555	559.8	555.7	553.7	548.8	526.4	527.1	523.5	550	574.9	572.7	564.3	553.9	528.7
3/2/2021	515.7	508.1	513.6	510	518.3	531.1	561.6	604.3	615.7	588.5	577.9	556.9	539.4	536.4	519.6	513.4	515	514.8	534.4	566.4	567.3	575.6	552.8	543.3
3/3/2021	515.1	518.7	518.7	519.3	519.5	535.3	558.5	595.1	593	576.8	559.7	539.4	567.3	581.8	579.2	557.1	562.2	554.2	565.5	589.1	595.5	583.2	577.3	539.8
3/4/2021	530.1	519.2	511.6	525.2	526	545.1	572.2	607.2	604.2	602.1	585.2	577.6	571.2	568.7	560.3	564.8	550.1	562.3	572.6	590.8	596.2	549.6	504.6	479.3
3/5/2021	471.4	460.1	466.2	470	475.8	482	517.2	553	569	570.1	559.4	538	525.2	515.5	504.5	499.8	500.7	507	513.5	538.8	537.5	528.6	515.1	499.2
3/6/2021	478.8	470.3	474.1	470.4	474.3	475	482.1	486.1	490.3	480.6	475.2	462.2	444.7	443.8	430.4	426.3	425.2	424	449.8	469.6	466.5	474.7	455.8	448.3
3/7/2021	435.1	426.8	433.7	419.6	437.8	436.6	455.9	461.8	467.1	460	443.7	431.7	423.8	417	409.4	400.3	403.2	420.8	436.3	470.7	468.9	465.8	448.8	434.8
3/8/2021	420.3	420.5	422.4	424.8	429.3	451.2	496.8	533.7	541.1	530	524	516.7	507.7	502.1	497.2	495.6	484.4	490	489.5	522.5	515.1	508.4	483.2	464
3/9/2021	442.7	441.9	440.3	438.9	438.5	458	488.9	518.6	528.2	527.3	517.1	511.8	507.5	503	489.9	490	485.5	481.5	492	520.6	515.8	495.9	483.9	462.5
3/10/2021	437.7	427.3	424.2	420.1	423.1	435.8	456	488.5	498.6	511.9	511.4	506.3	504	513.4	509.1	495.5	498.9	496.9	498.9	513.7	518.9	501.5	483.8	453.3
3/11/2021	435.1	414.7	416.5	403	410.1	413.5	430.7	468	488.8	501.7	503.3	513.2	498.4	527.7	509.1	510	506.6	513.3	522.9	526.8	519	506.7	482.1	461.7
3/12/2021	437.7	417.7	419.6	414.7	417.8	432.6	449.3	477.6	497.2	515.5	515.4	511.4	500	540.9	497	495.1	492.9	485.3	492.4	502.6	502.7	497.2	476.3	459.5
3/13/2021	425.3	416.4	415.3	407.3	406.3	407.9	409.2	419.7	437.3	448.5	456.9	450.9	452.2	443.3	440.4	440	434.7	431.9	444.8	466.4	464.7	459.2	440	424.9
3/14/2021	377.2	410.1	381.1	384.9	387.8	390.5	404.1	403	422.5	441.2	444.1	450.4	452.2	456.7	448.6	442.2	460.2	462.7	472.2	482.7	475	456.9	434	430.7

Dt	Hour1	Hour2	Hour3	Hour4	Hour5	Hour6	Hour7	Hour8	Hour9	Hour10	Hour11	Hour12	Hour13	Hour14	Hour15	Hour16	Hour17	Hour18	Hour19	Hour20	Hour21	Hour22	Hour23	Hour24
3/15/2021	407.2	403.8	399.9	407.6	424.4	453.9	513.4	527.2	547.4	555.2	564.1	554.2	551.4	545.1	539.1	524	527.9	512.8	519.3	535.4	537.1	512.8	489.8	469.9
3/16/2021	450.9	449.2	443.7	442.5	446.7	475.7	511.7	532.1	525.2	542.8	527.4	529.1	528.5	521	518.5	504	505.6	506.8	510.3	530	530	513.5	486.1	455.4
3/17/2021	454.8	442.9	445.5	440.2	452.7	482.4	520.1	533.3	540.5	538.7	538.3	536.5	525.5	518.8	535.3	528.9	518.6	518.7	522.5	528.1	522.6	506.7	473.5	451
3/18/2021	447.8	433.9	424.7	427.4	430.3	457.5	492.2	513.7	509.9	513.2	518.3	517	513	507.8	515.8	505.8	506.5	505.2	517.8	535.7	531.2	522	499.9	476.8
3/19/2021	467.9	463.6	457.7	464.7	475.1	503.1	546.1	562.5	566.9	563.6	544.7	531.9	515.6	519.8	493.9	485.7	480.9	476.8	487.6	516.3	515.4	506.5	491.1	466.2
3/20/2021	458.7	461.2	453	455.5	457.5	464.1	479.5	487.2	481	470.3	459.5	440.6	432.6	419.2	421	414.1	412.8	417.3	427.2	441.9	438.1	433.6	416.5	412.4
3/21/2021	395	393.3	397.2	390.7	391.8	407.6	437.5	433.6	442.2	422.6	413.7	404.4	410.3	397.4	398.5	402.4	403.7	415.7	425.3	433	439.3	431.6	405.1	383.7
3/22/2021	381	376.9	378	386.9	401.3	432	478.4	490.8	497.7	497.8	491.2	489.5	484.2	479.2	487.2	478.5	478.9	474.7	472.6	492.6	498.4	476.5	452.2	425.7
3/23/2021	416.3	409.9	402.9	397.7	410.3	430.2	456.4	478.1	485.5	489.7	488.3	497.6	492.3	504	493.9	492.1	492.3	490.7	497.8	507	502.7	485.2	457.6	437.5
3/24/2021	433.1	418.6	411.6	415.1	420.5	430.3	466.1	488.5	489.6	501.4	501.4	500.8	501.8	506.2	505	496.3	498.9	495	493.5	515.1	516.5	492.7	466	433.7
3/25/2021	418.3	411.3	405	403.7	410.7	427.3	470.5	486.1	498.9	519.1	528.9	517	508.7	509.7	506.4	506.6	505	512.5	512.6	514.2	515.2	487.2	467.9	445.5
3/26/2021	427.4	423.4	414.4	407.5	416.2	431.1	458.3	482.4	497.1	503.4	507.7	504.9	497.6	490.1	482.3	477.6	466.7	452.6	455	471.1	473.2	468	445.5	428.1
3/27/2021	412.7	405.7	403.4	408.1	402.5	401.9	413.9	417.9	428	436.1	425.1	429.8	422.3	423.6	433.5	436.7	448.9	455.3	448.8	465.3	454.2	437.2	425.3	395.8
3/28/2021	381.6	363.8	353.6	354.7	349.7	357.2	359.3	371.7	388.6	406.8	405	412.8	414.7	406.6	410.9	415.2	413.5	429.8	432.1	451.5	467.1	454.7	421.8	409.7
3/29/2021	407.7	403	400.8	416.8	440	473.9	528.3	541.1	532	518.8	512.3	499.9	490.4	488	483.3	485.4	472.9	472.1	486.8	497.4	501.5	483.2	454.4	427.1
3/30/2021	420.7	420.8	418.7	416.3	426.5	451.1	496.7	505.3	504.3	497.8	493.9	491.2	492.3	490.8	494.9	491.8	498.8	504.3	504.2	505.7	506.6	484	453.1	428.3
3/31/2021	421.9	413.4	403.4	402.7	412.9	437	483	499.9	508.9	507.6	502.8	502	507.2	510.6	503.8	496	489.5	482.5	496.5	520.6	534.6	514.5	496	476
4/1/2021	465.8	464.3	464.8	472.2	483.4	534.1	560.7	566.4	574.9	552.9	547.2	547.6	534.5	522.2	521	504.9	503.1	501.2	506.2	542.5	551.9	534.1	513.5	487.8
4/2/2021	482.5	482.7	483.2	487.8	495.5	517.4	550.1	549.5	539.5	528.7	516.3	497.6	489.2	473.6	465.8	459.1	449.4	454.6	454.3	474.8	494.7	481.4	476.6	453.4
4/3/2021	445.3	440.2	436.7	441.5	443.8	448.7	458.4	451.6	450.1	440.3	439.8	415.3	408.4	406.9	402.7	403.5	406.8	413	412.6	431.3	428.6	426.2	396.1	384.4
4/4/2021	367.3	364.5	365.3	360.3	367	384.9	390.8	399.6	403	405.4	402.5	397.8	395.7	381.5	389.8	394.7	399.7	416.3	418.6	434.5	434.4	418.4	393.6	368.6
4/5/2021	362.7	353.2	357.1	361.9	369.4	407.1	451.1	477	485	487.4	500.6	505.9	511.6	520.3	522.3	525.7	521.2	522.1	512.5	543.7	530	501.5	468.7	442.2
4/6/2021	421.6	408.7	402.5	399.8	411.3	432.8	465.9	482.9	495.9	505.7	510	521	538	546.5	556.7	562.4	557.7	559.4	554.4	564.9	556	528.7	481.7	458.1
4/7/2021	428.2	425.1	411.8	408.7	424.7	443.3	482.4	497.7	511.2	534.6	540.6	561.6	581.3	575.9	565.5	590.5	589.5	579.7	579.9	579.9	574.8	553	513.1	479.3
4/8/2021	461.7	447	437.7	431.8	428.1	445.8	478	495.6	506.1	518.9	528.7	522.1	520.7	522	520.5	513.7	503.3	500.7	509.7	511.5	517.5	491.1	468.3	436.6
4/9/2021	420.7	411.6	411.4	405.5	412.9	427.1	470.1	481.3	492.4	496.7	507.4	512.1	522.5	542.4	546.6	552.7	556.9	539.4	534.4	548	535.4	507.5	469.5	431.3
4/10/2021	422.1	408.9	399.1	388.4	380.4	383.3	386.3	391.7	410.4	435.8	445.7	438.3	449.2	439.8	437.2	439.4	442.4	435.7	430.2	433.7	435	421	394.6	368.9
4/11/2021	358.1	345.5	346	346.8	335.7	351.4	354	371.3	387.6	407.5	414.7	415.2	404.1	409.2	405.7	403.6	402.9	415.6	427	429.2	432.7	417.7	394.6	376.5
4/12/2021	364.2	362.4	372	374.4	385.9	420.4	455	481.5	481.7	483.1	488.1	482.9	493.7	499.4	495.8	497.3	500.4	505.8	492.8	507.4	515.2	483.8	454.3	419.5
4/13/2021	411.9	401	391.8	398	398.2	424.5	450.3	468.7	479.7	494.3	494.6	491.1	495	495	488.6	502	483.5	486.3	487.2	501.1	496.8	476.2	446.6	429.3
4/14/2021	409	406.4	400.1	399.7	398.7	423.7	469.9	486	504.4	499.3	505.2	500.3	505.9	493.6	492.9	491.6	486.5	488.7	482.4	504.2	505.8	481	447.5	431.7
4/15/2021	419.2	421.7	408.3	418.1	416.4	448.3	495.3	506.7	508.5	507.7	501.4	495.9	502.7	493.6	489	491.5	481.1	475.3	473.7	492.3	498.1	486.6	462.2	433.9
4/16/2021	430.7	425	416.7	430.4	420.5	452.3	482	492.5	501.2	495.3	499.5	490.8	486.4	485.4	480.3	482.5	477	476.9	470.3	479	483.2	459.9	442.7	412
4/17/2021	411.4	398.8	383.6	388	386.1	392.1	394.4	412.7	420	431.5	439.4	432.5	435.4	434.1	426.1	421.8	425.1	423	431.7	442.4	436.4	423.6	408.7	392.8
4/18/2021	373.4	376.5	370.7	368.3	374.8	383.3	392.7	404.3	409.3	408.7	408.4	404.6	411.9	413.9	419.7	424.8	429.4	442.2	440	457.5	441.8	429.6	406.4	388.6
4/19/2021	390.5	377.2	388.6	391.1	410.3	452.2	489	497.3	503.3	506.6	507.6	507.1	490.5	492.3	485.8	501.2	507.1	500.2	507.7	512.3	514.7	493.1	458.7	434.1
4/20/2021	416.8	408.7	413.1	410.3	424.4	444.8	485.1	505	501.4	511.3	496	498.9	504.9	501.5	503.1	502.2	488	491.9	508	530	535	530.7	510.9	487.6
4/21/2021	474	471.5	473.2	473.9	488.8	476.3	532.6	558.4	558.8	548.1	540.3	537.8	526.3	521.9	506.5	508.6	500.1	503.7	519.8	516.2	530.2	517.2	498.5	470.6
4/22/2021	452.5	450.4	452.8	456.5	467.7	500.9	526.5	543	534.7	532.2	519.9	509.2	512.2	505.2	498.4	489.3	488	478.3	486.1	498.9	512.5	496.8	464.7	441.1
4/23/2021	434.5	429.3	425.8	421.9	430.3	450.6	484.4	498.6	507.9	501.4	503.4	498.1	496.3	494.7	489.1	473.8	471.4	457.4	462.5	475.5	482.4	467.1	452.1	423.1
4/24/2021	403.3	396.8	388.8	384.3	381.6	388.1	387.9	413.4	433.5	444.2	458.8	457.9	461	450.6	456.8	448.1	438.2	447.3	444.6	447.3	460.3	436.7	424	399
4/25/2021	388.8	385.5	379.5	378.4	377	389.5	383.8	406.7	409.5	418.9	417.7	423.2	415.6	419.2	419.2	426.9	438	451.9	448.7	451.5	465.4	439.3	414.6	389.1
4/26/2021	373.4	375.4	371.8	386	404.8	429.7	471.8	494.4	501.7	507.4	500	513.6	522.2	532.9	533.9	543.2	537.9	537.8	541.6	540.9	546.9	516.5	488.7	452.8
4/27/2021	438.9	430.8	423.5	410.5	393.9	423.4	470.4	498.9	534.8	535.5	540.9	550.6	561.6	575	579.8	596.7	591	589.2	586.3	596.5	611.2	575.2	539.9	507.9
4/28/2021	491.8	468.7	457	456.7	456.7	467.9	507.4	534.3	549.1	570	591.5	601.5	614.6	616.2	604.8	610.4	630.5	594.7	597.6	597.7	588.2	573.8	534.5	494.6
4/29/2021	485.4	466.9	467.6	470.5	477.8	474.8	511.7	539.2	541	565.5	576	568.7	579.7	578.6	570.2	559.8	548.5	532.2	526.6	523.3	532.3	506.7	473.1	438.3
4/30/2021	430.7	421.7	408.6	414.8	405.2	423.4	447.1	480.5	499.3	506.6	516.5	523.9	531.4	538.7	543	544.4	542.1	546.4	527.8	517.1	525.5	499.3	468.5	471.9
5/1/2021	495	485.2	471.4	471.7	466.7	473.5	472.7	478.9	496.3	496.5	508.9	503.3	513.7	517.1	524.3	544.3	554.6	565.6	560.4	557.5	558.5	536	518.2	488.9
5/2/2021	470.2	459	454.6	449.3	444.2	448.6	445	462.6	476.9	503.5	510.9	522	524.2	531.9	534.1	536.3	543.4	547.8	554.1	558	547.2	537.3	514.5	489.1
5/3/2021	479.8	466.4	472.4	475.7	486.8	520.5	555.3	589.8	604.7	618.6	621.8	627.8	631	641.7	657.9	673	678.5	692.8	683.4	687.1	689	662.3	623.1	580
5/4/2021	569.8	547.7	547.3	544.6	539	555.2	583.5	610.5	610.6	633.2	635.3	653.4	652.8	659.1	661.9	666.5	649.2	639.8	637.4	618.8	619.8	595.2	569.6	536.5
5/5/2021	521.1	509	500.4	495	505.4	521.4	553.7	568.8	590	591.5	598.5	598	599.8	600.1	591.8	601.9	594.4	593.8	581.2	589.5	608	572.9	549.1	517.1
5/6/2021	503.8	494.1	496.8	497.2	502.5	525.9	542.8	574.2	576.3	583.9	591.3	595.5	595.6	599	608.4	602	579.3	584.6	581.1	584.8	590.3	573.9	548	515.2
5/7/2021	503.4	499.9	496.5	492.5	500.7	520.4	548.7	564.6	567.6	570.6	572.4	573.2	574.2	579.2	571.2	580.2	571.8	570.7	562.2	573.6	586.2	567.1	539.1	508.4
5/8/2021	493.5	483.1	467.3	467	465.5	460.9	462.8	473.2	491.4	491.3	504	501.8	503.4	493.2	498.5	511.1	501.8	504.7	509.5	507.8	517	506.1	490.6	470.8
5/9/2021	447	441.5	439.7	440.1	433.6	439	454.5	474.5	489.1	507.3	505.1	523.9	519.4	518.4	502.6	508	499.9	508.2	516	529.2	523.7	521.8	496.9	475.6
5/10/2021	467.7	462.4	469	472.8	483.6	518.5	550.4	576.2	590.6	589.1	600.8	585.7	602.6	599.6	598.5	602.3	603	588.9	590.3	596.7	613.8	577.1	552.5	520.5
5/11/2021	510.4	501.6	500.1	495.9	514.9	537.9	571.5	586.8	600.3	605.5	608.1	603.2	604.4	611.7	605.3	605.4	601	598.7	592.3	597.8	605.7	587.1	549.8	527.6
5/12/2021	505.7	506	506.9	502.5	504.9	531	564.8	583	584.6	592.3	597.3	590	590.2	593	588.8	586.3	582.7	577.3	585	584.5	594.9	577.3	545.7	518.4
5/13/2021	498.1	494.5	490.1	494.6	509.5	522.5	558.8	576.6	581.4	586.6	587.8	586.5	590.7	594.6	599.7	589.4	599.2	585.5	590.8	587.3	595.8	575	551	519.9
5/14/2021	501.4	491.7	488.8	492.4	502.8	517.6	552.1	565.3	581.1	591	598.8	601.4	595	609.2	597.5	601.6	597	603.2	594.7	587.3	594.6	570.3	549	498.8
5/15/2021	500.8	490.7	483.4	478.6	482.9	489	487.3	496.4	506.8	523	524.7	522.5	533.2	541.1	530.7	537.1	527.3	542.7	536.7	534.6	536.7	521.1	498.6	482.3
5/16/2021	465.4	453.9	446.1	448.2	448.1	445.4	452.9	468.7	483	504.5	509.2	516.9	528.7	536.7	547.7	567.1	583.9	591.5	593.4	589.4	600.7	578.6	546.3	514.4
5/17/2021	497.7	490.5	481.5	485.1	490.7	517.7	560.7	584.5	611.8	613.7	633.1	651.3	665.9	680.4	679.4	680	661.6	642.8	643.8	652.1	643.8	623.7	583.5	549.8
5/18/2021	532	519.5	523.8	508.9	520	531	619.9	604.8	616	636	647.3	664.4	682.3	689.3	702.4	693.2	684.9	664.1	669.8	661.4	672.6	653.5	622.4	579.9
5/19/2021	559.7	543.6	539.7	537.7	535.7	557.6	601.5	618	636	638	664.2	666	688.8	684.8	720.1	723.2	736.1	722.2	717.8	709.5	716.4	700.1	649.4	607.8
5/20/2021	593.1	567.9	550.3	542.3	546.1	555.8	591.6	628	663.4	689.8	706.7	745.4	759.5	799	806.9	815.9	804.6	783.1	765	737.3	728.5	702.5	644.6	602.3
5/21/2021	563.6	545	523	523.3	520.4	533.4	553.5	597.6	628	662.4	686.3	707.8	720.1	749.2	753.7	749.5	780.6	740.7	709.8	691.4	676.7	641.9	607.5	560
5/22/2021	524.1	513.3	494.5	490.2	475	483.7	481.2	524.2	558.2	598.2	635.1	672.8	703.7	727.7	748.4	754.7	747.4	747.7	726.5	702.6	690.3	668.7	611.2	580.3
5/23/2021	543.3	518.5	498.6	486.8	471.7	458.1	462.4	500.8	535.9	573.8	617.7	663	689.3	725.7	731.8	750.3	766.5	769.6	754.8	735.2	707.8	675.1	620.3	574
5/24/2021	539.7	515.7	502.4	497.7	500.1	523.1	561.9	592.4	645.9	680.4	738.8	777.3	798.7	833.4	847.2	863.3	864.1	866.4	829.5	806.7	774.1	743.7	677.8	620.7
5/25/2021	586.6	563.2	544.8	535.4	534.7	548.1	575.2	623.6	668.9	718.6	774.4	802	837.8	859	871.7	883.7	884.1	875	846.1	815.3	799.1	771.7	701	662.5
5/26/2021	616.1	594	577.5	565.1	561	571.8	610.7	637.8	651.8	653.2	675.9	668.3	674.9	692.5	704.4	706.4	722.9	733.4	727	720.2	715.5	690.2	642.5	588.7

Dt	Hour1	Hour2	Hour3	Hour4	Hour5	Hour6	Hour7	Hour8	Hour9	Hour10	Hour11	Hour12	Hour13	Hour14	Hour15	Hour16	Hour17	Hour18	Hour19	Hour20	Hour21	Hour22	Hour23	Hour24
5/27/2021	563.5	545.6	532.6	523.9	526.5	537.4	574.5	601.8	633.6	657.3	700.3	730.5	762	787.6	808.1	826.8	817.2	806.3	775.1	758.5	721.7	684.1	640.4	599.9
5/28/2021	572	547.5	544.2	532.1	539	547.5	574.6	607.2	628.5	642.3	622.3	677.7	687	694.1	683.1	611.3	505.5	508.8	494.3	545.5	512.7	499.8	521.3	460.2
5/29/2021	404.9	395.5	388.3	387.3	375.5	378.3	366.4	377.5	387.3	401.5	430.2	412.6	419.4	412.9	408.6	406.8	415.1	411.1	415.8	412.2	425.3	418.1	394.3	379.1
5/30/2021	362.4	356.6	358.1	346.9	348.9	347	352.5	363.2	377.6	386.4	395.6	396.9	402.3	402.4	409	417.4	424.4	430.7	429.6	416.7	429.6	419.7	390.2	377.7
5/31/2021	358.9	349.6	347.8	338.9	341.7	340.5	351.4	360.5	382.4	399.5	411.5	425.3	441.3	445.8	461.3	481.4	491.7	507.1	492.6	496.4	485	469.4	437.9	409.1
6/1/2021	393.2	386.8	378	381.7	388.4	414.3	448.1	486	506.1	520.8	541.7	553.4	554.4	563.6	556.9	557.7	545.7	537.3	541.2	548.6	541.1	524.3	495.3	467.4
6/2/2021	448.7	436.9	433.8	424.7	429.8	451.2	475.7	507.9	527.8	542.6	559	560.9	568.9	579.1	581.7	596.3	589.1	591.8	589.5	588.1	588.8	573.6	532.7	503.7
6/3/2021	475.3	466.2	454.7	451.9	451.6	464.4	495.2	517.5	546.4	559	563.6	573	595.9	591	585.8	601.8	607.6	611.7	613.6	595	599.9	581.1	534.4	498
6/4/2021	473.4	456.8	440.1	440.1	438.5	447.7	469.7	518.1	552.8	583.3	625.6	646.2	676.9	706.8	722.2	741.4	742.9	729	717.2	685.3	666.4	632.1	584.1	539.4
6/5/2021	502.8	490.5	463.8	451.6	444.6	430.8	435.2	465.1	492.7	546.9	587.2	622.8	647.3	676.2	695.3	712.2	723.2	719.6	708	677.6	646.1	618.6	569.9	531.7
6/6/2021	493.6	465.6	446	447.7	444.2	436.7	442.2	458.9	496.7	539.3	591.6	633.9	664.6	678.9	653.5	640.2	640.2	634.2	619	609.5	605.9	593.5	560.2	517.4
6/7/2021	495.6	471.3	462.7	469.9	476.4	495.3	540.7	576.2	620	646.1	677.4	692.2	716.4	740	761.9	771	784.9	779.9	766	742.4	724.3	697.7	646.6	596.1
6/8/2021	568.4	540.1	524.5	519.9	520.4	531.4	567.1	606.7	617.9	634.5	660.1	666.1	684.7	686	706.4	716	716.3	708.8	701.3	688	695.5	669.1	635.3	586.2
6/9/2021	564.2	542.1	523.6	517.1	521.5	533.2	564.5	592.1	619.5	640.8	664.7	692.4	732.7	758.3	762.3	747.9	731.6	725.2	736	721.4	713.5	689.4	644.4	588.9
6/10/2021	556.6	536.2	519.4	511.8	521.4	530.7	559.6	612.8	632.1	678.9	715.1	743.3	758.3	752.6	726.7	714.3	702.4	690	687.3	683.4	661.6	650.2	611.9	562.6
6/11/2021	537.2	511.5	505.8	498.3	497.6	511.8	538	591.2	625.3	679.5	735.5	764.4	781	826.6	853.7	866	868.1	866.5	840	823.6	787.9	750.2	686.4	636.9
6/12/2021	581.4	559.1	530.5	514.1	508.7	495.6	512.1	562.6	631.4	689	742.6	793.2	823.8	856.3	869.9	882.9	885.6	871.1	863.8	831.4	814.8	760.2	705.7	658.8
6/13/2021	603.1	573.4	548.7	521	506.6	486.9	492	525.3	574.7	630.7	675.7	712.6	762.7	790.5	799.6	825.2	817.1	820.3	806.3	772.5	731.9	702.4	638.9	582.3
6/14/2021	537	497.2	485.2	463.6	466.3	479.8	519.8	575.5	626.5	677.8	718.2	767.2	807.9	854.7	883.8	902.9	912.5	899.6	870.5	828.6	777.5	739	669.2	603.6
6/15/2021	560.3	517.9	497	480.5	473.2	479.9	495.2	557.1	586	624.4	656.1	686.4	709.9	734.4	754.6	764.1	754.7	760.9	745.8	719.6	693.8	660.5	607.4	558.5
6/16/2021	516.6	497.5	483.7	478.2	475	478.5	501.9	543.9	577.8	620.1	640.5	680	704.9	748.2	773.1	798.5	798.5	801.7	783.6	746.6	718.7	672.1	617.2	551.6
6/17/2021	511.4	501.2	477.8	472.3	468.4	478.2	508	564.6	596.1	652.3	686.2	727.9	762.9	796.4	829.8	853.9	855	846.1	839	803.5	767.9	732.6	673.2	632.1
6/18/2021	587	571.2	550.2	540.9	546	550.8	579.6	635.4	692.9	754.8	805	854.1	884.1	918.9	935	953.8	940.4	929.5	899.5	860.4	844.4	796.1	737.7	685
6/19/2021	644	613.8	584.1	561.7	538.1	515.3	516.9	516.9	539.3	568.5	613.2	630.7	664.9	709.9	748.5	771.2	781.1	790.2	765.7	727	714.2	676.8	636.3	602.2
6/20/2021	557	536.6	515.1	499.2	488.7	485.2	486.9	535.5	586.3	639.7	690.7	722.1	761.2	785.7	812.1	818.7	822.6	824	801.7	777.5	761.3	739.9	685.9	645.3
6/21/2021	609.2	594.5	587	575.5	600.5	600.8	631.2	673.3	683.3	697.6	707.9	712.1	712	704.1	684.6	651	643.5	631.6	610.8	598.6	586.7	570.3	534.7	503.7
6/22/2021	474.3	462.1	449.6	437.5	433.8	456.4	474.8	511.1	541.5	568.8	577.5	591	601.5	615.3	633.2	652.1	656.8	653.2	655.8	667.8	693.8	664.8	624.8	586.1
6/23/2021	555.6	546.8	532.5	537.6	530.8	541.6	558	592.7	619.9	647.1	670	687.1	714.8	735.6	762.2	779.1	788	794.5	780.4	758.5	735.6	706.4	658.3	616.5
6/24/2021	588.7	566.2	552.8	550.6	545.4	553.9	586.7	619	674.8	701	750.9	786.8	829.1	863	885.8	882.1	841.7	819.2	840.2	790.9	816.2	796.7	748.7	702.8
6/25/2021	683.2	646.6	644.8	639.9	646.8	664.9	682	711.4	751.9	780.4	813.4	851	861.5	879.1	890.3	891.7	888.5	866.3	848.6	851.8	822.5	812.4	770.1	719.1
6/26/2021	677.5	658.5	642.3	628.1	615.2	610.8	613.6	659	698.7	747.1	788.9	812.6	828.3	844.9	868.9	876.1	896.3	894.8	879.9	850.2	782.2	744.2	696.6	643.4
6/27/2021	598.4	588.3	583.5	524.1	515.3	500.9	495.3	530.1	589	640.7	694.5	734.5	771.1	790.7	811.6	805.5	831.6	832.7	803.8	801.9	769.8	732.8	676.2	627.6
6/28/2021	587.3	558.7	542.7	525.2	539.6	545.8	591	659.1	724.3	774.6	825.6	861.9	878	912.6	929.1	940.8	949.1	941.8	923	896.4	858.8	821.2	760.2	709.1
6/29/2021	668.9	631.3	606.1	586.9	596.1	599.1	623.9	691.7	747.4	814.2	871.3	904.1	941.8	938.8	926.5	916.9	892.3	868.3	847.3	833.9	820.8	782.7	727	670.6
6/30/2021	635.6	605.2	589.9	567.9	571.3	580.6	600.7	657.2	681.1	744.8	781.6	833.7	860.9	895	909.8	900.3	854.5	806.4	780.5	745.9	729.8	705.4	661.9	618
7/1/2021	593.9	565.1	548.8	542.2	542.1	559.1	591.1	614.1	652	656.5	656.9	664.5	680.7	702.7	721.6	746.6	767.3	780.4	775	746.4	727.7	696.6	654.6	605.8
7/2/2021	563.7	517.7	495.7	474.7	463.2	472.1	486.4	520.4	540.9	556.3	576.7	605.4	640.7	675.6	688.2	701.8	702.9	694.6	655.8	630.1	603.9	585.9	536	500.3
7/3/2021	461.4	437.6	429.7	411.8	409.7	399.5	402.1	414.5	443.5	475.2	505.5	524.5	558.1	577.1	611.1	620	635.5	633.9	606.8	585.8	558.6	535.1	499.2	473.2
7/4/2021	426.9	414.6	398.1	390.6	386.1	379.5	385.7	408	451.4	480.6	528.8	572.8	614.4	644.6	670.6	697.5	711.3	704.8	690.8	650	613.3	580.5	547.4	525.4
7/5/2021	486.8	451.9	429.4	410.9	417.4	410.1	424.6	462	509.1	572.7	619.7	676	704.8	738.2	771.1	786.4	800.2	808.2	784.1	762.8	737.8	700	637	582
7/6/2021	567.5	538.5	512.5	507.4	504	530.5	561.6	624.6	676.9	736.1	788.5	832.6	853.6	888.3	906.4	911.9	915.9	904.4	880.6	848	811.5	772.8	716.5	660.4
7/7/2021	622.1	591.1	577	560	552.4	561.1	587.9	640	692.1	733.3	784.8	814.9	838.8	865.5	879.5	889.7	892	876.9	862.8	824.2	795.9	760.5	701.7	647.7
7/8/2021	615.7	582.1	562	548.4	546.4	569.3	585.1	635.3	667.8	705.6	757	811.7	851.2	887.5	900.8	821	780.7	765.5	748.8	731.3	722.2	694.4	649.4	603.6
7/9/2021	569.4	544.9	529.1	506.9	506	513.5	533.2	574.3	608.4	653.3	678.8	713	730	756.7	785	801.1	801	783.3	757.4	731.4	713	676.9	635.8	583.6
7/10/2021	548.4	526	509.9	499.3	487.6	480.3	474.7	478.4	502.9	532.3	582.5	628.7	663	686.8	701.3	726.6	684.5	644	609.8	599	572.3	552	517.6	487.3
7/11/2021	466.2	443.7	433.5	426	429.2	423.2	428.5	456.7	478.8	507.5	531.5	546	558.7	560.3	569.6	586.6	626.1	648.4	647.8	634.1	625.1	602.8	563.9	526.3
7/12/2021	499.6	493.9	478.7	477.8	491.3	533.9	577	620	656	700.9	743.9	780.9	798.1	810.6	789.2	818.1	813.2	797.7	795.9	761.7	749.4	726	687.1	630.9
7/13/2021	596.3	580.7	568	558.8	560.7	580.3	607.7	646.6	667.1	691.4	718.2	756.3	800.7	836.7	855	871.3	863.4	863.1	850.3	825.5	792.6	766.7	708.1	664
7/14/2021	600.9	579.1	555.3	557.2	566.3	581	605.1	634.3	651.1	664.7	733.4	773.3	826.3	848.7	870.1	885.5	880.1	872.4	847.4	813.1	791.8	742.7	692.3	644
7/15/2021	607.2	578.9	555.1	548.8	539.3	560	584	639.2	686	733.7	796.1	837.2	866	875.8	917.4	925.9	933.1	911.5	883.1	844.3	831.7	793	731.5	694.4
7/16/2021	651.5	613.1	578.1	568.1	558.5	571.5	595.4	624.9	655.4	704.2	762.7	789.8	827.2	843.9	870.9	868.9	841.5	800.6	762.4	715.7	691.1	665.3	623.9	588.9
7/17/2021	556.7	534.1	527.5	513.4	507.4	508.4	499.5	518.5	542.8	581.8	605.3	641.4	666.9	694.3	720.7	735.6	757.6	747	733.8	693.2	675.4	640.2	601	552.8
7/18/2021	533.2	498	484.3	474.8	470	469.4	483	516.7	551.4	587.8	613.5	637.2	673	683.6	684.8	671	629.5	608.8	605	591.4	590.4	580.6	546.2	524.6
7/19/2021	490.8	477.6	457.9	459.4	460.3	485.4	518.7	559.9	607.6	643.4	683.9	716.1	754.3	775.8	805.6	811.2	809.7	797.5	782.3	740.3	721.5	665.9	624.2	578.2
7/20/2021	542	507.6	493.1	490	481.8	504.7	528	568.1	597	648.1	686.5	733.4	766.6	789.2	810.2	824.9	825.5	809.9	788.4	753	731.7	701.9	646.2	599.2
7/21/2021	565.1	537.8	522.9	510.1	503	532.7	559.1	601.9	639.8	688.2	728.8	785.2	816	841.9	856.6	864.8	866.8	839.8	817.4	769.2	735.5	703.8	644.3	600.4
7/22/2021	558.1	526.7	503.1	496.1	490.2	502.9	534.3	573.3	598.6	643.1	696.6	741.6	774.3	784.2	807.4	817.1	803.7	802.6	777.6	750.7	726.6	692.9	635.1	592
7/23/2021	550.3	519.7	497.2	490.7	479.7	498	512.8	555.3	597.9	643.3	693.5	739	776.7	803.6	813.9	826.8	820.8	808.6	786.3	750.2	718.7	690.3	631.6	587.9
7/24/2021	546	520.7	500.9	487.6	485.6	481	495.8	522.1	567.3	618.8	674.3	727.6	766.9	810.2	823.8	846.5	860.8	868.5	836	797	771.1	734.6	695.1	641.9
7/25/2021	601.8	567.4	533.3	518.4	508.6	512.9	515.6	518.9	551	576.9	613.7	648.5	686.7	723	771.5	793.4	822.2	823.7	810.7	771.9	757.5	722.3	672.4	621.7
7/26/2021	591.2	565.7	541.9	532.8	534.9	554.1	585.2	632.3	708.6	751.5	804.6	839.7	867.9	901.5	918.4	921.7	925.6	902.9	890.6	848.3	809.7	775.5	704.8	649.2
7/27/2021	603.9	569.6	497.8	537.7	517.6	543.9	551	599.6	639.1	708.2	774.9	828.6	863	902.6	913.7	914.8	921.1	897	875.7	828.1	799.7	748	684	649.3
7/28/2021	602.7	566.4	542.9	528.8	526.4	533	562.7	603.8	647.4	695.7	759.3	808.6	853.8	875.6	916.8	927.9	926.2	912.9	880.3	851.8	816.3	770.1	710.6	656.2
7/29/2021	619.3	591.8	563.1	548.3	549.8	556.6	585.6	629.3	657.6	711.7	767.6	813.2	865.7	896.4	934.2	938.7	936.6	917.1	902.1	866.8	841.7	809.4	770.8	716.3
7/30/2021	682.1	648.7	609.1	589.4	577.1	587.4	597.4	626.3	666.8	714.9	760.2	791.7	819.5	838.5	849.9	847.3	825.6	786.8	752.8	720.2	692.6	667.5	617.8	571.4
7/31/2021	531	500.1	477.7	467.9	455.6	445.5	434.4	459	473.9	520.6	539.6	545.4	557.5	547.8	562.2	559.5	556.8	564.3	560	548.1	545.6	533.8	500.9	474.9
8/1/2021	455.7	432.8	425.1	418.1	419.2	412.1	407.8	425	464.1	488.6	531.7	568.8	595.6	628.6	657.9	677.4	695.2	687.4	672.4	645.2	623.8	585.6	555.4	507.8
8/2/2021	481.1	455	434.7	433.2	445	461	483.7	521.6	548.7	586.2	611.7	647.4	671.1	690.5	709.9	734.3	727.7	731.1	712.6	679.6	667.4	631.3	582.5	535.6
8/3/2021	517.2	481.2	475	463.9	467.9	481.4	507.6	534.5	564.2	597.9	636.4	670.2	695.3	685.1	711.8	717.1	717.7	722.1	701.8	687.7	663.7	627.6	580.1	536.8
8/4/2021	515.2	494.6	478.6	475.8	467.8	486	516	549	583.1	627.7	662.8	698.4	722.9	728.5	748.2	769.3	771.6	754.4	734.5	717.6	684.2	647.5	591.5	555.9
8/5/2021	512.4	498.9	480.3	470.3	469.8	494.7	510.5	549.1	594.4	636.6	672.2	709.6	731.6	776.9	786.7	810.1	804.7	797.2	769.7	742.2	720.5	672.4	629.9	574.4
8/6/2021	541.4	518.4	498.8	489.2	493.4	498	528.6	559.5	597.3	637.8	672.1	710.1	738.7	782.5	801.5	813.9	823.9	815.6	783.4	744.5	727.7	691.2	645.1	600.2
8/7/2021	552.1	532.2	511.2	505.3	485	489.4	477.6	494.6	538.8	593.3	643.1	685.6	732	760.6	782.2	797.8	807.1	796.2	778	737.9	714.8	668.6	622.3	579.7

Dt	Hour1	Hour2	Hour3	Hour4	Hour5	Hour6	Hour7	Hour8	Hour9	Hour10	Hour11	Hour12	Hour13	Hour14	Hour15	Hour16	Hour17	Hour18	Hour19	Hour20	Hour21	Hour22	Hour23	Hour24
8/8/2021	550.7	509.9	488.1	476.4	471.9	470.8	464.3	495	528.5	576.9	629.9	679.1	733	765.3	793.2	808.6	829.5	814	789.2	768.2	748.6	706.2	648.1	589.9
8/9/2021	553.5	532.2	523.7	512.2	517.3	543	581.4	604.4	625	627.4	666.9	701	711.4	720	754.7	789.8	813.9	827.5	819.2	802.1	789.1	748	701.5	662.7
8/10/2021	635.1	612.3	601.8	589.4	582.9	597.6	629.5	673.1	725.8	771.1	835.2	878.5	934.2	965.2	982	993.6	978.5	954.4	870.7	821.3	796.3	750.9	693	654.7
8/11/2021	618.1	597.4	596.8	583.4	594.7	612.1	656.1	703.4	727.7	776.8	830.5	885.2	921.1	958.2	976.3	985.9	977	970.7	944.8	911	884.6	828.2	772.3	723.4
8/12/2021	688.5	658.3	644.9	627.3	625.7	633.6	659.1	701.2	737.1	797.8	843.8	898.9	939.1	980.6	998.6	1001.2	994.1	975.4	948.5	902	844.6	778.5	724.6	671.7
8/13/2021	653.9	610.5	593.1	576.4	572.7	583.5	607.1	638.8	661.8	697.6	736.2	778.1	828.7	858.3	879.2	892.2	893.9	878.6	847.3	814.4	794.5	757.2	705.2	662.8
8/14/2021	622.1	591	574.4	551.6	543.1	551.8	535.8	544.3	568.2	589.4	610.9	629.3	633.4	644.1	675.1	706.4	695.9	705.7	685.4	648.7	633.1	610.1	571.2	543
8/15/2021	508.9	491.5	479	532.4	531.7	526.5	530	543.1	571.7	613.3	633.1	666.1	700.8	727.4	739.4	727.1	728.3	718.4	717.8	706.1	706.5	680.2	640.9	606.8
8/16/2021	582.8	567.1	554.5	556.6	568.3	597.1	638.1	672	684	723.5	760.1	783.3	827.2	852.5	884.2	911.1	915.7	906.5	892.8	863.4	836.3	786.6	740.5	696.4
8/17/2021	675.6	630	619.4	597.1	605.7	611.4	651.2	680	727.3	769.3	808.2	819.6	873.6	898	913.4	901.8	883.3	867.7	853.6	826.4	810.8	753.2	700.3	650.8
8/18/2021	616.4	575.1	562.3	550.1	551.6	565.2	603.2	637.5	665	713	761.7	791.3	811.7	820.1	826.2	832	833.1	810.9	790.7	775.3	769.2	711.6	669.7	621
8/19/2021	583.5	573.6	546.1	547.1	548.1	571.6	608.1	633.9	667.6	701.8	751.7	777.2	822.1	845.2	862	883.6	873.7	859.2	831.5	815.8	796	747.1	697.7	645.3
8/20/2021	601.5	586.4	561.4	555	550.9	568.3	593.1	633.3	674.7	723.8	772	808.4	846.3	875	887.7	909	904.2	892.7	857	831.8	796.4	750.3	707.7	642.3
8/21/2021	607.5	582.6	560	550	532	528.6	524.8	555	580.4	624.2	681.3	734.6	775.8	794.1	778.8	753.6	711.4	678	654.4	636.1	637.5	600.5	579.9	533.2
8/22/2021	505.4	479	473.6	460.5	471.5	465.1	478.8	496.1	547.4	597.9	657.5	714.5	756.7	786.9	802.1	823.8	827.6	821.8	809.5	777.2	754.7	712.4	666.6	609.6
8/23/2021	575.2	550	534.4	528.3	527.4	557.1	593.4	627.1	688.5	729.5	789.6	834.3	872.2	904.8	923.7	947.7	937.2	925.9	884.5	852.7	817.1	772.5	707.7	663.1
8/24/2021	629.6	607.6	589.1	574.4	582.3	593.5	624.9	659.1	708.8	764.1	817.7	874.7	915.5	944.1	967.4	985	972.6	964	930.9	901.7	878.8	819.2	763.4	709.2
8/25/2021	668.2	638.8	615.1	601.5	598	606.5	642.1	681.3	723	777.9	834.7	895.1	929.1	962.7	986.6	994.8	993.4	977	946.6	918.1	880.5	832.1	775.9	714
8/26/2021	681.4	656	620.6	616.5	604.5	626.8	653	685.3	715.2	765.2	824.2	881	927.2	963.6	979.6	1002.6	999.8	981.1	948.5	932.8	890.6	840.8	788.8	733.5
8/27/2021	698.5	667.4	638.8	628.5	621.2	631.8	654.6	687.4	720.1	777.3	846.8	889.6	942.5	965.2	907.1	829.7	785.6	763.9	747.9	733.8	719.9	700.1	654.6	625.3
8/28/2021	580.7	566.8	543.8	543.7	524	524.9	514	541.7	594.2	658.9	711.6	771.1	815.9	832.4	858.3	873.6	866.9	867.8	838.3	797	761.8	712.3	660.1	612.7
8/29/2021	580.6	554	522.5	506.4	500.7	494.4	495.4	522.8	575.8	635.3	700.3	756.6	796.6	835.2	848.3	876.9	890.4	885.3	852.4	823.5	797.1	747.8	687.1	653.8
8/30/2021	612.3	589.9	564.6	557.3	557.9	596.2	633.1	672.2	708.7	742.6	753	783.3	813.8	826	853.9	834.1	810.1	787.6	754.1	730.1	714.4	673.6	632.7	593.3
8/31/2021	572.8	550.5	536.4	531.4	535.4	551.2	582.4	605.2	621.2	649.6	668.8	699.6	720.4	740.6	763	760.6	772.5	760.4	735.3	732.2	712.7	666.8	625.6	576.2
9/1/2021	551.1	532	518.5	509.7	514	531	570.8	600.5	609.3	631.5	662.6	701	728.9	763.6	761.5	801.1	791.1	768.4	744.5	706.9	681.5	635.3	578	527
9/2/2021	502.2	484.1	473.5	463	460.5	484.4	507.1	535.5	565.2	591.4	620.6	642.1	663	692	718	741.7	741.2	728.3	698.1	688.1	662.1	617.8	569.3	525.3
9/3/2021	500.7	485.3	467.3	454.1	453.2	469.1	494	520.7	544.4	573.2	605.9	627.8	656.6	689.4	704.8	725.8	719.5	689.8	658.2	643.1	626	589.7	547.5	503.3
9/4/2021	482.8	463.7	450.4	444.3	431.3	423.3	420	441.1	464.7	503.6	539.6	552.3	568.7	573.3	573.1	580.5	577.6	571	578.1	576.4	572.1	553.6	534.2	501.8
9/5/2021	480.6	458.5	453.9	443.6	446.7	445.8	453.4	455.8	472.7	508.3	520	537.1	560.5	579.1	602.1	613.6	637.7	624.3	601.2	567.7	544.6	514.4	487.3	449.1
9/6/2021	426.2	404	392.3	391.1	384.9	384.6	381.1	394.6	416.9	465.4	508.5	548.4	586.4	626.3	651.3	684.3	706.8	701.3	675.8	645.4	616.7	579.8	527.3	487.4
9/7/2021	457.7	442.1	434.3	427.6	430.6	446.3	499.5	525	572.1	607.4	650.9	690.9	722.3	743	781.9	796.6	804	792.2	750	733.2	696.8	657.7	605.9	559.1
9/8/2021	538	516.8	512.4	497.4	497.2	511.9	552.6	572.9	585.8	618.1	649.3	680.1	700.8	718.9	742.2	750.8	757.9	738.9	704.3	676.7	649.8	603	557.4	510.2
9/9/2021	486.9	475.1	453.3	449.3	450.9	469.1	497.2	513	544.4	564.2	598.9	621.6	646.5	672.1	695.7	695.9	704.8	694.5	669.9	659.3	624.8	591.1	551.2	507.7
9/10/2021	492.4	475.7	463	454.2	460.1	465.6	504.1	520.8	546.9	580.2	594.6	633.1	660.3	689.3	704.9	721.5	729.4	711.4	686.7	656.9	632.1	595.2	555.6	517.8
9/11/2021	488.4	468.7	456	451.2	436.5	436.1	439.8	450.1	466.5	504.6	537.7	577.6	603.1	638.4	665.6	686.2	692.6	686.1	652.1	636.6	621.2	585.3	553.1	518.6
9/12/2021	484.5	470.2	451.3	437	432.7	434	437.3	449.2	476.3	532.8	576	620.2	658.1	688.5	722.2	735.2	738.1	740.7	704.9	692.2	668.8	627.6	585.5	546.9
9/13/2021	507.3	499.9	471.5	478.4	484.3	507.8	553	582.6	605.9	654.1	712.9	763.9	799.9	832.3	856.9	875.2	878.2	860	835.3	803.8	771.5	726.5	676.6	637.7
9/14/2021	603.4	576.6	563.4	550.1	550.5	565	594.7	619.3	660.1	697	754.8	779.5	819.1	848.2	867.8	881.8	880.7	861.7	829.6	816.3	777.4	726.5	680.6	632.3
9/15/2021	599.4	574.6	554.6	542.5	543.1	554.4	607.8	620.6	635.6	660.7	693.8	723.2	753.1	746.4	754.3	777.7	769.7	754	719.9	696.5	666.5	632.6	577.6	537.1
9/16/2021	515	506.1	482	491.6	479.1	502.2	539	555.6	581.8	597.1	630.1	664.3	713.9	743.9	775.4	793	793.3	785.7	758.6	740.7	712.4	671.4	613.3	575.7
9/17/2021	540	527.6	513.9	505.7	503.8	522.7	548.4	566.1	609.6	642.2	684.6	718.6	760.1	778.8	789.3	784.9	778.9	762.1	734.9	711.3	679	650.6	610.3	572
9/18/2021	540.4	525.8	499.3	496.3	488.2	499.5	510.8	517.2	548	595.3	644.2	695.6	722.3	768.2	784.7	800.8	780.7	748.8	739.1	706.8	680.5	651.4	608.7	575.6
9/19/2021	534.2	509.8	497.1	473.8	472.6	466.7	476.4	489.8	531.2	561.7	587.6	612.5	603.4	598.5	590.1	601	608.4	620.9	616.9	621.7	604.7	583.9	556	524.7
9/20/2021	502.4	496.7	484.6	490.3	511.6	535	577	611.4	629.6	641.7	663.9	680.3	719.6	749.9	770.9	786.4	787.6	764.7	736.8	721.6	708.9	654.6	598.4	566.9
9/21/2021	527.1	507.4	488.3	487.1	487.3	506	549.8	569.4	592.3	606	616.7	636.2	651.4	690	698.3	704.9	676.5	670.2	644.5	626.7	605.5	544.5	536.3	493.8
9/22/2021	470.1	459.6	447.8	443.9	446.4	464.2	498.4	514.2	520.6	531.3	529.3	524.1	521	525.8	525.6	517.8	509.7	509.1	519.3	519.3	523.1	498.3	474.6	452.3
9/23/2021	436.2	429.9	416.3	420	424.8	443	473.7	490	499.1	510.5	515.6	522.4	527.4	534.1	540.7	536.2	536.8	530.7	519.7	531	518.2	502.1	472.1	440.9
9/24/2021	429.7	422.4	413.4	412.5	417.8	432.5	464.2	471.9	484.7	495.9	510.2	511.4	529.2	529.4	543.2	548.9	552.3	551.2	532.4	529.7	511.3	495.8	459.8	432.9
9/25/2021	419.2	405	402	400.1	398.2	399.5	418.4	425.3	443.8	449.6	455.4	483.5	489.2	508.5	513.3	536.6	538	537.5	518	515.2	489.4	463.3	436.1	410.5
9/26/2021	398.1	383.9	372	373.1	378.7	364.7	382.8	385.5	407.2	424	445.7	462.1	477.3	494	514.9	540.7	551	550.7	542.5	543.2	522.7	497	462.6	438.2
9/27/2021	420.2	416.9	407.8	411.5	419.1	450.9	486.1	507.5	530.8	551.7	573.4	598.8	633.4	669.8	693.7	710.2	725.5	700.2	683.9	666.9	646.3	605.6	564.6	518
9/28/2021	495.1	474.7	463.1	456.8	454.3	475.3	499.3	524.6	544	572.9	617.8	659.6	691.2	727.6	766.7	786.1	805	785.2	737.7	708.6	680	632.8	583	540.6
9/29/2021	514.1	485.4	476.5	466.7	470.1	490.8	520.4	541	571.3	591.4	643.5	684.7	719.8	755.1	771.8	793.3	789.6	766.1	727.2	707.6	678.4	635.9	583.7	542.6
9/30/2021	510.6	495.6	484.5	491.1	486.9	505	541.8	555.9	579.8	610.8	652.2	694.3	728.7	752.4	780.8	790.7	778.8	753.2	731.2	723.2	693.7	658.1	606.1	563.4
10/1/2021	531.7	518.8	501	492.2	484	500.7	534.2	546.3	561	585.9	645.8	697.9	721.3	744.3	770.3	779.4	785.4	761	737.3	729.4	691.3	658.2	628.9	593.7
10/2/2021	557.7	542.6	530.6	515.4	504.3	515.3	523.7	539.7	555.3	576.2	595.3	604.9	612.9	615.5	616.7	628.2	620.7	620.8	618	621.3	596.4	591.3	558.1	538.9
10/3/2021	515.5	500.4	495.8	492.1	495.9	496.5	512.9	510	544.5	568.5	591.4	616	647.1	667.6	684.2	689.9	682.3	664.7	648.7	640.5	615	584.4	554.1	531.5
10/4/2021	508	493.2	486.2	490.9	501.4	530.1	575.4	603.2	619.5	636.5	664.7	696.2	717.2	738.3	750	768.7	756	735.2	718.5	712.2	684.1	656.6	601.3	571.6
10/5/2021	534.3	521.5	511.8	514.4	504.9	534	587.8	610.7	617.4	628.4	692.7	658.6	719.8	726.7	743.4	750.8	754.5	725.8	736.6	720.1	696.2	661.4	617.2	572.5
10/6/2021	562.7	556.5	542	539.1	529.4	559.8	590.9	619.5	634.3	644	688.1	643.3	684.6	698.7	710.4	716.1	712.9	704.9	701.4	695	677.2	640.7	624.6	576.9
10/7/2021	560.9	551.7	540.1	529.3	509.3	547.8	575.8	607.8	630.9	642.6	653.1	673.1	693	731.7	743	717.6	708.3	687.3	681.3	683.1	662.1	643.7	600.1	569.5
10/8/2021	553.7	544.9	529.5	531	531.7	539.8	583.1	594.4	621.1	641.5	670.1	690.1	715.7	731.7	751.3	758	745.5	729.2	696.8	673.3	654	608.7	588.8	577.3
10/9/2021	586.2	566.2	550.8	545.7	546.3	548	545.9	552.9	558.4	607	642.8	678.7	716.6	735	758.1	776.7	787.6	763.5	739.4	718.6	689.3	671.8	646.1	622.3
10/10/2021	559.1	574.1	576.6	554.2	553.6	556.3	562.1	564	591.8	634	664.1	709.7	743	770.3	800.1	814.8	826.5	822.2	786.4	767.2	736.6	706.7	668.7	632.8
10/11/2021	531.2	514.9	508.8	511.3	516.1	545.7	578.6	601.1	636.2	640.4	683.2	713.5	755.4	764.2	760.5	753.9	728.4	696.8	696.9	689.9	670.1	635.3	562.6	544.6
10/12/2021	525.7	515	503.7	496	493.4	501.7	537.8	556.2	571.8	582.7	589.9	609.3	633.8	650.8	680.4	691.3	692.7	673.1	655.9	641	619.4	584.9	553.2	517.3
10/13/2021	496.2	491.6	480.9	483.1	485.7	509	547.1	571.3	577.6	595	616.9	641.6	651.8	656.4	671	683.9	689.6	675.7	692.7	692.4	678.2	650.3	624.6	584.7
10/14/2021	577.8	552.6	542	537.9	537.5	560.4	598.2	614.4	640.3	659.2	698.2	722.2	750.8	768.2	783.4	779.3	768.8	749.6	747	734.8	716.5	687.6	644	609.8
10/15/2021	590.9	578.8	560.1	557.2	560.3	574.5	612.7	625.6	639.9	659.1	676.1	698.5	709.3	738.4	749.5	724.1	704.8	695.8	686.5	667.4	632.8	593.1	551.2	519.4
10/16/2021	498.3	475.1	476.9	459.3	459	454.1	459.6	458.4	474.2	482.4	493.7	497.3	495.8	498.2	496.4	500.7	505.5	504.3	506.5	511.6	492.6	483	474.6	451.3
10/17/2021	435.1	426.6	430.4	419.7	424.7	418.9	436.1	447.5	452.7	458.9	462.6	467.4	471.9	482.2	487.1	490.9	501.4	508.7	511.4	513	495.2	481.8	458.7	445.1
10/18/2021	433.5	437.3	439.1	449.9	459.3	494	524.8	548.3	562.8	578.1	571.3	585.8	577.5	578.7	592.7	608	612.9	604.4	597.1	598.1	581.4	564.7	530.6	516
10/19/2021	494.9	490	489.9	484.4	491.9	506.6	551.1	563.5	567.1	571.7	574.4	584	595.8	604.5	592.9	600.1	590.5	592.3	601.3	603.8	589.9	569	539.1	519.9

Dt	Hour1	Hour2	Hour3	Hour4	Hour5	Hour6	Hour7	Hour8	Hour9	Hour10	Hour11	Hour12	Hour13	Hour14	Hour15	Hour16	Hour17	Hour18	Hour19	Hour20	Hour21	Hour22	Hour23	Hour24
10/20/2021	504.1	497.1	488.1	493.1	496.1	508.8	548.9	565	576.6	583	587.8	594.8	600.4	611.2	613.9	623.7	619.8	613.7	618.7	615.2	602.3	579.7	547.3	523.3
10/21/2021	504.6	499.5	502.2	497	492.2	517	560.9	579	592.4	601.5	603.8	605.9	606.3	610.7	607.6	606.9	600	589	590.7	593.6	585.7	566.3	536.6	513.1
10/22/2021	496.5	493.3	487.3	491.7	485.9	511.3	549.1	568.4	567.1	577.1	584.8	577.5	586	582	577	583.6	573.1	568.5	579.5	583.9	574.6	559.8	528.3	510.6
10/23/2021	496.2	492.4	485.9	483.6	481.6	485.9	494.5	493.4	508.2	509.5	517	520.6	514.6	513.6	525.5	521	521	529.5	535.4	533.7	521	507.3	495.3	469.3
10/24/2021	462.9	454.5	446	444.8	446.6	448.4	454.9	471.7	482.7	497.3	514.8	530.1	539	545.7	550.6	560.7	564.5	580	593.8	587.6	573.4	552.8	519.3	495.1
10/25/2021	487.3	473.5	466.7	468.3	479	518.7	559.4	581.9	579	592.1	589.3	584.7	585.1	590.3	587.3	585.3	586.6	581.3	599.3	594.5	585.6	563.6	535.6	514.6
10/26/2021	507.2	498.8	486.8	497.4	499.6	523.8	565.1	578.7	584.7	584.9	588.4	590.9	584.8	584.9	587.9	583	580.7	581.8	598.5	598.2	595.3	567.1	543.3	522.5
10/27/2021	516.1	508.9	502.5	509.5	521.1	544.8	591.4	598.6	598.4	593.1	602.3	594.5	590.4	596	588.5	600.2	597	587.1	592.7	588	575.4	562.6	534.6	519.2
10/28/2021	505.4	497.6	494.7	497.4	500.3	524.8	565.2	597.1	600.9	607.7	607.8	609.9	608.7	609.7	603.9	601.1	596.3	586.1	579.7	558.2	550.5	535.5	513.5	484.3
10/29/2021	481	464.8	461.1	462	467.6	489.3	524.6	538.6	546.9	566.2	585.5	598.3	594.8	586.9	566.8	496.4	499.1	486.1	501	499.7	491	480.3	447.8	428.6
10/30/2021	406.9	403	395.9	391.8	398.3	392.8	406.3	412.7	427.9	435.3	441.6	446.4	439.6	436.1	433	432.7	435.1	440.1	450.1	441.3	434.4	424.2	414.1	391.6
10/31/2021	378.6	376.8	370	366.9	366.9	375.7	389	397.3	414.3	410.6	420.5	428.1	427.7	432.9	433.7	432.1	428.8	428.2	453	443.7	443.1	430.2	408.7	388.7
11/1/2021	383.7	377.6	376.7	384.9	397.6	442.9	488.6	506.8	508.8	519.9	508.5	511.6	505.3	509.1	500.2	509.9	509.7	524.2	526.3	529.3	515.3	499.2	475	453.5
11/2/2021	436.3	435.3	432.9	441.3	442.9	471.6	509.1	529.6	528.1	529.5	521	517.1	516.4	508.4	505.9	500.8	503.1	516.3	543.8	548.5	529.7	523.1	494.4	472.4
11/3/2021	473.3	465.2	469.8	476.7	481.7	511.8	547.6	582.7	575	567.5	550.7	530	526.8	515.4	507.6	514.1	506.1	528.3	545.9	550.6	540.2	529.1	506	493
11/4/2021	479	481.9	477.4	480.9	498.8	521.9	563.4	583.5	571.9	551.3	541.7	519.5	515.1	504.3	498.7	497.1	506	509.2	533.9	544.1	540.9	508.7	500.4	481.2
11/5/2021	477.6	468	479	480.7	488.6	514.6	553.4	574.5	569.7	545.5	527	503.4	501.6	491.8	491.3	476.7	479.4	492.3	499.6	508.6	500.8	497.5	481.5	456.6
11/6/2021	453.8	455.4	454.3	461.6	454.2	462.8	478.6	493.8	482.5	468.9	452.5	443	434.5	423.5	416.3	416.6	426.3	436.1	452.6	443.2	442.8	428.3	416.8	410.5
11/7/2021	403.4	395.8	393.3	393.9	400.8	416.8	445.5	472.7	460.2	435.4	423.8	420.8	422.4	419.3	395.4	382.9	405.3	438.7	475.9	468.2	462	441.3	431.3	421.4
11/8/2021	401.9	401.7	402	401.4	407.7	430.9	475.3	530.1	530.4	520.7	507.4	508.4	517.3	503.3	519	502.3	496.8	520.3	535.6	519.1	520.7	504.4	485.6	463.4
11/9/2021	439.3	425.7	424.5	428.3	422.3	440.1	470.4	515.4	523.6	516.2	518.6	529.7	517.3	515.9	511	512.5	517	529.2	535.8	527.2	528.2	506.5	487.1	464.7
11/10/2021	440.5	434	429.1	423.9	429.6	433.3	456.3	485.9	509.5	499.6	515.6	516.1	515.1	522.7	521.6	518.2	524.1	517.8	533.2	523.2	516	508	488.5	457.5
11/11/2021	435.7	426.7	422.5	418.6	415.9	424.8	449.3	474.4	501.3	507.7	523.3	522.6	524.9	516.5	518.5	505.4	499	510.5	520.3	513.8	513.1	504.2	490.8	471.7
11/12/2021	445.2	452.7	450.1	439.2	442.1	453	472.4	510.1	525.7	533.1	526.3	539.6	541.6	527.5	520	509.4	503.8	521.3	525.7	524	516.6	521.3	501.1	481.6
11/13/2021	466.6	454.8	447.4	444.7	450.5	447.5	449.3	454.5	461.1	474.9	483.6	485.6	483.3	483.8	479.9	480	480.1	501.6	505.8	504.9	499	493.5	478.4	476.4
11/14/2021	444.5	438	432.4	423.8	431.2	422.8	434.9	439.2	452.4	463.2	477.9	468.4	469.1	462.4	460.4	453.4	461.6	488.3	513	515	501.3	502.8	485.4	469.6
11/15/2021	457.3	458.8	460.3	456.8	473.3	491.5	513.1	566.7	578.9	578.8	569.3	552.7	558.8	544.1	526.6	525.3	526.4	532	568.2	557	560.9	546.8	534.1	504
11/16/2021	482.4	480.3	469.4	471.9	474	478	504.1	544.2	548.3	535.8	526.4	513.3	515.6	509.3	509	511.4	515.4	517	539.5	530.5	524.3	517.7	486.8	473.1
11/17/2021	446.8	432.8	435.9	423.9	426.2	432.7	451.1	483.7	498	512.2	521.7	529.4	527.3	528.8	529.2	530.3	525.2	532.2	544.3	539.3	526.6	514.9	484.3	460.2
11/18/2021	436	421.5	426.4	423.7	427.8	439	464.2	495.1	523.6	520.3	525.6	525.1	509.6	519.8	509.7	505.8	516.6	522.8	558.7	559	556.3	547.4	538.5	516.2
11/19/2021	498.2	481.4	491.8	493.8	497.5	514.6	536.8	576	581.7	570.4	559.8	537.4	522.6	514.7	508.7	502.5	499.4	520.9	542.1	539.2	551.9	540.8	521.4	505.1
11/20/2021	476.5	466.6	464.7	456.6	455.3	457.2	466.2	480	475	479.3	472.4	461.5	456.9	444.3	436.2	435.4	434.2	454.3	474.1	468.1	469.6	451.6	440	424.7
11/21/2021	406.4	397.4	385.1	384.4	379.7	385.6	394.4	412.8	429.2	441.4	454.3	455	461.8	463	457.6	457.1	452.4	475.9	487.6	481.1	485.2	469.4	467.1	449.9
11/22/2021	432.6	428.1	432.1	429.7	446.5	461.2	500	549.7	560.8	571.5	575.6	563.1	566.2	558.3	555.9	548.1	559.5	573.2	604.6	596.9	599.9	593.4	571.3	553
11/23/2021	531	524.8	528.6	526	537.7	543.8	577.6	607.2	617.7	600.2	580.5	559.8	540.8	534.1	524.4	512.2	523.5	540.3	565.3	562.6	568.6	559.6	540.5	522.6
11/24/2021	490.3	485.8	484.5	480.6	478.6	490.9	508.6	540.6	547.9	556.3	545.8	537.6	520.4	492	504	499.8	493.6	507.6	522.8	520.7	508.6	491.5	462.3	425
11/25/2021	392.1	383.3	363.7	352.6	344.2	335.7	347.5	355.7	367.6	388	411.3	427.3	422.7	400.4	388.6	390.7	391.9	407.6	411.7	417.4	426.2	417.3	418.8	405.9
11/26/2021	395.4	393.7	393.9	389.5	399.7	411.4	427.3	443.7	453	456.7	443.5	432.3	425.6	413.4	403.9	390.4	409	433.6	477.7	471.3	474.4	462	458.2	441.6
11/27/2021	428.5	422.2	416.4	413.9	410.8	424.3	429.5	448.4	446.9	455.8	443.8	440.7	430.4	415.4	415.9	409.2	412.3	435.5	454.4	456.4	453.5	446.3	437.2	417.2
11/28/2021	410.4	389.8	395.1	389.8	387.9	397.4	401.8	422.9	430	423.8	430.7	428.4	422	425	421.2	419.5	431.9	460.3	492.8	499.1	493.8	490.3	486.9	459.1
11/29/2021	457.9	452.4	453.9	459.2	472.6	501	533	575.9	583.5	574.9	556.5	546.2	526.6	529.4	523.4	516.6	534.8	553.1	565.1	563.7	557	550.4	521.7	502.8
11/30/2021	479.8	468	463.3	457.9	461.6	464.8	492.1	529.5	543.3	537.7	522.7	515.1	510.9	510.1	505.9	508	500	518.3	539	540.3	543.9	537	521.7	505.1
12/1/2021	476.8	467.7	460	454.9	461.1	466.2	494.1	531.1	543.1	549.5	547.8	544	540	525.6	509.9	509.7	513.4	524.2	544.1	544.7	543.7	535.4	511.8	486.7
12/2/2021	466.3	457.7	447.8	440.3	440.1	447.1	478.1	516.6	518.5	518.6	501.8	503.9	510.3	505.5	500.4	502.4	497.4	513.2	524.7	527.4	523.6	519.3	491.3	476.3
12/3/2021	445.4	437.3	437.9	438.8	440.6	445.3	472	510.7	519.1	522.4	508.9	508.8	496.6	507.5	508.1	501.9	502.5	510.2	522.9	514.7	502.1	494.2	483.1	455.6
12/4/2021	429.7	424.4	409.8	411.5	406	412.7	417.8	433.5	438.2	453.2	441.1	443.1	433.6	431.9	432.1	423	441.3	458.8	473.5	481.8	467.7	471.1	461.6	443.9
12/5/2021	427.2	423	410.6	410.2	404.1	410.6	416.1	427.1	438.3	450.4	457.5	455.8	454.5	455.1	460.2	455.1	468.7	482.7	504.1	498.4	496.4	490.8	466.2	446.6
12/6/2021	416.9	402.6	398.9	396.5	405.1	412.9	448.6	493.4	521.4	528.7	539.4	529.1	533.1	531.1	523.9	533.3	543.3	565	592.9	592.6	597.7	591.4	569	549.5
12/7/2021	528.3	514.3	505	511.2	506.9	519	550.7	590.7	604.5	606.7	602.3	599.8	594.1	603.2	599.1	610.7	613	625	636	628.9	620.9	614.9	584.8	563.4
12/8/2021	537.3	519.2	519	512.6	509.2	520.7	564.8	605.1	614.2	612.4	583.7	577.9	557.3	542.7	539.7	541.5	541.2	560.1	585.3	582.3	594.6	578.3	560.5	546.1
12/9/2021	518.5	507.6	509.6	502	510.9	515.8	542.4	582.5	592.5	575.3	562.3	547.8	552.4	555	552.8	548.5	546.1	562	568.4	558	555.7	546.7	525.9	500.3
12/10/2021	482.9	466	459	449.9	443.9	449.8	474.8	514.9	527.7	531.8	543.5	535.8	528.2	534.9	536.9	535.1	536.1	540.7	551	537.9	537.4	522.9	509.5	485.4
12/11/2021	462	447.7	429.1	425.2	420	412.6	422.1	423.9	418	438	460.1	463.8	471.2	481.5	479.7	475.7	472.9	491	520.3	520.5	515.4	513	508	492.6
12/12/2021	496.5	480.4	476.1	480.1	479.7	488.2	502.7	509.5	516.7	514.9	508.5	490.9	473.8	479.5	462	464.6	475.6	504.2	539	533.2	532.1	528.8	516.9	498.5
12/13/2021	465.1	465.8	463.2	466.9	468.9	489.8	525.8	557.9	588.4	567.8	550.6	537.4	529.3	520	523.9	509.4	519.1	527.1	563.2	561.8	555.5	554.1	532.6	504.7
12/14/2021	490.4	477.5	482.6	476.2	480.4	493.9	517.9	553.8	552	550.7	548	540.3	534.1	536.5	524	523.5	528.9	548.5	553.5	551.5	548.2	540.3	510.4	485
12/15/2021	459.2	441.8	441.4	438.6	431.9	437.4	469.7	503.8	518.6	520.3	524	526.1	518	517.5	510.1	512.9	512.1	527.5	538.1	534.3	536.5	524.6	502.8	476
12/16/2021	457.7	447.2	437.7	443.9	434.9	448.8	470	504.5	525.7	534.1	537.5	543	529	531	541	530.8	531.7	540.5	546.7	550.2	552.4	547.9	532.6	503.9
12/17/2021	477.9	468.5	468.6	463.8	465.2	477.6	500.5	538	553.3	558.2	562	556	562.5	566.9	561.2	556.2	552.3	566.2	568.1	560.4	550.3	544.6	527.8	498.3
12/18/2021	473	459.2	450	441.2	431.7	435.8	443.1	445.9	449	462.6	486.6	492.4	498.9	500	500.5	499.1	504.5	527.1	527.4	522.8	513.6	508.5	500.1	481.7
12/19/2021	458.7	448.6	445.7	446.7	446.7	450.5	475.2	486.8	497.6	494	482.4	477.5	479.4	471.8	467.9	465.5	479.5	505	549.7	551.4	550	545.8	534.9	520.2
12/20/2021	504.2	498	497.9	503.8	518.5	531.3	556.6	599.7	620	602.7	588.4	568.8	553.8	544.5	537	530	532	551.3	582.7	587	590.2	589.1	579	559.5
12/21/2021	541.1	529	515.5	517.4	527.7	532.6	564.5	592	614.2	607.1	589.8	565.8	557.8	547	538.1	537.5	530.3	554	575	581.7	577.9	569.5	555.1	534.6
12/22/2021	515.7	507.6	500.9	500.2	507.8	518.8	542.6	582.9	590.8	593.5	574.6	574.5	559.1	543.3	547.6	527.8	535.9	558.5	592.7	587.1	594.7	585.6	563.7	532
12/23/2021	506	495.9	481	484.1	486.9	486.2	510.6	535.8	549.5	537.3	529.2	530.3	514.5	492.7	490.8	490.5	473.9	492	512.4	505	504.9	490.4	470.2	443.9
12/24/2021	423	401.1	389.7	372.9	370.7	366.2	373.5	385.4	387.2	405.8	415.2	425.9	427.2	425.9	406.4	417.9	407.2	413.1	429.5	412	407.7	399.2	401.3	376.6
12/25/2021	360	346.3	333.1	324.4	321.7	327.6	331.1	335.2	350	367.1	368.7	390.1	382.1	385.6	376.1	370.8	370.7	382.6	384.3	386.4	381.6	373.1	367.7	351.4
12/26/2021	338.4	328.6	324.1	323.2	324	326.5	335.9	354.1	359.5	380.1	398.4	404.7	403.5	398.4	399.4	400.5	406.5	425.5	455	444.9	441.6	427.4	425.9	398.7
12/27/2021	385.5	372.4	364.6	361.1	365	365.3	388.5	408.4	420.5	437.2	451.1	465.4	470.5	469.1	467.8	462.9	476	483.8	485.9	486.7	475.8	451.9	447	415.4
12/28/2021	392.7	379.9	376.2	384.5	381.7	395.8	407.3	442.6	466.2	487.2	499	500.1	501.8	496.7	499.7	498.4	483.6	501.3	508.7	493.8	494.7	472	456.6	433.4
12/29/2021	407.4	403.2	390.4	392	393.5	397	420.1	449.9	464.7	470.1	480.7	486.8	482.6	482.5	485.1	479.7	487.2	499.8	509.7	501.1	489.3	476.7	454.6	437.4
12/30/2021	411.2	394.9	388.3	387.5	389.4	399	417.6	440.6	452.2	465.9	469.4	474.2	476.8	473	476.6	468.1	469.8	478.1	496.5	493	475.7	468.4	456.4	435.5
12/31/2021	417.7	397.4	384.9	381.1	387.6	388.2	395.8	419.6	422	426.2	445.9	443.8	442.9	444.2	440.9	439.6	447.9	458.4	476.3	469.2	459.5	441.4	436.5	418.4

Attachment 4.3 2023-2024 MISO LOLE Study Report

Planning Year 2023-2024 Loss of Load Expectation Study Report

MISO — Resource Adequacy

Highlights

- MISO's seasonal construct, accepted by FERC in September 2022, introduces seasonal requirements to the Planning Resource Auction (PRA) to account for the unique risk profile of each season.

- MISO made several modeling improvements to the LOLE study to support the new seasonal construct.

- MISO's annual Loss of Load Expectation (LOLE) study sets the system-wide Planning Reserve Margin and the zonal Local Reliability Requirements for each season of the upcoming Planning Year.

Update (5/1/2023): outyear Planning Reserve Margin (PRM) and Local Reliability Requirement (LRR) results added to study report

Contents

Executive Summary

Midcontinent Independent System Operator (MISO) conducts an annual Loss of Load Expectation (LOLE) study to determine a Planning Reserve Margin Unforced Capacity (PRM UCAP), zonal per-unit Local Reliability Requirements (LRR), Zonal Import Ability (ZIA), Zonal Export Ability (ZEA), Capacity Import Limits (CIL) and Capacity Export Limits (CEL) for each season (Summer, Fall, Winter, & Spring) of the upcoming Planning Year. The results of the study and its deliverables supply inputs to the MISO Planning Resource Auction (PRA).

The Planning Year 2023-2024 (PY 2023-2024) LOLE Study:

- Establishes PRM UCAP for each season to be applied to the Load Serving Entity (LSE) seasonal coincident peaks for the Planning Year starting June 2023 and ending May 2024:
    - Summer 2023 PRM UCAP of 7.4%
    - Fall 2023 PRM UCAP of 14.9%
    - Winter 2023-2024 PRM UCAP of 25.5%
    - Spring 2024 PRM UCAP of 24.5%
- Uses the Strategic Energy Risk Valuation Model (SERVM) software for Loss of Load analysis to provide results applicable across the MISO market footprint.
- Provides zonal ZIA, ZEA, CIL and CEL for each Local Resource Zone (LRZ) (Figure ES-1). These values may be adjusted in March 2023 based on changes to MISO units with firm capacity commitments to non-MISO load, and equipment rating changes since the LOLE analysis. The Simultaneous Feasibility Test (SFT) process can further adjust CIL and CEL to ensure the resources cleared in the auction are simultaneously reliable.
- Determines a minimum planning reserve margin for each season of the studied Planning Year that would result in the MISO system experiencing a less than one-day loss of load event every 10 years, as per the MISO Tariff.[1] The MISO analysis shows that the system would achieve this reliability level for the summer 2023 season when the amount of installed capacity available (considering external support) is 1.159 times that of the MISO system summer 2023 coincident peak.
- Sets forth initial zonal-based (Table 1-1) PRA deliverables in the LOLE charter.

The stakeholder review process played an integral role in this study. The MISO staff would like to thank the Loss of Load Expectation Working Group (LOLEWG) for its assistance and input. There were several process improvements made to the LOLE study this year including updated transfer limits due to improved redispatch and four major LOLE modeling enhancements: seasonal outage rates, wind and solar hourly profiles, probabilistic modeling of non-firm support, and correlated cold weather outages.

[1] A one-day loss of load in 10 years (0.1 day/year) is not necessarily equal to 24 hours loss of load in 10 years (2.4 hours/year).

PRA and LOLE Metrics	LRZ 1	LRZ 2	LRZ 3	LRZ 4	LRZ 5	LRZ 6	LRZ 7	LRZ 8	LRZ 9	LRZ 10
Summer 2023 PRM UCAP	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%	7.4%
LRR UCAP per-unit of LRZ Peak Demand	1.139	1.120	1.299	1.212	1.333	1.172	1.171	1.473	1.157	1.538
Capacity Import Limit (CIL) (MW)	5,301	3,477	6,108	7,884	3,576	8,492	5,087	4,139	5,268	3,064
Capacity Export Limit (CEL) (MW)	3,959	2,550	4,310	No Limit Found[2]	No Limit Found	2,703	3,953	5,503	1,574	1,794
Zonal Import Ability (ZIA) (MW)	5,299	3,477	6,043	6,992	3,576	8,092	5,087	4,091	4,456	3,064
Zonal Export Ability (ZEA) (MW)	3,961	2,550	4,375	No Limit Found	No Limit Found	3,109	3,953	5,551	2,386	1,794

Table ES-1: Initial Planning Resource Auction Deliverables — Summer 2023

PRA and LOLE Metrics	LRZ 1	LRZ 2	LRZ 3	LRZ 4	LRZ 5	LRZ 6	LRZ 7	LRZ 8	LRZ 9	LRZ 10
Fall 2023 PRM UCAP	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%	14.9%
LRR UCAP per-unit of LRZ Peak Demand	1.274	1.218	1.408	1.254	1.452	1.247	1.345	1.490	1.278	1.619
Capacity Import Limit (CIL) (MW)	6,528	4,411	14,375[2]	5,173	5,380	6,070	4,285	4,705	6,045	2,425
Capacity Export Limit (CEL) (MW)	3,804	3,577	4,354	4,878	1,992	1,701	3,990	5,080	1,526	2,878
Zonal Import Ability (ZIA) (MW)	6,526	4,411	14,310[2]	4,281	5,380	5,670	4,285	4,657	5,233	2,425
Zonal Export Ability (ZEA) (MW)	3,806	3,577	4,419	5,770	1,992	2,101	3,990	5,128	2,338	2,878

Table ES-2: Initial Planning Resource Auction Deliverables — Fall 2023

[2] "No Limit Found" reflects no valid constraint identified.

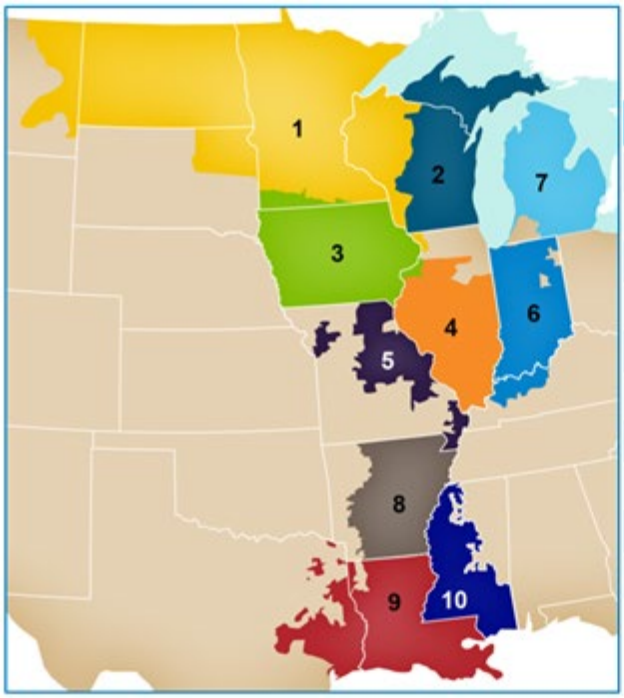
PRA and LOLE Metrics	LRZ 1	LRZ 2	LRZ 3	LRZ 4	LRZ 5	LRZ 6	LRZ 7	LRZ 8	LRZ 9	LRZ 10
Winter 23-24 PRM UCAP	25.5%	25.5%	25.5%	25.5%	25.5%	25.5%	25.5%	25.5%	25.5%	25.5%
LRR UCAP per-unit of LRZ Peak Demand	1.403	1.422	1.850	1.365	1.474	1.301	1.573	1.503	1.323	1.777
Capacity Import Limit (CIL) (MW)	4,937	4,905	11,039[2]	3,928	3,811	8,818	6,340	4,729	6,080	2,396
Capacity Export Limit (CEL) (MW)	3,501	4,198	7,002	3,445	6,348	1,242	4,350	5,351	877	1,980
Zonal Import Ability (ZIA) (MW)	4,935	4,905	10,974[2]	3,036	3,811	8,418	6,340	4,681	5,268	2,396
Zonal Export Ability (ZEA) (MW)	3,503	4,198	7,067	4,337	6,348	1,642	4,350	5,399	1,689	1,980

Table ES-3: Initial Planning Resource Auction Deliverables — Winter 2023-2024

PRA and LOLE Metrics	LRZ 1	LRZ 2	LRZ 3	LRZ 4	LRZ 5	LRZ 6	LRZ 7	LRZ 8	LRZ 9	LRZ 10
Spring 2024 PRM UCAP	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%	24.5%
LRR UCAP per-unit of LRZ Peak Demand	1.375	1.267	1.623	1.454	1.610	1.320	1.329	1.627	1.315	1.747
Capacity Import Limit (CIL) (MW)	6,185	4,454	7,675	5,906	3,881	8,162	5,559	4,606	6,250	2,144
Capacity Export Limit (CEL) (MW)	4,321	3,679	6,173	3,745	3,724	2,344	4,413	5,472	2,240	2,720
Zonal Import Ability (ZIA) (MW)	6,183	4,454	7,610	5,014	3,881	7,762	5,559	4,558	5,438	2,144
Zonal Export Ability (ZEA) (MW)	4,323	3,679	6,238	4,637	3,724	2,744	4,413	5,520	3,052	2,720

Table ES-4: Initial Planning Resource Auction Deliverables — Spring 2024

LRZ3 Fall and Winter ZIA and CIL were updated after the final results were presented at the October LOLEWG. Both studies resulted in No Limit found and the equation was updated to include Tier 2, the October 3rd 2022 LOLEWG presentation has also been updated accordingly.



Local Resource Zone	Local Balancing Authorities
1	DPC, GRE, MDU, MP, NSP, OTP, SMP
2	ALTE, MGE, MIUP, UPPC, WEC, WPS
3	ALTW, MEC, MPW
4	AMIL, CWLP, SIPC
5	AMMO, CWLD
6	BREC, CIN, HE, HMPL, IPL, NIPS, SIGE
7	CONS, DECO
8	EAI
9	CLEC, EES, LAFA, LAGN, LEPA
10	EMBA, SME

Figure ES-1: Local Resource Zones (LRZ)

1 LOLE Study Process Overview

In compliance with Module E-1 of the MISO Tariff, MISO performed its annual LOLE study to determine, for each season of Planning Year 2023-2024, the system unforced capacity (UCAP) Planning Reserve Margin (PRM) and the per-unit Local Reliability Requirements (LRR) of Local Resource Zone (LRZ) Peak Demand.

In addition to the LOLE analysis, MISO performed seasonal transfer analyses to determine seasonal Zonal Import Ability (ZIA), Zonal Export Ability (ZEA), Capacity Import Limits (CIL) and Capacity Export Limits (CEL). CIL, CEL, and ZIA are used, in conjunction with the LOLE analysis results, in the Planning Resource Auction (PRA). ZEA is informational and not used in the PRA.

The PY 2023-2024 per-unit seasonal LRR UCAP multiplied by the updated LRZ seasonal Peak Demand forecasts submitted for the 2023-2024 PRA determines each LRZ's seasonal LRR. Once the seasonal LRR is determined, the ZIA values and non-pseudo tied exports are subtracted from the seasonal LRR to determine each LRZ's seasonal Local Clearing Requirement (LCR) consistent with Section 68A.6 of Module E-1[3]. An example calculation pursuant to Section 68A.6 of the current effective Module E-1 shows how these values are reached (Table 1-1).

Local Resource Zone (LRZ) EXAMPLE	Example LRZ	Formula Key
Installed Capacity (ICAP)	17,442	[A]
Unforced Capacity (UCAP)	16,326	[B]
Adjustment to UCAP (1d in 10yr)	50	[C]
Local Reliability Requirement (LRR) (UCAP)	16,376	[D]=[B]+[C]
LRZ Peak Demand	14,270	[E]
LRR UCAP per-unit of LRZ Peak Demand	114.8%	[F]=[D]/[E]
Zonal Import Ability (ZIA)	3,469	[G]
Zonal Export Ability (ZEA)	2,317	[H]
Proposed PRA (UCAP) EXAMPLE	**Example LRZ**	**Formula Key**
Forecasted LRZ Peak Demand	14,270	[I]
Forecasted LRZ Coincident Peak Demand	13,939	[J]
Non-Pseudo Tied Exports UCAP	150	[K]
Local Reliability Requirement (LRR) UCAP	16,376	[L]=[F]x[I]
Local Clearing Requirement (LCR)	12,757	[M]=[L]-[G]-[K]
Planning Reserve Margin (PRM)	7.4%	[N]
Zone's System Wide PRMR	14,970	[O]=[1.074]x[J]
PRMR	14,970	[P]=Higher of [M] or [O]

Table 1-1: Example LRZ Calculation

[3] https://www.misoenergy.org/legal/tariff
Effective Date: November 1, 2018

The actual effective PRM Requirement (PRMR) for each season of Planning Year 2023-2024 will be determined after the updated LRZ Seasonal Peak Demand forecasts are submitted by November 1, 2022, for the 2023-2024 PRA. The ZIA, ZEA, CIL and CEL values are subject to updates in March 2023 based on changes to exports of MISO resources to non-MISO load, changes to pseudo tied commitments, and updates to facility ratings following the completion of the LOLE study.

Finally, the simultaneous feasibility test (SFT) is performed as part of the PRA where cleared generation is tested to ensure transmission reliability and if constraints arise, they are mitigated by adjusting CIL and CEL values as needed.

1.1 Study Improvements

The Planning Year 2023-2024 LOLE study incorporated a number of study improvements as a result of the approved seasonal construct. These improvements include seasonal outage rates, correlated cold weather outages, probabilistic distribution of non-firm support, and hourly wind and solar profiles.

Historically, the LOLE model utilized a 5-year average EFORd, based on historic GADS data, which was constant throughout the simulated year for all resources. This year, seasonal EFORd was calculated using the same GADS data but outages were classified by season to produce four unique seasonal EFORd values for each resource. This change better captures the seasonal availability of resources observed in operations.

Additional outages are added to the model during times of extreme cold temperatures to better capture the magnitude of correlated outages observed. The magnitude of forced outages added increases as temperatures decrease based on the relationship between outages and temperature determined from historic GADS and weather data. Each LRZ has a unique outage/temperature curve based on actual performance. The incremental cold weather outages are not assigned to a particular resource but instead represent the aggregate impact on the system for coal and gas resources.

For the last several years MISO has accounted for non-firm support in the LOLE process by simply reducing the PRM by a fixed amount on a 1-for-1 MW basis. This year's study incorporated seasonal distributions of non-firm support directly in the model which are based on historic Net Scheduled Interchange (NSI) data. As the model steps through time chronologically, SERVM will randomly draw import values from this distribution to be used to serve load.

In previous LOLE studies, wind resources were modeled as perfect units with a constant output equal to their monthly ELCC values while solar resources were modeled as perfect units with constant output equal to their capacity credit. For Planning Year 2023-2024, wind and solar resources were modeled as variable energy resources with 30 unique hourly profiles corresponding to the 30 unique weather years within SERVM.

2 Transfer Analysis

2.1 Calculation Methodology and Process Description

Transfer analyses determined CIL and CEL values for LRZs in each season for Planning Year 2023-2024. Annual adjustments are made for Border External Resources (BERs) and Coordinating Owner Resources (COs) to determine the ZIA and ZEA in each season. Further adjustments are made for exports to non-MISO Loads to arrive at the CIL and CEL values. The objective of transfer analysis is to determine constraints caused by the transfer of capacity between zones and the associated transfer capability. Multiple factors impacted the analysis when compared to previous studies, including:

- 3.7 GW of Retirements / Suspensions
- New Intermittent Resources
- Base Model Dispatch in MISO and Seams

2.1.1 Generation Pools

To determine an LRZ's import or export limit, a transfer is modeled by ramping generation up in a source subsystem and ramping generation down in a sink subsystem. The source and sink definitions depend on the limit being tested. The LRZ studied for import limits is the sink subsystem and the adjacent MISO LBA's are the source subsystem. The LRZ studied for export limits is the source subsystem and the rest of MISO is the sink subsystem. These are the same in all seasons for the upcoming Planning Year.

Transfers can cause potential issues, which are addressed through the study assumptions. First, an abundantly large source pool spreads the impact of the transfer widely which can cause differences in studied zones transfer capabilities and constraints identified. Second, ramping up generation from remote areas could cause electrically distant constraints for any given LRZ, which should not determine a zone's limit. For example, export constraints due to dispatch of LRZ 1 generation in the northwest portion of the footprint should not limit the import capability of LRZ 10, which covers the MISO portion of Mississippi.

To address these potential issues, the transfer studies limit the source pool for the import studies to the Tier 1 and Tier 2 adjacent LBA's to the study zone. Since the generation that is ramped up in export studies are contained in the study LRZ, these issues only apply to import studies. Generation within the zone studied for an export limit is ramped up and constraints are expected to be near or in the study zone.

2.1.2 Redispatch

Limited redispatch is applied after performing transfer analyses to mitigate constraints. Redispatch ensures constraints are not caused by the base dispatch and aligns with potential actions that can be implemented for the constraint in MISO operations. Redispatch scenarios can be designed to address multiple constraints as required and may be used for constraints that are electrically close to each other or to further optimize transfer limits for several constraints requiring only minor redispatch. The redispatch assumptions include:

- The use of no more than 10 conventional fuel plants or intermittent resources
- Redispatch limit at 2,000 MW total (1,000 MW up and 1,000 MW down)
- No adjustments to nuclear units
- No adjustments to the portions of pseudo-tied units committed to non-MISO load

2.1.3 Generation Limited Transfer for CIL/CEL and ZIA/ZEA

When conducting transfer analysis to determine import or export limits, the source subsystem might run out of generation to dispatch before identifying a valid constraint caused by a transmission limit. MISO developed a Generation Limited Transfer (GLT) process to identify transmission constraints in these situations, when possible, for both imports and exports.

After running the First Contingency Incremental Transfer Capability (FCITC) analysis to determine limits for each LRZ, MISO will determine whether a zone is experiencing a GLT (e.g. whether the first constraint would only occur after all the generation is dispatched at its maximum amount). If the LRZ experiences a GLT, MISO will adjust the base model depending on whether it is an import or export analysis and re-run the transfer analysis.

For an export study, when a transmission constraint has not been identified after dispatching all generation within the exporting system (LRZ under study) MISO will decrease load and generation dispatch in the study zone. The adjustment creates additional capacity to export from the zone. After the adjustments are complete, MISO will rerun the transfer analysis. If a GLT reappears, MISO will make further adjustments to the load and generation of the study zone.

For an import study, when a transmission constraint has not been identified after dispatching all generation within the source subsystem, MISO will decrease load and generation in the source subsystem. This increases the export capacity of the adjacent LBA's for the study zone. After the adjustments are complete, MISO will run the transfer analysis again. If a GLT reappears, MISO will make further adjustments to the model's load and generation in the source subsystem.

FCITC could indicate the transmission system can support larger thermal transfers than would be available based on installed generation for some zones. However, large variations in load and generation for any zone may lead to unreliable limits and constraints. Therefore, MISO limits load scaling for both import and export studies to 50 percent of the zone's load. In a GLT, redispatch, or GLT plus redispatch scenario, the FCITC of the most limiting constraint might exceed Zonal Export/Import Capability. If the GLT does not produce a limit for a zone(s), due to a valid constraint not being identified, or due to other considerations as listed in the prior paragraph, MISO shall report that LRZ as having no limit and ensure that the limit will not bind in the first iteration of the Simultaneous Feasibility Test (SFT).

2.1.4 Voltage Limited Transfer for CIL/CEL and ZIA/ZEA

Zonal imports may be limited by voltage constraints due to a decrease in the generation in the study zone. Voltage constraints might occur at lower transfer levels than thermal limits determined by linear FCITC. As such, LOLE studies may evaluate Power-Voltage curves for LRZs with known voltage-based transfer limitations identified through existing MISO or Transmission Owner studies. Such evaluation may also occur if an LRZ's import reaches a level where the majority of the zone's load would be served using imports from resources outside of the zone. MISO will coordinate with stakeholders as it encounters these scenarios. For Planning Year 2023-2024, all seasons only Zones 1, 4 and 7 import analysis included voltage screening and study. Only LRZ4 Summer identified a voltage limit with lower transfer capability than the thermal limit.

2.2 Powerflow Models and Assumptions

2.2.1 Tools Used

MISO used the Siemens PTI Power System Simulator for Engineering (PSS/E) and Transmission Adequacy and Reliability Assessment (TARA) for analysis tools.

2.2.2 Inputs Required

Thermal transfer analysis requires powerflow models and related input files. MISO used contingency files from MTEP[4] reliability assessment studies. Single-element contingencies in MISO/seam areas were also evaluated.

MISO developed a subsystem file to monitor its footprint and seam areas which was used for all seasons. LRZ definitions were developed as sources and sinks in the study. See Appendix B for tables containing adjacent area definitions (Tiers 1 and 2) used for this study. The monitored file includes all facilities under MISO functional control and single elements in the seam areas of 100 kV and above.

2.2.3 Powerflow Modeling

The MTEP22 models were built using MISO's Model on Demand (MOD) model data repository, with the following base assumptions (Table 2-1).

Scenario	Effective Date	Projects Applied	External Modeling	Load and Generation Profile	Wind %	Solar %
Summer 2023	July 15th	MTEP Appendix A and Target A	2021 Series 2023 Summer ERAG MMWG	Summer Peak	Capacity Credit ~15.5%	50%
Fall 2023	October 15th	MTEP Appendix A and Target A	2021 Series 2023 Summer ERAG MMWG	Fall Peak	32%	28.5%
Winter 2023-2024	January 15th	MTEP Appendix A and Target A	2021 Series 2023 Summer ERAG MMWG	Winter Peak	67%	0%
Spring 2024	April 15th	MTEP Appendix A and Target A	2021 Series 2023 Summer ERAG MMWG	Spring Peak	28.5%	32%

Table 2-1: Model Assumptions

MISO excluded several types of units from the transfer analysis dispatch—these units' base dispatch remained fixed.

- Nuclear dispatch does not change for any transfer
- Wind and solar resources can be ramped down, but not up
- Pseudo-tied resources were modeled at their expected commitments to non-MISO load, although portions of these units committed to MISO could participate in transfer analyses

System conditions such as load, dispatch, topology, and interchange have an impact on transfer capability. The model was reviewed as part of the base model build for MTEP22 analyses, with study files made available on MISO

[4] Refer to the Transmission Planning BPM (BPM-20) for more information regarding MTEP input files. https://www.misoenergy.org/legal/business-practice-manuals/

ShareFile. MISO worked closely with transmission owners and stakeholders in order to model the transmission system accurately, as well as to validate constraints and redispatch. Like other planning studies, transmission outage schedules were not included in the analysis. This is driven partly by limited availability of outage information as well as current transmission planning standards. Although no outage schedules were evaluated, single element contingencies were evaluated. This includes BES lines, transformers, and generators.

Contingency coverage covers most of category P1 and some of category P2 outlined in Table 1 of TPL-001: (https://www.nerc.com/pa/Stand/Reliability%20Standards/TPL-001-5.pdf).

2.2.4 General Assumptions

MISO uses TARA to process the powerflow model and associated input files to determine the import and export limits of each LRZ in each season by determining the transfer capability. Transfer capability measures the ability of interconnected power systems to reliably transfer power from one area to another under specified system conditions. The incremental amount of power that can be transferred is determined through FCITC analysis. FCITC analysis and base power transfers provide the information required to calculate the First Contingency Total Transfer Capability (FCTTC), which indicates the total amount of transferrable power before a constraint is identified. FCTTC is the base power transfer plus the incremental transfer capability (Equation 3-1). All published limits are based on the zone's FCTTC and may be adjusted for capacity exports.

$$First\ Contingency\ Total\ Transfer\ Capability\ (FCTTC) = FCITC + Base\ Power\ Transfer$$

Equation 2-1: Total Transfer Capability

FCITC constraints are identified under base case situations in each season or under P1 contingencies provided through the MTEP process. Linear FCITC analysis identifies the limiting constraints using a minimum transfer Distribution Factor (DF) cutoff of 3 percent, meaning the transfer must increase the loading on the overloaded element, under system intact or contingency conditions, by 3 percent or more.

A pro-rata dispatch is used, which ensures all available generators will reach their maximum dispatch level at the same time. The pro-rata dispatch is based on the MW reserve available for each unit and the cumulative MW reserve available in the subsystem. The MW reserve is found by subtracting a unit's base model generation dispatch from its maximum dispatch, which reflects the available capacity of the unit.

Table 2-2 and Equation 2-2 show an example of how one unit's dispatch is set, given all machine data for the source subsystem.

Machine	Base Model Unit Dispatch (MW)	Minimum Unit Dispatch (MW)	Maximum Unit Dispatch (MW)	Reserve MW (Unit Dispatch Max – Unit Dispatch Min)
1	20	20	100	80
2	50	10	150	100
3	20	20	100	80
4	450	0	500	50
5	500	100	500	0
			Total Reserve	**310**

Table 2-2: Example Subsystem

$$\textbf{\textit{Machine 1 Incremental Post Transfer Dispatch}} = \frac{\textbf{\textit{Machine 1 Reserve MW}}}{\textbf{\textit{Source Subsystem Reserve MW}}} \times \textbf{\textit{Transfer Level MW}}$$

$$Machine\ 1\ Incremental\ Post\ Transfer\ Dispatch = \frac{80}{310} \times 100 = 25.8$$

$$Machine\ 1\ Incremental\ Post\ Transfer\ Dispatch = 25.8$$

Equation 2-2: Machine 1 Dispatch Calculation for 100 MW Transfer

2.3 Results for CIL/CEL and ZIA/ZEA

Study constraints and associated ZIA, ZEA, CIL, and CEL for each LRZ for each season were presented and reviewed through the LOLEWG with final results for Planning Year 2023-2024 presented at the October 3rd, 2022 meeting. Table 2-3 below shows the Planning Year 2023-2024 CIL and ZIA with corresponding constraint, GLT, and redispatch (RDS) information.

All zones had an identified ZIA this year. If there is no valid constraint identified the following equation will be used where the FCITC will be replaced by the Tier 1 & 2 capacity.

$$\textbf{\textit{ZIA}} = \textbf{\textit{FCITC}} + \textbf{\textit{AI}} - \textbf{\textit{Border External Resources and Coordinating Owners}}$$

Equation 2-3: Zonal Import Ability (ZIA) Calculation

LRZ1	Monitored Element	Contingency	GLT	RDS	ZIA	CIL
Summer 2023	North Appleton - Werner W 345kV	North Appleton - Morgan 345kV	15%	494MWx2	5299	5301
Fall 2023	North Appleton - Werner W 345kV	North Appleton - Morgan 345kV	None	636MWx2	6526	6528
Winter 2023/24	Council Bluffs - Sarpy County 345kV	Arbor Hill - Raccoon Trail 345kV	None	681MWx2	4935	4937
Spring 2024	North Appleton - Werner W 345kV	North Appleton - Morgan 345kV	None	328MWx2	6183	6185
LRZ2	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Elk Mound - Wheaton 161kV	King - Eau Claire 345kV	10%	1000MWx2	3477	3477
Fall 2023	Arpin - Sigel 138kV	Rocky Run - Arpin 345kV	None	1000MWx2	4411	4411
Winter 2023/24	Arpin - Sigel 138kV	Rocky Run - Arpin 345kV	None	1000MWx2	4905	4905
Spring 2024	Arpin - Sigel 138kV	Rocky Run - Arpin 345kV	None	603MWx2	4454	4454
LRZ3	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	S3458 3 - S3456 3 345kV	S3455 - S3740 345kV	10%	113MWx2	6043	6108
Fall 2023	No Limit Found		None	None	14,310	14,375
Winter 2023/24	No Limit Found		None	None	10,974	11,039
Spring 2024	Prairie Island - North Rochester 345kV	North Rochester - Hampton Corner 345kV	None	345MWx2	7610	7675
LRZ4	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Bus 636410 Sub P Iowa City 161kV	Hills 345/161kV Transformer	None	None	6992	7884
Fall 2023	Marblehead 161/138kV Transformer	Herlman - Maywood 345kV	None	1000MWx2	4281	5173
Winter 2023/24	Marblehead 161/138kV Transformer	Herlman - Maywood 345kV	None	1000MWx2	3036	3928
Spring 2024	Marblehead 161/138kV Transformer	Herlman - Maywood 345kV	None	935MWx2	5014	5906
LRZ5	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Pike - Cryene 161kV	Maywood - Spencer Creek 345kV	10%	81MWx2	3576	3576
Fall 2023	Mississippi Tap - Sioux 138kV	Loss of Sioux Generation	15%	708MWx2	5380	5380
Winter 2023/24	Overton 345/161kV Transformer	Mc Credie - Overton 345kV	None	1000MWx2	3811	3811
Spring 2024	Calif - Apache Tap 161kV	Mc Credie - Montgomery 345kV	None	244MWx2	3881	3881
LRZ6	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Cayuga Sub - Cayuga 345kV	Kansas - Sugar Creek 345kV	20%	619MWx2	8092	8492
Fall 2023	Jord - West Frankfort 138kV	Mount Vernon - West Frankfort 345kV	None	1000MWx2	5670	6070
Winter 2023/24	Cayuga Sub - Cayuga 345kV	Kansas - Sugar Creek 345kV	None	923MWx2	8418	8818
Spring 2024	Cayuga Sub - Cayuga 345kV	Kansas - Sugar Creek 345kV	None	620MWx2	7762	8162
LRZ7	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Argenta - Tompkins 345kV	Argenta - Battle Creek 345kV	15%	1000MWx2	5087	5087
Fall 2023	Benton Harbor - Segreto 345kV	Cook - Segreto 345kV	None	1000MWx2	4285	4285
Winter 2023/24	Stillwell 345kV/138kV Transformer	Dumont - Stillwell 345kV	None	1000MWx2	6340	6340
Spring 2024	Benton Harbor - Segreto 345kV	Cook - Segreto 345kV	None	1000MWx2	5559	5559
LRZ8	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Lyon - Jonestown 115kV	Crossroads - Moonlake 230kV	None	180MWx2	4091	4139
Fall 2023	Moon Lake - Ritchie 230kV	Clarksdale - Crossroads 230/115kV Transformer	None	372MWx2	4657	4705
Winter 2023/24	Mount Olive - Vienna 115kV	Mount Olive - El Dorado 500kV	None	1000MWx2	4681	4729
Spring 2024	Mount Olive - Vienna 115kV	Mount Olive - El Dorado 500kV	None	181MWx2	4558	4606

LRZ9	Monitored Element	Contingency	GLT	RDS	ZIA	CIL
Summer 2023	Bogalusa - Barkers Corner 230kV	McKnight - Franklin 500kV	None	1000MWx2	4456	5268
Fall 2023	Braswell - Franklin 500kV	Franklin - Grand Gulf 500kV	None	325MWx2	5233	6045
Winter 2023/24	Camden - Smackover 115kV	McNeil - Camden 115kV	None	963MWx2	5268	6080
Spring 2024	Boogalusa 500/230kV Transformer	McKnight - Franklin 500kV	None	1000MWx2	5438	6250
LRZ10	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZIA**	**CIL**
Summer 2023	Braswell - Northside 230kV	Braswell - Lakeover 500kV	None	38MWx2	3064	3064
Fall 2023	Braswell - Northside 230kV	Braswell - Lakeover 500kV	None	33MWx2	2425	2425
Winter 2023/24	Adams Creek - Angie 230kV	Slidel - Logtown 230kV	None	134MWx2	2396	2396
Spring 2024	Hernando - Coldwater 115kV	Moonlake - Ritchie 230kV	None	31MWx2	2144	2144

Table 2-3: Planning Year 2023–2024 Import Limits

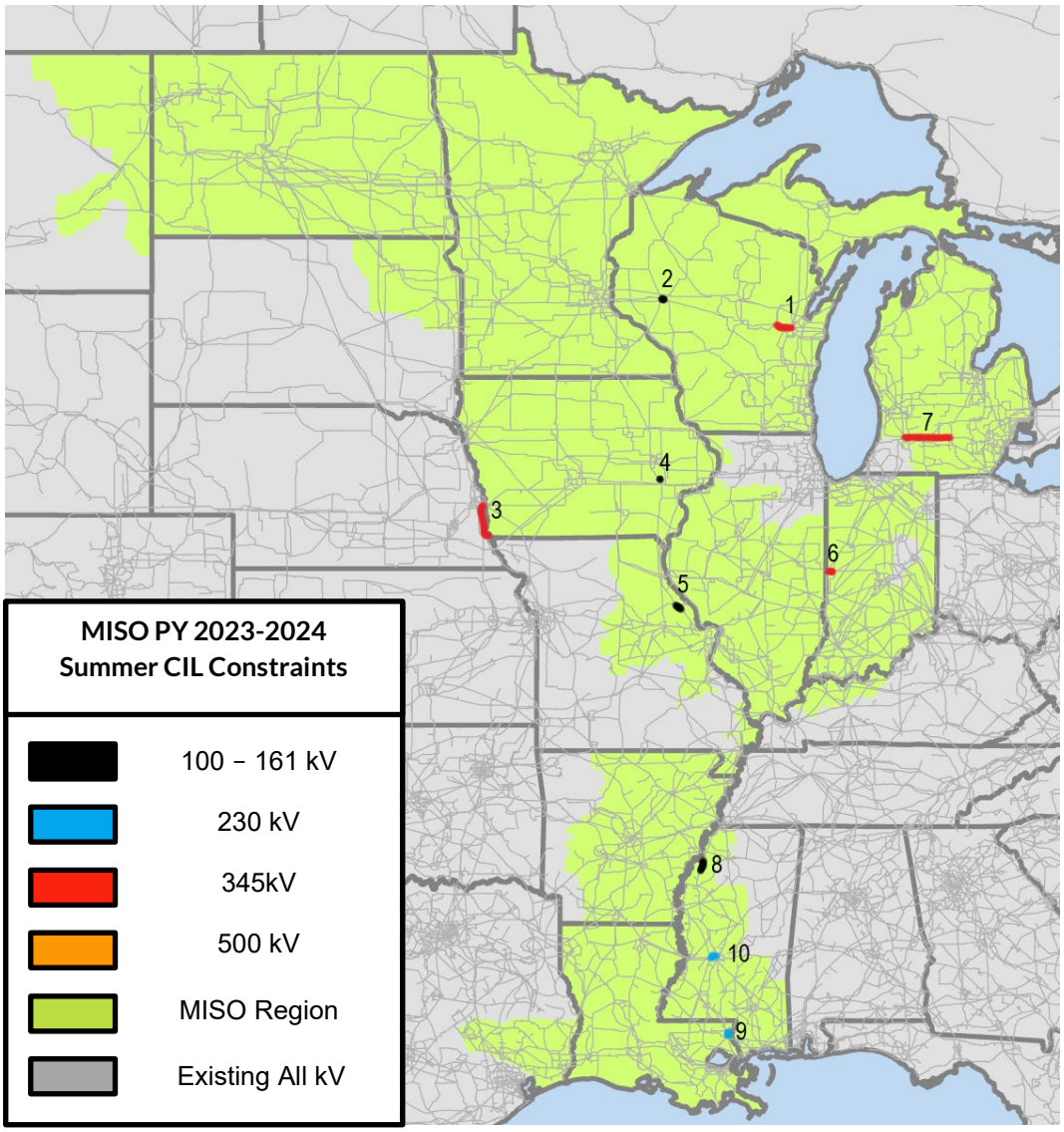


Figure 2-1: Planning Year 2023-2024 Summer Capacity Import Constraints Map

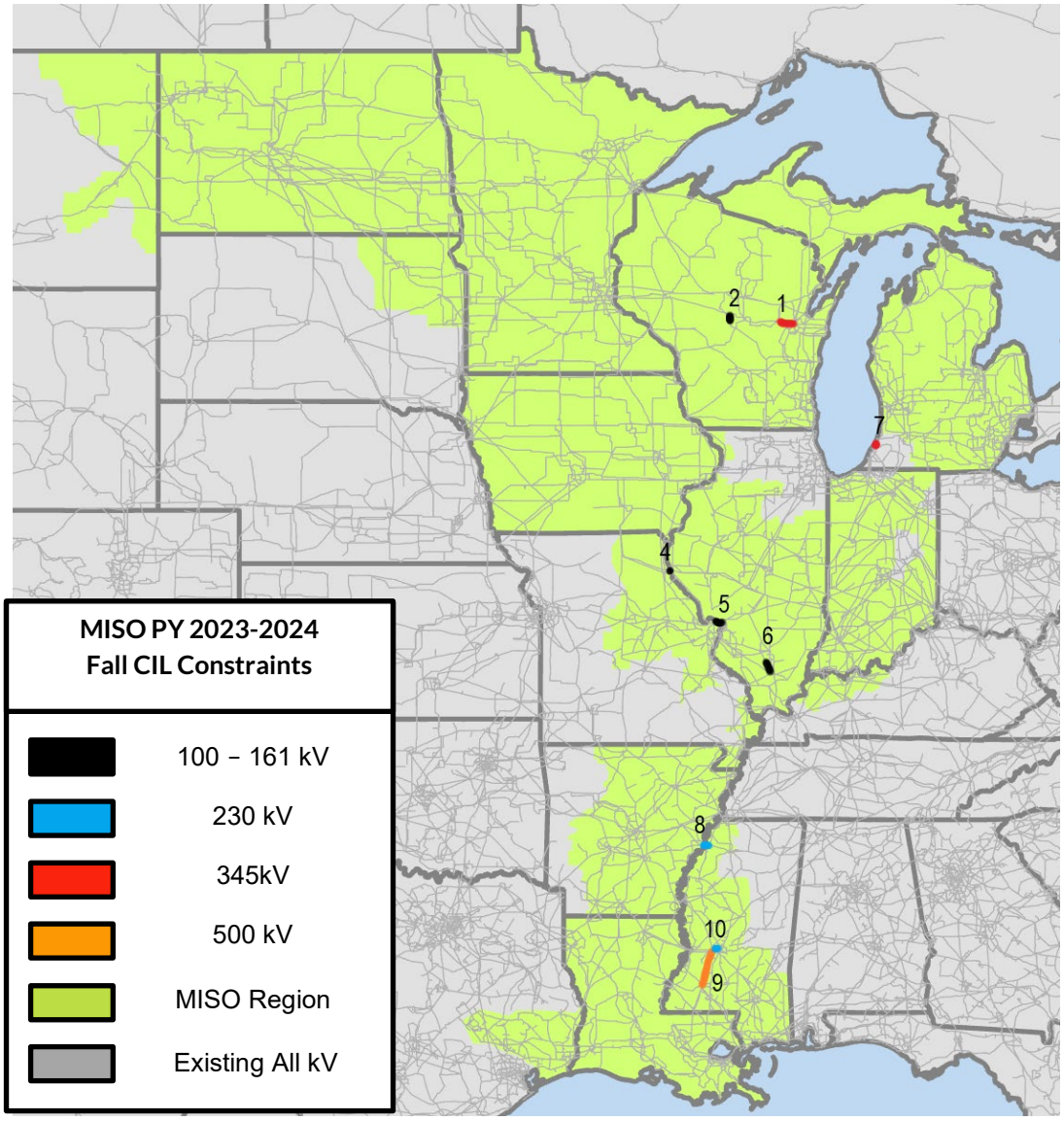


Figure 2-2: Planning Year 2023-2024 Fall Capacity Import Constraints Map

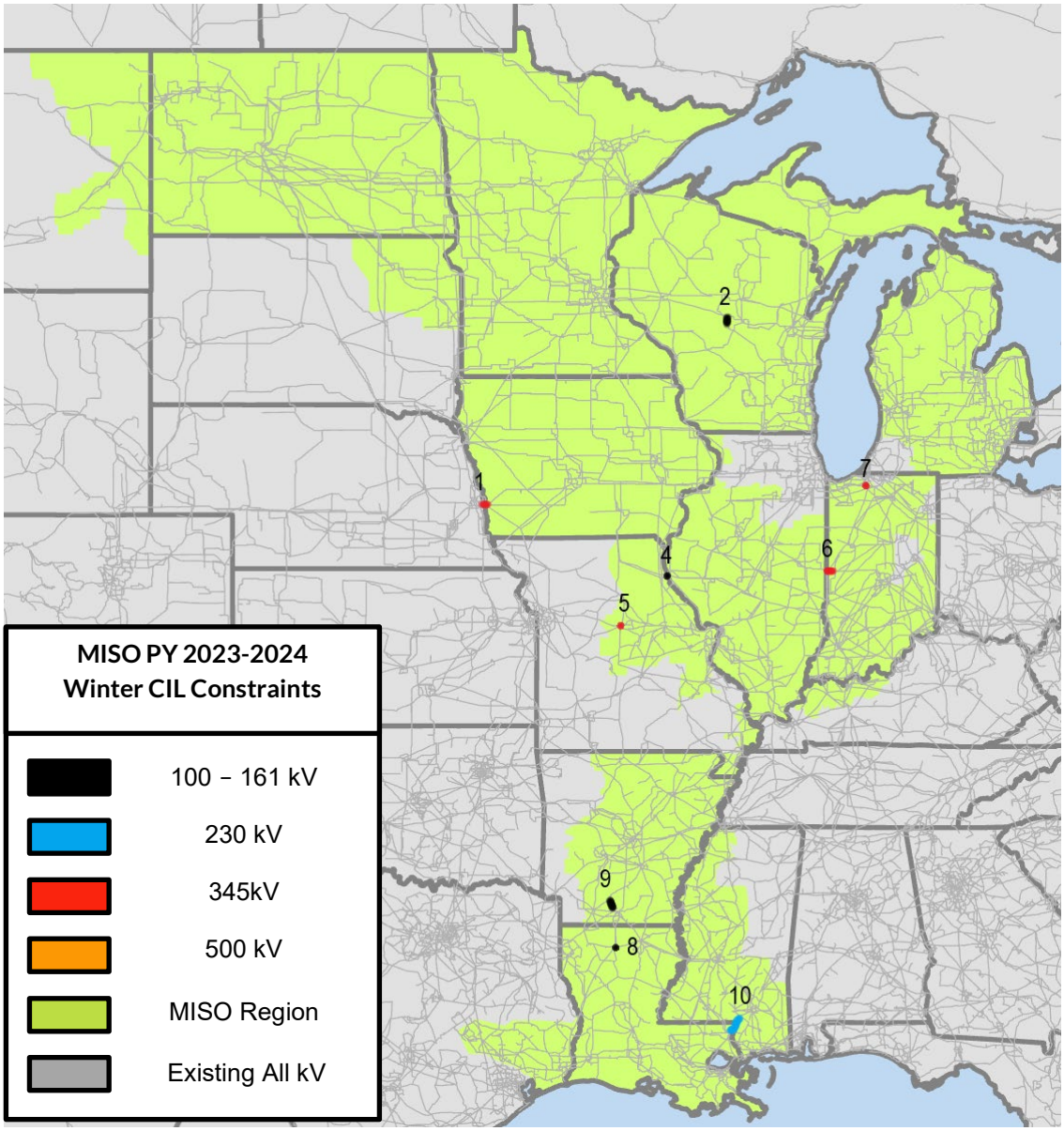


Figure 2-3: Planning Year 2023-2024 Winter Capacity Import Constraints Map

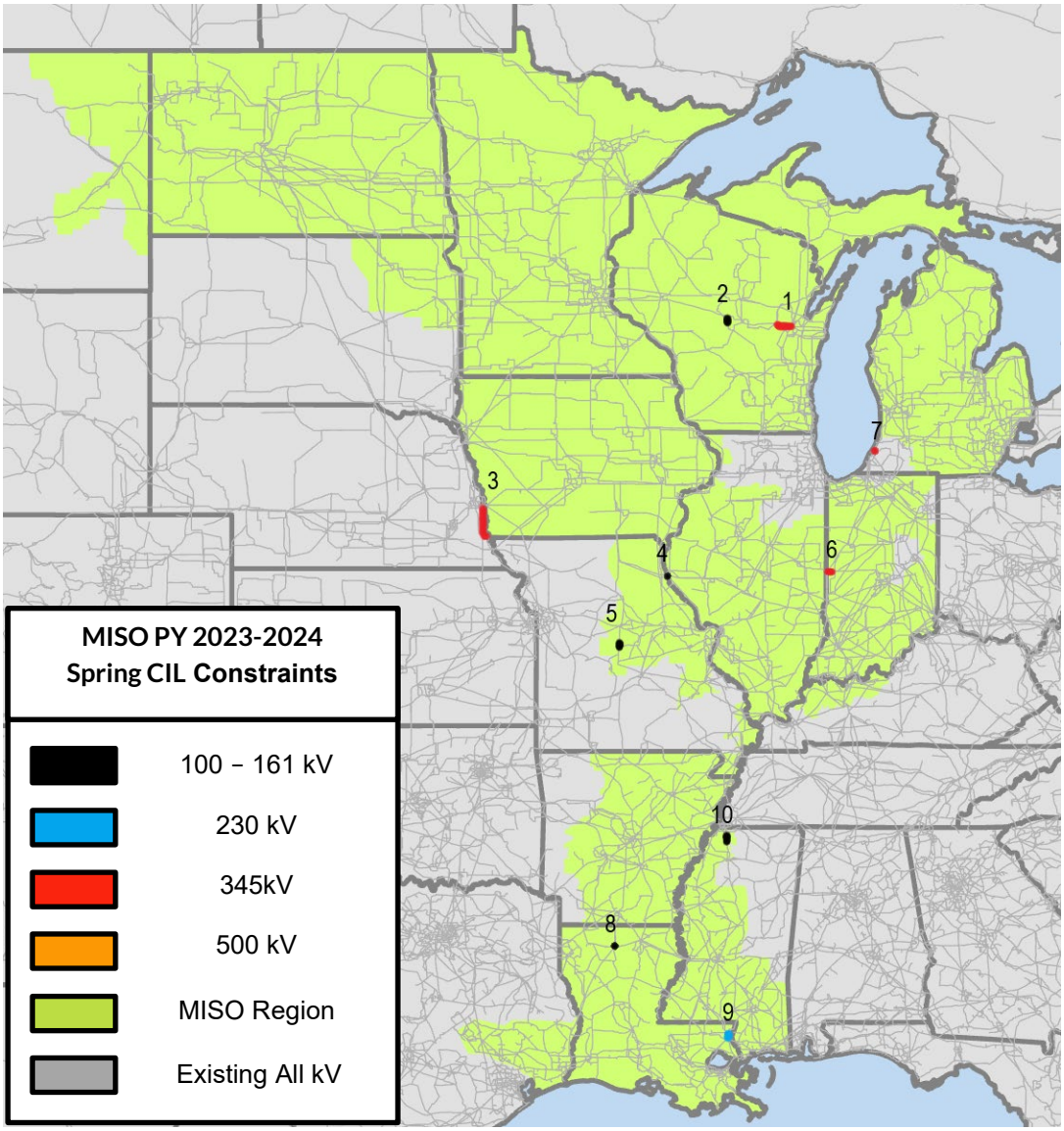


Figure 2-4: Planning Year 2023-2024 Spring Capacity Import Constraints Map

Capacity Exports Limits are found by increasing generation in the study zone and decreasing generation in the rest of the MISO footprint to create a transfer. Table 2-4 below shows the Planning Year 2023-2024 CEL and ZEA with corresponding constraint, GLT, and redispatch information.

LRZ1	Monitored Element	Contingency	GLT	RDS	ZEA	CEL
Summer 2023	Granville - Butler 138kV	Granville - Arcadian 345kV	15%	None	3961	3959
Fall 2023	Arpin - Sigel 138kV	Rocky Run - Arpin 345kV	None	18MWx2	3806	3804
Winter 2023/24	Arpin - Sigel 138kV	Rocky Run - Arpin 345kV	None	29MWx2	3503	3501
Spring 2024	Rocky Run - Werner 345kV	Highway 22 - Gardner Park 345kV	None	21MWx2	4323	4321
LRZ2	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Wempletown 345/138kV Transformer	Cherry Valley - Wempleton 345kV	20%	None	2550	2550
Fall 2023	Elm Road - Racine 345kV	Base Case	None	None	3577	3577
Winter 2023/24	Pleasant Prairie - Zion EC 345kV	Pleasant Prairie - Zion 345kV	15%	None	4198	4198
Spring 2024	Elm Road - Racine 345kV	Base Case	None	None	3679	3679
LRZ3	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Mercer - Sandburg 161kV	Sandburg - Oak Grove 345kV	45%	None	4375	4310
Fall 2023	Prar Creek - Marion 115	Prar Creek - Bertram 115kV	None	147MWx2	4419	4354
Winter 2023/24	Sandburg 161/138kV Transformer	Sandburg - Oak Grove 345kV	None	109MWx2	7067	7002
Spring 2024	Sandburg 161/138kV Transformer	Sandburg - Oak Grove 345kV	40%	None	6238	6173
LRZ4	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	No CEL Found	No CEL Found	50%	None	9999	9999
Fall 2023	No CEL Found	No CEL Found	50%	None	9999	9999
Winter 2023/24	No CEL Found	No CEL Found	50%	None	9999	9999
Spring 2024	No CEL Found	No CEL Found	50%	None	9999	9999
LRZ5	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	No CEL Found	No CEL Found	45%	None	9999	9999
Fall 2023	Jord - West Frankfort 138kV	Mount Vernon - West Frankfort 345kV	None	None	1992	1992
Winter 2023/24	Miles Avenue - Moro 138kV	Roxford - Moro 345kV	35%	121MWx2	6348	6348
Spring 2024	Mass 345/161 kV Transformer	Joppa - Mass 345kV	None	None	3724	3724
LRZ6	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Franscisco - Duff 345kV	AB Brown - Reid 345kV	15%	206MWx2	3109	2703
Fall 2023	Newtonville - Coleman 161kV	Duff - Coleman 345kV	None	493MWx2	2101	1701
Winter 2023/24	Newtonville- Grandview 138kV	Cutley - Dubois 138kV	None	42MWx2	1642	1242
Spring 2024	Newtonville - Coleman 161kV	AB Brown - Reid 345kV	None	65MWx2	2744	2344
LRZ7	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Monroe - Lulu 345kV	Monroe - Lallendorf 345kV	25%	None	3953	3953
Fall 2023	Monroe - Lulu 345kV	Monroe - Lallendorf 345kV	None	None	3990	3990
Winter 2023/24	Monroe - Lulu 345kV	Monroe - Lallendorf 345kV	None	None	4350	4350
Spring 2024	Monroe - Lulu 345kV	Monroe - Lallendorf 345kV	None	None	4413	4413
LRZ8	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Cash - Jonesboro 161kV	Ises - Powerlane Road 500kV	50%	218MWx2	5551	5503
Fall 2023	Arklahoma - HS EHV 115kV 2	Arklahoma - HS EHV 115kV 2	None	177MWx2	5128	5080
Winter 2023/24	Cash - Jonesboro 161kV	Ises - Powerlane Road 500kV	25%	134MWx2	5399	5351
Spring 2024	Cash - Jonesboro 161kV	Ises - Powerlane Road 500kV	None	177MWx2	5520	5472

LRZ9	Monitored Element	Contingency	GLT	RDS	ZEA	CEL
Summer 2023	Adams Creek - Angie 230kV	Slidel - Log Town 230kV	None	None	2386	1574
Fall 2023	Wrightsville - Keo 500kV	White Bluff - Keo 500kV	None	None	2338	1526
Winter 2023/24	Adams Creek - Angie 230kV	Slidel - Log Town 230kV	None	None	1689	877
Spring 2024	Adams Creek - Angie 230kV	Slidel - Log Town 230kV	None	None	3052	2240
LRZ10	**Monitored Element**	**Contingency**	**GLT**	**RDS**	**ZEA**	**CEL**
Summer 2023	Andrus 230/115kV Transformer	Andrus - Indianola	None	510MWx2	1794	1794
Fall 2023	Clarksdale - Lyon 115kV	Crossroads - Moon Lake 230kV	None	284MWx2	2878	2878
Winter 2023/24	Batesville - Tallahachie 161kV	Choctaw - Clay 500kV	None	690MWx2	1980	1980
Spring 2024	Clarksdale - Lyon 115kV	Crossroads - Moon Lake 230kV	None	535MWx2	2720	2720

Table 2-4: Planning Year 2023–2024 Export Limits

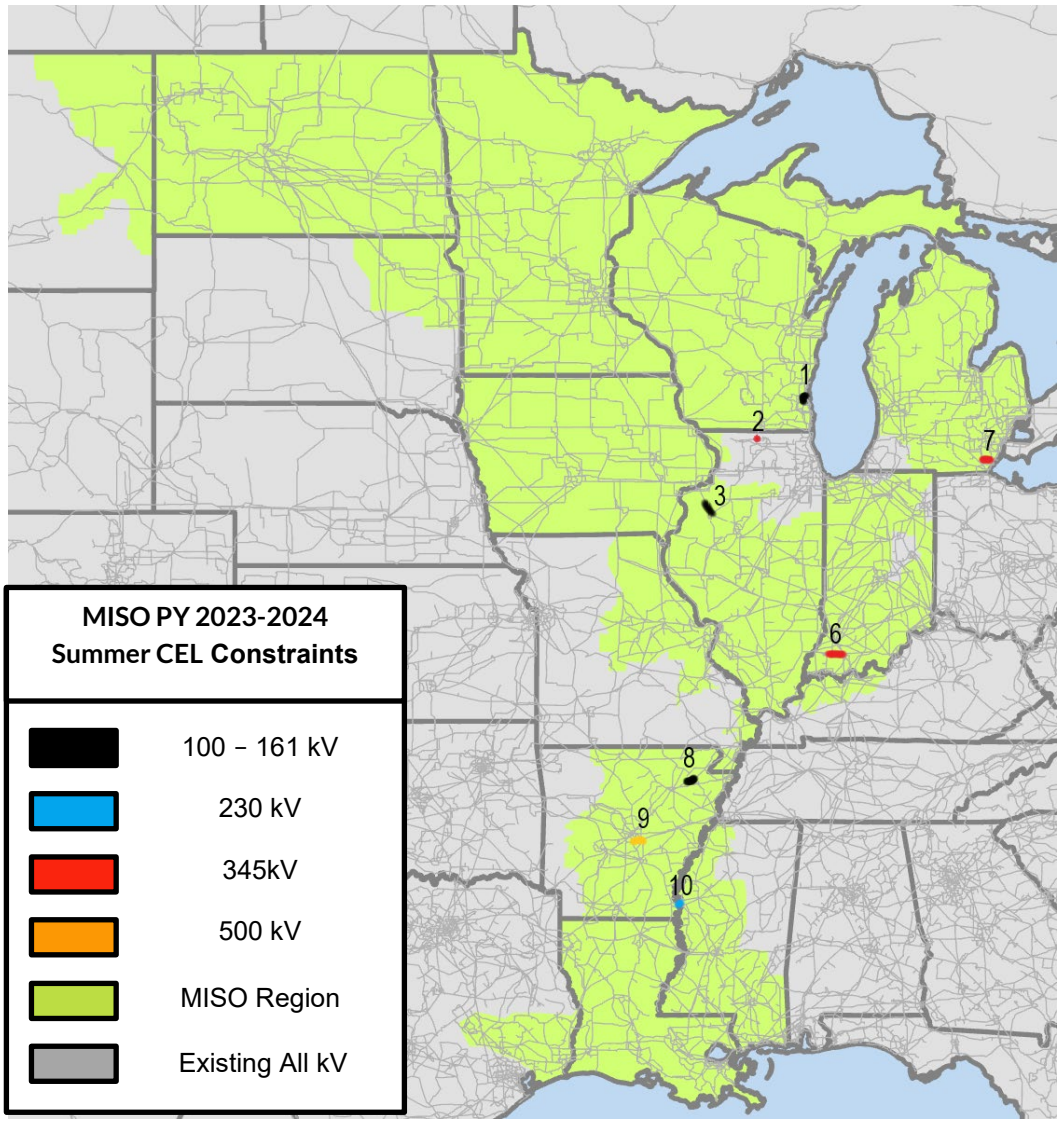


Figure 2-5: Planning Year 2023-2024 Summer Export Constraint Map

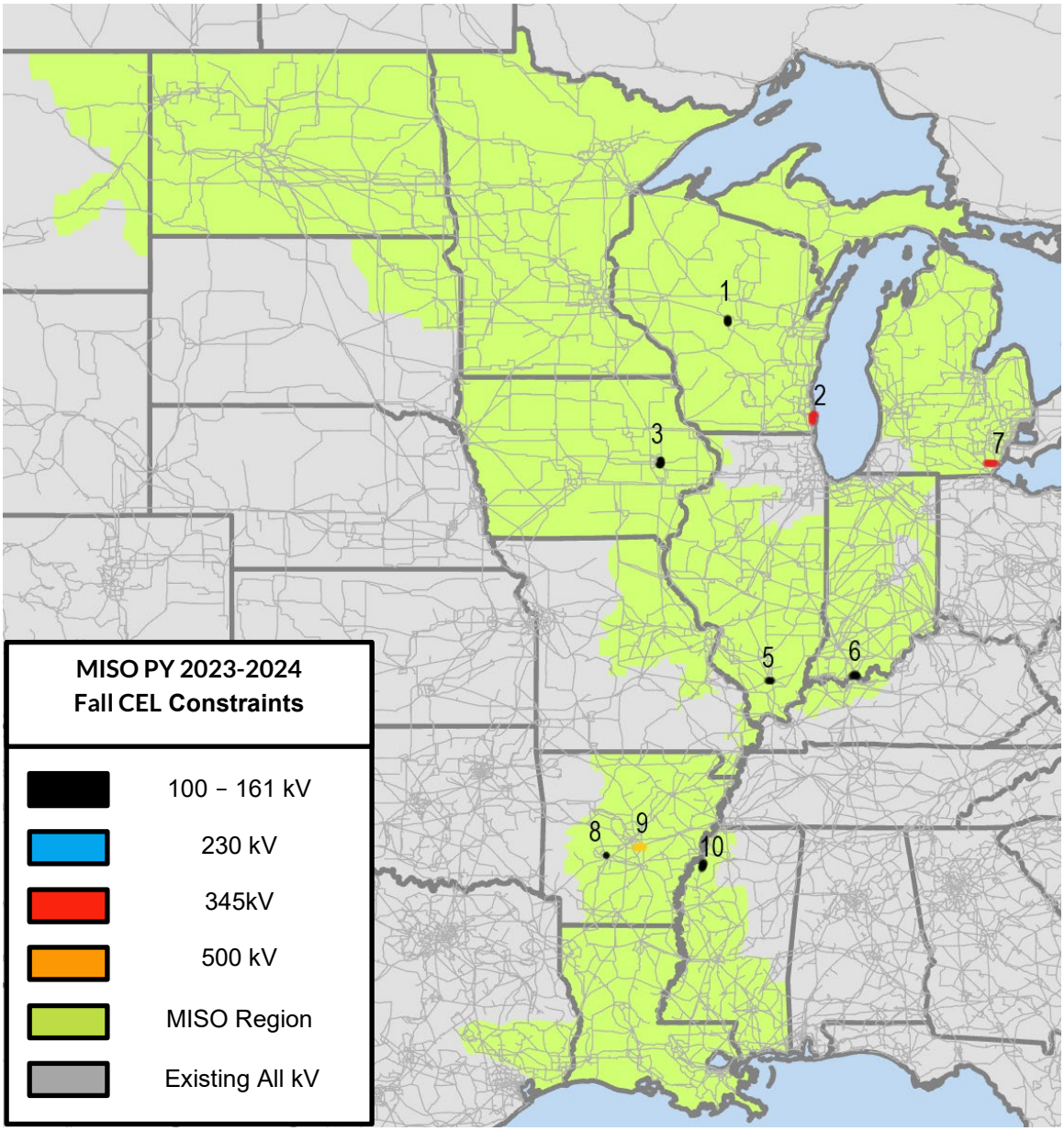


Figure 2-6: Planning Year 2023-2024 Fall Export Constraint Map

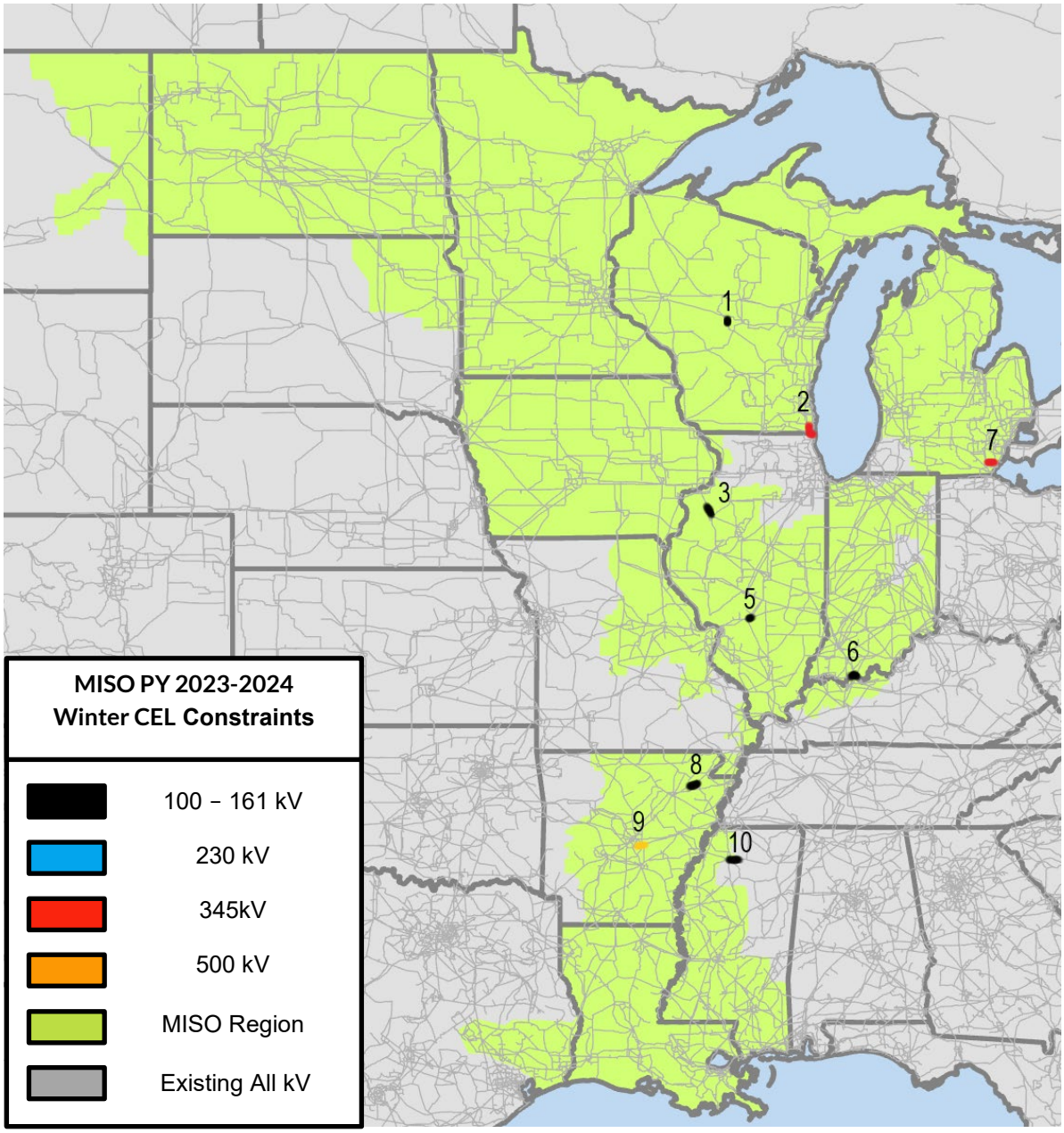


Figure 2-7: Planning Year 2023-2024 Winter Export Constraint Map

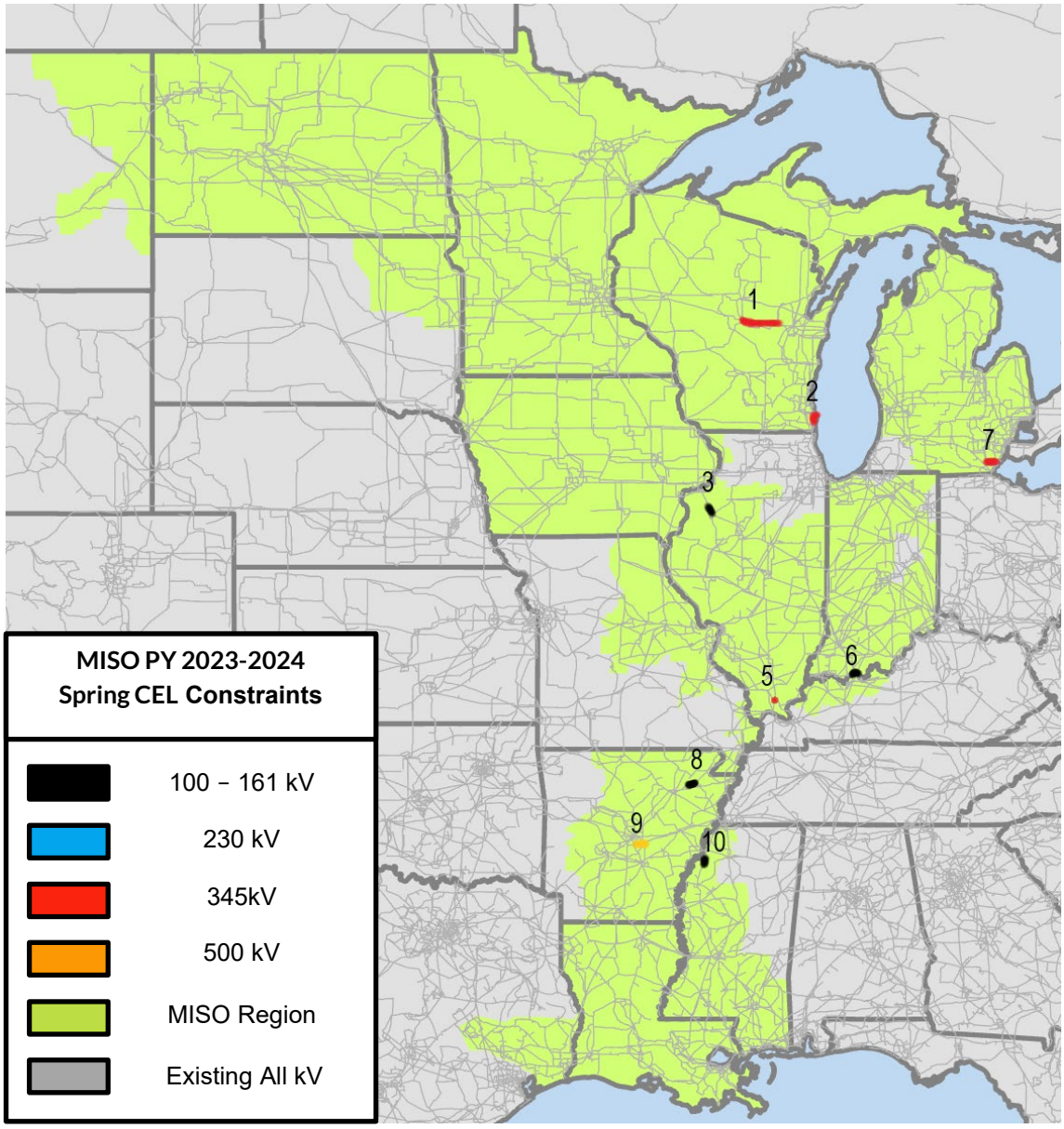


Figure 2-8: Planning Year 2023-2024 Spring Export Constraint Map

2.3.1 Outyear Analysis

In 2018, MISO and its stakeholders redesigned the outyear LOLE transfer analysis process through the LOLEWG and Resource Adequacy Subcommittee (RASC). The outyear analysis is now performed after the prompt Planning Year analyses are complete. The outyear results are informational only. The zones identified for outyear analysis are determined by BPM-011 criteria. The results will be documented outside of the LOLE report and recorded in RASC meeting materials in Q2 of 2023 and memorialized at a later date as an addendum to the LOLE report in 2023.

3 Loss of Load Expectation Analysis

3.1 LOLE Modeling Input Data and Assumptions

MISO uses a program managed by Astrapé Consulting called Strategic Energy & Risk Valuation Model (SERVM) to calculate the LOLE for the applicable Planning Year. SERVM uses a sequential Monte Carlo simulation to model a generation system and to assess the system's reliability based on any number of interconnected areas. SERVM calculates the LOLE for the MISO system and each LRZ by stepping through the year chronologically and taking into account generation, load, load modifying and energy efficiency resources, equipment forced outages, planned and maintenance outages, weather and economic uncertainty, and external support.

Building the SERVM model is the most time-consuming task of the LOLE study. Many scenarios are built in order to determine how certain variables impact the results. The base case models determine the seasonal MISO PRM Installed Capacity (ICAP), PRM UCAP, and the LRRs for each LRZ for future Planning Years one, four and six.

3.2 MISO Generation

3.2.1 Thermal Units

The Planning Year 2023-2024 LOLE study used the 2022-2023 PRA converted capacity as a starting point for which resources to include in the study. This ensured that only resources eligible as a Planning Resources were included in the LOLE study. An exception was made for resources with a signed GIA with an anticipated in-service date for PY 2023-2024—these resources were also included. All internal Planning Resources were modeled in the LRZ in which they are physically located. Additionally, Coordinating Owners and Border External Resources were modeled as being internal to the LRZ in which they are committed to serving load.

Forced outage rates and planned maintenance factors were calculated over a five-year period (January 2017 to December 2021) and modeled as four seasonal values for each unit. Some units did not have five years of historical data in MISO's Generator Availability Data System (PowerGADS)—however, if they had at least 3 consecutive months of seasonal data, unit-specific information was used to calculate their seasonal forced outage rates and maintenance factors. Units with fewer than 3 consecutive months of seasonal unit-specific data were assigned the corresponding MISO seasonal class average forced outage rate and seasonal planned maintenance factor based on their fuel type. The overall MISO ICAP-weighted seasonal class average forced outage rate and seasonal planned maintenance factor are applied in lieu of class averages for classes with fewer than 30 units. When the units are populated into the LOLE model, the weighted outage rate in SERVM may be different from the calculated MISO-wide weighted average because the MISO-wide weighted average excludes units with insufficient operating history. Therefore, the weighted outage rate is recalculated to include units that were assigned class average outage rates to gauge how SERVM views the MISO-wide weighted average. This value is for information only and is not assigned to any units.

Each nuclear unit has a fixed maintenance schedule, which was pulled from publicly available information and was modeled for each of the study years.

The historical class average outage rates as well as the MISO system-wide weighted average forced outage rate are provided in Table 3-1 to show the year-over-year trends, as well as in Table 3-2 on a seasonal basis.

Pooled EFORd GADS Years	2017-2021 (%)	2016-2020 (%)	2015-2019 (%)	2014-2018 (%)	2013-2017 (%)	2012-2016 (%)
LOLE Study Planning Year	**PY 2023-2024 LOLE Study – Summer 2023**	**PY 2022-2023 LOLE Study**	**PY 2021-2022 LOLE Study**	**PY 2020-2021 LOLE Study**	**PY 2019-2020 LOLE Study**	**PY 2018-2019 LOLE Study**
Combined Cycle	5.54	5.85	5.52	5.70	5.370	4.62
Combustion Turbine (0-20 MW)	23.40	35.20	36.38	40.39	23.18	29.02
Combustion Turbine (20-50 MW)	6.30	13.65	14.20	15.29	15.76	13.48
Combustion Turbine (50+ MW)	4.07	4.36	4.76	4.65	5.18	6.19
Diesel Engines	12.79	7.25	10.05	23.53	10.26	10.42
Fluidized Bed Combustion	*	*	*	*	*	*
Hydro (0-30 MW)	*	*	*	*	*	*
Hydro (30+ MW)	*	*	*	*	*	*
Nuclear	*	*	*	*	*	*
Pumped Storage	*	*	*	*	*	*
Steam - Coal (0-100 MW)	*	*	*	5.33	4.60	5.14
Steam - Coal (100-200 MW)	*	*	*	*	*	*
Steam - Coal (200-400 MW)	*	*	10.47	10.16	9.82	9.77
Steam - Coal (400-600 MW)	*	*	*	*	*	*
Steam - Coal (600-800 MW)	*	*	*	*	8.22	7.90
Steam - Coal (800-1000 MW)	*	*	*	*	*	*

Steam - Gas	11.26	11.84	12.91	12.54	11.56	11.94
Steam - Oil	*	*	*	*	*	*
Steam - Waste Heat	*	*	*	*	*	*
Steam - Wood	*	*	*	*	*	*
MISO Weighted System-wide	8.23	9.04	9.36	9.24	9.28	9.16
MISO Weighted as seen in SERVM	7.64	8.95	9.17	9.22	9.18	-

**MISO system-wide weighted forced outage rate used in place of class data for those with less than 30 units reporting 12 or more months of data*

Table 3-1: Historical Class Average Forced Outage Rates

Pooled EFORd GADS Years	**2017-2021 (%)**	**2017-2021 (%)**	**2017-2021 (%)**	**2017-2021 (%)**
LOLE Study Planning Year 2023-2024	**Summer 2023**	**Fall 2023**	**Winter 2023-2024**	**Spring 2024**
Combined Cycle	5.54	8.32	4.70	6.19
Combustion Turbine (0-20 MW)	23.40	53.44	42.92	58.75
Combustion Turbine (20-50 MW)	6.30	16.79	56.52	25.23
Combustion Turbine (50+ MW)	4.07	6.60	9.68	4.81
Diesel Engines	12.79	9.32	14.84	8.07
Fluidized Bed Combustion	*	*	*	*
Hydro (0-30 MW)	*	*	*	*
Hydro (30+ MW)	*	*	*	*

Nuclear	*	*	*	*
Pumped Storage	*	*	*	*
Steam - Coal (0-100 MW)	*	*	*	*
Steam - Coal (100-200 MW)	*	*	*	*
Steam - Coal (200-400 MW)	*	*	*	*
Steam - Coal (400-600 MW)	*	*	*	*
Steam - Coal (600-800 MW)	*	*	*	*
Steam - Coal (800-1000 MW)	*	*	*	*
Steam - Gas	12.48	13.66	8.28	11.26
Steam - Oil	*	*	*	*
Steam - Waste Heat	*	*	*	*
Steam - Wood	*	*	*	*
MISO Weighted System-wide	8.23	9.48	12.47	11.42

**MISO system-wide weighted forced outage rate used in place of class data for those with less than 30 units reporting 12 or more months of data*

Table 3-2: Planning Year 2023-2024 Seasonal Class Average Forced Outage Rates

3.2.2 Behind-the-Meter Generation

Behind-the-Meter Generation data came from the Module E Capacity Tracking (MECT) tool. Behind-the-Meter Generation backed by thermal resources were explicitly modeled just as any other thermal generator with a monthly capacity and forced outage rate. Performance data was pulled from PowerGADS. Behind-the-Meter Generation backed by wind or solar resources had their hourly generation tied to the hourly wind and solar profiles in the model.

3.2.3 Attachment Y

MISO obtained information on generating units with approved suspensions or retirements (as of June 1, 2022) through MISO's Attachment Y process. Any unit with approved retirement or suspension in Planning Year 2023-2024

was excluded from the year-one analysis during the months the unit has been approved to be out-of-service for. This same methodology is used for the four- and six-year analyses.

3.2.4 Future Generation

Future thermal generation and upgrades were added to the LOLE model based on unit information in the MISO Generator Interconnection Queue. The LOLE model included units with a signed generator interconnection agreement (as of June 1, 2022). These new units were assigned seasonal class average forced outage rates and planned maintenance factors based on their particular unit class. Units upgraded during the study period reflect the megawatt increase for each month, beginning the month the upgrade was finished. The LOLE analysis also included future wind and solar generation, tied to the same hourly wind and solar profiles used for existing wind and solar resources in the model.

3.2.5 Intermittent Resources

Intermittent resources such as run-of-river hydro, biomass, wind and solar were explicitly modeled as demand-side resources. Run-of-river hydro and biomass provide MISO with a minimum of 3 years and up to 15 years of historical output data during seasonal peak hours, defined as hours ending 15, 16, & 17 EST for summer, fall, and spring, and hours ending 8, 9, 19, & 20 for winter. This data is averaged at the seasonal level and modeled in the LOLE analysis as UCAP for all months within a given season. Each individual unit is modeled and put in the corresponding LRZ.

As a process improvement to the LOLE model for this year's study, in collaboration with the SERVM vendor Astrapé, hourly wind and solar profiles were developed and introduced into the model to better simulate the variance in renewable generation on an hourly basis.

Using historical hourly wind data from 246 front-of-meter wind resources from 2013 to 2021, normalized hourly capacity profiles were developed and aggregated at the LRZ level to represent wind in the model. As a result of the LOLE analysis being based on 30 weather years (1992 – 2021), synthetic shapes were created for the 1992 – 2013 period based on historical wind performance and temperatures. Once the weather and wind performance matching has been performed, the data is analyzed as a function of load to ensure the variability around the load profiles is reasonable.

Solar profiles were developed using historical solar irradiance data from the NREL National Solar Radiation Database (NSRDB) from 1998 – 2021.

For more details, refer to the supporting documentation Astrapé provided for stakeholders at the LOLEWG detailing the development of the wind and solar profiles: MISO Seasonal Inputs for the 2022 LOLE Study

3.2.6 Demand Response

Demand response data came from the MECT tool. These resources were explicitly modeled as dispatch-limited resources. Each demand response program was modeled individually with a monthly capacity, limited to the number of times each program can be called upon, and limited by duration.

3.3 MISO Load Data

The Planning Year 2023-2024 LOLE analysis used a load training process with neural net software to create a neural-net relationship between historical weather and load data. This relationship was then applied to 30 years of hourly historical weather data to create 30 different load shapes for each LRZ in order to capture both load diversity and seasonal variations. The average monthly loads of the predicted load shapes were adjusted to match each LRZ's

Module E 50/50 monthly zonal peak load forecasts for each study year. The results of this process are shown as the MISO System Peak Demand (Table 4-1) and LRZ Peak Demands (Table 5-1, Table 5-2, Table 5-3, & Table5-4).

Direct Control Load Management and Interruptible Demand types of demand response were explicitly included in the LOLE model as resources. These demand resources are implemented in the LOLE simulation before accumulating LOLE.

3.3.1 Weather Uncertainty

MISO has adopted a six-step load training process in order to capture the weather uncertainty associated with the 50/50 load forecasts. The first step of this process requires the collection of five years of historical real-time load modifying resource (LMR) performance and load data, as well as the collection of 30 years of historical weather data. Both the LMR and load data are taken from the MISO market for each LBA, while the historical weather data is collected from the National Oceanic and Atmospheric Administration (NOAA) for each LRZ. After collecting the data, the hourly gross load for each LRZ is calculated using the five years of historical data.

The second step of the process is to normalize the five years of load data to consistent economics. With the load growth due to economics removed from 5 years of historical LRZ load, the third step of the process utilizes neural network software to establish functional relationships between the five years of historical weather and load data. In the fourth step of the process the neural network relationships are applied to the 30 years of historical weather data in order to predict/create 30 years' worth of load shapes for each LRZ.

In the fifth step of the load training process, MISO undertakes extreme temperature verification on the 30 years of load shapes to ensure that the hourly load data is accurate at extremely hot or cold temperatures. This is required since there are fewer data points available at the temperature extremes when determining the neural network functional relationships. This lack of data at the extremes can result in inaccurate predictions when creating load shapes, which will need to be corrected before moving forward.

The sixth and final step of the load training process is to average the monthly peak loads of the predicted load shapes and adjust them to match each LR's Module E 50/50 monthly zonal peak load forecasts for each study year. In order to calculate this adjustment, the ratio of the first year's non-coincident peak forecast to the zonal coincident peak forecast is applied to future year's non-coincident peak forecast.

By adopting this new methodology for capturing weather uncertainty MISO is able to model multiple load shapes based off a functional relationship with weather. This modeling approach provides a variance in load shapes, as well as the peak loads observed in each load shape. This approach also provides the ability to capture the frequency and duration of severe weather patterns.

3.3.2 Economic Load Uncertainty

To account for economic load uncertainty in the Planning Year 2023-2024 LOLE model, MISO utilized a normal distribution of electric utility forecast error accounting for projected and actual Gross Domestic Product (GDP), as well as electricity usage. The historic projections for GDP growth were taken from the Congressional Budget Office (CBO), the actual GDP growth was taken from the Bureau of Economic Analysis (BEA), and the electric use was taken from the U.S. Energy Information Administration (EIA). Due to lack of statewide projected GDP data MISO relied on United States aggregate level data when calculating the economic uncertainty.

In order to calculate the electric utility forecast error, MISO first calculated the forecast error of GDP between the projected and actual values. The resulting GDP forecast error was then translated into electric utility forecast error

by multiplying by the rate at which electric load grows in comparison to the GDP. Finally, a standard deviation is calculated from the electric utility forecast error and used to create a normal distribution representing the probabilities of the load forecast errors (LFE) as shown in Table 3-3.

	LFE Levels				
	-2.0%	-1.0%	0.0%	1.0%	2.0%
Standard Deviation in LFE	Probability assigned to each LFE				
0.90%	4.8%	24.1%	42.1%	24.1%	4.8%

Table 3-3: Economic Uncertainty

As a result of stakeholder feedback MISO is exploring possible alternative methods for determining economic uncertainty to be used in the LOLE process.

3.4 External System

Firm imports from external areas to MISO are modeled at the individual unit level. The specific external units were modeled with their specific installed capacity amount and their corresponding Equivalent Forced Outage Rate demand (EFORd). This better captures the probabilistic reliability impact of firm external imports. These units are only modeled within the MISO PRM analysis and are not modeled when calculating the LRZ LRRs. Due to the locational Tariff filing, Border and Coordinating Owners External Resources are no longer considered firm imports. Instead, these resources are modeled as internal MISO units and are included in the PRM and LRR analysis. The external resources to include for firm imports were based on the amount offered into the Planning Year 2022-2023 Planning Resource Auction (PRA).

The LOLE analysis incorporates firm exports to neighboring regions where information was available. For units with capacity sold off-system, their monthly capacities were reduced by the megawatt amount exported. These values came from PJM's Reliability Pricing Model (RPM) as well as information on exports to other external areas taken from the Independent Market Monitor (IMM) exclusion list.

Firm exports from MISO to external areas were modeled the same as previous years. Capacity ineligible as MISO capacity due to transactions with external areas is removed from the model. Table 3-4 shows the amount of firm imports and exports in this year's study.

Contracts	Summer ICAP (MW)	Summer UCAP (MW)	Fall ICAP (MW)	Fall UCAP (MW)	Winter ICAP (MW)	Winter UCAP (MW)	Spring ICAP (MW)	Spring UCAP (MW)
Imports (MW)	1,731	1,673	1,734	1,672	1,874	1,819	1,803	1,755
Exports (MW)	2,543	2,287	2,543	2,287	2,543	2,287	2,543	2,287
Net	**-812**	**-614**	**-809**	**-615**	**-669**	**-468**	**-740**	**-532**

Table 3-4: Planning Year 2023-2024 Firm Imports and Exports

Non-firm imports in the Planning Year 2023-2024 LOLE study were modeled as a probabilistic distribution of capacity value. These distributions were developed using historic seasonal NSI data which accounted for imports into MISO during emergency pricing hours. Firm imports cleared in the PRA for each planning year were subtracted from the NSI data to isolate the non-firm values. An additional region was included in SERVM which contained 12,000 MW of perfect generation connected to the MISO system. A distribution of the regions export capability was modeled up to the upper and lower bounds. As SERVM steps through the hourly simulation, random draws on the export limits of the external region were used to represent the amount of capacity MISO could import to meet peak demand. The probability distribution of non-firm external imports used in the LOLE model has been provided in Table 3-5.

	Summer	Fall	Winter	Spring
p5	1,456	649	-	1,777
p10	2,663	1,259	205	2,144
p25	3,674	2,199	1,142	2,768
p50	4,708	3,393	3,143	4,031
p75	5,608	4,537	4,941	5,265
p90	6,465	5,453	7,249	6,271
p95	6,807	6,217	8,452	7,055

Table 3-5: Non-Firm External Import Distribution During Emergency Pricing Hours

3.5 Loss of Load Expectation Analysis and Metric Calculations

Upon completion of the annual LOLE study model refresh, MISO performed probabilistic analyses to determine the seasonal PRM ICAP and PRM UCAP for the Planning Year 2023-2024 as well as the seasonal Local Reliability Requirement for each of the 10 LRZs. These metrics were derived through probabilistic modeling of the system, first solving to the industry standard annual LOLE risk target of 1 day in 10 years, or 0.1 day per year, and then solving to the seasonal LOLE targets.

3.5.1 Seasonal LOLE Distribution

To determine the seasonal LOLE distribution that will be used to calculate the PRM and LRRs, MISO followed the process described in Section 68A.2.1 of Module E-1 of the MISO Tariff. This process involves first solving the LOLE model to an annual value of 0.1 and then checking the seasonal distribution of the annual LOLE of 0.1. If a season had an LOLE value of at least 0.01, then it met the minimum seasonal criteria and would be set to that LOLE. If a season had less than 0.01 LOLE, additional analysis was performed until the minimum seasonal criteria of 0.01 LOLE was met.

Example: Assume the model is solved to an annual LOLE of 0.1 with 0.05 occurring in both summer and winter while spring and fall had LOLE values of 0 from this simulation. In this case the summer and winter seasons would not need additional analysis since both had at least 0.01 LOLE naturally when the model was solved to an annual value of 0.1. Since spring and fall had 0 LOLE they would be assigned the LOLE minimum seasonal criteria of 0.01 and additional LOLE simulations would be performed until the minimum seasonal criteria was met.

The seasonal LOLE distribution determined in the Planning Year 2023-2024 LOLE study are shown in Table 3-6.

Region	Summer	Fall	Winter	Spring
MISO-wide	0.1	0.01	0.01	0.01
1	0.08	0.01	0.02	0.01
2	0.1	0.01	0.01	0.01
3	0.07	0.01	0.03	0.01
4	0.04	0.01	0.04	0.01
5	0.04	0.01	0.05	0.01
6	0.05	0.01	0.04	0.01
7	0.07	0.03	0.01	0.01
8	0.01	0.01	0.08	0.01
9	0.06	0.01	0.02	0.01
10	0.05	0.04	0.01	0.01

Table 3-6: Planning Year 2023-2024 Seasonal LOLE Distribution

3.7.1 MISO-Wide LOLE Analysis and PRM Calculation

MISO will determine the appropriate PRM for each season of the applicable Planning Year based upon probabilistic analysis of reliably serving expected demand. The probabilistic analysis will utilize a Loss of Load Expectation (LOLE) study which assumes that there are no internal transmission limitations.

To determine the PRM, the LOLE model will initially be run with no adjustments to the capacity. If the LOLE is less than 0.1 day per year, a negative unit with zero forced outage rate will be added until the LOLE reaches 0.1 day per year. This is comparable to adding load to the model. If the LOLE is greater than 0.1 day per year, proxy units based on a unit of typical size and forced outage rate will be added to the model until the LOLE reaches 0.1 day per year.

MISO's annual LOLE study will calculate the seasonal PRMs based on the LOLE targets identified in the previous section. The minimum seasonal PRM requirement will be determined using the LOLE analysis by either adding a zero EFORd, negative output unit or adding proxy units until a minimum LOLE of 0.01 day per season is reached.

The formulas for the PRM values for the MISO system are:

PRM ICAP % = (Installed Capacity + Firm External Support ICAP + ICAP Adjustment to meet LOLE target – MISO Coincident Peak Demand)/MISO Coincident Peak Demand

PRM UCAP % = (Unforced Capacity + Firm External Support UCAP + UCAP Adjustment to meet LOLE target – MISO Coincident Peak Demand)/MISO Coincident Peak Demand

Where Unforced Capacity (UCAP) = Installed Capacity (ICAP) x (1 – XEFORd)

3.7.2 LRZ LOLE Analysis and Local Reliability Requirement Calculation

For the LRZ analysis, each LRZ included only the generating units within the LRZ (including Coordinating Owners and Border External Resources) and was modeled without consideration of the benefit of the LRZ's import capability. Much like the MISO analysis, unforced capacity is either added or removed in each LRZ such that an LOLE of 0.1 day per year is achieved when solving for the annual target and a minimum LOLE at least 0.01 day per season when solving for a seasonal target. The minimum amount of unforced capacity above each LRZ's Peak Demand that was required to meet the reliability criteria was used to establish each LRZ's LRR.

The Planning Year 2023-2024 seasonal LRRs were determined using the LOLE analysis by first either adding or removing capacity until the annual LOLE reaches 0.1 day per year for the LRZ. If the LOLE is less than 0.1 day per year, a perfect negative unit with zero forced outage rate will be added until the LOLE reaches 0.1 day per year. If the LOLE is greater than 0.1 day per year, proxy units based on a unit of typical size and forced outage rate will be added to the model until the LOLE reaches 0.1 day per year.

After solving each LRZ for to the annual LOLE target of 0.1 day per year, MISO will calculate each seasonal LRR such that the summation of seasonal LOLE across the year in each zone is 1 day in 10 years, or 0.1 day per year. An LOLE target of 0.01 will be used to calculate the LRR in seasons with less than 0.01 LOLE risk. The seasonal Local Reliability Requirement will be determined using the LOLE analysis by either adding a zero EFORd, negative output unit or adding proxy units until a minimum LOLE of 0.01 day per season is reached.

For Planning Year 2023-2024, only LRZ-1 had sufficient capacity internal to the LRZ to achieve any of the seasonal LOLE targets as an island. In the nine zones without sufficient capacity as an island, proxy units of typical size (160 MW) and class average seasonal EFORd were added to the LRZ. When needed, a fraction of the final proxy unit was added to achieve the exact seasonal LOLE target for the LRZ.

LRR UCAP % = (Unforced Capacity + UCAP Adjustment to meet LOLE target – Zonal Coincident Peak Demand)/Zonal Coincident Peak Demand

4 MISO System Planning Reserve Margin Results

4.1 Planning Year 2023-2024 MISO Planning Reserve Margin Results

For Planning Year 2023-2024, the ratio of MISO capacity to forecasted MISO system peak demand yielded a planning ICAP reserve margin of 15.9 percent and a planning UCAP reserve margin of 7.4 percent for the summer season. Numerous values and calculations went into determining the MISO system PRM ICAP and PRM UCAP (Table 4-1).

MISO Planning Reserve Margin (PRM)	2023/2024 PY Summer	2023/2024 PY Fall	2023/2024 PY Winter	2023/2024 PY Spring	Formula Key
MISO System Peak Demand (MW)	123,711	111,012	103,455	99,113	[A]
Installed Capacity (ICAP) (MW)	144,268	144,992	150,673	145,366	[B]
Unforced Capacity (UCAP) (MW)	133,764	132,911	134,503	130,753	[C]
Firm External Support (ICAP) (MW)	1,731	1,734	1,874	1,803	[D]
Firm External Support (UCAP) (MW)	1,707	1,714	1,857	1,778	[E]
Adjustment to ICAP {1d in 10yr} (MW)	-2,650	-7,100	-6,500	-9,150	[F]
Adjustment to UCAP {1d in 10yr} (MW)	-2,650	-7,100	-6,500	-9,150	[G]
ICAP PRM Requirement (PRMR) (MW)	143,349	139,626	146,047	138,019	[H]=[B]+[D]+[F]
UCAP PRM Requirement (PRMR) (MW)	132,821	127,525	129,860	123,381	[I]=[C]+[E]+[G]
MISO PRM ICAP	**15.9%**	**25.8%**	**41.2%**	**39.3%**	[J]=([H]-[A])/[A]
MISO PRM UCAP	**7.4%**	**14.9%**	**25.5%**	**24.5%**	[K]=([I]-[A])/[A]

Table 4-1: Planning Year 2023-2024 MISO System Planning Reserve Margins

4.2 Comparison of PRM Targets Across 10 Years

Figure 4-1 compares the PRM UCAP values over the last 10 Planning Years. The last endpoint of the green line shows the Planning Year 2023-2024 Summer PRM value.

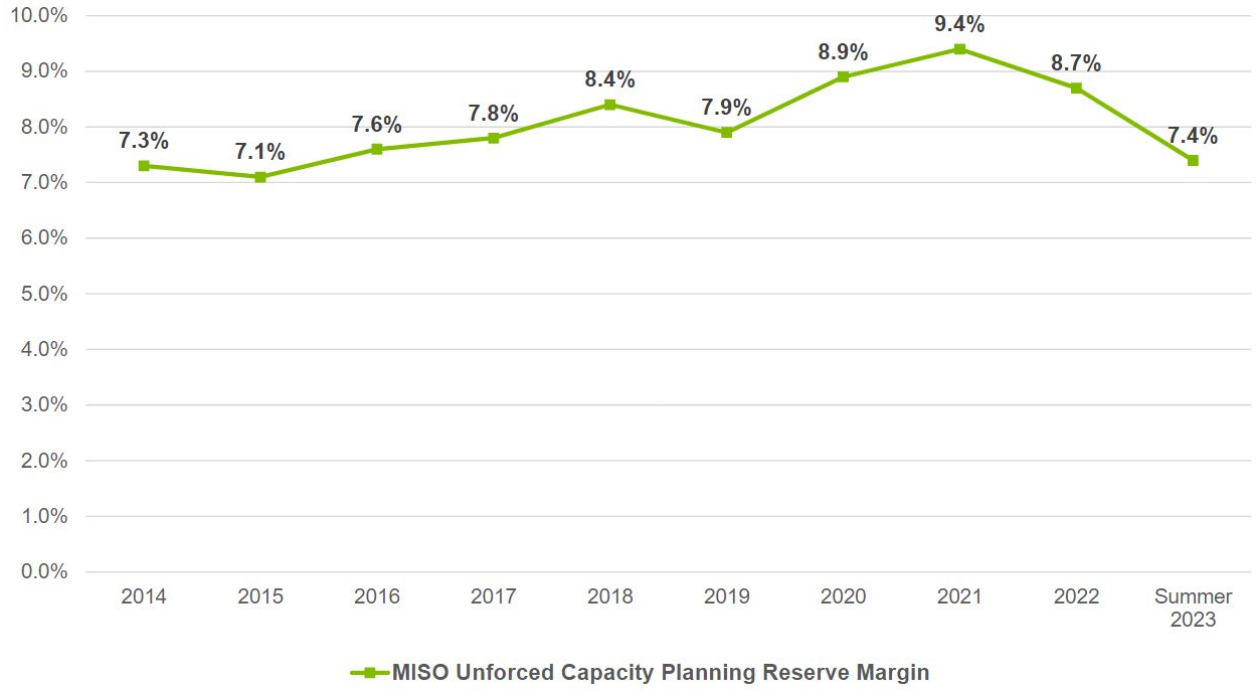


Figure 4-1: Comparison of PRM Targets Across 10 Years

4.3 Future Years 2023 through 2032 Planning Reserve Margins

Beyond the Planning Year 2023-2024 LOLE study analysis, an LOLE analysis will be performed for the four-year-out Planning Year of 2026-2027, as well as for the six-year-out Planning Year of 2028-2029. All other future Planning Years in scope will be derived from interpolation and extrapolation of the three modeled Planning Years.

5 Local Resource Zone Analysis – LRR Results

5.1 Planning Year 2023-2024 Local Resource Zone Analysis

MISO calculated the per-unit LRR of LRZ Seasonal Peak Demand for Planning Year 2023-2024 on a seasonal basis (Table 5-1, Table 5-2, Table 5-3, and Table 5-4). The UCAP values in the seasonal LRR tables reflect the assumed seasonal UCAP within each LRZ, including Border External Resources and Coordinating Owners. The adjustments to UCAP values are the megawatt adjustments needed in each LRZ so that the reliability criterion of 0.1 days per year LOLE is met. The LRR is the summation of the UCAP and adjustment to UCAP megawatts. The LRR is then divided by each LRZ's Seasonal Peak Demand to determine the per-unit LRR UCAP. The Planning Year 2023-2024 per-unit LRR UCAP values will be multiplied by the updated seasonal peak demand forecasts submitted for the 2023-2024 PRA to determine each LRZ's LRR. The zonal LRR LOLE targets have been provided for peak demand timestamps for all 30 weather years modeled in SERVM is shown in Table 5-5. These peak demand timestamps are the result of the SERVM load training process and are not necessarily the actual peaks for each year.

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2023-2024 Local Reliability Requirements – Summer 2023											
Installed Capacity (ICAP) (MW)	21,839	13,026	11,651	8,734	7,917	17,585	21,512	11,290	24,264	6,449	[A]
Unforced Capacity (UCAP) (MW)	20,843	12,145	11,225	7,986	7,410	15,973	20,476	10,866	21,097	5,743	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-255	2,062	1,583	3,242	2,859	4,844	3,952	403	2,897	1,209	[C]
LRR (UCAP) (MW)	20,588	14,207	12,808	11,228	10,269	20,817	24,428	11,269	23,994	6,952	[D]=[B]+[C]
Peak Demand (MW)	18,077	12,686	9,859	9,263	7,704	17,760	20,855	7,652	20,739	4,521	[E]
LRR UCAP per-unit of LRZ Peak Demand	**113.9%**	**112.0%**	**129.9%**	**121.2%**	**133.3%**	**117.2%**	**117.1%**	**147.3%**	**115.7%**	**153.8%**	[F]=[D]/[E]

Table 5-1: Planning Year 2023-2024 LRZ Local Reliability Requirements for Summer 2023

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2023-2024 Local Reliability Requirements – Fall 2023											
Installed Capacity (ICAP) (MW)	21,895	13,096	12,134	8,748	8,068	17,659	21,574	11,149	24,245	6,424	[A]
Unforced Capacity (UCAP) (MW)	20,460	12,097	11,545	7,787	7,201	16,014	20,269	10,190	21,787	5,561	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,230	1,289	1,046	3,138	2,625	4,170	3,848	28	2,821	1,177	[C]
LRR (UCAP) (MW)	19,230	13,386	12,591	10,925	9,825	20,184	24,117	10,218	24,607	6,738	[D]=[B]+[C]
Peak Demand (MW)	15,093	10,991	8,942	8,713	6,767	16,180	17,933	6,858	19,258	4,162	[E]
LRR UCAP per-unit of LRZ Peak Demand	**127.4%**	**121.8%**	**140.8%**	**125.4%**	**145.2%**	**124.7%**	**134.5%**	**149.0%**	**127.8%**	**161.9%**	[F]=[D]/[E]

Table 5-2: Planning Year 2023-2024 LRZ Local Reliability Requirements for Fall 2023

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2023-2024 Local Reliability Requirements – Winter 2023-2024											
Installed Capacity (ICAP) (MW)	22,449	13,578	14,291	9,028	8,528	18,244	21,710	11,298	24,921	6,626	[A]
Unforced Capacity (UCAP) (MW)	20,931	12,041	13,353	7,125	7,032	16,480	20,151	9,901	21,775	5,714	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-255	1,536	1,491	3,054	2,692	4,562	1,789	379	2,728	1,138	[C]
LRR (UCAP) (MW)	20,676	13,577	14,844	10,179	9,724	21,042	21,940	10,280	24,503	6,852	[D]=[B]+[C]
Peak Demand (MW)	14,738	9,549	8,025	7,456	6,599	16,173	13,945	6,839	18,523	3,856	[E]
LRR UCAP per-unit of LRZ Peak Demand	**140.3%**	**142.2%**	**185.0%**	**136.5%**	**147.4%**	**130.1%**	**157.3%**	**150.3%**	**132.3%**	**177.7%**	[F]=[D]/[E]

Table 5-3: Planning Year 2023-2024 LRZ Local Reliability Requirements for Winter 2023-2024

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2023-2024 Local Reliability Requirements – Spring 2024											
Installed Capacity (ICAP) (MW)	21,224	13,196	12,339	8,776	8,281	18,041	21,224	11,228	24,631	6,427	[A]
Unforced Capacity (UCAP) (MW)	19,769	11,963	11,601	7,265	7,342	16,150	19,638	9,700	21,470	5,856	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,330	626	1,147	2,907	2,371	3,615	1,836	152	2,601	726	[C]
LRR (UCAP) (MW)	18,439	12,590	12,748	10,172	9,713	19,765	21,475	9,852	24,071	6,582	[D]=[B]+[C]
Peak Demand (MW)	13,407	9,938	7,856	6,998	6,034	14,977	16,157	6,055	18,310	3,768	[E]
LRR UCAP per-unit of LRZ Peak Demand	**137.5%**	**126.7%**	**162.3%**	**145.4%**	**161.0%**	**132.0%**	**132.9%**	**162.7%**	**131.5%**	**174.7%**	[F]=[D]/[E]

Table 5-4: Planning Year 2023-2024 LRZ Local Reliability Requirements for Spring 2024

Weather Year Time of Peak Demand (ESTHE)	MISO	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS
1992	7/9/92 16:00	8/9/92 17:00	8/10/92 18:00	7/8/92 17:00	7/2/92 15:00	7/2/92 17:00	1/16/92 8:00	7/2/92 16:00	7/16/92 17:00	7/11/92 18:00	7/12/92 17:00
1993	7/27/93 17:00	8/11/93 17:00	8/27/93 14:00	8/22/93 19:00	7/17/93 17:00	7/27/93 16:00	7/25/93 16:00	7/9/93 15:00	7/31/93 17:00	8/14/93 16:00	7/31/93 18:00
1994	7/6/94 15:00	6/14/94 17:00	6/15/94 17:00	7/19/94 17:00	7/5/94 17:00	7/19/94 18:00	1/19/94 6:00	6/18/94 17:00	6/29/94 18:00	8/14/94 17:00	7/5/94 17:00
1995	7/13/95 17:00	7/13/95 18:00	7/13/95 16:00	7/14/95 17:00	7/14/95 17:00	7/13/95 16:00	7/13/95 17:00	7/13/95 17:00	8/17/95 14:00	7/27/95 17:00	7/12/95 15:00
1996	6/29/96 17:00	8/6/96 17:00	6/29/96 17:00	7/18/96 17:00	7/18/96 18:00	7/18/96 17:00	7/19/96 17:00	8/7/96 15:00	7/20/96 15:00	2/5/96 7:00	7/3/96 18:00
1997	7/26/97 16:00	7/16/97 16:00	7/16/97 17:00	7/25/97 18:00	7/18/97 16:00	7/26/97 17:00	7/26/97 16:00	7/16/97 16:00	7/25/97 18:00	8/16/97 16:00	7/25/97 18:00
1998	7/20/98 16:00	7/13/98 16:00	6/25/98 18:00	7/20/98 18:00	7/20/98 18:00	7/19/98 16:00	7/19/98 17:00	6/25/98 18:00	7/6/98 17:00	8/28/98 18:00	8/27/98 15:00
1999	7/30/99 14:00	7/25/99 15:00	7/13/95 16:00	7/30/99 18:00	7/18/99 22:00	7/30/99 17:00	7/26/97 16:00	7/30/99 14:00	7/25/99 17:00	8/14/99 18:00	8/20/99 18:00
2000	8/31/00 16:00	6/8/00 19:00	9/1/00 17:00	8/31/00 16:00	9/1/00 15:00	8/17/00 16:00	9/1/00 15:00	9/1/00 14:00	7/19/00 17:00	8/30/00 16:00	8/30/00 17:00
2001	8/8/01 16:00	8/7/01 16:00	8/9/01 16:00	7/31/01 16:00	7/23/01 17:00	7/23/01 17:00	8/7/01 17:00	8/8/01 16:00	7/11/01 16:00	7/10/01 16:00	7/20/01 17:00
2002	7/3/02 16:00	7/6/02 18:00	8/1/02 15:00	7/20/02 18:00	7/5/02 17:00	8/1/02 16:00	8/3/02 16:00	7/3/02 16:00	7/9/02 17:00	8/2/02 19:00	10/4/02 15:00
2003	8/21/03 16:00	8/24/03 17:00	8/21/03 16:00	7/26/03 18:00	8/21/03 16:00	8/21/03 18:00	8/27/03 17:00	8/21/03 17:00	7/18/03 14:00	8/10/03 16:00	7/17/03 17:00
2004	7/22/04 16:00	6/7/04 17:00	7/22/04 16:00	7/20/04 17:00	7/13/04 17:00	7/13/04 16:00	1/31/04 9:00	7/22/04 16:00	7/14/04 17:00	7/24/04 17:00	7/25/04 15:00
2005	7/24/05 17:00	7/17/05 17:00	7/24/05 16:00	7/25/05 17:00	7/24/05 16:00	7/24/05 18:00	7/25/05 17:00	7/24/05 18:00	8/21/05 18:00	7/25/05 16:00	8/21/05 15:00
2006	7/31/06 17:00	7/31/06 17:00	8/1/06 17:00	7/19/06 18:00	7/31/06 18:00	7/31/06 16:00	7/31/06 16:00	7/31/06 16:00	7/31/93 17:00	8/15/06 18:00	7/16/06 15:00
2007	8/1/07 17:00	7/26/07 15:00	8/2/07 15:00	7/17/07 17:00	8/15/07 18:00	8/15/07 18:00	8/29/07 17:00	7/31/07 18:00	8/17/95 14:00	8/14/07 15:00	8/14/07 15:00

2008	7/16/08 17:00	7/11/08 18:00	7/17/08 17:00	8/3/08 17:00	7/20/08 17:00	7/20/08 16:00	8/23/08 16:00	8/24/08 12:00	8/17/95 14:00	7/20/08 17:00	7/27/08 16:00
2009	6/25/09 16:00	6/22/09 19:00	7/28/09 16:00	7/24/09 18:00	8/9/09 16:00	8/9/09 16:00	1/16/09 8:00	6/25/09 16:00	6/22/09 16:00	7/2/09 16:00	7/2/09 18:00
2010	8/10/10 17:00	8/8/10 18:00	8/20/10 14:00	7/17/10 19:00	7/15/10 15:00	8/3/10 16:00	8/2/91 18:00	9/1/10 17:00	8/17/95 14:00	8/1/10 17:00	8/2/10 17:00
2011	7/20/11 18:00	6/7/11 19:00	7/13/95 16:00	7/20/11 16:00	9/1/11 16:00	8/31/11 16:00	7/26/97 16:00	7/20/11 19:00	7/31/93 17:00	7/2/11 17:00	7/10/11 18:00
2012	7/6/12 17:00	7/6/12 18:00	7/13/95 16:00	7/7/12 16:00	7/7/12 17:00	7/25/12 18:00	7/26/97 16:00	7/6/12 17:00	7/30/12 17:00	6/26/12 16:00	7/3/12 15:00
2013	7/19/13 16:00	7/18/13 19:00	8/27/13 16:00	8/30/13 16:00	9/11/13 16:00	8/31/13 17:00	8/31/13 15:00	7/19/13 14:00	6/27/13 18:00	8/7/13 16:00	8/8/13 17:00
2014	7/22/14 16:00	7/22/14 17:00	7/22/14 16:00	7/22/14 16:00	9/5/14 16:00	7/26/14 15:00	2/7/14 9:00	7/22/14 17:00	7/27/14 17:00	8/23/14 16:00	7/26/14 17:00
2015	7/29/15 16:00	8/14/15 15:00	8/14/15 17:00	7/13/15 15:00	9/3/15 16:00	7/13/15 16:00	7/18/15 17:00	8/2/15 16:00	8/7/15 18:00	8/10/15 16:00	7/30/15 16:00
2016	7/20/16 15:00	7/21/16 17:00	8/10/16 17:00	7/22/16 16:00	9/22/16 16:00	7/23/16 17:00	6/11/16 14:00	8/10/16 14:00	7/20/16 13:00	9/1/16 16:00	7/20/16 15:00
2017	7/20/17 16:00	7/6/17 17:00	6/12/17 14:00	7/21/17 17:00	9/26/17 15:00	7/12/17 15:00	9/26/17 16:00	6/12/17 14:00	7/21/17 15:00	8/19/17 15:00	7/20/17 15:00
2018	6/29/18 15:00	6/29/18 15:00	6/29/18 15:00	5/28/18 14:00	9/5/18 15:00	8/6/18 16:00	9/5/18 16:00	9/5/18 15:00	1/17/18 6:00	1/17/18 6:00	9/19/18 16:00
2019	7/19/19 14:00	7/19/19 18:00	7/19/19 16:00	7/19/19 14:00	9/12/19 16:00	10/1/19 15:00	9/13/19 16:00	7/19/19 13:00	8/13/19 14:00	10/4/19 15:00	10/2/19 16:00
2020	7/9/20 15:00	7/2/20 17:00	8/27/20 14:00	7/8/20 14:00	7/8/20 15:00	7/11/20 15:00	8/25/20 15:00	7/9/20 15:00	7/12/20 15:00	7/11/20 15:00	9/4/20 16:00
2021	8/24/21 15:00	7/27/21 16:00	8/10/21 15:00	7/28/21 16:00	8/27/21 15:00	8/25/21 16:00	8/24/21 16:00	8/24/21 15:00	8/10/21 14:00	8/23/21 16:00	7/29/21 14:00

Table 5-5: Historical Peak Days/Hours by Local Resource Zone

6 Appendix A: Comparison of Planning Year 2022 to 2023

Multiple study sensitivity analyses were performed to compute changes in the PRM target on an UCAP basis, from Planning Year 2022-2023 to Planning Year 2023-2024. These sensitivities included one-off incremental changes of input parameters to quantify how each change affected the PRM result independently. Note the impact of the incremental PRM changes from Planning Year 2022-2023 to Planning Year 2023-2024 in the waterfall chart of Figure A-1. Summer was determined to be the season most comparable to the annual PRM from last year's study. The following subsections provide more details around each of the sensitivities.

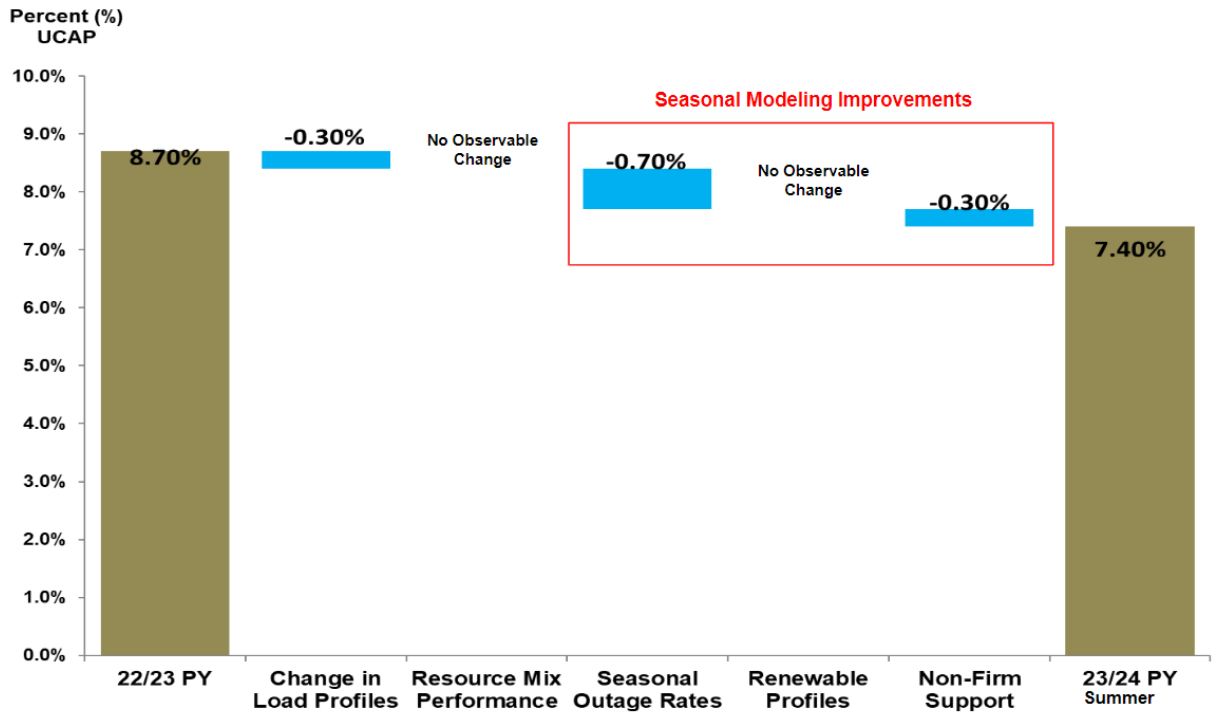


Figure A-1: Waterfall Chart of PY 2022-2023 Annual PRM UCAP to PY 2023-2024 Summer PRM UCAP

6.1 A.1 Waterfall Chart Details

6.1.1 A.1.1 Load

The MISO Coincident Peak Demand increased from the 2021-2022 planning year, which was driven by the updated actual load forecasts submitted by the LSEs. Overall, the magnitude of changes in the load profiles and economic uncertainty resulted in a slight decrease in the PRM.

6.1.2 A.1.2 Units

Changes from 2022-2023 planning year values are due to changes in Generation Verification Test Capacity (GVTC), seasonal EFORd or equivalent forced outage rate demand, new units, retirements, suspensions, and changes in the resource mix. The MISO fleet weighted average forced outage rate decreased from an annual 9.04 percent to a summer value of 8.23 percent from the previous study to this study. A general decrease in unit outage rates lead to a decrease in summer reserve margin. Non-firm support was included in the model which resulted in a slight decrease to the summer PRM.

7 Appendix B: Capacity Import Limit Tier 1 & 2 Source Subsystem Definitions

MISO Local Resource Zone 1

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
XEL / 600	ITCM / 627	WEC / 295
MP / 608	ALTE / 694	MIUP / 296
SMMPA / 613	WPS / 696	AMMO / 356
GRE / 615	MGE / 697	AMIL / 357
OTP / 620		MPW / 633
MDU / 661		MEC / 635
BEPC-MISO / 663		
DPC / 680		

MISO Local Resource Zone 2

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
WEC / 295	METC / 218	NIPS / 217
MIUP / 296	XEL / 600	ITCT / 219
ALTE / 694	MP / 608	SMMPA / 613
WPS / 696	DPC / 680	GRE / 615
MGE / 697		OTP / 620
UPPC / 698		ITCM / 627

MISO Local Resource Zone 3

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #	
ITCM / 627	AMMO / 356	DEI / 208	GRE / 615
MPW / 633	AMIL / 357	NIPS / 217	OTP / 620
MEC / 635	XEL / 600	CWLP / 360	ALTE / 694
	SMMPA / 613	SIPC/ 361	WPS / 696
	DPC / 680	GLHB / 362	MGE / 697
		MP / 608	

MISO Local Resource Zone 4

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #	
ITCM / 627	AMMO / 356	DEI / 208	GRE / 615
MPW / 633	AMIL / 357	NIPS / 217	OTP / 620
MEC / 635	XEL / 600	CWLP / 360	ALTE / 694
	SMMPA / 613	SIPC/ 361	WPS / 696
	DPC / 680	GLHB / 362	MGE / 697
		MP / 608	

MISO Local Resource Zone 5

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #	
CWLD / 333	AMIL / 357	DEI / 208	XEL / 600
AMMO / 356	GLHB / 362	NIPS / 217	SMMPA / 613
	ITCM / 627	CWLP / 360	MPW / 633
	MEC / 635	SIPC / 361	DPC / 680

MISO Local Resource Zone 6

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
HE / 207	METC / 218	ITCT / 219
DEI / 208	AMIL / 357	MIUP / 296
SIGE / 210	SIPC / 361	AMMO / 356
IPL / 216		CWLP / 360
NIPS / 217		GLHB / 362
BREC / 314		ITCM / 627
HMPL / 315		MEC / 635

MISO Local Resource Zone 7

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
HE / 207	METC / 218	ITCT / 219
DEI / 208	AMIL / 357	MIUP / 296
SIGE / 210	SIPC / 361	AMMO / 356
IPL / 216		CWLP / 360
NIPS / 217		GLHB / 362
BREC / 314		ITCM / 627
HMPL / 315		MEC / 635

MISO Local Resource Zone 8

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
HE / 207	METC / 218	ITCT / 219
DEI / 208	AMIL / 357	MIUP / 296
SIGE / 210	SIPC / 361	AMMO / 356
IPL / 216		CWLP / 360
NIPS / 217		GLHB / 362
BREC / 314		ITCM / 627
HMPL / 315		MEC / 635

MISO Local Resource Zone 9

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
LAGN / 332	EES-EMI / 326	Cooperative Energy / 349
EES / 351	EES-EAI / 327	
CLEC / 502		
LAFA / 503		
LEPA / 504		

MISO Local Resource Zone 10

LRZ Area Name / Area #	Tier-1 Area Name / Area #	Tier-2 Area Name / Area #
EES-EMI / 326	EES-EAI / 327	LAGN / 332
Cooperative Energy / 349	EES / 351	CLEC / 502
		LAFA / 503

8 Appendix C: Compliance Conformance Table

Requirements under: Standard BAL-502-RF-03	Response
R1 The Planning Coordinator shall perform and document a Resource Adequacy analysis annually. The Resource Adequacy analysis shall:	The Planning Year 2023-2024 LOLE Study Report is the annual Resource Adequacy Analysis for the peak season of June 2023 through May 2024 and beyond. Analysis of Planning Year 2023-2024 is in Sections 4.1 and 5.1. Analysis of Future Years 2024-2033 is in Section 10.
R1.1 Calculate a planning reserve margin that will result in the sum of the probabilities for loss of Load for the integrated peak hour for all days of each planning year[1] analyzed (per R1.2) being equal to 0.1. (This is comparable to a "one day in 10 year" criterion).	Section 3.5 of this report outlines the utilization of LOLE in the reserve margin determination. "These metrics were determined by a probabilistic LOLE analysis such that the LOLE for the planning year was one day in 10 years, or 0.1 day per year."
R1.1.1 The utilization of Direct Control Load Management or curtailment of Interruptible Demand shall not contribute to the loss of Load probability.	Section 3.3 of this report. "Direct Control Load Management and Interruptible Demand types of demand response were explicitly included in the LOLE model as resources. These demand resources are implemented in the LOLE simulation before accumulating LOLE or shedding of firm load."
R1.1.2 The planning reserve margin developed from R1.1 shall be expressed as a percentage of the median forecast peak Net Internal Demand (planning reserve margin).	Section 4.1 of this report. "…the ratio of MISO capacity to forecasted MISO system peak demand yielded a planning ICAP reserve margin…"
R1.2 Be performed or verified separately for each of the following planning years.	Covered in the segmented R1.2 responses below.
R1.2.1 Perform an analysis for Year One.	In Sections 4.1 and 5.1, a full analysis was performed for Planning Year 2023-2024.
R1.2.2 Perform an analysis or verification at a minimum for one year in the 2 through 5 year period and at a minimum one year in the 6 though 10 year period.	Sections 4.3 and 5.1 show a full analysis was performed for future planning years 2025 and 2027.
R1.2.2.1 If the analysis is verified, the verification must be supported by current or past studies for the same planning year.	Analysis was performed.
R1.3 Include the following subject matter and documentation of its use:	Covered in the segmented R1.3 responses below.

R1.3.1 Load forecast characteristics: • Median (50:50) forecast peak load • Load forecast uncertainty (reflects variability in the Load forecast due to weather and regional economic forecasts). • Load diversity. • Seasonal Load variations. • Daily demand modeling assumptions (firm, interruptible). • Contractual arrangements concerning curtailable/Interruptible Demand.	Median forecasted load – In Section 3.3 of this report: "The average monthly loads of the predicted load shapes were adjusted to match each LRZ's Module E 50/50 monthly zonal peak load forecasts for each study year." Load Forecast Uncertainty – A detailed explanation of the weather and economic uncertainties are given in Sections 3.3 and 3.3.2. Load Diversity/Seasonal Load Variations — In Section 3.3 of this report: "The Planning Year 2023-2024 LOLE analysis used a load training process with neural net software to create a neural-net relationship between historical weather and load data. This relationship was then applied to 30 years of hourly historical weather data to create 30 different load shapes for each LRZ in order to capture both load diversity and seasonal variations." Demand Modeling Assumptions/Curtailable and Interruptible Demand — All Load Modifying Resources must first meet registration requirements through Module E. As stated in Section 3.2.6: "Each demand response program was modeled individually with a monthly capacity and was limited to the number of times each program can be called upon as well as limited by duration."
R1.3.2 Resource characteristics: • Historic resource performance and any projected changes • Seasonal resource ratings • Modeling assumptions of firm capacity purchases from and sales to entities outside the Planning Coordinator area. • Resource planned outage schedules, deratings, and retirements. • Modeling assumptions of intermittent and energy limited resource such as wind and cogeneration. • Criteria for including planned resource additions in the analysis.	Section 3.2 details how historic performance data and seasonal ratings are gathered, and includes discussion of future units and the modeling assumptions for intermittent capacity resources. A more detailed explanation of firm capacity purchases and sales is in Section 3.4.
R1.3.3 Transmission limitations that prevent the delivery of generation reserves	Annual MTEP deliverability analysis identifies transmission limitations preventing delivery of generation reserves. Additionally, Section 2 of this report details the transfer analysis to capture transmission constraints limiting capacity transfers.
R1.3.3.1 Criteria for including planned Transmission Facility additions in the analysis	Inclusion of the planned transmission addition assumptions is detailed in Section 2.2.3.

R1.3.4 Assistance from other interconnected systems including multi-area assessment considering Transmission limitations into the study area.	Section 3.4 provides the analysis on the treatment of external support assistance and limitations.
R1.4 Consider the following resource availability characteristics and document how and why they were included in the analysis or why they were not included: • Availability and deliverability of fuel. • Common mode outages that affect resource availability. • Environmental or regulatory restrictions of resource availability. • Any other demand (Load) response programs not included in R1.3.1. • Sensitivity to resource outage rates. • Impacts of extreme weather/drought conditions that affect unit availability. • Modeling assumptions for emergency operation procedures used to make reserves available. • Market resources not committed to serving Load (uncommitted resources) within the Planning Coordinator area.	Fuel availability, environmental restrictions, common mode outage and extreme weather conditions are all part of the historical availability performance data that goes into the unit's EFORd statistic. The use of the EFORd values is covered in Section 3.2.1. The use of demand response programs is mentioned in Section 3.2.6. The effects of resource outage characteristics on the reserve margin are outlined in Section 3.7.1 by examining the difference between PRM ICAP and PRM UCAP values.
R1.5 Consider Transmission maintenance outage schedules and document how and why they were included in the Resource Adequacy analysis or why they were not included	Transmission maintenance schedules were not included in the analysis of the transmission system due to the limited availability of reliable long-term maintenance schedules and minimal impact to the results of the analysis. However, Section 2 treats worst-case theoretical outages by Perform First Contingency Total Transfer Capability (FCTTC) analysis for each LRZ, by modeling NERC Category P0 (system intact) and Category P1 (N-1) contingencies.
R1.6 Document that capacity resources are appropriately accounted for in its Resource Adequacy analysis	MISO internal resources are among the quantities documented in the tables provided in Sections 4 and 5.
R1.7 Document that all Load in the Planning Coordinator area is accounted for in its Resource Adequacy analysis	MISO load is among the quantities documented in the tables provided in Sections 4 and 5.
R2 The Planning Coordinator shall annually document the projected Load and resource capability, for each area or Transmission constrained sub-area identified in the Resource Adequacy analysis.	In Sections 4 and 5, the peak load and estimated amount of resources for Planning Years 2023-2024, 2026-2027, and 2028-2029 are shown. This includes the detail for each transmission constrained sub-area.

R2.1 This documentation shall cover each of the years in year one through ten.	Section 10.3 and Tables 10-3, 10-4, 10-5, and 10-6 show the three calculated study years, in-between years estimated by interpolation, and future outyears estimated by extrapolation. Estimated transmission limitations may be determined through a review of the PY 2023-2024 LOLE study transfer analysis shown in Section 2 of this report, along with the results from previous LOLE studies.
R2.2 This documentation shall include the Planning Reserve margin calculated per requirement R1.1 for each of the three years in the analysis.	Covered in Sections 10.1 and 10.2.
R2.3 The documentation as specified per requirement R2.1 and R2.2 shall be publicly posted no later than 30 calendar days prior to the beginning of Year One.	The 2023-2024 LOLE Study Report documentation is posted on November 1 prior to the planning year.
R3 The Planning Coordinator shall identify any gaps between the needed amount of planning reserves defined in Requirement R1, Part 1.1 and the projected planning reserves documented in Requirement R2.	In Sections 4 and 5, the difference between the needed amount and the projected planning reserves for Planning Years 2023-2024, 2026-2027, and 2028-2029 are shown in the adjustments to ICAP and UCAP in Table 4-1, Table 10-1, and Table 10-2.

9 Appendix D: Acronyms List Table

CEL	Capacity Export Limit
CIL	Capacity Import Limit
CPNode	Commercial Pricing Node
DF	Distribution Factor
EFORd	Equivalent Forced Outage Rate demand
ELCC	Effective Load Carrying Capability
ERZ	External Resource Zone
EUE	Expected Unserved Energy
FERC	Federal Energy Regulatory Commission
FCITC	First Contingency Incremental Transfer Capability
FCTTC	First Contingency Total Transfer Capability
GADS	Generator Availability Data System
GLT	Generation Limited Transfer
GVTC	Generation Verification Test Capacity
ICAP	Installed Capacity
LBA	Local Balancing Authority
LCR	Local Clearing Requirement
LFE	Load Forecast Error
LFU	Load Forecast Uncertainty
LOLE	Loss of Load Expectation
LOLEWG	Loss of Load Expectation Working Group
LRR	Local Reliability Requirement
LRZ	Local Resource Zones
LSE	Load Serving Entity
MARS	Multi-Area Reliability Simulation
MECT	Module E Capacity Tracking
MISO	Midcontinent Independent System Operator
MOD	Model on Demand
MTEP	MISO Transmission Expansion Plan
MW	Megawatt
MWh	Megawatt hours
NERC	North American Electric Reliability Corp.

PRA	Planning Resource Auction
PRM	Planning Reserve Margin
PRM ICAP	PRM Installed Capacity
PRM UCAP	PRM Unforced Capacity
PRMR	Planning Reserve Margin Requirement
PSS E	Power System Simulator for Engineering
RCF	Reciprocal Coordinating Flowgate
RDS	Redispatch
RPM	Reliability Pricing Model
SERVM	Strategic Energy & Risk Valuation Model
SPS	Special Protection Scheme
TARA	Transmission Adequacy and Reliability Assessment
UCAP	Unforced Capacity
XEFORd	Equivalent forced outage rate demand with adjustment to exclude events outside management control
ZIA	Zonal Import Ability
ZEA	Zonal Export Ability

10 Appendix E: Outyear PRM and LRR Results

Beyond the prompt Planning Year 2023-2024, LOLE analyses were performed for the four-year-out Planning Year of 2026-2027, and the six-year-out Planning Year of 2028-2029. Tables 10-1 and 10-2 show the capacity and demand values that went into the MISO system seasonal Planning Reserve Margin for outyears four and six, respectively. Tables 10-3, 10-4, 10-5, and 10-6 show the seasonal outyear PRM projections ten years out based on future capacity and demand assumptions. Tables 10-7, 10-8, 10-9, and 10-10 show the MISO zonal seasonal Local Reliability Requirements for outyear four while Tables 10-11, 10-12, 10-13, and 10-14 show the Local Reliability Requirements for outyear six.

10.1 Planning Year 2026-2027 MISO Planning Reserve Margin Results

For Planning Year 2026-2027, the ratio of MISO capacity to forecasted MISO system peak demand yielded a planning ICAP reserve margin of 17.9 percent and a planning UCAP reserve margin of 8.8 percent for the summer season. Numerous values and calculations went into determining the four-year-out MISO system seasonal PRM ICAP and PRM UCAP (Table 10-1).

MISO Planning Reserve Margin (PRM)	**2026/2027 PY** Summer	**2026/2027 PY** Fall	**2026/2027 PY** Winter	**2026/2027 PY** Spring	**Formula Key**
MISO System Peak Demand (MW)	125,138	111,950	104,946	99,950	[A]
Installed Capacity (ICAP) (MW)	155,038	152,619	155,210	149,975	[B]
Unforced Capacity (UCAP) (MW)	144,623	139,494	138,423	133,904	[C]
Firm External Support (ICAP) (MW)	1,731	1,734	1,874	1,803	[D]
Firm External Support (UCAP) (MW)	1,707	1,714	1,857	1,778	[E]
Adjustment to ICAP {1d in 10yr} (MW)	-9,200	-11,000	-9,200	-11,850	[F]
Adjustment to UCAP {1d in 10yr} (MW)	-9,200	-11,000	-9,200	-11,850	[G]
ICAP PRM Requirement (PRMR) (MW)	147,569	143,353	147,884	139,928	[H]=[B]+[D]+[F]
UCAP PRM Requirement (PRMR) (MW)	136,130	130,208	131,080	123,832	[I]=[C]+[E]+[G]
MISO PRM ICAP	**17.9%**	**28.1%**	**40.9%**	**40.0%**	[J]=([H]-[A])/[A]
MISO PRM UCAP	**8.8%**	**16.3%**	**24.9%**	**23.9%**	[K]=([I]-[A])/[A]

Table 10-1: Planning Year 2026-2027 MISO System Planning Reserve Margins

10.2 Planning Year 2028-2029 MISO Planning Reserve Margin Results

For Planning Year 2028-2029, the ratio of MISO capacity to forecasted MISO system peak demand yielded a planning ICAP reserve margin of 18.4 percent and a planning UCAP reserve margin of 9.2 percent for the summer season. Numerous values and calculations went into determining the six-year-out MISO system seasonal PRM ICAP and PRM UCAP (Table 10-2).

MISO Planning Reserve Margin (PRM)	**2028/2029 PY** Summer	**2028/2029 PY** Fall	**2028/2029 PY** Winter	**2028/2028 PY** Spring	**Formula Key**
MISO System Peak Demand (MW)	125,794	112,548	105,525	100,486	[A]
Installed Capacity (ICAP) (MW)	157,656	155,189	157,826	152,532	[B]
Unforced Capacity (UCAP) (MW)	146,097	141,837	140,816	136,237	[C]
Firm External Support (ICAP) (MW)	1,731	1,734	1,874	1,803	[D]
Firm External Support (UCAP) (MW)	1,707	1,714	1,857	1,778	[E]
Adjustment to ICAP {1d in 10yr} (MW)	-10,400	-14,360	-10,400	-13,165	[F]
Adjustment to UCAP {1d in 10yr} (MW)	-10,400	-14,360	-10,400	-13,165	[G]
ICAP PRM Requirement (PRMR) (MW)	148,987	142,563	149,300	141,170	[H]=[B]+[D]+[F]
UCAP PRM Requirement (PRMR) (MW)	137,404	129,191	132,272	124,850	[I]=[C]+[E]+[G]
MISO PRM ICAP	**18.4%**	**26.7%**	**41.5%**	**40.5%**	[J]=([H]-[A])/[A]
MISO PRM UCAP	**9.2%**	**14.8%**	**25.3%**	**24.2%**	[K]=([I]-[A])/[A]

Table 10-2: Planning Year 2028-2029 MISO System Planning Reserve Margins

10.3 MISO Planning Reserve Margin Outyear Projections

Tables 10-3, 10-4, 10-5, and 10-6 show the outyear seasonal PRM projections. Years one, four, and six were probabilistically modeled. PRM projections in years two, three, and five are the result of interpolation of the years studied and years seven through ten are the resulting extrapolations of the outyear analyses.

Metric	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
PRM ICAP	15.9%	16.6%	17.2%	17.9%	18.2%	18.4%	19.6%	20.1%	20.7%	21.2%
PRM UCAP	7.4%	7.9%	8.3%	8.8%	9.0%	9.2%	10.1%	10.4%	10.8%	11.2%
Demand (GW)	123.7	124.3	124.9	125.5	125.7	125.8	126.9	127.3	127.8	128.2
ICAP (GW)	144.3	150.5	153.0	155.0	155.0	157.7	157.7	157.7	157.7	157.7

Table 10-3: MISO Summer Planning Reserve Margin Outyear Projections

Metric	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
PRM ICAP	25.8%	26.6%	27.3%	28.1%	27.4%	26.7%	27.8%	28.1%	28.3%	28.5%
PRM UCAP	14.9%	15.4%	15.8%	16.3%	15.6%	14.8%	15.4%	15.4%	15.5%	15.5%
Demand (GW)	111.0	111.3	111.7	112.0	112.3	112.5	113.1	113.4	113.8	114.1
ICAP (GW)	144.3	148.8	150.3	152.6	152.6	155.2	155.2	155.2	155.2	155.2

Table 10-4: MISO Fall Planning Reserve Margin Outyear Projections

Metric	23-24	24-25	25-26	26-27	27-28	28-29	29-30	30-31	31-32	32-33
PRM ICAP	41.2%	41.1%	41.0%	40.9%	41.2%	41.5%	41.4%	41.5%	41.5%	41.5%
PRM UCAP	25.5%	25.3%	25.1%	24.9%	25.1%	25.3%	25.0%	25.0%	24.9%	24.8%
Demand (GW)	103.5	104.0	104.4	104.9	105.2	105.5	106.4	106.8	107.2	107.6
ICAP (GW)	150.7	154.0	154.7	155.2	155.2	157.8	157.8	157.8	157.8	157.8

Table 10-5: MISO Winter Planning Reserve Margin Outyear Projections

Metric	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
PRM ICAP	39.3%	39.5%	39.8%	40.0%	40.3%	40.5%	41.0%	41.2%	41.4%	41.7%
PRM UCAP	24.5%	24.3%	24.1%	23.9%	24.1%	24.2%	23.9%	23.8%	23.8%	23.7%
Demand (GW)	99.1	99.4	99.7	100.0	100.3	100.5	101.1	101.4	101.7	101.9
ICAP (GW)	145.4	148.9	149.9	150.0	150.0	152.5	152.5	152.5	152.5	152.5

Table 10-6: MISO Spring Planning Reserve Margin Outyear Projections

10.4 Planning Year 2026-2027 MISO Local Reliability Requirement Results

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2026-2027 Local Reliability Requirements – Summer 2026											
Installed Capacity (ICAP) (MW)	22,350	15,251	12,350	9,629	9,494	19,595	21,761	12,368	25,425	6,814	[A]
Unforced Capacity (UCAP) (MW)	21,349	14,232	11,903	8,881	8,690	17,946	20,388	11,944	22,182	6,108	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-317	48	2,369	3,060	2,235	3,935	4,012	278	2,230	1,113	[C]
LRR (UCAP) (MW)	21,032	14,280	14,272	11,942	10,925	21,881	24,400	12,222	24,412	7,221	[D]=[B]+[C]
Peak Demand (MW)	18,622	13,121	9,976	9,384	8,121	18,517	21,003	7,880	22,036	4,802	[E]
LRR UCAP per-unit of LRZ Peak Demand	**112.9%**	**108.8%**	**143.1%**	**127.3%**	**134.5%**	**118.2%**	**116.2%**	**155.1%**	**110.8%**	**150.4%**	[F]=[D]/[E]

Table 10-7: Planning Year 2026-2027 LRZ Local Reliability Requirements for Summer 2026

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2026-2027 Local Reliability Requirements – Fall 2026											
Installed Capacity (ICAP) (MW)	22,303	14,924	12,708	9,267	9,296	19,057	21,756	11,773	24,952	6,584	[A]
Unforced Capacity (UCAP) (MW)	20,862	13,680	12,104	8,306	8,124	17,356	20,120	10,815	22,406	5,721	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,150	-608	1,303	2,861	2,032	3,138	3,906	-296	2,172	1,083	[C]
LRR (UCAP) (MW)	19,712	13,072	13,407	11,167	10,156	20,495	24,026	10,519	24,577	6,805	[D]=[B]+[C]
Peak Demand (MW)	18,622	13,121	9,976	9,384	8,121	18,517	21,003	7,880	22,036	4,802	[E]
LRR UCAP per-unit of LRZ Peak Demand	**105.9%**	**99.6%**	**134.4%**	**119.0%**	**125.1%**	**110.7%**	**114.4%**	**133.5%**	**111.5%**	**141.7%**	[F]=[D]/[E]

Table 10-8: Planning Year 2026-2027 LRZ Local Reliability Requirements for Fall 2026

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2026-2027 Local Reliability Requirements – Winter 2026-2027											
Installed Capacity (ICAP) (MW)	22,576	15,148	14,708	9,272	9,380	19,027	21,721	11,471	25,252	6,654	[A]
Unforced Capacity (UCAP) (MW)	21,048	13,357	13,748	7,369	7,698	17,193	20,149	10,074	22,044	5,742	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-317	45	2,231	2,882	2,105	3,706	1,915	262	2,100	1,048	[C]
LRR (UCAP) (MW)	20,731	13,402	15,980	10,251	9,803	20,899	22,064	10,336	24,145	6,790	[D]=[B]+[C]
Peak Demand (MW)	18,622	13,121	9,976	9,384	8,121	18,517	21,003	7,880	22,036	4,802	[E]
LRR UCAP per-unit of LRZ Peak Demand	**111.3%**	**102.1%**	**160.2%**	**109.2%**	**120.7%**	**112.9%**	**105.0%**	**131.2%**	**109.6%**	**141.4%**	[F]=[D]/[E]

Table 10-9: Planning Year 2026-2027 LRZ Local Reliability Requirements for Winter 2026-2027

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2026-2027 Local Reliability Requirements – Spring 2027											
Installed Capacity (ICAP) (MW)	21,384	14,796	12,729	9,040	9,196	18,876	21,235	11,457	24,783	6,480	[A]
Unforced Capacity (UCAP) (MW)	19,924	13,355	11,985	7,528	7,922	16,950	18,781	9,929	21,622	5,908	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,085	-700	1,023	2,827	1,980	2,719	2,722	53	1,994	647	[C]
LRR (UCAP) (MW)	18,839	12,655	13,008	10,356	9,902	19,669	21,503	9,982	23,616	6,556	[D]=[B]+[C]
Peak Demand (MW)	18,622	13,121	9,976	9,384	8,121	18,517	21,003	7,880	22,036	4,802	[E]
LRR UCAP per-unit of LRZ Peak Demand	**101.2%**	**96.5%**	**130.4%**	**110.4%**	**121.9%**	**106.2%**	**102.4%**	**126.7%**	**107.2%**	**136.5%**	[F]=[D]/[E]

Table 10-10: Planning Year 2026-2027 LRZ Local Reliability Requirements for Spring 2027

10.5 Planning Year 2028-2029 MISO Local Reliability Requirement Results

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2028-2029 Local Reliability Requirements – Summer 2028											
Installed Capacity (ICAP) (MW)	22,350	16,418	12,350	9,629	9,494	19,595	23,212	12,368	25,425	6,814	[A]
Unforced Capacity (UCAP) (MW)	21,349	15,324	11,903	8,881	8,690	17,946	21,769	11,944	22,182	6,108	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-232	-463	1,981	3,089	2,294	4,020	2,628	39	2,283	1,132	[C]
LRR (UCAP) (MW)	21,117	14,861	13,884	11,970	10,983	21,967	24,398	11,983	24,465	7,240	[D]=[B]+[C]
Peak Demand (MW)	18,177	13,132	10,172	9,485	8,001	18,099	20,705	7,725	21,417	4,716	[E]
LRR UCAP per-unit of LRZ Peak Demand	**116.2%**	**113.2%**	**136.5%**	**126.2%**	**137.3%**	**121.4%**	**117.8%**	**155.1%**	**114.2%**	**153.5%**	[F]=[D]/[E]

Table 10-11: Planning Year 2028-2029 LRZ Local Reliability Requirements for Summer 2028

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2028-2029 Local Reliability Requirements – Fall 2028											
Installed Capacity (ICAP) (MW)	22,303	16,090	12,708	9,267	9,296	19,057	23,160	11,773	24,952	6,584	[A]
Unforced Capacity (UCAP) (MW)	20,862	14,727	12,104	8,306	8,124	17,356	21,415	10,815	22,406	5,721	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,035	-1,100	1,275	2,903	2,078	3,260	2,559	-281	2,223	1,102	[C]
LRR (UCAP) (MW)	19,827	13,627	13,379	11,209	10,202	20,616	23,975	10,534	24,629	6,823	[D]=[B]+[C]
Peak Demand (MW)	18,177	13,132	10,172	9,485	8,001	18,099	20,705	7,725	21,417	4,716	[E]
LRR UCAP per-unit of LRZ Peak Demand	**109.1%**	**103.8%**	**131.5%**	**118.2%**	**127.5%**	**113.9%**	**115.8%**	**136.4%**	**115.0%**	**144.7%**	[F]=[D]/[E]

Table 10-12: Planning Year 2028-2029 LRZ Local Reliability Requirements for Fall 2028

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2028-2029 Local Reliability Requirements – Winter 2028-2029											
Installed Capacity (ICAP) (MW)	22,576	16,326	14,708	9,272	9,380	19,027	23,159	11,471	25,252	6,654	[A]
Unforced Capacity (UCAP) (MW)	21,048	14,468	13,748	7,369	7,698	17,193	21,430	10,074	22,044	5,742	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-232	-463	1,866	2,909	2,160	3,786	1,301	289	2,150	1,066	[C]
LRR (UCAP) (MW)	20,816	14,005	15,614	10,278	9,858	20,980	22,731	10,363	24,194	6,808	[D]=[B]+[C]
Peak Demand (MW)	18,177	13,132	10,172	9,485	8,001	18,099	20,705	7,725	21,417	4,716	[E]
LRR UCAP per-unit of LRZ Peak Demand	**114.5%**	**106.6%**	**153.5%**	**108.4%**	**123.2%**	**115.9%**	**109.8%**	**134.2%**	**113.0%**	**144.4%**	[F]=[D]/[E]

Table 10-13: Planning Year 2028-2029 LRZ Local Reliability Requirements for Winter 2028-2029

Local Resource Zone (LRZ)	LRZ-1 MN/ND	LRZ-2 WI	LRZ-3 IA	LRZ-4 IL	LRZ-5 MO	LRZ-6 IN	LRZ-7 MI	LRZ-8 AR	LRZ-9 LA/TX	LRZ-10 MS	Formula Key
PY 2028-2029 Local Reliability Requirements – Spring 2029											
Installed Capacity (ICAP) (MW)	21,384	15,965	12,729	9,040	9,196	18,876	22,622	11,457	24,783	6,480	[A]
Unforced Capacity (UCAP) (MW)	19,924	14,365	11,985	7,528	7,922	16,950	20,104	9,929	21,622	5,908	[B]
Adjustment to UCAP {1d in 10yr} (MW)	-1,030	-1,072	1,471	2,932	1,995	2,970	1,774	50	2,266	652	[C]
LRR (UCAP) (MW)	18,894	13,293	13,456	10,460	9,917	19,920	21,878	9,979	23,887	6,560	[D]=[B]+[C]
Peak Demand (MW)	18,177	13,132	10,172	9,485	8,001	18,099	20,705	7,725	21,417	4,716	[E]
LRR UCAP per-unit of LRZ Peak Demand	**103.9%**	**101.2%**	**132.3%**	**110.3%**	**123.9%**	**110.1%**	**105.7%**	**129.2%**	**111.5%**	**139.1%**	[F]=[D]/[E]

Table 10-14: Planning Year 2028-2029 LRZ Local Reliability Requirements for Spring 2029

11 Appendix F: Outyear CIL/CEL Results

MISO will not be conducting the outyear CIL/CEL study as part of the PY 2023-2024 LOLE study report. This has been communicated to stakeholders at the February 2023 RASC: https://cdn.misoenergy.org/20230228-0301%20RASC%20Item%2004d%20Out-Year%202027-28%20CIL-CEL%20Study%20Update627986.pdf

The usefulness and value created by the outyear CIL/CEL study is being evaluated by MISO. Any updates or changes to the outyear CIL/CEL study going forward will be communicated through the RASC and/or LOLEWG.

Attachment 4.4 Confidential Long-Term Electric Energy and Demand Input-Output Files

SEE ATTACHMENT: Confidential Model Outputs.zip

Attachment 6.1 CEI South Electric 2018-2020 DSM Plan

Vectren South 2021-2023
Electric Energy Efficiency Plan

Prepared by:
Southern Indiana Gas & Electric Company d/b/a Vectren Energy Delivery of Indiana Inc. (Vectren South)

5/8/2020

Table of Contents

List of Acronyms & Abbreviations

Acronym	Description
ARCA	Appliance Recycling Centers of America Inc.
BTU	Building Tune-Up
BYOT	Bring Your Own Thermostat
C&I	Commercial and Industrial
CAC	Central Air Conditioning
CVR	Conservation Voltage Reduction
DLC	Direct Load Control
DR	Demand Response
DSM	Demand Side Management
EAP	Energy Assistance Program
ECM	Electronically Commutated Motors
EDA	Energy Design Assistance
EE	Energy Efficiency
EISA	Energy Independence and Security Act
EM&V	Evaluation, Measurement and Verification
ES	ENERGY STAR
FPL	Federal Poverty Level
H&S	Health & Safety
HEA	Home Energy Assessment
HEMS	Home Energy Management Systems
HERS	Home Efficiency Rating System
HVAC	Heating, Ventilation and Air Conditioning
IQW	Income Qualified & Weatherization
IRP	Integrated Resource Plan
IURC	Indiana Utility Regulatory Commission
kW/kWh	Kilowatt, Kilowatt hour
LED	Light Emitting Diode
MPS	Market Potential Study
MW,MWh	Megawatt, Megawatt hour
NEF	National Energy Foundation
NPV	Net Present Value
O&M	Operations and Maintenance
PCT	Participant Cost Test
PPC	Program Partner Center

Acronym	Description
RIM	Ratepayer Impact Measure
RNC	Residential New Construction
SEM	Strategic Energy Management
TRM	Technical Reference Manual
UCT	Utility Cost Test

1. Introduction

Southern Indiana Gas and Electric Company d/b/a Vectren Energy Delivery of Indiana, Inc. (Vectren South), a CenterPoint Energy Company. Vectren South provides energy delivery services to approximately 147,000 electric customers and 112,000 natural gas customers located in Southwestern Indiana. Vectren South is a direct, wholly owned subsidiary of Vectren Utility Holdings, Inc. ("Vectren"), which is a wholly-owned indirect subsidiary of CenterPoint Energy Company, headquartered in Houston, TX. This Vectren South 2021-2023 Electric Demand Side Management (DSM) Plan ("2021-2023 Plan" or "Plan") describes the details of the electric Energy Efficiency (EE) and Demand Response (DR) programs Vectren South plans to offer in its service territory in 2021-2023.

Vectren South is proposing a 2021-2023 Plan designed to cost effectively reduce energy use by approximately 1.3% of eligible retail sales each year over the three-year plan. The EE savings goals are consistent with Vectren South's 2019 Integrated Resource Plan ("2019 IRP"), reasonably achievable and cost effective. The Plan includes program budgets, including the direct and indirect costs of energy efficiency programs. The 2021-2023 Plan recommends electric EE and DR programs for the residential and commercial & industrial (C&I) sectors in Vectren South's service territory. Where appropriate, it also describes opportunities for coordination with some of Vectren South's gas EE programs to leverage the best total EE and DR opportunities for customers and to share costs of delivery. Vectren South utilizes a portfolio of DSM programs to achieve demand reductions and energy savings, thereby providing reliable electric service to its customers. Vectren's DSM programs have been approved by the Indiana Utility Regulatory Commission ("Commission" or "IURC") and implemented pursuant to various IURC orders over the years.

2. Vectren South DSM Strategy

Energy efficiency remains at the core of Vectren's culture as one of the company's objectives is to partner with customers to help them use energy wisely. Vectren proactively works with its oversight boards in each state it serves to assemble progressive, cost-effective programs that work toward achieving that objective.

Vectren South's 2019 Integrated Resource Plan ("2019 IRP") includes EE programs for all customer classes and sets an annual savings target of 1.25% of retail sales for 2021-2023. The framework for the 2021-2023 Plan was modeled at a savings level of 1.3% of retail sales adjusted for an opt-out rate of 77% eligible load, as provided for in Indiana Code § 8-1-8.5-10 ("Section

10"). The IRP load forecast also includes an ongoing level of EE related to codes and standards embedded in the load forecast projections. Ongoing EE and DR programs are also important given the integration of Vectren South's natural gas and electric EE and DR programs.

A. Integration with Vectren South Gas

Opportunities exist to gain both natural gas and electric savings from some EE programs and measures. In these instances, energy savings will be captured by the respective utility. For the programs where integration opportunities exist, Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric. Below is a list of programs that Vectren South has identified as integrated:

- Residential Prescriptive
- Residential New Construction
- Home Energy Assessment
- Income Qualified Weatherization
- Energy Efficient Schools
- Residential Behavioral Savings
- Residential Midstream
- Home Energy Management Systems (HEMS)
- Commercial and Industrial (C&I) Prescriptive
- Commercial Midstream
- Commercial and Industrial (C&I) Custom
- Small Business Energy Solutions

B. Vectren Oversight Board

The Vectren Oversight Board (VOB) provides input into the planning and evaluation of Vectren South's EE programs. The VOB was formed in 2010 pursuant to the Final Order issued in Cause No. 43427 and included the Indiana Office of the Utility Consumer Counselor (OUCC) and Vectren South as voting members. The Citizens Action Coalition was added as a voting member of the VOB in 2013 pursuant to the Final Order issued in Cause No. 44318. In 2014, the Vectren South Electric Oversight Board merged with the Vectren South Gas Oversight Board and Vectren North Gas Oversight Board to form one governing body, the VOB. Vectren and the VOB have worked collaboratively over the last several years and Vectren requests to continue the current voting structure.

3. Vectren South Planning Process

Vectren South has offered a variety of EE programs since April 2010 and has engaged in a similar planning process each time a new portfolio is presented to the Commission for approval.

The 2021-2023 Plan was developed in conjunction with the 2019 IRP planning process and therefore the 2019 IRP served as a key input into the 2021-2023 Plan. As such, this process aligns with Indiana Code § 8-1-8.5-10 ("Section 10"), which requires that EE goals be consistent with an electricity supplier's IRP.

Consistent with the 2019 IRP, the framework for the 2021-2023 Plan was modeled at a savings level of 1.3% of retail sales with opt-out assumptions incorporated. Once the level of EE programs to be offered from 2021 through 2023 was established, Vectren South engaged in a process to develop the 2021-2023 Plan. The objective of the planning process was to develop a plan based upon market-specific information for Vectren South's territory, which could be successfully implemented utilizing realistic assessments of achievable market potential.

The program design used the Electric Market Potential Study (MPS) for guidance to validate that the plan estimates were reasonable. While building from the bottom up with estimates from program implementers to help determine participation, this comparison to the MPS allowed the planning team to determine if the results were reasonable.

In 2018, Vectren South engaged GDS Associates, Inc., to conduct an MPS and Action Plan. For this effort, GDS evaluated electric energy-efficiency resources in the residential, commercial, and industrial sectors for the years 2020-2025. The study included a detailed, bottom-up assessment of

the Vectren South market in the Evansville metropolitan area to deliver a projection of baseline electric energy use, forecasts of the energy savings achievable through efficiency measures, and program designs and strategies to optimally deliver those savings. The study assessed various tiers of technical, economic and achievable potential by sector, customer type and measure.

In addition, vendors and other implementation partners who operate the current programs were involved in the planning process by providing suggestions for program changes and enhancements. The vendors and partners also provided technical information about measures to include recommended incentives, estimated participation and estimated implementation costs. This data provided a foundation for the 2021-2023 Plan based on actual experience within Vectren South's territory. These companies also bring their experience operating programs for other utilities. Once the draft version of the 2021-2023 Plan was developed, Vectren South solicited feedback from the VOB for consideration in the final design.

Other sources of program information were also considered. Current evaluations and the Indiana Technical Resource Manual (TRM) were used for adjustments to inputs. In addition, best practices were researched and reviewed to gain insights into the program design of successful EE and DR programs implemented by other utility companies.

VOB feedback was incorporated into the planning process, as applicable.

4. Cost Effectiveness Analysis

Vectren South's last step of the planning process was the cost benefit analysis. Vectren South retained Mr. Richard Morgan, President of Morgan Marketing Partners, to complete the cost benefit modeling. Utilizing DSMore, the measures and programs were analyzed for cost effectiveness. The DSMore tool is nationally recognized and used in many states across the country to determine cost-effectiveness. Developed and licensed by Integral Analytics based in Newport, KY, the DSMore cost-effectiveness modeling tool takes hourly prices and hourly energy savings from the specific measures/technologies being considered for the EE program, and then correlates both to weather. This tool looks at more than 30 years of historic weather variability to get the full weather variances appropriately modeled. In turn, this allows the model to capture the low probability, but high consequence weather events and apply appropriate value to them. Thus, a more accurate view of the value of the efficiency measure can be captured in comparison to other alternative supply options.

The outputs of DSMore include all the California Standard Practice Manual results including Total Resource Cost (TRC), Utility Cost Test (UCT), Participant Cost Test (PCT) and Ratepayer Impact Measure (RIM) tests. Inputs into the model include the following: participation rates, incentives paid, energy savings of the measure, life of the measure, implementation costs, and administrative costs, incremental costs to the participant of the high efficiency measure, and escalation rates and discount rates. Vectren South considers the results of each test and ensures that the portfolio passes the TRC test as it includes the total costs and benefits to both the utility and the consumer. The model includes a full range of economic perspectives typically used in EE and DSM analytics. The perspectives include:

- Total Resource Cost Test - shows the combined perspective of the utility and the participating customers. This test compares the level of benefits associated with the reduced energy supply costs to utility programs and participant costs.
- Utility Cost Test - shows the value of the program considering only avoided utility supply cost (based on the next unit of generation) in comparison to program costs.
- Participant Cost Test - shows the value of the program from the perspective of the utility's customer participating in the program. The test compares the participant's bill savings over the life of the EE/DR program to the participant's cost of participation.
- Ratepayer Impact Measure Test - shows the impact of a program on all utility customers through impacts in average rates. This perspective also includes the estimates of revenue losses, which may be experienced by the utility as a result of the program.

The cost effectiveness analysis produces two types of resulting metrics:

- Net Benefits (dollars) = NPV $\sum$ benefits – NPV $\sum$ costs
- Benefit Cost Ratio = NPV $\sum$ benefits ÷ NPV $\sum$ costs

Cost effectiveness analysis is performed using each of the four primary tests. The results of each test reflect a distinct perspective and have a separate set of inputs demonstrating the treatment of costs and benefits. A summary of benefits and costs included in each cost effectiveness test can be found in Appendix A.

5. 2021 - 2023 Plan Objectives and Impact

The framework for the 2021-2023 Plan aligns with Vectren South's 2019 IRP and was designed to reach a reduction in sales of approximately 1.3% of eligible retail sales with opt-out assumptions incorporated. Table 1 below provides an overview of energy savings and demand impacts, participation and budget by the residential and C&I sectors and for the total portfolio. Table 2 provides an overview of budget and energy savings by program and by year.

Table 1: 2021-2023 Portfolio Summary of Participation, Impacts & Budget

Program Year	Participants/ Measures	Annual Energy Savings kWh	Annual Demand Savings kW	Res & C&I Direct Program Budget	Cost/Kwh *	Levelized Costs /Kwh**	Indirect Portfolio Level Budget	Other Costs Budget	Portfolio Total Budget Including Indirect & Other
2021	235,332	44,325,438	10,061	$10,061,209	$0.23	$0.03	$1,046,819	$400,000	$11,508,027
2022	225,146	43,961,753	9,571	$10,092,043	$0.23	$0.03	$1,051,408	$200,000	$11,343,451
2023	218,863	43,533,925	10,303	$10,073,357	$0.23	$0.03	$1,061,922	$200,000	$11,335,280

* Cost per Kwh is calculated by dividing program cost by total savings and does not include carry forward costs related to smart thermostat, BYOT and CVR programs. The cost per kWh excludes indirect and other costs for budget. Including indirect and other costs, the cost per kwh is $0.26/Kwh.

** Levelized Costs per kWh are consistent with the 2019 IRP.

Table 2: Vectren South 2021 - 2023 Plan Overview by Program

	Total Budget ($)			Total Savings (kWh)			Total Demand (kW)		
Residential Programs	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**
Residential Specialty Lighting	$ 606,656	$ 546,634	$ 521,634	5,046,833	4,801,366	4,385,296	698	664	607
Residential Prescriptive	$ 1,135,825	$ 960,500	$ 953,909	1,657,282	1,317,201	1,319,270	866	482	419
Residential New Construction	$ 88,852	$ 88,049	$ 85,065	163,986	188,637	188,637	56	66	66
Home Energy Assessment	$ 239,713	$ 256,589	$ 296,868	550,810	576,574	684,783	52	54	63
Income Qualified Weatherization	$ 687,423	$ 707,709	$ 714,673	485,948	460,780	444,441	102	111	103
Community Based - LED Specialty Bulb Distribution	$ 168,110	$ 171,693	$ 177,923	1,159,285	1,159,285	1,159,285	160	160	160
Energy Efficient Schools	$ 118,451	$ 122,451	$ 102,451	733,118	696,462	661,639	78	74	71
Residential Behavioral Savings	$ 254,105	$ 261,391	$ 268,896	7,020,000	7,100,000	6,790,000	1,350	1,270	1,210
Appliance Recycling	$ 244,152	$ 246,902	$ 249,152	1,322,563	1,250,423	1,082,097	175	165	143
CVR Residential	$ 354,969	$ 348,828	$ 418,537			1,067,954			430
Smart Cycle (DLC Change Out)	$ 984,328	$ 1,063,328	$ 1,142,328	362,577	362,577	362,577	1,140	1,140	1,140
BYOT (Bring Your Own Thermostat)	$ 126,646	$ 156,496	$ 189,246				456	513	570
Residential Midstream	$ 439,289	$ 417,849	$ 498,073	922,215	1,061,351	1,271,737	695	745	938
Home Energy Management Systems	$ 203,513	$ 210,513	$ 220,513	515,000	515,000	515,000	80	80	80
Residential Subtotal	**$ 5,652,032**	**$ 5,558,932**	**$ 5,839,268**	**19,939,618**	**19,489,656**	**19,932,715**	**5,908**	**5,523**	**6,000**
C&I Programs	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**	**2021**	**2022**	**2023**
Commercial Prescriptive	$ 2,513,494	$ 2,431,243	$ 2,234,780	15,650,556	13,813,073	12,520,261	2,961	2,593	2,695
Commercial Midstream	$ 15,577	$ 15,577	$ 15,577	31,570	31,570	31,570	5	5	5
Commercial Custom	$ 847,795	$ 982,471	$ 933,500	5,509,079	6,677,683	6,221,324	702	892	831
Small Business Energy Solutions	$ 807,181	$ 884,304	$ 878,048	3,194,615	3,949,771	3,952,715	485	558	558
CVR Commercial	$ 225,130	$ 219,516	$ 172,184	0	0	875,340	0	0	214
Commercial Subtotal	**$ 4,409,177**	**$ 4,533,111**	**$ 4,234,089**	**24,385,820**	**24,472,097**	**23,601,210**	**4,153**	**4,048**	**4,303**
Residential & Commercial Subtotal	**$10,061,209**	**$10,092,043**	**$10,073,357**	**44,325,438**	**43,961,753**	**43,533,925**	**10,061**	**9,571**	**10,303**
Portfolio Level Costs Subtotal*	$ 1,046,819	$ 1,051,408	$ 1,061,922						
Other Costs Subtotal**	$ 400,000	$ 200,000	$ 200,000						
DSM Portfolio Total including Other Costs	**$11,508,027**	**$11,343,451**	**$11,335,280**	**44,325,438**	**43,961,753**	**43,533,925**	**10,061**	**9,571**	**10,303**

*Portfolio level costs include: Contact Center, Online Audit, Outreach & Education, and Evaluation.

**Other Costs include Market Potential Study and Emerging Markets.

A. Plan Savings

The planned savings goal for 2021-2023 was calculated based on a percentage of forecasted weather normalized electric sales for 2021 to 2023 with a target of 1.3% of eligible retail sales. The forecast is consistent with Vectren South's 2019 IRP sales forecast. Goals are based on gross energy savings with opt-out assumptions incorporated. Table 3 demonstrates the portfolio, residential and C&I energy savings targets at the 1.3% eligible retail sales level. Table 4 demonstrates the portfolio energy and demand savings by program and by year.

Table 3: Vectren South 2021 - 2023 Plan Portfolio Summary Planned Energy Savings

Portfolio Summary	Total Savings (kWh)			Total Demand (kW)		
	2021	2022	2023	2021	2022	2023
Residential Total	19,939,618	19,489,656	19,932,715	5,908	5,523	6,000
Commercial & Industrial Total	24,385,820	24,472,097	23,601,210	4,153	4,048	4,303
Portfolio Total	44,325,438	43,961,753	43,533,925	10,061	9,571	10,303

Table 4: Vectren South 2021 - 2023 Plan Portfolio Planned Energy Savings

Residential	**2021 kWh**	**2021 kW**	**2022 kWh**	**2022 kW**	**2023 kWh**	**2023 kW**
Residential Specialty Lighting	5,046,833	698	4,801,366	664	4,385,296	607
Residential Prescriptive	1,657,282	866	1,317,201	482	1,319,270	419
Residential New Construction	163,986	56	188,637	66	188,637	66
Home Energy Assessment	550,810	52	576,574	54	684,783	63
Income Qualified Weatherization	485,948	102	460,780	111	444,441	103
Community Based - LED Specialty Bulb Distribution	1,159,285	160	1,159,285	160	1,159,285	160
Energy Efficient Schools	733,118	78	696,462	74	661,639	71
Residential Behavioral Savings	7,020,000	1,350	7,100,000	1,270	6,790,000	1,210
Appliance Recycling	1,322,563	175	1,250,423	165	1,082,097	143
CVR Residential	0	0	0	0	1,067,954	430
Smart Cycle (DLC Change Out)	362,577	1,140	362,577	1,140	362,577	1,140
BYOT (Bring Your Own Thermostat)	0	456	0	513	0	570
Residential Midstream	922,215	695	1,061,351	745	1,271,737	938
Home Energy Management Systems	515,000	80	515,000	80	515,000	80
Residential Total	**19,939,618**	**5,908**	**19,489,656**	**5,523**	**19,932,715**	**6,000**
Commercial & Industrial	**2021 kWh**	**2021 kW**	**2022 kWh**	**2022 kW**	**2023 kWh**	**2023 kW**
Commercial Prescriptive	15,650,556	2,961	13,813,073	2,593	12,520,261	2,695
Commercial Midstream	31,570	5	31,570	5	31,570	5
Commercial Custom	5,509,079	702	6,677,683	892	6,221,324	831
Small Business Energy Solutions	3,194,615	485	3,949,771	558	3,952,715	558
CVR Commercial	0	0	0	0	875,340	214
Commercial & Industrial Total	**24,385,820**	**4,153**	**24,472,097**	**4,048**	**23,601,210**	**4,303**
Portfolio Total	**44,325,438**	**10,061**	**43,961,753**	**9,571**	**43,533,925**	**10,303**

B. Plan Budget

The total planned program budget includes the direct and indirect costs of implementing Vectren South's electric energy efficiency programs. In addition, a budget for other costs are being requested as described below.

Direct program costs include three main categories: vendor implementation, program incentives and administration costs. The program budgets were built based upon multiple resources. Program budgets were discussed with program implementers as a basis for the development of this plan. Vendor implementation budgets were estimated using historical data and estimates provided by the current vendors with consideration for MPS costs. This helps to assure that the estimates are realistic for successful delivery. Program incentives were calculated by assigning measures with appropriate incentive values based upon existing program incentives, evaluation results and vendor recommendations. Lastly, administrative costs are comprised of internal costs for Vectren South's management and oversight of the programs. Administrative costs were allocated back to programs based on the percent of savings these programs represent as well as estimated staff time spent on programs.

Indirect costs are costs that are not directly tied to a single program, but rather support multiple programs or the entire portfolio. These include: Contact Center, Online Audit, Outreach & Education, and Evaluation, Measurement and Verification (EM&V). These costs are budgeted at the portfolio level.

Other costs are also being requested in the 2021-2023 filed plan. Vectren South requests approval to continue funding for Emerging Markets, which is discussed later in the Plan. Emerging Markets funding allows Vectren's EE portfolio to offer leading-edge program designs for next-generation technologies, services, and engagement strategies to growing markets in the Vectren South territory. This funding will not be used to support existing measures or programs, but rather support new program development or new measures within an existing program. Tables 5 through 8 below list the summary budgets by year, program and category.

Table 5: Vectren South 2021 – 2023 Summary Budgets by Year

Residential	2021	2022	2023	Total Budget
Residential Specialty Lighting	$606,656	$546,634	$521,634	$1,674,924
Residential Prescriptive	$1,135,825	$960,500	$953,909	$3,050,235
Residential New Construction	$88,852	$88,049	$85,065	$261,965
Home Energy Assessment	$239,713	$256,589	$296,868	$793,169
Income Qualified Weatherization	$687,423	$707,709	$714,673	$2,109,806
Community Based - LED Specialty Bulb Distribution	$168,110	$171,693	$177,923	$517,727
Energy Efficient Schools	$118,451	$122,451	$102,451	$343,352
Residential Behavioral Savings	$254,105	$261,391	$268,896	$784,392
Appliance Recycling	$244,152	$246,902	$249,152	$740,205
CVR Residential	$354,969	$348,828	$418,537	$1,122,334
Smart Cycle (DLC Change Out)	$984,328	$1,063,328	$1,142,328	$3,189,985
BYOT (Bring Your Own Thermostat)	$126,646	$156,496	$189,246	$472,388
Residential Midstream	$439,289	$417,849	$498,073	$1,355,211
Home Energy Management Systems	$203,513	$210,513	$220,513	$634,538
Residential Total	**$5,652,032**	**$5,558,932**	**$5,839,268**	**$17,050,232**
Commercial & Industrial	**2021**	**2022**	**2023**	**Total Budget**
Commercial Prescriptive	$2,513,494	$2,431,243	$2,234,780	$7,179,517
Commercial Midstream	$15,577	$15,577	$15,577	$46,732
Commercial Custom	$847,795	$982,471	$933,500	$2,763,766
Small Business Energy Solutions	$807,181	$884,304	$878,048	$2,569,533
CVR Commercial	$225,130	$219,516	$172,184	$616,829
Commercial & Industrial Total	**$4,409,177**	**$4,533,111**	**$4,234,089**	**$13,176,377**
Total Direct Program Costs	**$10,061,209**	**$10,092,043**	**$10,073,357**	**$30,226,609**
Indirect Portfolio Level Costs	**2021**	**2022**	**2023**	**Total Budget**
Contact Center	$64,008	$65,032	$67,130	$196,170
Online Audit	$43,598	$44,295	$45,724	$133,617
Outreach & Education	$416,560	$423,225	$436,877	$1,276,661
Evaluation	$522,653	$518,856	$512,192	$1,553,701
Indirect Portfolio Level Costs Subtotal	**$1,046,819**	**$1,051,408**	**$1,061,922**	**$3,160,149**
Total Portfolio	**$11,108,027**	**$11,143,451**	**$11,135,280**	**$33,386,758**
Other Costs	**2021**	**2022**	**2023**	**Total Budget**
Emerging Markets	$200,000	$200,000	$200,000	$600,000
Market Potential Study	$200,000	$0	$0	$200,000
Other Costs Subtotal	**$400,000**	**$200,000**	**$200,000**	**$800,000**
DSM Portfolio Total including Other Costs	**$11,508,027**	**$11,343,451**	**$11,335,280**	**$34,186,758**

Table 6: Vectren South 2021 Summary Budgets by Category

Residential	Administrative	Implementation	Incentives	Total Budget
Residential Specialty Lighting	$ 112,254	$ 189,402	$ 305,000	$ 606,656
Residential Prescriptive	$ 40,411	$ 610,334	$ 485,080	$ 1,135,825
Residential New Construction	$ 5,613	$ 58,614	$ 24,625	$ 88,852
Home Energy Assessment	$ 5,613	$ 223,720	$ 10,380	$ 239,713
Income Qualified Weatherization	$ 11,225	$ 676,198		$ 687,423
Community Based - LED Specialty Bulb Distribution	$ 33,676	$ 134,434		$ 168,110
Energy Efficient Schools	$ 22,451	$ 96,000		$ 118,451
Residential Behavioral Savings	$ 11,225	$ 242,879		$ 254,105
Appliance Recycling	$ 44,902	$ 130,500	$ 68,750	$ 244,152
CVR Residential	$ 41,225	$ 313,744		$ 354,969
Smart Cycle (DLC Change Out)	$ 55,004	$ 815,764	$ 113,560	$ 984,328
BYOT (Bring Your Own Thermostat)	$ 16,838	$ 52,288	$ 57,520	$ 126,646
Residential Midstream	$ 5,613	$ 140,976	$ 292,700	$ 439,289
Home Energy Management Systems	$ 5,613	$ 197,900		$ 203,513
Residential Subtotal	**$ 411,663**	**$ 3,882,754**	**$1,357,615**	**$ 5,652,032**
Commercial & Industrial				**Total Budget**
Commercial Prescriptive	$ 56,127	$ 752,660	$ 1,704,707	$ 2,513,494
Commercial Midstream	$ 5,613	$ 4,826	$ 5,139	$ 15,577
Commercial Custom	$ 67,352	$ 354,804	$ 425,638	$ 847,795
Small Business Energy Solutions	$ 5,613	$ 239,848	$ 561,720	$ 807,181
CVR Commercial	$ 14,902	$ 210,228		$ 225,130
Commercial Subtotal	**$ 149,606**	**$ 1,562,366**	**$2,697,204**	**$ 4,409,177**
Residential & Commercial Subtotal	**$ 561,270**	**$ 5,445,120**	**$4,054,819**	**$ 10,061,209**
Indirect Costs				**Total Budget**
Contact Center				$ 64,008
Online Audit				$ 43,598
Outreach & Education				$ 416,560
Portfolio Costs Subtotal				$ 524,166
Subtotal - Before evaluation				$ 10,585,374
Evaluation				$ 522,653
DSM Portfolio Total				**$ 11,108,027**
Other Costs				**Total Budget**
Emerging Markets				$ 200,000
Market Potential Study				$ 200,000
Other Costs Subtotal				**$ 400,000**
DSM Portfolio Total including Other Costs				**$ 11,508,027**

Table 7: Vectren South 2022 Summary Budgets by Category

Residential	Administrative	Implementation	Incentives	Total Budget
Residential Specialty Lighting	$ 112,254	$ 144,380	$ 290,000	$ 546,634
Residential Prescriptive	$ 40,411	$ 535,729	$ 384,360	$ 960,500
Residential New Construction	$ 5,613	$ 53,186	$ 29,250	$ 88,049
Home Energy Assessment	$ 5,613	$ 240,596	$ 10,380	$ 256,589
Income Qualified Weatherization	$ 11,225	$ 696,484		$ 707,709
Community Based - LED Specialty Bulb Distribution	$ 33,676	$ 138,017		$ 171,693
Energy Efficient Schools	$ 22,451	$ 100,000		$ 122,451
Residential Behavioral Savings	$ 11,225	$ 250,166		$ 261,391
Appliance Recycling	$ 44,902	$ 137,000	$ 65,000	$ 246,902
CVR Residential	$ 41,225	$ 307,603		$ 348,828
Smart Cycle (DLC Change Out)	$ 55,004	$ 874,764	$ 133,560	$ 1,063,328
BYOT (Bring Your Own Thermostat)	$ 16,838	$ 69,388	$ 70,270	$ 156,496
Residential Midstream	$ 5,613	$ 90,486	$ 321,750	$ 417,849
Home Energy Management Systems	$ 5,613	$ 204,900		$ 210,513
Residential Subtotal	**$ 411,663**	**$ 3,842,698**	**$1,304,570**	**$ 5,558,932**
Commercial & Industrial				**Total Budget**
Commercial Prescriptive	$ 56,127	$ 820,040	$ 1,555,076	$ 2,431,243
Commercial Midstream	$ 5,613	$ 4,826	$ 5,139	$ 15,577
Commercial Custom	$ 67,352	$ 383,785	$ 531,334	$ 982,471
Small Business Energy Solutions	$ 5,613	$ 265,897	$ 612,794	$ 884,304
CVR Commercial	$ 14,902	$ 204,614		$ 219,516
Commercial Subtotal	**$ 149,606**	**$ 1,679,163**	**$2,704,342**	**$ 4,533,111**
Residential & Commercial Subtotal	**$ 561,270**	**$ 5,521,861**	**$4,008,912**	**$ 10,092,043**
Indirect Costs				**Total Budget**
Contact Center				$ 65,032
Online Audit				$ 44,295
Outreach & Education				$ 423,225
Portfolio Costs Subtotal				$ 532,552
Subtotal - Before evaluation				$ 10,624,595
Evaluation				$ 518,856
DSM Portfolio Total				**$ 11,143,451**
Other Costs				**Total Budget**
Emerging Markets				$ 200,000
Market Potential Study				$ -
Other Costs Subtotal				**$ 200,000**
DSM Portfolio Total including Other Costs				**$ 11,343,451**

Table 8: Vectren South 2023 Summary Budgets by Category

Residential	**Administrative**	**Implementation**	**Incentives**	**Total Budget**
Residential Specialty Lighting	$ 112,254	$ 144,380	$ 265,000	$ 521,634
Residential Prescriptive	$ 40,411	$ 542,843	$ 370,655	$ 953,909
Residential New Construction	$ 5,613	$ 50,202	$ 29,250	$ 85,065
Home Energy Assessment	$ 5,613	$ 280,875	$ 10,380	$ 296,868
Income Qualified Weatherization	$ 11,225	$ 703,448		$ 714,673
Community Based - LED Specialty Bulb Distribution	$ 33,676	$ 144,247		$ 177,923
Energy Efficient Schools	$ 22,451	$ 80,000		$ 102,451
Residential Behavioral Savings	$ 11,225	$ 257,671		$ 268,896
Appliance Recycling	$ 44,902	$ 148,000	$ 56,250	$ 249,152
CVR Residential	$ 41,225	$ 377,311		$ 418,537
Smart Cycle (DLC Change Out)	$ 55,004	$ 933,764	$ 153,560	$ 1,142,328
BYOT (Bring Your Own Thermostat)	$ 16,838	$ 88,388	$ 84,020	$ 189,246
Residential Midstream	$ 5,613	$ 93,311	$ 399,150	$ 498,073
Home Energy Management Systems	$ 5,613	$ 214,900		$ 220,513
Residential Subtotal	**$ 411,663**	**$ 4,059,340**	**$1,368,265**	**$ 5,839,268**
Commercial & Industrial				**Total Budget**
Commercial Prescriptive	$ 56,127	$ 757,586	$ 1,421,067	$ 2,234,780
Commercial Midstream	$ 5,613	$ 4,826	$ 5,139	$ 15,577
Commercial Custom	$ 67,352	$ 366,652	$ 499,496	$ 933,500
Small Business Energy Solutions	$ 5,613	$ 269,179	$ 603,256	$ 878,048
CVR Commercial	$ 14,902	$ 157,282		$ 172,184
Commercial Subtotal	**$ 149,606**	**$ 1,555,525**	**$2,528,957**	**$ 4,234,089**
Residential & Commercial Subtotal	**$ 561,270**	**$ 5,614,865**	**$3,897,222**	**$ 10,073,357**
Indirect Costs				**Total Budget**
Contact Center				$ 67,130
Online Audit				$ 45,724
Outreach & Education				$ 436,877
Portfolio Costs Subtotal				$ 549,730
Subtotal - Before evaluation				$ 10,623,088
Evaluation				$ 512,192
DSM Portfolio Total				**$ 11,135,280**
Other Costs				**Total Budget**
Emerging Markets				$ 200,000
Market Potential Study				$ -
Other Costs Subtotal				**$ 200,000**
DSM Portfolio Total including Other Costs				**$ 11,335,280**

C. Cost Effectiveness Results

The total portfolio for the Vectren South programs passes the TRC and UCT test for both the Residential and Commercial & Industrial sectors. Table 9 below confirms that all programs pass the TRC at greater than one. In completing the cost effectiveness testing, Vectren South used 6.19% as the weighted average cost of capital (WACC) as approved by the Commission on May 29, 2019 in Cause No. 44910. For the 2021 - 2023 Plan, Vectren South utilized the avoided costs aligned with its 2019 IRP[1] adjusted down for fixed capacity.

Table 9: Vectren South 2021-2023 Plan Cost Effectiveness Results without Performance Incentive

Residential	TRC	UCT	RIM	Participant	TRC NPV $	UCT NPV $	Levelized Cost/kWh	Cost/kWh
Residential Specialty Lighting	3.19	3.65	0.62	8.51	$ 3,967,261	$ 4,193,963	$0.02	$0.12
Residential Prescriptive	1.08	1.40	0.65	1.71	$ 300,270	$ 1,164,193	$0.09	$0.69
Residential New Construction	1.16	2.14	0.74	1.08	$ 72,542	$ 281,636	$0.08	$0.54
Home Energy Assessment	1.05	1.05	0.35	n/a	$ 37,257	$ 37,257	$0.04	$0.44
Income Qualified Weatherization	0.46	0.46	0.28	n/a	$ (1,078,445)	$ (1,078,445)	$0.14	$1.41
Community Based - LED Specialty Bulb Distribution	5.79	5.79	0.66	n/a	$ 2,336,936	$ 2,336,936	$0.01	$0.15
Energy Efficient Schools	3.67	3.67	0.60	n/a	$ 865,233	$ 865,233	$0.02	$0.16
Residential Behavioral Savings	1.62	1.62	0.44	n/a	$ 459,597	$ 459,597	$0.03	$0.04
Appliance Recycling	1.58	1.31	0.39	n/a	$ 335,377	$ 214,881	$0.03	$0.18
CVR Residential	1.05	1.05	0.51	n/a	$ 55,675	$ 55,675	$0.08	$0.00
Smart Cycle (DLC Change Out)	2.30	2.01	1.44	n/a	$ 3,407,118	$ 3,031,604	$0.19	$2.71
BYOT (Bring Your Own Thermostat)	4.76	4.76	4.45	n/a	$ 1,643,293	$ 1,643,293	$1.12	$0.00
Residential Midstream	1.78	3.38	1.11	1.26	$ 1,888,023	$ 3,034,364	$0.08	$0.48
Home Energy Management Systems	1.01	1.01	0.43	n/a	$ 5,611	$ 5,611	$0.07	$0.40
Residential Portfolio	**1.79**	**2.01**	**0.72**	**4.53**	**$14,295,750**	**$16,245,800**	**$0.05**	**$0.28**
Commercial & Industrial	**TRC**	**UCT**	**RIM**	**Participant**	**TRC NPV $**	**UCT NPV $**	**Levelized Cost/kWh**	**Cost/kWh**
Commercial Prescriptive	2.70	3.71	0.53	4.84	$ 15,853,125	$ 18,417,119	$0.02	$0.16
Commercial Midstream	2.64	1.77	0.46	0.00	$ 48,350	$ 33,814	$0.02	$0.49
Commercial Custom	2.23	4.06	0.53	3.85	$ 5,822,944	$ 7,947,156	$0.03	$0.15
Small Business Energy Solutions	1.96	3.93	0.62	2.45	$ 4,661,100	$ 7,084,994	$0.03	$0.25
CVR Commercial	1.04	1.04	0.39	n/a	$ 21,853	$ 21,853	$0.05	$0.00
Commercial & Industrial Total	**2.35**	**3.69**	**0.54**	**4.00**	**$26,407,372**	**$33,504,937**	**$0.02**	**$0.18**
Indirect Portfolio Level Costs					$ (3,744,371)	$ (3,744,371)		
Total Portfolio	**1.90**	**2.43**	**0.58**	**4.16**	**$36,958,750**	**$46,006,366**	**$0.04**	**$0.26**

* Cost per Kwh is calculated by dividing program cost by total savings and do not include carry forward costs related to smart thermostat, BYOT and CVR programs. The cost per kWh excludes indirect and other costs for budget. Levelized cost per kWh is .03 per kWh, excluding IQW and CVR.

Table 10: Vectren South 2021-2023 Plan Cost Effectiveness Results including Performance Incentive

Including Performance Incentive	TRC	UCT	RIM	Participant	TRC NPV $	UCT NPV $	Levelized Cost/kWh	First Year Cost/kWh
Total Portfolio	**1.71**	**2.13**	**0.57**	**4.16**	**$32,525,115**	**$41,572,731**	**$0.04**	**$0.29**

* Cost per kWh includes indirect and other costs for budget. Utility Performance Incentive does not include IQW or CVR.

[1] Avoided costs aligned with Vectren South's 2019 IRP, with an adjustment down to fixed capacity cost assumptions.

6. New or Modified Program Initiatives

Vectren South's 2021-2023 filing largely extends the existing momentum of the portfolio of programs from 2019 and 2020 while applying the lessons learned from Vectren's program experience and evaluations as well as making refinements to key data and assumptions as described in this document. Below is a summary which outlines notable changes for the 2021-2023 Plan from previous filings. More in depth details on the following topics can be found within the Program Descriptions portion of this document.

A. Residential Specialty Lighting & Community Based LED

These programs have been modified to remove LED A-line standard bulbs. Both LED specialty and reflector bulbs will continue to be offered.

B. Residential Prescriptive

The Residential Prescriptive program will continue to run mostly unchanged from previous years. One program enhancement will include new delivery mechanisms to complement the existing program design. This expansion will include many of the same measures from Residential Prescriptive to be offered through Residential Midstream, instant rebates and an online marketplace. These additional channels of program delivery will be provided to reach additional customers and markets.

C. Residential Behavioral Savings Program

This program will be expanded to target more customers as identified in the MPS, including a low-income segment, which will motivate customers to act on energy savings tips. The main delivery channel will be targeted mail and email with the addition of specific tips provided to the low-income customer segment.

D. Smart Cycle DLC Change Out & BYOT

Vectren will be partnering with a demand response provider beginning in 2020 that will manage customer enrollments, energy savings, and provide a platform for management of Demand Response (DR) events. Our previous DR provider, Nest, will no longer offer these services and does not have the capability to manage other thermostats in the market such as Ecobee.

E. Residential and Commercial Midstream

Following the successful launch of a Residential Midstream pilot in Q2 2020, Vectren will continue to offer the Residential Midstream program for this 2021-2023 Plan. Midstream measures and savings will continue to shift from prescriptive to midstream based on program performance. The 2020 pilot will include high-efficiency measures such as the Air Source Heat Pump (18 SEER) and Ductless Heat Pump (21 & 23 SEER). Additional measures will be transitioned over the Residential Midstream program during the 2021-2023 Plan period, specifically a Heat Pump Water Heater.

Through midstream incentives, the program aims to influence the equipment that distributors stock, fine-tune incentives to fit desired program outcomes. Because distributors have a large influence on the HVAC equipment that customers eventually install, the pilot will be able to encourage distributors to supply more energy-efficient options. Midstream incentives can be more easily adjusted, as customers receive the discount at the time of equipment purchase, not after a lengthy application process. Because customers receive a discount at the time of purchase, the pilot may influence quicker purchasing decisions.

F. Home Energy Management Systems (HEMS)

The Home Energy Management Systems (HEMS) program is a behavioral program that provides real time energy usage data to encourage customers to take action to reduce energy consumption. The objectives of this program include:

- Motivate customers to save energy by increasing customer awareness and engagement around energy consumption and their utility bill
- Increase customer knowledge of and participation in Company programs including, but not limited to, energy efficiency programs and advanced data analytics
- Deliver energy and demand savings

G. Commercial & Industrial Prescriptive

C&I Prescriptive - Program includes a Compressed Air Leak Repair component as suggested in the MPS. The program would offer a compressed air leak study for no cost to the customer if they agree to a predefined customer commitment (e.g. fixing a certain % of the leaks). High usage compressed air industries include food manufacturers, plastics, metals and chemical plants. The

Strategic Energy Management (SEM) program will continue to be offered to select large energy users for program years 2021-2023. Upon enrollment, customers are assigned an energy manager and must undergo a training process that introduces customers to SEM and ISO 50001 concepts and gives them instructions on how to implement energy efficient change within their organization.

A targeted marketing effort will be launched related to food service equipment, offering a bonus incentive to Trade Allies to push the adoption of the equipment to customers. Additionally, the 2019 midstream pilot within Prescriptive will expand beyond just furnaces to cover large HVAC equipment, water heaters and food service equipment. The electric Commercial Prescriptive Program will be offering the addition of Advanced Rooftop Controls.

The program will also take the simple functionality of the Mobile Assessment Tool used in the Small Business Program and expand it into the prescriptive program. This will allow Trade Allies the option of generating a report detailing all the savings opportunities and their associated rebates for any of their Vectren customers.

Commercial & Industrial Program Reporting

Several of the Commercial & Industrial programs have been consolidated to better reflect overall program progress. Multi-Family Retrofit has been combined to the Small Business Energy Solutions program and Commercial New Construction and Building Tune up have been added to the C&I Custom program. Additionally, for scorecard reporting, C&I Programs are reported in total.

7. Program Descriptions

A. Residential Specialty Lighting

The Residential Specialty Lighting Program is a market-based residential EE program designed to reach residential customers through retail outlets. This program has been modified to remove standard A-line LED bulbs and replace with specialty and reflector bulbs. The program consists of a buy-down strategy that provides incentives to consumers to facilitate the purchase of EE specialty lighting products. The overall program goal is to increase the penetration of ENERGY STAR qualified specialty lighting products based on the most up-to-date standards.

Table 11: Residential Lighting Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Residential Specialty Lighting**				
	Number of Measures	115,000	110,000	100,000	325,000
	Energy Savings kWh	5,046,833	4,801,366	4,385,296	14,233,495
	Peak Demand kW	698.0	664.0	606.5	1,968.5
	Total Program Budget $	606,656	546,634	521,634	1,674,924
	Per Participant Avg Energy Savings (kWh)*	43.9	43.6	43.9	43.8
	Per Participant Avg Demand Savings (kW)*				0.006
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				50%

Eligible Customers

Any customer of a participating retailer in Vectren South's electric territory.

Marketing Plan

The program is designed to reach residential customers through retail outlets. Proposed marketing efforts include point of purchase promotional activities, the use of utility bill inserts and customer emails, utility web site and social media promotions and coordinated advertising with selected manufacturers and retail outlets.

Barriers/Theory

The program addresses the market barriers by empowering customers to take advantage of new lighting technologies through education and availability in the marketplace; accelerating the adoption of proven energy efficient technologies through incentives to lower price; and working with retailers to allow them to sell more high-efficient products.

Initial Measures, Products and Services

The measures will include a variety of ENERGY STAR qualified specialty lighting products currently available at retailers in Indiana, including specialty LED bulbs, reflectors and decorative.

Program Delivery

Vectren South will oversee the program and partner with CLEAResult to deliver the program.

Evaluation, Measurement and Verification

The implementation contractor will verify the paperwork of the participating retail stores. They will also spot check stores to assure that the program guidelines are being followed. A third-party evaluator will evaluate the program using standard EM&V protocols.

B. Residential Prescriptive

Program Description

The program is designed to incent customers to purchase energy efficient equipment by covering part of the incremental cost. The program also offers home weatherization rebates to residential customers for attic insulation, wall insulation and duct sealing. If a product vendor or contractor chooses to do so, the rebates can be presented as an "instant discount" to Vectren South residential customers on their invoice.

One program enhancement will include new delivery mechanisms to complement the existing program design. This expansion will include many of the same measures from Residential Prescriptive to be offered through residential midstream, instant rebates and an online marketplace. The online marketplace allows customers to purchase smart thermostats, LED specialty and reflector bulbs, smart power strips and other products with an instant rebate applied. The Instant Rebates will provide Vectren customers the flexibility to receive targeted coupons either in store or via email that can be used at point-of-purchase for smart thermostats, heat pump water heaters and air purifiers.

Table 12: Residential Prescriptive Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Residential Prescriptive**				
	Number of Measures	3,771	3,679	3,792	11,242
	Energy Savings kWh	1,657,282	1,317,201	1,319,270	4,293,754
	Peak Demand kW	865.8	481.6	419.3	1,766.8
	Total Program Budget $	1,135,825	960,500	953,909	3,050,235
	Per Participant Avg Energy Savings (kWh)*				381.9
	Per Participant Avg Demand Savings (kW)*				0.157
	Weighted Avg Measure Life*				16
	Net To Gross Ratio				68%

Eligible Customers

Any residential customer located in the Vectren South electric service territory. For the equipment rebates, the applicant must reside in a single-family home or multi-family complex with up to 12 units. Only single-family homes are eligible for insulation and duct sealing remediation measures.

Marketing Plan

The marketing plan includes program specific materials that will target contractors, trade allies, distributors, manufacturers, industry organizations and appropriate retail outlets in the Heating, Ventilation and Air Conditioning (HVAC) industry. Marketing outreach medium include targeted direct marketing, direct contact by vendor personnel, trade shows and trade associations. Vectren will also use web banners, bill inserts, customer emails, social media outreach, press releases and

mass market advertising. Program marketing will direct customers and contractors to the Vectren South website or call center for additional information.

Barriers/Theory

The initial cost is one of the key barriers. Customers do not always understand the long-term benefits of the energy savings from efficient alternatives. Trade allies are also often reluctant to sell the higher cost items as they do not want to be the high cost bidder. Incentives help address the initial cost issue and provide a good reason for Trade Allies to promote these higher efficient options.

Initial Measures, Products and Services

Details of the measures, savings, and incentives can be found in Appendix B. Measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified.

Program Delivery

Vectren South will oversee the program and will partner with CLEAResult for prescriptive. A Third Party, which has not been identified, will oversee Marketplace and Instant Rebates. Vendors will work with local contractors to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

As part of the Quality Assurance/Quality Control process, the vendor will provide 100% paper verification that the equipment/products purchased meet the program efficiency standards and a field verification of 5% of the measures installed. A third-party evaluator will review the program using appropriate EM&V protocols.

C. Residential New Construction

Program Description

The Residential New Construction (RNC) program produces long-term energy savings by encouraging the construction of single-family homes, duplexes, or end-unit townhomes with only one shared wall that are inspected and evaluated through the Home Efficiency Rating System (HERS). Builders can select from two rebate tiers, based on HERS ratings plus an additional rebate if the builder reaches the Platinum eligible HERS rating and installs a tankless water heater. Gold Star homes must achieve a HERS rating of 61 to 63. Platinum Star homes must meet a HERS rating of 60 or less. Additionally, we will continue to deliver energy efficiency kits for new homes being constructed by Habitat for Humanity.

The RNC Program provides incentives and encourages home builders to construct homes that are more efficient than current building codes and address the lost opportunities in this customer segment by promoting EE at the time the initial decisions are being made. The Residential New Construction program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances. The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

Table 15: Residential New Construction Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Residential New Construction**				
	Number of Homes	148	171	171	490
	Energy Savings kWh	163,986	188,637	188,637	541,260
	Peak Demand kW	56.1	66.0	66.0	188.0
	Total Program Budget $	88,852	88,049	85,065	261,965
	Per Participant Avg Energy Savings (kWh)*				1104.6
	Per Participant Avg Demand Savings (kW)*				0.384
	Weighted Avg Measure Life*				23
	Net To Gross Ratio				54%

Eligible Customers

Any customer or home builder constructing an eligible home in the Vectren South service territory.

Marketing Plan

In order to move the market toward an improved home building standard, education will be required for home builders, architects and designers as well as customers buying new homes. A combination

of in-person meetings with these market participants as well as other educational methods will be necessary.

Barriers/Theory

The Residential New Construction program addresses the primary barriers of first cost as well as builder and customer knowledge. First cost is addressed by program incentives to help reduce the cost of the EE upgrades. The program provides opportunities for builders and developers to gain knowledge and skills concerning EE building practices and coaches them on application of these skills. The HERS rating system allows customers to understand building design and construction improvements through a rating system completed by professionals.

Incentive Strategy

Program incentives are designed to be paid to both all-electric and combination homes that have natural gas heating. It is important to note that the program is structured such that an incentive will not be paid for an all-electric home that has natural gas available to the home site. Incentives can be paid to either the home builder or the customer/account holder. Incentives will be based on the rating tier qualification. For all-electric homes, where Vectren South natural gas service is not available, the initial incentives will be:

Tier	HERS Rating	Total Incentive
Platinum Plus	60 or less & install and installs a tankless water heater (.9 energy factor)	$1,200
Platinum	60 or less	$1,000
Gold	61 to 63	$700

For homes with central air conditioning and Vectren South natural gas space heating, the electric portion of the incentive will be:

Tier	HERS Rating	Total Incentive	Gas Portion	Electric Portion
Platinum Plus	60 or less & install and installs a tankless water heater (.9 energy factor)	$1,200	$900	$300
Platinum	60 or less	$1,000	$750	$250
Gold	61 to 63	$700	$525	$175

Program Delivery

Vectren South will oversee the program and will partner with CLEAResult to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory.

Evaluation, Measurement and Verification

Field inspections will occur at least once during construction and upon completion by a certified HERS Rater. As part of the Quality Assurance/Quality Control process, the vendor will provide 100% paper verification that the equipment/products purchased meet the program efficiency standards. A third-party evaluator will evaluate the program using standard EM&V protocols.

D. Home Energy Assessments

Program Description

The Home Energy Assessment (HEA) program is designed to produce long term energy and demand savings in the residential market. The program provides direct installation of energy-saving measures such as LED light bulbs, aerators, pipe wrap, water heater set-back and a smart thermostat (if qualified). It also provides a detailed report which educates consumers on ways to reduce energy consumption further.

The contractor will educate the customer while performing installation of appropriate direct install measures during the assessment. A comprehensive leave behind report outlining the results and recommendations is also provided. Duct sealing may be available if needed. In order to receive the duct sealing rebate, customers provide a minimum co-pay of $100 and the contractor will specify the leak reduction. If the home is eligible for air sealing and/or insulation, the customer will be referred to a program approved insulation contractor..

Table 16: Home Energy Assessments & Weatherization Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Home Energy Assessment**				
	Number of Homes	400	420	504	1,324
	Energy Savings kWh	550,810	576,574	684,783	1,812,167
	Peak Demand kW	52.0	54.0	63.0	169.0
	Total Program Budget $	239,713	256,589	296,868	793,169
	Per Participant Avg Energy Savings (kWh)*				1368.7
	Per Participant Avg Demand Savings (kW)*				0.128
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				75%

Eligible Customers

Any residential customer located in the Vectren South electric service territory. Any customer that qualifies for the residential low-income weatherization program will be referred to that program and not included in the HEA program. Additional requirements include:

- Home was not built within the last five years;
- How has not had an audit within the last three years; and
- Is owner occupied or authorized non-owner occupied where the occupants have the electric service in their name.
- Building type is single-family, or condo/apartment with four units or less

Marketing Plan

Proposed marketing efforts include utilizing direct mailers, email blasts, Vectren South online audit tools, bill inserts, social media outreach, as well as other outreach and education efforts and

promotional campaigns throughout the year to ensure participation levels are maintained. The preferred program contractor will also market the program to their current customer base as an additional incentive opportunity for use of their services.

Barriers/Theory

The audit requires the customer to select an appointment for the audit to occur. The requirement to be at the appointment can create difficulty for the customer. This program provides customers with some basic improvements to help them save energy and provides the customer with feedback that the customer can use to further improve its energy efficiency such as insulation referral or duct sealing. It is the customer's choice whether they will make the suggested upgrades to save energy.

Initial Measures, Products and Services

Measures available for installation will vary based on the home and include:

- GSL and Specialty LED bulbs/lamps (interior/exterior/candelabra/retrofit – up to 30 bulbs)
- High Efficiency Kitchen and bathroom aerators
- High Efficiency Showerheads (Standard or Handheld)
- Pipe Wrap
- Filter Whistles
- Smart Thermostat
- Water Heater Temperature Setback
- Smart Power Strip
- Duct Sealing/Insulation (requires co-pay)

For customers who elect to move forward with duct sealing, air sealing or attic insulation recommended in the audit report, an instant rebate is available and savings are applied to the HEA.

Program Delivery

Vectren South will oversee the program and partner with a local contractor to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure compliance with program guidelines, field visits with auditors will occur as well as spot check verifications of measure installations. A third-party evaluator will evaluate the program using standard EM&V protocols.

E. Income Qualified Weatherization

Program Description

The Income Qualified Weatherization (IQW) program is designed to produce long-term energy and demand savings in the residential market. The program is designed to provide weatherization upgrades to low-income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption. Customers eligible through the Income Qualified Weatherization Program will have opportunity to receive deeper retrofit measures including refrigerators, attic insulation, duct sealing, air infiltration reduction and installation of new central air conditioner or air source heat pump.

Collaboration and coordination between gas and electric low-income programs along with state and federal funding is recommended to provide the greatest efficiencies among all programs. The challenge of meeting the goals set for this program have centered on health and safety as well as customer cancellations and scheduling. Vectren South is committed to finding innovative solutions to these areas. A health and safety (H&S) budget has been established, and we continue to work on improving methods of customer engagement with various confirmations via phone and email reminders prior to the appointment. Vectren continues to look for ways to do more of a qualitative approach within this program to ensure the maximum savings is reached and H&S issues are addressed appropriately.

Table 17: Income Qualified Weatherization Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Income Qualified Weatherization**				
	Number of Homes	788	735	710	2,233
	Energy Savings kWh	485,948	460,780	444,441	1,391,169
	Peak Demand kW	101.8	111.0	103.5	316.3
	Total Program Budget $	687,423	707,709	714,673	2,109,806
	Per Participant Avg Energy Savings (kWh)*				623.0
	Per Participant Avg Demand Savings (kW)*				0.142
	Weighted Avg Measure Life*				12
	Net To Gross Ratio				100%

Eligible Customers

This program is available to residential customer who receive either electric only or gas and electric service from Vectren where Vectren is the homes primary heat source. Homes must be at 5 years or older and have not received an audit within the last three years; and is owner occupied or authorized non-owner occupied where occupants have the service in their name. Eligible homes must be less than 4 total units, and units should not be stacked. The traditional IQW will continue in its current state offering a home audit, direct install measures and air sealing for customers up to 300% of the Federal Poverty Level (FPL). Additionally, deeper measures including weatherization, air conditioner or air source heat pump

replacement will be performed under a "Whole Home IQW" which is offered to customers who qualify with income of up to 200% FPL.

Marketing Plan

Vectren South will provide a list to the implementation contractor of high consumption customers who have received Energy Assistance Program (EAP) funds within the past 12 months to help prioritize those customers who will benefit most from the program. This will also help in any direct marketing activities to specifically target those customers. In addition to utilizing the EAP List, the program will utilize census data to target low-income areas within Vectren territory. Vectren uses door-to-door canvassing for obtaining most of the appointments. The program is marketed to the public as "Neighborhood Weatherization" at various community events also working closely with the Vectren Foundation.

Barriers/Theory

Lower-income homeowners do not have the money to make even simple improvements to lower their bill and often live in homes with the most need for EE improvements. They may also lack the knowledge, experience, or capability to do the work. Health and safety can also be at risk for low-income homeowners, as their homes typically are not as "tight", and indoor air quality can be compromised. In order to increase participation and eligibility, Vectren South has incorporated a H&S budget into the program. An average of $250 per fuel type or $500 per home has been budgeted, but H&S dollars can be spent up to $5,000 per home, upon approval by Vectren. This program provides customers with basic improvements to help them start saving energy without needing to make the investment themselves.

Initial Measures, Products and Services

As specified above under program changes, the measures available for installation will vary based on the home and include:

Traditional IQW - Income requirement of up to 300% FPL

- GSL and Specialty LED Bulbs/Lamps (Interior/Exterior/Candelabras)
- High Efficiency Kitchen and Bathroom Aerators
- High Efficiency Showerhead (Standard or Handheld)
- Pipe Wrap
- Filter Whistles
- Infiltration Reduction
- Attic Insulation
- Duct Repair, Seal and Insulation
- Air Sealing - Gas Furnace with CAC, Heat Pump, Electric Furnace with CAC

- Refrigerator replacement
- Smart thermostat
- Water Heater Temperature Setback
- Smart power strips
- CAC or Furnace Tune-Up

Whole Home IQW - Income requirement of up to 200% FPL. Includes all the "Traditional" measures plus:

- Water heater replacement
- Attic Insulation
- Wall Insulation
- Exterior caulking
- CAC or Furnace Replacement

Program Delivery

Vectren South will oversee the program and will partner with CLEAResult to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

To assure quality installations, 5% of the installations will be field inspected. A third-party evaluator will evaluate the program using standard EM&V protocols.

F. Community Based – LED Specialty Bulb Distribution (formerly Food Bank LED)

Program Description

The Community Based Specialty LED Distribution program is designed to provide energy efficient specialty lighting products to low-income community members who receive assistance from local food banks and township trustees. The program is intended to educate low-income community members on the benefits of energy efficient lighting and provide them with products which would otherwise be unaffordable.

Eligible Customers

The Community Based Specialty LED Distribution program targets local food banks and township trustees who serve low-income homeowners and tenants within Vectren electric service territory.

Marketing Plan

Marketing materials will be created to educate product recipients on the benefits of energy efficiency lighting.

Barriers/Theory

Lower income customers often do not have the money to make even simple improvements to lower their bill and often live in homes with the most need for EE improvements. This program provides those customers with products to help them start saving energy without needing to make the investment themselves.

Initial Measures, Products and Services

LED specialty bulbs will be offered.

Table 18. Community Based LED Distribution Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Community Based - LED Specialty Bulb Distribution**				
	Number of Measures	33,976	33,976	33,976	101,928
	Energy Savings kWh	1,159,285	1,159,285	1,159,285	3,477,855
	Peak Demand kW	159.7	159.7	159.7	479.1
	Total Program Budget $	168,110	171,693	177,923	517,727
	Per Participant Avg Energy Savings (kWh)*				34.1
	Per Participant Avg Demand Savings (kW)*				0.005
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Program Delivery

Vectren South will oversee the program and will partner with CLEAResult to deliver the program.

Evaluation, Measurement and Verification

A third-party evaluator will evaluate the program using standard EM&V protocols.

G. Energy Efficient Schools

Program Description

The Energy Efficient Schools Program is designed to impact students by teaching them how to conserve energy and to produce cost effective electric savings by influencing students and their families to focus on the efficient use of electricity.

The program consists of a school education program for 5th grade students attending schools served by Vectren South. To help in this effort, each child that participates will receive a take-home energy kit with various energy saving measures for their parents to install in the home. The kits, along with the in-school teaching materials, are designed to make a lasting impression on the students and help them learn ways to conserve energy.

Table 19: Energy Efficient Schools Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Energy Efficient Schools**				
	Number of Kits	2,600	2,600	2,600	7,800
	Energy Savings kWh	733,118	696,462	661,639	2,091,220
	Peak Demand kW	78.3	74.4	70.7	223.4
	Total Program Budget $	118,451	122,451	102,451	343,352
	Per Participant Avg Energy Savings (kWh)*				268.1
	Per Participant Avg Demand Savings (kW)*				0.029
	Weighted Avg Measure Life*				10
	Net To Gross Ratio				100%

Eligible Customers

The program will be available to selected 5th grade students/schools in the Vectren South electric service territory.

Marketing Plan

The program will be marketed directly to elementary schools in Vectren South electric service territory as well as other channels identified by the implementation contractor. A list of the eligible schools will be provided by Vectren South to the implementation contractor for direct marketing to the schools via email, phone, and mail (if necessary) to obtain desired participation levels in the program.

Barriers/Theory

This program addresses the barrier of education and awareness of EE opportunities. Working through schools, both students and families are educated about opportunities to save. As well, the families receive energy savings devices they can install to begin their savings.

Initial Measures, Products and Services

The kits for students will include:

- High Efficiency Kitchen Aerator
- High Efficiency Bathroom Aerators (2)
- High Efficiency Showerhead
- GSL LED bulbs 11 Watt (2)
- GSL LED Bulb 15 Watt (1)
- LED Nightlight
- Filter Whistle

Please note that bulb type may be updated to include the BR30.

Program Delivery

Vectren South will oversee the program and will partner with National Energy Foundation (NEF) to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

Classroom participation will be tracked. A third-party evaluator will evaluate the program using standard EM&V protocols.

H. Residential Behavior Savings

Program Description

The Residential Behavioral Savings Program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and emailed home energy reports. The report and web portal include a comparison against a group of similarly sized and equipped homes in the area, usage history comparisons, goal setting tools, and progress trackers. The Home Energy Report program anonymously compares customers' energy use with that of other customers with similar home size and demographics. Customers can view the past 12 months of their energy usage and compare and contrast their energy consumption and costs with others in the same neighborhood. Once a consumer understands better how they use energy, they can then start conserving energy. This program will be expanded to target more customers as identified in the MPS, including a low-income segment, which will motivate customers to act on energy savings tips. The main delivery channel will be targeted mail and email with the addition of specific tips provided to the low-income customer segment. Customers in this low-income wave will also be offered a direct-ship kit with energy saving measures.

Program data and design was provided by Opower, the implementation vendor for the program. Opower provides energy usage insight that drives customers to take action by selecting the most relevant information for each particular household, which ensures maximum relevancy and high response rate to recommendations.

Table 20: Residential Behavior Savings Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Residential Behavioral Savings**				
	Number of Participants	41,543	42,016	40,182	123,741
	Energy Savings kWh	7,020,000	7,100,000	6,790,000	20,910,000
	Peak Demand kW	1,350	1,270	1,210	3,830
	Total Program Budget $	254,105	261,391	268,896	784,392
	Per Participant Avg Energy Savings (kWh)*				169.0
	Per Participant Avg Demand Savings (kW)*				0.031
	Weighted Avg Measure Life*				1
	Net To Gross Ratio				100%

Eligible Customers

Residential customers who receive electric service from Vectren South are eligible to participate in this integrated natural gas and electric EE program.

Barriers/Theory

The Residential Behavioral Savings program provides residential customers with better energy information through personalized reports delivered by mail, email and an integrated web portal to help them put their energy usage in context and make better energy usage decisions. Behavioral science research has demonstrated that peer-based comparisons are highly motivating ways to present information. The program will leverage a dynamically created comparison group for each residence and compare it to other similarly sized and located households.

Implementation & Delivery Strategy

The program will be delivered by Opower and include energy reports and a web portal. Customers typically receive between 4 to 6 reports annually and monthly emailed reports. These reports provide updates on energy consumption patterns compared to similar homes and provide energy savings strategies to reduce energy use. They also promote other Vectren South programs to interested customers. The web portal is an interactive system for customers to perform a self-audit, monitor energy usage over time, access energy savings tips and be connected to other Vectren South gas and electric programs. In efforts to enhance program savings to low income customers, Opower will provide specific tips to the low-income customer segment.

Program Delivery

Vectren South will oversee the program and partner with Opower to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

A third-party evaluator will complete the evaluation of this program and work with Vectren South to select the participant and non-participant groups.

I. Appliance Recycling

Program Description

The Residential Appliance Recycling program encourages customers to recycle their old inefficient air conditioners, refrigerators, and freezers in an environmentally safe manner. The program recycles operable refrigerators and freezers, so the appliance no longer uses electricity, and keeps 95% of the appliance out of landfills. An older refrigerator can use up to three times the amount of energy as new efficient refrigerators. An incentive of $50 will be provided to the customer for each operational unit picked up. Additionally, air conditioners were added to the mix offering a $25 rebate. To qualify for the air conditioner pick up, customers must have a refrigerator or freezer to be picked up.

Table 21: Appliance Recycling Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Appliance Recycling**				
	Number of Measures	1,375	1,300	1,125	3,800
	Energy Savings kWh	1,322,563	1,250,423	1,082,097	3,655,083
	Peak Demand kW	174.6	165.1	142.9	482.6
	Total Program Budget $	244,152	246,902	249,152	740,205
	Per Participant Avg Energy Savings (kWh)*				961.9
	Per Participant Avg Demand Savings (kW)*				0.127
	Weighted Avg Measure Life*				8
	Net To Gross Ratio				67%

Eligible Customers

Any residential customer with an operable secondary air conditioner, refrigerator, or freezer receiving electric service from Vectren South.

Marketing Plan

The program will be marketed through a variety of mediums, including the use of utility bill inserts and customer emails, press releases, retail campaigns coordinated with appliance sales outlets as well as the potential for direct mail, web and social and mass media promotional campaigns.

Barriers/Theory

Many homes have second air conditioners, refrigerators, and freezers that are very inefficient. Customers are not aware of the high energy consumption of these units. Customers also often have no way to move and dispose of the units, so they are kept in homes past their usefulness. This program educates customers about the waste of these units and provides a simple way for customers to dispose of the units.

Program Delivery

Vectren South will work directly with Appliance Recycling Centers of America Inc. (ARCA), to implement this program.

Evaluation, Measurement and Verification

Recycled units will be logged and tracked to assure proper handling and disposal. The utility will monitor the activity for disposal. Customer satisfaction surveys will also be used to understand the customer experience with the program. A third-party evaluator will evaluate the program using standard EM&V protocols.

J. Smart Cycle (DLC Change Out) Program

Program Description

Vectren South has had a Direct Load Control (DLC) program since the early 1990's and currently has approximately 22,994 switches that remain in the program. However, with the advent of smart thermostats and the myriad of benefits they offer for both EE and DR, Vectren South began replacing DLC switches with smart thermostats in 2018. Smart thermostats provide an alternative to traditional residential load control switches as well as enhance the way customers manage and understand their home energy use.

Throughout the 2018-2020 plan period, Vectren South replaced approximately 1,000 DLC switches with smart thermostats each year. As an alternative to DLC switches, smart thermostats can optimize heating and cooling of a home to reduce energy usage and control load while utilities can learn from occupant behavior/preference, adjusting heating, ventilation, and air conditioning (HVAC) settings. Evaluation results show significantly more load reduction can be delivered by smart thermostats. The current DLC switch program is a well-established means for Vectren South to shed load during peak demand; however, over time, to optimize results while minimizing cost to the customer, designing a program incorporating a change out from switches to smart thermostats is a strategic option for cost effective load control solutions. Vectren South's 2021-2023plan continues to replace 1,000 DLC switches with smart thermostats each year.

Vectren will be partnering with Energy Hub beginning in 2020 that will manage customer enrollments, energy savings, and provide a platform for management of Demand Response (DR) events. Our previous DR provider, Nest, will no longer offer these services and does not have the capability to manage other thermostats in the market such as Ecobee.

During the months of June through September, customers in this program will receive a monthly bill credit of $5 for participating in the program. Customers are notified of all events and have the capability of opting out of events at any time during the actual event.

Table 22: Smart Cycle (DLC Change Out) Program & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Smart Cycle (DLC Change Out)**				
	Number of Measures	1,000	1,000	1,000	3,000
	Energy Savings kWh	362,577	362,577	362,577	1,087,731
	Peak Demand kW	1,140	1,140	1,140	3,420
	Total Program Budget $	984,328	1,063,328	1,142,328	3,189,985
	Per Participant Avg Energy Savings (kWh)*				362.6
	Per Participant Avg Demand Savings (kW)*				1.710
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Eligible Customers

Customers in the Vectren South territory who currently participate in the DLC Summer Cycler program and have access to Wi-Fi.

Marketing Plan

Proposed marketing efforts include utilizing direct mailers, email blasts, Vectren South online audit tools, bill inserts as well as other outreach and education efforts and promotional campaigns throughout the year to ensure participation levels are maintained.

Incentive Strategy

Customers will receive a professionally installed Wi-Fi thermostat at no additional cost and a monthly bill credit of $5 during the months of June to September. Additionally, the Smart Cycle program includes incentives for existing customers from the 2016 Pilot Program to participate in the Demand Response events for 2021-2023.

Program Delivery

Vectren South will oversee the program.

Evaluation, Measurement and Verification

A third-party evaluator will evaluate the program using standard EM&V protocols.

K. Bring Your Own Thermostat (BYOT)

Program Description

The Bring Your Own Thermostat (BYOT) program is a further expansion of the residential smart thermostat initiative. BYOT allows customers to purchase their own device from multiple vendors and participate in DR with Vectren South and other load curtailing programs managed through the utility. Taking advantage of two-way communicating smart thermostats, the BYOT program can help reduce acquisition costs for load curtailment programs and improve customer satisfaction.

Table 23: BYOT Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**BYOT (Bring Your Own Thermostat)**				
	Number of Participants	400	450	500	1,350
	Energy Savings kWh				
	Peak Demand kW	456.0	513.0	570.0	1,539.0
	Total Program Budget $	126,646	156,496	189,246	472,388
	Per Participant Avg Energy Savings (kWh)*				0.0
	Per Participant Avg Demand Savings (kW)*				1.140
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Eligible Customers

Residential single or multi-family customers in the Vectren South territory with access to Wi-Fi and who own a qualifying compatible Wi-Fi thermostat that operates the central air-conditioning cooling system.

Marketing Plan

Proposed marketing efforts include utilizing direct mailers, email blasts, Vectren South online audit tools, bill inserts as well as other outreach and education efforts and promotional campaigns throughout the year to ensure participation levels are maintained.

Incentive Strategy

Customers will receive a one-time enrollment incentive of $75 and a bill credit of $5 during the months of June to September. The enrollment incentive will be provided in the first year to new enrollees only.

Program Delivery

Vectren South will oversee the program.

Evaluation, Measurement and Verification

A third-party evaluator will evaluate the program using standard EM&V protocols.

M. Residential Midstream

Program Description

Following the successful launch of a residential midstream pilot in Q2 2020, Vectren will continue to offer the Residential Midstream program. Midstream measures and savings will continue to shift from prescriptive to midstream based on program performance. The program targets a small number of distributors that serve the broader market, rather than individual customers. As the HVAC market in Vectren territory matures, midstream offerings can increase market penetration and enlist participants that have historically not taken part in incentive programs.

This approach moves a limited selection of current downstream HVAC measures to a midstream model to test the success of the delivery channel in Vectren territory. The measure selection will target measures that are currently experiencing limited uptake in the market so as not to disrupt the current downstream program. With success, the midstream offering will evaluate additional measures while incorporating feedback from Vectren and distributors.

Table 25: Residential Midstream Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Residential Midstream**				
	Number of Participants	1,310	1,411	1,771	4,492
	Energy Savings kWh	922,215	1,061,351	1,271,737	3,255,303
	Peak Demand kW	695.3	744.6	938.4	2,378.4
	Total Program Budget $	439,289	417,849	498,073	1,355,211
	Per Participant Avg Energy Savings (kWh)*				724.7
	Per Participant Avg Demand Savings (kW)*				0.529
	Weighted Avg Measure Life*				18
	Net To Gross Ratio				100%

Eligible Customers

Any residential customer located in the Vectren South electric service territory.

Marketing Plan

The marketing plan will target distributors through direct outreach to contractor trade networks. Co-branded materials will be available to participating distributors to draw attention to, and provide education on, the HVAC measures within the program. Fact Sheets will also be created to keep the program top of mind. CleaResult will provide program approved verbiage for email blast content for Distributors to promote the program to their Contractors.

Barriers/Theory

The main barrier for this program is the administrative burden and costs of implementation for the distributor. To address this burden, incentives are paid directly to the distributor, with savings passed along to the customer. With program activity focused on engaging distributors, customers find energy efficiency programs simple and appealing, as their participation varies little from their typical purchasing practices.

Initial Measures, Products and Services

Details of the measures, savings, and incentives can be found in Appendix B. Measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified.

Program Delivery

Vectren South will oversee the program and will partner with CLEAResult to deliver the program. CLEAResult with partner with Distributors (or Participating Partners) to implement the Midstream Program. Participating Partners will be given access and trained on the program-specific platform, Program Partner Center (PPC). Within PPC, distributors will be able to validate that customers are eligible, verify that products meet the requirements of the program, and upload their sales data. Once data is uploaded, PPC will validate that information provided is accurate and meets eligibility requirements set forth by the program. Once all data has been verified, the incentive reimbursement will be processed for the participating partner.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

As part of the Quality Assurance/Quality Control process, the vendor will provide 100% paper verification that the equipment/products purchased meet the program efficiency standards and a field verification of the measures installed. A third-party evaluator will review the program using appropriate EM&V protocols.

P. Conservation Voltage Reduction - Residential and Commercial and Industrial

Program Description

Conservation Voltage Reduction (CVR) achieves energy conservation through automated monitoring and control of voltage levels provided on distribution circuits. End use customers realize lower energy and demand consumption when CVR is applied to the distribution circuit from which they are served. The first CVR was put into service on July 2017, for the Buckwood substation and the second CVR is being put into service in 2021 at the Eastside substation. This filing has the third CVR being planned in 2023.

Energy and demand savings occur when CVR is applied to distribution circuits. Once applied, a step change in energy and demand consumption by customers is realized, dependent upon where customer loads are located within the voltage zones, the load characteristics of the circuit, and how end-use loads respond to the voltage reduction. The resultant energy and demand consumption reduction persists at the new levels if tighter voltage bandwidth operation is applied. As a result, ongoing energy and demand savings persists for the duration of the life of the CVR equipment and if the equipment is maintained and operated in the voltage bandwidth mode.

As approved in Cause 44927, Vectren South capitalized the costs to implement the CVR program and will recover the program budget, consisting of ongoing maintenance, carrying cost, and depreciation expense associated with the implementation along with annual ongoing O&M expense through the annual DSMA rider. The 2021-2023 Plan will contain these expenses for the Buckwood and Eastside substation as well as the substation for the 2023 year.

Table 24: Conservation Voltage Reduction Energy Savings Targets[2]

Market	Program	2021	2022	2023	Total Program
Residential	**CVR Residential**				
	Number of Participants			4,965	4,965
	Energy Savings kWh			1,067,954	1,067,954
	Peak Demand kW			430	430
	Total Program Budget $	354,969	348,828	418,537	1,122,334
	Per Participant Avg Energy Savings (kWh)*				215.1
	Per Participant Avg Demand Savings (kW)*				0.087
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Market	Program	2021	2022	2023	Total Program
Commercial & Industrial	**CVR Commercial**				
	Number of Participants			662	662
	Energy Savings kWh			875,340	875,340
	Peak Demand kW			213.9	213.9
	Total Program Budget $	225,130	219,516	172,184	616,829
	Per Participant Avg Energy Savings (kWh)*				1322.3
	Per Participant Avg Demand Savings (kW)*				0.323
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Program Delivery

Vectren South will oversee the program and will partner with an implementer to deliver the program.

Eligible Customers

Vectren South has identified substations that will benefit from the CVR program. For this program, one substation will be installed in 2023.

Barriers/Theory

CVR is both a DR and an EE program. First, it seeks to cost effectively deploy new technology to targeted distribution circuits, in part to reduce the peak demand experienced on Vectren South's electrical power supply system. The voltage reduction stemming from the CVR program operates to effectively reduce consumption during the times in which system peaks are set and as a result directly reduces peak demand. CVR also cost effectively reduces the level of ongoing energy consumption by end-use devices located on the customer side of the utility meter as many end-use devices consume less energy with lower voltages consistently applied. Like an equipment maintenance service program, the voltage optimization

[2] For purposes of this filing, the CVR savings include only the 2023 CVR substation because savings are recognized fully the first year of implementation, therefore Buckwood substation and Eastside substation savings were recognized fully in 2017 and 2021.

allows the customer's equipment to operate at optimum levels which saves energy without requiring direct customer intervention or change.

Initial Measures, Products and Services

Vectren South will install the required communication and control equipment on the appropriate circuits from the substation. No action is required of the customers.

Q. Home Energy Management Systems (HEMS)

Program Description

A HEMS program is a behavioral program that provides real time energy usage data to encourage customers to take action to reduce energy consumption. The HEMS program will be piloted using advanced metering infrastructure (AMI) data to communicate energy usage to customers. The platform will utilize a smart phone application to communicate with customers about their home energy usage and provide suggestions for ways customers can save energy. To enhance customer engagement, participants in the program will receive a smart thermostat at no cost, if they do not currently have one installed in their home. The objectives of this program include:

- Motivate customers to save energy by increasing customer awareness and engagement around energy consumption and their utility bill
- Increase customer knowledge of and participation in Company programs including, but not limited to, energy efficiency programs and advanced data analytics
- Deliver energy and demand savings

Table 26: HEMS Program Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Residential	**Home Energy Management Systems**				
	Number of Participants	1,000	1,000	1,000	3,000
	Energy Savings kWh	515,000	515,000	515,000	1,545,000
	Peak Demand kW	80.0	80.0	80.0	240.0
	Total Program Budget $	203,513	210,513	220,513	634,538
	Per Participant Avg Energy Savings (kWh)*				515.0
	Per Participant Avg Demand Savings (kW)*				0.080
	Weighted Avg Measure Life*				6
	Net To Gross Ratio				100%

Eligible Customers

Any residential customer located in the Vectren South electric service territory, having an AMI meter.

Program Delivery

Vectren South will oversee the program and will partner with a third-party to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

A third-party evaluator will review the program using appropriate EM&V protocols.

R. Commercial and Industrial Prescriptive

Program Description

The Commercial & Industrial (C&I) Prescriptive Program is designed to provide financial incentives on qualifying products to produce greater energy savings in the C&I market. The rebates are designed to promote lower electric energy consumption, assist customers in managing their energy costs, and build a sustainable market around EE.

Program participation is achieved by offering incentives structured to cover a portion of the customer's incremental cost of installing prescriptive efficiency measures.

Table 27: Commercial & Industrial Prescriptive Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Commercial & Industrial	**Commercial Prescriptive**				
	Number of Measures	31,875	26,229	25,750	83,854
	Energy Savings kWh	15,650,556	13,813,073	12,520,261	41,983,890
	Peak Demand kW	2,960.7	2,592.7	2,694.7	8,248.0
	Total Program Budget $	2,513,494	2,431,243	2,234,780	7,179,517
	Per Participant Avg Energy Savings (kWh)*				500.7
	Per Participant Avg Demand Savings (kW)*				0.098
	Weighted Avg Measure Life*				14
	Net To Gross Ratio				84%

Eligible Customers

Any eligible participating commercial or industrial customer receiving Vectren South electric service.

Marketing Plan

Proposed marketing efforts include trade ally outreach, trade ally meetings, direct mail, face-to-face meetings with customers, marketing campaigns and bonuses, web-based marketing, and coordination with key account executives.

Barriers/Theory

Customers often have the barrier of higher first cost for EE measures, which precludes them from purchasing the more expensive EE alternative. They also lack information on high-efficiency alternatives. Trade allies often run into the barrier of not being able to promote more EE alternatives because of first cost or lack of knowledge. Trade allies also gain credibility with customers for their EE claims when a measure is included in a utility prescriptive program. Through the program the trade allies can promote EE measures directly to their customers encouraging them to purchase more efficient equipment while helping customers get over the initial cost barrier.

Initial Measures, Products and Services

Measures will include high-efficient lighting and lighting controls, HVAC equipment including variable frequency drives, commercial kitchen equipment including electronically commutated motors (ECMs), and miscellaneous items including compressed air equipment.

Note that measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified. Detailed measure listings, participation and incentives are in Appendix B.

Implementation & Delivery Strategy

The program will be delivered primarily through the trade allies working with their customers. Vectren South and its implementation partners will work with the trade allies to make them aware of the offerings and help them promote the program to their customers. The implementation partner will provide training and technical support to the trade allies to become familiar with the EE technologies offered through the program. The program will be managed by the same implementation provider as the Commercial & Industrial Custom program so that customers can seamlessly receive assistance and all incentives can be efficiently processed through a single procedure.

Incentive Strategy

Incentives are provided to customers to reduce the difference in first cost between the lower efficient technology and the high-efficient option. There is no fixed incentive percentage amount based on the difference in price because some technologies are newer and need higher amounts. Others have been available in the marketplace longer and do not need as much to motivate customers. Incentives will be adjusted to respond to market activity and bonuses may be available for limited time, if required, to meet goals.

Program Delivery

Vectren South will oversee the program partner Nexant to deliver the program.

Evaluation, Measurement and Verification

Site visits will be made on 5% of the installations, as well as all projects receiving incentive greater than $20,000, to verify the correct equipment was installed. Standard EM&V protocols will be used for the third-party evaluation of the program.

S. Commercial Midstream

Program Description

The Commercial Midstream program will provide incentives to actors at the distributor level (firms positioned between the manufacturer and the end user). An example will be to provide incentives for HVAC equipment such as Ductless Heat Pumps, Air Source Heat Pumps and Heat Pump Water Heaters.

Through midstream incentives, the program aims to influence the equipment that distributors stock and fine-tune incentives to fit desired program outcomes. Because distributors have a large influence on the essential equipment that customers install, the program will be able to encourage distributors to stock and promote more energy-efficient equipment to their clientele. Midstream incentives can be more easily adjusted, as customers receive the discount at the time of equipment purchase, not after a lengthy application process.

Table 28: Commercial & Industrial Midstream Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Commercial & Industrial	**Commercial Midstream**				
	Number of Projects	12	12	12	36
	Energy Savings kWh	31,570	31,570	31,570	94,710
	Peak Demand kW	5.5	5.5	5.5	16.4
	Total Program Budget $	15,577	15,577	15,577	46,732
	Per Participant Avg Energy Savings (kWh)*				2630.8
	Per Participant Avg Demand Savings (kW)*				0.454
	Weighted Avg Measure Life*				18
	Net To Gross Ratio				100%

Eligible Customers

In order to receive midstream incentives, equipment must be installed at an active electric or natural gas General Service customer of Vectren Energy Delivery of Indiana on Rate 120, 125 Vectren South or 220, 225 Vectren North at the location of installation.

Marketing Plan

The marketing plan will target distributors and regional account representatives through direct outreach to contractor trade networks. Co-branded materials will be available to participating distributors to draw attention to, and provide education on, the measures within the program. Fact Sheets will also be created to keep the program top of mind. CleaResult will provide program approved verbiage for email blast content for Distributors to promote the program to their Contractors.

Barriers/Theory

The main barrier for this program is the administrative burden and costs of implementation for the distributor. To address this burden, incentives are paid directly to the distributor, with savings passed along to the customer. With program activity focused on engaging distributors, customers find energy efficiency programs simple and appealing, as their participation varies little from their typical purchasing practices.

Initial Measures, Products and Services

Details of the measures, savings, and incentives can be found in Appendix B. Measures included in the program will change over time as baselines change, new technologies become available and customer needs are identified.

Program Delivery

Vectren South will oversee the program and will partner with a third-party implementer to deliver the program. Participating Partners will be given access and trained on the program-specific platform, Program Partner Center (PPC). Within PPC, distributors will be able to validate that customers are eligible, verify that products meet the requirements of the program, and upload their sales data. Once data is uploaded, PPC will validate that information provided is accurate and meets eligibility requirements set forth by the program. Once all data has been verified, the incentive reimbursement will be processed for the participating partner.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas/electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

As part of the Quality Assurance/Quality Control process, the vendor will provide 100% paper verification that the equipment/products purchased meet the program efficiency standards and a field verification of the measures installed. A third-party evaluator will review the program using appropriate EM&V protocols.

T. Commercial and Industrial Custom

Program Description

To maximize cost-effectiveness and streamline program delivery, the Commercial Custom Program encompasses several different options for commercial & industrial customers to participate. These include: Custom Program, Commercial New Construction, Building Tune Up, and Strategic Energy Management (SEM).

The **Custom Program** promotes the implementation of customized energy-saving projects at qualifying customer facilities. Incentives promoted through this program serve to reduce the cost of implementing energy-reducing projects and upgrading to high-efficiency equipment. Due to the nature of a custom EE program, a wide variety of projects are eligible. Under the Custom program, Vectren will offer a Compressed Air Leak Repair component as suggested in the MPS. The program would offer a compressed air leak study for no cost to the customer if they agree to a predefined customer commitment (e.g. fixing a certain % of the leaks). High usage compressed air industries include food manufacturers, plastics, metals and chemical plants.

Specific to **Commercial New Construction-Energy Design Assistance (EDA)**, this program provides value by promoting EE designs with the goal of developing projects that are more energy efficient than current Indiana building code. This program applies to new construction and major renovation projects. Major renovation is defined as the replacement of at least two systems within an existing space (e.g. lighting, HVAC, controls, building envelope). The program provides incentives as part of the facility design process to explore opportunities in modeling EE options to craft an optimal package of investments. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment in order to reduce the higher capital cost for the EE solutions.

The **Building Tune-Up** program provides a targeted, turnkey, and cost-effective retro-commissioning solution for small- to mid-sized customer facilities. It is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures. Most of these measures will be no- or low-cost with low payback periods and will capture energy savings from building automation systems.

Vectren will offer a **Strategic Energy Management** (SEM) offering to select large energy users throughout 18-month training process. Upon enrollment, the customer is assigned an energy manager to provide personalized service, as well as technical support, and a facility audit. Because of the 18-month

training process, anticipated savings from this will be realized across program years. Savings will capture both prescriptive/custom capital investments and behavioral changes through on-site consultation.

Table 29: Commercial & Industrial Custom Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Commercial & Industrial	**Commercial Custom**				
	Number of Measures	56	69	65	190
	Energy Savings kWh	5,509,079	6,677,683	6,221,324	18,408,086
	Peak Demand kW	702.0	892.0	831.0	2,425.0
	Total Program Budget $	847,795	982,471	933,500	2,763,766
	Per Participant Avg Energy Savings (kWh)*				96884.7
	Per Participant Avg Demand Savings (kW)*				12.763
	Weighted Avg Measure Life*				16
	Net To Gross Ratio				85%

Eligible Customers

Applicants must be an active electric or natural gas General Service customer of Vectren Energy Delivery of Indiana on Rate 120, 125 Vectren South or 220, 225 Vectren North at the location of installation.

Building Tune Up also requires applicants to be both an active Vectren South electric customer on a qualifying commercial rate and an active natural gas General Service customer on Rate 120 or 125.

Marketing Plan

Proposed marketing efforts include individualized outreach to large C&I customers through a variety of channels and coordination with key account representatives to leverage the contacts and relationships they have with the customers. Direct mail, media outreach, trade shows, marketing campaigns and bonuses, trade ally meetings, and educational seminars could also be used to promote the program. The Building Tune-Up and Commercial New Construction programs will now be marketed through the Commercial Custom Program through outreach and direct personal communication from Vectren South staff and third-party contractors. The program implementer will provide service provider specific-marketing collateral to support these companies as they connect with customers. SEM marketing includes individualized outreach to large C&I customers through a variety of channels to solicit program participants. We anticipate these outreach efforts will include several on-site meetings at customer facilities.

Barriers/Theory

Applications of some specific EE technologies are unique to that customer's application or process. The energy savings estimates for these measures are highly variable and cannot be assessed without an engineering estimation of that application; however, they offer a large opportunity for energy savings. To promote the installation of these high efficient technologies or measures, the Commercial & Industrial

Custom program will provide incentives based on the kWh saved as calculated by the engineering analysis. To assure savings, these projects will require program engineering reviews and pre approvals. The custom energy assessments offered will help remove customer barriers regarding opportunity identification and determining energy savings potential.

The Building Tune-Up program will typically target customers with buildings between 50,000 square feet and 150,000 square feet. Customers in this size range face unique barriers to energy efficiency. For example, although they are large enough to have a Building Automation System (BAS), they are usually too small to have a dedicated facility manager or staff with experience achieving operational efficiency. Also, most retro-commissioning service companies prefer larger projects and are too expensive for small-to-midsized customers. We have specifically tailored the incentive structure and program design to eliminate these barriers. The Building Tune-Up program is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures eligible for incentive offerings.

Initial Measures, Products and Services

All technologies or measures that save kWh qualify for the program. There are different services offered in the Building Tune-Up, New Construction and SEM sub-programs. The BTU program will specifically target measures that provide no- and low-cost operational savings. Most measures involve optimizing the building automation system (BAS) settings but the program will also investigate related capital measures, like controls, operations, processes, and HVAC.

The New Construction service provides energy design assistance at the design phase to encourage new buildings to go beyond what Indiana code requires. Each recommendation is provided to the customer through a report that estimates the savings and cost impacts. Customers are then provided additional rebates for each recommendation they select and install from the report.

The service within the SEM program provides in-depth consulting and support to large energy users who are interested in becoming ISO 50001 Ready. The program assigns a certified trainer to help set up their Energy Management System and trains them on best practices of energy management over an 18-month period. The participating customer will also receive an energy audit that will identify areas of opportunity to optimize the energy use in their facility.

Implementation & Delivery Strategy

The implementation partner will work collaboratively with Vectren South staff to recruit and screen customers for receiving facility energy assessments, technical assistance and energy management

education. The implementation partner will also provide engineering field support to customers and trade allies to calculate the energy savings. Customers or trade allies with a proposed project will complete an application form with the energy savings calculations for the project. The implementation team will review all calculations and where appropriate complete site visits to assess and document pre installation conditions. Customers will be informed, and funds reserved for the project. Implementation engineering staff will review the final project information as installed and verify the energy savings. Incentives are then paid on the verified savings.

C&I New Construction - The new construction program is designed as a proactive, cost-effective way to achieve energy efficiency savings and foster economic growth. Typically, program participants face time and cost constraints throughout the project that make it difficult to invest in sustainable building practices. Participants need streamlined and informed solutions that are specific to their projects and locations. This scenario is particularly true for small- to medium-sized new construction projects, where design fees and schedules provide for a very limited window of opportunity.

To help overcome the financial challenge, a Standard Energy Design Assistance (EDA) is offered. This provides additional engineering expertise during the design phase to identify energy-saving opportunities. Commercial and industrial projects for buildings greater than 100,000 square feet still in the conceptual design phase qualify for Vectren South's Enhanced EDA incentives which include energy modeling. The Vectren South implementation partner staff expert will work with the design team through the conceptual design, schematic design and design development processes providing advice and counsel on measures that should be considered and EE modeling issues. Incentives will be paid after the design team submits completed construction documents for review to verify that the facility design reflects the minimum energy savings requirements. For those projects that are past the phase where EDA can be of benefit, the C&I New Construction program offers the opportunity to receive prescriptive or custom rebates towards eligible equipment.

The **Building Tune-Up** program is designed to encourage high levels of implementation by customers seeking to optimize the operation of their existing HVAC system.

SEM is a new, comprehensive approach to energy management, customers are provided with expert support during their participation in the program. As soon as a customer enrolls in the program, an energy manager is assigned to provide personalized service throughout the 18-month training process. That process starts with a series of trainings that will introduce SEM and ISO 50001 concepts to the customer

and gives them specific instructions on how they can implement lasting change within their organization. Key strategies include:

- **Energy Managers.** Program-provided energy managers guide customers through the process, helping them complete program requirements, and supporting their implementation of SEM.

- **High-Quality Training.** Energy Managers prepare each customer's energy champion for the cohort training, which is conducted in which customers learn the basic elements of ISO 50001 and how to apply them to their facilities.

- **Free Facility Audit.** SEM is focused on long-term change, and the program provides each customer with a free facility audit to identify both operational and capital energy efficiency projects. The energy audit also serves as a teaching moment for the companies' energy team on how to systematically identify opportunities for improvement. The low- and no-cost operational projects can be completed almost immediately, while the capital projects help customers continue to take advantage of savings.

Incentive Strategy

Incentives will be calculated on a per kWh basis. The initial kWh rate will be $0.10/kWh and is paid based on the first-year annual savings reduction. Rates may change over time and vary with some of the special initiatives. Incentives will not pay more than 50% of the project cost nor provide incentives for projects with paybacks less than 12 months. Vectren South will offer a cost share on facility energy assessments that will cover up to 100% of the assessment cost.

The Commercial New Construction program will provide incentives to help offset some of the expenses for the design team's participation in the EDA process with the design team incentive. The design team incentive is a fixed amount based on the new/renovated conditioned square footage and is paid when the proposed EE projects associated with the construction documents exceed a minimum energy savings threshold. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment in order to reduce the higher capital cost for the EE solutions. Program specific savings and incentive include:

Facility Size – Square Feet	Design Team Incentives	Minimum Savings
Small <25,000	$750	25,000 kWh
Medium 25,000 - 100,000	$2,250	75,000 kWh
Large >100,000	$3,750	150,000 kWh
Enhance Large >100,000	$5,000	10% beyond code

Program Delivery

Vectren South will oversee the program partner Nexant to deliver the program. Additionally, Nexant will oversee the SEM Program's implementation, training and modeling.

Integration

Vectren South will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory. Vectren South has allocated implementation costs based on the net benefits split between natural gas and electric.

Evaluation, Measurement and Verification

Given the variability and uniqueness of each project, all projects will be pre-approved. Pre and post visits to the site to verify installation and savings will be performed as defined by the program implementation partner. Monitoring and verification may occur on the largest projects. A third-party evaluator will be used for this project and use standard EM&V protocols.

U. Small Business Energy Solutions (SBES)

Program Description

The SBES Program provides value by directly installing EE products such as high efficiency lighting, pre-rinse sprayers, refrigeration controls, electrically commutated motors, smart thermostats and vending machine controls. The program helps small businesses, multi-family and not-for-profit customers identify and install cost effective energy saving measures by providing an on-site energy assessment customized for their business. The Multi-Family Retrofit program that began in 2017 will continue to be offered under the SBES program. This program is an integrated gas and electric and is targeting dual fuel customers. Vectren also permits the program to include eligible non-profit establishment of any size to participate within this program.

Table 30: Small Business Energy Solutions Budget & Energy Savings Targets

Market	Program	2021	2022	2023	Total Program
Commercial & Industrial	**Small Business Energy Solutions**				
	Number of Projects	78	78	78	234
	Energy Savings kWh	3,194,615	3,949,771	3,952,715	11,097,100
	Peak Demand kW	484.9	557.9	557.9	1,600.6
	Total Program Budget $	807,181	884,304	878,048	2,569,533
	Per Participant Avg Energy Savings (kWh)*				47423.5
	Per Participant Avg Demand Savings (kW)*				6.840
	Weighted Avg Measure Life*				15
	Net To Gross Ratio				100%

Eligible Customers

Any participating Vectren South business customer with a maximum peak energy demand of less than 400 kW. Additionally, multifamily building owners with Vectren general electric service may qualify for the program, including apartment buildings, condominiums, cooperatives, duplexes, quadraplexes, townhomes, nursing homes and retirement communities.

Marketing Plan

The SBES Program will be marketed primarily through in-network trade ally outreach. The program implementer will provide trade ally-specific marketing collateral to support trade allies as they connect with customers.

The program will provide targeted marketing efforts as needed to individual customer segments (e.g., hospitality, grocery stores, and retail) to increase participation in under-performing segments, including direct customer outreach and enhanced incentive campaigns. Additional program marketing may occur through direct mail, trade associations, local business organizations, marketing campaigns and bonuses, educational seminars, and direct personal communication from Vectren South staff and third-party contractors.

Barriers/Theory

Small business customers generally do not have the knowledge, time or money to invest in EE upgrades. This program assists these small businesses with direct installation and turn-key services to get measures installed at no or low out-of-pocket cost.

There is an implementation contractor in place providing suggested additions and changes to the program based on results and local economics.

Implementation & Delivery Strategy

Trade Ally Network: Trained trade ally energy advisors will provide energy assessments to business customers with less than 400 kW of annual peak demand. The program implementer will issue an annual Request for Qualification to select the trade allies with the best ability to provide high-quality and cost-effective service to small businesses and provide training to Small Business Energy Solutions trade allies on the program process, with an emphasis on improving energy efficiency sales.

Energy Assessment: Trade allies will walk through small businesses and record site characteristics and energy efficiency opportunities at no cost to the customer. They will provide an energy assessment report that will detail customer-specific opportunities, costs, energy savings, incentives, and simple payback periods. The trade ally will then review the report with the customer, presenting the program benefits and process, while addressing any questions.

Initial Measures, Products and Services

The program will have two types of measures provided. The first are measures that will be installed at no cost to the customer. They will include but are not limited to the following:

- Smart thermostats
- Programmable thermostats
- Program the programmable thermostats
- Pre-rinse sprayers
- Faucet aerators

The second types of measures require the customer to pay a portion of the labor and materials. These measures include:

- Interior LED Lighting (replacing incandescent, high bays and linear fluorescents)
- Linear Fluorescent Delamping
- Exterior LED Lighting
- Interior Lighting Controls EC motors
- Anti-Sweat Heater Controls
- Refrigerated LED
- Refrigerated Case Cover
- Furnace Tune-Up
- Steam Trap Replacement
- Vending Machine Control

Incentive Strategy

In addition to the no-cost measures identified during the audit, the program will also pay a cash incentive on every recommended improvement identified through the assessment. Incentive rates may change over time and vary with special initiatives.

Program Delivery

Vectren South will oversee the program partner Nexant to deliver the program.

Integration with Vectren South Gas

Vectren South will offer this integrated natural gas and electric EE program in its combined natural gas and electric service territory.

Evaluation, Measurement and Verification

On-site verification will be provided for the first three projects completed by each trade ally, in addition to the program standard 5% of all completed projects and all projects receiving incentives greater than $20,000. These verifications allow the program to validate energy savings, in addition to providing an opportunity to ensure the trade allies are providing high-quality customer services and the incentivized equipment satisfies program requirements. A third-party evaluator will evaluate the program using standard EM&V protocols.

8. Program Administration

As in previous years, Vectren South will continue to serve as the program administrator for the 2021-2023 Plan. Vectren South will utilize third-party program implementers to deliver specific programs or program components where specialty expertise is required. Contracting directly with specialty vendors avoids an unnecessary layer of management, oversight and expense that occurs when utilizing a third-party administration approach.

Program administration costs are allocated at the program level and include costs associated with program support and internal labor. Program support includes costs associated with outside consulting and annual license and maintenance fees for DSMore, Data Management, and Esource. Based upon the EE and DR programs proposed in the 2021 - 2023 Plan, Vectren South is proposing to maintain the staffing levels that were previously approved to support the portfolio. The major responsibilities associated with these FTEs are as follows:

- **Portfolio Management and Implementation** - Oversees the overall portfolio and staff necessary to support program administration. Serves as primary contact for regulatory and oversight of programs.
- **Reporting and Analysis** - Responsible for all aspects of program reporting including, budget analysis/reporting, scorecards and filings.
- **Outreach and Education** - Serves as contact to trade allies regarding program awareness. Also serves as point of contact for residential and commercial/industrial customers to assist with responding to program inquiries.
- **Research and Evaluation** - Works with the selected EM&V Administrator and facilitates measurement and verification efforts, assists with program reporting/tracking.

9. Support Services

Support services are considered indirect costs which support the entire portfolio and include: Contact Center, Online Audit, Outreach & Education, and Evaluation, Measurement and Verification (EM&V). These costs are budgeted at the portfolio level.

Table 31: Portfolio Level Costs by Year

Indirect Portfolio Level Costs	2021	2022	2023
Contact Center	$64,008	$65,032	$67,130
Online Audit	$43,598	$44,295	$45,724
Outreach & Education	$416,560	$423,225	$436,877
Evaluation	$522,653	$518,856	$512,192
Total Indirect Portfolio Level Costs	**$1,046,819**	**$1,051,408**	**$1,061,922**

A. Contact Center

The Vectren Contact Center, called the Energy Efficiency Advisory Team, fields referrals from the company's general call center and serves as a resource for interested customers. A toll-free number is provided on all outreach and education materials. Direct calls are initial contacts from customers or market providers coming through the dedicated toll-free number printed on all Vectren South's energy efficiency materials. Transferred calls are customers that have spoken with a Vectren Contact Center representative and have either asked or been offered a transfer to an Energy Efficiency Advisor who is trained to respond to energy efficiency questions or conduct the on-line energy audit.

These customer communication channels provide support mechanisms for Vectren South customers to receive the following services:

- Provide general guidance on energy saving behaviors and investments using customer specific billing data via the on-line tool (bill analyzer and energy audit).
- Respond to questions about the residential and general service programs.
- Facilitate the completion of and provide a hard copy report from the online audit tool for customers without internet access or who have difficulty understanding how to use the tool.
- Respond to inquiries about rebate fulfillment status.

B. Online Audit

The Online Energy Audit tool is a customer engagement and messaging tool that uses actual billing data from a customer's energy bills to pinpoint ways to save energy in their home. Data collected drives account messaging through providing tips and rebates relevant to that customer's situation. Additionally, data collected from the online energy audit is used to validate neighbor comparison data, which illustrates how the customer's monthly energy use compares to their neighbors and is designed to inspire customers to try and save more energy than their efficient neighbors. This tool provides the online ability and means to communicate, cross promote, and educate customers about energy efficiency and Vectren's energy efficiency programs. The Online Energy Audit tool provides tools and messaging to educate customers and provide suggestions, tips, and advice on energy usage. The budget for the Online Audit tool is shared across Vectren's Indiana Gas DSM, Electric DSM and Vectren Energy Delivery of Ohio, Inc. (VEDO) DSM portfolios.

C. Outreach & Education

Vectren South's Customer Outreach and Education program serves to raise awareness and drive customer participation as well as educate customers on how to manage their energy bills. The program includes the following goals as objectives:

- Build awareness;
- Educate consumers on how to conserve energy and reduce demand;
- Educate customers on how to manage their energy costs and reduce their bill;
- Communicate support of customer EE needs; and
- Drive participation in the EE and DR programs.

The marketing approach includes paid media as well as web-based tools to help analyze bills, energy audit tools, EE and DSM program education and information. Informational guides and sales promotion materials for specific programs are included in this budget.

This effort is the key to achieving greater energy savings by convincing the families and businesses making housing/facility, appliance and equipment investments to opt for greater EE. The first step in convincing the public and businesses to invest in EE is to raise their awareness.

It is essential that a broad public education and outreach campaign not only raise awareness of what consumers can do to save energy and control their energy bills, but also prime them for participation in the various EE and DR programs.

Vectren South will oversee outreach and education for the programs and work closely with implementation partners to provide consistent messaging across different program outreach and education efforts. Vectren South will utilize the services of communication and EE experts to deliver the EE and DR message.

The Outreach budget also includes funds for program development and staff training. Examples of these costs include memberships to EE related organizations, outreach for home/trade shows and travel and training related to EE associated staff development.

Another outreach opportunity that Vectren South has employed is a jointly facilitated Industrial Energy Efficiency Workshop. Vectren South first offered this workshop in June 2019 to share resources available for commercial and industrial customers. There were 25 total attendees, with 10 customers represented (6 opt-out and 4 opt-in). The workshop featured speakers from the Midwest Energy Efficiency Alliance (MEEA), Department of Energy (DOE) ENERGY STAR® division, Nexant and Vectren, and included a bonus incentive for companies who attended in an effort to increase program participation. The workshop was well received and Vectren South plans to continue offering this resource during the 2021-2023 Plan period. Evaluation

Vectren South will work with an independent third-party evaluator, selected by the VOB, to conduct an evaluation of DSM programs approved as part of its 2021-2023 Plan. The evaluation will include standard EM&V analyses, such as a process, impact, and/or market effects evaluation of Vectren South's portfolio of DSM programs. Gas impacts will be calculated for all of Vectren South's integrated gas programs. EM&V costs are based on 5% of the budget and allocated at the portfolio level.

10. Other Costs

Other costs being requested in the 2021-2023 filed plan include a Market Potential Study and funding for Emerging Markets.

Table 32: Other Costs by Year

Other Costs	2021	2022	2023
Emerging Markets	$200,000	$200,000	$200,000
Market Potential Study	$200,000	$0	$0
Total	**$400,000**	**$200,000**	**$200,000**

A. Emerging Markets

The Emerging Markets funding allows Vectren's DSM portfolio to offer leading-edge program designs for next-generation technologies, services, and engagement strategies to growing markets in the Vectren territory. The budget will be $200,000 each year for 2021-2023 and will not be used to support existing programs, but rather support new program development or new measures within an existing program.

Incentives promoted through this program may range from innovative rebate offerings to engineering and trade ally assistance to demand-control services that encourage early adoption of new, efficient technologies in high-impact market sectors. Depending on the development of certain technologies and growth areas in the service territory, a wide variety of projects and services are eligible.

To offset the risks of oversaturation of common prescriptive measures and redefined prescriptive baselines, this program will bring to market next generation technologies and energy-saving strategies that have significant savings and cost-effectiveness potential. As new technologies develop towards lower costs and higher efficiency, their market penetration and energy-savings potential will increase. This program will allow Vectren to be on the forefront of emerging technologies to understand the market disruption a new product may cause, test strategies for capturing their energy-saving opportunities, and plan for future program savings growth. This offering will supplement the other DSM programs that do not easily fit into other program offerings. Additionally, growing segments of Vectren South electric customers may require tailored offerings to accommodate their needs in order to participate.

Because this program will focus on innovative new approaches and leading the DSM market, the exact list of measures cannot be set at this time. However, potential measures and services include: new technologies, such as Advanced Lighting Controls; new strategies for achieving significant energy savings, such as midstream incentives, contractor bids to provide energy efficiency projects, and targeting

high-impact market sectors; and integrated DSM (iDSM) approaches, such as demand response, combined energy efficiency and demand response measures, and load shifting.

Emerging technologies and measures will be reviewed and may be offered using this funding as long as they do not fall into a current program offering. Innovative engagement and incentivizing approaches may also be used as a tool to provide reduced costs to new systems, equipment and/or services to help reduce peak demand and electric usage. This program also allows Vectren to take steps toward an integrated Demand Side Management approach to address both energy efficiency and demand response together.

B. Market Potential Study

Vectren South is requesting $200,000 to complete a refresh and Market Potential Study (MPS) in 2021 to include 2026. The current MPS is for program years 2021-2025, including 2026 is necessary to support future EE filings which will be based on 2022 IRP. Vectren will issue a Request for Quote to select a consultant to perform this work.

11. Conclusion

Vectren South has developed a 2021-2023 Electric Energy Efficiency Plan that is aligned with the 2019 Integrated Resource Plan and is reasonably achievable and cost effective. The cost effectiveness analysis was performed for 2021-2023 using the DSMore model – a nationally recognized economic analysis tool that is specifically designed to evaluate the cost effectiveness of implementing energy efficiency and demand response programs.

Program costs were determined by referencing current program delivery costs, based on prior contracts and performance in the field and consultation with the program vendors that will deliver the DSM Plan. Energy and demand savings were primarily determined by using recent EM&V results and the IN TRM version 2.2. For measures that were not addressed in the IN TRM or EM&V, Vectren South used Technical Resource Manual resources from nearby states or vendor input. Vectren South utilized the avoided costs from 2019 IRP[1] adjusted down for fixed capacity.

Based on this information, Vectren South requests IURC approval of this 2021-2023 DSM Plan as well as the costs associated with Emerging Markets and the Market Potential study for 2021 and beyond.

[1] Avoided costs aligned with Vectren South's 2019 IRP, with an adjustment down to fixed capacity cost assumptions.

12. Appendix A: Cost Effectiveness Tests Benefits & Costs Summary

Test	Benefits	Costs
Participant Cost Test	• Incentive payments • Annual bill savings • Applicable tax credits	• Incremental technology/equipment costs • Incremental installation costs
Utility Cost Test (Program Administrator Cost Test)	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs
Rate Impact Measure Test	• Avoided energy costs • Avoided capacity costs	• All program costs (startup, marketing, labor, evaluation, promotion, etc.) • Utility/Administrator incentive costs • Lost revenue due to reduced energy bills
Total Resource Cost Test	• Avoided energy costs • Avoided capacity costs • Applicable participant tax credits	• All program costs (not including incentive costs) • Incremental technology/equipment costs (whether paid by the participant or the utility)

Appendix B: Program Measure Detail

Program Name	Measure	Measure Life	NTG	Average kWh/ Unit	Average KW/ Unit	2021 Participation	2022 Participation	2023 Participation	Avg Incentive/Unit	IMC/unit	2021 kWh	2022 kWh	2023 kWh	2021 kW	2022 kW	2023 kW
Lighting	LED Specialty	15	50%	34.1	0.005	40,000	40,000	35,000	$ 2.00	$ 3.50	1,364,829	1,364,828	1,194,224	188	188	165
Lighting	LED Reflector	15	50%	49.1	0.007	75,000	70,000	65,000	$ 3.00	$ 3.50	3,682,005	3,436,538	3,191,071	510	476	442
Lighting Total			50%			115,000	110,000	100,000			5,046,834	4,801,366	4,385,295	698	664	607
EE Products - Electric	AC Tune Up	2	63%	111.1	0.123	250	325	350	$ 25.00	$ 82.00	27,787	36,122	38,901	31	40	43
EE Products - Electric	Air Purifier	9	69%	681.1	0.078	5	5	5	$ 50.00	$ 70.00	3,405	3,405	3,405	0	0	0
EE Products - Electric	Air Source Heat Pump 16 SEER	18	65%	880.8	0.464	150	50	40	$ 300.00	$ 870.00	132,122	44,041	35,233	70	23	19
EE Products - Electric	Air Source Heat Pump 18 SEER	18	65%	1,590.0	0.530	40	20	15	$ 500.00	$ 870.00	63,598	31,799	23,849	21	11	8
EE Products - Electric	ASHP Tune Up	2	63%	285.0	-	15	20	25	$ 50.00	$ 64.00	4,275	5,700	7,125	-	-	-
EE Products - Electric	Attic Insulation - South (Dual - Gas & Electric)	25	68%	303.6	0.464	100	100	100	$ 360.00	$ 750.00	30,359	30,359	30,359	46	46	46
EE Products - Electric	Attic Insulation - South (Electric Only)	25	68%	3,018.7	0.103	20	10	10	$ 450.00	$ 1,500.00	60,373	30,187	30,187	2	1	1
EE Products - Electric	Central Air Conditioner 16 SEER	18	65%	434.9	0.540	600	500	400	$ 200.00	$ 400.00	260,950	217,458	173,967	324	270	216
EE Products - Electric	Central Air Conditioner 18 SEER	18	65%	666.0	0.577	40	35	30	$ 400.00	$ 800.00	26,640	23,310	19,980	23	20	17
EE Products - Electric	Dual Fuel Air Source Heat Pump 16 SEER	18	65%	695.3	0.330	10	10	10	$ 300.00	$ 1,000.00	6,953	6,953	6,953	3	3	3
EE Products - Electric	Dual Fuel Air Source Heat Pump 18 SEER	18	65%	991.7	0.325	5	5	5	$ 500.00	$ 1,666.67	4,958	4,958	4,958	2	2	2
EE Products - Electric	Duct Sealing - South (Dual - Gas & Electric)	20	68%	217.5	0.382	21	21	21	$ 240.00	$ 175.00	4,568	4,568	4,568	8	8	8
EE Products - Electric	Ductless Heat Pump 19 SEER 9.5 HSPF	18	65%	3,066.5	0.380	10	5	5	$ 300.00	$ 2,333.33	30,665	15,332	15,332	4	2	2
EE Products - Electric	Ductless Heat Pump 21 SEER 10.0 HSPF	18	65%	2,932.2	0.368	15	10	10	$ 500.00	$ 2,833.33	43,984	29,322	29,322	6	4	4
EE Products - Electric	Ductless Heat Pump 23 SEER 10.0 HSPF	18	65%	4,306.1	0.711	20	15	10	$ 500.00	$ 3,333.33	86,123	64,592	43,061	14	11	7
EE Products - Electric	Heat Pump Water Heater	10	69%	2,556.8	0.349	7	10	12	$ 500.00	$ 1,000.00	17,897	25,568	30,681	2	3	4
EE Products - Electric	Pool Heater	10	69%	1,266.5	-	2	4	5	$ 1,000.00	$ 3,333.33	2,533	5,066	6,332	-	-	-
EE Products - Electric	Smart Programmable Thermostat - South (Dual -	15	78%	299.4	-	700	650	500	$ 60.00	$ 63.81	209,606	194,634	149,718	-	-	-
EE Products - Electric	Smart Programmable Thermostat - South (Electr	15	78%	740.3	-	120	100	80	$ 75.00	$ 127.61	88,830	74,025	59,220	-	-	-
EE Products - Electric	Variable Speed Pool Pump	15	69%	1,172.6	1.716	160	-	-	$ 300.00	$ 750.00	187,612	-	-	275	-	-
EE Products - Electric	Wall Insulation - South (Dual - Gas & Electric)	25	68%	29.3	0.259	94	94	94	$ 360.00	$ 750.00	2,758	2,758	2,758	24	24	24
EE Products - Electric	Wall Insulation - South (Electric Only)	25	68%	801.0	0.019	12	12	12	$ 450.00	$ 1,500.00	9,612	9,612	9,612	0	0	0
EE Products - Electric	Wifi Thermostat - South (Dual - Gas & Electric)	15	78%	294.6	-	80	75	60	$ 40.00	$ 51.60	23,570	22,097	17,678	-	-	-
EE Products - Electric	Wifi Thermostat - South (Electric Only)	15	78%	294.6	-	30	25	20	$ 50.00	$ 103.20	8,839	7,366	5,893	-	-	-
EE Products - Electric Total						2,506	2,101	1,819			1,338,016	889,232	749,092	856	469	405
Marketplace - Electric	Air Purifier	9	69%	681.1	0.078	10	10	15	$ 50.00	$ 70.00	6,811	6,811	10,216	1	1	1
Marketplace - Electric	Smart Power Strips	4	100%	25.8	0.002	50	50	50	$ 10.00	$ 35.00	1,292	1,292	1,292	0	0	0
Marketplace - Electric	Smart Programmable Thermostat - South (Dual -	15	78%	299.4	-	200	230	250	$ 60.00	$ 63.81	59,887	68,870	74,859	-	-	-
Marketplace - Electric	Smart Programmable Thermostat - South (Electr	15	78%	740.3	-	35	42	50	$ 75.00	$ 127.61	25,909	31,091	37,013	-	-	-
Marketplace - Electric	LED Specialty	15	23%	34.1	0.005	250	250	250	$ 2.00	$ 3.50	8,530	8,530	8,530	1	1	1
Marketplace - Electric	LED Reflector	15	39%	49.1	0.007	250	250	250	$ 3.00	$ 3.50	12,273	12,273	12,273	2	2	2
Marketplace - Electric Total						795	832	865			114,702	128,867	144,183	4	4	4
Instant Rebates - Electric	Smart Programmable Thermostat - South (Dual -	15	78%	299.4	-	385	663	995	$ 60.00	$ 63.81	115,283	198,527	297,940	-	-	-
Instant Rebates - Electric	Smart Programmable Thermostat - South (Electr	15	78%	740.3	-	55	47	71	$ 75.00	$ 127.61	40,714	34,792	52,558	-	-	-
Instant Rebates - Electric	Heat Pump Water Heater	10	69%	2,556.8	0.349	15	22	25	$ 500.00	$ 1,000.00	38,352	56,249	63,919	5	8	9
Instant Rebates - Electric	Air Purifier	9	69%	681.1	0.078	15	14	17	$ 50.00	$ 70.00	10,216	9,535	11,578	1	1	1
Instant Rebates - Electric Total						470	746	1,108			204,565	299,102	425,995	6	9	10
RNC-Electric	Gold Star: HERS Index Score ≤ 63 - Electric Heate	25	54%	0.5	-	-	-	700	$ 2,059.00	$ -	-	-	-	-	-	36
RNC-Electric	Gold Star: HERS Index Score ≤ 63 - Gas Heated Sc	25	54%	0.4	75.000	90	90	175	$ 846.80	$ 77,490.58	92,989	92,989	30	36	36	0
RNC-Electric	Habitat Kit Electric Only	14	100%	0.1	8.000	8	8	-	$ 48.75	$ 19,140.39	19,140	19,140	0	0	0	1
RNC-Electric	Habitat Kit Gas and Electric	14	100%	0.0	20.000	20	20	-	$ 48.75	$ 14,368.44	14,368	14,368	1	1	1	6
RNC-Electric	Platinum Star Plus: HERS Index Score ≤ 60 - Elect	25	54%	2.1	-	-	-	1,200	$ 3,793.19	$ -	-	-	-	-	-	
RNC-Electric	Platinum Star Plus: HERS Index Score ≤ 60 - Gas H	25	54%	1.2	5.000	5	5	300	$ 2,492.27	$ 7,224.29	7,224	7,224	6	6	6	
RNC-Electric	Platinum Star: HERS Index Score ≤ 60 - Electric He	25	54%	0.6	-	-	-	1,000	$ 3,079.19	$ -	-	-	-	-	-	
RNC-Electric	Platinum Star: HERS Index Score ≤ 60 - Gas Heate	25	54%	0.5		48	48	250	$ 1,778.27	$ 45,762.41	54,915	54,915	19	23	23	23
RNC-Electric Total						171	171	3,625			188,637	188,637	56	66	66	66

Program Name	Measure	Measure Life	NTG	Average kWh/ Unit	Average KW/ Unit	2021 Participation	2022 Participation	2023 Participation	Avg Incentive/Unit	IMC/unit	2021 kWh	2022 kWh	2023 kWh	2021 kW	2022 kW	2023 kW
Home Energy Assessments	Bathroom Aerator 1.0 gpm - Elec DHW	10		23.7	0.003	60	63	76			1,423	1,494	1,793	0	0	0
Home Energy Assessments	Customer Education (Audit & Report)	1		63.1	0.007	332	349	418			20,959	22,007	26,408	2	3	3
Home Energy Assessments	Duct Sealing Electric Heat Pump	20		298.0	0.293	8	8	8			2,384	2,384	2,384	2	2	2
Home Energy Assessments	Duct Sealing Gas Heating w/ CAC	20		169.0	0.293	6	6	6			1,014	1,014	1,014	2	2	2
Home Energy Assessments	Attic Insulation - South (Electric Only)	25		3,018.7	0.103	8	8	8			24,149	24,149	24,149	1	1	1
Home Energy Assessments	Attic Insulation - South (Dual - Gas & Electric)	25		303.6	0.464	5	5	5			1,518	1,518	1,518	2	2	2
Home Energy Assessments	Wall Insulation - South (Electric Only)	25		801.0	0.019	8	8	8			6,408	6,408	6,408	0	0	0
Home Energy Assessments	Wall Insulation - South (Dual - Gas & Electric)	25		29.3	0.259	2	2	2			59	59	59	1	1	1
Home Energy Assessments	Exterior 9W LED (A19-9W Exterior)	15		84.2	0.008	113	118	142			9,492	9,967	11,960	1	1	1
Home Energy Assessments	Interior 9W LED (A19-9W Interior)	15		31.7	0.004	4,725	4,961	5,953			149,833	157,325	188,790	20	21	25
Home Energy Assessments	Exterior 6W LED	15		21.3	0.003	655	688	826			13,948	14,646	17,575	2	2	2
Home Energy Assessments	LED Lamp Candelabra	15		32.8	0.004	1,435	1,507	1,808			47,127	49,483	59,379	6	7	8
Home Energy Assessments	LED Lamp Downlight Retro	15		41.8	0.005	233	244	293			9,723	10,209	12,251	1	1	2
Home Energy Assessments	LED Night Light -.5W	8		13.1	-	838	880	1,056			11,017	11,567	13,881	-	-	-
Home Energy Assessments	LED 8W Dimmable R30 (BR30-8W)	15		52.6	0.007	1,172	1,231	1,477			61,642	64,724	77,669	8	9	10
Home Energy Assessments	Furnace Whistle (Elec)	15		238.7	0.050	12	13	15			2,864	3,008	3,609	1	1	1
Home Energy Assessments	Furnace Whistle (Gas)	15		62.9	0.002	64	67	81			4,023	4,224	5,069	0	0	0
Home Energy Assessments	Kitchen Flip Aerator 1.5 gpm - Elec DHW	5		162.9	0.007	40	42	50			6,515	6,840	8,208	0	0	0
Home Energy Assessments	Low Flow Showerhead 1.5 gpm - Elec DHW	10		259.4	0.015	40	42	50			10,374	10,893	13,071	1	1	1
Home Energy Assessments	Pipe Wrap - Elec DHW (per home)	15		74.8	0.009	8	8	10			599	628	754	0	0	0
Home Energy Assessments	PowerStrip (Tier 1 Advanced -7 outlet plug)	4		25.6	0.002	120	126	151			3,071	3,225	3,870	0	0	0
Home Energy Assessments	Smart Thermostat - Elec Heated	15		1,224.2	-	60	63	76			73,452	77,125	92,550	-	-	-
Home Energy Assessments	Smart Thermostat - Gas Heated	15		277.2	-	320	336	403			88,689	93,123	111,748	-	-	-
Home Energy Assessments	Water Heater Setback - Elec DHW	15		66.0	0.008	8	8	10			528	554	665	0	0	0
Home Energy Assessments Total						400	420	504			550,810	576,574	684,783	50	53	61
IQW - Electric	5W Candelabra	15	100%	10.4	0.001	1,138	900	719		$ 2.08	11,795	9,332	7,453	2	1	1
IQW - Electric	9W LED	15	100%	33.4	0.004	1,950	1,800	1,725		$ 3.21	65,119	60,110	57,605	8	7	7
IQW - Electric	Air Sealing Gas Furnace w/ CAC	15	100%	124.9	0.162	25	35	30		$ 50.00	3,122	4,370	3,746	4	6	5
IQW - Electric	Air Source Heat Pump 16 SEER	18	100%	694.0	0.407	1	1	1		$ 5,400.00	694	694	694	0	0	0
IQW - Electric	Attic Insulation - Gas Heated (Electric)	25	100%	383.3	0.378	50	55	50		$ 706.30	19,163	21,080	19,163	19	21	19
IQW - Electric	Audit Recommendations - dual (Electric)	1	100%	82.9	0.004	650	600	575		$ 26.00	53,876	49,732	47,659	2	2	2
IQW - Electric	Audit Recommendations - Electric Only	1	100%	102.2	0.004	38	35	30		$ 106.00	3,882	3,576	3,065	0	0	0
IQW - Electric	Bathroom Aerator 1.0 gpm - Elec DHW	10	100%	34.6	0.003	98	90	86		$ 0.52	3,376	3,116	2,987	0	0	0
IQW - Electric	Central Air Conditioner 16 SEER	18	100%	587.2	1.047	20	20	20		$ 3,500.00	11,744	11,744	11,744	21	21	21
IQW - Electric	Duct Sealing Gas Heating with A/C	20	100%	155.1	0.269	25	40	35		$ 110.00	3,877	6,204	5,428	7	11	9
IQW - Electric	Exterior LED Lamps	15	100%	99.0	-	195	180	173		$ 7.20	19,305	17,820	17,078	-	-	-
IQW - Electric	Filter Whistle	15	100%	46.0	0.076	7	6	6		$ 1.64	299	276	264	0	0	0
IQW - Electric	HVAC/Furnace Tune Up (With filter replacemen	2	100%	155.1	0.197	145	165	150		$ 75.00	22,496	25,599	23,272	29	33	30
IQW - Electric	IQW - Whole Home (Dual - Gas & Electric)	15	100%	1,316.4	-	-	-	5		$ -	-	-	6,582	-	-	-
IQW - Electric	IQW - Whole Home (Electric Only)	10	100%	1,490.4	-	-	-	1		$ -	-	-	1,490	-	-	-
IQW - Electric	IQW MFDI 9W LED	15	100%	33.3	0.004	400	200	200		$ 3.21	13,324	6,662	6,662	2	1	1
IQW - Electric	IQW MFDI Bathroom Aerator 1.0 gpm - Elec DHW	10	100%	29.4	0.003	80	80	70		$ -	2,350	2,350	2,056	0	0	0
IQW - Electric	IQW MFDI Kitchen Flip Aerator 1.5 gpm - Elec DH	16	100%	96.7	0.007	70	70	80		$ -	6,772	6,772	7,739	0	0	1
IQW - Electric	IQW MFDI LED Nightlight	8	100%	13.6	-	-	100	100		$ 2.75	-	1,364	1,364	-	-	-
IQW - Electric	IQW MFDI Low Flow Showerhead 1.5 gpm - Elec	1	100%	266.7	0.015	75	75	75		$ -	20,005	20,005	20,005	1	1	1
IQW - Electric	IQW MFDI Site Visit and DI - Electric Only		100%	46.1	0.002	100	100	100		$ 22.50	4,609	4,609	4,609	0	0	0

Program Name	Measure	Measure Life	NTG	Average kWh/ Unit	Average KW/ Unit	2021 Participation	2022 Participation	2023 Participation	Avg Incentive/Unit	IMC/unit	2021 kWh	2022 kWh	2023 kWh	2021 kW	2022 kW	2023 kW
IQW - Electric	IQW MFDI Smart Thermostat (Electric Only)		100%	740.5	-	100	100	100		$ 39.00	74,048	74,048	74,048	-	-	-
IQW - Electric	Kitchen Flip Aerator 1.5 gpm - Elec DHW	10	100%	145.7	0.007	65	60	58		$ 1.34	9,469	8,740	8,376	0	0	0
IQW - Electric	LED 5W Globe	15	100%	19.6	0.002	650	600	575		$ 8.75	12,729	11,750	11,260	2	1	1
IQW - Electric	LED Nightlight	8	100%	13.6	-	1,300	1,200	1,150		$ 2.75	17,727	16,364	15,682	-	-	-
IQW - Electric	LED R30 Dimmable	15	100%	32.6	0.004	163	150	144		$ 11.54	5,297	4,889	4,686	1	1	1
IQW - Electric	Low Flow Showerhead 1.5 gpm - Elec DHW	5	100%	342.6	0.015	52	48	46		$ 3.32	17,815	16,445	15,759	1	1	1
IQW - Electric	Pipe Wrap - Elec DHW (per home)	15	100%	99.3	0.011	13	12	12		$ 1.72	1,291	1,191	1,142	0	0	0
IQW - Electric	Refrigerator Replacement	8	100%	359.8	0.053	20	20	20		$ 580.00	7,197	7,197	7,197	1	1	1
IQW - Electric	Smart Power Strips	4	100%	25.8	0.002	195	180	173		$ 35.00	5,037	4,650	4,456	0	0	0
IQW - Electric	Smart Thermostat (Dual)	15	100%	429.0	-	130	108	86		$ 39.00	55,770	46,332	37,001	-	-	-
IQW - Electric	Smart Thermostat (Electric)	15	100%	1,580.2	-	8	8	8		$ 39.00	12,642	12,642	12,642	-	-	-
IQW - Electric	Wall Insulation - Dual (gas heated)	25	100%	58.3	0.042	15	15	22		$ 877.00	874	874	1,282	1	1	1
IQW - Electric	Water Heater Temperature Setback - Elec DHW	4	100%	81.5	0.009	3	3	3		$ 6.50	245	245	245	0	0	0
IQW - Electric Total						788	735	710			485,948	460,780	444,441	102	111	103
Foodbank	9W LED	15	100%	34.1	0.005	33,976	33,976	33,976			1,159,285	1,159,285	1,159,285	160	160	160
Foodbank Total						33,976	33,976	33,976			1,159,285	1,159,285	1,159,285	160	160	160
Energy Efficiency Schools	15W LED	15	100%	38.2	0.004	2,600	2,600	2,600			104,581	99,352	94,385	11	11	10
Energy Efficiency Schools	11W LED	15	100%	28.2	0.003	2,600	2,600	2,600			77,060	73,207	69,547	8	8	8
Energy Efficiency Schools	11W LED	15	100%	28.2	0.003	2,600	2,600	2,600			77,060	73,207	69,547	8	8	8
Energy Efficiency Schools	Low Flow Showerhead	5	100%	99.3	0.003	2,600	2,600	2,600			271,411	257,841	244,949	7	7	6
Energy Efficiency Schools	Kitchen Aerator	10	100%	41.0	0.001	2,600	2,600	2,600			112,018	106,417	101,096	3	3	3
Energy Efficiency Schools	Bathroom Aerator	10	100%	8.1	0.000	2,600	2,600	2,600			22,086	20,982	19,933	1	1	1
Energy Efficiency Schools	Bathroom Aerator	10	100%	8.1	0.000	2,600	2,600	2,600			22,086	20,982	19,933	1	1	1
Energy Efficiency Schools	LED Night Light	8	100%	6.0	-	2,600	2,600	2,600			16,345	15,527	14,751	-	-	-
Energy Efficiency Schools	Furnace Filter Whistle	5	100%	11.1	0.014	2,600	2,600	2,600			30,471	28,947	27,500	38	36	34
Energy Efficiency Schools Total						2,600	2,600	2,600			733,118	696,462	661,639	78	74	70
Residential Behavioral	Residential Behavioral	1	100%	169.0	0.031	41,543	42,016	40,182			7,020,000	7,100,000	6,790,000	1,350	1,270	1,210
Residential Behavioral Total						41,543	42,016	40,182			7,020,000	7,100,000	6,790,000	1,350	1,270	1,210
Appliance Recycling	Refridgerator	8	100%	1,065.0	0.137	1,040	1,000	880	$ 50.00		1,120,313	1,064,203	925,206	142	137	121
Appliance Recycling	Freezer	8	100%	692.0	0.075	260	250	220	$ 50.00		182,000	172,885	150,304	19	19	17
Appliance Recycling	AC Pickup/unit	8	100%	267.8	0.216	75	50	25	$ 25.00		20,250	13,337	6,588	15	10	7
Appliance Recycling Total						1,375	1,300	1,125			1,322,563	1,250,424	1,082,098	176	166	145
CVR Residential	CVR Residential	15	100%	189.8	0.076			5,627					1,067,954			430
CVR Residential Total						-	-	5,627			-	-	1,067,954	-	-	430
Smart DLC Changeout	Smart DLC Changeout	15	100%	362.6	1.140	1,000	1,000	1,000			362,577	362,577	362,577	1,140	1,140	1,140
Smart DLC Changeout Total						1,000	1,000	1,000			362,577	362,577	362,577	1,140	1,140	1,140
Bring Your Own Thermostat (BYOT)	BYOT	15	100%	-	1.140	400	450	500						456	513	570
Bring Your Own Thermostat (BYOT) Total						400	450	500			-	-	-	456	513	570
Midstream HVAC - Electric	Ductless Heat Pump 19 SEER 9.5 HSPF	18	65%	3,066.5	0.380	38	51	55	$ 250.00		116,527	156,391	168,657	14	19	21
Midstream HVAC - Electric	Ductless Heat Pump 21 SEER 10 HSPF	18	65%	2,932.2	0.368	14	19	26	$ 400.00		41,051	55,713	76,238	5	7	10
Midstream HVAC - Electric	Ductless Heat Pump 23 SEER 10 HSPF	18	65%	4,306.1	0.711	27	30	35	$ 400.00		116,266	129,184	150,715	19	21	25
Midstream HVAC - Electric	Air Source Heat Pump 16 SEER	18	65%	880.8	0.464	142	189	190	$ 200.00		125,076	166,474	167,355	66	88	88
Midstream HVAC - Electric	Air Source Heat Pump 18 SEER	18	65%	1,590.0	0.530	28	37	40	$ 400.00		44,519	58,828	63,598	15	20	21
Midstream HVAC - Electric	Central Air Conditioner 16 SEER	18	65%	434.9	0.540	986	986	1,315	$ 200.00		428,827	428,827	571,915	533	533	710
Midstream HVAC - Electric	Central Air Conditioner 18 SEER	18	65%	666.0	0.577	75	99	110	$ 400.00		49,949	65,933	73,259	43	57	63
Midstream HVAC - Electric Total						1,310	1,411	1,771			922,215	1,061,351	1,271,737	695	745	938

Program Name	Measure	Measure Life	NTG	Average kWh/ Unit	Average KW/ Unit	2021 Participation	2022 Participation	2023 Participation	Avg Incentive/Unit	IMC/unit	2021 kWh	2022 kWh	2023 kWh
Home Energy Management Systems	HEMS	6	100%	515.0	0.080	1,000	1,000	1,000			515,000	515,000	515,000
Home Energy Management Systems Total						1,000	1,000	1,000			515,000	515,000	515,000
C&I Custom	Building Tune-Up (Electric)	7	83%	50,000.0	0.050	5	6	6	$ 2,500.00	$ 3,000.00	250,000	300,000	300,000
C&I Custom	Custom Electric	17	83%	114,089.8	15.121	32	41	37	$ 7,959.36	$ 38,513.34	3,650,875	4,677,683	4,221,324
C&I Custom	EDA Lighting Power Density Reduction	15	83%	41,571.7	7.170	10	10	10	$ 3,345.02	$ 4,000.00	410,894	418,128	418,128
C&I Custom	EDA Non-Lighting (Electric)	13	83%	28,187.2	18.000	7	10	10	$ 2,254.98	$ 4,000.00	197,310	281,872	281,872
C&I Custom	SEM Electric	13	83%	500,000.0	10.000	2	2	2	$ 60,000.00	$ 35,000.00	1,000,000	1,000,000	1,000,000
C&I Custom Total						56	69	65			5,509,079	6,677,683	6,221,324
C&I Prescriptive	Advanced Rooftop Controls	9	83%	3,034.0	2.620	150	150	188	$ 827.15	$ 1,000.00	455,100	455,100	570,392
C&I Prescriptive	Agriculture - Automatic Milker Take Off	15	83%	10,062.0	2.100	1	1	1	$ 1.67	$ -	10,062	10,062	10,062
C&I Prescriptive	Agriculture - Dairy Plate Cooler	15	83%	76.2	0.016	1	1	1	$ 1.00	$ -	76	76	76
C&I Prescriptive	Agriculture - HE Diary Scroll Compressor	12	83%	279.5	0.069	1	1	1	$ 16.67	$ -	279	279	279
C&I Prescriptive	Agriculture - Heat Mat	5	83%	657.0	-	1	1	1	$ 21.67	$ 225.00	657	657	657
C&I Prescriptive	Agriculture - Heat Reclaimer	14	83%	152.7	-	1	1	1	$ 1.67	$ -	153	153	153
C&I Prescriptive	Agriculture - High Speed Fans	7	83%	625.0	0.198	1	1	1	$ 25.00	$ 150.00	625	625	625
C&I Prescriptive	Agriculture - High Volume Low Speed Fans	10	83%	8,543.0	3.100	1	1	1	$ 250.00	$ 4,180.00	8,543	8,543	8,543
C&I Prescriptive	Agriculture - Livestock Waterer	10	83%	1,592.0	0.525	1	1	1	$ 66.67	$ 787.50	1,592	1,592	1,592
C&I Prescriptive	Agriculture - Poultry Farm LED Lighting	7	83%	292.0	0.050	1	1	1	$ 0.03	$ 30.00	292	292	292
C&I Prescriptive	Agriculture - VSD Milk Pump	15	83%	32.0	0.007	1	1	1	$ 1.67	$ 4,000.00	32	32	32
C&I Prescriptive	Air Compressor	15	83%	36,724.0	6.552	2	2	2	$ 1,875.00	$ -	73,448	73,448	73,448
C&I Prescriptive	Air Conditioners	15	83%	1,520.0	4.731	75	75	100	$ 309.00	$ 100.00	114,000	114,000	152,000
C&I Prescriptive	Barrel Wrap Insulation	5	83%	360.1	0.068	1	1	1	$ 30.00	$ -	360	360	360
C&I Prescriptive	Chilled Water Reset Control	10	83%	16,536.0	3.059	3	3	3	$ 238.50	$ 681.34	49,608	49,608	49,608
C&I Prescriptive	Chiller	20	83%	191,462.0	8.245	3	3	4	$ 5,830.43	$ 79.46	574,386	574,386	765,848
C&I Prescriptive	Chiller Tune-Up	5	83%	34,339.9	7.204	6	6	6	$ 1,100.63	$ -	206,039	206,039	206,039
C&I Prescriptive	Clothes Washer	10	83%	541.5	-	3	3	3	$ 60.00	$ 475.33	1,625	1,625	1,625
C&I Prescriptive	Compressed Air Leak Study	2	83%	172,000.0	10.000	9	9	1	$ 5,676.00	$ 6,364.00	1,548,000	1,548,000	172,000
C&I Prescriptive	Compressed Air Nozzles	15	83%	888.2	0.337	2	2	2	$ 6.50	$ 14.00	1,776	1,776	1,776
C&I Prescriptive	EC Motors	15	83%	410.1	0.042	125	125	125	$ 37.75	$ 50.00	51,266	51,266	51,266
C&I Prescriptive	Exterior LED	15	83%	1,315.0	0.020	1,342	1,042	956	$ 105.00	$ 270.24	1,764,730	1,370,230	1,257,140
C&I Prescriptive	Food Service - Anti-Sweat Heater Control	12	83%	1,278.0	-	75	75	75	$ 100.00	$ 200.00	95,850	95,850	95,850
C&I Prescriptive	Food Service - Combination Oven	12	83%	18,431.7	3.535	1	1	1	$ 1,000.00	$ 2,125.00	18,432	18,432	18,432
C&I Prescriptive	Food Service - Commercial Dishwasher	16	83%	3,090.0	1.911	8	8	8	$ 442.00	$ 616.25	24,720	24,720	24,720
C&I Prescriptive	Food Service - Convection Oven	12	83%	3,234.8	0.620	1	1	1	$ 350.00	$ 1,113.00	3,235	3,235	3,235
C&I Prescriptive	Food Service - Freezer	12	83%	2,931.2	0.313	8	8	8	$ 200.00	$ 220.25	23,450	23,450	23,450
C&I Prescriptive	Food Service - Fryer	12	83%	1,526.2	0.220	1	1	1	$ 80.00	$ 500.00	1,526	1,526	1,526
C&I Prescriptive	Food Service - Griddle	12	83%	10,032.7	1.924	3	3	3	$ 550.00	$ 2,090.00	30,098	30,098	30,098
C&I Prescriptive	Food Service - Hot Food Holding Cabinet	12	83%	5,256.0	0.506	8	8	8	$ 420.00	$ 1,110.00	42,048	42,048	42,048
C&I Prescriptive	Food Service - Ice Machine	9	83%	924.3	0.143	3	3	3	$ 170.00	$ 1,333.60	2,773	2,773	2,773
C&I Prescriptive	Food Service - Low Flow Pre-Rinse Sprayer	5	83%	713.0	-	1	1	1	$ 10.00	$ -	713	713	713
C&I Prescriptive	Food Service - Refrigerated Case Cover	6	83%	157.5	-	1	1	1	$ 10.00	$ 42.00	158	158	158
C&I Prescriptive	Food Service - Refrigerator	12	83%	1,482.6	0.066	7	7	7	$ 58.43	$ 180.00	10,378	10,378	10,378
C&I Prescriptive	Food Service - Steam Cooker	12	83%	2,225.9	0.433	1	1	1	$ 200.00	$ 3,500.00	2,226	2,226	2,226
C&I Prescriptive	Heat Pump	15	83%	660.1	0.677	11	11	11	$ 78.00	$ 143.64	7,293	7,246	7,246
C&I Prescriptive	Heat Pump Water Heater	10	83%	1,534.0	0.032	1	1	1	$ 500.00	$ -	1,534	1,534	1,534
C&I Prescriptive	High Efficiency Hand Dryer	15	83%	769.0	-			10	$ 180.00	$ 200.00			7,690

Program Name	Measure	Measure Life	NTG	Average kWh/ Unit	Average KW/ Unit	2021 Participation	2022 Participation	2023 Participation	Avg Incentive/Unit	IMC/unit	2021 kWh	2022 kWh	2023 kWh	2021 kW	2022 kW	2023 kW
C&I Prescriptive	Interior LED - High-Bay	15	83%	1,005.9	0.371	1,183	1,062	1,002	$ 81.00	$ 113.54	1,189,977	1,068,264	1,007,910	439	394	372
C&I Prescriptive	Interior LED - Low-Bay	15	83%	241.2	0.052	28,314	23,367	22,967	$ 21.74	$ 78.04	6,840,582	5,631,299	5,535,124	1,474	1,217	1,196
C&I Prescriptive	Lighting Control	8	83%	401.9	0.216	582	305	306	$ 35.00	$ 98.75	233,900	122,610	123,012	126	66	66
C&I Prescriptive	Lighting Power Density Reduction	15	83%	156,097.2	7.166	11	11	11	$ 14,778.31	$ -	1,717,082	1,717,082	1,717,043	79	79	79
C&I Prescriptive	Pellet Dryer Duct Insulation	5	83%	198.5	0.030	1	1	1	$ 30.00	$ -	198	198	198	0	0	0
C&I Prescriptive	Plug Load Occupancy Sensor	8	83%	169.0	-	1	1	1	$ 20.00	$ 70.00	169	169	169	-	-	-
C&I Prescriptive	Programmable Thermostat	15	83%	648.9	-	215	214	214	$ 50.00	$ 35.00	139,518	138,870	138,870	-	-	-
C&I Prescriptive	Refrigerated LED	8	83%	237.0	0.048	820	820	820	$ 16.00	$ 35.89	194,340	194,340	194,340	39	39	39
C&I Prescriptive	Showerheads	5	83%	7,130.5	-	1	1	1	$ 10.00	$ -	7,130	7,130	7,130	-	-	-
C&I Prescriptive	Smart Strip Plug Outlet	8	83%	23.4	-	1	1	1	$ 8.00	$ 15.00	23	23	23	-	-	-
C&I Prescriptive	Vending Machine Control	5	83%	1,054.4	-	3	3	3	$ 41.67	$ 179.67	3,163	3,163	3,163	-	-	-
C&I Prescriptive	VFD-Fan	15	83%	107,827.9	2.975	5	5	5	$ 7,500.00	$ 3,638.33	539,140	539,140	539,140	15	15	15
C&I Prescriptive	VFD-Pump	15	83%	122,828.9	8.175	5	5	5	$ 7,500.00	$ -	614,145	614,145	614,145	41	41	41
C&I Prescriptive	Wifi-Enabled Thermostat	15	83%	649.0	-	115	115	115	$ 100.00	$ 250.00	74,635	74,635	74,635	-	-	-
C&I Prescriptive	Window Air Conditioner & PTAC	14	83%	207.3	0.143	5	5	5	$ 46.85	$ 196.00	1,036	1,036	1,036	1	1	1
C&I Prescriptive	Window Film	10	83%	3.1	0.001	1	1	1	$ 1.00	$ 2.67	3	3	3	0	0	0
C&I Prescriptive Total						33,122	27,476	26,997			16,650,556	14,813,073	13,520,261	3,215	2,847	2,948
Commercial Midstream	Ductless Heat Pump 19 SEER 9.5 HSPF	18	100%	3,066.5	0.380	3	3	3	$ 300.00	$ 2,333.33	9,199	9,199	9,199	1	1	1
Commercial Midstream	Ductless Heat Pump 21 SEER 10 HSPF	18	100%	2,932.2	0.368	2	2	2	$ 500.00	$ 2,833.33	5,864	5,864	5,864	1	1	1
Commercial Midstream	Ductless Heat Pump 23 SEER 10 HSPF	18	100%	4,306.1	0.711	2	2	2	$ 500.00	$ 3,333.33	8,612	8,612	8,612	1	1	1
Commercial Midstream	Air Source Heat Pump 18 SEER	18	100%	1,590.0	0.530	4	4	4	$ 500.00	$ 870.00	6,360	6,360	6,360	2	2	2
Commercial Midstream	Heat Pump Water Heater	10	100%	1,534.0	0.032	1	1	1	$ 238.50	$ 1,362.68	1,534	1,534	1,534	0	0	0
Commercial Midstream Total						12	12	12			31,570	31,570	31,570	5	5	5
SBES	Anti-Sweat Heater Control	12	83%	909.3	-	1	1	1	$ 170.00	$ 200.00	909	909	909	-	-	-
SBES	EC Motors	15	83%	403.2	0.042	8	9	9	$ 77.25	$ 50.00	3,210	3,637	3,637	0	0	0
SBES	Exterior LED	15	83%	1,583.6	0.015	597	853	853	$ 295.37	$ 181.64	945,410	1,350,813	1,350,813	9	13	13
SBES	Faucet Aerator	10	83%	507.8	-	1	1	1	$ 4.72	$ 2.00	508	508	508	-	-	-
SBES	Interior LED	15	83%	183.8	0.036	5,935	7,836	7,836	$ 35.20	$ 131.43	1,090,612	1,439,939	1,439,939	214	283	283
SBES	Lighting Control	8	83%	136.2	0.026	188	188	188	$ 26.00	$ 107.33	25,568	25,568	25,691	5	5	5
SBES	Low Flow Pre-Rinse Sprayer	5	83%	7,130.5	-	1	1	1	$ 60.00	$ -	7,130	7,130	7,130	-	-	-
SBES	Program the Programmable Thermostat	5	83%	736.5	-	12	12	12	$ 25.00	$ 25.00	8,838	8,838	8,838	-	-	-
SBES	Programmable Thermostat	15	83%	1,737.0	-	9	9	9	$ 100.00	$ 35.00	15,633	15,633	15,633	-	-	-
SBES	Refrigerated Case Cover	6	83%	415.0	0.195	15	15	15	$ 83.40	$ 14.50	6,225	6,225	6,225	3	3	3
SBES	Refrigerated LED	8	83%	409.5	0.070	3	3	3	$ 47.50	$ 190.00	1,228	1,228	1,228	0	0	0
SBES	Vending Machine Control	5	83%	1,410.4	-	3	3	5	$ 265.00	$ 215.50	4,231	4,231	7,052	-	-	-
SBES	Wifi-Enabled Thermostat	15	83%	1,737.0	-	49	49	49	$ 100.00	$ 250.00	85,111	85,111	85,111	-	-	-
SBES Total						78	78	78			2,194,615	2,949,771	2,952,715	231	304	304
CVR Commercial	CVR Commercial	15	100%	155.6	0.038			5,627					875,340			214
CVR Commercial Total						-	-	5,627			-	-	875,340	-	-	214
Portfolio Total						236,579	226,393	225,737			44,325,438	43,961,753	43,533,925	10,061	9,571	10,303

Attachment 6.2 2019 DSM Market Potential Study

GDS Associates, Inc.
ENGINEERS & CONSULTANTS

prepared for

CENTERPOINT ENERGY

2022 Demand Side Management Market Potential Study

May 22,
2023

FINAL REPORT

prepared by

GDS ASSOCIATES INC

VOLUME I *2022 Demand Side Management Market Potential Study Report*

Market Potential Study ***List of Tables***

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VOLUME I

2022 CenterPoint Energy Market Potential Study

prepared for

MAY 2023

1 Introduction

1.1 BACKGROUND & STUDY SCOPE

This Market Potential Study was conducted to support the Integrated Resource Plan ("IRP") and DSM planning for CenterPoint Energy in Indiana ("CenterPoint"). The study included a comprehensive review of current programs, historical savings, and projected energy savings opportunities to develop estimates of technical, economic, and achievable potential. Separate estimates of electric energy efficiency ("EE") and demand response potential were developed. The GDS Team worked collaboratively alongside CenterPoint and the CenterPoint Oversight Board to produce estimates of future saving potential, using the best available information and best practices for developing market potential saving estimates.

1.2 TYPES OF POTENTIAL ESTIMATED

The scope of this study distinguishes three types of energy efficiency potential: (1) technical, (2) economic, and (3) achievable.

- ***Technical Potential*** is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is constrained only by factors such as technical feasibility and applicability of measures.
- ***Economic Potential*** refers to the subset of the technical potential that is economically cost-effective as compared to conventional supply-side energy resources. Economic potential follows the same adoption rates as technical potential. Like technical potential, the economic scenario ignores market barriers to ensuring actual implementation of efficiency. Finally, economic potential only considers the costs of efficiency measures themselves, ignoring any programmatic costs (e.g., marketing, analysis, administration) that would be necessary to capture them. This study uses the Utility Cost Test ("UCT") to assess cost-effectiveness.
- ***Achievable Potential*** is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and Evaluation, Measurement & Verification ("EM&V"); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and willingness to participate ("WTP") in programs, technical constraints, and other barriers the "program intervention" is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:
- ***Maximum Achievable Potential ("MAP")*** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
- ***Realistic Achievable Potential (`"RAP")*** estimates achievable potential with CenterPoint paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined spending levels.

1.3 STUDY LIMITATIONS

As with any assessment of energy efficiency potential, this study necessarily builds on various assumptions and data sources, including the following:

- Energy efficiency and demand response measure lives, savings, and costs
- Projected penetration rates for energy efficiency measures
- Projections of electric avoided costs
- Future known changes to codes and standards
- CenterPoint load forecasts and assumptions on their disaggregation by sector, segment, and end use
- End-use saturations and fuel shares

While the GDS team has sought to use the best and most current available data, there are often reasonable alternative assumptions which would yield slightly different results.

2 Baseline Forecast

The load forecast is a critical input into CenterPoint's 2022 DSM Market Potential Study, having various uses in estimation of residential and business sector potential. Therefore, the GDS Team took considerable time and effort to review CenterPoint's most recently completed load forecast models and documentation to produce the various forecast components necessary as inputs into this analysis. The chapter describes the various ways in which the forecast is used for this study, presents the baseline and disaggregated forecasts, and describes the methodology and data sources used by GDS for the purposes of generating the load forecasts that were used in the potential analysis.

2.1 CENTERPOINT LOAD FORECASTING SYSTEM

CenterPoint employs a sophisticated load forecasting system that uses econometric and Statistically Adjusted End-Use ("SAE") models to project number of consumers, average consumption per consumer, and total energy sales by class. Residential, Commercial, and Industrial consumers are projected using traditional econometric techniques. Residential average usage and commercial energy sales are projected using SAE model specifications. Industrial energy sales are projected using econometric techniques.

A residential SAE model specification takes end-use data drawn from utility, regional, and even national sources and develops monthly end-use indices designed to predict average household consumption. The end-use data includes market shares of key electric consuming appliances, average device efficiency trends, average building shell efficiency trends, price elasticity of demand, income elasticity of demand, and elasticity associated with the average number of people per household. A cooling index is developed to represent space cooling load and is further modified by Cooling Degree Days to incorporate summer weather into the model. Likewise, a heating index representing space heating is modified by Heating Degree Days. Finally, a base index is developed to represent consumption of all other end-uses in the home.

A commercial SAE model specification is very similar to a residential specification, except end-use energy intensity indices are developed for each commercial building type based on area employment in various industry codes. National and regional commercial data is used to estimate end-use consumption for various industries (for example, restaurants will have higher cooking usage shares than offices).

CenterPoint also projects the impacts of DSM programs it has run in the past. The DSM impacts included in the load forecast based on the evaluated results of CenterPoint DSM programs.

2.2 ADJUSTMENTS TO THE CENTERPOINT LOAD FORECAST

Before assessing the future potential for energy efficiency and demand response in the CenterPoint service area, a few modifications to CenterPoint's 2021-vintage forecast were necessary to create an adjusted baseline forecast. These modifications are addressed in more detail below.

2.2.1 Adjustment for Large C&I Opt-Out Customers

The 2021 CenterPoint business sector customer database containing usage and demographic data for all C&I customers, with indication for large customer opt-out of DSM/EE programs status was utilized to determine how to adjust for opt-out customers. The number of customers and total energy use was calculated both including and excluding opt-out customers. The load forecast for the C&I sectors was adjusted down by the percent of load attributed to opt-out customers from the customer database, in effect excluding from the potential analysis any load of opt-out customers. The opt-out adjustment was held constant for all years of the load forecast. In total, GDS removed approximately 11% of commercial energy sales and 72% of industrial energy sales due to large customer opt-out.

2.2.2 Reclassification of Load

The 2021 CenterPoint C&I sector customer database designated commercial and industrial ("C&I") rate code based on current tariff definition. When only using the account type/tariff definition to classify customers as either commercial or industrial, there were several manufacturing type premises classified as commercial, as well as several customers that GDS typically classifies as commercial classified as industrial, (i.e. a retail service building coded as an industrial account).

Additionally, the dataset also identified each business by North American Industry Classification System ("NAICS") code. To reclassify CenterPoint C&I sector data, GDS mapped industry codes to a specified building type and classified the building type as either commercial or industrial. Customers with a building type classified as "Industrial Manufacturing" were coded as Industrial customers, while all other building types were coded as Commercial. While the goal for this analysis is to determine the actual amount of energy sales attributable to the commercial and industrial customer classes as a whole, it is only achievable by analyzing individual customer data. The result of this reclassification was a shift of approximately 23% of industrial sector sales, or 135,742 MWh, to the commercial sector. This 23% shift was then applied to the CenterPoint case forecasted sales for the commercial and industrial classes. It is important to have accurate energy sales by customer class so that specific DSM/EE programs have the correct amount of energy sales eligible for savings.

2.3 LOAD FORECAST DISAGGREGATION

The baseline forecasts represent projected total energy sales by class. For the potential studies, it is useful to have the class forecasts disaggregated in several different ways. This section presents the forecast disaggregation scenarios used by GDS to determine intensity by end-use.

2.3.1 Residential Sector

The residential electric calibration effort led to an end-use intensity breakdown as shown below in Figure 2-1. Overall, we estimated per home consumption to be 9,835 kWh per year for 2025 (which grows to 10,475 per home by 2042). The Cooling end use is the leading stand-alone end-use, followed by Lighting, Appliances, Heating, Water Heating, TV, and Cooking. The Miscellaneous end-use includes small appliances and plug loads, and accounts for about 25% of the per home consumption. This reflects the increasing prominence of electronics and other plug-in load devices within the typical residential home.

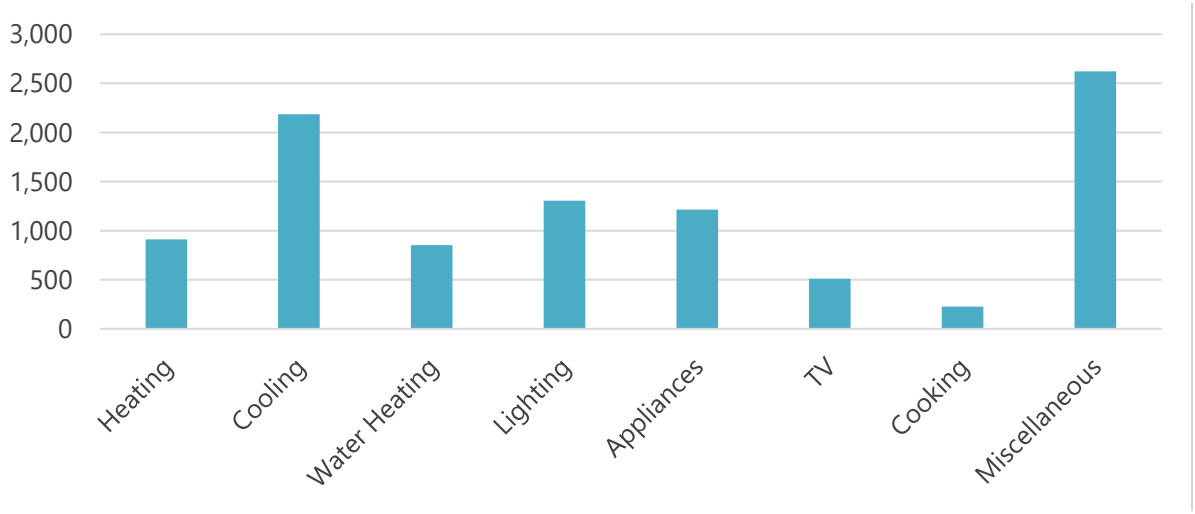


FIGURE 2-1 RESIDENTIAL ELECTRIC END-USE BREAKDOWN

2.3.2 C&I Sector

In the C&I sector, disaggregated forecast data provides the foundation for the development of energy efficiency potential estimates. GDS received a base case sales forecast from CenterPoint for the residential, commercial and industrial sectors. As noted above, the C&I forecast was adjusted from the base case by using NAICS information from CenterPoint to reclassify usage as commercial or industrial. NAICS information from CenterPoint, along with Commercial Buildings Energy Consumption Survey ("CBECS") building type consumption tables, was then used to segment the forecast into building types. The forecast was further segmented into end-uses by building type using regional specifical projections of end-use consumption contained within Energy Information Administration's ("EIA") Annual Energy Outlook supporting workpapers. Figure 2-2 provides a breakdown of commercial electric sales by building type.[1]

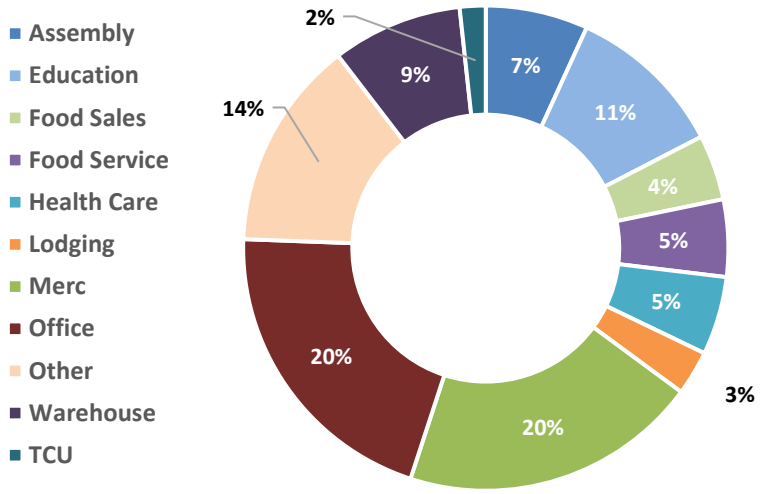


FIGURE 2-2: COMMERCIAL ELECTRIC SALES BREAKDOWN BY BUILDING TYPE

Figure 2-3 provides an illustration of the leading end-uses across all building types in the commercial sector. Lighting, space cooling, and ventilation are the primary end-uses with a significant share of load across most building types. Shares of refrigeration and office/computing are often dependent on the type of building, with refrigeration loads greatest in food sales and food service while office/computing loads are greatest in offices and education. Miscellaneous plug load is also a significant share of load in some building types, indicating that various small electric devices are becoming more common in commercial buildings.

1 "Other" commercial building types include buildings that engage in several different activities, a majority of which are commercial (e.g. retail space), though the single largest activity may be industrial or agricultural; "other" also includes miscellaneous buildings that do not fit into any other category.

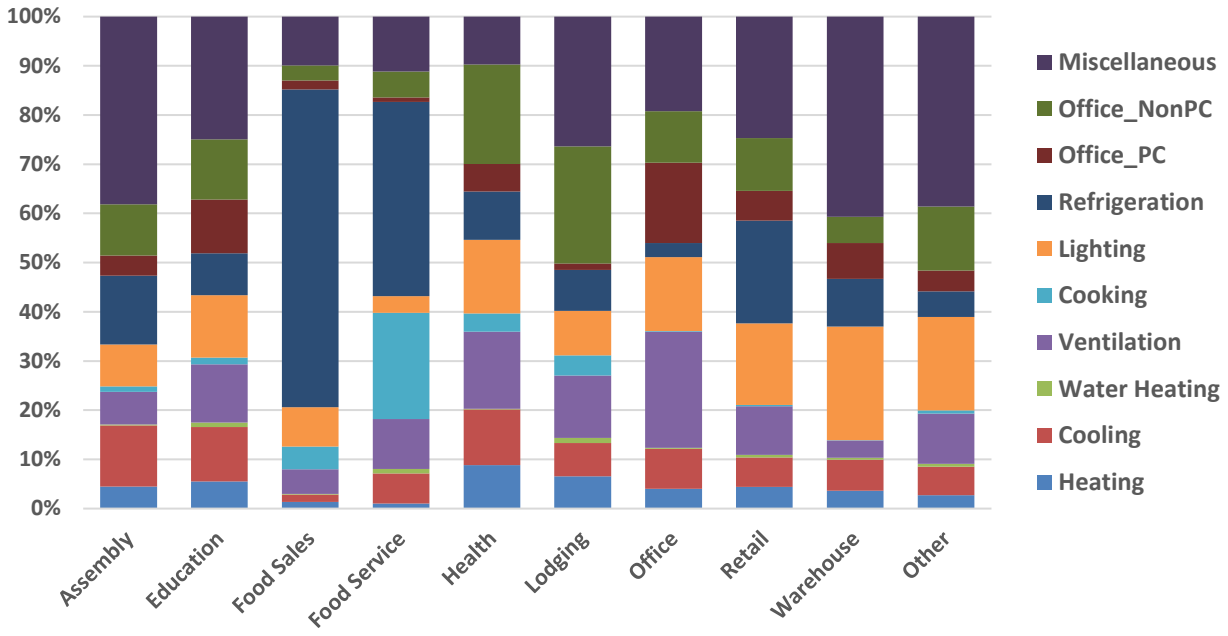


FIGURE 2-3: COMMERCIAL ELECTRIC END-USE BREAKDOWN BY BUILDING TYPE

Industrial sales were also segmented by end-use based on the overall distribution of sales by industry type and EIA Manufacturing Energy Consumption Survey ("MECS") data on end-use consumption by industrial segment. Figure 2-4 provides a breakdown of the sales by end-use. Overall, the weighted average industrial sales by end-use in the CenterPoint service area was roughly 50% Machine Drive, 13% Process Heat, 7% Process Refrigeration, 8% HVAC, and 6% Lighting. The remaining 15% was split between other process and other facility loads.

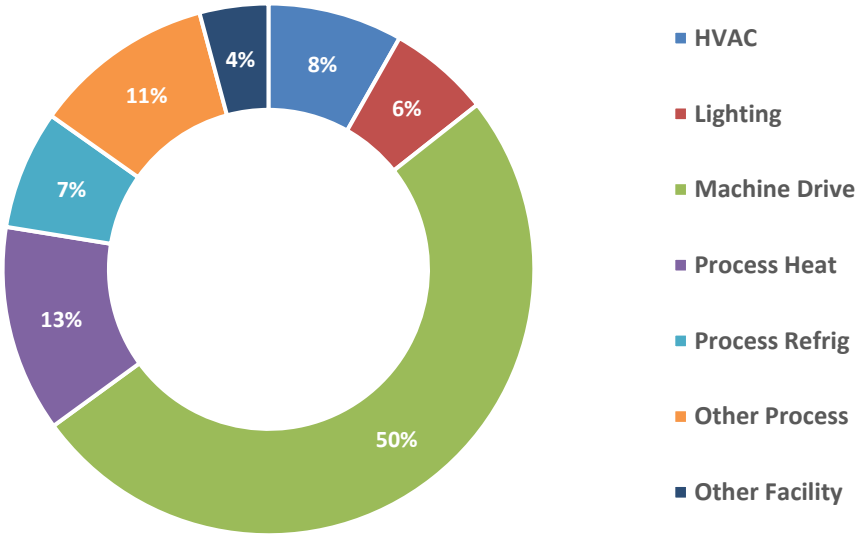


FIGURE 2-4: INDUSTRIAL ELECTRIC END-USE BREAKDOWN

3 Energy Efficiency Potential Analysis

This chapter describes the overall methodology utilized to assess the electric energy efficiency potential in the CenterPoint service area. The main objectives of this demand-side management ("DSM") market potential study ("MPS", or "study") were to estimate the technical, economic, maximum, and realistic potential savings from energy efficiency ("EE") in the CenterPoint service territory; and to quantify these estimates of potential in terms of MWh and MW savings, for each level of energy efficiency and demand response ("DR") potential (see Chapter 4 for details on the DR analysis).

3.1 OVERVIEW OF APPROACH

For the residential sector, GDS utilized a bottom-up approach to the modeling of energy efficiency potential, whereby measure-level estimates of costs, savings, and useful lives were used as the basis for developing the technical, economic, and achievable potential estimates. The measure data was used to build-up the technical potential, by applying the data to each relevant market segment. The measure data allowed for benefit-cost screening to assess economic potential, which was in turn used as the basis for achievable potential, taking into consideration incentives and estimates of annual adoption rates. For the C&I sector, GDS employed a bottom-up modeling approach to first estimate measure-level savings, costs, and cost-effectiveness, and then applied measure savings to all applicable shares of energy load.

3.2 MARKET CHARACTERIZATION

The initial step in the analysis was to gather a clear understanding of the current market segments in the CenterPoint service area. The GDS team coordinated with CenterPoint to gather utility sales and customer data and existing market research to define appropriate market sectors, market segments, vintages, saturation data and end uses. This information served as the basis for completing a forecast disaggregation and market characterization of both the residential and non-residential sectors.

3.2.1 Forecast Disaggregation

Through the development of the baseline forecasts, the GDS Team produced disaggregated forecasts by sector and end-use. The resulting aggregate baseline forecasts were disaggregated by sector and then further segmented as follows:

- ***Residential.*** The residential forecast was broken out by housing type as well as existing vs. new construction.
- ***Commercial.*** Typically based on major EIA CBECS business types: retail, warehouse, food sales, office, lodging, health, food service, education, and miscellaneous.
- ***Industrial.*** As determined by actual load consumption shares and major industry types as defined by EIA's MECS data.

The segmentation analysis was performed by applying CenterPoint-specific segment and end-use consumption shares, derived from CenterPoint's customer database and NAICS code analysis (building segmentation), and by EIA CBECS and MECS data (end-use segmentation) to forecast year sales. Within the residential, commercial, and industrial market segments, the sector level disaggregated forecasts were further segmented by the major end uses shown in Table 3-1.

TABLE 3-1: ELECTRIC END-USE LOADS

Residential	C&I	
	Commercial	Industrial
Heating	Interior Lighting	Lighting
Cooling	Exterior Lighting	HVAC
Water Heating	Refrigeration	Machine Drive
Cooking	Space Cooling	Process Heat

Refrigerator	**Space Heating**	**Process Cool / Refrigeration**
Freezer	**Ventilation**	**Other Process**
Dishwasher	**Water Heating**	**Process – Machine Drive**
Clothes Washer	**Plug Loads / Office Equipment**	**Other Facility**
Dryer	**Cooking**	**Compressed Air**
TV	**Other**	
Light	**Whole Building / Behavioral**	
Miscellaneous		

3.2.2 Eligible Opt-Out Customers

In Indiana, individual commercial or industrial customer sites with a peak load greater than 1MW are eligible to opt out of utility-funded electric energy efficiency programs. In the CenterPoint service area, approximately 11% of total reclassified retail commercial sales have opted out of utility-funded electric energy efficiency programs, while roughly 72% of total reclassified retail industrial sales have opted out.

Figure 3-1 shows the total sales for the C&I sectors, as well as the sales, by sector, that have currently opted out of paying the charge levied to support utility-administered energy efficiency programs. The portion of sales that have not opted out include both ineligible load (i.e., does not meet the 1 MW peak demand requirement) as well as eligible load that has not yet opted out.

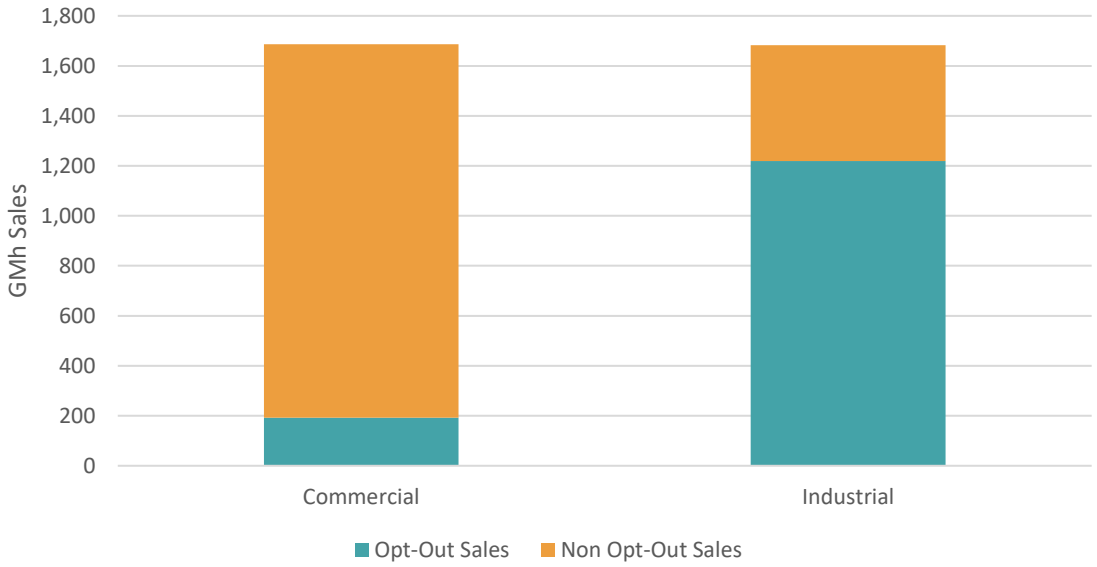


FIGURE 3-1 OPT-OUT SALES BY C&I SECTOR

GDS removed the sales from opt-out GDS also examined the full potential in the C&I sector if these customers were no longer able to opt-out of utility-funded electric energy efficiency programs. These results are included in the appendices of this report.

3.2.3 Building Stock/Equipment Saturation

To assess the potential electric energy efficiency savings available, estimates of the current saturation of baseline equipment and energy efficiency measures are necessary.

3.2.3.1 Residential Sector

For the residential sector, GDS relied on a 2021 Energy Efficiency Baseline Survey conducted by CenterPoint and other historical research efforts. Other data sources included ENERGY STAR unit shipment data,

CenterPoint evaluation reports, and EIA Residential Energy Consumption Survey data. The ENERGY STAR unit shipment data filled data gaps related to the increased saturation of energy efficient equipment across the U.S. in the last decade.

3.2.3.2 Business Sector

For the commercial sector, building stock and equipment saturation data was informed from a combination of historical primary market research as well as other available regional or national data. The data helped inform the disaggregation of the end-use sales forecast further into measure groups consistent with the measures included in the potential analysis as well as saturation of energy efficient equipment.

For the industrial sector, the analysis employed a top-down analysis at the end-use level. Accordingly, it was not critical to disaggregate the industrial sales at a measure-level. Instead, measures were developed to estimate savings at a total end-use level.

3.2.4 Remaining Factor

The remaining factor is the proportion of a given market segment that is not yet efficient and can still be converted to an efficient alternative. It is the inverse of the saturation of an energy efficient measure, prior to any adjustments. In this study, two key adjustments were made in order to recognize that the energy efficient saturation does not necessarily always fully represent the state of market transformation. First, while a percentage of installed measures may already be efficient, some customers may backslide (i.e. revert to standard technologies, or otherwise less efficient alternatives in the future, based on considerations like measure cost and availability and customer preferences). For example, customers who purchased efficient HVAC equipment in the past may not want to pay the full cost for an efficient piece of equipment again due to price increases in recent years.

Second, for measures categorized as market opportunity (i.e. replace-on-burnout), we assumed that 50% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. This adjustment assumes that 50% of the market is transformed, and no future savings potential exists, whereas the remaining 50% of the market is not transformed and could backslide without the intervention of a CenterPoint program and an incentive. Similarly, for retrofit measures, we assumed that only 10% of the instances in which an efficient measure is already installed, the burnout or failure of those measures would be eligible for inclusion in the estimate of future savings potential. This recognizes the more proactive nature of retrofit measures, as the implementation of these measures are more likely to be elective in nature, compared to market opportunity measures, which are more likely to be needs-based. The uncertainty in these assumptions is appropriate, as they factor in a key component of natural customer decision making.

3.3 MEASURE CHARACTERIZATION

3.3.1 Measure Lists

The study's sector-level energy efficiency measure lists were informed by a range of sources including the Illinois Technical Reference Manual ("TRM"), current CenterPoint program offerings, measures included in other recent Indiana utility market potential studies, and commercially viable emerging technologies, among others. Measure list development was a collaborative effort in which GDS developed draft lists that were shared with CenterPoint and stakeholders. The final measure lists ultimately included in the study reflected the informed comments and considerations from the parties that participated in the measure list review process.

In total, GDS analyzed 356 measure types for this study. Several measures were included with multiple permutations to account for different specific market segments, such as different building types, efficiency levels, and replacement options. In total, GDS developed 2,440 measure permutations for this study. Each permutation was screened for cost-effectiveness under the UCT cost test. The parameters for cost-effectiveness under the UCT are discussed in detail later in Section 3.4.3.

TABLE 3-2: NUMBER OF MEASURES EVALUATED

	# of Measures	Total # of Measure Permutations
Residential	172	770
Commercial	184	1,670
Total	***356***	***2,440***

3.3.2 Emerging Technologies

GDS considered several specific emerging technologies as part of analyzing future potential. In the residential sector, these technologies include several smart technologies, including smart appliances, smart water heater ("WH") tank controls, smart window coverings, smart TVs, heat pump dryers and smart vents/sensors. In the non-residential sector, specific emerging technologies that were considered as part of the analysis include several commercial behavioral options, triple pane windows, energy recovery ventilators, variable refrigerant flow heat pumps, switch reluctance motels, Q-Sync Motors for Refrigeration, ozone commercial laundry, advanced lighting controls, power distribution equipment upgrades, and server virtualization. While this is likely not an exhaustive list of possible emerging technologies over the next twenty years it does consider many of the known technologies that are available today but may not yet have widespread market acceptance and/or product availability.

In addition to these specific technologies, GDS acknowledges that there could be future opportunities for new technologies as equipment standards improve and market trends occur. While this analysis does not make any explicit assumption about unknown future technologies, the methodology assumes that subsequent equipment replacement that occurs over the course of the study timeframe, and at the end of the initial equipment's useful life, will continue to achieve similar levels of energy savings, relative to improved baselines, at similar incremental costs.

3.3.3 Assumptions & Sources

A significant amount of data is needed to estimate the electric savings potential for individual energy efficiency measures or programs across the residential and nonresidential customer sectors. GDS utilized data specific to CenterPoint when it was available and current. GDS used the most recent CenterPoint evaluation report findings (as well as CenterPoint program planning documents), the Illinois TRM, and the Michigan Energy Measures Database ("MEMD"), and EIA data for a large amount of the data requirements. Additional source documents included American Council for an Energy-Efficient Economy ("ACEEE") research reports covering topics like emerging technologies.

Measure Savings: GDS relied on existing CenterPoint evaluation report findings and the Illinois TRM to inform calculations supporting estimates of annual measure savings as a percentage of base equipment usage. For custom measures and measures not included in the Illinois TRM, GDS estimated savings from a variety of sources, including:

- MEMD, IN TRM, and other regional/state TRMs
- Secondary sources such as the ACEEE, Department of Energy ("DOE"), EIA, ENERGY STAR©, and other technical potential studies

Measure Costs: Measure costs represent either incremental or full costs. These costs typically include the incremental cost of measure installation, when appropriate based on the measure definition. For purposes of this study, nominal measure costs held constant over time.

GDS obtained measure cost estimates primarily from CenterPoint evaluation report findings and the Illinois TRM. GDS also used the following supplementary data sources:

- MEMD, IN, and other regional/state TRMs

- Secondary sources such as the ACEEE, ENERGY STAR, and NREL

Costs and savings for new construction and replace on burnout measures were calculated as the incremental difference between the code minimum equipment and the energy efficiency measure. This approach was utilized because the consumer must select an efficiency level that is at least the code minimum equipment when purchasing new equipment. The incremental cost is calculated as the difference between the cost of high efficiency and standard efficiency (code compliant) equipment. However, for retrofit or direct install measures, the measure cost was the "full" cost of the measure, as the baseline scenario assumes the consumer would not make energy efficiency improvements in the absence of a program. In general, the savings for retrofit measures are calculated as the difference between the energy use of the removed equipment and the energy use of the new high efficiency equipment (until the removed equipment would have reached the end of its useful life).

Measure Life: Measure life represents the number of years that energy using equipment is expected to operate. GDS obtained measure life estimates from the CenterPoint evaluation report findings and the Illinois TRM:

- MEMD, IN TRM, and other regional/state TRMs
- Manufacturer data
- Savings calculators and life-cycle cost analyses

All measure savings, costs, and useful life assumption sources are documented in the Appendices volume of this report.

3.3.4 Treatment of Codes & Standards

Although this analysis does not attempt to predict how energy codes and standards will change over time, the analysis does attempt to reflect the latest legislated improvements to federal codes and standards. Where possible, improvements to baseline equipment standards can typically be met with incremental improvements to efficient equipment standards. However, in select cases, such as screw-in lighting improvements to the baseline standard effectively were expected to eliminate the efficient technology from future consideration.

3.3.5 Net to Gross (NTG)

All estimates of technical, economic, and achievable potential, as well as measure level cost-effectiveness screening were conducted in terms of gross savings to reflect the absence of program design considerations in these phases of the analysis. The impacts of free-riders (participants who would have installed the high efficiency option in the absence of the program) and spillover customers (participants who install efficiency measures due to program activities, but never receive a program incentive) were considered in the development of DSM Inputs into CenterPoint's upcoming IRP.

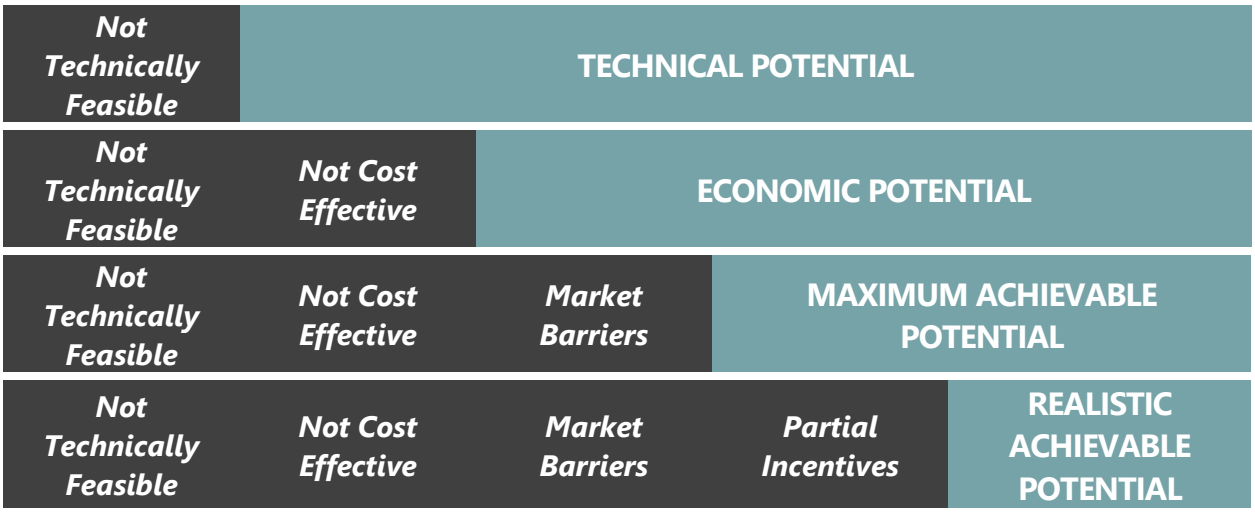
3.4 ENERGY EFFICIENCY POTENTIAL

3.4.1 Types of Potential

This section reviews the types of potential analyzed in this report, as well as some key methodological considerations in the development of technical, economic, and achievable potential.

The first two types of potential, technical and economic, provide a theoretical upper bound for energy savings from energy efficiency measures. Still, even the best-designed portfolio of programs is unlikely to capture 100% of the technical or economic potential. Therefore, achievable potential attempts to estimate what savings may realistically be achieved through market interventions, when it can be captured, and how much it would cost to do so. Figure 3-2 illustrates the types of energy efficiency potential considered in this analysis.

FIGURE 3-2: TYPES OF ENERGY EFFICIENCY POTENTIAL

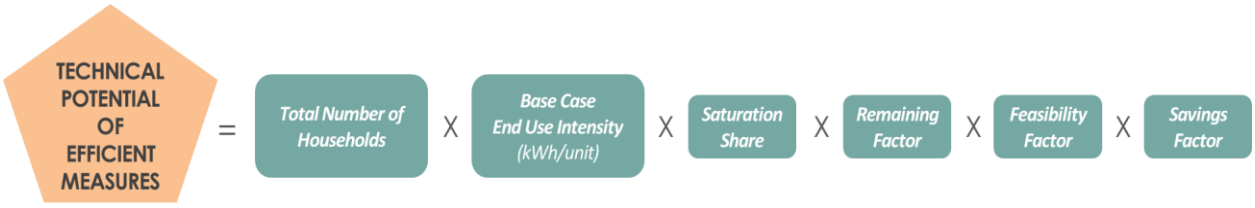


3.4.2 Technical Potential

Technical potential is the theoretical maximum amount of energy use that could be displaced by efficiency, disregarding all non-engineering constraints such as cost-effectiveness and the willingness of end users to adopt the efficiency measures. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. Under technical potential, GDS assumed that 100% of new construction and market opportunity measures are adopted as those opportunities become available (e.g., as new buildings are constructed, they immediately adopt efficiency measures, or as existing measures reach the end of their useful life). For retrofit measures, implementation was assumed to be resource constrained and that it was not possible to install all retrofit measures all at once. Rather, retrofit opportunities were assumed to be replaced incrementally until 100% of stock was converted to the efficient measure over a period of no more than 15 years.

The core equation used in the residential sector energy efficiency technical potential analysis for each individual efficiency measure is shown in Equation 3-1 below. The C&I sector employs a similar analytical approach.

EQUATION 3-1 CORE EQUATION FOR RESIDENTIAL SECTOR TECHNICAL POTENTIAL



Where…

Base Case Equipment End-Use Intensity = the electricity used per customer per year by each base-case technology in each market segment. In other words, the base case equipment end-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential water heating, the saturation share would be the fraction of all residential electric customers that have electric water heating in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of electric water heaters that is not already energy efficient.

Feasibility Factor = (also functions as the applicability factor) the fraction of the applicable units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (e.g., it may not be possible to install heat pump water heaters in all homes because of space limitations).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

3.4.2.1 Competing Measures & Interactive Effects Adjustments

GDS prevents double-counting of savings, and accounts for competing measures and interactive savings effects, through three primary adjustment factors:

Baseline Saturation Adjustment. Competing measure shares are factored into the baseline saturation estimates. For example, nearly all homes can receive insulation. To account for this, GDS' analysis used multiple measure permutations that account for varying impacts of different heating/cooling combinations and baseline saturations were applied to reflect the proportions of households with each heating/cooling combination.

Applicability Factor Adjustment. Combined measures into measure groups, where total applicability factor across measures is set to 100%. For example, homes cannot receive a programmable thermostat and a smart thermostat for the same zone. In general, the models assign the measure with the most savings the greatest applicability factor in the measure group, with competing measures picking up any remaining share.

Interactive Savings Adjustment. As savings are introduced from select measures, the per-unit savings from other measures need to be adjusted (downward) to avoid over-counting. The analysis typically prioritizes market opportunity equipment measures (versus retrofit measures that can be installed at any time). For example, the savings from building shell upgrades are adjusted down to reflect the efficiency gains of installing an efficient HVAC equipment.

3.4.3 Economic Potential

Economic potential refers to the subset of the technical potential that is economically cost-effective (based on screening with the UCT) as compared to conventional supply-side energy resources.

3.4.3.1 Utility Cost Test & Incentive Levels

The economic potential assessment included a screen for cost-effectiveness using the UCT at the measure level. In the CenterPoint territory, the UCT considers electric energy, capacity, and transmission & distribution ("T&D") savings as benefits, and utility incentives and direct install equipment expenses as the cost. Consistent with application of economic potential according to the National Action Plan for Energy Efficiency ("NAPEE"), the measure level economic screening does not consider non-incentive/measure delivery costs (e.g. admin, marketing, evaluation etc.) in determining cost-effectiveness.[2]

Apart from the low-income segment of the residential sector, all measures were required to have a UCT benefit-cost ratio greater than 1.0 to be included in economic potential and all subsequent estimates of energy efficiency potential. Low-income measures were not required to be cost-effective.

For both the calculation of the measure-level UCT, as well as the determination of RAP, historical incentive levels (as a % of incremental measure cost) were calculated for current measure offerings. GDS relied on the prior CenterPoint DSM plan estimates and historical CenterPoint evaluation reports files to map current measure offerings to their historical incentive levels.

- In the residential sector, incentives by program ranged from 34% to 100% and averaged 62%.

[2] National Action Plan for Energy Efficiency: Understanding Cost-Effectiveness of Energy Efficiency Programs. *Note: Non-incentive delivery costs are included in the assessment of achievable potential.*

- In the non-residential sector, prescriptive incentives averaged 61% of the measure cost for interior lighting, 16% for exterior lighting and 33% for non-lighting measures.
- Custom measures received incentives equal to $0.10 per first-year kWh saved (up to 50% of the measure cost).
- In the MAP scenario, incentives were increased up to 100% of the incremental measure cost.[3]

3.4.3.2 Avoided Costs

Avoided energy supply costs are used to assess the value of energy savings. Avoided cost values for electric energy, electric capacity, and avoided T&D were provided by CenterPoint as part of an initial data request. Electric energy is based on an annual system marginal cost. For years outside of the avoided cost forecast timeframe, future year avoided costs are escalated by the rate of inflation.

CenterPoint provided the GDS team with annual on and off-peak avoided energy costs. GDS used this data to create 8,760 avoided cost values for each forecast year. GDS then applied these avoided costs to the 8,760 savings from each measure based on assigned end-use load shapes[4] to determine the value of measures that save more energy during peak periods than those that might saving during off-peak periods. In addition, the avoided capacity and T&D avoided costs were applied to the estimated coincident peak demand savings for each measure.

3.4.4 Achievable Potential

Achievable potential is the amount of energy that can realistically be saved given various market barriers. Achievable potential considers real-world barriers to encouraging end users to adopt efficiency measures; the non-measure costs of delivering programs (for administration, marketing, analysis, and EM&V); and the capability of programs and administrators to boost program activity over time. Barriers include financial, customer awareness and WTP in programs, technical constraints, and other barriers the "program intervention" is modeled to overcome. Additional considerations include political and/or regulatory constraints. The potential study evaluated two achievable potential scenarios:

- ***MAP*** estimates achievable potential on paying incentives equal to 100% of measure incremental costs and aggressive adoption rates.
- ***RAP*** estimates achievable potential with CenterPoint paying incentive levels (as a percent of incremental measure costs) closely calibrated to historical levels but is not constrained by any previously determined spending levels.

3.4.4.1 Market Adoption Rates

GDS assessed achievable potential on a measure-by-measure basis. In addition to accounting for the natural replacement cycle of equipment in the achievable potential scenario, GDS estimated measure specific maximum adoption rates that reflect the presence of possible market barriers and associated difficulties in achieving the 100% market adoption assumed in the technical and economic scenarios.

The initial step was to assess the long-term market adoption potential for energy efficiency technologies. Due to the wide variety of measures across multiple end-uses, GDS employed varied measure and end-use-specific ultimate adoption rates versus a singular universal market adoption curve. These long-term market adoption estimates were based on a combination of CenterPoint-specific WTP research (conducted for the prior CenterPoint MPS) and more recent WTP surveys conducted in neighboring Indiana utility service areas.

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[3] The GDS team lowered MAP incentives to less than 100% of measure incremental cost in some cases if 100% incentives would preclude the measure from being cost-effective. MAP incentives were lowered to either 75% or 50% of the incremental measure cost if either of those incentive levels would allow for a measure to remain cost-effective.

[4] End-use load shapes were derived from building energy simulation models created by housing type and building type, specific to the CenterPoint service area.

The CenterPoint-specific research included questions to residential homeowners and nonresidential facility managers regarding their perceived willingness to purchase and install energy efficient technologies across various end uses and incentive/payback performance levels. One caveat to this approach is that the WTP adoption score is generally a simple function of incentive levels and/or payback performance. There are other factors (both as barriers and motivations) that may influence a customer's willingness to purchase an energy efficiency measure. For example, increased marketing and education programs can have a critical impact on the success of energy efficiency programs. The secondary WTP research conducted in neighboring jurisdictions included additional questions related to these barriers and motivations factors, and the general impact of these additional elements were layered onto the initial CenterPoint-specific research to be able to update and refine the original long-term adoption rates. The WTP approach and results were provided to the CenterPoint Oversight Board during a discussion of draft methodology and results.

GDS utilized likelihood and WTP data to estimate the long-term market adoption potential for both the maximum and realistic achievable scenarios. Table 3-3 presents the long-term market adoption rates at varied incentive levels used for the residential sector. Most end-uses are based on the WTP primary market research. Behavior was set to 100% to reflect that the program design is typically opt-out and participation levels are dictated by the utility.

TABLE 3-3 RESIDENTIAL LONG-TERM MARKET ADOPTION RATES AT DISCRETE INCENTIVE LEVELS

End Use/Housing Type/Income	0% Incentive	25% Incentive	50% Incentive	75% Incentive	100% Incentive
Water Heating	20%	37%	49%	65%	93%
HVAC Equipment	22%	36%	43%	60%	89%
Appliances	21%	37%	53%	68%	95%
Building Shell	20%	35%	48%	64%	91%
Behavior	100%	100%	100%	100%	100%

Table 3-4 presents the long-term market adoption rates used in the nonresidential sector. . Again, the adoption scores were informed by a combination of CenterPoint-specific WTP research (conducted for the prior CenterPoint MPS) and more recent WTP surveys conducted in neighboring Indiana utility service areas. GDS also included a custom project opportunity adjustment of 80% to reflect the difficulty in raising awareness levels for all potential custom project opportunities compared to the discrete energy efficient opportunities included in the WTP survey research. This adjustment was applied to all measures mapped to the Custom Program.

TABLE 3-4 NONRESIDENTIAL LONG-TERM MARKET ADOPTION RATES AT DISCRETE PAYBACK INTERVALS

End-Use	20 Year Payback Period	10 Year Payback Period	5 Year Payback Period	3 Year Payback Period	1 Year Payback Period	0 Year Payback Period
Lighting/Office	19%	28%	47%	71%	88%	95%
HVAC	27%	41%	55%	70%	83%	93%
Refrigeration	24%	36%	59%	77%	84%	88%
Water Heat	20%	31%	51%	68%	80%	84%
Motors/Process	23%	34%	48%	62%	73%	83%

GDS then estimated initial year adoption rates by reviewing the current saturation levels of efficient technologies and (if necessary) calibrating the estimates of 2025 annual potential to recent historical levels achieved by CenterPoint's current DSM portfolio. Although this calibration ensured that near-term savings

indicated in the MPS demonstrated achievable incremental increases relative to recent historical levels, the near-term adjustment had little impact on the long-term potential. GDS then assumed a non-linear ramp rate from the initial year market adoption rate to the various long-term market adoption rates for each specific end-use.

3.4.4.2 Non-Incentive Costs

Consistent with (NAPEE) guidelines[5], utility non-incentive costs were included in the overall assessment of cost-effectiveness at the RAP scenario. Program non-incentive costs were calibrated to recent projected levels (using the 2022 Operating Plan) and set at:

- $0.037 per Behavioral program participant
- $0.307 per first year kWh saved for measures in the Residential Prescriptive program;
- $0.164 per first year kWh saved for residential Appliance Recycling program measures;
- $0.410 per first year kWh saved for Income-Qualified program measures;
- $0.134 per first year kWh saved for the remaining residential measures,
- $0.061 per first year kWh saved for prescriptive C&I measures;
- $0.082 per first year kWh saved for Small Business Direct Install measures;
- $0.115 per first year kWh saved for custom C&I measures.

Non-incentive costs were then escalated annually at the rate of inflation.[6]

3.5 RESIDENTIAL ENERGY EFFICIENCY POTENTIAL

This section provides the potential results for technical, economic, MAP and RAP for the residential sector. The cost-effectiveness results and budgets for the RAP scenario are also provided.

3.5.1 Scope of Measures & End Uses Analyzed

There were 172 total unique residential electric measures included in the analysis. Table 3-5 provides the number of unique measures by end-use. The measure list was developed based on a review of current CenterPoint programs, the Indiana TRM, other regional TRMs, and industry documents related to emerging technologies. Data collection activities to characterize measures formed the basis of the assessment of incremental costs, electric energy and demand savings, and measure life.

TABLE 3-5: RESIDENTIAL ENERGY EFFICIENCY MEASURES – BY END USE

End-Use	Number of Unique Measures
Appliances	23
Behavior	5
HVAC	55
Lighting	14
New Construction	6
Plug Loads	4
Pool/Pump	5
Shell	45
Water Heating	15
Total	**172**

[5] National Action Plan for Energy Efficiency (2007). Guide for Conducting Energy Efficiency Potential Studies. Prepared by Optimal Energy. This study notes that economic potential only considers the cost of efficiency measures themselves, ignoring programmatic costs. Conversely, achievable potential should consider the non-measures costs of delivering programs. Pg. 2-4.
[6] Measure costs and utility incentives were not escalated over analysis timeframe to keep those costs constant in nominal dollars.

3.5.2 Summary of Residential Electric Potential

Figure 3-3 provides the technical, economic, MAP and RAP results for the 3-year, 6-year, and 18-year timeframes. The respective 18-yr technical and economic potential is 34% and 30% of residential sector sales. The MAP reaches 3.5% in three years and grows to 6.8% over six years, while the RAP reaches 2.5% in three years and grows to 4.9% over six years. The MAP and RAP reach 20% and 14% of residential sector sales, respectively, over the 18-yr timeframe of the study.

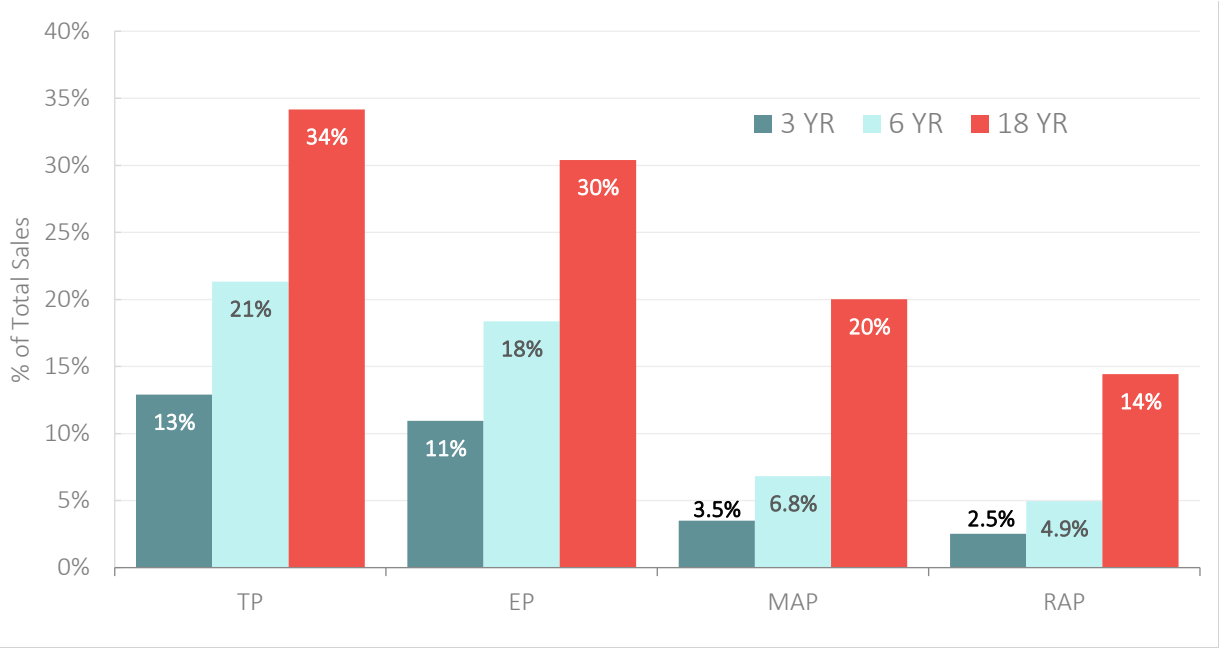


FIGURE 3-3: RESIDENTIAL ELECTRIC ENERGY CUMULATIVE ANNUAL POTENTIAL (AS A % OF SECTOR SALES)

Table 3-6 provides cumulative annual technical, economic, MAP and RAP energy savings, in total MWh and as a percentage of the sector-level sales forecast. The MW demand savings for each level of potential are also provided. In 2025, the RAP is 1.0% of sector sales with nearly 14,000 MWh in estimated energy savings and 5 MW in demand savings. By 2030, the estimated cumulative annual savings in the RAP scenario reaches 4.9% of sector sales at nearly 67,000 MWh and 28 MW in demand savings.

TABLE 3-6: RESIDENTIAL CUMULATIVE ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2025	2026	2027	2030	2042
MWh					
Technical	74,412	126,483	170,550	287,834	501,010
Economic	62,782	105,733	144,625	247,761	445,761
MAP	18,914	32,248	46,162	91,987	293,458
RAP	13,744	23,531	33,467	66,783	211,623
Forecasted Sales	1,310,095	1,316,263	1,322,505	1,349,158	1,466,187
Savings as a % of Sales					
Technical	5.7%	9.6%	12.9%	21.3%	34.2%
Economic	4.8%	8.0%	10.9%	18.4%	30.4%
MAP	1.4%	2.4%	3.5%	6.8%	20.0%
RAP	1.0%	1.8%	2.5%	4.9%	14.4%
MW					
Technical	33	58	81	141	253
Economic	26	47	65	114	214
MAP	6	11	17	39	147
RAP	5	8	12	28	105

Table 3-7 provides the incremental annual technical, economic, MAP and RAP energy savings, in total MWh and as a percentage of the sector-level sales forecast. The MW demand savings for each level of potential are also provided. The incremental MAP ranges from 1.4% to 2.0% of sector sales over the next six years. The incremental RAP ranges from 1.0% to 1.4% per year over the next six years.

TABLE 3-7: RESIDENTIAL INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2025	2026	2027	2030	2042
MWh					
Technical	74,412	71,635	70,211	67,063	63,281
Economic	62,782	61,518	60,346	57,963	55,469
MAP	18,914	21,033	22,596	27,528	40,816
RAP	13,744	17,118	18,557	22,847	32,103
Forecasted Sales	1,310,095	1,316,263	1,322,505	1,349,158	1,466,187
Savings as a % of Sales					
Technical	5.7%	5.4%	5.3%	5.0%	4.3%
Economic	4.8%	4.7%	4.6%	4.3%	3.8%
MAP	1.4%	1.6%	1.7%	2.0%	2.8%
RAP	1.0%	1.3%	1.4%	1.7%	2.2%
MW					
Technical	33	31	30	30	29
Economic	26	26	25	25	25
MAP	6	8	8	12	16
RAP	5	6	7	9	11

3.5.3 Residential Technical, Economic and Achievable Potential Summary and Detail by End-Use

Figure 3-4 provides the technical and economic potential across the 18-yr timeframe of the study. The green and red bars provide the respective incremental annual technical and economic in MWh per year energy savings. The green and orange lines provide the corresponding cumulative annual technical and economic as a percent of forecasted annual sales. The technical potential ("TP") rises to 34% by 2042, and the economic potential ("EP") rises to 30%.

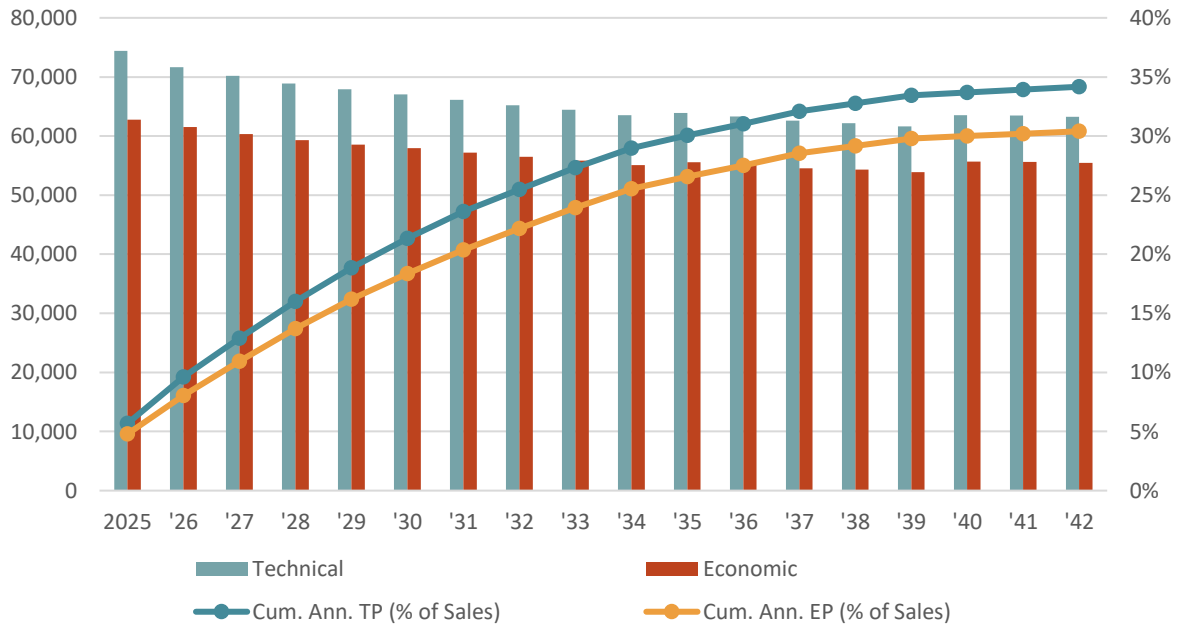


FIGURE 3-4: RESIDENTIAL ANNUAL TP AND EP

Table 3-8 provides cumulative annual technical, economic, and achievable potential results, by end-use, across the 18-yr study timeframe. The HVAC end use has the most potential in each scenario, with the Water Heating, Shell, and Appliances end uses also contributing a significant amount potential in each scenario.

TABLE 3-8: RESIDENTIAL ELECTRIC POTENTIAL – DETAIL BY END-USE

End Use	Technical	Economic	MAP	RAP
Appliances	65,043	63,946	42,049	35,256
Behavior	13,639	13,876	11,903	12,690
HVAC	159,628	141,759	82,867	57,112
Lighting	42,519	42,519	35,605	14,525
Pool/Pump	4,381	4,125	2,423	1,518
New Construction	11,525	12,044	4,336	3,469
Plug Loads	19,876	19,684	6,206	4,173
Shell	89,311	56,601	39,254	35,845
Water Heating	95,089	91,206	68,814	47,035
Total	**501,010**	**445,761**	**293,458**	**211,623**
Savings as % of Forecast	**34.2%**	**30.4%**	**20.0%**	**14.4%**

Figure 3-5 provides the MAP and RAP across the 18-yr timeframe of the study. The green and red bars provide the respective incremental annual MAP and RAP in MWh per year energy savings. The green and orange lines provide the corresponding cumulative annual MAP and RAP as a percent of forecasted annual sales. The MAP rises to 20% by 2042, and the RAP rises to 14%.

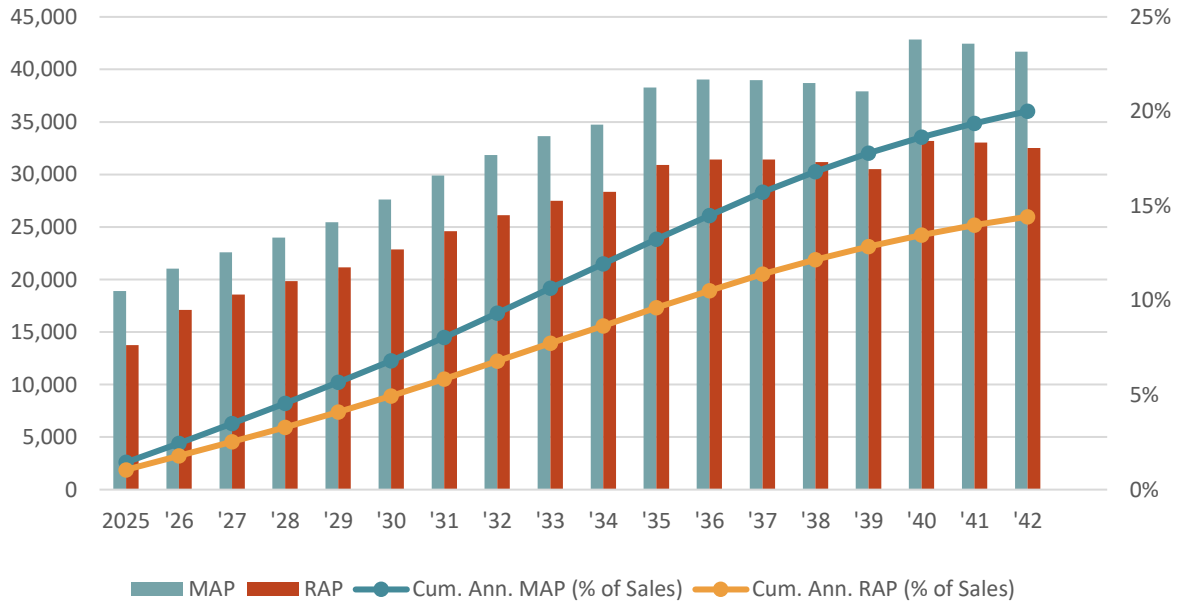


FIGURE 3-5: RESIDENTIAL ANNUAL MAP AND RAP

Figure 3-6 provides a breakdown of the RAP potential in 2042 across end-uses and building type market segments. As in technical and economic potential, HVAC is the leading end-use accounting for 27% of the total. The Shell, Water Heating and Appliances end-uses combine to account for an additional 56% of the RAP. The single-family housing segment represents 72% of the potential and the multifamily segment represents 5% of

the potential. The new construction segment accounts for 6% of potential, and measures dedicated to low-income customers account for 17% of potential.

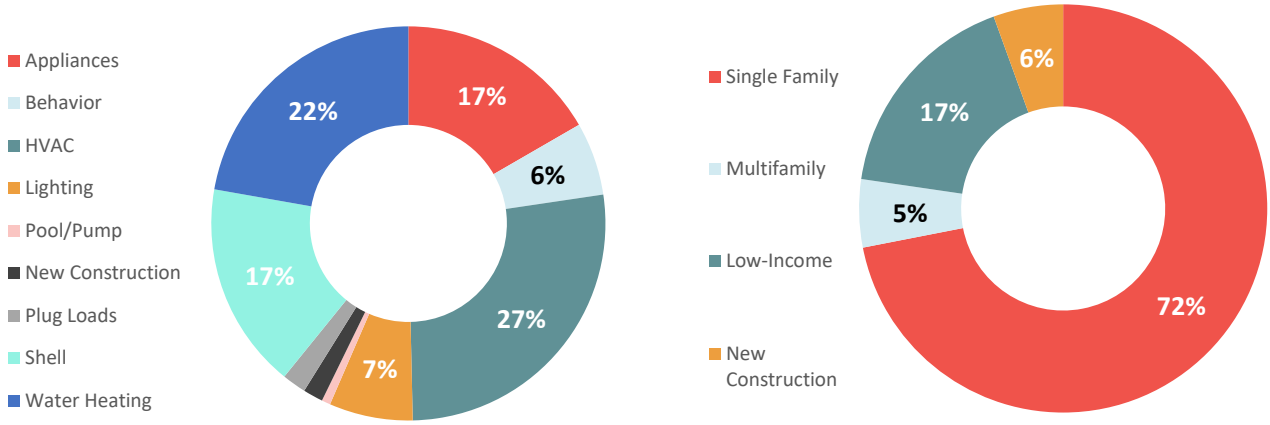


FIGURE 3-6: RESIDENTIAL POTENTIAL BY END-USE AND BUILDING TYPE – RAP 2042

Table 3-9 provides additional end-use level detail for the incremental annual residential MAP and RAP. On an incremental annual basis, the Behavior end-use is the leading end-use, with the HVAC, Shell, Water Heating and Appliances end-uses provide significant levels of achievable potential each year as well.

TABLE 3-9: RESIDENTIAL INCREMENTAL ANNUAL MAP AND RAP – END-USE DETAIL

	2025	2026	2027	2028	2029	2030
MAP Incremental Annual MWh						
Appliances	1,379	1,537	1,716	1,923	2,163	2,430
Behavior	7,671	8,486	9,188	9,777	10,262	10,667
HVAC	5,572	5,434	5,346	5,200	5,002	5,060
Lighting	738	1,102	1,226	1,317	1,454	1,821
New Construction	29	39	53	71	95	125
Plug Loads	55	67	79	96	121	160
Pool/Pump	129	193	214	230	364	482
Shell	1,271	1,632	1,797	2,022	2,288	2,736
Water Heating	2,071	2,543	2,975	3,364	3,716	4,047
Total	**18,914**	**21,033**	**22,596**	**24,000**	**25,465**	**27,528**
% of Forecasted Sales	**1.4%**	**1.6%**	**1.7%**	**1.8%**	**1.9%**	**2.0%**
RAP Incremental Annual MWh						
Appliances	1,211	1,399	1,546	1,713	1,908	2,124
Behavior	7,319	8,540	9,275	9,900	10,424	10,870
HVAC	2,495	3,031	3,044	3,036	3,006	3,179
Lighting	296	441	491	528	583	731
New Construction	16	22	30	41	55	72
Plug Loads	44	54	64	77	97	128
Pool/Pump	86	128	143	153	243	322
Shell	960	1,407	1,558	1,750	1,982	2,387
Water Heating	1,317	2,094	2,406	2,656	2,856	3,036
Total	**13,744**	**17,118**	**18,557**	**19,854**	**21,155**	**22,847**
% of Forecasted Sales	**1.0%**	**1.3%**	**1.4%**	**1.5%**	**1.6%**	**1.7%**

3.5.4 Residential Achievable Potential Benefits & Costs

Table 3-10 provides the net present value ("NPV") benefits and costs, as calculated using the UCT, across the 2025-2042 timeframe for the MAP and RAP scenarios. The overall UCT ratio in the RAP scenario is 1.79. The overall UCT ratio in the MAP scenario is 1.41 due to higher assumed incentive costs.

TABLE 3-10: RESIDENTIAL MAP AND RAP NPV BENEFITS & COSTS

End Use	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
MAP	$318,964,649	$226,308,700	$92,655,949	1.41
RAP	$237,975,390	$133,134,210	$104,841,181	1.79

Figure 3-7 provides the budget for the MAP and RAP scenarios. For the RAP scenarios, the budget is broken into incentive and non-incentive budgets for each year of the study timeframe. The RAP budgets range from $4.4 million to $18 million, with incentives accounting for approximately 52% of the total RAP budget. The MAP budgets range from $9 million to $32 million.

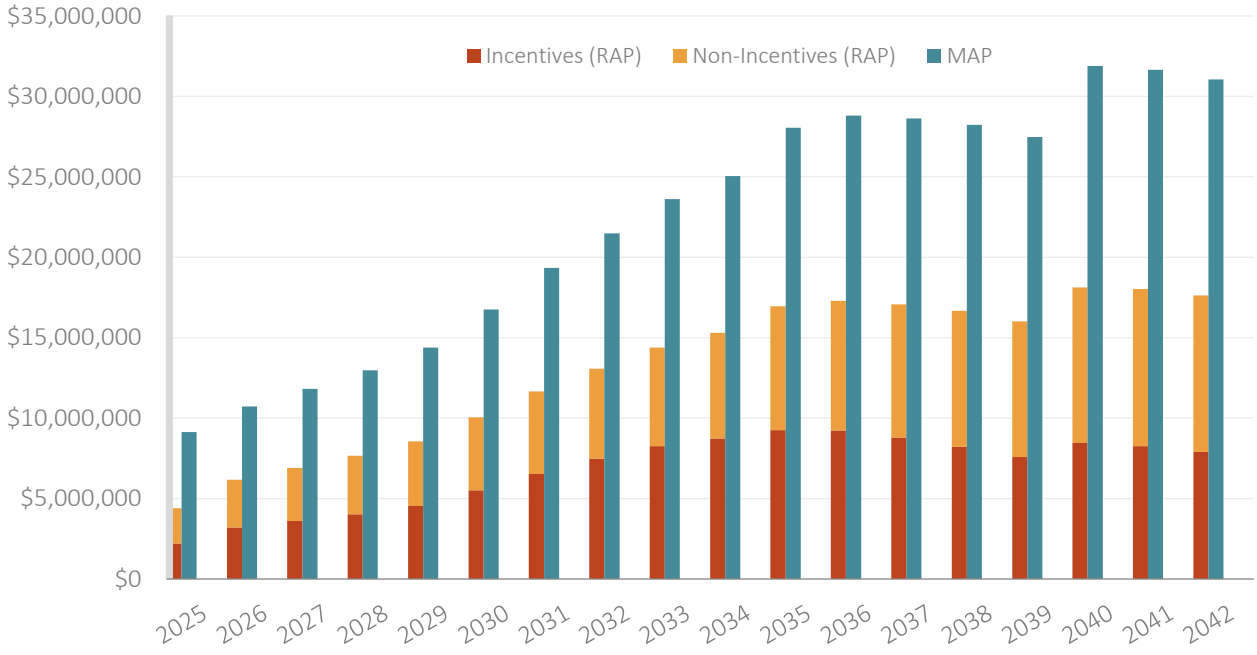


FIGURE 3-7: RESIDENTIAL ANNUAL BUDGETS – MAP AND RAP

3.6 COMMERCIAL AND INDUSTRIAL ENERGY EFFICIENCY POTENTIAL

This section provides the potential results for technical, economic, MAP and RAP for the commercial and industrial sector. The cost-effectiveness results and budgets for the RAP scenario are also provided.

3.6.1 Scope of Measures & End Uses Analyzed

There were 170 total unique commercial and industrial (C&I) electric measures included in the analysis. Table 3-11 provides the number of unique measures by end-use. The measure list was developed based on a review of current CenterPoint programs, the Indiana TRM, other regional TRMs, and industry documents related to emerging technologies. Data collection activities to characterize measures formed the basis of the assessment of incremental costs, electric energy and demand savings, and measure life.

TABLE 3-11: COMMERCIAL AND INDUSTRIAL ENERGY EFFICIENCY MEASURES – BY END USE

End-Use	Number of Unique Measures
HVAC	57
Lighting	33
Refrigeration	27
Office Equipment	11
Whole Building	10
Cooking	9
Process	8
Compressed Air	7
Behavioral	6
Miscellaneous	6
Hot Water	5
Motors	5
Total	**184**

3.6.2 Summary of Commercial and Industrial Electric Potential

Figure 3-8 provides the technical, economic, MAP and RAP results for the 3-year, 6-year, and 18-year timeframes. The respective 18-yr technical and economic potential is 31% and 30% of C&I sector sales. The MAP reaches 4.9% in three years and grows to 10.1% over six years, while the RAP reaches 3.1% in three years and grows to 6.4% over six years. The MAP and RAP reach 24% and 16% of C&I sector sales, respectively, over the 18-yr timeframe of the study.

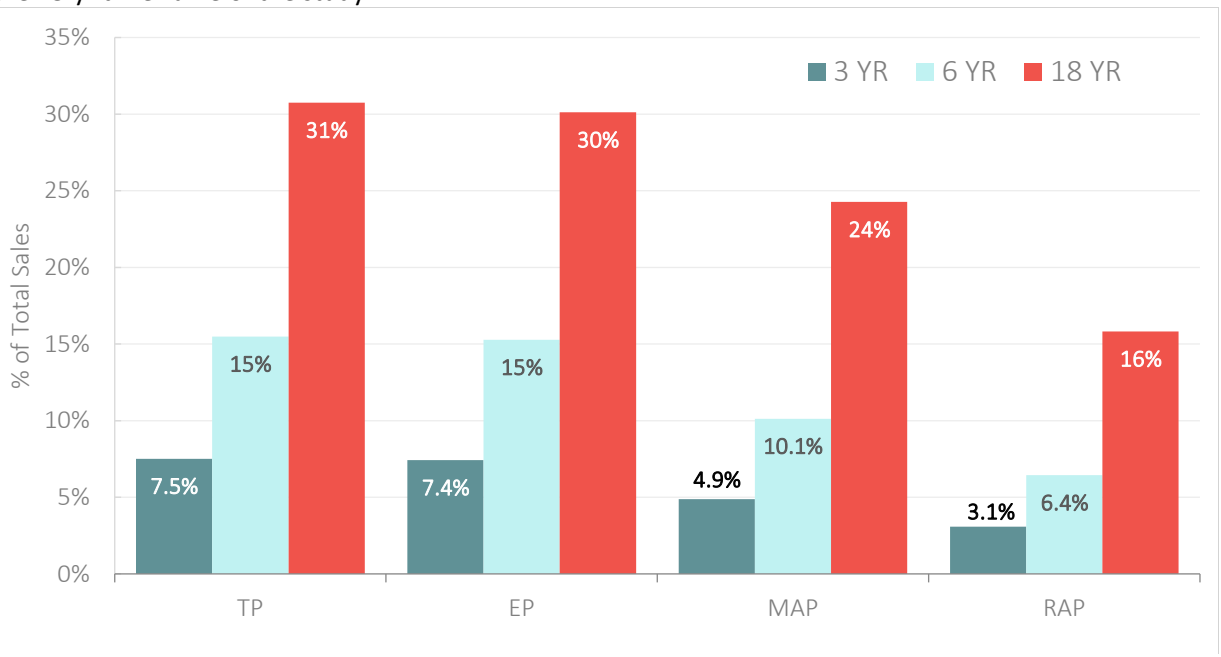


FIGURE 3-8: C&I ELECTRIC ENERGY CUMULATIVE ANNUAL POTENTIAL (AS A % OF COMMERICAL AND INDUSTRIAL SALES)

Table 3-12 provides cumulative annual technical, economic, MAP and RAP energy savings, in total MWh and as a percentage of the sector-level sales forecast. The MW demand savings for each level of potential are also provided. In 2025, the RAP is 0.9% of sector sales with more than 21,000 MWh in estimated energy savings and 5 MW in demand savings. By 2030, the estimated cumulative annual savings in the RAP scenario reaches 6.4% of sector sales at nearly 148,000 MWh and 33 MW in demand savings.

TABLE 3-12: C&I CUMULATIVE ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2025	2026	2027	2030	2042
MWh					
Technical	52,423	109,850	170,504	355,588	738,789
Economic	51,828	108,456	168,281	350,674	723,732
MAP	34,328	71,839	110,811	232,609	583,159
RAP	21,377	45,043	69,832	147,777	380,213
Forecasted Sales	2,254,314	2,260,433	2,268,314	2,296,773	2,403,292
Technical	2.3%	4.9%	7.5%	15.5%	30.7%
Economic	2.3%	4.8%	7.4%	15.3%	30.1%
MAP	1.5%	3.2%	4.9%	10.1%	24.3%
RAP	0.9%	2.0%	3.1%	6.4%	15.8%
MW					
Technical	12	24	37	78	167
Economic	12	24	37	78	167
MAP	8	16	25	54	138
RAP	5	10	15	33	84

Table 3-13 provides the incremental annual technical, economic, MAP and RAP energy savings, in total MWh and as a percentage of the sector-level sales forecast. The MW demand savings for each level of potential are also provided. The incremental MAP ranges from 1.5% to 1.9% of sector sales over the next six years. The incremental RAP ranges from 0.9% to 1.2% per year over the next six years.

TABLE 3-13: C&I INCREMENTAL ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY

	2025	2026	2027	2030	2042
MWh					
Technical	52,423	57,427	61,147	58,432	77,954
Economic	51,828	56,628	59,842	66,062	70,675
MAP	34,328	37,511	38,980	43,596	39,160
RAP	21,377	23,666	24,796	28,197	26,666
Forecasted Sales	2,254,314	2,260,433	2,268,314	2,296,773	2,403,292
Technical	2.3%	2.5%	2.7%	2.5%	3.2%
Economic	2.3%	2.5%	2.6%	2.9%	2.9%
MAP	1.5%	1.7%	1.7%	1.9%	1.6%
RAP	0.9%	1.0%	1.1%	1.2%	1.1%
MW					
Technical	12	13	13	15	14
Economic	12	13	13	15	14
MAP	8	9	9	10	8
RAP	5	5	5	6	5

3.6.3 Commercial and Industrial Technical & Economic Potential

Figure 3-9 provides the technical and economic potential across the 18-yr timeframe of the study. The green and red bars provide the respective incremental annual technical and economic in MWh per year energy savings. The green and orange lines provide the corresponding cumulative annual technical and economic as a percent of forecasted annual sales. The technical potential rises to 31% by 2042, and the economic potential rises to 30%.

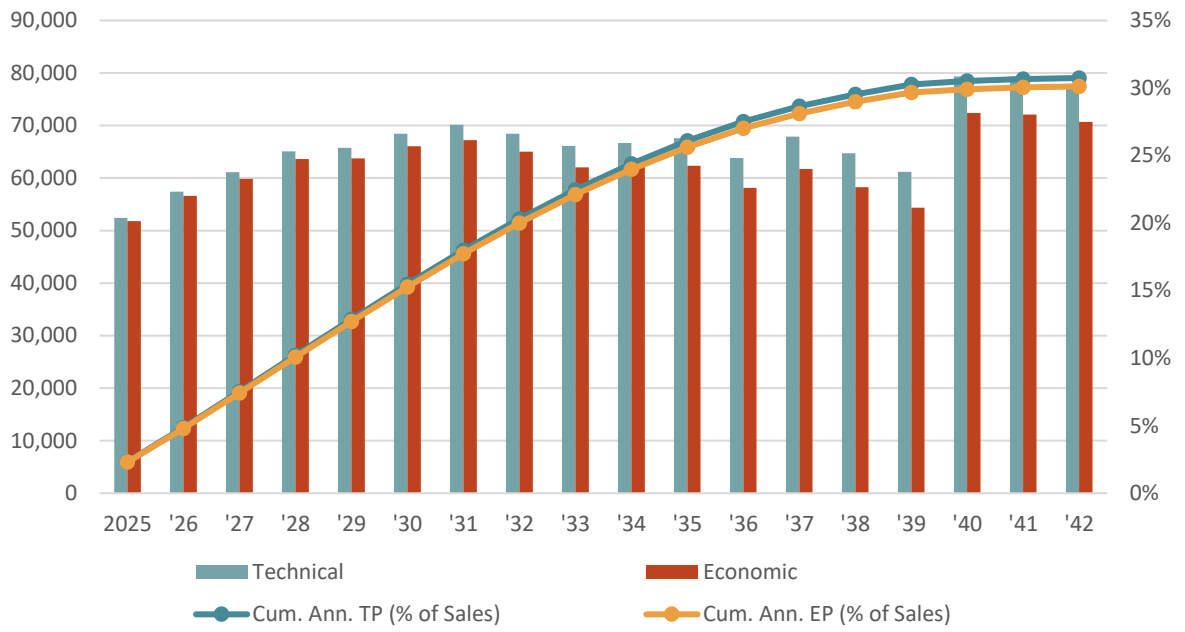


FIGURE 3-9: C&I ANNUAL TP AND EP

Table 3-14 provides cumulative annual technical, economic, and achievable potential results, by end-use, across the 18-yr study timeframe. The Lighting end use has the most potential in each scenario, which, along with the HVAC, Whole Building and Refrigeration end uses, contributes approximately 75% of the RAP.

TABLE 3-14: C&I ELECTRIC POTENTIAL – DETAIL BY END-USE

	Technical	Economic	MAP	RAP
End Use				
Lighting	168,415	168,286	149,753	104,645
HVAC	158,636	157,496	134,226	76,091
Whole Building	96,233	96,317	90,402	54,323
Refrigeration	72,893	72,457	46,365	34,874
Process	59,118	59,118	35,878	21,919
Motors	39,838	39,838	32,542	22,672
Office Equipment	45,951	45,951	38,417	22,798
Compressed Air	20,983	20,983	18,231	13,047
Miscellaneous	34,965	34,965	19,778	13,847
Behavioral	28,898	15,464	8,348	8,370
Cooking	8,086	8,086	6,133	5,025
Hot Water	4,772	4,772	3,086	2,601
Total	**738,789**	**723,732**	**583,159**	**380,213**
Savings as % of Forecast	**30.7%**	**30.1%**	**24.3%**	**15.8%**

3.6.4 Commercial and Industrial Achievable Potential

Figure 3-10 provides the MAP and RAP across the 18-yr timeframe of the study. The green and red bars provide the respective incremental annual MAP and RAP in MWh per year energy savings. The green and orange lines provide the corresponding cumulative annual MAP and RAP as a percent of forecasted annual sales. The MAP rises to 24% by 2042, and the RAP rises to 16%.

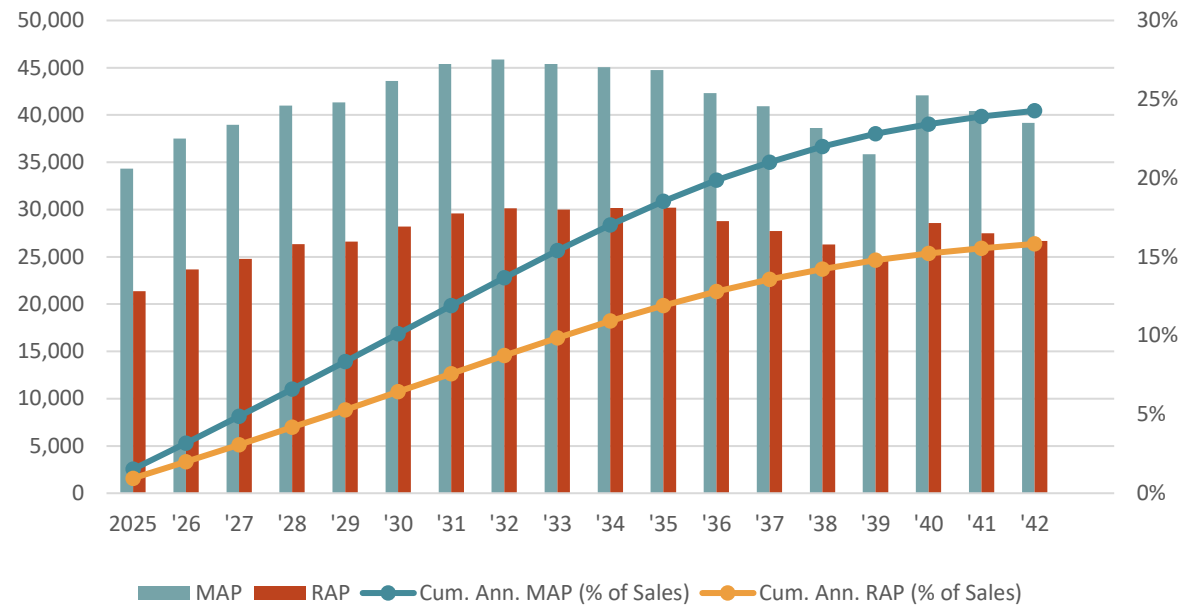


FIGURE 3-10: COMMERCIAL AND INDUSTIRAL ANNUAL MAP AND RAP

Figure 3-11 provides a breakdown of the RAP potential in 2042 across end-uses and building type market segments. As in technical and economic potential, HVAC and Lighting are the leading end-uses, accounting for 48% of the total. The Whole Building, Refrigeration, Process, Motors, and Office Equipment end-uses each contribute at least six percent of the total and combine to account for an additional 41% of the RAP. The commercial sector represents 76% of the potential and the industrial sector represents 24% of the potential.

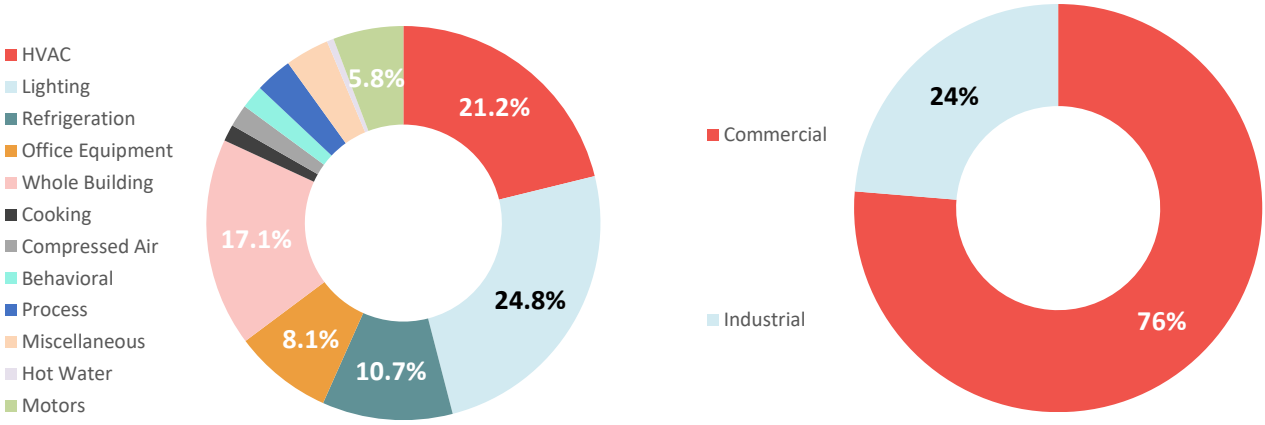


FIGURE 3-11: COMMERCIAL AND INDUSTRIAL POTENTIAL BY END-USE AND BUILDING TYPE – RAP 2042

Table 3-15 provides additional end-use level detail for the incremental annual commercial and industrial MAP and RAP. The incremental annual savings have a similar representation as the cumulative annual savings across end-uses, with Lighting and HVAC leading the way, followed by the Whole Building, Refrigeration, Process, Motors, Office Equipment and Compressed Air end-uses each providing more than 1,000 MWh in annual savings by 2030.

TABLE 3-15: COMMERCIAL AND INDUSTRIAL ANNUAL MAP AND RAP – END-USE DETAIL

	2025	2026	2027	2028	2029	2030
MAP Incremental Annual MWh						

	2025	2026	2027	2028	2029	2030
Lighting	17,268	17,329	16,868	16,000	14,785	13,461
HVAC	8,496	9,315	9,836	10,518	10,665	10,727
Whole Building	2,916	3,780	4,329	5,228	5,333	6,411
Refrigeration	938	1,418	1,591	1,721	1,961	2,702
Process	481	607	764	1,107	1,369	1,660
Motors	726	1,067	1,186	1,281	1,419	1,767
Office Equipment	1,140	1,287	1,462	1,759	2,137	2,511
Compressed Air	951	1,074	1,180	1,361	1,437	1,531
Miscellaneous	717	781	828	879	943	1,331
Behavioral	238	350	390	558	666	854
Cooking	309	342	371	398	420	439
Hot Water	149	162	175	188	203	202
Total	34,328	37,511	38,980	40,998	41,338	43,596
% of Forecasted Sales	1.5%	1.7%	1.7%	1.8%	1.8%	1.9%
RAP Incremental Annual MWh						
Lighting	10,862	11,232	11,197	10,808	10,110	9,325
HVAC	4,917	5,345	5,617	6,070	6,117	6,096
Whole Building	1,563	2,031	2,350	2,946	2,983	3,685
Refrigeration	684	1,037	1,166	1,265	1,441	1,974
Process	305	381	475	704	866	1,047
Motors	498	739	822	884	976	1,219
Office Equipment	687	771	869	1,039	1,268	1,495
Compressed Air	769	856	924	1,041	1,077	1,117
Miscellaneous	491	533	563	597	641	912
Behavioral	215	319	357	512	616	799
Cooking	254	280	304	324	342	356
Hot Water	132	142	153	164	176	172
Total	21,377	23,666	24,796	26,355	26,612	28,197
% of Forecasted Sales	0.9%	1.0%	1.1%	1.2%	1.2%	1.2%

3.6.5 Commercial and Industrial Achievable Potential Benefits & Costs

Table 3-16 provides the net present value (NPV) benefits and costs, as calculated using the UCT, across the 2025-2042 timeframe for the MAP and RAP scenarios. The overall UCT ratio in the RAP scenario is 4.84. The overall UCT ratio in the MAP scenario is 2.11 due to higher assumed incentive costs.

TABLE 3-16: C&I MAP AND RAP NPV BENEFITS & COSTS

End Use	NPV Benefits	NPV Costs	Net Benefits	UCT Ratio
MAP	$411,885,368	$195,172,667	$216,712,701	2.11
RAP	$250,846,614	$51,877,902	$198,968,711	4.84

Figure 3-12 provides the budget for the MAP and RAP scenarios. For the RAP scenarios, the budget is broken into incentive and non-incentive budgets for each year of the study timeframe. The RAP budgets range from $3.9 million to $7.2 million, with incentives accounting for approximately 43% of the total RAP budget. The MAP budgets range from $16 million to $24 million.

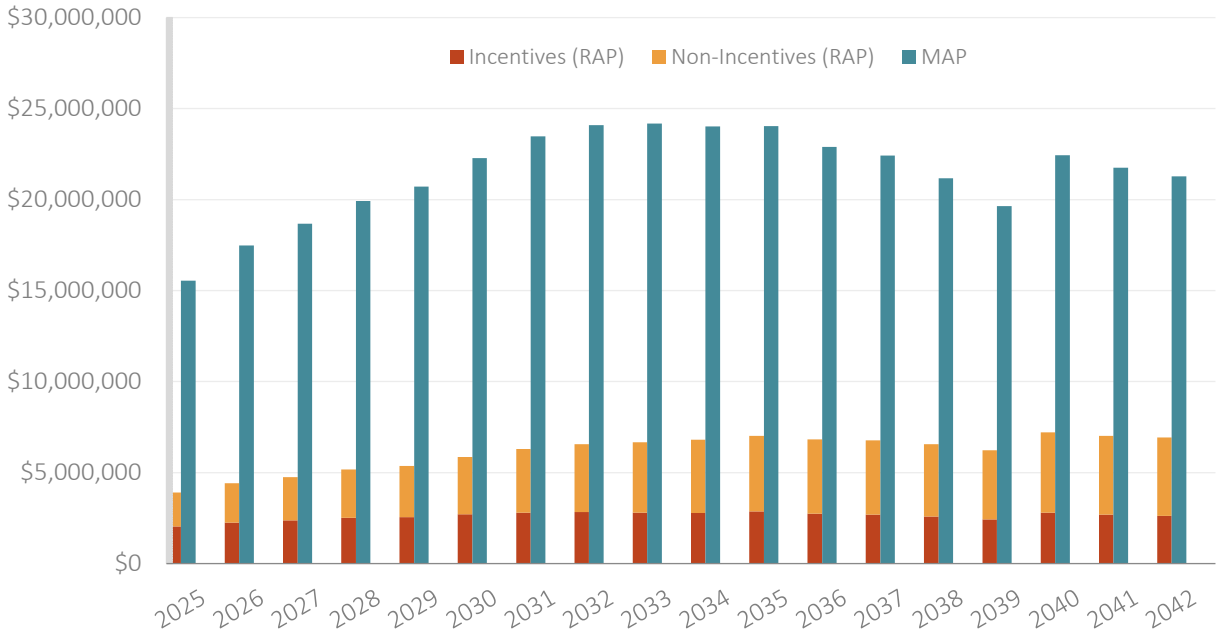


FIGURE 3-12: COMMERCIAL AND INDUSTRIAL ANNUAL BUDGETS – MAP AND RAP

4 Demand Response Potential

This chapter provides the results of the MAP and RAP potential for the demand response analysis. Results are broken down by sector and program. The cost-effectiveness results and budgets for the MAP and RAP scenarios are also provided. Section 4.1 provides a description of the demand response methodology.

4.1 DEMAND RESPONSE PROGRAM OPTIONS

Table 4-1 provides a brief description of the demand response program options considered and identifies the eligible customer segment for each demand response program that was considered in this study. This includes direct load control (DLC) and rate design options.

TABLE 4-1 DEMAND RESPONSE PROGRAM OPTIONS AND ELIGIBLE MARKETS

Demand Response Program Option	Program Description	Eligible Markets
DLC AC (Switch)	The compressor of the air conditioner is remotely shut off (cycled) by the system operator for periods that may range from 7 ½ to 15 minutes during every 30-minute period (i.e., 25%-50% duty cycle). GDS looked at both the one-way communicating Cannon switches and two-way communicating L+G switches. Both switch options were assumed to be phased out as customers switch to thermostats over time.	Residential and C&I Customers
DLC AC (Thermostat)	The system operator can remotely raise the AC's thermostat set point during peak load conditions, lowering AC load. GDS looked at the three options CenterPoint currently has: a customer is given a free thermostat to participate along with an annual incentive, a customer is given a rebate through the marketplace or a storefront along with an annual incentive, or the customer brings an existing thermostat and is only given an annual incentive.	Residential and C&I Customers
DLC Pool Pumps	The swimming pool pump is remotely shut off by the system operator for periods normally ranging from 2 to 4 hours.	Residential Customers
DLC Water Heaters	The water heater is remotely shut off by the system operator for periods normally ranging from 2 to 8 hours.	Residential and C&I Customers
Critical Peak Pricing with Enabling Technology	A retail rate in which an extra-high price for electricity is provided during critical periods (e.g. 100 hours) of the year. Prices can be fixed or fluctuate with the market. Market-based prices. are typically provided on a day-ahead basis, or an hour-ahead basis. Enabling technology, such as smart thermostat, is provided to the customer.	Residential and C&I Customers
Critical Peak Pricing without Enabling Technology	A retail rate in which an extra-high price for electricity is provided during critical periods (e.g. 100 hours) of the year. Prices can be fixed or fluctuate with the market. Market-based prices. are typically provided on a day-ahead basis, or an hour-ahead basis. Customer is not required to have enabling technology.	Residential and C&I Customers
Peak Time Rebates	Customers are given a rebate for less consumption during times selected as critical periods.	Residential and C&I Customers
Time of Use	A retail rate with different prices for usage during different blocks of time. Daily pricing blocks could include on-peak, mid-peak, and off-peak periods.	Residential and C&I Customers

Demand Response Program Option	Program Description	Eligible Markets
Real Time Pricing	A retail rate in which the price for electricity fluctuates hourly during all hours of the year. Prices are typically provided on a day-ahead basis, or an hour-ahead basis	C&I Customers

Double-counting savings from demand response programs that affect the same end uses is a common issue that must be addressed when calculating the demand response savings potential. For example, a direct load control (DLC) program of air conditioning and a rate program both assume load reduction of the customers' air conditioners. For this reason, it is typically assumed that customers cannot participate in programs that affect the same end uses. One cannot save a kW of load in a specific hour more than once. In general, the hierarchy of demand response programs is accounted for by subtracting the number participants in a higher priority program from the eligible market for a lower priority program. Table 4-2 shows the hierarchy for each sector, with 1 being the top priority. Note that only cost-effective programs are included in the hierarchy.

TABLE 4-2 DR HIERARCHY FOR EACH SECTOR

Order	Residential Hierarchy	C&I Hierarchy
1	Direct Load Control	Direct Load Control
2	Critical Peak Pricing with Enabling Technology	Critical Peak Pricing with Enabling Technology
3	Critical Peak Pricing without Enabling Technology	Critical Peak Pricing without Enabling Technology
4	Peak Time Rebate	N/A
5	Time of Use	N/A

4.1.1 Demand Response Potential Assessment Approach Overview

The analysis of demand response, where possible, closely followed the approach outlined for energy efficiency. The framework for assessing the cost-effectiveness of demand response programs is based *on A Framework for Evaluating the Cost-Effectiveness of Demand Response, prepared for the National Forum on the National Action Plan (NAPA) on Demand Response*.[7] Additionally, GDS reviewed the May 2017 National Standard Practice Manual published by the National Efficiency Screening Project.[8] GDS utilized this guide to define avoided ancillary services and energy and/or capacity price suppression benefits.

Direct load control and rate programs demand response analysis was conducted using the GDS Demand Response Model. GDS determined the estimated savings for each demand response program by performing a review of all benefits and cost associated with each program. A modeling approach that considers numerous required inputs for each program was used, including expected life, coincident peak (CP) kW load reductions, proposed incentive levels, program related expenses such as vendor service fees, marketing and evaluation cost and on-going O&M expenses.

The UCT was used to determine the cost-effectiveness of each demand response program. Benefits are based on avoided demand, energy (including load shifting), wholesale cost reductions and T&D costs. Costs include incremental program equipment costs (such as control switches or smart thermostats), fixed program capital costs (such as the cost of a central controller), program administrative, marketing, and evaluation costs. Incremental equipment program costs are included for both new and replacement units (such as control switches) to account for units that are replaced at the end of their useful life.

[7] Study was prepared by Synapse Energy Economics and the Regulatory Assistance Project, February 2013.
[8] National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources, May 18, 2017, Prepared by The National Efficiency Screening Project

The demand response analysis includes estimates of technical, economic, and achievable potential. Achievable potential is broken into maximum achievable potential (MAP) and realistic achievable potential (RAP) in this study:

MAP represents an estimate of the maximum cost-effective demand response potential that can be achieved over the 18-year study period. For this study, this is defined as customer participation in demand response program options that reflect a "best practices" estimate of what could eventually be achieved. MAP assumes no barriers to effective delivery of programs.

RAP represents an estimate of the amount of demand response potential that can be realistically achieved over the 18-year study period. For this study, this is defined as achieving customer participation in demand response program options that reflect a realistic estimate of what could eventually be achieved assuming typical or "average" industry experience. RAP is a discounted MAP, by considering program barriers that limit participation, therefore reducing savings that could be achieved.

4.1.2 Avoided Costs

Demand response avoided costs were consistent with those utilized in the energy efficiency potential analysis and were provided by CenterPoint. The primary benefit of demand response is avoided generation capacity, resulting from a reduction in the need for new peaking generation capacity. Demand response can also produce energy related benefits. If the demand response option is considered "load shifting", such as direct load control of electric water heating, the consumption of energy is shifted from the control period to the period immediately following the period of control. For this study, GDS assumed that the energy is shifted with no loss of energy. If the program is not considered to be "load shifting" the measure is turned off during peak control hours, and the energy is saved altogether. Demand response programs can also potentially delay the construction of new transmission and distribution lines and facilities, which is reflected in avoided T&D costs.

4.1.3 Demand Response Program Assumptions

This section briefly discusses the general assumptions and sources used to complete the demand response potential analysis.

4.1.3.1 Direct Load Control Program Assumptions

Load Reduction: Demand reductions were based on load reductions found in CenterPoint's existing demand response programs, and various secondary data sources including the FERC and other industry reports, including demand response potential studies that conducted primary research. DLC and thermostat-based demand response options were typically calculated based on a per-unit kW demand reduction.

Useful Life: The useful life of a smart thermostat is assumed to be 15 years . Load control switches have a useful life of 15 years. This life was used for all direct load control measures in this study.

Program Costs: One-time program development costs included in the first year of the analysis for new programs. No program development costs are assumed for programs that already exist. Each new program includes an evaluation cost. It was assumed that there would be a cost of $50[9] per new participant for marketing for the DLC programs for RAP. Marketing costs are assumed to be 33.3% higher for MAP. All program costs were escalated each year by the general rate of inflation assumed for this study.

Saturation: The number of control units per participant was assumed to be 1 for all direct load control programs using switches (such as water heaters and air conditioning switches), because load control switches can control up to two units. However, for controllable thermostats, some participants have more than one

[9] TVA Potential Study Volume III: Demand Response Potential, Global Energy Partners, December 2011

thermostat. The average number of residential thermostats per single family home was assumed to be 1.72 thermostats.[10]

Program Adoption Levels: Long-term program adoption levels (or "steady state" participation) represent the enrollment rate once the fully achievable participation has been reached. GDS reviewed industry data and program adoption levels from several utility demand response programs. The main sources of participant rates are several studies completed by the Brattle Group. As noted earlier in this section, for direct load control programs, MAP participation rates rely on industry best adoption rates and RAP participation rates are based on industry average adoption levels. For the rate programs, the MAP steady-state participation rates assumed programs were opt-out based and RAP participation assumed opt-in status.

Customer participation in new demand response programs is assumed to reach the steady state take rate over a five-year period. The path to steady state customer participation follows an "S-shaped" curve, in which participation growth accelerates over the first half of the five-year period, and then slows over the second half of the period (see Figure 4-1). Existing programs have already gone through this ramp-up period, so they were escalated linearly to the final participation rate.

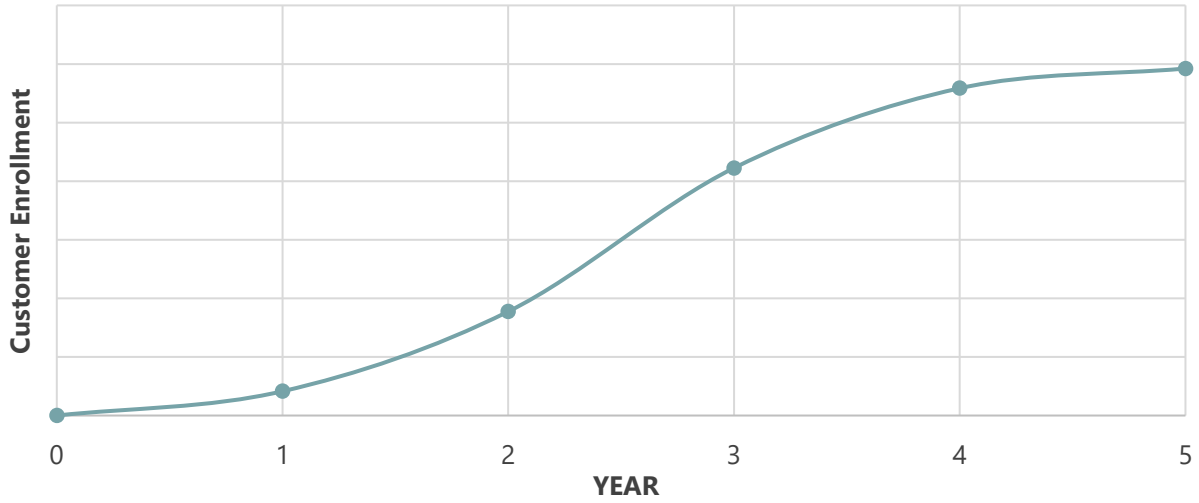


FIGURE 4-1: ILLUSTRATION OF S-SHAPED MARKET ADOPTION CURVE

4.1.3.2 Rate Program Assumptions

Load Reduction: Demand reductions were based on various secondary data sources including the FERC and other industry reports, including demand response potential studies that conducted primary research. Rate-based demand response options were typically assumed to reduce a percentage of the total facility coincident peak load.

Useful Life: The useful life of a smart thermostat is assumed to be 15 years. Smart thermostats were assumed to be the enabling technology required for the CPP with Enabling Technology program. For other rate programs that did not require any additional technology, the only equipment needed is a smart meter. The life of a smart meter was assumed to be 20 years.

Program Costs: One-time program development costs included in the first year of the analysis for new programs. No program development costs are assumed for programs that already exist. Each new program includes an evaluation cost, with evaluation cost for existing programs already being included in the

[10] Vectren Electric Baseline Study 2016

administration costs. It was assumed that there would be a cost of $50[11] per new participant for marketing for the DLC programs. Marketing costs are assumed to be 33.3% higher for MAP. All program costs were escalated each year by the general rate of inflation assumed for this study.

4.2 TOTAL DEMAND RESPONSE POTENTIAL

Figure 4-2 provides the technical and economic demand response potential across the 3-year, 6-year, and 18-year timeframes. The technical potential ranges from 437 MW to 531 MW, whereas the economic potential ranges from 383 MW to 454 MW, which indicates that most technical potential is cost-effective.

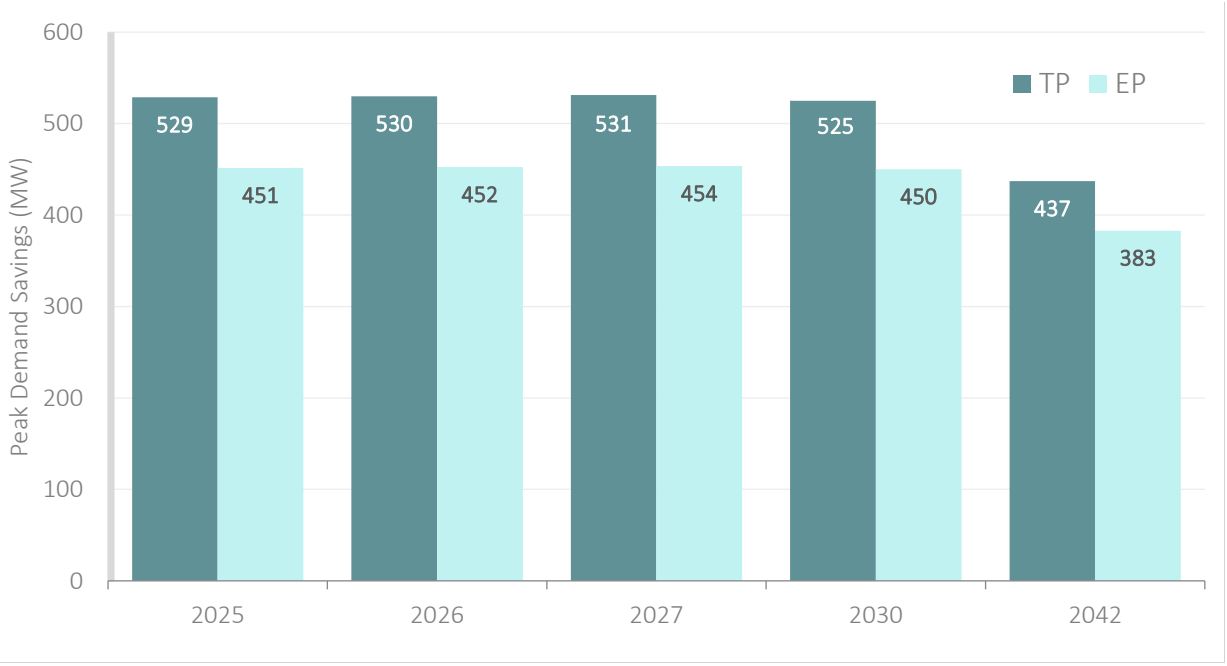


FIGURE 4-2: RESIDENTIAL ELECTRIC ENERGY CUMULATIVE ANNUAL POTENTIAL (AS A % OF SECTOR SALES)

Table 4-3 and Table 4-4 show the cumulative annual MAP and RAP savings for across the first six years of the study timeframe (2025-2030). These values are at the customer meter. The MAP assumes the maximum participation that would happen in the real-world, while the RAP considers additional barriers to program implementation that could limit the amount of savings achieved. The DLC Thermostat program options provide the most potential in the residential sector, and the Critical Peak Pricing and DLC Thermostat program options provide the most potential in the commercial sector. Overall, the MAP ranges from 23 MW to 41 MW over the next six years, and the RAP ranges from 16 MW to 27 MW over the next six years.

TABLE 4-3: MAP SAVINGS BY PROGRAM AND SECTOR

Sector	Program	2025	2026	2027	2028	2029	2030
Residential	DLC AC Thermostat (Utility Incentivized)	2.6	2.9	3.2	3.5	3.8	4.1
	DLC AC Thermostat (BYOT)	7.6	9.0	10.5	12.0	13.5	14.9
	DLC AC Switch	2.8	2.6	2.5	2.3	2.2	2.0
	DLC Water Heaters	5.0	4.9	4.7	4.5	4.4	4.2
	DLC Pool Pumps	0.1	0.1	0.1	0.1	0.1	0.1
	Critical Peak Pricing (with Enabling Technologies)	0.0	0.5	0.8	1.4	2.2	3.3

[11] TVA Potential Study6 Volume III: Demand Response Potential, Global Energy Partners, December 2011

Sector	Program	2025	2026	2027	2028	2029	2030
	Critical Peak Pricing (without Enabling Technologies)	0.0	0.3	0.5	0.8	1.3	2.0
	Peak Time Rebates	0.0	0.4	0.6	1.0	1.5	2.3
	Time of Use Rates	0.0	0.1	0.2	0.4	0.6	0.8
	Residential Total	**18.1**	**20.8**	**23.1**	**25.9**	**29.3**	**33.7**
Commercial	DLC AC Thermostat (Utility Incentivized)	0.4	0.4	0.5	0.5	0.6	0.6
	DLC AC Thermostat (BYOT)	1.1	1.3	1.5	1.8	2.0	2.2
	DLC AC Switch	2.8	2.6	2.5	2.3	2.2	2.0
	DLC Water Heaters	0.0	0.0	0.0	0.0	0.0	0.0
	Critical Peak Pricing (with Enabling Technologies)	0.0	0.3	0.4	0.7	1.1	1.7
	Critical Peak Pricing (without Enabling Technologies)	0.0	0.1	0.1	0.1	0.2	0.4
	Real Time Pricing	0.0	0.0	0.0	0.0	0.0	0.0
	Peak Time Rebates	0.0	0.0	0.0	0.0	0.0	0.0
	Time of Use Rates	0.0	0.0	0.0	0.0	0.0	0.0
	Commercial Total	**4.3**	**4.7**	**5.0**	**5.4**	**6.0**	**6.8**
All Sectors Combined		**22.3**	**25.5**	**28.1**	**31.3**	**35.3**	**40.5**

TABLE 4-4 RAP SAVINGS BY PROGRAM AND SECTOR

Sector	Program	2025	2026	2027	2028	2029	2030
Residential	DLC AC Thermostat (Utility Incentivized)	2.6	2.9	3.2	3.5	3.8	4.1
	DLC AC Thermostat (BYOT)	7.6	9.0	10.5	12.0	13.5	14.9
	DLC AC Switch	2.8	2.6	2.5	2.3	2.2	2.0
	DLC Water Heaters	0.5	0.5	0.5	0.5	0.4	0.4
	DLC Pool Pumps	0.1	0.1	0.1	0.1	0.1	0.1
	Critical Peak Pricing (with Enabling Technologies)	0.0	0.1	0.2	0.3	0.5	0.8
	Critical Peak Pricing (without Enabling Technologies)	0.0	0.1	0.1	0.2	0.3	0.4
	Peak Time Rebates	0.0	0.1	0.1	0.2	0.4	0.6
	Time of Use Rates	0.0	0.0	0.1	0.1	0.2	0.3
	Residential Total	**13.5**	**15.4**	**17.2**	**19.1**	**21.2**	**23.6**
Commercial	DLC AC Thermostat (Utility Incentivized)	0.4	0.4	0.5	0.5	0.6	0.6
	DLC AC Thermostat (BYOT)	1.1	1.3	1.5	1.8	2.0	2.2
	DLC AC Switch	0.4	0.4	0.4	0.3	0.3	0.3
	DLC Water Heaters	0.0	0.0	0.0	0.0	0.0	0.0
	Critical Peak Pricing (with Enabling Technologies)	0.0	0.1	0.1	0.2	0.3	0.5

Sector	Program	2025	2026	2027	2028	2029	2030
	Critical Peak Pricing (without Enabling Technologies)	0.0	0.0	0.0	0.0	0.1	0.1
	Real Time Pricing	0.0	0.0	0.0	0.0	0.0	0.0
	Peak Time Rebates	0.0	0.0	0.0	0.0	0.0	0.0
	Time of Use Rates	0.0	0.0	0.0	0.0	0.0	0.0
	Commercial Total	**1.9**	**2.2**	**2.5**	**2.8**	**3.2**	**3.7**
All Sectors Combined		**15.5**	**17.7**	**19.7**	**22.0**	**24.4**	**27.3**

Figure 4-3 shows the cumulative annual RAP (MW) by program in the residential sector. The two DLC AC Thermostat options provide the greatest amount of potential, with the Critical Peak Pricing options and Peak Time Rebates program options growing over time as well. The DLC AC Switch and DLC Water Heaters program options contribute some RAP early in the study timeframe before fading out over time. Overall the residential RAP grows from 14 MW in 2025 to 60 MW in 2042.

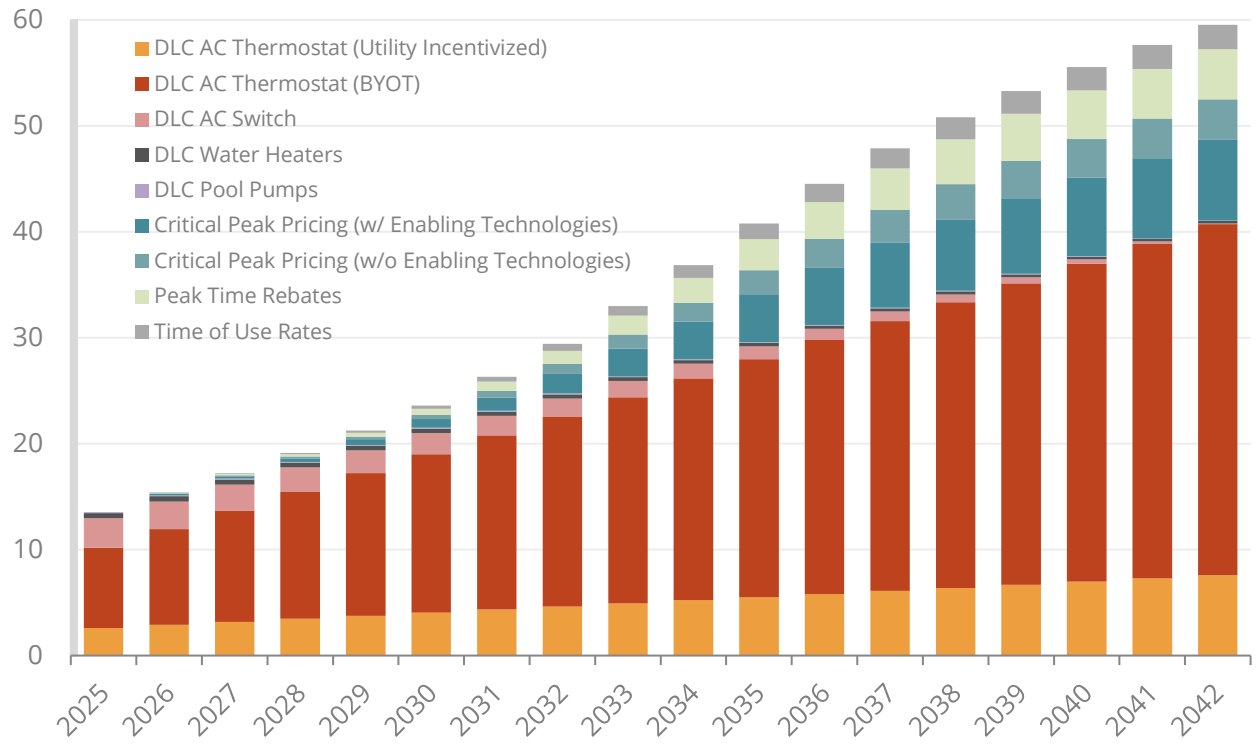


FIGURE 4-3 RESIDENTIAL SECTOR DEMAND RESPONSE RAP – BY PROGRAM

Figure 4-4 shows the cumulative annual RAP (MW) by program in the commercial sector. The two DLC AC Thermostat options provide the greatest amount of potential in the early years of the study timeframe, with the Critical Peak Pricing options growing significantly over time as well. Overall the commercial RAP grows from 2 MW in 2025 to 12 MW in 2042.

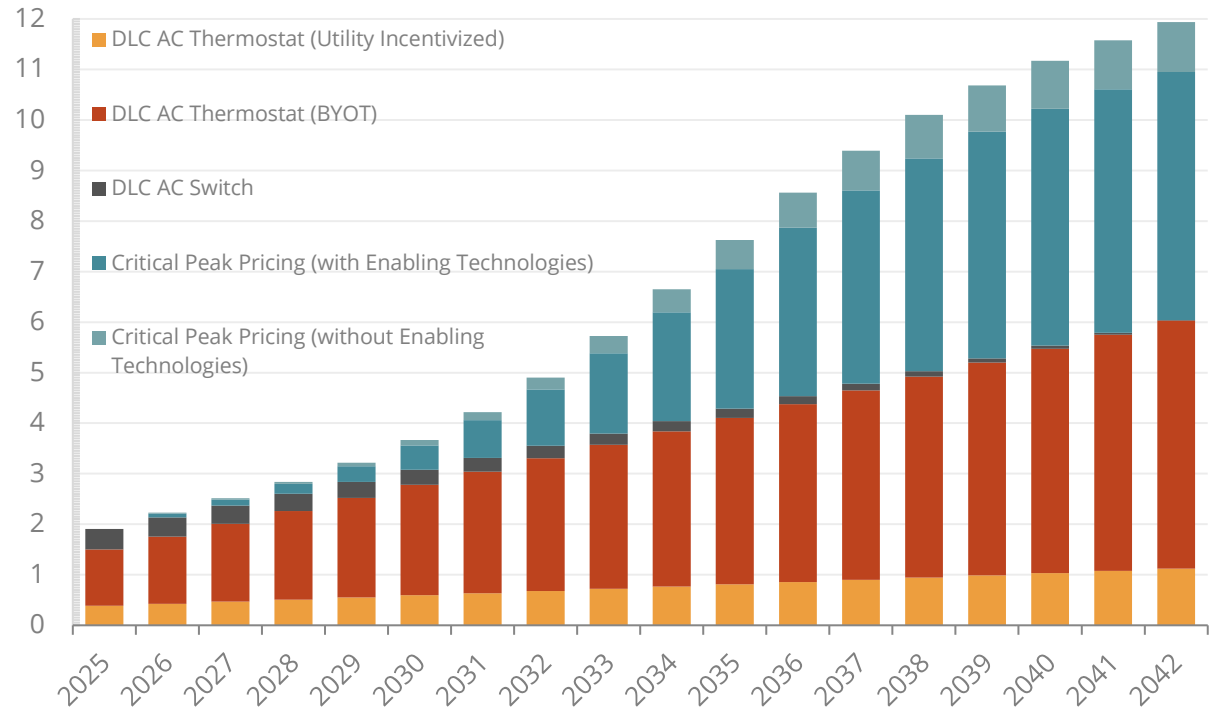


FIGURE 4-4 COMMERCIAL SECTOR DEMAND RESPONSE RAP – BY PROGRAM

4.3 BENEFITS & COSTS

Figure 4-5 provides the budget for the MAP and RAP scenarios, with a breakout shown for the residential and commercial sectors. For the MAP scenario, the budget ranges from $2.3 million to $4.2 million. For the RAP scenario, the budget ranges from $2.0 million to $3.3 million. The residential sector accounts for 81% of the total RAP budget and 83% of the total MAP budget.

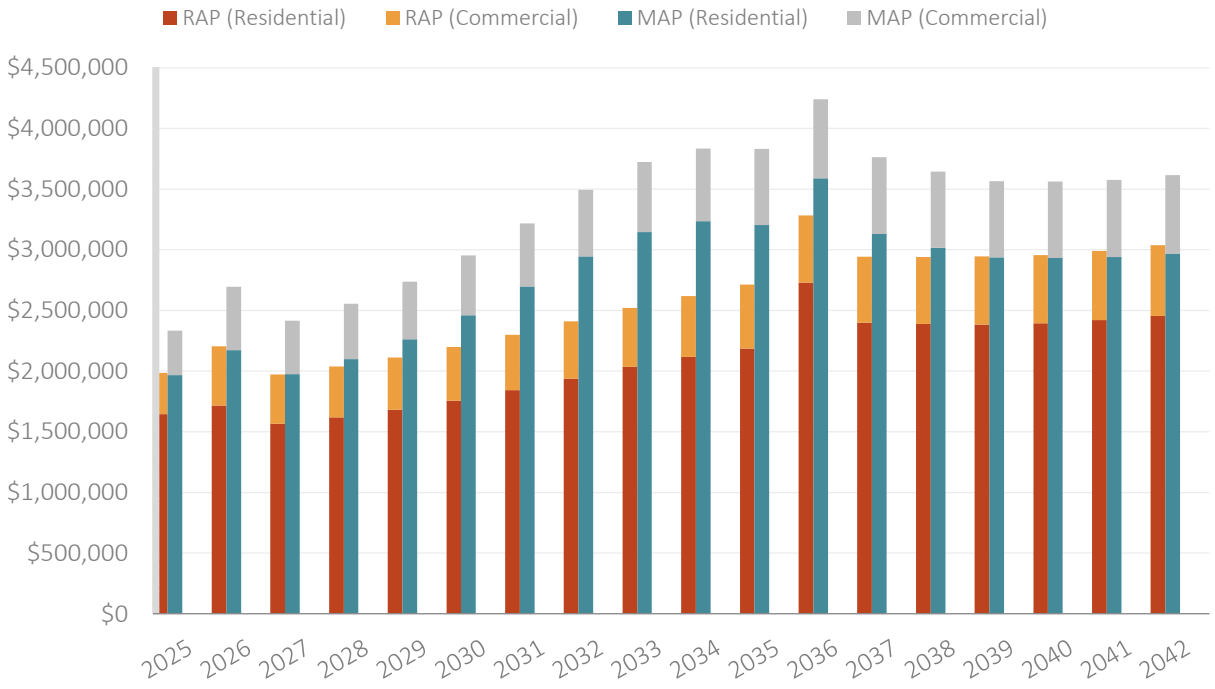


FIGURE 4-5: DEMAND RESPONSE ANNUAL BUDGETS – MAP AND RAP

Table 4-5 and Table 4-6 show the MAP and RAP residential NPVs of the total benefits, costs, and savings, along with the TRC ratio for each program for the length of the study.

TABLE 4-5 MAP NPV BENEFITS, COSTS, AND TRC RATIOS FOR EACH DEMAND RESPONSE PROGRAM

Sector	Program	NPV Benefits	NPV Costs	TRC Ratio
Residential	DLC AC Thermostat (Utility Incentivized)	8,787,424	2,454,193	3.58
	DLC AC Thermostat (BYOT)	34,120,895	11,869,557	2.87
	DLC AC Switch	3,125,746	3,356,379	0.93
	DLC Water Heaters	722,311	1,739,204	0.42
	DLC Pool Pumps	137,709	1,038,307	0.13
	Critical Peak Pricing (w/ Enabling Technologies)	18,300,247	1,537,084	11.91
	Critical Peak Pricing (w/o Enabling Technologies)	9,647,179	1,918,625	5.03
	Peak Time Rebates	8,709,602	1,684,783	5.17
	Time of Use Rates	2,266,606	1,294,072	1.75
	Residential Total	**$85,817,719**	**$26,892,204**	**3.19**
Commercial	DLC AC Thermostat (Utility Incentivized)	1,292,270	853,892	1.51
	DLC AC Thermostat (BYOT)	5,018,993	1,609,334	3.12
	DLC AC Switch	458,809	946,154	0.48
	DLC Water Heaters	17,189	695,563	0.02
	DLC Pool Pumps	9,764,337	690,926	14.13
	Critical Peak Pricing (w/ Enabling Technologies)	1,776,247	670,535	2.65
	Critical Peak Pricing (w/o Enabling Technologies)	134,411	923,789	0.15
	Peak Time Rebates	257,338	792,370	0.32
	Time of Use Rates	776,244	801,377	0.97
	Commercial Total	**$19,495,838**	**$7,983,939**	**2.44**
Residential & Commercial Total		**$105,313,558**	**$34,876,144**	**3.02**

TABLE 4-6 RAP NPV BENEFITS, COSTS, AND TRC RATIOS FOR EACH DEMAND RESPONSE PROGRAM

Sector	Program	NPV Benefits	NPV Costs	TRC Ratio
Residential	DLC AC Thermostat (Utility Incentivized)	8,787,424	1,883,531	4.67
	DLC AC Thermostat (BYOT)	34,120,895	9,574,949	3.56
	DLC AC Switch	3,125,746	2,680,835	1.17
	DLC Water Heaters	722,311	1,408,519	0.51
	DLC Pool Pumps	137,709	1,026,180	0.13
	Critical Peak Pricing (w/ Enabling Technologies)	4,858,797	720,738	6.74
	Critical Peak Pricing (w/o Enabling Technologies)	2,423,264	788,727	3.07
	Peak Time Rebates	3,103,847	966,077	3.21

Sector	Program	NPV Benefits	NPV Costs	TRC Ratio
	Time of Use Rates	1,546,670	1,034,266	1.50
	Residential Total	**$58,826,662**	**$20,083,823**	**2.93**
Commercial	DLC AC Thermostat (Utility Incentivized)	1,292,270	796,945	1.62
	DLC AC Thermostat (BYOT)	5,018,993	1,384,722	3.62
	DLC AC Switch	458,809	877,693	0.52
	DLC Water Heaters	17,189	689,725	0.02
	DLC Pool Pumps	3,018,612	550,641	5.48
	Critical Peak Pricing (w/ Enabling Technologies)	622,728	552,735	1.13
	Critical Peak Pricing (w/o Enabling Technologies)	450,715	930,878	0.48
	Peak Time Rebates	273,035	741,627	0.37
	Time of Use Rates	457,273	702,040	0.65
	Commercial Total	**$11,609,625**	**$7,227,008**	**1.61**
Residential & Commercial Total		**$70,436,288**	**$27,310,831**	**2.58**

5 Action Plan Summary

5.1 DEVELOPMENT OF DSM ACTION PLAN

The Market Potential Study serves as the basis for developing CenterPoint Indiana's DSM Action Plan. The DSM Action Plan is designed to extract the insights and data from the Market Potential Study and translate them into opportunities to deliver to customers. The DSM Action Plan provides guidance to mobilize the results of the Market Potential Study findings to provide a pathway to advance efforts that are reasonable and relevant in developing CenterPoint Indiana's portfolio in future years. The following section lays out the process, principles, and elements of CenterPoint Indiana's portfolio of programs. A summary of the results for the proposed portfolio is also provided.

5.2 DSM ACTION PLAN – GUIDING PRINCIPLES AND FRAMEWORK

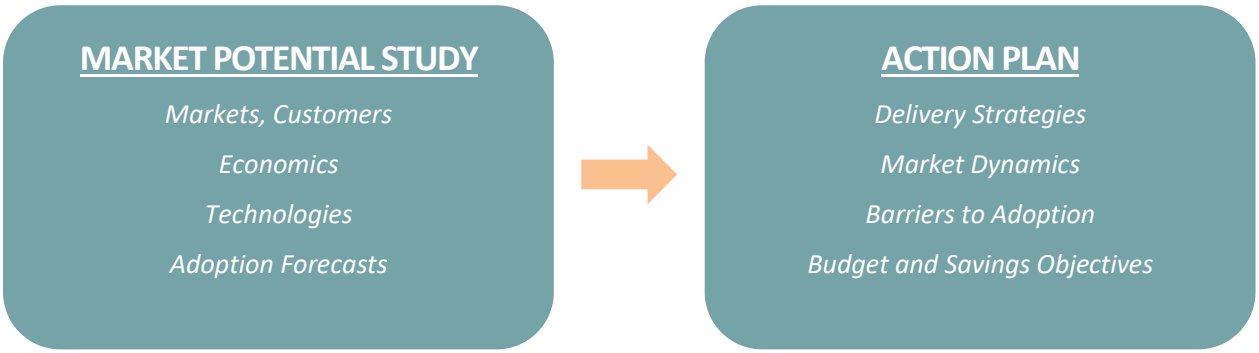
CenterPoint Indiana's DSM Action Plan was developed in accordance with a number of guiding principles and considerations. The process was built on using the most recent Market Potential Study as the foundation, and was then designed to incorporate industry best standards, implementer experiences, and projected changes in the market (such as codes and standards) in order to translate the insights and knowledge from the Market Potential Study into actionable energy efficiency programs for CenterPoint Indiana's planning purposes and customers.[12] Key planning guidelines and considerations used to frame the Action Plan are listed in Table 5-1 below.

TABLE 5-1: KEY PLANNING GUIDELINES IN DEVELOPING THE ACTION PLAN

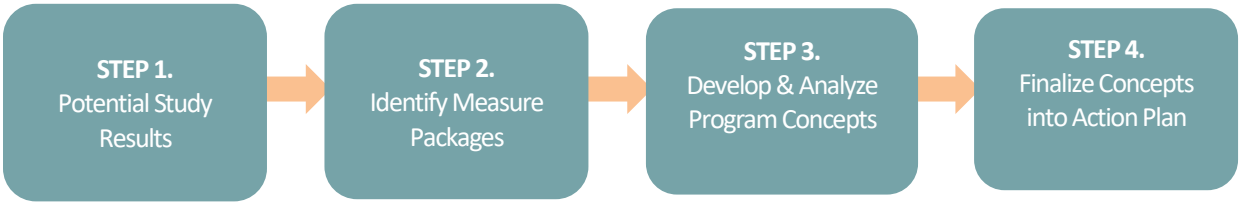
Plan Consideration	Description
Market Coverage	Consideration was given to crafting a portfolio of programs that offers opportunities for savings across all CenterPoint Indiana's customer groups.
Market Potential Study	The Action Plan is linked to the Market Potential Study.
Current Program Efforts	The Action Plan leverages current CenterPoint Indiana offerings to take advantage of market and trade ally understanding, to utilize existing market relationships, retain the relevant elements of programs already working well, and to continue promotional efforts.
Cost Effectiveness Analysis	All programs were screened for cost-effectiveness using the TRC test (except for the Income Qualified program)
Income-Qualified Programs	Program funding is linked to the Market Potential Study.
Program Costs and Budgets	A budget that characterizes the estimated costs for delivering programs to customers is presented for each program. The costs include all participant incentive, implementation, admin, and evaluation costs for each year of program operation.

The development of the Action Plan is designed to translate the insights and information from the broader Market Potential Study analysis into discrete and specific offerings for CenterPoint Indiana's customers. The Market Potential Study and the Action Plan are related and share common values, but the Action Plan provides more detail, specificity, and mobilization strategies. The Action Plan outlines recommended gas programs for 2025-2030, a shorter timeframe than the potential research. The Action Plan lays out how to achieve the savings uncovered in the potential study research, shifting the broad and high-level forecast of savings opportunities in the Market Potential Study results into specific and actionable savings opportunities. An illustrative view between the Market Potential Study and the Action Plan elements follows:

[12] The DSM Action Plan represents modified versions of the RAP from the MPS. The residential sector includes minor modifications to better align program measure mapping with current CenterPoint Indiana offerings. The C&I sector is a slightly enhanced version of RAP and yields approximately 8% higher savings and 24% higher costs over the DSM Action Plan timeframe.



The effort to develop CenterPoint Indiana's energy efficiency programs follows a grounded and sequential process. The process was built on applying the recent market potential analytics as a starting point and, from there, developing program offerings that cost-effectively meet CenterPoint Indiana's planning and program objectives. An illustrative review of the process follows.



5.3 DSM ACTION PLAN – PORTFOLIO SUMMARY

Figure 5-1 below provides an overview of the savings and budgets. The annual savings range from approximately 36,000 MWh to nearly 44,000 MWh with annual budgets ranging from $13.9 million to $17.9 million.

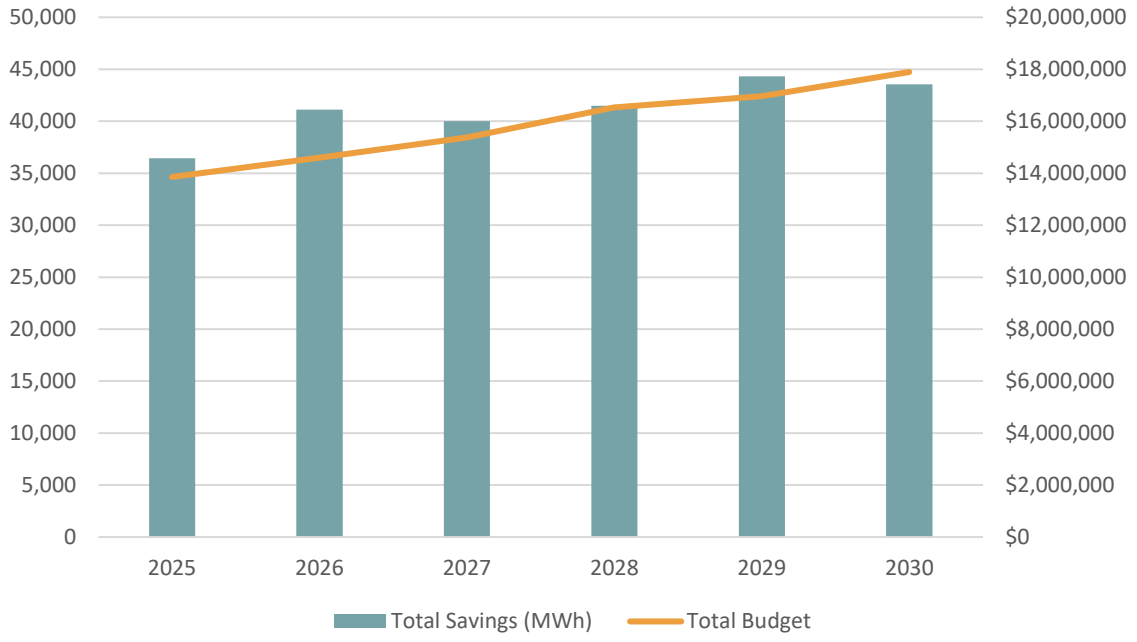


FIGURE 5-1: ANNUAL SAVINGS (MWH) AND BUDGET (2025-2030)

Table 5-2 below provides additional savings and budget detail by sector, as well as detailed indirect costs.13 The residential sector accounts for approximately 40% of total savings and 50% of total spending.

TABLE 5-2: ANNUAL SAVINGS AND BUDGET DETAIL BY SECTOR (2025-2030)

	2025	2026	2027	2028	2029	2030
Residential Savings (MWh)	16,131	17,446	16,895	17,052	18,331	17,624
C&I Savings (MWh)	20,305	23,659	23,121	24,420	25,985	25,915
Total Savings (MWh)	***36,436***	***41,105***	***40,016***	***41,472***	***44,316***	***43,538***
Residential Budget	$6,743,571	$7,259,632	$7,715,562	$8,160,427	$8,731,718	$9,194,431
C&I Budget	$5,489,577	$5,955,173	$6,221,726	$6,582,211	$6,693,151	$7,097,700
Outreach & Education	$561,116	$572,338	$583,785	$595,461	$607,370	$619,517
Contact Center	$69,842	$71,239	$72,664	$74,117	$75,599	$77,111
Online Audit	$47,571	$48,523	$49,493	$50,483	$51,493	$52,523
Evaluation	$645,584	$695,345	$732,161	$773,135	$807,967	$852,064
Market Potential Study	$300,000	$0	$0	$300,000	$0	$0
Total Budget	***$13,857,261***	***$14,602,251***	***$15,375,391***	***$16,535,833***	***$16,967,297***	***$17,893,346***

Table 5-3 below provides additional savings and budget detail by sector. Annual budgets range from $13.9 million to $17.9 million from 2025-2030. Incentives are the greatest expenditure by category, followed by delivery and implementation, indirect costs, and administrative costs. Refer to Chapter 6 for additional detail.

TABLE 5-3: ANNUAL BUDGET DETAIL BY SECTOR AND SPENDING CATEGORY (2025-2030)

	2025	2026	2027	2028	2029	2030
Residential						
Incentives	$3,675,161	$3,975,275	$4,164,544	$4,349,463	$4,506,756	$4,714,800
Delivery & Implementation	$2,637,032	$2,829,665	$3,073,741	$3,311,780	$3,691,705	$3,924,052
Admin	$431,378	$454,692	$477,276	$499,184	$533,257	$555,579
Residential Budget	**$6,743,571**	**$7,259,632**	**$7,715,562**	**$8,160,427**	**$8,731,718**	**$9,194,431**
Commercial						
Incentives	$3,172,801	$3,341,490	$3,408,169	$3,492,443	$3,452,667	$3,532,609
Delivery & Implementation	$1,865,199	$2,102,724	$2,262,624	$2,483,593	$2,604,165	$2,863,851
Admin	$451,577	$510,959	$550,934	$606,176	$636,319	$701,240
Commercial Budget	**$5,489,577**	**$5,955,173**	**$6,221,726**	**$6,582,211**	**$6,693,151**	**$7,097,700**
All Sectors						
Incentives	$6,847,962	$7,316,766	$7,572,713	$7,841,906	$7,959,423	$8,247,408
Delivery & Implementation	$4,502,231	$4,932,389	$5,336,365	$5,795,373	$6,295,870	$6,787,903
Admin	$882,955	$965,651	$1,028,210	$1,105,359	$1,169,576	$1,256,820
Indirect	$1,624,113	$1,387,445	$1,438,103	$1,793,195	$1,542,428	$1,601,215
Total Budget	**$13,857,261**	**$14,602,251**	**$15,375,391**	**$16,535,833**	**$16,967,297**	**$17,893,346**

[13] Indirect costs include outreach and education, contact center, online audit, and evaluation.

5.4 PORTFOLIO TARGETS BY YEAR

The following tables present the portfolio participation, savings, and costs targets by each program year.

TABLE 5-4: 2025 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	2,952	620,886	297	$357,897	$114,419	$18,533	$490,848
Residential Midstream	1,963	1,271,863	581	$581,774	$518,820	$21,054	$1,121,647
Residential Marketplace	14,856	2,625,568	1,330	$1,082,814	$2,883	$37,474	$1,123,170
Residential Instant Rebate	2,319	810,272	48	$32,214	$68,091	$29,848	$130,153
Residential New Construction	209	76,496	43	$75,549	$14,912	$2,415	$92,876
Community Connections	1,767	311,197	203	$126,464	$118,236	$6,223	$250,923
Income Qualified Weatherization	2,413	443,552	303	$588,184	$191,509	$10,079	$789,772
Residential Behavioral	40,002	7,678,859	2,098	$908	$294,627	$116,300	$411,835
Appliance Recycling	1,071	671,801	86	$49,162	$157,115	$7,585	$213,861
Residential Emerging Markets Pilot	17,539	1,620,646	618	$401,918	$249,265	$40,374	$691,556
CVR – Residential	0	0	0	$0	$256,228	$12,843	$269,071
Smart Cycle	2,841	0	3	$56,811	$265,231	$74,359	$396,400
Bring Your Own Thermostat	8,242	0	8	$321,468	$401,120	$55,000	$777,588
Residential Subtotal	***96,174***	***16,131,139***	***5,618***	***$3,675,161***	***$2,652,455***	***$432,086***	***$6,759,702***
Commercial & Industrial							
Commercial Prescriptive	21,079	9,943,108	2,741	$1,280,711	$651,371	$162,843	$2,094,925
Commercial Custom	78	6,394,169	1,150	$685,440	$641,012	$160,253	$1,486,705
Small Business Energy Solutions	15,628	3,967,243	864	$1,206,650	$320,354	$80,089	$1,607,092
CVR – Commercial	0	0	0	$0	$230,723	$51,371	$282,094
Commercial & Industrial Subtotal	***36,786***	***20,304,520***	***4,755***	***$3,172,801***	***$1,843,460***	***$454,556***	***$5,470,817***
Indirect Costs							
Contact Center							$69,842
Online Audit							$47,571
Outreach							$561,116
Indirect Costs Subtotal							***$678,529***
Other Costs							
Evaluation							$645,452
Market Potential Study							$300,000
Other Costs Subtotal							**$945,452**
DSM Portfolio Totals	**132,960**	**36,435,659**	**10,372**	**$6,847,962**	**$4,495,915**	**$886,642**	**$13,854,500**

TABLE 5-5: 2026 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	4,165	867,546	426	$507,931	$164,793	$26,692	$699,416
Residential Midstream	2,183	1,413,437	641	$643,888	$589,298	$23,914	$1,257,099
Residential Marketplace	15,029	2,505,155	1,339	$1,064,098	$2,843	$36,956	$1,103,896
Residential Instant Rebate	2,791	958,708	60	$38,486	$82,541	$36,182	$157,209
Residential New Construction	214	78,830	45	$80,517	$15,912	$2,577	$99,006
Community Connections	1,917	352,995	243	$154,431	$138,056	$7,266	$299,752
Income Qualified Weatherization	3,565	441,355	294	$601,877	$195,757	$10,303	$807,937
Residential Behavioral	47,304	7,596,136	2,062	$1,045	$301,284	$118,928	$421,257
Appliance Recycling	1,071	671,801	86	$49,162	$160,728	$7,759	$217,649
Residential Emerging Markets Pilot	18,402	1,754,890	694	$453,040	$269,711	$43,686	$766,437
CVR – Residential	5,097	1,328,231	1,011	$0	$344,113	$13,228	$357,341
Smart Cycle	3,151	0	3	$63,024	$233,406	$72,085	$368,515
Bring Your Own Thermostat	9,824	0	9	$317,778	$434,529	$56,210	$808,517
Residential Subtotal	***114,713***	***17,969,082***	***6,912***	***$3,975,275***	***$2,932,971***	***$455,786***	***$7,364,032***
Commercial & Industrial							
Commercial Prescriptive	21,977	10,326,534	2,962	$1,341,984	$696,126	$174,031	$2,212,141
Commercial Custom	97	7,977,395	1,455	$862,774	$828,242	$207,061	$1,898,077
Small Business Energy Solutions	15,458	3,931,082	866	$1,136,732	$325,895	$81,474	$1,544,101
CVR – Commercial	674	524,327	284	$0	$250,466	$52,913	$303,378
Commercial & Industrial Subtotal	***38,206***	***22,759,338***	***5,567***	***$3,341,490***	***$2,100,729***	***$515,478***	***$5,957,698***
Indirect Costs							
Contact Center							$71,239
Online Audit							$48,523
Outreach							$572,338
Indirect Costs Subtotal							***$692,100***
Other Costs							
Evaluation							$700,691
Market Potential Study							$0
Other Costs Subtotal							**$700,691**
DSM Portfolio Totals	**152,919**	**40,728,420**	**12,479**	**$7,316,766**	**$5,033,700**	**$971,264**	**$14,714,521**

TABLE 5-6: 2027 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	4,530	952,995	464	$563,775	$187,049	$30,297	$781,121
Residential Midstream	2,378	1,537,465	693	$698,268	$655,200	$26,588	$1,380,055
Residential Marketplace	14,752	2,331,078	1,279	$1,002,954	$2,728	$35,467	$1,041,149
Residential Instant Rebate	3,258	1,109,820	73	$46,810	$97,957	$42,940	$187,708
Residential New Construction	213	79,310	44	$84,389	$16,620	$2,692	$103,701
Community Connections	2,130	412,859	317	$204,697	$166,521	$8,764	$379,982
Income Qualified Weatherization	4,421	470,929	315	$600,050	$215,146	$11,323	$826,520
Residential Behavioral	52,064	7,511,612	2,024	$1,200	$308,079	$121,610	$430,889
Appliance Recycling	1,071	671,801	86	$49,162	$164,425	$7,938	$221,525
Residential Emerging Markets Pilot	18,620	1,817,360	741	$491,068	$286,238	$46,362	$823,668
CVR – Residential	0	0	0	$0	$384,236	$13,625	$397,861
Smart Cycle	3,463	0	3	$69,253	$238,955	$73,713	$381,922
Bring Your Own Thermostat	11,415	0	11	$352,919	$494,016	$57,447	$904,382
Residential Subtotal	***118,313***	***16,895,229***	***6,050***	***$4,164,544***	***$3,217,171***	***$478,766***	***$7,860,482***
Commercial & Industrial							
Commercial Prescriptive	21,719	10,288,046	3,066	$1,364,528	$713,802	$178,451	$2,256,781
Commercial Custom	110	9,072,627	1,664	$1,000,185	$976,000	$244,000	$2,220,185
Small Business Energy Solutions	14,774	3,760,299	836	$1,043,455	$320,361	$80,090	$1,443,906
CVR – Commercial	0	0	0	$0	$283,279	$54,500	$337,779
Commercial & Industrial Subtotal	***36,603***	***23,120,971***	***5,566***	***$3,408,169***	***$2,293,443***	***$557,041***	***$6,258,652***
Indirect Costs							
Contact Center							$72,664
Online Audit							$49,493
Outreach							$583,785
Indirect Costs Subtotal							***$705,942***
Other Costs							
Evaluation							$741,254
Market Potential Study							$0
Other Costs Subtotal							**$741,254**
DSM Portfolio Totals	**154,916**	**40,016,201**	**11,616**	**$7,572,713**	**$5,510,614**	**$1,035,807**	**$15,566,329**

TABLE 5-7: 2028 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	4,935	1,078,993	518	$661,776	$219,726	$35,589	$917,092
Residential Midstream	2,543	1,642,378	737	$744,124	$715,480	$29,034	$1,488,638
Residential Marketplace	13,962	2,105,012	1,162	$905,489	$2,536	$32,964	$940,988
Residential Instant Rebate	3,664	1,248,210	86	$57,485	$113,045	$49,554	$220,084
Residential New Construction	214	81,828	44	$89,620	$17,794	$2,882	$110,296
Community Connections	2,327	464,194	389	$255,186	$193,291	$10,173	$458,650
Income Qualified Weatherization	4,988	489,101	319	$603,539	$229,891	$12,100	$845,530
Residential Behavioral	56,315	7,427,133	1,985	$1,368	$315,021	$124,350	$440,739
Appliance Recycling	1,071	671,801	86	$49,162	$168,207	$8,120	$225,489
Residential Emerging Markets Pilot	18,273	1,843,573	771	$517,969	$297,512	$48,189	$863,671
CVR – Residential	0	0	0	$0	$376,075	$14,034	$390,109
Smart Cycle	3,775	0	3	$75,501	$244,672	$75,383	$395,556
Bring Your Own Thermostat	13,013	0	12	$388,244	$553,799	$58,710	$1,000,753
Residential Subtotal	***125,081***	***17,052,221***	***6,111***	***$4,349,463***	***$3,447,049***	***$501,082***	***$8,297,594***
Commercial & Industrial							
Commercial Prescriptive	20,727	10,153,038	3,247	$1,375,613	$726,184	$181,546	$2,283,343
Commercial Custom	131	10,798,876	1,996	$1,180,522	$1,200,377	$300,094	$2,680,993
Small Business Energy Solutions	13,610	3,467,768	774	$936,308	$304,571	$76,143	$1,317,021
CVR – Commercial	0	0	0	$0	$275,063	$56,135	$331,198
Commercial & Industrial Subtotal	***34,468***	***24,419,682***	***6,016***	***$3,492,443***	***$2,506,194***	***$613,918***	***$6,612,555***
Indirect Costs							
Contact Center							$74,117
Online Audit							$50,483
Outreach							$595,461
Indirect Costs Subtotal							***$720,061***
Other Costs							
Evaluation							$781,510
Market Potential Study							$300,000
Other Costs Subtotal							**$1,081,510**
DSM Portfolio Totals	**159,550**	**41,471,903**	**12,127**	**$7,841,906**	**$5,953,243**	**$1,115,000**	**$16,711,720**

TABLE 5-8: 2029 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	5,290	1,217,625	568	$774,602	$256,963	$41,621	$1,073,186
Residential Midstream	2,679	1,728,605	772	$781,583	$769,891	$31,242	$1,582,716
Residential Marketplace	11,775	1,592,209	1,007	$738,591	$2,006	$26,073	$766,669
Residential Instant Rebate	3,955	1,358,296	99	$70,726	$126,389	$55,404	$252,519
Residential New Construction	226	89,105	46	$101,276	$20,150	$3,264	$124,689
Community Connections	3,666	647,368	477	$311,507	$276,051	$14,529	$602,087
Income Qualified Weatherization	6,011	516,760	338	$602,056	$249,775	$13,146	$864,977
Residential Behavioral	60,043	7,342,957	1,945	$1,540	$322,122	$127,153	$450,815
Appliance Recycling	1,071	671,801	86	$49,162	$172,076	$8,307	$229,544
Residential Emerging Markets Pilot	21,302	2,360,975	875	$569,952	$390,532	$63,255	$1,023,739
CVR – Residential	3,182	554,744	422	$0	$410,842	$14,455	$425,297
Smart Cycle	4,089	0	4	$81,780	$250,874	$77,126	$409,780
Bring Your Own Thermostat	14,621	0	13	$423,983	$614,070	$60,002	$1,098,055
Residential Subtotal	***137,910***	***18,080,443***	***6,654***	***$4,506,756***	***$3,861,741***	***$535,577***	***$8,904,074***
Commercial & Industrial							
Commercial Prescriptive	19,243	9,639,114	3,198	$1,337,248	$710,428	$177,607	$2,225,284
Commercial Custom	143	11,834,726	2,159	$1,296,488	$1,360,806	$340,201	$2,997,495
Small Business Energy Solutions	12,093	3,087,629	697	$818,931	$280,470	$70,117	$1,169,518
CVR – Commercial	713	988,633	606	$0	$348,106	$57,819	$405,925
Commercial & Industrial Subtotal	***32,192***	***25,550,102***	***6,659***	***$3,452,667***	***$2,699,810***	***$645,745***	***$6,798,222***
Indirect Costs							
Contact Center							$75,599
Online Audit							$51,493
Outreach							$607,370
Indirect Costs Subtotal							***$734,462***
Other Costs							
Evaluation							$821,838
Market Potential Study							$0
Other Costs Subtotal							**$821,838**
DSM Portfolio Totals	**170,103**	**43,630,545**	**13,313**	**$7,959,423**	**$6,561,550**	**$1,181,322**	**$17,258,595**

TABLE 5-9: 2030 PORTFOLIO TARGETS

	Participants	Energy Savings (kWh)	Demand Savings (kW)	Incentives	Implementation	Admin	Total Budget
Residential							
Residential Prescriptive	6,668	1,441,958	747	$924,015	$313,462	$50,772	$1,288,249
Residential Midstream	2,787	1,798,099	800	$811,400	$818,866	$33,229	$1,663,495
Residential Marketplace	10,469	1,383,030	839	$621,958	$1,782	$23,170	$646,910
Residential Instant Rebate	4,095	1,430,293	111	$86,634	$136,968	$60,041	$283,642
Residential New Construction	250	102,512	51	$121,111	$24,121	$3,907	$149,139
Community Connections	3,744	662,572	518	$342,823	$291,315	$15,332	$649,470
Income Qualified Weatherization	7,770	524,654	345	$610,567	$260,589	$13,715	$884,871
Residential Behavioral	63,262	7,262,069	1,908	$1,707	$329,396	$130,025	$461,127
Appliance Recycling	1,071	671,801	86	$49,162	$176,033	$8,498	$233,693
Residential Emerging Markets Pilot	23,692	2,346,687	1,058	$597,049	$398,097	$64,480	$1,059,626
CVR – Residential	0	0	0	$0	$448,682	$14,888	$463,571
Smart Cycle	4,405	0	4	$88,105	$257,641	$78,953	$424,698
Bring Your Own Thermostat	16,241	0	15	$460,270	$674,977	$61,322	$1,196,570
Residential Subtotal	***144,454***	***17,623,675***	***6,481***	***$4,714,800***	***$4,131,928***	***$558,333***	***$9,405,060***
Commercial & Industrial							
Commercial Prescriptive	18,138	9,291,629	3,129	$1,289,422	$704,462	$176,115	$2,169,999
Commercial Custom	167	13,937,265	2,500	$1,519,017	$1,651,219	$412,805	$3,583,041
Small Business Energy Solutions	10,412	2,685,738	608	$724,170	$255,709	$63,927	$1,043,806
CVR – Commercial	0	0	0	$0	$382,901	$59,554	$442,455
Commercial & Industrial Subtotal	***28,718***	***25,914,632***	***6,238***	***$3,532,609***	***$2,994,291***	***$712,401***	***$7,239,301***
Indirect Costs							
Contact Center							$77,111
Online Audit							$52,523
Outreach							$619,517
Indirect Costs Subtotal							***$749,151***
Other Costs							
Evaluation							$869,676
Market Potential Study							$0
Other Costs Subtotal							**$869,676**
DSM Portfolio Totals	**173,172**	**43,538,308**	**12,718**	**$8,247,408**	**$7,126,220**	**$1,270,734**	**$18,263,188**

6 Action Plan Program Detail

The 2025-2030 Action Plan is built from currently offered existing programs by CenterPoint Indiana to its electric customers. The programs in the 2025-2030 Action Plan include:

Residential Programs:

- Residential Prescriptive Program (Prescriptive, Midstream, Marketplace, Instant Rebates)
- Residential New Construction Program
- Income Qualified Weatherization
- Community Connections
- Residential Behavior Savings Program
- Appliance Recycling
- Bring Your Own Thermostat (BYOT)
- Smart Cycle
- Residential Emerging Markets Program
- Conservation Voltage Reduction

Business Programs

- Commercial Prescriptive (Rx) Rebates Program
- Commercial Small Business Energy Solutions (SBES) Program
- Commercial Custom Program

6.1 RESIDENTIAL PRESCRIPTIVE PROGRAM

Program Description: The program includes the Residential Prescriptive, Residential Midstream, Online Marketplace, and Instant Rebates pathways (each is a separate program under the Residential Prescriptive Program umbrella). The program is designed to incent customers to purchase energy efficient equipment by covering part of the incremental cost. The program also offers home weatherization rebates to residential customers for attic insulation.

The following tables indicate the measures in each of the programs, along with average incentives, and savings per unit.

TABLE 6-1: RESIDENITAL PRESCRIPTIVE PROGRAM MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Wifi Thermostat	$41.15	207.1	0.00
Smart Thermostat	$61.84	216.7	0.00
Attic Insulation	$445.51	636.3	0.24
ENERGY STAR Dehumidifier	$35.00	134.4	0.03
AC Tune Up	$25.00	74.2	0.12
ASHP Tune Up	$50.00	239.8	0.12
ENERGY STAR Clothes Washer	$50.00	157.6	0.02
Duct Sealing	$240.00	105.1	0.15
Wall Insulation	$450.00	610.2	0.05
Heat Pump Water Heater	$500.00	1,543.7	0.21

TABLE 6-2: RESIDENITAL MIDSTREAM PROGRAM MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Air Source Heat Pump 16 SEER	$200.00	4,037.8	0.14
Air Source Heat Pump 17 SEER	$300.00	3,939.7	0.20

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Air Source Heat Pump 18 SEER	$400.00	3,864.7	0.25
Air Source Heat Pump 21 SEER	$400.00	3,804.2	0.38
Central Air Conditioner 15 SEER	$200.00	110.5	0.12
Central Air Conditioner 16 SEER	$200.00	214.6	0.23
Central Air Conditioner 17 SEER	$300.00	292.4	0.32
Central Air Conditioner 18 SEER	$400.00	368.2	0.40
Ductless Heat Pump 17 SEER 9.5 HSPF	$373.02	3,621.3	0.29
Ductless Heat Pump 19 SEER 9.5 HSPF	$357.08	3,316.5	0.44
Ductless Heat Pump 21 SEER 10.0 HSPF	$536.63	3,791.6	0.58
Ductless Heat Pump 23 SEER 10.0 HSPF	$566.55	3,615.7	0.67

TABLE 6-3: RESIDENITAL MARKETPLACE PROGRAM MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
ENERGY STAR Air Purifier	$50.00	303.0	0.03
ENERGY STAR Dehumidifier	$35.00	206.2	0.05
Smart Thermostat	$61.84	274.3	0.00
Wifi Thermostat	$41.15	262.2	0.00
Air Sealing	$200.00	273.1	0.28
Kitchen Faucet Aerator 1.5 gpm	$1.25	141.3	0.01
Bathroom Aerator 1.0 gpm	$1.25	35.5	0.00

TABLE 6-4: RESIDENITAL INSTANT REBATE PROGRAM MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
ENERGY STAR Dehumidifier	$35.00	170.8	0.04
Smart Thermostat	$75.00	825.7	0.00
Heat Pump Water Heater	$500.00	2,389.2	0.33
Low Flow Showerhead 1.5 gpm	$1.25	321.1	0.01

Eligible Customers: The program is available to all residential customers located in the CenterPoint Indiana electric service territory. For the equipment rebates, the applicant must reside in a single-family home or multi-family complex with up to 12 units. Only single-family homes are eligible for insulation measures.

Marketing: The marketing plan includes program specific marketing materials that will target contractors and trade allies in the Heating, Ventilation and Air Conditioning (HVAC) industry. The HVAC industry will be marketed by using targeted direct marketing, direct contact by the program vendor personnel, trade shows and trade association outreach. The program will be promoted through trade allies, distributors, manufacturers, industry organizations and appropriate retail outlets. CenterPoint Indiana will also use web banners, bill inserts, and mass market advertising. Program marketing directs customers and contractors to the CenterPoint Indiana website or call center for information.

The Midstream marketing plan will target distributors through direct outreach to contractor trade networks. Co-branded materials will be available to participating distributors to draw attention to, and provide education on, the HVAC measures within the program. Fact Sheets will also be created to keep the program top of mind.

The program implementation contractor will provide program approved verbiage for email blast content for distributors to promote the program to their contractors.

Program Delivery Channels: CenterPoint Indiana will oversee the program and will partner with a program implementation contractor for the Prescriptive and Midstream pathways. CenterPoint Indiana will also oversee Marketplace and Instant Rebates and will partner with a program implementation contractor. Vendors will work with local contractors to deliver the program.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets: The following four tables provide the measure-level annual participation, incentive budget, and savings for each program under the Residential Prescriptive program umbrella. The fifth table provides program-level budget summaries and a total for the Residential Prescriptive program, with all four pathways aggregated.

TABLE 6-5: RESIDENTIAL PRESCRIPTIVE PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Wifi Thermostat						
Participation	509	671	671	636	572	492
Incentive Budget	$20,926	$27,609	$27,609	$26,158	$23,544	$20,234
Projected kWh Savings	105,326	138,965	138,965	131,658	118,504	101,844
Projected kW Savings	0	0	0	0	0	0
Smart Thermostat						
Participation	319	420	420	398	358	308
Incentive Budget	$19,700	$25,992	$25,992	$24,625	$22,165	$19,049
Projected kWh Savings	69,026	91,071	91,071	86,283	77,662	66,744
Projected kW Savings	0	0	0	0	0	0
Attic Insulation						
Participation	374	503	561	694	838	973
Incentive Budget	$167,557	$226,755	$251,636	$305,942	$371,187	$433,217
Projected kWh Savings	246,891	330,498	361,820	436,536	525,109	607,654
Projected kW Savings	94	126	137	169	202	233
ENERGY STAR Dehumidifier						
Participation	53	90	122	163	217	284
Incentive Budget	1,861	3,162	4,267	5,717	7,591	9,952
Projected kWh Savings	7,167	12,160	16,390	21,941	29,120	38,179
Projected kW Savings	2	3	4	5	7	9
AC Tune Up						
Participation	1,037	1,440	1,520	1,520	1,440	2,283
Incentive Budget	25,915	35,990	37,988	37,988	35,990	57,063
Projected kWh Savings	76,956	106,872	112,804	112,804	106,872	169,447
Projected kW Savings	125	174	184	184	174	276
ASHP Tune Up						
Participation	37	57	69	80	89	129
Incentive Budget	1,825	2,856	3,458	4,024	4,471	6,456
Projected kWh Savings	8,753	13,694	16,583	19,295	21,437	30,959
Projected kW Savings	4	7	8	9	10	15

Measure	2025	2026	2027	2028	2029	2030
ENERGY STAR Clothes Washer						
Participation	186	314	420	556	728	937
Incentive Budget	9,299	15,689	20,984	27,794	36,376	46,866
Projected kWh Savings	29,304	49,441	66,124	87,585	114,629	147,685
Projected kW Savings	4	7	9	12	16	20
Duct Sealing						
Participation	417	634	700	824	964	1,152
Incentive Budget	100,176	152,080	168,085	197,821	231,348	276,426
Projected kWh Savings	44,005	69,267	75,896	86,562	98,982	118,312
Projected kW Savings	62	102	112	125	142	171
Wall Insulation						
Participation	2	2	2	3	3	4
Incentive Budget	682	913	1,005	1,258	1,523	1,773
Projected kWh Savings	952	1,262	1,376	1,706	2,046	2,358
Projected kW Savings	0	0	0	0	0	0
Heat Pump Water Heater						
Participation	20	34	46	61	81	106
Incentive Budget	$9,956	$16,886	$22,751	$30,449	$40,408	$52,979
Projected kWh Savings	32,507	54,315	71,967	94,624	123,264	158,776
Projected kW Savings	4	7	10	13	17	22

TABLE 6-6: RESIDENTIAL MIDSTREAM PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Air Source Heat Pump 16 SEER						
Participation	19	21	23	24	26	26
Incentive Budget	$3,828	$4,235	$4,584	$4,872	$5,103	$5,282
Projected kWh Savings	77,288	85,493	92,544	98,367	103,019	106,640
Projected kW Savings	3	3	3	4	4	4
Air Source Heat Pump 17 SEER						
Participation	15	16	18	19	20	20
Incentive Budget	$4,392	$4,859	$5,259	$5,590	$5,855	$6,060
Projected kWh Savings	57,680	63,803	69,066	73,411	76,884	79,585
Projected kW Savings	3	3	3	4	4	4
Air Source Heat Pump 18 SEER						
Participation	13	15	16	17	18	18
Incentive Budget	$5,289	$5,851	$6,333	$6,732	$7,050	$7,298
Projected kWh Savings	51,102	56,527	61,189	65,040	68,116	70,509
Projected kW Savings	3	4	4	4	4	5
Air Source Heat Pump 21 SEER						
Participation	17	19	20	21	23	23
Incentive Budget	$6,753	$7,470	$8,086	$8,595	$9,001	$9,318
Projected kWh Savings	64,226	71,044	76,903	81,742	85,608	88,616
Projected kW Savings	6	7	8	8	9	9

Measure	2025	2026	2027	2028	2029	2030
Central Air Conditioner 15 SEER						
Participation	351	409	464	513	555	590
Incentive Budget	$70,274	$81,822	$92,762	$102,609	$111,072	$118,061
Projected kWh Savings	38,811	45,189	51,231	56,669	61,343	65,203
Projected kW Savings	43	49	56	62	67	71
Central Air Conditioner 16 SEER						
Participation	423	480	531	575	611	640
Incentive Budget	$84,671	$95,993	$106,183	$114,940	$122,173	$127,951
Projected kWh Savings	90,863	103,012	113,948	123,346	131,107	137,308
Projected kW Savings	98	111	123	133	141	148
Central Air Conditioner 17 SEER						
Participation	495	536	570	597	618	634
Incentive Budget	$148,538	$160,789	$170,906	$178,989	$185,279	$190,073
Projected kWh Savings	144,768	156,708	166,568	174,446	180,576	185,249
Projected kW Savings	159	172	182	191	198	203
Central Air Conditioner 18 SEER						
Participation	468	506	538	563	583	598
Incentive Budget	$187,048	$202,475	$215,215	$225,394	$233,314	$239,351
Projected kWh Savings	172,172	186,373	198,099	207,469	214,759	220,316
Projected kW Savings	189	204	217	227	235	241
Ductless Heat Pump 17 SEER 9.5 HSPF						
Participation	38	43	47	51	54	57
Incentive Budget	$13,879	$15,791	$17,537	$19,070	$20,375	$21,461
Projected kWh Savings	139,076	156,049	171,151	184,157	195,065	204,081
Projected kW Savings	11	12	14	15	16	16
Ductless Heat Pump 19 SEER 9.5 HSPF						
Participation	49	55	61	66	70	73
Incentive Budget	$17,186	$19,550	$21,707	$23,600	$25,212	$26,557
Projected kWh Savings	164,514	184,677	202,627	218,095	231,077	241,819
Projected kW Savings	21	24	27	29	30	32
Ductless Heat Pump 21 SEER 10.0 HSPF						
Participation	36	41	44	48	50	53
Incentive Budget	$19,016	$21,473	$23,693	$25,626	$27,266	$28,632
Projected kWh Savings	135,679	152,580	167,702	180,787	191,806	200,940
Projected kW Savings	21	23	26	27	29	30
Ductless Heat Pump 23 SEER 10.0 HSPF						
Participation	38	42	46	49	52	54
Incentive Budget	$20,898	$23,582	$26,003	$28,106	$29,884	$31,356
Projected kWh Savings	135,682	151,982	166,436	178,850	189,245	197,832
Projected kW Savings	25	28	31	33	35	37

TABLE 6-7: RESIDENTIAL MARKETPLACE PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
ENERGY STAR Air Purifier						
Participation	210	238	264	286	304	320
Incentive Budget	$10,507	$11,918	$13,190	$14,291	$15,216	$15,979
Projected kWh Savings	63,674	72,225	79,934	86,606	92,210	96,832
Projected kW Savings	7	8	9	10	11	11
ENERGY STAR Dehumidifier						
Participation	5	6	7	9	11	14
Incentive Budget	$178	$215	$253	$302	$376	$486
Projected kWh Savings	1,048	1,266	1,489	1,778	2,214	2,865
Projected kW Savings	0	0	0	0	1	1
Smart Thermostat						
Participation	1,159	884	663	491	0	0
Incentive Budget	$71,690	$54,641	$40,994	$30,393	$0	$0
Projected kWh Savings	317,965	242,349	181,821	134,801	0	0
Projected kW Savings	0	0	0	0	0	0
Wifi Thermostat						
Participation	1,850	1,410	1,058	785	0	0
Incentive Budget	$76,152	$58,042	$43,546	$32,285	$0	$0
Projected kWh Savings	485,179	369,797	277,439	205,691	0	0
Projected kW Savings	0	0	0	0	0	0
Low Flow Showerhead 1.5 gpm						
Participation	4,577	4,647	4,473	4,089	3,566	2,983
Incentive Budget	$915,468	$929,477	$894,612	$817,840	$713,130	$596,552
Projected kWh Savings	1,275,899	1,283,838	1,224,406	1,109,050	958,519	794,668
Projected kW Savings	1,294	1,300	1,237	1,118	965	799
Kitchen Faucet Aerator 1.5 gpm						
Participation	2,188	2,432	2,570	2,575	2,449	2,220
Incentive Budget	$2,735	$3,041	$3,213	$3,219	$3,061	$2,774
Projected kWh Savings	309,069	343,627	363,074	363,787	345,966	313,552
Projected kW Savings	15	17	18	18	17	16
Bathroom Aerator 1.0 gpm						
Participation	4,866	5,411	5,717	5,727	5,446	4,933
Incentive Budget	$6,083	$6,763	$7,146	$7,159	$6,807	$6,167
Projected kWh Savings	172,734	192,053	202,915	203,300	193,300	175,113
Projected kW Savings	13	14	15	15	14	13

TABLE 6-8: RESIDENTIAL INSTANT REBATE PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
ENERGY STAR Dehumidifier						
Participation	274	352	443	545	652	759
Incentive Budget	$9,574	$12,322	$15,521	$19,074	$22,825	$26,575
Projected kWh Savings	46,721	60,135	75,743	93,084	111,387	129,690
Projected kW Savings	11	14	17	21	25	29

Measure	2025	2026	2027	2028	2029	2030
Smart Thermostat						
Participation	101	80	63	48	36	26
Incentive Budget	$7,541	$6,025	$4,688	$3,573	$2,681	$1,987
Projected kWh Savings	83,023	66,334	51,615	39,340	29,515	21,882
Projected kW Savings	0	0	0	0	0	0
Heat Pump Water Heater						
Participation	25	34	46	62	82	108
Incentive Budget	$12,700	$17,233	$23,219	$31,076	$41,239	$54,069
Projected kWh Savings	64,128	85,721	113,579	149,337	194,538	250,584
Projected kW Savings	9	12	16	20	27	34
Low Flow Showerhead 1.5 gpm						
Participation	1,919	2,325	2,706	3,009	3,185	3,201
Incentive Budget	$2,399	$2,906	$3,382	$3,762	$3,981	$4,002
Projected kWh Savings	616,399	746,518	868,883	966,449	1,022,856	1,028,137
Projected kW Savings	28	34	40	45	47	47

TABLE 6-9: RESIDENTIAL PRESCRIPTIVE PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Prescriptive						
Incentives	$357,897	$507,931	$563,775	$661,776	$774,602	$924,015
Delivery & Implementation	$114,419	$164,793	$187,049	$219,726	$256,963	$313,462
Admin	$18,533	$26,692	$30,297	$35,589	$41,621	$50,772
Total Budget	**$490,848**	**$699,416**	**$781,121**	**$917,092**	**$1,073,186**	**$1,288,249**
Participation	2,952	4,165	4,530	4,935	5,290	6,668
Savings (kWh)	620,886	867,546	952,995	1,078,993	1,217,625	1,441,958
Demand Savings (kW)	297	426	464	518	568	747
Weighted Program EUL	17.4	17.2	17.0	17.3	17.6	17.1
NTG	78%	78%	78%	77%	77%	77%
Midstream						
Incentives	$581,774	$643,888	$698,268	$744,124	$781,583	$811,400
Delivery & Implementation	$518,820	$589,298	$655,200	$715,480	$769,891	$818,866
Admin	$21,054	$23,914	$26,588	$29,034	$31,242	$33,229
Total Budget	**$1,121,647**	**$1,257,099**	**$1,380,055**	**$1,488,638**	**$1,582,716**	**$1,663,495**
Participation	1,963	2,183	2,378	2,543	2,679	2,787
Savings (kWh)	1,271,863	1,413,437	1,537,465	1,642,378	1,728,605	1,798,099
Demand Savings (kW)	581	641	693	737	772	800
Weighted Program EUL	18.0	18.0	18.0	18.0	18.0	18.0
NTG	85%	85%	85%	85%	85%	85%
Marketplace						
Incentives	$1,082,814	$1,064,098	$1,002,954	$905,489	$738,591	$621,958
Delivery & Implementation	$2,883	$2,843	$2,728	$2,536	$2,006	$1,782
Admin	$37,474	$36,956	$35,467	$32,964	$26,073	$23,170
Total Budget	**$1,123,170**	**$1,103,896**	**$1,041,149**	**$940,988**	**$766,669**	**$646,910**

	2025	2026	2027	2028	2029	2030
Participation	14,856	15,029	14,752	13,962	11,775	10,469
Savings (kWh)	2,625,568	2,505,155	2,331,078	2,105,012	1,592,209	1,383,030
Demand Savings (kW)	1,330	1,339	1,279	1,162	1,007	839
Weighted Program EUL	13.9	13.8	13.6	13.4	13.0	12.8
NTG	92%	92%	92%	92%	90%	91%
Instant Rebate						
Incentives	$32,214	$38,486	$46,810	$57,485	$70,726	$86,634
Delivery & Implementation	$68,091	$82,541	$97,957	$113,045	$126,389	$136,968
Admin	$29,848	$36,182	$42,940	$49,554	$55,404	$60,041
Total Budget	**$130,153**	**$157,209**	**$187,708**	**$220,084**	**$252,519**	**$283,642**
Participation	2,319	2,791	3,258	3,664	3,955	4,095
Savings (kWh)	810,272	958,708	1,109,820	1,248,210	1,358,296	1,430,293
Demand Savings (kW)	48	60	73	86	99	111
Weighted Program EUL	11.0	10.9	10.9	10.9	10.9	11.1
NTG	100%	100%	100%	100%	100%	100%
Total						
Incentives	$2,054,698	$2,254,403	$2,311,807	$2,368,874	$2,365,502	$2,444,006
Delivery & Implementation	$704,212	$839,474	$942,934	$1,050,787	$1,155,249	$1,271,078
Admin	$106,908	$123,743	$135,291	$147,141	$154,339	$167,212
Total Budget	**$2,865,818**	**$3,217,621**	**$3,390,032**	**$3,566,802**	**$3,675,090**	**$3,882,296**
Participation	22,090	24,168	24,917	25,104	23,700	24,019
Savings (kWh)	5,328,589	5,744,845	5,931,358	6,074,592	5,896,734	6,053,380
Demand Savings (kW)	2,256	2,466	2,509	2,502	2,447	2,496

6.2 RESIDENTIAL NEW CONSTRUCTION PROGRAM

Program Description: The Residential New Construction program produces long-term savings by encouraging the construction of single-family homes, duplexes, or end-unit townhomes with only one shared wall to be built more energy efficient. The program incentivizes builders and helps improve cost effectiveness. The Residential New Construction program allows builders to individually select high-efficiency measures at a tiered approach, which improves flexibility enhancing the ability to meet participant demand. This approach also helps encourage a more energy efficiency focus at the measure level. Structuring this program around specific measures allows CenterPoint Indiana to analyze specific measures, add or remove measures and ensure the program is cost-effective. The Residential New Construction Program will work closely with builders, educating them on the benefits of energy efficient new homes. Homes may feature additional insulation, better windows, and higher efficiency appliances. The homes should also be more efficient and comfortable than standard homes constructed to current building codes.

TABLE 6-10: RESIDENTIAL NEW CONSTRUCTION MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Air Source Heat Pump 16 SEER	$200.00	4,457.1	0.16
Air Source Heat Pump 17 SEER	$300.00	4,539.9	0.22
Air Source Heat Pump 18 SEER	$400.00	4,733.0	0.28
Air Source Heat Pump 21 SEER	$400.00	4,899.6	0.42
Central Air Conditioner 15 SEER	$200.00	99.2	0.11
Central Air Conditioner 16 SEER	$200.00	185.8	0.21
Central Air Conditioner 17 SEER	$300.00	261.8	0.30

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Central Air Conditioner 18 SEER	$400.00	332.5	0.38
Smart Thermostat	$62.72	289.1	0.00
Wifi Thermostat	$41.51	247.5	0.00
ENERGY STAR New Home	$2,242.72	1,325.6	0.24

Eligible Customers: Any customer or home builder constructing a home to the program specifications in the CenterPoint Indiana electric service territory.

Marketing: To move the market toward an improved home building standard, education will be required for home builders, architects and designers as well as customers buying new homes. A combination of in-person meetings with these market participants as well as other educational methods will be necessary.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-11: RESIDENTIAL NEW CONSTRUCTION PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Air Source Heat Pump 16 SEER						
Participation	1.1	1.0	0.9	0.8	0.7	0.7
Incentive Budget	$220	$196	$172	$154	$147	$147
Projected kWh Savings	4,766	4,337	3,830	3,488	3,329	3,343
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 17 SEER						
Participation	0.8	0.7	0.6	0.6	0.5	0.5
Incentive Budget	$239	$213	$186	$167	$159	$160
Projected kWh Savings	3,510	3,192	2,818	2,565	2,448	2,458
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 18 SEER						
Participation	0.7	0.6	0.5	0.5	0.4	0.4
Incentive Budget	$260	$232	$202	$182	$173	$174
Projected kWh Savings	2,989	2,717	2,398	2,182	2,082	2,091
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 21 SEER						
Participation	0.7	0.7	0.6	0.5	0.5	0.5
Incentive Budget	$300	$266	$232	$208	$198	$199
Projected kWh Savings	3,555	3,228	2,847	2,590	2,470	2,481
Projected kW Savings	0	0	0	0	0	0
Central Air Conditioner 15 SEER						
Participation	28	30	32	33	36	40

Measure	2025	2026	2027	2028	2029	2030
Incentive Budget	$5,538	$6,056	$6,330	$6,615	$7,127	$7,925
Projected kWh Savings	2,671	2,971	3,131	3,309	3,576	3,974
Projected kW Savings	3	3	4	4	4	5
Central Air Conditioner 16 SEER						
Participation	52	56	57	58	61	66
Incentive Budget	$10,448	$11,125	$11,315	$11,514	$12,102	$13,170
Projected kWh Savings	9,448	10,233	10,494	10,798	11,387	12,381
Projected kW Savings	11	12	12	12	13	14
Central Air Conditioner 17 SEER						
Participation	38	36	33	30	30	30
Incentive Budget	$11,336	$10,721	$9,808	$9,113	$8,883	$9,100
Projected kWh Savings	9,648	9,282	8,561	8,044	7,867	8,051
Projected kW Savings	11	11	10	9	9	9
Central Air Conditioner 18 SEER						
Participation	36	37	36	35	35	37
Incentive Budget	$14,564	$14,709	$14,222	$13,828	$13,971	$14,708
Projected kWh Savings	11,805	12,122	11,813	11,611	11,767	12,379
Projected kW Savings	14	14	14	13	13	14
Smart Thermostat						
Participation	31	29	26	23	22	22
Incentive Budget	$1,970	$1,810	$1,607	$1,471	$1,405	$1,411
Projected kWh Savings	8,992	8,315	7,418	6,818	6,512	6,538
Projected kW Savings	0	0	0	0	0	0
Wifi Thermostat						
Participation	7	9	10	13	16	20
Incentive Budget	$292	$362	$431	$523	$655	$847
Projected kWh Savings	1,738	2,158	2,570	3,124	3,910	5,053
Projected kW Savings	0	0	0	0	0	0
ENERGY STAR New Home						
Participation	14	16	18	20	25	33
Incentive Budget	$30,381	$34,828	$39,882	$45,844	$56,457	$73,271
Projected kWh Savings	17,373	20,274	23,431	27,299	33,757	43,763
Projected kW Savings	3	4	4	5	6	8

TABLE 6-12: RESIDENTIAL NEW CONSTRUCTION PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$75,549	$80,517	$84,389	$89,620	$101,276	$121,111
Delivery & Implementation	$14,912	$15,912	$16,620	$17,794	$20,150	$24,121
Admin	$2,415	$2,577	$2,692	$2,882	$3,264	$3,907
Total Budget	**$92,876**	**$99,006**	**$103,701**	**$110,296**	**$124,689**	**$149,139**
Participation	209	214	213	214	226	250
Energy Savings (kWh)	76,496	78,830	79,310	81,828	89,105	102,512
Demand Savings (kW)	43	45	44	44	46	51
Weighted Program EUL	18.6	18.9	19.2	19.6	20.0	20.3
NTG	80%	79%	78%	77%	76%	74%

6.3 INCOME QUALIFIED WEATHERIZATION PROGRAM

Program Description: The Income Qualified Weatherization program is designed to produce long term energy and demand savings in the residential market. The program is designed to provide weatherization upgrades to low-income homes that otherwise would not have been able to afford the energy saving measures. The program provides direct installation of energy-saving measures and educates consumers on ways to reduce energy consumption. Customers eligible through the Income Qualified Weatherization Program will have opportunity to receive deeper retrofit measures including refrigerators, attic insulation, duct sealing, air infiltration reduction and installation of new central air conditioner or air source heat pump.

TABLE 6-13: INCOME QUALIFIED WEATHERIZATION MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
ENERGY STAR Refrigerator	$288.53	503.4	0.07
Audit Recommendations	$47.27	38.2	0.01
Air Source Heat Pump 16 SEER	$613.38	2,482.6	0.09
Air Source Heat Pump 17 SEER	$817.84	2,461.9	0.13
Air Source Heat Pump 18 SEER	$1,022.30	2,485.4	0.16
Air Source Heat Pump 21 SEER	$1,022.30	2,485.0	0.24
AC Tune Up	$12.27	76.2	0.10
Central Air Conditioner 16 SEER	$109.94	114.3	0.13
Smart Thermostat	$132.96	146.4	0.00
Filter whistle	$1.55	20.6	0.03
Attic Insulation	$745.15	147.3	0.15
Duct Sealing	$230.82	67.5	0.08
Wall Insulation	$604.88	130.5	0.05
Air Sealing	$200.00	275.2	0.30
Low Flow Showerhead 1.5 gpm	$0.66	155.9	0.01
Kitchen Faucet Aerator 1.5 gpm	$0.66	62.0	0.00
Bathroom Aerator 1.0 gpm	$0.66	14.2	0.00
Pipe Wrap	$4.78	47.6	0.01
Water Heater Temperature Setback	$4.87	39.7	0.00

Eligible Customers: This program is available to residential customers who receive either electric only or gas and electric service from CenterPoint Indiana where CenterPoint Indiana is the homes primary heat source. Homes must be at least 5 years or older and have not received an audit within the last three years; and is owner occupied or authorized non-owner occupied where occupants have the service in their name up. Non-owner participation will be limited to a maximum of ten participants. Eligible homes must be less than 4 total units, and units should not be stacked. Eligible income qualified customer must receive a total household income not exceeding 200% of the federal-established poverty level.

Marketing: CenterPoint Indiana will provide a list to the implementation contractor of high consumption customers who have received Energy Assistance Program (EAP) funds within the past 12 months to help prioritize those customers who will benefit most from the program. In addition to utilizing the EAP List, the program will utilize census data to target low-income areas within CenterPoint Indiana territory. CenterPoint Indiana uses door-to-door canvassing for obtaining most of the appointments. The program is marketed to the public as “Neighborhood Weatherization” at various community events and works closely with the CenterPoint Energy Foundation.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-14: INCOME QUALIFIED WEATHERIZATION PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
ENERGY STAR Refrigerator						
Participation	59	84	114	154	205	269
Incentive Budget	$33,961	$31,740	$37,172	$45,206	$52,254	$55,003
Projected kWh Savings	59,256	55,381	64,859	78,877	91,174	95,971
Projected kW Savings	9	8	10	12	14	14
Audit Recommendations						
Participation	80	209	349	498	663	869
Incentive Budget	$7,951	$13,587	$19,527	$25,205	$29,135	$30,667
Projected kWh Savings	6,651	11,247	15,991	20,418	23,345	24,312
Projected kW Savings	2	3	4	5	6	6
Air Source Heat Pump 16 SEER						
Participation	1	1	1	2	2	3
Incentive Budget	$721	$673	$789	$959	$1,109	$1,167
Projected kWh Savings	2,917	2,726	3,192	3,882	4,488	4,724
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 17 SEER						
Participation	0	1	1	1	2	2
Incentive Budget	$807	$754	$883	$1,074	$1,242	$1,307
Projected kWh Savings	2,430	2,271	2,659	3,234	3,739	3,935
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 18 SEER						
Participation	0	1	1	1	2	2
Incentive Budget	$922	$862	$1,009	$1,227	$1,419	$1,493
Projected kWh Savings	2,241	2,095	2,453	2,984	3,449	3,630
Projected kW Savings	0	0	0	0	0	0
Air Source Heat Pump 21 SEER						
Participation	1	1	1	1	2	3
Incentive Budget	$1,122	$1,049	$1,228	$1,494	$1,726	$1,817
Projected kWh Savings	2,727	2,549	2,985	3,631	4,197	4,417
Projected kW Savings	0	0	0	0	0	0
AC Tune Up						
Participation	200	226	459	537	836	975
Incentive Budget	$5,003	$3,663	$6,427	$6,788	$9,185	$8,604
Projected kWh Savings	31,045	22,735	39,885	42,126	56,998	53,394
Projected kW Savings	39	29	51	54	72	68

Measure	2025	2026	2027	2028	2029	2030
Central Air Conditioner 16 SEER						
Participation	17	25	33	45	60	79
Incentive Budget	$3,783	$3,536	$4,141	$5,036	$5,821	$6,128
Projected kWh Savings	3,933	3,676	4,305	5,235	6,052	6,370
Projected kW Savings	4	4	5	6	7	7
Smart Thermostat						
Participation	112	177	197	211	232	291
Incentive Budget	$28,062	$28,771	$27,567	$26,687	$25,533	$25,662
Projected kWh Savings	30,897	31,677	30,351	29,382	28,111	28,254
Projected kW Savings	0	0	0	0	0	0
Filter whistle						
Participation	350	553	614	658	725	1,276
Incentive Budget	$1,051	$1,077	$1,032	$999	$956	$1,351
Projected kWh Savings	13,964	14,316	13,717	13,279	12,705	17,958
Projected kW Savings	23	23	22	22	21	29
Attic Insulation						
Participation	183	289	321	344	378	473
Incentive Budget	$256,043	$262,508	$251,519	$243,492	$232,960	$234,142
Projected kWh Savings	51,819	52,613	49,913	47,842	45,338	45,135
Projected kW Savings	51	52	49	47	45	45
Duct Sealing						
Participation	270	426	473	507	558	699
Incentive Budget	$117,057	$120,012	$114,989	$111,319	$106,504	$107,044
Projected kWh Savings	35,067	35,605	33,777	32,375	30,681	30,544
Projected kW Savings	41	41	39	37	35	35
Wall Insulation						
Participation	42	67	74	79	87	109
Incentive Budget	$47,927	$49,137	$47,080	$45,577	$43,606	$43,827
Projected kWh Savings	10,590	10,752	10,201	9,777	9,266	9,224
Projected kW Savings	4	4	4	3	3	3
Air Sealing						
Participation	399	402	410	418	427	435
Incentive Budget	$79,840	$80,474	$82,014	$83,638	$85,335	$87,082
Projected kWh Savings	114,561	116,353	115,930	115,372	114,773	114,138
Projected kW Savings	123	122	124	125	127	129
Low Flow Showerhead 1.5 gpm						
Participation	104	164	182	195	215	269
Incentive Budget	$130	$133	$127	$123	$118	$119
Projected kWh Savings	30,424	31,192	29,886	28,932	27,681	27,821
Projected kW Savings	2	2	2	1	1	1
Kitchen Faucet Aerator 1.5 gpm						
Participation	73	115	127	136	150	188
Incentive Budget	$91	$93	$89	$86	$83	$83
Projected kWh Savings	8,464	8,677	8,314	8,049	7,701	7,740
Projected kW Savings	1	1	0	0	0	0
Bathroom Aerator 1.0 gpm						

Measure	2025	2026	2027	2028	2029	2030
Participation	146	230	255	274	301	377
Incentive Budget	$182	$187	$179	$173	$166	$166
Projected kWh Savings	3,876	3,974	3,808	3,686	3,527	3,545
Projected kW Savings	0	0	0	0	0	0
Pipe Wrap						
Participation	241	380	422	452	498	623
Incentive Budget	$2,160	$2,214	$2,122	$2,054	$1,965	$1,975
Projected kWh Savings	21,512	22,056	21,132	20,458	19,573	19,672
Projected kW Savings	2	3	2	2	2	2
Water Heater Temperature Setback						
Participation	137	217	385	474	669	830
Incentive Budget	$1,371	$1,406	$2,156	$2,400	$2,940	$2,929
Projected kWh Savings	11,178	11,461	17,569	19,560	23,964	23,870
Projected kW Savings	1	1	2	2	3	3

TABLE 6-15: INCOME QUALIFIED WEATHERIZATION BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$588,184	$601,877	$600,050	$603,539	$602,056	$610,567
Delivery & Implementation	$191,509	$195,757	$215,146	$229,891	$249,775	$260,589
Admin	$10,079	$10,303	$11,323	$12,100	$13,146	$13,715
Total Budget	**$789,772**	**$807,937**	**$826,520**	**$845,530**	**$864,977**	**$884,871**
Participation	2,413	3,565	4,421	4,988	6,011	7,770
Energy Savings (kWh)	443,552	441,355	470,929	489,101	516,760	524,654
Demand Savings (kW)	303	294	315	319	338	345
Weighted Program EUL	12.6	12.8	11.9	11.5	10.9	10.8
NTG	100%	100%	100%	100%	100%	100%

6.4 COMMUNITY CONNECTIONS PROGRAM

Program Description: The Community Connections program is designed to provide energy efficient products to low-income community members who receive assistance from local food banks and township trustees. The program is intended to educate low-income community members on the benefits of energy efficient measures and provide them with products which would otherwise be unaffordable.

TABLE 6-16: COMMUNITY CONNECTIONS MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Smart Power Strips	$10.00	117.5	0.02
Air Sealing	$200.00	275.2	0.30

Eligible Customers: Community Connections program targets local food banks and township trustees who serve low-income homeowners and tenants within CenterPoint electric service territory.

Marketing: Marketing materials will be created to educate product recipients on the benefits of energy efficiency products.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-17: COMMUNITY CONNECTIONS PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Smart Power Strips						
Participation	1,195	1,205	1,165	1,107	2,219	2,136
Incentive Budget	$11,946	$12,047	$11,646	$11,069	$22,192	$21,362
Projected kWh Savings	146,877	147,129	139,975	127,455	258,248	241,237
Projected kW Savings	26	26	25	23	46	43
Air Sealing						
Participation	573	712	965	1,221	1,447	1,607
Incentive Budget	$114,519	$142,384	$193,051	$244,117	$289,315	$321,460
Projected kWh Savings	164,321	205,866	272,884	336,739	389,119	421,336
Projected kW Savings	177	217	291	366	431	475

TABLE 6-18: COMMUNITY CONNECTIONS PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$126,464	$154,431	$204,697	$255,186	$311,507	$342,823
Delivery & Implementation	$118,236	$138,056	$166,521	$193,291	$276,051	$291,315
Admin	$6,223	$7,266	$8,764	$10,173	$14,529	$15,332
Total Budget	**$250,923**	**$299,752**	**$379,982**	**$458,650**	**$602,087**	**$649,470**
Participation	1,767	1,917	2,130	2,327	3,666	3,744
Energy Savings (kWh)	311,197	352,995	412,859	464,194	647,368	662,572
Demand Savings (kW)	203	243	317	389	477	518
Weighted Program EUL	13.9	13.8	13.7	13.5	13.8	13.7
NTG						

6.5 RESIDENTIAL BEHAVIORAL SAVINGS PROGRAM

Program Description: Residential Behavioral Savings Program motivates behavior change and provides relevant, targeted information to the consumer through regularly scheduled direct contact via mailed and emailed home energy reports. The report and web portal include a comparison against a group of similarly sized and equipped homes in the area, usage history comparisons, goal setting tools, and progress trackers. The Home Energy Report program anonymously compares customers' energy use with that of other customers with similar home size and demographics. Customers can view the past 12 months of their energy usage and compare and contrast their energy consumption and costs with others in the same neighborhood. Once a consumer understands better how they use energy, they can then start conserving energy.

TABLE 6-19: RESIDENTIAL BEHAVIORAL SAVINGS MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Home Energy Reports	$0.00	140.8	0.04
AMI Data Portal	$0.24	137.7	0.02

Eligible Customers: Residential customers who receive electric service from CEI South are eligible to participate in this integrated natural gas and electric program.

Marketing: CenterPoint Indiana will work with an implementation contractor and evaluation contractor to determine which customers are in the treatment/participant group and which are in the non-participant group.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor. The main delivery channel will be targeted mail and email with the addition of specific tips provided to the low-income customer segment.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-20: RESIDENTIAL BEHAVIORAL SAVINGS PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Home Energy Reports						
Participation	37,252	43,559	47,326	50,470	53,022	55,057
Incentive Budget	$0	$0	$0	$0	$0	$0
Projected kWh Savings	7,143,072	6,985,928	6,818,155	6,645,215	6,472,287	6,307,171
Projected kW Savings	2,037	1,992	1,945	1,895	1,846	1,799
AMI Data Portal						
Participation	2,750	3,745	4,738	5,846	7,021	8,205
Incentive Budget	$908	$1,045	$1,200	$1,368	$1,540	$1,707
Projected kWh Savings	535,787	610,208	693,458	781,917	870,670	954,898
Projected kW Savings	61	70	79	89	99	109

TABLE 6-21: RESIDENTIAL BEHAVIORAL SAVINGS PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$908	$1,045	$1,200	$1,368	$1,540	$1,707
Delivery & Implementation	$294,627	$301,284	$308,079	$315,021	$322,122	$329,396
Admin	$116,300	$118,928	$121,610	$124,350	$127,153	$130,025
Total Budget	**$411,835**	**$421,257**	**$430,889**	**$440,739**	**$450,815**	**$461,127**
Participation	40,002	47,304	52,064	56,315	60,043	63,262
Energy Savings (kWh)	7,678,859	7,596,136	7,511,612	7,427,133	7,342,957	7,262,069
Demand Savings (kW)	2,098	2,062	2,024	1,985	1,945	1,908
Weighted Program EUL	1.0	1.0	1.0	1.0	1.0	1.0
NTG	100%	100%	100%	100%	100%	100%

6.6 APPLIANCE RECYCLING PROGRAM

Program Description: The Residential Appliance Recycling program encourages customers to recycle their old inefficient refrigerators and freezers in an environmentally safe manner. The program recycles operable refrigerators and freezers, so the appliance no longer uses electricity, and keeps 95% of the appliance out of landfills. An older refrigerator can use up to three times the amount of energy as new efficient refrigerators. An incentive of $50 will be provided to the customer for each operational unit picked up. Additionally, the $25 air conditioners rebate will continue to be offered. Customers can choose a no-contact pickup if they so desire.

TABLE 6-22: APPLIANCE RECYCLING MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
Refrigerator Recycling	$50.00	628.7	0.09
Dehumidifier Recycling	$20.00	620.0	0.00

Eligible Customers: Any residential customer with an operable secondary refrigerator, window A/C or freezer receiving electric service from CenterPoint Indiana.

Marketing: The program will be marketed through a variety of mediums, including the use of utility bill inserts, retail campaigns coordinated with appliance sales outlets as well as the potential for direct mail, web and media promotional campaigns.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-23: APPLIANCE RECYCLNG PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
Refrigerator Recycling						
Participation	925	925	925	925	925	925
Incentive Budget	$46,250	$46,250	$46,250	$46,250	$46,250	$46,250
Projected kWh Savings	581,523	581,523	581,523	581,523	581,523	581,523
Projected kW Savings	86	86	86	86	86	86
Dehumidifier Recycling						
Participation	146	146	146	146	146	146
Incentive Budget	$2,912	$2,912	$2,912	$2,912	$2,912	$2,912
Projected kWh Savings	90,277	90,277	90,277	90,277	90,277	90,277
Projected kW Savings	0	0	0	0	0	0

TABLE 6-24: APPLIANCE RECYCLING PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$49,162	$49,162	$49,162	$49,162	$49,162	$49,162
Delivery & Implementation	$157,115	$160,728	$164,425	$168,207	$172,076	$176,033
Admin	$7,585	$7,759	$7,938	$8,120	$8,307	$8,498
Total Budget	**$213,861**	**$217,649**	**$221,525**	**$225,489**	**$229,544**	**$233,693**
Participation	1,071	1,071	1,071	1,071	1,071	1,071
Energy Savings (kWh)	671,801	671,801	671,801	671,801	671,801	671,801
Demand Savings (kW)	86	86	86	86	86	86
Weighted Program EUL	8.0	8.0	8.0	8.0	8.0	8.0
NTG	62%	62%	62%	62%	62%	62%

6.7 BRING YOUR OWN THERMOSTAT PROGRAM

Program Description: The BYOT program allows customers with a compatible thermostat to participate in demand response (DR) events – utility managed load curtailing programs during periods when electricity demand is high. The BYOT program allows the utility to avoid the costs of hardware, installation, and maintenance associated with traditional load control methods.

By taking advantage of two-way communicating smart thermostats, BYOT programs can help utilities curtail load, reduce acquisition costs associated with typical load curtailment programs and improve customer satisfaction. With smart enabled thermostats, the utility can remotely verify how many customers are participating in DR events. Customers are notified of all events and have the capability of opting out of events at any time during the actual event.

Eligible Customers: Any eligible residential customer who receives electric service from CenterPoint Indiana at a single-family residence.

Marketing: Customers will receive a one-time enrollment incentive of $75 and a bill credit of $5 during the months of June to September. The enrollment incentive, the amount for which was determined based on research of other utility BYOT programs, will be provided in the first year to new enrollees only.

Program Delivery Channels: CenterPoint Indiana oversees the program and has partnered with Energy Hub to provide delivery of the BYOT program.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-25: BRING YOUR OWN THERMOSTAT PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$321,468	$317,778	$352,919	$388,244	$423,983	$460,270
Delivery & Implementation	$401,120	$434,529	$494,016	$553,799	$614,070	$674,977
Admin	$55,000	$56,210	$57,447	$58,710	$60,002	$61,322
Total Budget	**$777,588**	**$808,517**	**$904,382**	**$1,000,753**	**$1,098,055**	**$1,196,570**
Participation	8,242	9,824	11,415	13,013	14,621	16,241
Energy Savings (kWh)	0	0	0	0	0	0
Demand Savings (MW)	8	9	11	12	13	15
Weighted Program EUL	15.0	15.0	15.0	15.0	15.0	15.0
NTG	100%	100%	100%	100%	100%	100%

6.8 SMART CYCLE PROGRAM

Program Description: CenterPoint Indiana continues to replace DLC switches with smart thermostats each year. As an alternative to DLC switches, smart thermostats can optimize heating and cooling of a home to reduce energy usage and control load while utilities can learn from occupant behavior/preference, adjusting heating, ventilation, and air conditioning (HVAC) settings.

Eligible Customers: The Smart Cycle (DLC Change Out) Program will focus on residential single-family homes and apartment dwellers that have access to a Wi-Fi network and are participants of the DLC program.

Marketing: Customers who participate in the Demand Response events will be enrolled to receive a bill credit for the months of June through September.

Program Delivery Channels: CenterPoint Indiana will oversee the program.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-26: SMART CYCLE PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$56,811	$63,024	$69,253	$75,501	$81,780	$88,105
Delivery & Implementation	$265,231	$233,406	$238,955	$244,672	$250,874	$257,641
Admin	$74,359	$72,085	$73,713	$75,383	$77,126	$78,953
Total Budget	**$396,400**	**$368,515**	**$381,922**	**$395,556**	**$409,780**	**$424,698**
Participation	2,841	3,151	3,463	3,775	4,089	4,405
Energy Savings (kWh)	0	0	0	0	0	0
Demand Savings (MW)	3	3	3	3	4	4
Weighted Program EUL	15.0	15.0	15.0	15.0	15.0	15.0
NTG	100%	100%	100%	100%	100%	100%

6.9 RESIDENTIAL EMERGING MARKETS PROGRAM

Program Description: The Residential Emerging Markets Program offers a variety of measures which are not currently offered by existing programs. This program is envisioned to operate similarly to the Residential Prescriptive Program. The program is designed to incent customers to purchase energy efficient equipment by covering part of the incremental cost.

TABLE 6-27: RESIDENTIAL EMERGING MARKETS MEASURES

Measure	Avg. Incentive per Unit	Savings per Unit (kWh)	Savings per Unit (kW)
ENERGY STAR Clothes Washer	$50.00	187.0	0.02
ENERGY STAR Clothes Dryer	$50.00	373.3	0.13
Packaged Terminal Heat Pump	$1,147.53	1,951.5	0.96
Packaged Terminal Air Conditioner	$1,147.53	3,257.3	0.96
Filter whistle	$3.00	44.4	0.07
Attic Fan	$100.00	170.5	0.18
ENERGY STAR Bath Vent Fan	$20.00	29.6	0.02
Smart Power Strips	$10.00	136.1	0.02
Duct Sealing	$296.07	1,053.7	0.24
Radiant Barrier	$575.86	946.9	0.13
Smart Water Heater	$96.00	414.0	0.02
Thermostatic Restrictor Shower Valve	$24.00	67.0	0.00
Pipe Wrap	$8.98	82.3	0.01

Eligible Customers: The program is available to all residential customers located in the CenterPoint Indiana electric service territory.

Marketing: The program may leverage a variety of marketing techniques similar to those currently used for the Residential Prescriptive Program.

Program Delivery Channels: CenterPoint Indiana will oversee the program with the help of an implementation contractor.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-28: RESIDENTIAL EMERGING MARKETS PROGRAM SUMMARY

Measure	2025	2026	2027	2028	2029	2030
ENERGY STAR Clothes Washer						
Participation	908	1,116	1,336	1,556	1,765	1,955
Incentive Budget	$45,423	$55,819	$66,791	$77,785	$88,254	$97,764
Projected kWh Savings	169,921	208,809	249,852	290,979	330,143	365,716
Projected kW Savings	22	27	32	37	43	47
ENERGY STAR Clothes Dryer						
Participation	110	121	131	140	146	152
Incentive Budget	$5,477	$6,061	$6,563	$6,980	$7,317	$7,586
Projected kWh Savings	41,351	45,612	49,201	52,086	54,303	55,949
Projected kW Savings	15	16	18	19	19	20
Packaged Terminal Heat Pump						
Participation	0	121	131	140	146	1,723
Incentive Budget	$63	$6,061	$6,563	$6,980	$7,317	$34,459
Projected kWh Savings	108	45,612	49,201	52,086	54,303	51,033
Projected kW Savings	0	16	18	19	19	41
Packaged Terminal Air Conditioner						
Participation	2	2	3	3	4	4
Incentive Budget	$2,145	$2,637	$3,156	$3,678	$4,177	$4,636
Projected kWh Savings	6,090	7,486	8,959	10,440	11,858	13,159
Projected kW Savings	2	2	3	3	3	4
Filter whistle						
Participation	2,564	2,851	3,013	3,021	2,877	5,267
Incentive Budget	$7,691	$8,553	$9,040	$9,064	$8,632	$15,802
Projected kWh Savings	113,912	126,683	133,889	134,218	127,745	233,252
Projected kW Savings	186	207	218	219	208	380
Attic Fan						
Participation	912	1,141	1,382	1,608	1,788	1,891
Incentive Budget	$91,183	$114,125	$138,191	$160,848	$178,850	$189,080
Projected kWh Savings	155,454	194,568	235,597	274,224	304,915	322,356
Projected kW Savings	165	207	250	291	324	342
ENERGY STAR Bath Vent Fan						

Measure	2025	2026	2027	2028	2029	2030
Participation	3,494	3,314	2,988	2,575	2,137	1,723
Incentive Budget	$69,880	$66,279	$59,753	$51,492	$42,734	$34,459
Projected kWh Savings	103,492	98,160	88,495	76,259	63,289	51,033
Projected kW Savings	84	79	71	62	51	41
Smart Power Strips						
Participation	3,884	3,341	2,763	2,213	5,633	4,693
Incentive Budget	$38,835	$33,407	$27,627	$22,125	$56,329	$46,926
Projected kWh Savings	528,544	454,666	375,999	301,124	766,643	638,669
Projected kW Savings	97	83	69	55	140	117
Duct Sealing						
Participation	77	93	108	120	127	127
Incentive Budget	$22,742	$27,538	$32,043	$35,600	$37,576	$37,576
Projected kWh Savings	83,158	99,723	114,891	126,380	132,128	130,872
Projected kW Savings	19	23	26	29	30	30
Radiant Barrier						
Participation	12	13	13	12	11	10
Incentive Budget	$7,156	$7,553	$7,553	$7,156	$6,441	$5,536
Projected kWh Savings	12,040	12,585	12,461	11,689	10,421	8,871
Projected kW Savings	2	2	2	2	1	1
Smart Water Heater						
Participation	23	31	41	55	73	96
Incentive Budget	$2,161	$2,932	$3,950	$5,286	$7,015	$9,198
Projected kWh Savings	9,849	13,163	17,438	22,926	29,864	38,468
Projected kW Savings	0	1	1	1	1	2
Thermostatic Restrictor Shower Valve						
Participation	3,947	4,386	4,632	4,636	4,400	3,974
Incentive Budget	$94,724	$105,276	$111,173	$111,275	$105,609	$95,364
Projected kWh Savings	264,429	293,883	310,349	310,641	294,843	266,278
Projected kW Savings	13	14	15	15	14	13
Pipe Wrap						
Participation	1,608	1,871	2,078	2,194	2,194	2,078
Incentive Budget	$14,438	$16,800	$18,664	$19,700	$19,700	$18,664
Projected kWh Savings	132,299	153,941	171,029	180,521	180,521	171,029
Projected kW Savings	15	18	20	21	21	20

TABLE 6-29: RESIDENTIAL EMERGING MARKETS PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$401,918	$453,040	$491,068	$517,969	$569,952	$597,049
Delivery & Implementation	$249,265	$269,711	$286,238	$297,512	$390,532	$398,097
Admin	$40,374	$43,686	$46,362	$48,189	$63,255	$64,480
Total Budget	**$691,556**	**$766,437**	**$823,668**	**$863,671**	**$1,023,739**	**$1,059,626**
Participation	17,539	18,402	18,620	18,273	21,302	23,692
Energy Savings (kWh)	1,620,646	1,754,890	1,817,360	1,843,573	2,360,975	2,346,687
Demand Savings (kW)	618	694	741	771	875	1,058
Weighted Program EUL	9.8	10.3	10.8	11.2	9.8	9.8

	2025	2026	2027	2028	2029	2030
NTG	99%	99%	98%	98%	99%	99%

6.10 CONSERVATION VOLTAGE REDUCTION PROGRAM

Program Description: The Conservation Voltage Reduction Program achieves energy conservation through automated monitoring and control of voltage levels provided on distribution circuits. End use customers realize lower energy and demand consumption when CVR is applied to the distribution circuit from which they are served.

Eligible Customers: Customers receiving service from the Tekoppel substation.

Program Delivery Channels: Delivery of the CVR Program will be achieved through the installation of control logic, telecommunication equipment, and voltage control equipment in order to control the voltage bandwidth on CVR circuits within voltage compliance levels required by the Indiana Utility Regulatory Commission

Evaluation: A third-party evaluator will evaluate the program using standard EM&V protocols.

Estimated Participation, Savings, and Budgets: Annual budgets for the CVR program are approximately $250,000 for residential customers and $300,000 for C&I customers.

6.11 COMMERCIAL PRESCRIPTIVE (RX) REBATES PROGRAM

Program Description: The Commercial Prescriptive Rebate Program is designed to influence commercial customers to install energy efficient alternatives on equipment types typically found in most business facilities. Financial incentives (mail-in rebates) are intended to encourage customers to purchase high efficiency products that would have otherwise purchased standard efficiency products in the absence of the program.

The program will increase demand by educating customers about the energy and money saving benefits associated with efficient products via outreach and education, website, and equipping trade allies to communicate such benefits to customers. The program will foster sustainable improvements in the local CenterPoint Indiana market for these products. Product availability is addressed as market providers adjust to meet increased demand generated by incentive offers and consumer education activities.

The table below describes the end-uses included in this program, and an estimate of average savings per project within each end-use. Total program savings and costs for this program align with the "enhanced" program potential identified in the MPS. However, because the MPS' definition of "unit" varied by measure, GDS used historical program savings and project counts to identify an "average" savings per project, by end-use.

TABLE 6-30: COMMERCIAL REBATE PRESCRIPTIVE MEASURES

End-Use	Avg. Incentive per Project/Unit	Savings per Project/Unit (kWh)	Demand per Project/Unit (kWh)
Compressed Air	$217 - $309	1,815	0.42
Cooking	$55 - $57	534	0.07
Cooling	$1852 - $2000	8,089	6.04
Heating	$253 - $268	1,574	0.91
Hot Water	$377 - $721	6,400	0.19
Lighting - Exterior	$154 - $178	1,160	0.00
Lighting - Interior	$15 - $16	268	0.06
Miscellaneous	$21 - $31	603	0.03
Refrigeration	$98 - $132	1,623	0.31
Ventilation	$2704 - $2704	17,963	3.79

Eligible Customers: Commercial Prescriptive rebates target non-residential electric customers. CenterPoint Indiana customers who have elected to opt out of participating in CenterPoint Indiana's energy efficiency programs are not eligible.

Marketing: The Commercial Prescriptive Rebate Program relies on networking with trade allies, mass media messages to consumers and businesses, and website tools and promotions.

Program Delivery Channels: The program is delivered primarily through trade allies. CenterPoint Indiana and its implementation partners work with the trade allies to make them aware of the offerings and help them promote the program to their customers. The implementation partner will provide training and technical support to the trade allies to become familiar with the EE technologies offered through the program. The program will be managed by the same implementation provider as the C&I Custom Program so that customers can seamlessly receive assistance and all incentives can be efficiently processed through a single procedure. To verify the correct equipment was installed, site visits will be made on 5% of the installations, as well as all projects receiving incentives greater than $20,000.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-31: COMMERCIAL PRESCRIPTIVE REBATE PROGRAM SUMMARY

End-Use	2025	2026	2027	2028	2029	2030
Compressed Air						
Participation	318	347	363	366	356	337
Incentive Budget	$68,920	$79,194	$88,179	$95,402	$100,743	$104,389
Projected kWh Savings	485,255	529,727	554,167	557,288	542,065	514,300
Projected kW Savings	112	126	137	145	149	149
Cooking						
Participation	482	532	577	617	650	678
Incentive Budget	$27,299	$29,898	$32,220	$34,233	$35,929	$37,322
Projected kWh Savings	216,284	238,663	258,889	276,615	291,711	304,228
Projected kW Savings	27	30	32	34	36	37
Cooling						
Participation	110	123	135	171	177	180
Incentive Budget	$207,505	$240,448	$270,619	$316,655	$333,964	$343,220
Projected kWh Savings	746,870	838,389	919,591	1,162,025	1,203,245	1,221,333
Projected kW Savings	558	625	684	871	903	918
Heating						
Participation	120	141	162	183	202	218
Incentive Budget	$30,318	$36,144	$42,097	$47,941	$53,466	$58,510
Projected kWh Savings	158,443	186,653	214,813	241,799	266,683	288,824
Projected kW Savings	92	109	126	144	160	174
Hot Water						
Participation	17	19	21	23	26	26
Incentive Budget	$6,374	$8,334	$10,497	$12,897	$15,546	$18,438
Projected kWh Savings	90,881	101,958	113,443	124,958	137,195	137,568
Projected kW Savings	3	4	5	6	8	9
Lighting - Exterior						

End-Use	2025	2026	2027	2028	2029	2030
Participation	1,134	911	712	545	381	247
Incentive Budget	$174,736	$140,660	$110,141	$84,379	$62,426	$44,069
Projected kWh Savings	1,105,036	887,489	693,873	531,040	371,393	241,126
Projected kW Savings	0	0	0	0	0	0
Lighting - Interior						
Participation	17,932	18,811	18,590	17,605	16,154	14,694
Incentive Budget	$279,285	$296,493	$295,398	$279,484	$253,099	$224,071
Projected kWh Savings	4,036,741	4,234,738	4,185,002	3,963,346	3,636,540	3,307,920
Projected kW Savings	912	954	941	889	816	744
Miscellaneous						
Participation	614	637	663	699	747	1,112
Incentive Budget	$12,724	$14,769	$17,220	$20,130	$23,461	$30,568
Projected kWh Savings	310,935	322,766	335,946	353,864	378,164	563,277
Projected kW Savings	14	19	24	30	37	45
Refrigeration						
Participation	184	283	323	356	401	512
Incentive Budget	$18,102	$30,018	$37,332	$44,262	$52,646	$67,635
Projected kWh Savings	251,166	385,632	440,818	485,524	546,737	697,481
Projected kW Savings	48	74	83	90	101	127
Ventilation						
Participation	168	172	170	163	150	134
Incentive Budget	$455,448	$466,024	$460,825	$440,230	$405,966	$361,200
Projected kWh Savings	2,541,498	2,600,518	2,571,505	2,456,579	2,265,381	2,015,573
Projected kW Savings	536	548	542	518	478	425

TABLE 6-32: COMMERCIAL PRESCRIPTIVE REBATE PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$1,280,711	$1,341,984	$1,364,528	$1,375,613	$1,337,248	$1,289,422
Delivery & Implementation	$651,371	$696,126	$713,802	$726,184	$710,428	$704,462
Admin	$162,843	$174,031	$178,451	$181,546	$177,607	$176,115
Total Budget	**$2,094,925**	**$2,212,141**	**$2,256,781**	**$2,283,343**	**$2,225,284**	**$2,169,999**
Participation	21,079	21,977	21,719	20,727	19,243	18,138
Energy Savings (kWh)	9,943,108	10,326,534	10,288,046	10,153,038	9,639,114	9,291,629
Demand Savings (kW)	2,741	2,962	3,066	3,247	3,198	3,129
Weighted Program EUL	10.1	10.1	10.2	10.1	10.3	10.3
NTG	0.84	0.84	0.84	0.84	0.84	0.84

6.12 SMALL BUSINESS ENERGY SOLUTIONS (SBES) PROGRAM

Program Description: The Small Business Energy Solutions Program (SBES) helps small businesses and multi-family customers identify and install cost-effective energy-saving measures by providing an onsite energy assessment customized for their business and access to the highest rebates available for CenterPoint Indiana business customers.

The table below describes the end-uses included in this program. Lighting measures include most linear fluorescent lighting bulbs and fixtures, downlight fixtures, exterior wall packs and garage fixtures, LED exit signs, occupancy sensor, and daylighting controls. Non-lighting measures include smart thermostats, rooftop controls, pre-rinse spray valves, vending machine controllers, and select refrigeration equipment.

TABLE 6-33: SMALL BUSINESS ENERGY SOLUTIONS ELIGIBLE END-USES

End-Use	Avg. Incentive per Project/Unit	Savings per Project/Unit (kWh)	Demand per Project/Unit (kWh)
Lighting	$66 - $75	299	0.07
Non-Lighting	$576 - $881	1,797	0.16

Eligible Customers: Any participating CenterPoint Indiana electric business customer with a monthly electric demand of 400 kilowatts (kW) or less is eligible to participate in the program. Additionally, there is no kW restriction for nonprofit entities and multi-family building owners with CenterPoint Indiana's general electric service may qualify for the program, including apartment buildings, condominiums, cooperatives, duplexes, quadraplexes, townhomes, nursing homes, and retirement communities.

Marketing: The Small Business Energy Solutions program relies on networking with trade allies, mass media messages to consumers and businesses, and website tools and promotions.

Program Delivery Channels: Trained trade ally energy advisors provide energy assessments to business customers with less than 400 kW peak demand and to multi-family buildings. The program implementer issues an annual Request for Qualification (RFQ) to select the trade allies with the best ability to provide high-quality and cost-effective service to small businesses and provide training to SBES trade allies on the program process, with an emphasis on improving energy efficiency sales.

Trade allies walk through small businesses and record site characteristics and energy efficiency opportunities at no cost to the customer. They provide an energy assessment report that details customer-specific opportunities, costs, energy savings, incentives, and simple payback periods. The trade ally then reviews the report with the customer, presenting the program benefits and process, while addressing any questions.

Onsite verification is provided for the first three projects completed by each trade ally, in addition to the program standard of 5% of all completed projects and all projects receiving incentives greater than $20,000. These verifications allow the program to validate energy savings, in addition to providing an opportunity to ensure trade allies provide high-quality customer services and the incentivized equipment satisfies program requirements.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-34: SMALL BUSINESS ENERGY SOLUTIONS PROGRAM SUMMARY

End-Use	2025	2026	2027	2028	2029	2030
Lighting						
Participation	15,595	15,419	14,735	13,571	12,053	10,356
Incentive Budget	$1,177,262	$1,107,890	$1,016,464	$911,428	$795,874	$683,291
Projected kWh Savings	3,916,866	3,872,586	3,700,821	3,408,500	3,027,240	2,600,965
Projected kW Savings	860	859	829	766	688	598
Non-Lighting						
Participation	33	39	39	39	40	56
Incentive Budget	$29,387	$28,843	$26,991	$24,880	$23,056	$40,879
Projected kWh Savings	50,377	58,495	59,477	59,269	60,389	84,773
Projected kW Savings	4	7	7	8	9	11

TABLE 6-35: COMMERCIAL SMALL BUSINESS ENERGY SOLUTIONS PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$1,206,650	$1,136,732	$1,043,455	$936,308	$818,931	$724,170
Delivery & Implementation	$320,354	$325,895	$320,361	$304,571	$280,470	$255,709
Admin	$60,066	$61,105	$60,068	$57,107	$52,588	$47,945
Total Budget	**$1,607,092**	**$1,544,101**	**$1,443,906**	**$1,317,021**	**$1,169,518**	**$1,043,806**
Participation	15,628	15,458	14,774	13,610	12,093	10,412
Energy Savings (kWh)	3,967,243	3,931,082	3,760,299	3,467,768	3,087,629	2,685,738
Demand Savings (kW)	864	866	836	774	697	608
Weighted Program EUL	10.2	10.2	10.2	10.1	10.1	10.0
NTG	84%	84%	84%	84%	84%	84%

6.13 COMMERCIAL CUSTOM PROGRAM

Program Description: The Commercial Custom Program offers business customers incentives for qualifying energy efficiency upgrades not covered under the Commercial Prescriptive Rebate Program. This program encourages the purchase and installation of efficient technologies or implementation of process improvements. CenterPoint Indiana envisions utilizing the same implementor for both the prescriptive rebate and custom programs.

CenterPoint Indiana staff and the third-party implementor will work with key customers and market providers to identify potential energy savings projects and answer questions on program requirements. Once prospective energy saving projects are identified, CenterPoint Indiana and the program implementor will work with the customer and/or market provider to complete custom engineering calculations.

Included in this program are conventional custom projects, commercial new construction, building retro-commissioning (RCx) opportunities and strategic energy management (SEM). The table below provides the average incentive and savings on a per project basis. Per project estimates are based on recent historical data, with total custom program savings informed by the current MPS' enhanced program potential scenario.

TABLE 6-36: COMMERCIAL CUSTOM PROJECTS

Program	Sub-Category	Avg. Incentive per kWh Saved	Savings per Project/Unit (kWh)	Demand per Project/Unit (kWh)
Custom	Lighting	$10,160 - $11,947	69,703	10.7
Custom	Non-Lighting & New Construction	$8,815 - $9,037	102,472	20.2
Custom	RCx	$7,630 - $7,841	80,996	13.5
Custom	SEM	$2,649 - $3,310	75,000	10.0

Eligible Customers: Commercial Prescriptive rebates target non-residential electric customers. CenterPoint Indiana customers who have elected to opt out of participating in CenterPoint Indiana's energy efficiency programs are not eligible.

Marketing: CenterPoint Indiana will provide outreach and education to contractors to inform them of the program offerings through direct contacts with key customers and market providers (e.g., mechanical contractors). This approach is highly dependent upon referrals and networking with trade allies to identify projects. Outreach will include in-person visits to customers and market providers, attending and presenting

at public seminars and trade association meetings, (e.g., ASHRAE, school administrators, hospitality), direct mail, newsletters and other targeted media and networking.

Program Delivery Channels: CenterPoint Indiana staff will oversee the program and will utilize the services of a third-party implementation firm to perform project tracking, the engineering review, and rebate fulfillment services.

Conventional Custom Projects

Similar to previous program years, customers may propose new custom retrofit projects. CenterPoint Indiana staff and the third-party implementor will work with key customers and market providers to identify potential energy savings projects and answer questions on program requirements. Once prospective energy saving projects are identified, CenterPoint Indiana and the program implementor will work with the customer and/or market provider to complete custom engineering calculations.

If the project is deemed eligible, the third-party implementor and CenterPoint Indiana staff will assist the customer or market provider in completing the grant application and will manage the allocation of funds. Prior to starting a project, customers must complete an application and attach documentation verifying the energy savings potential, payback horizon, project eligibility and incentive amount. When the project is approved, CenterPoint Energy will send a Letter of Intent (LOI) to the applicant confirming the amount of the incentive that will be paid once the project is completed.

Once projects are implemented, the customer will submit incentive claims along with all necessary documentation to CenterPoint Indiana. The third-party implementor will review the applications and a qualified engineer will verify savings calculations are correct prior to payment. The CenterPoint Indiana representative will monitor the status of the rebate application and project until the point of payment.

Conventional New Construction

The Commercial New Construction (CNC) component promotes energy-efficient designs with the goal of developing projects that are more energy efficient than the current Indiana building code. This program applies to new construction and major renovation projects. Major renovation is defined as the replacement of at least two systems within an existing space (e.g., lighting, HVAC, controls, building envelope). The program provides incentives as part of the facility design process to explore opportunities in modeling EE options to craft an optimal package of investments. The program also offers customers the opportunity to receive prescriptive or custom rebates toward eligible equipment to reduce the higher capital cost for an energy efficient solution.

Commercial Retro-Commissioning (RCx)

A targeted, turnkey, and cost-effective retro-commissioning solution for small- to mid-sized customer facilities. It is designed as a comprehensive customer solution that will identify, validate, quantify, and encourage the installation of both operational and capital measures. Most of these measures will be no- or low-cost with low payback periods and will capture energy savings from a previously untapped source: building automation systems.

Facility energy assessments are offered to customers who are eligible and motivated to implement multiple energy efficiency measures. The RCx component specifically targets measures that provide no- and low-cost operational savings. Most measures involve optimizing the building automation system (BAS) settings, but the program also investigates related capital measures, like controls, operations, processes, and HVAC. The implementation partner works collaboratively with CenterPoint Indiana staff to recruit and screen customers for receiving facility energy assessments.

Strategic Energy Management

An extension of the SEM pilot, this custom component is a guided operations and maintenance program with benchmarking and regular follow-up meetings to chart customer performance. The implementer will recruit customers to participate in the program and achieve energy savings for their facilities. The implementer will then measure their performance over time (usually a period of 6 months or a year) using energy billing data to determine the amount of energy savings the customer achieved and provide incentives to the customer accordingly.

Evaluation: CenterPoint Indiana will hire a third-party evaluator contractor to evaluate the program savings. The evaluation budget is an estimated 5% of the total budget for the program. CenterPoint Indiana is not expected to evaluate the program every year but will evaluate the program at least once every three years.

Estimated Participation, Savings, and Budgets:

TABLE 6-37: COMMERCIAL CUSTOM PROGRAM SUMMARY

End-Use	2025	2026	2027	2028	2029	2030
Custom Lighting						
Participation	25	28	32	35	37	38
Incentive Budget	$249,811	$299,563	$351,065	$397,672	$434,117	$459,429
Projected kWh Savings	1,593,797	1,838,286	2,079,277	2,281,531	2,418,357	2,492,936
Projected kW Savings	245	288	329	364	388	400
Custom Non-Lighting						
Participation	39	51	58	68	75	90
Incentive Budget	$347,653	$449,210	$519,386	$617,468	$674,679	$812,282
Projected kWh Savings	3,758,595	4,848,220	5,542,448	6,514,568	7,141,031	8,565,536
Projected kW Savings	741	967	1,110	1,314	1,409	1,653
Custom RCx						
Participation	10	13	14	18	21	27
Incentive Budget	$75,941	$98,028	$112,018	$141,617	$160,792	$207,801
Projected kWh Savings	749,687	951,308	1,077,575	1,386,171	1,567,117	1,996,328
Projected kW Savings	125	158	179	232	262	332
Custom SEM						
Participation	4	5	5	9	10	13
Incentive Budget	$12,035	$15,973	$17,716	$23,766	$26,899	$39,505
Projected kWh Savings	292,091	339,582	373,327	616,606	708,220	882,465
Projected kW Savings	39	42	46	87	101	116

TABLE 6-38: COMMERCIAL CUSTOM PROGRAM BUDGET SUMMARY

	2025	2026	2027	2028	2029	2030
Incentives	$685,440	$862,774	$1,000,185	$1,180,522	$1,296,488	$1,519,017
Delivery & Implementation	$641,012	$828,242	$976,000	$1,200,377	$1,360,806	$1,651,219
Admin	$120,190	$155,295	$183,000	$225,071	$255,151	$309,604
Total Budget	$1,486,705	$1,898,077	$2,220,185	$2,680,993	$2,997,495	$3,583,041
Participation	78	97	110	131	143	167
Energy Savings (kWh)	6,394,169	7,977,395	9,072,627	10,798,876	11,834,726	13,937,265
Demand Savings (kW)	1,150	1,455	1,664	1,996	2,159	2,500
Weighted Program EUL	9.2	9.1	9.1	8.6	8.4	8.3
NTG	93%	93%	93%	93%	93%	93%

6.14 COST-EFFECTIVENESS

As part of the development of the DSM Action Plan, GDS evaluated the cost-effectiveness results of each program. Table 6-39 provides program-level, sector-level and overall portfolio-level cost-effectiveness results. The TRC and UCT ratios are provided, along with TRC and UCT net benefits.[14] The overall portfolio has a TRC ratio of 1.6 and a UCT ratio of 2.1.

TABLE 6-39: DSM ACTION PLAN BENEFIT-COST RATIOS – BY PROGRAM AND SECTOR

Program/Sector	TRC Ratio	UCT Ratio	TRC Net Benefits ($)	UCT Net Benefits ($)
Residential				
Residential Prescriptive	2.3	2.2	$30,850,282	$28,998,433
Residential New Construction	1.5	1.5	$301,459	$299,674
Community Connections	1.8	2.0	$1,955,223	$2,273,593
Income Qualified Weatherization	0.6	0.5	($1,904,830)	($1,972,814)
Residential Behavioral	1.6	1.6	$1,339,915	$1,339,915
Appliance Recycling	1.6	1.5	$680,369	$583,399
Residential Emerging Markets Pilot	1.8	2.3	$5,565,511	$5,659,599
Smart Cycle	1.5	1.5	$791,867	$791,867
Bring Your Own Thermostat	1.5	1.9	$3,218,513	$4,410,366
Residential Sub-total	***1.9***	***1.9***	***$42,798,308***	***$42,384,033***
Commercial				
Prescriptive Rebate	2.0	3.8	$21,732,120	$32,132,056
Small Business Energy Solutions	1.9	2.0	$6,511,460	$6,934,175
Custom	1.3	3.1	$8,870,404	$25,942,934
Commercial	***1.6***	***3.1***	***$37,113,984***	***$65,009,165***
All Sectors				
Total	***1.6***	***2.1***	***$79,912,292***	***$107,393,199***

Table 6-40 provides the annual program-level TRC ratios in the DSM Action Plan. All programs are cost-effective each year of the analysis. The overall portfolio is cost-effective when factoring in indirect costs.

TABLE 6-40: ANNUAL TRC RATIOS – BY PROGRAM

Annual TRC Ratios	2025	2026	2027	2028	2029	2030
Residential Programs						
Residential Prescriptive	2.32	2.35	2.39	2.37	2.35	2.23
Residential New Construction	1.44	1.49	1.52	1.55	1.57	1.57
Community Connections	1.50	1.30	1.29	1.32	1.25	1.08

[14] The Income Qualified Weatherization program does not need to be cost-effective.

Annual TRC Ratios	2025	2026	2027	2028	2029	2030
Income Qualified Weatherization	0.47	0.41	0.41	0.42	0.39	0.34
Residential Behavioral	1.59	1.59	1.61	1.66	1.67	1.67
Appliance Recycling	1.58	1.61	1.64	1.66	1.68	1.70
Residential Emerging Markets Pilot	1.56	1.69	1.82	1.92	1.72	1.88
Smart Cycle	1.04	1.26	1.37	1.47	1.58	1.67
Bring Your Own Thermostat	1.03	1.45	1.57	1.67	1.77	1.86
Residential Sub-total	***1.70***	***1.76***	***1.81***	***1.79***	***1.72***	***1.67***
C&I Programs						
Prescriptive Rebate	1.78	1.90	2.00	2.08	2.15	2.13
Small Business Energy Solutions	1.67	1.78	1.89	1.97	2.03	2.03
Custom	1.22	1.25	1.29	1.31	1.33	1.36
C&I Sub-total	***1.54***	***1.59***	***1.64***	***1.66***	***1.68***	***1.65***
Total	**1.49**	**1.56**	**1.69**	**1.59**	**1.59**	**1.55**

Table 6-42 provides the annual program-level UCT ratios in the DSM Action Plan. All programs are cost-effective each year of the analysis. The overall portfolio is cost-effective when factoring in indirect costs.

TABLE 6-41: ANNUAL UCT RATIOS – BY PROGRAM

Annual UCT Ratios	2025	2026	2027	2028	2029	2030
Residential Programs						
Residential Prescriptive	2.49	2.49	2.47	2.48	2.44	2.42
Residential New Construction	1.57	1.57	1.55	1.52	1.48	1.44
Community Connections	1.65	1.40	1.41	1.45	1.41	1.22
Income Qualified Weatherization	0.44	0.37	0.37	0.38	0.37	0.32
Residential Behavioral	1.59	1.59	1.61	1.66	1.67	1.67
Appliance Recycling	1.44	1.47	1.50	1.52	1.54	1.57
Residential Emerging Markets Pilot	2.10	2.20	2.29	2.38	2.29	2.48
Smart Cycle	1.04	1.26	1.37	1.47	1.58	1.67
Bring Your Own Thermostat	1.53	1.80	1.91	2.01	2.10	2.19
Residential Sub-total	***1.85***	***1.83***	***1.84***	***1.84***	***1.80***	***1.76***
C&I Programs						
Prescriptive Rebate	3.53	3.67	3.79	3.88	3.99	4.09

Annual UCT Ratios	2025	2026	2027	2028	2029	2030
Small Business Energy Solutions	1.77	1.89	2.00	2.08	2.15	2.14
Custom	3.02	3.08	3.13	3.07	3.08	3.08
C&I Sub-total	***2.84***	***2.98***	***3.11***	***3.16***	***3.22***	***3.26***
Total	**2.01**	**2.11**	**2.01**	**2.16**	**2.20**	**2.20**

VOLUME II

Appendices

prepared for

MAY 2023

Appendix A. C&I Opt-Out Results

This section provides the potential results for technical, economic, MAP and RAP for the C&I sector, with opt-out customers included. A comparison of the RAP scenario (with without opt-out customers included) savings potential and RAP budgets is also provided.

Table A-1 provides cumulative annual technical, economic, MAP and RAP energy savings, in total MWh and as a percentage of the sector-level sales forecast. The forecasted sales, including opt-out customers are nearly double the forecast used in the base analysis, with nearly 90% of the forecasted sales growth coming from the industrial sector.

TABLE A-1: C&I CUMULATIVE ANNUAL ENERGY EFFICIENCY POTENTIAL SUMMARY – INCLUDING OPT-OUT

	2025	2026	2027	2030	2042
MWh					
Technical	84,651	176,410	272,966	567,724	1,205,797
Economic	83,977	174,830	270,437	562,069	1,187,492
MAP	46,905	98,486	152,758	329,062	916,832
RAP	30,222	63,733	99,147	214,159	599,723
Forecasted Sales	4,311,831	4,327,633	4,347,983	4,421,467	4,696,513
Technical	2.0%	4.1%	6.3%	12.8%	25.7%
Economic	1.9%	4.0%	6.2%	12.7%	25.3%
MAP	1.1%	2.3%	3.5%	7.4%	19.5%
RAP	0.7%	1.5%	2.3%	4.8%	12.8%

Figure A-1 provides the RAP results for the 3-year, 6-year, and 18-year timeframes for both the RAP scenario and the RAP scenario including opt-out customers. The savings as a percentage of forecasted sales are higher in the base RAP scenario, through total MWh savings are higher in the scenario in which opt-out customers are included in the analysis. Savings (as a percentage of forecasted sales) are lower when opt-out sales are included because of the large increase in the industrial sector, where overall future potential is estimates to be lower than in the commercial sector.

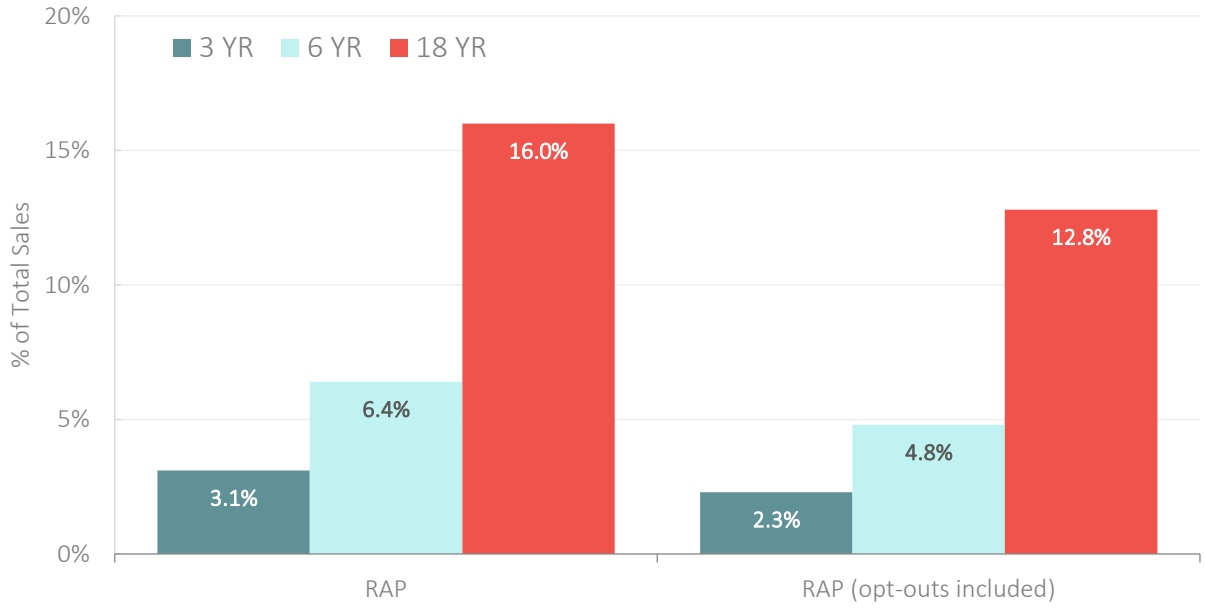


FIGURE A-1: C&I ELECTRIC ENERGY CUMULATIVE ANNUAL POTENTIAL (AS A % OF C&I SALES)

Figure A-2 provides the annual budgets for commercial RAP, with and without opt-out customers. The budgets in the RAP scenario range from roughly $4 million to $7 million, while the budgets in the RAP scenario with opt-out customers included range from $5.4 million to $12 million.

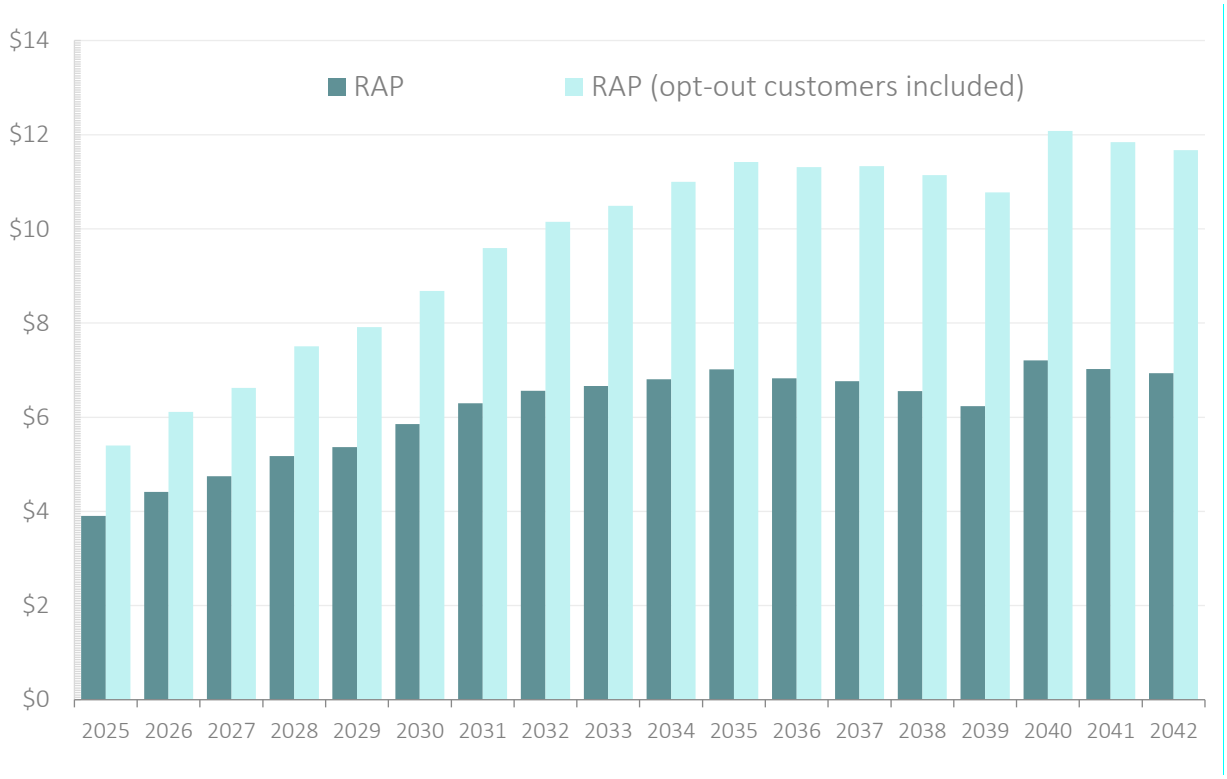


FIGURE A-2: C&I RAP BUDGETS – WITHOUT AND WITH OPT-OUT CUSTOMERS

Appendix B. Residential Sector Measure Detail

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
1001	Appliances	ENERGY STAR Air Purifier	Residential Instant Rebate	SF	N/A	MO	533	57%	303	0.03	9	$92	100%	54%	PUR-1	12%	29%	98%	55%	3.0
1002	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	SF	N/A	MO	533	57%	303	0.03	9	$92	100%	54%	PUR-1	12%	29%	98%	55%	3.0
1003	Appliances	ENERGY STAR Air Purifier	Residential Instant Rebate	SF	N/A	NC	533	57%	303	0.03	9	$92	100%	54%	PUR-2	12%	0%	99%	55%	3.0
1004	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	SF	N/A	NC	533	57%	303	0.03	9	$92	100%	54%	PUR-2	12%	0%	99%	55%	3.0
1005	Appliances	ENERGY STAR Air Purifier	Residential Instant Rebate	MF	N/A	MO	533	57%	303	0.03	9	$92	100%	54%	PUR-3	12%	29%	98%	55%	3.0
1006	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MF	N/A	MO	533	57%	303	0.03	9	$92	100%	54%	PUR-3	12%	29%	98%	55%	3.0
1007	Appliances	ENERGY STAR Air Purifier	Residential Instant Rebate	MF	N/A	NC	533	57%	303	0.03	9	$92	100%	54%	PUR-4	12%	0%	99%	55%	3.0
1008	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MF	N/A	NC	533	57%	303	0.03	9	$92	100%	54%	PUR-4	12%	0%	99%	55%	3.0
1009	Appliances	ENERGY STAR Refrigerator - early replacement	IQW	SF	LI	ER1	1,012	100%	1,012	0.15	6	$580	100%	100%	REF-2	100%	38%	96%	95%	0.7
1010	Appliances	ENERGY STAR Refrigerator - early replacement	IQW	MF	LI	ER1	1,012	100%	1,012	0.15	6	$580	100%	100%	REF-5	100%	38%	96%	95%	0.7
1011	Appliances	ENERGY STAR Refrigerator	No program	SF	NLI	MO	369	10%	37	0.01	16	$40	80%	80%	REF-1	100%	38%	48%	55%	1.0
1012	Appliances	ENERGY STAR Refrigerator	No program	SF	N/A	NC	369	10%	37	0.01	16	$40	80%	80%	REF-3	115%	0%	35%	55%	1.0
1013	Appliances	ENERGY STAR Refrigerator	No program	MF	NLI	MO	369	10%	37	0.01	16	$40	80%	80%	REF-4	100%	38%	48%	55%	1.0
1014	Appliances	ENERGY STAR Refrigerator	No program	MF	N/A	NC	369	10%	37	0.01	16	$40	80%	80%	REF-6	107%	0%	35%	55%	1.0
1015	Appliances	CEE Tier 2 Refrigerator	No program	SF	NLI	MO	369	15%	55	0.01	16	$140	80%	80%	REF-1	100%	38%	48%	55%	0.4
1016	Appliances	CEE Tier 2 Refrigerator	No program	SF	N/A	NC	369	15%	55	0.01	16	$140	80%	80%	REF-3	115%	0%	35%	55%	0.4
1017	Appliances	CEE Tier 2 Refrigerator	No program	MF	NLI	MO	369	15%	55	0.01	16	$140	80%	80%	REF-4	100%	38%	48%	55%	0.4
1018	Appliances	CEE Tier 2 Refrigerator	No program	MF	N/A	NC	369	15%	55	0.01	16	$140	80%	80%	REF-6	107%	0%	35%	55%	0.4
1019	Appliances	Smart Refrigerator	No program	SF	NLI	MO	369	20%	74	0.01	16	$1,078	80%	80%	REF-1	100%	38%	48%	55%	0.1
1020	Appliances	Smart Refrigerator	No program	SF	N/A	NC	369	20%	74	0.01	16	$1,078	80%	80%	REF-3	115%	0%	35%	55%	0.1
1021	Appliances	Smart Refrigerator	No program	MF	NLI	MO	369	20%	74	0.01	16	$1,078	80%	80%	REF-4	100%	38%	48%	55%	0.1
1022	Appliances	Smart Refrigerator	No program	MF	N/A	NC	369	20%	74	0.01	16	$1,078	80%	80%	REF-6	107%	0%	35%	55%	0.1
1023	Appliances	Refrigerator Recycling	Appliance Recycling	SF	N/A	Recycle	1,014	100%	1,014	0.15	8	$50	100%	100%	REF REC-1	15%	0%	99%	95%	9.9
1024	Appliances	Refrigerator Recycling	Appliance Recycling	MF	N/A	Recycle	1,014	100%	1,014	0.15	8	$50	100%	100%	REF REC-2	15%	0%	99%	95%	9.9
1025	Appliances	Freezer Recycling	Appliance Recycling	SF	N/A	Recycle	722	100%	722	0.11	8	$50	100%	100%	FRZ REC-1	2%	0%	99%	95%	7.0
1026	Appliances	Freezer Recycling	Appliance Recycling	MF	N/A	Recycle	722	100%	722	0.11	8	$50	100%	100%	FRZ REC-2	2%	0%	99%	95%	7.0
1027	Appliances	Dehumidifier Recycling	Appliance Recycling	SF	N/A	Recycle	1,000	100%	1,000	0.00	7	$20	100%	100%	DEH-1	30%	0%	47%	73%	14.1
1028	Appliances	Dehumidifier Recycling	Appliance Recycling	MF	N/A	Recycle	1,000	100%	1,000	0.00	7	$20	100%	100%	DEH-3	30%	0%	47%	73%	14.1
1029	Appliances	ENERGY STAR Freezer - Chest	No program	SF	N/A	MO	311	10%	31	0.01	22	$35	75%	71%	FRZ-1	27%	16%	37%	49%	1.5
1030	Appliances	ENERGY STAR Freezer - Chest	No program	SF	N/A	NC	311	10%	31	0.01	22	$35	75%	71%	FRZ-2	29%	0%	33%	49%	1.5
1031	Appliances	ENERGY STAR Freezer - Chest	No program	MF	N/A	MO	311	10%	31	0.01	22	$35	75%	71%	FRZ-3	27%	16%	37%	49%	1.5
1032	Appliances	ENERGY STAR Freezer - Chest	No program	MF	N/A	NC	311	10%	31	0.01	22	$35	75%	71%	FRZ-4	29%	0%	33%	49%	1.5
1033	Appliances	ENERGY STAR Freezer - Compact Upright	No program	SF	N/A	MO	467	10%	47	0.01	22	$35	100%	71%	FRZ-1	27%	16%	42%	49%	2.2
1034	Appliances	ENERGY STAR Freezer - Compact Upright	No program	SF	N/A	NC	467	10%	47	0.01	22	$35	100%	71%	FRZ-2	29%	0%	47%	49%	2.2
1035	Appliances	ENERGY STAR Freezer - Compact Upright	No program	MF	N/A	MO	467	10%	47	0.01	22	$35	100%	71%	FRZ-3	27%	16%	42%	49%	2.2
1036	Appliances	ENERGY STAR Freezer - Compact Upright	No program	MF	N/A	NC	467	10%	47	0.01	22	$35	100%	71%	FRZ-4	29%	0%	47%	49%	2.2
1037	Appliances	ENERGY STAR Dehumidifier	Residential Prescriptive	SF	N/A	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-1	30%	88%	95%	95%	2.7
1038	Appliances	ENERGY STAR Dehumidifier	Residential Instant Rebate	SF	N/A	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-1	30%	88%	95%	95%	2.7
1039	Appliances	ENERGY STAR Dehumidifier	Residential Prescriptive	SF	N/A	NC	1,095	12%	134	0.03	10	$10	100%	100%	DEH-2	30%	0%	99%	95%	2.7
1040	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	SF	N/A	NC	1,095	12%	134	0.03	10	$10	100%	100%	DEH-2	30%	0%	99%	95%	2.7
1041	Appliances	ENERGY STAR Dehumidifier	Residential Prescriptive	MF	N/A	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-3	30%	88%	95%	95%	2.7
1042	Appliances	ENERGY STAR Dehumidifier	Residential Instant Rebate	MF	N/A	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-3	30%	88%	95%	95%	2.7
1043	Appliances	ENERGY STAR Dehumidifier	Residential Prescriptive	MF	N/A	NC	1,095	12%	134	0.03	10	$10	100%	100%	DEH-4	30%	0%	99%	95%	2.7
1044	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	MF	N/A	NC	1,095	12%	134	0.03	10	$10	100%	100%	DEH-4	30%	0%	99%	95%	2.7
1045	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Prescriptive	SF	N/A	MO	1,095	25%	273	0.06	10	$75	100%	47%	DEH-1	30%	88%	95%	51%	5.5
1046	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Instant Rebate	SF	N/A	MO	1,095	25%	273	0.06	10	$75	100%	47%	DEH-1	30%	88%	95%	51%	5.5
1047	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Prescriptive	SF	N/A	NC	1,095	25%	273	0.06	10	$75	100%	47%	DEH-2	30%	0%	99%	51%	5.5
1048	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	SF	N/A	NC	1,095	25%	273	0.06	10	$75	100%	47%	DEH-2	30%	0%	99%	51%	5.5

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
1049	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Prescriptive	MF	N/A	MO	1,095	25%	273	0.06	10	$75	100%	47%	DEH-3	30%	88%	95%	51%	5.5
1050	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Instant Rebate	MF	N/A	MO	1,095	25%	273	0.06	10	$75	100%	47%	DEH-3	30%	88%	95%	51%	5.5
1051	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Prescriptive	MF	N/A	NC	1,095	25%	273	0.06	10	$75	100%	47%	DEH-4	30%	0%	99%	51%	5.5
1052	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	MF	N/A	NC	1,095	25%	273	0.06	10	$75	100%	47%	DEH-4	30%	0%	99%	51%	5.5
1053	Appliances	ENERGY STAR Dishwasher (E WH)	No program	SF	N/A	MO	307	12%	37	0.00	11	$76	66%	66%	DISH-1	26%	92%	93%	46%	0.4
1054	Appliances	ENERGY STAR Dishwasher (E WH)	No program	SF	N/A	NC	307	12%	37	0.00	11	$76	66%	66%	DISH-3	26%	0%	31%	46%	0.4
1055	Appliances	ENERGY STAR Dishwasher (E WH)	No program	MF	N/A	MO	307	12%	37	0.00	11	$76	66%	66%	DISH-5	26%	92%	93%	46%	0.4
1056	Appliances	ENERGY STAR Dishwasher (E WH)	No program	MF	N/A	NC	307	12%	37	0.00	11	$76	66%	66%	DISH-6	26%	0%	31%	46%	0.4
1057	Appliances	ENERGY STAR Dishwasher (NG WH)	No program	SF	N/A	MO	135	12%	16	0.00	11	$76	66%	66%	DISH-2	41%	92%	93%	46%	0.2
1058	Appliances	ENERGY STAR Dishwasher (NG WH)	No program	SF	N/A	NC	135	12%	16	0.00	11	$76	66%	66%	DISH-4	41%	0%	31%	46%	0.2
1059	Appliances	ENERGY STAR Dishwasher (NG WH)	No program	MF	N/A	MO	135	12%	16	0.00	11	$76	66%	66%	DISH-7	41%	92%	93%	46%	0.2
1060	Appliances	ENERGY STAR Dishwasher (NG WH)	No program	MF	N/A	NC	135	12%	16	0.00	11	$76	66%	66%	DISH-8	41%	0%	31%	46%	0.2
1061	Appliances	Smart Dishwasher (E WH)	No program	SF	N/A	MO	307	8%	24	0.00	11	$76	66%	66%	DISH-1	26%	92%	93%	46%	0.3
1062	Appliances	Smart Dishwasher (E WH)	No program	SF	N/A	NC	307	8%	24	0.00	11	$76	66%	66%	DISH-3	26%	0%	31%	46%	0.3
1063	Appliances	Smart Dishwasher (E WH)	No program	MF	N/A	MO	307	8%	24	0.00	11	$76	66%	66%	DISH-5	26%	92%	93%	46%	0.3
1064	Appliances	Smart Dishwasher (E WH)	No program	MF	N/A	NC	307	8%	24	0.00	11	$76	66%	66%	DISH-6	26%	0%	31%	46%	0.3
1065	Appliances	Smart Dishwasher (NG WH)	No program	SF	N/A	MO	135	8%	11	0.00	11	$76	66%	66%	DISH-2	41%	92%	93%	46%	0.1
1066	Appliances	Smart Dishwasher (NG WH)	No program	SF	N/A	NC	135	8%	11	0.00	11	$76	66%	66%	DISH-4	41%	0%	31%	46%	0.1
1067	Appliances	Smart Dishwasher (NG WH)	No program	MF	N/A	MO	135	8%	11	0.00	11	$76	66%	66%	DISH-7	41%	92%	93%	46%	0.1
1068	Appliances	Smart Dishwasher (NG WH)	No program	MF	N/A	NC	135	8%	11	0.00	11	$76	66%	66%	DISH-8	41%	0%	31%	46%	0.1
1069	Appliances	ENERGY STAR Clothes Washer (Electrc WH/Dryer)	Residential Prescriptive	SF	N/A	MO	590	34%	202	0.03	10	$84	100%	60%	CW-1	56%	63%	96%	58%	2.3
1070	Appliances	ENERGY STAR Clothes Washer (Electrc WH/Dryer)	Residential Prescriptive	SF	N/A	NC	590	34%	202	0.03	10	$84	100%	60%	CW-2	56%	0%	99%	58%	2.3
1071	Appliances	ENERGY STAR Clothes Washer (Electrc WH/Dryer)	Residential Prescriptive	MF	N/A	MO	590	34%	202	0.03	10	$84	100%	60%	CW-3	56%	63%	96%	58%	2.3
1072	Appliances	ENERGY STAR Clothes Washer (Electrc WH/Dryer)	Residential Prescriptive	MF	N/A	NC	590	34%	202	0.03	10	$84	100%	60%	CW-4	56%	0%	99%	58%	2.3
1073	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	Residential Prescriptive	SF	N/A	MO	434	47%	202	0.03	10	$84	100%	60%	CW-5	56%	63%	96%	58%	2.3
1074	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	Residential Prescriptive	SF	N/A	NC	434	47%	202	0.03	10	$84	100%	60%	CW-6	56%	0%	99%	58%	2.3
1075	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	Residential Prescriptive	MF	N/A	MO	434	47%	202	0.03	10	$84	100%	60%	CW-7	56%	63%	96%	58%	2.3
1076	Appliances	ENERGY STAR Clothes Washer (NG WH/E Dryer)	Residential Prescriptive	MF	N/A	NC	434	47%	202	0.03	10	$84	100%	60%	CW-8	56%	0%	99%	58%	2.3
1077	Appliances	Smart/CEE Tier 2 Clothes Washer (Electrc WH/Dryer)	Residential Emerging Markets Pilot	SF	N/A	MO	590	40%	236	0.03	10	$141	75%	35%	CW-1	56%	63%	64%	32%	2.7
1078	Appliances	Smart/CEE Tier 2 Clothes Washer (Electrc WH/Dryer)	Residential Emerging Markets Pilot	SF	N/A	NC	590	40%	236	0.03	10	$141	75%	35%	CW-2	56%	0%	33%	32%	2.7
1079	Appliances	Smart/CEE Tier 2 Clothes Washer (Electrc WH/Dryer)	Residential Emerging Markets Pilot	MF	N/A	MO	590	40%	236	0.03	10	$141	75%	35%	CW-3	56%	63%	64%	32%	2.7
1080	Appliances	Smart/CEE Tier 2 Clothes Washer (Electrc WH/Dryer)	Residential Emerging Markets Pilot	MF	N/A	NC	590	40%	236	0.03	10	$141	75%	35%	CW-4	56%	0%	33%	32%	2.7
1081	Appliances	Smart/CEE Tier 2 Clothes Washer (NG WH/E Dryer)	Residential Emerging Markets Pilot	SF	N/A	MO	434	26%	114	0.01	10	$141	35%	35%	CW-5	56%	63%	64%	32%	1.3
1082	Appliances	Smart/CEE Tier 2 Clothes Washer (NG WH/E Dryer)	Residential Emerging Markets Pilot	SF	N/A	NC	434	26%	114	0.01	10	$141	35%	35%	CW-6	56%	0%	31%	32%	1.3
1083	Appliances	Smart/CEE Tier 2 Clothes Washer (NG WH/E Dryer)	Residential Emerging Markets Pilot	MF	N/A	MO	434	26%	114	0.01	10	$141	35%	35%	CW-7	56%	63%	64%	32%	1.3
1084	Appliances	Smart/CEE Tier 2 Clothes Washer (NG WH/E Dryer)	Residential Emerging Markets Pilot	MF	N/A	NC	434	26%	114	0.01	10	$141	35%	35%	CW-8	56%	0%	31%	32%	1.3
1085	Appliances	ENERGY STAR Clothes Dryer (Electric)	Residential Prescriptive	SF	N/A	MO	769	21%	160	0.02	11	$152	50%	33%	CD-1	56%	17%	50%	41%	2.0

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
1086	Appliances	ENERGY STAR Clothes Dryer (Electric)	Residential Prescriptive	SF	N/A	NC	769	21%	160	0.02	11	$152	50%	33%	CD-2	56%	0%	55%	41%	2.0
1087	Appliances	ENERGY STAR Clothes Dryer (Electric)	Residential Prescriptive	MF	N/A	MO	769	21%	160	0.02	11	$152	50%	33%	CD-3	56%	17%	50%	41%	2.0
1088	Appliances	ENERGY STAR Clothes Dryer (Electric)	Residential Prescriptive	MF	N/A	NC	769	21%	160	0.02	11	$152	50%	33%	CD-4	56%	0%	55%	41%	2.0
1089	Appliances	Smart Clothes Dryer (Electric)	Residential Emerging Markets Pilot	SF	N/A	MO	769	7%	54	0.01	11	$636	8%	8%	CD-1	56%	17%	38%	19%	0.7
1090	Appliances	Smart Clothes Dryer (Electric)	Residential Emerging Markets Pilot	SF	N/A	NC	769	7%	54	0.01	11	$636	8%	8%	CD-2	56%	0%	31%	19%	0.7
1091	Appliances	Smart Clothes Dryer (Electric)	Residential Emerging Markets Pilot	MF	N/A	MO	769	7%	54	0.01	11	$636	8%	8%	CD-3	56%	17%	38%	19%	0.7
1092	Appliances	Smart Clothes Dryer (Electric)	Residential Emerging Markets Pilot	MF	N/A	NC	769	7%	54	0.01	11	$636	8%	8%	CD-4	56%	0%	31%	19%	0.7
1093	Appliances	Heat Pump Dryer	Residential Emerging Markets Pilot	SF	N/A	MO	769	49%	378	0.14	11	$900	6%	6%	CD-1	56%	17%	38%	18%	7.2
1094	Appliances	Heat Pump Dryer	Residential Emerging Markets Pilot	SF	N/A	NC	769	49%	378	0.14	11	$900	6%	6%	CD-2	56%	0%	31%	18%	7.2
1095	Appliances	Heat Pump Dryer	Residential Emerging Markets Pilot	MF	N/A	MO	769	49%	378	0.14	11	$900	6%	6%	CD-3	56%	17%	38%	18%	7.2
1096	Appliances	Heat Pump Dryer	Residential Emerging Markets Pilot	MF	N/A	NC	769	49%	378	0.14	11	$900	6%	6%	CD-4	56%	0%	31%	18%	7.2
2001	Behavior	Home Energy Reports	Residential Behavioral	SF	N/A	MO	9,835	2%	194	0.06	1	$0	100%	35%	HER-1	100%	28%	104%	100%	1.0
2002	Behavior	Home Energy Reports	Residential Behavioral	SF	N/A	NC	9,835	2%	194	0.06	1	$0	100%	35%	HER-2	100%	28%	104%	100%	1.0
2003	Behavior	Home Energy Reports	Residential Behavioral	MF	N/A	MO	9,835	2%	194	0.06	1	$0	100%	35%	HER-3	100%	28%	104%	100%	1.0
2004	Behavior	Home Energy Reports	Residential Behavioral	MF	N/A	NC	9,835	2%	194	0.06	1	$0	100%	35%	HER-4	100%	28%	104%	100%	1.0
2005	Behavior	Audit Recommendations - dual (Electric)	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,835	1%	81	0.02	1	$100	100%	100%	AUDIT-1	87%	0%	47%	73%	0.1
2006	Behavior	Audit Recommendations - Electric Only	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,835	1%	114	0.02	1	$100	100%	100%	AUDIT-2	11%	0%	47%	73%	0.1
2007	Behavior	Audit Recommendations - dual (Electric)	Residential Emerging Markets Pilot	MF	NLI	Retrofit	9,835	1%	81	0.02	1	$100	100%	100%	AUDIT-5	87%	0%	47%	73%	0.1
2008	Behavior	Audit Recommendations - Electric Only	Residential Emerging Markets Pilot	MF	NLI	Retrofit	9,835	1%	114	0.02	1	$100	100%	100%	AUDIT-6	11%	0%	47%	73%	0.1
2009	Behavior	Audit Recommendations - dual (Electric)	IQW	SF	LI	Retrofit	9,835	1%	81	0.02	1	$100	100%	100%	AUDIT-3	87%	0%	104%	100%	0.1
2010	Behavior	Audit Recommendations - Electric Only	IQW	SF	LI	Retrofit	9,835	1%	114	0.02	1	$100	100%	100%	AUDIT-4	11%	0%	104%	100%	0.1
2011	Behavior	Audit Recommendations - dual (Electric)	IQW	MF	LI	Retrofit	9,835	1%	81	0.02	1	$100	100%	100%	AUDIT-7	87%	0%	104%	100%	0.1
2012	Behavior	Audit Recommendations - Electric Only	IQW	MF	LI	Retrofit	9,835	1%	114	0.02	1	$100	100%	100%	AUDIT-8	11%	0%	104%	100%	0.1
2013	Behavior	Customer Education	Residential Emerging Markets Pilot	SF	N/A	MO	9,835	0%	27	0.00	1	$0	100%	35%	JSTOMER EI	100%	0%	47%	32%	1.0
2014	Behavior	Customer Education	Residential Emerging Markets Pilot	SF	N/A	NC	9,835	0%	27	0.00	1	$0	100%	35%	JSTOMER EI	100%	0%	47%	32%	1.0
2015	Behavior	Customer Education	Residential Emerging Markets Pilot	MF	N/A	MO	9,835	0%	27	0.00	1	$0	100%	35%	JSTOMER EI	100%	0%	47%	32%	1.0
2016	Behavior	Customer Education	Residential Emerging Markets Pilot	MF	N/A	NC	9,835	0%	27	0.00	1	$0	100%	35%	JSTOMER EI	100%	0%	47%	32%	1.0
2017	Behavior	AMI Data Portal	Residential Behavioral	SF	N/A	MO	9,835	2%	197	0.02	1	$0	100%	100%	AMI-1	100%	0%	104%	100%	35.6
2018	Behavior	AMI Data Portal	Residential Behavioral	SF	N/A	NC	9,835	2%	197	0.02	1	$0	100%	100%	AMI-2	100%	0%	104%	100%	35.6
2019	Behavior	AMI Data Portal	Residential Behavioral	MF	N/A	MO	9,835	2%	197	0.02	1	$0	100%	100%	AMI-3	100%	0%	104%	100%	35.6
2020	Behavior	AMI Data Portal	Residential Behavioral	MF	N/A	NC	9,835	2%	197	0.02	1	$0	100%	100%	AMI-4	100%	0%	104%	100%	35.6
3001	HVAC	ASHP Tune Up	Residential Prescriptive	SF	N/A	Retrofit	6,485	4%	289	0.14	5	$64	100%	78%	HP TUNE-1	4%	49%	83%	63%	3.3
3002	HVAC	ASHP Tune Up	Residential Prescriptive	MF	N/A	Retrofit	2,125	14%	289	0.14	5	$64	100%	78%	HP TUNE-2	4%	49%	83%	63%	3.3
3003	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	7%	454	0.13	15	$1,233	16%	16%	HP-4	4%	56%	59%	30%	2.5
3004	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	IQW	SF	LI	MO	6,485	7%	454	0.13	15	$1,233	100%	100%	HP-5	4%	56%	88%	89%	0.4
3005	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	Residential New Construction	SF	N/A	NC	6,485	7%	454	0.13	15	$1,233	16%	16%	HP-9	5%	20%	31%	30%	2.5

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3006	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	7%	146	0.09	15	$1,233	16%	16%	HP-13	4%	56%	59%	30%	1.2
3007	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	IQW	MF	LI	MO	2,125	7%	146	0.09	15	$1,233	100%	100%	HP-14	4%	56%	88%	89%	0.2
3008	HVAC	Air Source Heat Pump 16 SEER - Heat pump baseline	Residential New Construction	MF	N/A	NC	2,125	7%	146	0.09	15	$1,233	16%	16%	HP-15	5%	20%	31%	30%	1.2
3009	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	10%	675	0.17	15	$1,644	18%	18%	HP-4	4%	56%	59%	32%	2.3
3010	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	IQW	SF	LI	MO	6,485	10%	675	0.17	15	$1,644	100%	100%	HP-5	4%	56%	88%	89%	0.4
3011	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	Residential New Construction	SF	N/A	NC	6,485	10%	675	0.17	15	$1,644	18%	18%	HP-9	5%	20%	31%	32%	2.3
3012	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	11%	226	0.17	15	$1,644	18%	18%	HP-13	4%	56%	59%	32%	1.5
3013	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	IQW	MF	LI	MO	2,125	11%	226	0.17	15	$1,644	100%	100%	HP-14	4%	56%	88%	89%	0.3
3014	HVAC	Air Source Heat Pump 17 SEER - Heat pump baseline	Residential New Construction	MF	N/A	NC	2,125	11%	226	0.17	15	$1,644	18%	18%	HP-15	5%	20%	31%	32%	1.5
3015	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	16%	1,060	0.23	15	$2,055	19%	19%	HP-4	4%	56%	59%	32%	2.6
3016	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	IQW	SF	LI	MO	6,485	16%	1,060	0.23	15	$2,055	100%	100%	HP-5	4%	56%	88%	89%	0.5
3017	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	Residential New Construction	SF	N/A	NC	6,485	16%	1,060	0.23	15	$2,055	19%	19%	HP-9	5%	20%	31%	32%	2.6
3018	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	16%	349	0.23	15	$2,055	19%	19%	HP-13	4%	56%	59%	32%	1.6
3019	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	IQW	MF	LI	MO	2,125	16%	349	0.23	15	$2,055	100%	100%	HP-14	4%	56%	88%	89%	0.3
3020	HVAC	Air Source Heat Pump 18 SEER - Heat pump baseline	Residential New Construction	MF	N/A	NC	2,125	16%	349	0.23	15	$2,055	19%	19%	HP-15	5%	20%	31%	32%	1.6
3021	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	23%	1,479	0.40	15	$2,055	50%	19%	HP-4	4%	56%	59%	32%	4.0
3022	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	IQW	SF	LI	MO	6,485	23%	1,479	0.40	15	$2,055	100%	100%	HP-5	4%	56%	88%	89%	0.8
3023	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	Residential New Construction	SF	N/A	NC	6,485	23%	1,479	0.40	15	$2,055	50%	19%	HP-9	5%	20%	31%	32%	4.0
3024	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	24%	505	0.40	15	$2,055	19%	19%	HP-13	4%	56%	59%	32%	2.6
3025	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	IQW	MF	LI	MO	2,125	24%	505	0.40	15	$2,055	100%	100%	HP-14	4%	56%	88%	89%	0.5
3026	HVAC	Air Source Heat Pump 21 SEER - Heat pump baseline	Residential New Construction	MF	N/A	NC	2,125	24%	505	0.40	15	$2,055	19%	19%	HP-15	5%	20%	31%	32%	2.6
3027	HVAC	Ground Source Heat Pump 20 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	MO	6,485	16%	1,054	0.53	25	$11,871	80%	80%	HP-4	4%	56%	59%	55%	0.2
3028	HVAC	Ground Source Heat Pump 20 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	16%	1,054	0.53	25	$11,871	80%	80%	HP-9	4%	0%	35%	55%	0.2
3029	HVAC	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	MO	6,485	23%	1,514	0.64	25	$11,871	80%	80%	HP-4	4%	56%	59%	55%	0.3
3030	HVAC	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	23%	1,514	0.64	25	$11,871	80%	80%	HP-9	4%	0%	35%	55%	0.3
3031	HVAC	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	MO	6,485	30%	1,931	0.76	25	$11,871	80%	80%	HP-4	4%	56%	59%	55%	0.4
3032	HVAC	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	30%	1,931	0.76	25	$11,871	80%	80%	HP-9	4%	0%	35%	55%	0.4
3033	HVAC	Ground Source Heat Pump 29 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	MO	6,485	38%	2,434	1.02	25	$11,871	80%	80%	HP-4	4%	56%	59%	55%	0.5
3034	HVAC	Ground Source Heat Pump 29 SEER - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	38%	2,434	1.02	25	$11,871	80%	80%	HP-9	4%	0%	35%	55%	0.5
3035	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	9%	571	0.25	15	$267	100%	94%	HP-4	4%	56%	88%	80%	3.1
3036	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	LI	MO	6,485	9%	571	0.25	15	$267	100%	94%	HP-5	4%	56%	88%	80%	3.1
3037	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	N/A	NC	6,485	9%	571	0.25	15	$267	100%	94%	HP-9	4%	0%	92%	80%	3.1

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3038	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	9%	197	0.17	15	$267	100%	94%	HP-13	4%	56%	88%	80%	1.7
3039	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	LI	MO	2,125	9%	197	0.17	15	$267	100%	94%	HP-14	4%	56%	88%	80%	1.7
3040	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	N/A	NC	2,125	9%	197	0.17	15	$267	100%	94%	HP-15	4%	0%	92%	80%	1.7
3041	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	12%	769	0.44	15	$267	100%	94%	HP-4	4%	56%	88%	80%	5.1
3042	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	LI	MO	6,485	12%	769	0.44	15	$267	100%	94%	HP-5	4%	56%	88%	80%	5.1
3043	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	SF	N/A	NC	6,485	12%	769	0.44	15	$267	100%	94%	HP-9	4%	0%	92%	80%	5.1
3044	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	13%	284	0.30	15	$267	100%	94%	HP-13	4%	56%	88%	80%	2.9
3045	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	LI	MO	2,125	13%	284	0.30	15	$267	100%	94%	HP-14	4%	56%	88%	80%	2.9
3046	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Residential Midstream	MF	N/A	NC	2,125	13%	284	0.30	15	$267	100%	94%	HP-15	4%	0%	92%	80%	2.9
3047	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	17%	1,130	0.60	15	$533	100%	75%	HP-4	4%	56%	88%	60%	4.4
3048	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	LI	MO	6,485	17%	1,130	0.60	15	$533	100%	75%	HP-5	4%	56%	88%	60%	4.4
3049	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	N/A	NC	6,485	17%	1,130	0.60	15	$533	100%	75%	HP-9	4%	0%	92%	60%	4.4
3050	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	19%	409	0.40	15	$533	100%	75%	HP-13	4%	56%	88%	60%	2.5
3051	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	LI	MO	2,125	19%	409	0.40	15	$533	100%	75%	HP-14	4%	56%	88%	60%	2.5
3052	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	N/A	NC	2,125	19%	409	0.40	15	$533	100%	75%	HP-15	4%	0%	92%	60%	2.5
3053	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	NLI	MO	6,485	19%	1,262	0.73	15	$820	100%	49%	HP-4	4%	56%	88%	43%	5.2
3054	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	LI	MO	6,485	19%	1,262	0.73	15	$820	100%	49%	HP-5	4%	56%	88%	43%	5.2
3055	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	SF	N/A	NC	6,485	19%	1,262	0.73	15	$820	100%	49%	HP-9	4%	0%	92%	43%	5.2
3056	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	NLI	MO	2,125	22%	467	0.49	15	$820	100%	49%	HP-13	4%	56%	88%	43%	3.0
3057	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	LI	MO	2,125	22%	467	0.49	15	$820	100%	49%	HP-14	4%	56%	88%	43%	3.0
3058	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Residential Midstream	MF	N/A	NC	2,125	22%	467	0.49	15	$820	100%	49%	HP-15	4%	0%	92%	43%	3.0
3059	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	Residential Midstream	SF	NLI	MO	11,910	55%	6,533	0.19	15	$1,233	100%	16%	HP-1	6%	56%	88%	30%	20.0
3060	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	IQW	SF	LI	MO	11,910	55%	6,533	0.19	15	$1,233	100%	100%	HP-2	6%	56%	88%	89%	3.2
3061	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	Residential New Construction	SF	N/A	NC	11,910	55%	6,533	0.19	15	$1,233	100%	16%	HP-3	6%	20%	89%	30%	20.0
3062	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	Residential Midstream	MF	NLI	MO	3,156	51%	1,612	0.19	15	$1,233	75%	16%	HP-10	6%	56%	59%	30%	6.3
3063	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	IQW	MF	LI	MO	3,156	51%	1,612	0.19	15	$1,233	100%	100%	HP-11	6%	56%	88%	89%	1.0
3064	HVAC	Air Source Heat Pump 16 SEER - Furnace baseline	Residential New Construction	MF	N/A	NC	3,156	51%	1,612	0.19	15	$1,233	75%	16%	HP-12	6%	20%	52%	30%	6.3
3065	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	Residential Midstream	SF	NLI	MO	11,910	57%	6,733	0.27	15	$1,644	100%	18%	HP-1	6%	56%	88%	32%	14.2
3066	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	IQW	SF	LI	MO	11,910	57%	6,733	0.27	15	$1,644	100%	100%	HP-2	6%	56%	88%	89%	2.6
3067	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	Residential New Construction	SF	N/A	NC	11,910	57%	6,733	0.27	15	$1,644	100%	18%	HP-3	6%	20%	89%	32%	14.2
3068	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	Residential Midstream	MF	NLI	MO	3,156	53%	1,674	0.27	15	$1,644	75%	18%	HP-10	6%	56%	59%	32%	4.8
3069	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	IQW	MF	LI	MO	3,156	53%	1,674	0.27	15	$1,644	100%	100%	HP-11	6%	56%	88%	89%	0.9

Appendix B: Residential Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3070	HVAC	Air Source Heat Pump 17 SEER - Furnace baseline	Residential New Construction	MF	N/A	NC	3,156	53%	1,674	0.27	15	$1,644	75%	18%	HP-12	6%	20%	52%	32%	4.8
3071	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	Residential Midstream	SF	NLI	MO	11,910	59%	7,075	0.34	15	$2,055	100%	19%	HP-1	6%	56%	88%	32%	11.4
3072	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	IQW	SF	LI	MO	11,910	59%	7,075	0.34	15	$2,055	100%	100%	HP-2	6%	56%	88%	89%	2.2
3073	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	Residential New Construction	SF	N/A	NC	11,910	59%	7,075	0.34	15	$2,055	100%	19%	HP-3	6%	20%	89%	32%	11.4
3074	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	Residential Midstream	MF	NLI	MO	3,156	56%	1,770	0.34	15	$2,055	50%	19%	HP-10	6%	56%	59%	32%	4.0
3075	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	IQW	MF	LI	MO	3,156	56%	1,770	0.34	15	$2,055	100%	100%	HP-11	6%	56%	88%	89%	0.8
3076	HVAC	Air Source Heat Pump 18 SEER - Furnace baseline	Residential New Construction	MF	N/A	NC	3,156	56%	1,770	0.34	15	$2,055	50%	19%	HP-12	6%	20%	31%	32%	4.0
3077	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	Residential Midstream	SF	NLI	MO	11,910	63%	7,456	0.50	15	$2,055	100%	19%	HP-1	6%	56%	88%	32%	12.8
3078	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	IQW	SF	LI	MO	11,910	63%	7,456	0.50	15	$2,055	100%	100%	HP-2	6%	56%	88%	89%	2.5
3079	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	Residential New Construction	SF	N/A	NC	11,910	63%	7,456	0.50	15	$2,055	100%	19%	HP-3	6%	20%	89%	32%	12.8
3080	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	Residential Midstream	MF	NLI	MO	3,156	60%	1,893	0.50	15	$2,055	75%	19%	HP-10	6%	56%	59%	32%	5.0
3081	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	IQW	MF	LI	MO	3,156	60%	1,893	0.50	15	$2,055	100%	100%	HP-11	6%	56%	88%	89%	1.0
3082	HVAC	Air Source Heat Pump 21 SEER - Furnace baseline	Residential New Construction	MF	N/A	NC	3,156	60%	1,893	0.50	15	$2,055	75%	19%	HP-12	6%	20%	52%	32%	5.0
3083	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	NLI	MO	11,910	56%	6,643	0.40	15	$1,004	100%	25%	HP-1	6%	56%	88%	36%	17.8
3084	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	LI	MO	11,910	56%	6,643	0.40	15	$1,004	100%	100%	HP-2	6%	56%	59%	73%	4.4
3085	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	N/A	NC	11,910	56%	6,643	0.40	15	$1,004	100%	25%	HP-3	6%	0%	92%	36%	17.8
3086	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	NLI	MO	3,156	52%	1,653	0.27	15	$1,004	100%	25%	HP-10	6%	56%	88%	36%	5.7
3087	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	LI	MO	3,156	52%	1,653	0.27	15	$1,004	100%	100%	HP-11	6%	56%	59%	73%	1.4
3088	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	N/A	NC	3,156	52%	1,653	0.27	15	$1,004	100%	25%	HP-12	6%	0%	92%	36%	5.7
3089	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	NLI	MO	11,910	57%	6,827	0.60	15	$1,004	100%	25%	HP-1	6%	56%	88%	36%	19.7
3090	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	LI	MO	11,910	57%	6,827	0.60	15	$1,004	100%	100%	HP-2	6%	56%	59%	73%	4.9
3091	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	SF	N/A	NC	11,910	57%	6,827	0.60	15	$1,004	100%	25%	HP-3	6%	0%	92%	36%	19.7
3092	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	NLI	MO	3,156	55%	1,722	0.40	15	$1,004	100%	25%	HP-10	6%	56%	88%	36%	6.8
3093	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	LI	MO	3,156	55%	1,722	0.40	15	$1,004	100%	100%	HP-11	6%	56%	59%	73%	1.7
3094	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric furnace baseline	Residential Midstream	MF	N/A	NC	3,156	55%	1,722	0.40	15	$1,004	100%	25%	HP-12	6%	0%	92%	36%	6.8
3095	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	NLI	MO	11,910	60%	7,153	0.75	15	$1,070	100%	37%	HP-1	6%	56%	88%	40%	13.5
3096	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	LI	MO	11,910	60%	7,153	0.75	15	$1,070	100%	100%	HP-2	6%	56%	59%	73%	5.1
3097	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	N/A	NC	11,910	60%	7,153	0.75	15	$1,070	100%	37%	HP-3	6%	0%	92%	40%	13.5
3098	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	NLI	MO	3,156	58%	1,820	0.50	15	$1,070	100%	37%	HP-10	6%	56%	88%	40%	4.9
3099	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	LI	MO	3,156	58%	1,820	0.50	15	$1,070	100%	100%	HP-11	6%	56%	59%	73%	1.8
3100	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	N/A	NC	3,156	58%	1,820	0.50	15	$1,070	100%	37%	HP-12	6%	0%	92%	40%	4.9
3101	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	NLI	MO	11,910	61%	7,276	0.89	15	$1,557	100%	26%	HP-1	6%	56%	88%	36%	14.3

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3102	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	LI	MO	11,910	61%	7,276	0.89	15	$1,557	100%	100%	HP-2	6%	56%	59%	73%	3.7
3103	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	SF	N/A	NC	11,910	61%	7,276	0.89	15	$1,557	100%	26%	HP-3	6%	0%	92%	36%	14.3
3104	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	NLI	MO	3,156	59%	1,866	0.59	15	$1,557	100%	26%	HP-10	6%	56%	88%	36%	5.4
3105	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	LI	MO	3,156	59%	1,866	0.59	15	$1,557	100%	100%	HP-11	6%	56%	59%	73%	1.4
3106	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric furnace baseline	Residential Midstream	MF	N/A	NC	3,156	59%	1,866	0.59	15	$1,557	100%	26%	HP-12	6%	0%	92%	36%	5.4
3107	HVAC	AC Tune Up	Residential Prescriptive	SF	NLI	Retrofit	2,131	4%	89	0.15	5	$64	100%	39%	AC TUNE-1	90%	44%	85%	40%	5.1
3108	HVAC	AC Tune Up	Residential Prescriptive	MF	NLI	Retrofit	796	11%	89	0.15	5	$64	100%	39%	AC TUNE-2	90%	44%	85%	40%	5.1
3109	HVAC	AC Tune Up	IQW	SF	LI	Retrofit	2,131	7%	155	0.20	2	$64	100%	39%	AC TUNE-3	90%	44%	85%	40%	3.0
3110	HVAC	AC Tune Up	IQW	MF	LI	Retrofit	796	19%	155	0.20	2	$64	100%	39%	AC TUNE-4	90%	44%	85%	40%	3.0
3111	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	NLI	MO	11,911	56%	6,652	0.40	15	$2,324	100%	11%	HP-6	1%	56%	88%	27%	17.8
3112	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	LI	MO	11,911	56%	6,652	0.40	15	$2,324	100%	11%	HP-7	1%	56%	88%	27%	17.8
3113	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	N/A	NC	11,911	56%	6,652	0.40	15	$2,324	100%	11%	HP-8	1%	0%	92%	27%	17.8
3114	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	NLI	MO	3,114	53%	1,640	0.27	15	$2,324	50%	11%	HP-16	1%	56%	59%	27%	5.7
3115	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	LI	MO	3,114	53%	1,640	0.27	15	$2,324	100%	11%	HP-17	1%	56%	88%	27%	5.7
3116	HVAC	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	N/A	NC	3,114	53%	1,640	0.27	15	$2,324	50%	11%	HP-18	1%	0%	45%	27%	5.7
3117	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	NLI	MO	11,911	57%	6,835	0.60	15	$2,324	100%	11%	HP-6	1%	56%	88%	27%	19.7
3118	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	LI	MO	11,911	57%	6,835	0.60	15	$2,324	100%	11%	HP-7	1%	56%	88%	27%	19.7
3119	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	SF	N/A	NC	11,911	57%	6,835	0.60	15	$2,324	100%	11%	HP-8	1%	0%	92%	27%	19.7
3120	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	NLI	MO	3,114	55%	1,707	0.40	15	$2,324	50%	11%	HP-16	1%	56%	59%	27%	6.8
3121	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	LI	MO	3,114	55%	1,707	0.40	15	$2,324	100%	11%	HP-17	1%	56%	88%	27%	6.8
3122	HVAC	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric baseboard baseline	Residential Midstream	MF	N/A	NC	3,114	55%	1,707	0.40	15	$2,324	50%	11%	HP-18	1%	0%	45%	27%	6.8
3123	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	NLI	MO	11,911	60%	7,159	0.75	15	$2,590	100%	15%	HP-6	1%	56%	88%	30%	13.5
3124	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	LI	MO	11,911	60%	7,159	0.75	15	$2,590	100%	15%	HP-7	1%	56%	88%	30%	13.5
3125	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	N/A	NC	11,911	60%	7,159	0.75	15	$2,590	100%	15%	HP-8	1%	0%	92%	30%	13.5
3126	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	NLI	MO	3,114	58%	1,803	0.50	15	$2,590	50%	15%	HP-16	1%	56%	59%	30%	4.9
3127	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	LI	MO	3,114	58%	1,803	0.50	15	$2,590	100%	15%	HP-17	1%	56%	88%	30%	4.9

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3128	HVAC	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	N/A	NC	3,114	58%	1,803	0.50	15	$2,590	50%	15%	HP-18	1%	0%	45%	30%	4.9
3129	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	NLI	MO	11,911	61%	7,282	0.89	15	$2,877	100%	14%	HP-6	1%	56%	88%	29%	14.3
3130	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	LI	MO	11,911	61%	7,282	0.89	15	$2,877	100%	14%	HP-7	1%	56%	88%	29%	14.3
3131	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	SF	N/A	NC	11,911	61%	7,282	0.89	15	$2,877	100%	14%	HP-8	1%	0%	92%	29%	14.3
3132	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	NLI	MO	3,114	59%	1,847	0.59	15	$2,877	50%	14%	HP-16	1%	56%	59%	29%	5.4
3133	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	LI	MO	3,114	59%	1,847	0.59	15	$2,877	100%	14%	HP-17	1%	56%	88%	29%	5.4
3134	HVAC	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric baseboard baseline	Residential Midstream	MF	N/A	NC	3,114	59%	1,847	0.59	15	$2,877	50%	14%	HP-18	1%	0%	45%	29%	5.4
3135	HVAC	Central Air Conditioner 15 SEER	Residential Midstream	SF	NLI	MO	2,131	7%	142	0.15	18	$104	100%	100%	CAC-1	90%	50%	88%	89%	2.1
3136	HVAC	Central Air Conditioner 15 SEER	Residential Midstream	SF	LI	MO	2,131	7%	142	0.15	18	$104	100%	100%	CAC-2	90%	50%	88%	89%	2.1
3137	HVAC	Central Air Conditioner 15 SEER	Residential New Construction	SF	N/A	NC	2,131	7%	142	0.15	18	$104	100%	100%	CAC-3	95%	20%	89%	89%	2.1
3138	HVAC	Central Air Conditioner 15 SEER	Residential Midstream	MF	NLI	MO	796	7%	53	0.10	18	$104	100%	100%	CAC-4	90%	50%	88%	89%	1.3
3139	HVAC	Central Air Conditioner 15 SEER	Residential Midstream	MF	LI	MO	796	7%	53	0.10	18	$104	100%	100%	CAC-5	90%	50%	88%	89%	1.3
3140	HVAC	Central Air Conditioner 15 SEER	Residential New Construction	MF	N/A	NC	796	7%	53	0.10	18	$104	100%	100%	CAC-6	95%	20%	89%	89%	1.3
3141	HVAC	Central Air Conditioner 16 SEER	Residential Midstream	SF	NLI	MO	2,131	13%	266	0.28	18	$221	100%	90%	CAC-1	90%	50%	88%	76%	3.9
3142	HVAC	Central Air Conditioner 16 SEER	IQW	SF	LI	MO	2,131	13%	266	0.28	18	$221	100%	100%	CAC-2	90%	50%	88%	89%	3.5
3143	HVAC	Central Air Conditioner 16 SEER	Residential New Construction	SF	N/A	NC	2,131	13%	266	0.28	18	$221	100%	90%	CAC-3	95%	20%	89%	76%	3.9
3144	HVAC	Central Air Conditioner 16 SEER	Residential Midstream	MF	NLI	MO	796	13%	100	0.19	18	$221	100%	90%	CAC-4	90%	50%	88%	76%	2.4
3145	HVAC	Central Air Conditioner 16 SEER	IQW	MF	LI	MO	796	13%	100	0.19	18	$221	100%	100%	CAC-5	90%	50%	88%	89%	2.1
3146	HVAC	Central Air Conditioner 16 SEER	Residential New Construction	MF	N/A	NC	796	13%	100	0.19	18	$221	100%	90%	CAC-6	95%	20%	89%	76%	2.4
3147	HVAC	Central Air Conditioner 17 SEER	Residential Midstream	SF	NLI	MO	2,131	18%	376	0.40	18	$620	100%	48%	CAC-1	90%	50%	88%	43%	3.7
3148	HVAC	Central Air Conditioner 17 SEER	Residential Midstream	SF	LI	MO	2,131	18%	376	0.40	18	$620	100%	48%	CAC-2	90%	50%	88%	43%	3.7
3149	HVAC	Central Air Conditioner 17 SEER	Residential New Construction	SF	N/A	NC	2,131	18%	376	0.40	18	$620	100%	48%	CAC-3	95%	20%	89%	43%	3.7
3150	HVAC	Central Air Conditioner 17 SEER	Residential Midstream	MF	NLI	MO	796	18%	141	0.27	18	$620	75%	48%	CAC-4	90%	50%	55%	43%	2.2
3151	HVAC	Central Air Conditioner 17 SEER	Residential Midstream	MF	LI	MO	796	18%	141	0.27	18	$620	100%	48%	CAC-5	90%	50%	88%	43%	2.2
3152	HVAC	Central Air Conditioner 17 SEER	Residential New Construction	MF	N/A	NC	796	18%	141	0.27	18	$620	75%	48%	CAC-6	95%	20%	52%	43%	2.2
3153	HVAC	Central Air Conditioner 18 SEER	Residential Midstream	SF	NLI	MO	2,131	22%	474	0.50	18	$620	100%	65%	CAC-1	90%	50%	88%	52%	3.5
3154	HVAC	Central Air Conditioner 18 SEER	Residential Midstream	SF	LI	MO	2,131	22%	474	0.50	18	$620	100%	65%	CAC-2	90%	50%	88%	52%	3.5
3155	HVAC	Central Air Conditioner 18 SEER	Residential New Construction	SF	N/A	NC	2,131	22%	474	0.50	18	$620	100%	65%	CAC-3	95%	20%	89%	52%	3.5
3156	HVAC	Central Air Conditioner 18 SEER	Residential Midstream	MF	NLI	MO	796	22%	177	0.34	18	$620	100%	65%	CAC-4	90%	50%	88%	52%	2.1
3157	HVAC	Central Air Conditioner 18 SEER	Residential Midstream	MF	LI	MO	796	22%	177	0.34	18	$620	100%	65%	CAC-5	90%	50%	88%	52%	2.1
3158	HVAC	Central Air Conditioner 18 SEER	Residential New Construction	MF	N/A	NC	796	22%	177	0.34	18	$620	100%	65%	CAC-6	90%	20%	89%	52%	2.1
3159	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	SF	NLI	Retrofit	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-1	87%	35%	35%	36%	1.9
3160	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	SF	LI	Retrofit	2,442	8%	205	0.00	15	$250	75%	24%	T-STAT-3	87%	35%	43%	36%	1.9
3161	HVAC	Smart Thermostat (Dual)	IQW	SF	LI	Retrofit	9,740	3%	337	0.00	15	$250	100%	100%	T-STAT-3	87%	35%	87%	89%	0.8
3162	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential New Construction	SF	N/A	NC	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-5	90%	20%	31%	36%	1.9
3163	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	MF	NLI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-7	87%	35%	35%	36%	0.7

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3164	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	MF	LI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-9	87%	35%	35%	36%	0.7
3165	HVAC	IQW MFDI Smart Thermostat - dual (Electric)	IQW	MF	LI	Retrofit	2,744	8%	225	0.00	15	$250	100%	100%	T-STAT-9	87%	35%	87%	89%	0.5
3166	HVAC	Smart Programmable Thermostat - South (Dual - Gas & Electric)	Residential New Construction	MF	N/A	NC	878	8%	74	0.00	15	$250	24%	24%	T-STAT-11	90%	20%	31%	36%	0.7
3167	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	SF	NLI	Retrofit	2,442	8%	205	0.00	15	$140	50%	29%	T-STAT-1	87%	35%	35%	37%	2.9
3168	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	SF	LI	Retrofit	2,442	8%	205	0.00	15	$140	100%	29%	T-STAT-3	87%	35%	87%	37%	2.9
3169	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential New Construction	SF	N/A	NC	2,442	8%	205	0.00	15	$140	50%	29%	T-STAT-5	87%	0%	45%	37%	2.9
3170	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	MF	NLI	Retrofit	878	8%	74	0.00	15	$140	29%	29%	T-STAT-7	87%	35%	35%	37%	1.0
3171	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential Prescriptive	MF	LI	Retrofit	878	8%	74	0.00	15	$140	50%	29%	T-STAT-9	87%	35%	35%	37%	1.0
3172	HVAC	Wifi Thermostat - South (Dual - Gas & Electric)	Residential New Construction	MF	N/A	NC	878	8%	74	0.00	15	$140	29%	29%	T-STAT-11	87%	0%	39%	37%	1.0
3173	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Marketplace	SF	NLI	Retrofit	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-1	87%	35%	35%	36%	1.9
3174	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Marketplace	SF	LI	Retrofit	2,442	8%	205	0.00	15	$250	75%	24%	T-STAT-3	87%	35%	43%	36%	1.9
3175	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential New Construction	SF	N/A	NC	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-5	90%	20%	31%	36%	1.9
3176	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Marketplace	MF	NLI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-7	87%	35%	35%	36%	0.7
3177	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Marketplace	MF	LI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-9	87%	35%	35%	36%	0.7
3178	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential New Construction	MF	N/A	NC	878	8%	74	0.00	15	$250	24%	24%	T-STAT-11	90%	20%	31%	36%	0.7
3179	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential Marketplace	SF	NLI	Retrofit	2,442	8%	205	0.00	15	$140	50%	29%	T-STAT-1	87%	35%	35%	37%	2.9
3180	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential Marketplace	SF	LI	Retrofit	2,442	8%	205	0.00	15	$140	100%	29%	T-STAT-3	87%	35%	87%	37%	2.9
3181	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential New Construction	SF	N/A	NC	2,442	8%	205	0.00	15	$140	50%	29%	T-STAT-5	87%	0%	45%	37%	2.9
3182	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential Marketplace	MF	NLI	Retrofit	878	8%	74	0.00	15	$140	29%	29%	T-STAT-7	87%	35%	35%	37%	1.0
3183	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential Marketplace	MF	LI	Retrofit	878	8%	74	0.00	15	$140	50%	29%	T-STAT-9	87%	35%	35%	37%	1.0
3184	HVAC	WiFi Tstat - South (Dual - Gas & Electric)	Residential New Construction	MF	N/A	NC	878	8%	74	0.00	15	$140	29%	29%	T-STAT-11	87%	0%	39%	37%	1.0
3185	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Instant Rebate	SF	NLI	Retrofit	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-1	87%	35%	35%	36%	1.9
3186	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Instant Rebate	SF	LI	Retrofit	2,442	8%	205	0.00	15	$250	75%	24%	T-STAT-3	87%	35%	43%	36%	1.9
3187	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential New Construction	SF	N/A	NC	2,442	8%	205	0.00	15	$250	24%	24%	T-STAT-5	90%	20%	31%	36%	1.9
3188	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Instant Rebate	MF	NLI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-7	87%	35%	35%	36%	0.7
3189	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential Instant Rebate	MF	LI	Retrofit	878	8%	74	0.00	15	$250	24%	24%	T-STAT-9	87%	35%	35%	36%	0.7
3190	HVAC	Smart Thermostat - South (Dual - Gas & Electric)	Residential New Construction	MF	N/A	NC	878	8%	74	0.00	15	$250	24%	24%	T-STAT-11	90%	20%	31%	36%	0.7
3191	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential Prescriptive	SF	NLI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-2	11%	35%	87%	38%	6.1
3192	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential Prescriptive	SF	LI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-4	11%	35%	87%	38%	6.1
3193	HVAC	Smart Thermostat (Electric)	IQW	SF	LI	Retrofit	9,740	14%	1,364	0.00	15	$250	100%	100%	T-STAT-4	11%	35%	87%	89%	3.0
3194	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential New Construction	SF	N/A	NC	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-6	10%	20%	89%	38%	6.1
3195	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential Prescriptive	MF	NLI	Retrofit	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-8	11%	35%	35%	38%	1.7
3196	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential Prescriptive	MF	LI	Retrofit	2,744	8%	232	0.00	15	$250	75%	30%	T-STAT-10	11%	35%	43%	38%	1.7

Appendix B: Residential Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3197	HVAC	Smart Thermostat (Electric)	IQW	MF	LI	Retrofit	2,744	8%	225	0.00	15	$250	100%	100%	T-STAT-10	11%	35%	87%	89%	0.5
3198	HVAC	Smart Programmable Thermostat - South (Electric Only)	Residential New Construction	MF	N/A	NC	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-12	10%	20%	31%	38%	1.7
3199	HVAC	Wifi Thermostat - South (Electric Only)	Residential Prescriptive	SF	NLI	Retrofit	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-2	11%	35%	87%	39%	9.2
3200	HVAC	Wifi Thermostat - South (Electric Only)	Residential Prescriptive	SF	LI	Retrofit	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-4	11%	35%	87%	39%	9.2
3201	HVAC	Wifi Thermostat - South (Electric Only)	Residential New Construction	SF	N/A	NC	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-6	11%	0%	92%	39%	9.2
3202	HVAC	Wifi Thermostat - South (Electric Only)	Residential Prescriptive	MF	NLI	Retrofit	2,744	8%	232	0.00	15	$140	75%	36%	T-STAT-8	11%	35%	43%	39%	2.6
3203	HVAC	Wifi Thermostat - South (Electric Only)	Residential Prescriptive	MF	LI	Retrofit	2,744	8%	232	0.00	15	$140	100%	36%	T-STAT-10	11%	35%	87%	39%	2.6
3204	HVAC	Wifi Thermostat - South (Electric Only)	Residential New Construction	MF	N/A	NC	2,744	8%	232	0.00	15	$140	75%	36%	T-STAT-12	11%	0%	62%	39%	2.6
3205	HVAC	Smart Thermostat - South (Electric Only)	Residential Marketplace	SF	NLI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-2	11%	35%	87%	38%	6.1
3206	HVAC	Smart Thermostat - South (Electric Only)	Residential Marketplace	SF	LI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-4	11%	35%	87%	38%	6.1
3207	HVAC	Smart Thermostat - South (Electric Only)	Residential New Construction	SF	N/A	NC	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-6	10%	20%	89%	38%	6.1
3208	HVAC	Smart Thermostat - South (Electric Only)	Residential Marketplace	MF	NLI	Retrofit	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-8	11%	35%	35%	38%	1.7
3209	HVAC	Smart Thermostat - South (Electric Only)	Residential Marketplace	MF	LI	Retrofit	2,744	8%	232	0.00	15	$250	75%	30%	T-STAT-10	11%	35%	43%	38%	1.7
3210	HVAC	Smart Thermostat - South (Electric Only)	Residential New Construction	MF	N/A	NC	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-12	10%	20%	31%	38%	1.7
3211	HVAC	WiFi Tstat - South (Electric Only)	Residential Marketplace	SF	NLI	Retrofit	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-2	11%	35%	87%	39%	9.2
3212	HVAC	WiFi Tstat - South (Electric Only)	Residential Marketplace	SF	LI	Retrofit	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-4	11%	35%	87%	39%	9.2
3213	HVAC	WiFi Tstat - South (Electric Only)	Residential New Construction	SF	N/A	NC	9,740	8%	826	0.00	15	$140	100%	36%	T-STAT-6	11%	0%	92%	39%	9.2
3214	HVAC	WiFi Tstat - South (Electric Only)	Residential Marketplace	MF	NLI	Retrofit	2,744	8%	232	0.00	15	$140	75%	36%	T-STAT-8	11%	35%	43%	39%	2.6
3215	HVAC	WiFi Tstat - South (Electric Only)	Residential Marketplace	MF	LI	Retrofit	2,744	8%	232	0.00	15	$140	100%	36%	T-STAT-10	11%	35%	87%	39%	2.6
3216	HVAC	WiFi Tstat - South (Electric Only)	Residential New Construction	MF	N/A	NC	2,744	8%	232	0.00	15	$140	75%	36%	T-STAT-12	11%	0%	62%	39%	2.6
3217	HVAC	Smart Thermostat - South (Electric Only)	Residential Instant Rebate	SF	NLI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-2	11%	35%	87%	38%	6.1
3218	HVAC	Smart Thermostat - South (Electric Only)	Residential Instant Rebate	SF	LI	Retrofit	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-4	11%	35%	87%	38%	6.1
3219	HVAC	Smart Thermostat - South (Electric Only)	Residential New Construction	SF	N/A	NC	9,740	8%	826	0.00	15	$250	100%	30%	T-STAT-6	10%	20%	89%	38%	6.1
3220	HVAC	Smart Thermostat - South (Electric Only)	Residential Instant Rebate	MF	NLI	Retrofit	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-8	11%	35%	35%	38%	1.7
3221	HVAC	Smart Thermostat - South (Electric Only)	Residential Instant Rebate	MF	LI	Retrofit	2,744	8%	232	0.00	15	$250	75%	30%	T-STAT-10	11%	35%	43%	38%	1.7
3222	HVAC	Smart Thermostat - South (Electric Only)	Residential New Construction	MF	N/A	NC	2,744	8%	232	0.00	15	$250	30%	30%	T-STAT-12	10%	20%	31%	38%	1.7
3223	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTHP Baseline SEER 10.5 HPSF 7.7	Residential Emerging Markets Pilot	SF	N/A	MO	6,485	36%	2,351	1.15	15	$1,434	100%	80%	HP-4	4%	56%	59%	55%	3.0
3224	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTHP Baseline SEER 10.5 HPSF 7.7	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	36%	2,351	1.15	15	$1,434	100%	80%	HP-9	4%	0%	47%	55%	3.0
3225	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTHP Baseline SEER 10.5 HPSF 7.7	Residential Emerging Markets Pilot	MF	N/A	MO	2,125	37%	777	0.77	15	$1,434	100%	80%	HP-13	4%	56%	59%	55%	1.6
3226	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTHP Baseline SEER 10.5 HPSF 7.7	Residential Emerging Markets Pilot	MF	N/A	NC	2,125	37%	777	0.77	15	$1,434	100%	80%	HP-15	4%	0%	47%	55%	1.6
3227	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTAC SEER 10.5 Electric Resistance Heat	Residential Emerging Markets Pilot	SF	N/A	MO	6,491	60%	3,924	1.15	15	$1,434	100%	80%	HP-1	6%	56%	59%	55%	3.8

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3228	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTAC SEER 10.5 Electric Resistance Heat	Residential Emerging Markets Pilot	SF	N/A	NC	6,491	60%	3,924	1.15	15	$1,434	100%	80%	HP-3	6%	0%	47%	55%	3.8
3229	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTAC SEER 10.5 Electric Resistance Heat	Residential Emerging Markets Pilot	MF	N/A	MO	3,156	63%	1,987	0.77	15	$1,434	100%	80%	HP-10	6%	56%	59%	55%	2.2
3230	HVAC	PTHP Variable Speed SEER 17 11.9 HPSF Upgrade from PTAC SEER 10.5 Electric Resistance Heat	Residential Emerging Markets Pilot	MF	N/A	NC	3,156	63%	1,987	0.77	15	$1,434	100%	80%	HP-12	6%	0%	47%	55%	2.2
3231	HVAC	Filter whistle	Residential Emerging Markets Pilot	SF	NLI	Retrofit	6,485	1%	46	0.07	5	$3	100%	100%	FW-1	97%	49%	38%	73%	21.8
3232	HVAC	Filter whistle	IQW	SF	LI	Retrofit	6,485	1%	46	0.07	5	$3	100%	100%	FW-2	97%	49%	83%	89%	21.8
3233	HVAC	Filter whistle	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	1%	46	0.07	5	$3	100%	100%	FW-3	97%	0%	47%	73%	21.8
3234	HVAC	Filter whistle	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,125	1%	19	0.03	5	$3	100%	100%	FW-4	97%	49%	38%	73%	9.0
3235	HVAC	Filter whistle	IQW	MF	LI	Retrofit	2,125	1%	19	0.03	5	$3	100%	100%	FW-5	97%	49%	83%	89%	9.0
3236	HVAC	Filter whistle	Residential Emerging Markets Pilot	MF	N/A	NC	2,125	1%	19	0.03	5	$3	100%	100%	FW-6	97%	0%	47%	73%	9.0
3237	HVAC	ENERGY STAR Room Air Conditioner	Residential Emerging Markets Pilot	SF	N/A	MO	408	8%	32	0.07	12	$40	100%	63%	RAC-1	15%	49%	54%	44%	5.1
3238	HVAC	ENERGY STAR Room Air Conditioner	Residential Emerging Markets Pilot	SF	N/A	NC	408	8%	32	0.07	12	$40	100%	63%	RAC-2	15%	0%	47%	44%	5.1
3239	HVAC	ENERGY STAR Room Air Conditioner	Residential Emerging Markets Pilot	MF	N/A	MO	408	8%	32	0.07	12	$40	100%	63%	RAC-3	15%	49%	54%	44%	5.1
3240	HVAC	ENERGY STAR Room Air Conditioner	Residential Emerging Markets Pilot	MF	N/A	NC	408	8%	32	0.07	12	$40	100%	63%	RAC-4	15%	0%	47%	44%	5.1
3241	HVAC	Smart Room AC	Residential Emerging Markets Pilot	SF	N/A	MO	408	3%	12	0.02	12	$40	75%	63%	RAC-1	15%	49%	54%	44%	1.7
3242	HVAC	Smart Room AC	Residential Emerging Markets Pilot	SF	N/A	NC	408	3%	12	0.02	12	$40	75%	63%	RAC-2	15%	0%	33%	44%	1.7
3243	HVAC	Smart Room AC	Residential Emerging Markets Pilot	MF	N/A	MO	408	3%	12	0.02	12	$40	75%	63%	RAC-3	15%	49%	54%	44%	1.7
3244	HVAC	Smart Room AC	Residential Emerging Markets Pilot	MF	N/A	NC	408	3%	12	0.02	12	$40	75%	63%	RAC-4	15%	0%	33%	44%	1.7
3245	HVAC	Room AC Recycling	Appliance Recycling	SF	N/A	Recycle	314	100%	314	0.21	4	$25	100%	100%	RACR-1	3%	0%	92%	89%	7.1
3246	HVAC	Room AC Recycling	Appliance Recycling	MF	N/A	Recycle	314	100%	314	0.21	4	$25	100%	100%	RACR-2	3%	0%	92%	89%	7.1
3247	HVAC	Smart Vents/Sensors - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	5%	324	0.11	15	$1,625	80%	80%	SVS-1	4%	3%	34%	55%	0.3
3248	HVAC	Smart Vents/Sensors - Heat pump baseline	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	5%	324	0.11	15	$1,625	80%	80%	SVS-2	4%	0%	35%	55%	0.3
3249	HVAC	Smart Vents/Sensors - Heat pump baseline	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	5%	106	0.08	15	$1,040	80%	80%	SVS-3	4%	3%	34%	55%	0.2
3250	HVAC	Smart Vents/Sensors - Heat pump baseline	Residential Emerging Markets Pilot	MF	N/A	NC	2,125	5%	106	0.08	15	$1,040	80%	80%	SVS-4	4%	0%	35%	55%	0.2
3251	HVAC	Smart Vents/Sensors - Furnace baseline	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	5%	595	0.11	15	$1,625	80%	80%	SVS-5	6%	3%	34%	55%	0.4
3252	HVAC	Smart Vents/Sensors - Furnace baseline	Residential Emerging Markets Pilot	SF	N/A	NC	11,910	5%	595	0.11	15	$1,625	80%	80%	SVS-6	6%	0%	35%	55%	0.4
3253	HVAC	Smart Vents/Sensors - Furnace baseline	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	5%	158	0.08	15	$1,040	80%	80%	SVS-7	6%	3%	34%	55%	0.3
3254	HVAC	Smart Vents/Sensors - Furnace baseline	Residential Emerging Markets Pilot	MF	N/A	NC	3,156	5%	158	0.08	15	$1,040	80%	80%	SVS-8	6%	0%	35%	55%	0.3
3255	HVAC	Smart Vents/Sensors - Gas/CAC baseline	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	5%	122	0.11	15	$1,625	80%	80%	SVS-9	87%	3%	34%	55%	0.2
3256	HVAC	Smart Vents/Sensors - Gas/CAC baseline	Residential Emerging Markets Pilot	SF	N/A	NC	2,442	5%	122	0.11	15	$1,625	80%	80%	SVS-10	87%	0%	35%	55%	0.2
3257	HVAC	Smart Vents/Sensors - Gas/CAC baseline	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	5%	44	0.08	15	$1,040	80%	80%	SVS-11	87%	3%	34%	55%	0.2
3258	HVAC	Smart Vents/Sensors - Gas/CAC baseline	Residential Emerging Markets Pilot	MF	N/A	NC	878	5%	44	0.08	15	$1,040	80%	80%	SVS-12	87%	0%	35%	55%	0.2

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
3259	HVAC	Whole House Attic Fan	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,131	18%	384	0.41	15	$711	100%	80%	WHAF-1	94%	7%	43%	55%	1.7
3260	HVAC	Whole House Attic Fan	Residential Emerging Markets Pilot	SF	N/A	NC	2,131	18%	384	0.41	15	$711	100%	80%	WHAF-2	94%	0%	47%	55%	1.7
3261	HVAC	Whole House Attic Fan	Residential Emerging Markets Pilot	MF	N/A	Retrofit	796	18%	143	0.27	15	$711	80%	80%	WHAF-3	94%	7%	32%	55%	1.0
3262	HVAC	Whole House Attic Fan	Residential Emerging Markets Pilot	MF	N/A	NC	796	18%	143	0.27	15	$711	80%	80%	WHAF-4	94%	0%	35%	55%	1.0
3263	HVAC	Attic Fan	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,131	8%	170	0.18	15	$125	100%	80%	WHAF-1	94%	8%	43%	55%	4.4
3264	HVAC	Attic Fan	Residential Emerging Markets Pilot	SF	N/A	NC	2,131	8%	170	0.18	15	$125	100%	80%	WHAF-2	94%	0%	47%	55%	4.4
3265	HVAC	Attic Fan	Residential Emerging Markets Pilot	MF	N/A	Retrofit	796	8%	64	0.12	15	$125	100%	80%	WHAF-3	94%	8%	43%	55%	2.6
3266	HVAC	Attic Fan	Residential Emerging Markets Pilot	MF	N/A	NC	796	8%	64	0.12	15	$125	100%	80%	WHAF-4	90%	0%	47%	55%	2.6
3267	HVAC	ENERGY STAR Bath Vent Fan	Residential Emerging Markets Pilot	SF	N/A	Retrofit	49	61%	30	0.02	19	$44	100%	46%	BATH FAN-1	100%	51%	38%	37%	3.7
3268	HVAC	ENERGY STAR Bath Vent Fan	Residential Emerging Markets Pilot	SF	N/A	NC	49	61%	30	0.02	19	$44	100%	46%	BATH FAN-2	100%	0%	47%	37%	3.7
3269	HVAC	ENERGY STAR Bath Vent Fan	Residential Emerging Markets Pilot	MF	N/A	Retrofit	49	61%	30	0.02	19	$44	100%	46%	BATH FAN-3	100%	51%	38%	37%	3.7
3270	HVAC	ENERGY STAR Bath Vent Fan	Residential Emerging Markets Pilot	MF	N/A	NC	49	61%	30	0.02	19	$44	100%	46%	BATH FAN-4	100%	0%	47%	37%	3.7
3271	HVAC	Energy Recovery Ventilator - Heat Pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	51%	3,317	0.26	15	$3,000	100%	100%	ERV-1	4%	0%	47%	73%	0.8
3272	HVAC	Energy Recovery Ventilator - Electric Resistance	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	37%	4,396	0.34	15	$3,000	100%	100%	ERV-2	6%	0%	47%	73%	1.0
3273	HVAC	Energy Recovery Ventilator - Heat Pump	Residential Emerging Markets Pilot	SF	N/A	NC	6,485	51%	3,317	0.26	15	$3,000	100%	100%	ERV-3	4%	0%	47%	73%	0.8
3274	HVAC	Energy Recovery Ventilator - Electric Resistance	Residential Emerging Markets Pilot	SF	N/A	NC	11,910	37%	4,396	0.34	15	$3,000	100%	100%	ERV-4	6%	0%	47%	73%	1.0
3275	HVAC	Energy Recovery Ventilator - Heat Pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	85%	1,815	0.14	15	$3,000	100%	100%	ERV-5	4%	0%	47%	73%	0.4
3276	HVAC	Energy Recovery Ventilator - Electric Resistance	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	76%	2,404	0.19	15	$3,000	100%	100%	ERV-6	6%	0%	47%	73%	0.6
3277	HVAC	Energy Recovery Ventilator - Heat Pump	Residential Emerging Markets Pilot	MF	N/A	NC	2,125	85%	1,815	0.14	15	$3,000	100%	100%	ERV-7	4%	0%	47%	73%	0.4
3278	HVAC	Energy Recovery Ventilator - Electric Resistance	Residential Emerging Markets Pilot	MF	N/A	NC	3,156	76%	2,404	0.19	15	$3,000	100%	100%	ERV-8	6%	0%	47%	73%	0.6
4001	Lighting	LED Standard	CBL	SF	N/A	MO	37	43%	16	0.00	15	$2	100%	59%	STAN-1	3003%	59%	97%	58%	10.2
4002	Lighting	LED Standard	CBL	SF	N/A	NC	37	43%	16	0.00	15	$2	100%	59%	STAN-2	3003%	0%	99%	58%	10.2
4003	Lighting	LED Standard	CBL	MF	N/A	MO	37	43%	16	0.00	15	$2	100%	59%	STAN-3	1915%	59%	97%	58%	10.2
4004	Lighting	LED Standard	CBL	MF	N/A	NC	37	43%	16	0.00	15	$2	100%	59%	STAN-4	1915%	0%	99%	58%	10.2
4005	Lighting	LED Reflector	Residential Marketplace	SF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-1	738%	59%	97%	95%	33.6
4006	Lighting	LED Reflector	Residential Marketplace	SF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-1	738%	59%	97%	95%	33.6
4007	Lighting	LED Reflector	Residential Instant Rebate	SF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-1	738%	59%	97%	95%	33.6
4008	Lighting	LED Reflector	IQW	SF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-2	738%	59%	97%	95%	33.6
4009	Lighting	LED Reflector	Residential Marketplace	SF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-2	738%	59%	97%	95%	33.6
4010	Lighting	LED Reflector	Residential Marketplace	SF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-2	738%	59%	97%	95%	33.6
4011	Lighting	LED Reflector	Residential Instant Rebate	SF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-2	738%	59%	97%	95%	33.6
4012	Lighting	LED Reflector	Residential Marketplace	SF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-3	738%	0%	99%	95%	33.6
4013	Lighting	LED Reflector	Residential Marketplace	SF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-3	738%	0%	99%	95%	33.6
4014	Lighting	LED Reflector	Residential Instant Rebate	SF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-3	738%	0%	99%	95%	33.6
4015	Lighting	LED Reflector	Residential Marketplace	MF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-4	471%	59%	97%	95%	33.6
4016	Lighting	LED Reflector	Residential Marketplace	MF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-4	471%	59%	97%	95%	33.6
4017	Lighting	LED Reflector	Residential Instant Rebate	MF	NLI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-4	471%	59%	97%	95%	33.6
4018	Lighting	LED Reflector	IQW	MF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-5	471%	59%	97%	95%	33.6
4019	Lighting	LED Reflector	Residential Marketplace	MF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-5	471%	59%	97%	95%	33.6
4020	Lighting	LED Reflector	Residential Marketplace	MF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-5	471%	59%	97%	95%	33.6
4021	Lighting	LED Reflector	Residential Instant Rebate	MF	LI	MO	65	75%	49	0.04	15	$3	100%	100%	REFL-5	471%	59%	97%	95%	33.6

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
4022	Lighting	LED Reflector	Residential Marketplace	MF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-6	471%	0%	99%	95%	33.6
4023	Lighting	LED Reflector	Residential Marketplace	MF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-6	471%	0%	99%	95%	33.6
4024	Lighting	LED Reflector	Residential Instant Rebate	MF	N/A	NC	65	75%	49	0.04	15	$3	100%	100%	REFL-6	471%	0%	99%	95%	33.6
4025	Lighting	LED Specialty	Residential Marketplace	SF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-1	446%	59%	97%	95%	29.4
4026	Lighting	LED Specialty	Residential Marketplace	SF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-1	446%	59%	97%	95%	29.4
4027	Lighting	LED Specialty	Residential Instant Rebate	SF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-1	446%	59%	97%	95%	29.4
4028	Lighting	LED Specialty	IQW	SF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-2	446%	59%	97%	95%	29.4
4029	Lighting	LED Specialty	Residential Marketplace	SF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-2	446%	59%	97%	95%	29.4
4030	Lighting	LED Specialty	Residential Marketplace	SF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-2	446%	59%	97%	95%	29.4
4031	Lighting	LED Specialty	Residential Instant Rebate	SF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-2	446%	59%	97%	95%	29.4
4032	Lighting	LED Specialty	Residential Marketplace	SF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-3	446%	0%	99%	95%	29.4
4033	Lighting	LED Specialty	Residential Marketplace	SF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-3	446%	0%	99%	95%	29.4
4034	Lighting	LED Specialty	Residential Instant Rebate	SF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-3	446%	0%	99%	95%	29.4
4035	Lighting	LED Specialty	Residential Marketplace	MF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-4	284%	59%	97%	95%	29.4
4036	Lighting	LED Specialty	Residential Marketplace	MF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-4	284%	59%	97%	95%	29.4
4037	Lighting	LED Specialty	Residential Instant Rebate	MF	NLI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-4	284%	59%	97%	95%	29.4
4038	Lighting	LED Specialty	IQW	MF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-5	284%	59%	97%	95%	29.4
4039	Lighting	LED Specialty	Residential Marketplace	MF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-5	284%	59%	97%	95%	29.4
4040	Lighting	LED Specialty	Residential Marketplace	MF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-5	284%	59%	97%	95%	29.4
4041	Lighting	LED Specialty	Residential Instant Rebate	MF	LI	MO	44	75%	33	0.02	15	$2	100%	100%	SPEC-5	284%	59%	97%	95%	29.4
4042	Lighting	LED Specialty	Residential Marketplace	MF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-6	284%	0%	99%	95%	29.4
4043	Lighting	LED Specialty	Residential Marketplace	MF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-6	284%	0%	99%	95%	29.4
4044	Lighting	LED Specialty	Residential Instant Rebate	MF	N/A	NC	44	75%	33	0.02	15	$2	100%	100%	SPEC-6	284%	0%	99%	95%	29.4
4045	Lighting	Exterior LED Lamp	Residential Emerging Markets Pilot	SF	NLI	MO	127	72%	92	0.00	7	$2	100%	100%	EXT-1	503%	59%	62%	73%	14.7
4046	Lighting	Exterior LED Lamp	IQW	SF	LI	MO	127	72%	92	0.00	7	$2	100%	100%	EXT-2	503%	59%	97%	95%	14.7
4047	Lighting	Exterior LED Lamp	Residential Emerging Markets Pilot	SF	N/A	NC	127	72%	92	0.00	7	$2	100%	100%	EXT-3	503%	0%	47%	73%	14.7
4048	Lighting	Exterior LED Lamp	Residential Emerging Markets Pilot	MF	NLI	MO	127	72%	92	0.00	7	$2	100%	100%	EXT-4	289%	59%	62%	73%	14.7
4049	Lighting	Exterior LED Lamp	IQW	MF	LI	MO	127	72%	92	0.00	7	$2	100%	100%	EXT-5	289%	59%	97%	95%	14.7
4050	Lighting	Exterior LED Lamp	Residential Emerging Markets Pilot	MF	N/A	NC	127	72%	92	0.00	7	$2	100%	100%	EXT-6	289%	0%	47%	73%	14.7
4051	Lighting	LED Nightlights	Residential Marketplace	SF	NLI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-1	40%	59%	97%	95%	2.1
4052	Lighting	LED Nightlights	Community Connections	SF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-2	40%	59%	97%	95%	2.1
4053	Lighting	LED Nightlights	Community Connections	SF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-2	40%	59%	97%	95%	2.1
4054	Lighting	LED Nightlights	Residential Marketplace	MF	NLI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-3	40%	59%	97%	95%	2.1
4055	Lighting	LED Nightlights	Community Connections	MF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-4	40%	59%	97%	95%	2.1
4056	Lighting	LED Nightlights	Community Connections	MF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-4	40%	59%	97%	95%	2.1
4057	Lighting	Ceiling Fan	Residential Emerging Markets Pilot	SF	N/A	MO	110	75%	82	0.00	10	$46	54%	54%	CEIL-1	92%	59%	62%	40%	1.3
4058	Lighting	Ceiling Fan	Residential Emerging Markets Pilot	SF	N/A	NC	110	75%	82	0.00	10	$46	54%	54%	CEIL-2	92%	0%	31%	40%	1.3
4059	Lighting	Ceiling Fan	Residential Emerging Markets Pilot	MF	N/A	MO	110	75%	82	0.00	10	$46	54%	54%	CEIL-3	98%	59%	62%	40%	1.3
4060	Lighting	Ceiling Fan	Residential Emerging Markets Pilot	MF	N/A	NC	110	75%	82	0.00	10	$46	54%	54%	CEIL-4	98%	0%	31%	40%	1.3
4061	Lighting	LED 3-Way Bulb	Residential Emerging Markets Pilot	SF	N/A	MO	11	75%	9	0.00	15	$3	100%	50%	STAN-1	3003%	59%	62%	38%	4.4
4062	Lighting	LED 3-Way Bulb	Residential Emerging Markets Pilot	SF	N/A	NC	11	75%	9	0.00	15	$3	100%	50%	STAN-2	3003%	0%	47%	38%	4.4
4063	Lighting	LED 3-Way Bulb	Residential Emerging Markets Pilot	MF	N/A	MO	11	75%	9	0.00	15	$3	100%	50%	STAN-3	1915%	59%	62%	38%	4.4
4064	Lighting	LED 3-Way Bulb	Residential Emerging Markets Pilot	MF	N/A	NC	11	75%	9	0.00	15	$3	100%	50%	STAN-4	1915%	0%	47%	38%	4.4
4065	Lighting	Linear LED	Residential Emerging Markets Pilot	SF	N/A	MO	23	44%	10	0.01	9	$7	100%	80%	LINEAR-1	509%	59%	62%	55%	3.8
4066	Lighting	Linear LED	Residential Emerging Markets Pilot	SF	N/A	NC	23	44%	10	0.01	9	$3	100%	80%	LINEAR-2	509%	0%	47%	55%	10.6

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
4067	Lighting	Linear LED	Residential Emerging Markets Pilot	MF	N/A	MO	23	44%	10	0.01	9	$7	100%	80%	LINEAR-3	325%	59%	62%	55%	3.8
4068	Lighting	Linear LED	Residential Emerging Markets Pilot	MF	N/A	NC	23	44%	10	0.01	9	$3	100%	80%	LINEAR-4	325%	0%	47%	55%	10.6
4069	Lighting	Smart LED	Residential Emerging Markets Pilot	SF	N/A	MO	19	10%	2	0.00	10	$2	80%	80%	STAN-1	3003%	59%	62%	55%	0.5
4070	Lighting	Smart LED	Residential Emerging Markets Pilot	SF	N/A	NC	19	10%	2	0.00	10	$2	80%	80%	STAN-2	3003%	0%	35%	55%	0.5
4071	Lighting	Smart LED	Residential Emerging Markets Pilot	MF	N/A	MO	19	10%	2	0.00	10	$2	80%	80%	STAN-3	1915%	59%	62%	55%	0.5
4072	Lighting	Smart LED	Residential Emerging Markets Pilot	MF	N/A	NC	19	10%	2	0.00	10	$2	80%	80%	STAN-4	1915%	0%	35%	55%	0.5
4073	Lighting	LED Fixture	Residential Emerging Markets Pilot	SF	N/A	MO	82	59%	49	0.06	15	$26	100%	80%	STAN-1	3003%	59%	62%	55%	6.8
4074	Lighting	LED Fixture	Residential Emerging Markets Pilot	SF	N/A	NC	82	59%	49	0.06	15	$3	100%	80%	STAN-2	3003%	0%	47%	55%	68.2
4075	Lighting	LED Fixture	Residential Emerging Markets Pilot	MF	N/A	MO	82	59%	49	0.06	15	$26	100%	80%	STAN-3	1915%	59%	62%	55%	6.8
4076	Lighting	LED Fixture	Residential Emerging Markets Pilot	MF	N/A	NC	82	59%	49	0.06	15	$3	100%	80%	STAN-4	1915%	0%	47%	55%	68.2
4077	Lighting	Occupancy Sensor	Residential Emerging Markets Pilot	SF	N/A	Retrofit	124	30%	37	0.05	10	$30	100%	80%	OCC-1	1047%	31%	34%	55%	3.2
4078	Lighting	Occupancy Sensor	Residential Emerging Markets Pilot	SF	N/A	NC	124	30%	37	0.05	10	$30	100%	80%	OCC-2	1047%	0%	47%	55%	3.2
4079	Lighting	Occupancy Sensor	Residential Emerging Markets Pilot	MF	N/A	Retrofit	124	30%	37	0.05	10	$30	100%	80%	OCC-3	1047%	31%	34%	55%	3.2
4080	Lighting	Occupancy Sensor	Residential Emerging Markets Pilot	MF	N/A	NC	124	30%	37	0.05	10	$30	100%	80%	OCC-4	1047%	0%	47%	55%	3.2
4081	Lighting	Smart Lighting Switch	Residential Emerging Markets Pilot	SF	N/A	Retrofit	124	17%	21	0.05	10	$43	100%	47%	OCC-1	668%	31%	34%	37%	3.6
4082	Lighting	Smart Lighting Switch	Residential Emerging Markets Pilot	SF	N/A	NC	124	17%	21	0.05	10	$43	100%	47%	OCC-2	668%	0%	47%	37%	3.6
4083	Lighting	Smart Lighting Switch	Residential Emerging Markets Pilot	MF	N/A	Retrofit	124	17%	21	0.05	10	$43	100%	47%	OCC-3	668%	31%	34%	37%	3.6
4084	Lighting	Smart Lighting Switch	Residential Emerging Markets Pilot	MF	N/A	NC	124	17%	21	0.05	10	$43	100%	47%	OCC-4	668%	0%	47%	37%	3.6
4085	Lighting	Exterior Lighting Controls	Residential Emerging Markets Pilot	SF	N/A	Retrofit	146	44%	65	0.03	10	$30	100%	80%	ELC-1	252%	31%	34%	55%	2.5
4086	Lighting	Exterior Lighting Controls	Residential Emerging Markets Pilot	SF	N/A	NC	146	44%	65	0.03	10	$30	100%	80%	ELC-2	252%	0%	47%	55%	2.5
4087	Lighting	Exterior Lighting Controls	Residential Emerging Markets Pilot	MF	N/A	Retrofit	146	44%	65	0.03	10	$30	100%	80%	ELC-3	145%	31%	34%	55%	2.5
4088	Lighting	Exterior Lighting Controls	Residential Emerging Markets Pilot	MF	N/A	NC	146	44%	65	0.03	10	$30	100%	80%	ELC-4	145%	0%	47%	55%	2.5
4089	Lighting	ENERGY STAR LED Trim Kits	Residential Emerging Markets Pilot	SF	N/A	MO	18	70%	13	0.00	15	$5	100%	100%	TRIM-1	446%	59%	62%	73%	2.2
4090	Lighting	ENERGY STAR LED Trim Kits	Residential Emerging Markets Pilot	SF	N/A	NC	18	70%	13	0.00	15	$5	100%	100%	TRIM-2	446%	0%	47%	73%	2.2
4091	Lighting	ENERGY STAR LED Trim Kits	Residential Emerging Markets Pilot	MF	N/A	MO	18	70%	13	0.00	15	$5	100%	100%	TRIM-3	284%	59%	62%	73%	2.2
4092	Lighting	ENERGY STAR LED Trim Kits	Residential Emerging Markets Pilot	MF	N/A	NC	18	70%	13	0.00	15	$5	100%	100%	TRIM-4	284%	0%	47%	73%	2.2
5001	Pool/Pump	Variable Speed Pool Pump	Residential Emerging Markets Pilot	SF	N/A	MO	1,167	26%	308	0.22	10	$314	100%	96%	PUMP-1	8%	35%	46%	68%	1.4
5002	Pool/Pump	Variable Speed Pool Pump	Residential Emerging Markets Pilot	SF	N/A	NC	1,167	26%	308	0.22	10	$314	100%	96%	PUMP-2	8%	0%	47%	68%	1.4
5003	Pool/Pump	Variable Speed Pool Pump	Residential Emerging Markets Pilot	MF	N/A	MO	1,167	26%	308	0.22	10	$314	100%	96%	PUMP-3	8%	35%	46%	68%	1.4
5004	Pool/Pump	Variable Speed Pool Pump	Residential Emerging Markets Pilot	MF	N/A	NC	1,167	26%	308	0.22	10	$314	100%	96%	PUMP-4	8%	0%	47%	68%	1.4
5005	Pool/Pump	Pool Timer	Residential Emerging Markets Pilot	SF	N/A	MO	1,167	40%	467	0.00	2	$25	100%	80%	PUMP-1	8%	35%	46%	55%	1.9
5006	Pool/Pump	Pool Timer	Residential Emerging Markets Pilot	SF	N/A	NC	1,167	40%	467	0.00	2	$25	100%	80%	PUMP-2	8%	0%	47%	55%	1.9

Appendix B: Residential Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
5007	Pool/Pump	Pool Timer	Residential Emerging Markets Pilot	MF	N/A	MO	1,167	40%	467	0.00	2	$25	100%	80%	PUMP-3	8%	35%	46%	55%	1.9
5008	Pool/Pump	Pool Timer	Residential Emerging Markets Pilot	MF	N/A	NC	1,167	40%	467	0.00	2	$25	100%	80%	PUMP-4	8%	0%	47%	55%	1.9
5009	Pool/Pump	Pool Heater (COP 5.5-5.9)	Residential Prescriptive	SF	N/A	MO	2,364	38%	900	0.00	8	$1,250	40%	40%	OOL HEATER	0%	1%	47%	46%	0.6
5010	Pool/Pump	Pool Heater (COP >= 6.0)	Residential Prescriptive	SF	N/A	MO	2,364	52%	1,234	0.00	8	$1,250	80%	80%	OOL HEATER	0%	1%	75%	73%	0.4
5011	Pool/Pump	Pool Heater (COP 5.5-5.9)	Residential Prescriptive	SF	N/A	NC	2,364	38%	900	0.00	8	$1,250	40%	40%	OOL HEATER	0%	0%	47%	46%	0.6
5012	Pool/Pump	Pool Heater (COP >= 6.0)	Residential Prescriptive	SF	N/A	NC	2,364	52%	1,234	0.00	8	$1,250	80%	80%	OOL HEATER	0%	0%	75%	73%	0.4
5013	Pool/Pump	Pool Heater (COP 5.5-5.9)	Residential Prescriptive	MF	N/A	MO	2,364	38%	900	0.00	8	$1,250	40%	40%	OOL HEATER	0%	1%	47%	46%	0.6
5014	Pool/Pump	Pool Heater (COP >= 6.0)	Residential Prescriptive	MF	N/A	MO	2,364	52%	1,234	0.00	8	$1,250	80%	80%	OOL HEATER	0%	1%	75%	73%	0.4
5015	Pool/Pump	Pool Heater (COP 5.5-5.9)	Residential Prescriptive	MF	N/A	NC	2,364	38%	900	0.00	8	$1,250	40%	40%	OOL HEATER	0%	0%	47%	46%	0.6
5016	Pool/Pump	Pool Heater (COP >= 6.0)	Residential Prescriptive	MF	N/A	NC	2,364	52%	1,234	0.00	8	$1,250	8%	8%	OOL HEATER	0%	0%	31%	25%	3.9
5017	Pool/Pump	Well Pump	Residential Emerging Markets Pilot	SF	N/A	MO	411	33%	136	0.02	20	$110	100%	80%	WELL-1	4%	25%	41%	55%	1.5
5018	Pool/Pump	Well Pump	Residential Emerging Markets Pilot	SF	N/A	NC	411	33%	136	0.02	20	$110	100%	80%	WELL-2	4%	0%	47%	55%	1.5
5019	Pool/Pump	Well Pump	Residential Emerging Markets Pilot	MF	N/A	MO	411	33%	136	0.02	20	$110	100%	80%	WELL-3	0%	25%	0%	55%	1.5
5020	Pool/Pump	Well Pump	Residential Emerging Markets Pilot	MF	N/A	NC	411	33%	136	0.02	20	$110	100%	80%	WELL-4	0%	0%	0%	55%	1.5
6001	New Construction	Gold Star HERS Index Score 62 - Electric Heated	Residential New Construction	SF	N/A	NC	9,835	44%	4,598	0.40	25	$2,696	100%	100%	NC-1	11%	0%	47%	73%	1.8
6002	New Construction	Gold Star HERS Index Score 62 - Gas Heated South (Dual)	Residential New Construction	SF	N/A	NC	9,835	12%	1,218	0.40	25	$2,696	100%	100%	NC-2	87%	0%	47%	73%	0.8
6003	New Construction	Gold Star HERS Index Score 63 - Electric Heated	Residential New Construction	SF	N/A	NC	9,835	44%	4,598	0.40	25	$2,504	100%	100%	NC-1	11%	0%	47%	73%	2.0
6004	New Construction	Gold Star HERS Index Score 63 - Gas Heated South (Dual)	Residential New Construction	SF	N/A	NC	9,835	12%	1,218	0.40	25	$2,504	100%	100%	NC-2	87%	0%	47%	73%	0.8
6005	New Construction	Gold Star HERS Index Score 65 - Electric Heated	Residential New Construction	SF	N/A	NC	9,835	16%	1,703	0.40	25	$2,121	100%	100%	NC-1	11%	0%	47%	73%	1.2
6006	New Construction	Gold Star HERS Index Score 65 - Gas Heated South (Dual)	Residential New Construction	SF	N/A	NC	9,835	13%	1,349	0.40	25	$2,121	100%	100%	NC-2	87%	0%	47%	73%	1.0
6007	New Construction	Gold Star HERS Index Score 62 - Electric Heated	Residential New Construction	MF	N/A	NC	9,835	44%	4,598	0.40	25	$2,696	100%	100%	NC-3	11%	0%	47%	73%	1.8
6008	New Construction	Gold Star HERS Index Score 62 - Gas Heated South (Dual)	Residential New Construction	MF	N/A	NC	9,835	12%	1,218	0.40	25	$2,696	100%	100%	NC-4	87%	0%	47%	73%	0.8
6009	New Construction	Gold Star HERS Index Score 63 - Electric Heated	Residential New Construction	MF	N/A	NC	9,835	44%	4,598	0.40	25	$2,504	100%	100%	NC-3	11%	0%	47%	73%	2.0
6010	New Construction	Gold Star HERS Index Score 63 - Gas Heated South (Dual)	Residential New Construction	MF	N/A	NC	9,835	12%	1,218	0.40	25	$2,504	100%	100%	NC-4	87%	0%	47%	73%	0.8
6011	New Construction	Gold Star HERS Index Score 65 - Electric Heated	Residential New Construction	MF	N/A	NC	9,835	16%	1,703	0.40	25	$2,121	100%	100%	NC-3	11%	0%	47%	73%	1.2
6012	New Construction	Gold Star HERS Index Score 65 - Gas Heated South (Dual)	Residential New Construction	MF	N/A	NC	9,835	13%	1,349	0.40	25	$2,121	100%	100%	NC-4	87%	0%	47%	73%	1.0
7001	Plug Loads	Smart Power Strips - Tier 1	Residential Marketplace	SF	NLI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7002	Plug Loads	Smart Power Strips - Tier 1	Community Connections	SF	LI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7003	Plug Loads	Smart Power Strips - Tier 1	Community Connections	SF	LI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7004	Plug Loads	Smart Power Strips - Tier 1	Residential Marketplace	SF	N/A	NC	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	0%	99%	95%	0.5
7005	Plug Loads	Smart Power Strips - Tier 1	Residential Marketplace	MF	NLI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7006	Plug Loads	Smart Power Strips - Tier 1	Community Connections	MF	LI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7007	Plug Loads	Smart Power Strips - Tier 1	Community Connections	MF	LI	Retrofit	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	16%	98%	95%	0.5
7008	Plug Loads	Smart Power Strips - Tier 1	Residential Marketplace	MF	N/A	NC	466	5%	25	0.00	4	$10	100%	100%	OWER STRIP	178%	0%	99%	95%	0.5
7009	Plug Loads	Smart Power Strips - Tier 2	Residential Emerging Markets Pilot	SF	NLI	Retrofit	466	29%	136	0.02	4	$60	50%	17%	OWER STRIP	100%	16%	32%	23%	3.7
7010	Plug Loads	Smart Power Strips - Tier 2	Community Connections	SF	LI	Retrofit	466	29%	136	0.02	4	$60	100%	17%	OWER STRIP	100%	16%	38%	23%	3.7
7011	Plug Loads	Smart Power Strips - Tier 2	Community Connections	SF	LI	Retrofit	466	29%	136	0.02	4	$60	100%	17%	OWER STRIP	100%	16%	38%	23%	3.7
7012	Plug Loads	Smart Power Strips - Tier 2	Residential Emerging Markets Pilot	SF	N/A	NC	466	29%	136	0.02	4	$60	50%	17%	OWER STRIP	100%	0%	31%	23%	3.7
7013	Plug Loads	Smart Power Strips - Tier 2	Residential Emerging Markets Pilot	MF	NLI	Retrofit	466	29%	136	0.02	4	$60	50%	17%	OWER STRIP	100%	16%	32%	23%	3.7
7014	Plug Loads	Smart Power Strips - Tier 2	Community Connections	MF	LI	Retrofit	466	29%	136	0.02	4	$60	100%	17%	OWER STRIP	100%	16%	38%	23%	3.7

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
Measure #: Each measure permutation, in order. **End-use:** The end-use of each meaure. **Measure Name:** Generic measure name (multiple permutations for each measure). **Program:** Each measure is mapped to a program. **Home Type:** Each measure is either a single-family (SF), or multifamily (MF) home. **Income Type:** Each measure is either low-income (LI), non-low-income (NLI) or not income-specific (N/A). **Replacement Type:** Market opportunity (MO), Retrofit, Recylce or New Construction (NC). **EE EUL:** measure useful life. **End Use Measure Group:** Categorizes measures competing to save the same kWh of energy used. **Base Saturation:** Saturation of baseline equipment (% of homes with the measure). **EE Saturation:** % of existing equipment stock that is already efficient. **MAP Adoption Rate:** Long-term ultimate market adoption rate in the MAP scenario. **RAP Adoption Rate:** Long-term adoption rate in the RAP scenario. **UCT Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
7015	Plug Loads	Smart Power Strips - Tier 2	Community Connections	MF	LI	Retrofit	466	29%	136	0.02	4	$60	100%	17%	OWER STRIP	100%	16%	38%	23%	3.7
7016	Plug Loads	Smart Power Strips - Tier 2	Residential Emerging Markets Pilot	MF	N/A	NC	466	29%	136	0.02	4	$60	50%	17%	OWER STRIP	100%	0%	31%	23%	3.7
7017	Plug Loads	Smart Television	Residential Emerging Markets Pilot	SF	N/A	MO	83	20%	17	0.00	6	$0	100%	100%	TV-1	100%	46%	31%	73%	0.6
7018	Plug Loads	Smart Television	Residential Emerging Markets Pilot	SF	N/A	NC	83	20%	17	0.00	6	$0	100%	100%	TV-2	100%	0%	47%	73%	0.6
7019	Plug Loads	Smart Television	Residential Emerging Markets Pilot	MF	N/A	MO	83	20%	17	0.00	6	$0	100%	100%	TV-3	100%	46%	31%	73%	0.6
7020	Plug Loads	Smart Television	Residential Emerging Markets Pilot	MF	N/A	NC	83	20%	17	0.00	6	$0	100%	100%	TV-4	100%	0%	47%	73%	0.6
7021	Plug Loads	Smart Outlets	Residential Emerging Markets Pilot	SF	N/A	Retrofit	466	6%	28	0.00	7	$50	20%	20%	OUTLET-1	100%	14%	32%	25%	1.1
7022	Plug Loads	Smart Outlets	Residential Emerging Markets Pilot	SF	N/A	NC	466	6%	28	0.00	7	$50	20%	20%	OUTLET-2	100%	0%	31%	25%	1.1
7023	Plug Loads	Smart Outlets	Residential Emerging Markets Pilot	MF	N/A	Retrofit	466	6%	28	0.00	7	$50	20%	20%	OUTLET-3	100%	14%	32%	25%	1.1
7024	Plug Loads	Smart Outlets	Residential Emerging Markets Pilot	MF	N/A	NC	466	6%	28	0.00	7	$50	20%	20%	OUTLET-4	100%	0%	31%	25%	1.1
8001	Shell	Advanced Walls - Electric Only	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,740	10%	974	0.23	20	$2,470	80%	80%	WALL-1	10%	80%	52%	55%	0.6
8002	Shell	Advanced Walls - Electric Only	Residential Emerging Markets Pilot	SF	LI	Retrofit	9,740	10%	974	0.23	20	$2,470	80%	80%	WALL-3	10%	80%	52%	55%	0.6
8003	Shell	Advanced Walls - Electric Only	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,744	10%	274	0.23	20	$1,581	80%	80%	WALL-5	10%	80%	52%	55%	0.6
8004	Shell	Advanced Walls - Electric Only	Residential Emerging Markets Pilot	MF	LI	Retrofit	2,744	10%	274	0.23	20	$1,581	80%	80%	WALL-7	10%	80%	52%	55%	0.6
8005	Shell	Advanced Walls - Dual (gas heated)	Residential Emerging Markets Pilot	SF	NLI	Retrofit	2,442	10%	244	0.23	20	$2,470	80%	80%	WALL-2	87%	80%	52%	55%	0.4
8006	Shell	Advanced Walls - Dual (gas heated)	Residential Emerging Markets Pilot	SF	LI	Retrofit	2,442	10%	244	0.23	20	$2,470	80%	80%	WALL-4	87%	80%	52%	55%	0.4
8007	Shell	Advanced Walls - Dual (gas heated)	Residential Emerging Markets Pilot	MF	NLI	Retrofit	878	10%	88	0.23	20	$1,581	80%	80%	WALL-6	87%	80%	52%	55%	0.5
8008	Shell	Advanced Walls - Dual (gas heated)	Residential Emerging Markets Pilot	MF	LI	Retrofit	878	10%	88	0.23	20	$1,581	80%	80%	WALL-8	87%	80%	52%	55%	0.5
8009	Shell	Air Sealing Average Sealing - Heat pump	Residential Marketplace	SF	NLI	Retrofit	6,485	11%	728	0.18	15	$200	100%	100%	AIR SEAL-1	4%	76%	48%	73%	3.7
8010	Shell	Air Sealing Average Sealing - Heat pump	Community Connections	SF	LI	Retrofit	6,485	11%	728	0.18	15	$200	100%	100%	AIR SEAL-10	4%	76%	48%	73%	3.7
8011	Shell	Air Sealing Average Sealing - Heat pump	Residential Marketplace	MF	NLI	Retrofit	2,125	17%	364	0.09	15	$200	100%	100%	AIR SEAL-19	4%	76%	48%	73%	1.9
8012	Shell	Air Sealing Average Sealing - Heat pump	Community Connections	MF	LI	Retrofit	2,125	17%	364	0.09	15	$200	100%	100%	AIR SEAL-28	4%	76%	48%	73%	1.9
8013	Shell	Air Sealing Inadequate Sealing - Heat pump	Residential Marketplace	SF	NLI	Retrofit	6,485	13%	857	0.25	15	$200	100%	100%	AIR SEAL-2	4%	76%	48%	73%	4.8
8014	Shell	Air Sealing Inadequate Sealing - Heat pump	Community Connections	SF	LI	Retrofit	6,485	13%	857	0.25	15	$200	100%	100%	AIR SEAL-11	4%	76%	48%	73%	4.8
8015	Shell	Air Sealing Inadequate Sealing - Heat pump	Residential Marketplace	MF	NLI	Retrofit	2,125	20%	429	0.13	15	$200	100%	100%	AIR SEAL-20	4%	76%	48%	73%	2.4
8016	Shell	Air Sealing Inadequate Sealing - Heat pump	Community Connections	MF	LI	Retrofit	2,125	20%	429	0.13	15	$200	100%	100%	AIR SEAL-29	4%	76%	48%	73%	2.4
8017	Shell	Air Sealing Poor Sealing - Heat pump	Residential Marketplace	SF	NLI	Retrofit	6,485	19%	1,206	0.39	15	$200	100%	100%	AIR SEAL-3	4%	86%	59%	73%	7.0
8018	Shell	Air Sealing Poor Sealing - Heat pump	Community Connections	SF	LI	Retrofit	6,485	19%	1,206	0.39	15	$200	100%	100%	AIR SEAL-12	4%	86%	59%	73%	7.0
8019	Shell	Air Sealing Poor Sealing - Heat pump	Residential Marketplace	MF	NLI	Retrofit	2,125	28%	603	0.19	15	$200	100%	100%	AIR SEAL-21	4%	86%	59%	73%	3.5
8020	Shell	Air Sealing Poor Sealing - Heat pump	Community Connections	MF	LI	Retrofit	2,125	28%	603	0.19	15	$200	100%	100%	AIR SEAL-30	4%	86%	59%	73%	3.5
8021	Shell	Air Sealing Average Sealing - Electric Heating	Residential Marketplace	SF	NLI	Retrofit	9,740	14%	1,332	0.21	15	$200	100%	100%	AIR SEAL-4	6%	76%	48%	73%	5.7
8022	Shell	Air Sealing Average Sealing - Electric Heating	Community Connections	SF	LI	Retrofit	9,740	14%	1,332	0.21	15	$200	100%	100%	AIR SEAL-13	6%	76%	48%	73%	5.7
8023	Shell	Air Sealing Average Sealing - Electric Heating	Residential Marketplace	MF	NLI	Retrofit	2,744	24%	666	0.11	15	$200	100%	100%	AIR SEAL-22	6%	76%	48%	73%	2.9

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
8024	Shell	Air Sealing Average Sealing - Electric Heating	Community Connections	MF	LI	Retrofit	2,744	24%	666	0.11	15	$200	100%	100%	AIR SEAL-31	6%	76%	48%	73%	2.9
8025	Shell	Air Sealing Inadequate Sealing - Electric Heating	Residential Marketplace	SF	NLI	Retrofit	9,740	16%	1,539	0.29	15	$200	100%	100%	AIR SEAL-5	6%	76%	48%	73%	7.1
8026	Shell	Air Sealing Inadequate Sealing - Electric Heating	Community Connections	SF	LI	Retrofit	9,740	16%	1,539	0.29	15	$200	100%	100%	AIR SEAL-14	6%	76%	48%	73%	7.1
8027	Shell	Air Sealing Inadequate Sealing - Electric Heating	Residential Marketplace	MF	NLI	Retrofit	2,744	28%	769	0.15	15	$200	100%	100%	AIR SEAL-23	6%	76%	48%	73%	3.5
8028	Shell	Air Sealing Inadequate Sealing - Electric Heating	Community Connections	MF	LI	Retrofit	2,744	28%	769	0.15	15	$200	100%	100%	AIR SEAL-32	6%	76%	48%	73%	3.5
8029	Shell	Air Sealing Poor Sealing - Electric Heating	Residential Marketplace	SF	NLI	Retrofit	9,740	20%	1,926	0.38	15	$200	100%	100%	AIR SEAL-6	6%	86%	59%	73%	8.9
8030	Shell	Air Sealing Poor Sealing - Electric Heating	Community Connections	SF	LI	Retrofit	9,740	20%	1,926	0.38	15	$200	100%	100%	AIR SEAL-15	6%	86%	59%	73%	8.9
8031	Shell	Air Sealing Poor Sealing - Electric Heating	Residential Marketplace	MF	NLI	Retrofit	2,744	35%	963	0.19	15	$200	100%	100%	AIR SEAL-24	6%	86%	59%	73%	4.5
8032	Shell	Air Sealing Poor Sealing - Electric Heating	Community Connections	MF	LI	Retrofit	2,744	35%	963	0.19	15	$200	100%	100%	AIR SEAL-33	6%	86%	59%	73%	4.5
8033	Shell	Air Sealing - Average Sealing - Gas Heating	Residential Marketplace	SF	NLI	Retrofit	2,442	7%	172	0.35	15	$200	100%	100%	AIR SEAL-7	87%	76%	48%	73%	3.8
8034	Shell	Air Sealing - Average Sealing - Gas Heating	Community Connections	SF	LI	Retrofit	2,442	7%	172	0.35	15	$200	100%	100%	AIR SEAL-16	87%	76%	74%	91%	3.8
8035	Shell	Air Sealing - Average Sealing - Gas Heating	Residential Marketplace	MF	NLI	Retrofit	878	10%	86	0.18	15	$200	100%	100%	AIR SEAL-25	87%	76%	48%	73%	1.9
8036	Shell	Air Sealing - Average Sealing - Gas Heating	Community Connections	MF	LI	Retrofit	878	10%	86	0.18	15	$200	100%	100%	AIR SEAL-34	87%	76%	74%	91%	1.9
8037	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Residential Marketplace	SF	NLI	Retrofit	2,442	13%	308	0.39	15	$200	100%	100%	AIR SEAL-8	87%	76%	48%	73%	4.6
8038	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Community Connections	SF	LI	Retrofit	2,442	13%	308	0.39	15	$200	100%	100%	AIR SEAL-17	87%	76%	74%	91%	4.6
8039	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Residential Marketplace	MF	NLI	Retrofit	878	18%	154	0.20	15	$200	100%	100%	AIR SEAL-26	87%	76%	48%	73%	2.3
8040	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Community Connections	MF	LI	Retrofit	878	18%	154	0.20	15	$200	100%	100%	AIR SEAL-35	87%	76%	74%	91%	2.3
8041	Shell	Air Sealing - Poor Sealing - Gas Heating	Residential Marketplace	SF	NLI	Retrofit	2,442	9%	213	0.31	15	$200	100%	100%	AIR SEAL-9	87%	86%	59%	73%	3.5
8042	Shell	Air Sealing - Poor Sealing - Gas Heating	Community Connections	SF	LI	Retrofit	2,442	9%	213	0.31	15	$200	100%	100%	AIR SEAL-18	87%	86%	62%	91%	3.5
8043	Shell	Air Sealing - Poor Sealing - Gas Heating	Residential Marketplace	MF	NLI	Retrofit	878	12%	106	0.16	15	$200	100%	100%	AIR SEAL-27	87%	86%	59%	73%	1.8
8044	Shell	Air Sealing - Poor Sealing - Gas Heating	Community Connections	MF	LI	Retrofit	878	12%	106	0.16	15	$200	100%	100%	AIR SEAL-36	87%	86%	62%	91%	1.8
8045	Shell	Attic Insulation - Average Insulation - Electric Heating	Residential Prescriptive	SF	NLI	Retrofit	9,740	3%	291	0.05	25	$898	50%	50%	ATTIC-1	10%	73%	46%	48%	0.9
8046	Shell	Attic Insulation - Average Insulation - Electric Heating	Residential Prescriptive	SF	LI	Retrofit	9,740	3%	291	0.05	25	$898	100%	100%	ATTIC-7	10%	73%	46%	73%	0.4
8047	Shell	Attic Insulation - Average Insulation - Electric Heating	Residential Prescriptive	MF	NLI	Retrofit	2,744	3%	82	0.01	25	$575	78%	78%	ATTIC-13	10%	73%	46%	67%	0.2
8048	Shell	Attic Insulation - Average Insulation - Electric Heating	Residential Prescriptive	MF	LI	Retrofit	2,744	3%	82	0.01	25	$575	100%	100%	ATTIC-19	10%	73%	46%	73%	0.2
8049	Shell	Attic Insulation - Inadequate Insulation - Electric Heating	Residential Prescriptive	SF	NLI	Retrofit	9,740	7%	649	0.13	25	$1,597	28%	28%	ATTIC-2	10%	73%	46%	37%	2.0
8050	Shell	Attic Insulation - Inadequate Insulation - Electric Heating	Residential Prescriptive	SF	LI	Retrofit	9,740	7%	649	0.13	25	$1,597	100%	100%	ATTIC-8	10%	73%	46%	73%	0.6
8051	Shell	Attic Insulation - Inadequate Insulation - Electric Heating	Residential Prescriptive	MF	NLI	Retrofit	2,744	7%	183	0.04	25	$1,022	44%	44%	ATTIC-14	10%	73%	46%	45%	0.6
8052	Shell	Attic Insulation - Inadequate Insulation - Electric Heating	Residential Prescriptive	MF	LI	Retrofit	2,744	7%	183	0.04	25	$1,022	100%	100%	ATTIC-20	10%	73%	46%	73%	0.2
8053	Shell	Attic Insulation - Poor Insulation - Electric Heating	Residential Prescriptive	SF	NLI	Retrofit	9,740	41%	4,041	0.43	25	$1,597	100%	28%	ATTIC-3	10%	80%	70%	37%	10.1
8054	Shell	Attic Insulation - Poor Insulation - Electric Heating	Residential Prescriptive	SF	LI	Retrofit	9,740	41%	4,041	0.43	25	$1,597	100%	100%	ATTIC-9	10%	80%	52%	73%	2.8
8055	Shell	Attic Insulation - Poor Insulation - Electric Heating	Residential Prescriptive	MF	NLI	Retrofit	2,744	41%	1,138	0.12	25	$1,022	100%	44%	ATTIC-15	10%	80%	70%	45%	2.8

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
8056	Shell	Attic Insulation - Poor Insulation - Electric Heating	Residential Prescriptive	MF	LI	Retrofit	2,744	41%	1,138	0.12	25	$1,022	100%	100%	ATTIC-21	10%	80%	52%	73%	1.3
8057	Shell	Attic Insulation - Average Insulation - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	2%	52	0.08	25	$898	40%	40%	ATTIC-4	87%	73%	46%	42%	0.7
8058	Shell	Attic Insulation - Average Insulation - Gas Heating	IQW	SF	LI	Retrofit	2,442	2%	52	0.08	25	$898	100%	100%	ATTIC-10	87%	73%	77%	91%	0.3
8059	Shell	Attic Insulation - Average Insulation - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	2%	19	0.03	25	$575	63%	63%	ATTIC-16	87%	73%	46%	55%	0.2
8060	Shell	Attic Insulation - Average Insulation - Gas Heating	IQW	MF	LI	Retrofit	878	2%	19	0.03	25	$575	100%	100%	ATTIC-22	87%	73%	77%	91%	0.2
8061	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	4%	99	0.14	25	$1,597	23%	23%	ATTIC-5	87%	73%	46%	33%	1.3
8062	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	IQW	SF	LI	Retrofit	2,442	4%	99	0.14	25	$1,597	100%	100%	ATTIC-11	87%	73%	77%	91%	0.3
8063	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	4%	35	0.05	25	$1,022	35%	35%	ATTIC-17	87%	73%	46%	40%	0.5
8064	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	IQW	MF	LI	Retrofit	878	4%	35	0.05	25	$1,022	100%	100%	ATTIC-23	87%	73%	77%	91%	0.2
8065	Shell	Attic Insulation - Poor Insulation - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	18%	451	0.38	25	$1,597	50%	23%	ATTIC-6	87%	80%	52%	33%	3.9
8066	Shell	Attic Insulation - Poor Insulation - Gas Heating	IQW	SF	LI	Retrofit	2,442	18%	446	0.42	25	$1,597	100%	100%	ATTIC-12	87%	80%	70%	91%	0.9
8067	Shell	Attic Insulation - Poor Insulation - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	18%	162	0.14	25	$1,022	35%	35%	ATTIC-18	87%	80%	52%	40%	1.4
8068	Shell	Attic Insulation - Poor Insulation - Gas Heating	IQW	MF	LI	Retrofit	878	18%	160	0.15	25	$1,022	100%	100%	ATTIC-24	87%	80%	70%	91%	0.5
8069	Shell	Duct Sealing - Average Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,740	3%	298	0.04	20	$450	53%	53%	DUCT-1	10%	76%	48%	40%	1.2
8070	Shell	Duct Sealing - Average Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	LI	Retrofit	9,740	3%	298	0.04	20	$450	100%	100%	DUCT-7	10%	76%	48%	73%	0.7
8071	Shell	Duct Sealing - Average Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,744	3%	84	0.01	20	$288	83%	83%	DUCT-13	10%	76%	48%	57%	0.3
8072	Shell	Duct Sealing - Average Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	LI	Retrofit	2,744	3%	84	0.01	20	$288	100%	100%	DUCT-19	10%	76%	48%	73%	0.3
8073	Shell	Duct Sealing - Inadequate Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,740	5%	485	0.11	20	$450	100%	53%	DUCT-2	10%	90%	66%	40%	2.5
8074	Shell	Duct Sealing - Inadequate Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	LI	Retrofit	9,740	5%	485	0.11	20	$450	100%	100%	DUCT-8	10%	90%	66%	73%	1.3
8075	Shell	Duct Sealing - Inadequate Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,744	5%	137	0.03	20	$288	83%	83%	DUCT-14	10%	90%	66%	57%	0.7
8076	Shell	Duct Sealing - Inadequate Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	LI	Retrofit	2,744	5%	137	0.03	20	$288	100%	100%	DUCT-20	10%	90%	66%	73%	0.6
8077	Shell	Duct Sealing/Insulation - Poor Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	NLI	Retrofit	9,740	13%	1,238	0.28	20	$450	100%	53%	DUCT-3	10%	96%	81%	40%	6.4
8078	Shell	Duct Sealing/Insulation - Poor Sealing - Electric Heating	Residential Emerging Markets Pilot	SF	LI	Retrofit	9,740	13%	1,238	0.28	20	$450	100%	100%	DUCT-9	10%	96%	81%	73%	3.4
8079	Shell	Duct Sealing/Insulation - Poor Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,744	13%	349	157.30	20	$288	100%	83%	DUCT-15	10%	96%	81%	57%	1,514.8
8080	Shell	Duct Sealing/Insulation - Poor Sealing - Electric Heating	Residential Emerging Markets Pilot	MF	LI	Retrofit	2,744	13%	349	157.30	20	$288	100%	100%	DUCT-21	10%	96%	81%	73%	1,262.4
8081	Shell	Duct Sealing - Average Sealing - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	5%	117	0.13	20	$450	53%	53%	DUCT-4	87%	76%	48%	50%	1.6
8082	Shell	Duct Sealing - Average Sealing - Gas Heating	IQW	SF	LI	Retrofit	2,442	5%	117	0.13	20	$450	100%	100%	DUCT-10	87%	76%	74%	91%	0.9
8083	Shell	Duct Sealing - Average Sealing - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	5%	42	0.05	20	$288	83%	83%	DUCT-16	87%	76%	48%	72%	0.6
8084	Shell	Duct Sealing - Average Sealing - Gas Heating	IQW	MF	LI	Retrofit	878	5%	42	0.05	20	$288	100%	100%	DUCT-22	87%	76%	74%	91%	0.5
8085	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	7%	163	0.11	20	$450	53%	53%	DUCT-5	87%	90%	66%	50%	1.6
8086	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	IQW	SF	LI	Retrofit	2,442	7%	163	0.11	20	$450	100%	100%	DUCT-11	87%	90%	66%	91%	0.8
8087	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	7%	59	0.04	20	$288	83%	83%	DUCT-17	87%	90%	66%	72%	0.6

Appendix B: Residential Measure Assumptions

This file provides measure-level detail, including measure name, estimates of savings, costs, useful lives. A brief overview of key descriptor columns is provided below:
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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
8088	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	IQW	MF	LI	Retrofit	878	7%	59	0.04	20	$288	100%	100%	DUCT-23	87%	90%	66%	91%	0.5
8089	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Residential Prescriptive	SF	NLI	Retrofit	2,442	9%	210	0.37	20	$450	100%	53%	DUCT-6	87%	96%	81%	50%	4.2
8090	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	IQW	SF	LI	Retrofit	2,442	7%	165	0.27	20	$450	100%	100%	DUCT-12	87%	96%	81%	91%	1.6
8091	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Residential Prescriptive	MF	NLI	Retrofit	878	9%	76	0.13	20	$288	100%	83%	DUCT-18	87%	96%	81%	72%	1.5
8092	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	IQW	MF	LI	Retrofit	878	7%	59	0.10	20	$288	100%	100%	DUCT-24	87%	96%	81%	91%	0.9
8093	Shell	Wall Insulation - Electric Only	Residential Prescriptive	SF	NLI	Retrofit	9,740	9%	869	0.07	25	$1,235	50%	36%	WALL-1	10%	80%	52%	41%	2.1
8094	Shell	Wall Insulation - Electric Only	IQW	SF	LI	Retrofit	9,740	6%	560	0.10	25	$1,235	100%	100%	WALL-3	10%	80%	70%	91%	0.6
8095	Shell	Wall Insulation - Electric Only	Residential Prescriptive	MF	NLI	Retrofit	2,744	32%	869	0.07	25	$790	75%	57%	WALL-5	10%	80%	52%	52%	2.1
8096	Shell	Wall Insulation - Electric Only	IQW	MF	LI	Retrofit	2,744	20%	560	0.10	25	$790	100%	100%	WALL-7	10%	80%	70%	91%	0.9
8097	Shell	Wall Insulation - Dual (gas heated)	Residential Prescriptive	SF	NLI	Retrofit	2,442	4%	94	0.09	25	$1,235	29%	29%	WALL-2	87%	80%	52%	37%	0.9
8098	Shell	Wall Insulation - Dual (gas heated)	IQW	SF	LI	Retrofit	2,442	3%	78	0.08	25	$1,235	100%	100%	WALL-4	87%	80%	70%	91%	0.2
8099	Shell	Wall Insulation - Dual (gas heated)	Residential Prescriptive	MF	NLI	Retrofit	878	11%	94	0.09	25	$790	46%	46%	WALL-6	87%	80%	52%	45%	0.9
8100	Shell	Wall Insulation - Dual (gas heated)	IQW	MF	LI	Retrofit	878	9%	78	0.08	25	$790	100%	100%	WALL-8	87%	80%	70%	91%	0.4
8101	Shell	Basement Sidewall Insulation - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	6%	357	0.03	25	$1,204	80%	80%	BSI-1	4%	80%	52%	55%	0.4
8102	Shell	Basement Sidewall Insulation - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	8%	178	0.02	25	$1,204	80%	80%	BSI-2	4%	80%	52%	55%	0.2
8103	Shell	Basement Sidewall Insulation - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	8%	932	0.03	25	$1,204	80%	80%	BSI-3	6%	80%	52%	55%	0.9
8104	Shell	Basement Sidewall Insulation - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	15%	466	0.02	25	$1,204	80%	80%	BSI-4	6%	80%	52%	55%	0.5
8105	Shell	Basement Sidewall Insulation - Gas Heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	-1%	-31	-0.04	25	$1,204	80%	80%	BSI-5	87%	80%	52%	55%	0.0
8106	Shell	Basement Sidewall Insulation - Gas Heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	-2%	-15	-0.02	25	$1,204	80%	80%	BSI-6	87%	80%	52%	55%	0.0
8107	Shell	Floor Insulation Above Crawlspace - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	1%	38	-0.04	25	$1,204	80%	80%	FLOOR-1	4%	80%	52%	55%	0.0
8108	Shell	Floor Insulation Above Crawlspace - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	1%	19	-0.02	25	$1,204	80%	80%	FLOOR-4	4%	80%	52%	55%	0.0
8109	Shell	Floor Insulation Above Crawlspace - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	2%	238	-0.03	25	$1,204	80%	80%	FLOOR-2	6%	80%	52%	55%	0.1
8110	Shell	Floor Insulation Above Crawlspace - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	4%	119	-0.01	25	$1,204	80%	80%	FLOOR-5	6%	80%	52%	55%	0.1
8111	Shell	Floor Insulation Above Crawlspace - Gas Heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	-1%	-21	0.00	25	$1,204	80%	80%	FLOOR-3	87%	80%	52%	55%	0.0
8112	Shell	Floor Insulation Above Crawlspace - Gas Heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	-1%	-10	0.00	25	$1,204	80%	80%	FLOOR-6	87%	80%	52%	55%	0.0
8113	Shell	Radiant Barrier - Heat pump	Residential Emerging Markets Pilot	SF	NLI	Retrofit	6,485	15%	978	0.14	25	$720	100%	80%	RB-1	4%	75%	48%	55%	2.1
8114	Shell	Radiant Barrier - Heat pump	Residential Emerging Markets Pilot	SF	LI	Retrofit	6,485	15%	978	0.14	25	$720	100%	80%	RB-2	4%	75%	48%	55%	2.1
8115	Shell	Radiant Barrier - Heat pump	Residential Emerging Markets Pilot	MF	NLI	Retrofit	2,125	22%	474	0.07	25	$720	80%	80%	RB-3	4%	75%	48%	55%	1.0
8116	Shell	Radiant Barrier - Heat pump	Residential Emerging Markets Pilot	MF	LI	Retrofit	2,125	22%	474	0.07	25	$720	100%	80%	RB-4	4%	75%	48%	55%	1.0
8117	Shell	Radiant Barrier - Electric furnace	Residential Emerging Markets Pilot	SF	NLI	Retrofit	11,910	8%	978	0.14	25	$720	100%	80%	RB-5	6%	75%	48%	55%	2.1
8118	Shell	Radiant Barrier - Electric furnace	Residential Emerging Markets Pilot	SF	LI	Retrofit	11,910	8%	978	0.14	25	$720	100%	80%	RB-6	6%	75%	48%	55%	2.1
8119	Shell	Radiant Barrier - Electric furnace	Residential Emerging Markets Pilot	MF	NLI	Retrofit	3,156	15%	474	0.07	25	$720	80%	80%	RB-7	6%	75%	48%	55%	1.0
8120	Shell	Radiant Barrier - Electric furnace	Residential Emerging Markets Pilot	MF	LI	Retrofit	3,156	15%	474	0.07	25	$720	100%	80%	RB-8	6%	75%	48%	55%	1.0
8121	Shell	ENERGY STAR Door - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	5%	319	0.02	20	$1,275	80%	80%	ES DOOR-1	4%	75%	48%	55%	0.3

Appendix B: Residential Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
8122	Shell	ENERGY STAR Door - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	8%	159	0.01	20	$1,275	80%	80%	ES DOOR-4	4%	75%	48%	55%	0.1
8123	Shell	ENERGY STAR Door - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	2%	197	0.01	20	$1,275	80%	80%	ES DOOR-2	6%	75%	48%	55%	0.2
8124	Shell	ENERGY STAR Door - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	3%	98	0.01	20	$1,275	80%	80%	ES DOOR-5	6%	75%	48%	55%	0.1
8125	Shell	ENERGY STAR Door - Gas Heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	1%	21	0.02	20	$1,275	80%	80%	ES DOOR-3	87%	75%	48%	55%	0.1
8126	Shell	ENERGY STAR Door - Gas Heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	1%	11	0.01	20	$1,275	80%	80%	ES DOOR-6	87%	75%	48%	55%	0.0
8127	Shell	ENERGY STAR Windows - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	6%	400	0.25	20	$11,300	80%	80%	WIND-1	4%	70%	45%	55%	0.1
8128	Shell	ENERGY STAR Windows - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	9%	194	0.12	20	$7,232	80%	80%	WIND-4	4%	70%	45%	55%	0.1
8129	Shell	ENERGY STAR Windows - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	5%	611	0.25	20	$11,300	80%	80%	WIND-2	6%	70%	45%	55%	0.1
8130	Shell	ENERGY STAR Windows - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	9%	296	0.12	20	$7,232	80%	80%	WIND-5	6%	70%	45%	55%	0.1
8131	Shell	ENERGY STAR Windows - Gas Heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	6%	137	0.25	20	$11,300	80%	80%	WIND-3	87%	70%	45%	55%	0.1
8132	Shell	ENERGY STAR Windows - Gas Heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	8%	67	0.12	20	$7,232	80%	80%	WIND-6	87%	70%	45%	55%	0.1
8133	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	16%	1,005	0.35	7	$6,780	80%	80%	INDOW FILM	4%	70%	45%	55%	0.1
8134	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	16%	329	0.23	7	$4,339	80%	80%	INDOW FILM	4%	70%	45%	55%	0.1
8135	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	16%	1,846	0.35	7	$6,780	80%	80%	INDOW FILM	6%	70%	45%	55%	0.2
8136	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	16%	489	0.23	7	$4,339	80%	80%	INDOW FILM	6%	70%	45%	55%	0.1
8137	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	16%	378	0.35	7	$6,780	80%	80%	INDOW FILM	87%	70%	45%	55%	0.1
8138	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	16%	136	0.23	7	$4,339	80%	80%	INDOW FILM	87%	70%	45%	55%	0.1
8139	Shell	Thin Triple Windows - Heat pump	Residential Emerging Markets Pilot	SF	N/A	Retrofit	6,485	35%	2,247	0.67	40	$12,964	80%	80%	WIND-1	4%	70%	45%	55%	0.5
8140	Shell	Thin Triple Windows - Heat pump	Residential Emerging Markets Pilot	MF	N/A	Retrofit	2,125	68%	1,439	0.43	40	$8,297	80%	80%	WIND-4	4%	70%	45%	55%	0.5
8141	Shell	Thin Triple Windows - Electric furnace	Residential Emerging Markets Pilot	SF	N/A	Retrofit	11,910	18%	2,182	0.67	40	$12,964	80%	80%	WIND-2	6%	70%	45%	55%	0.5
8142	Shell	Thin Triple Windows - Electric furnace	Residential Emerging Markets Pilot	MF	N/A	Retrofit	3,156	44%	1,397	0.43	40	$8,297	80%	80%	WIND-5	6%	70%	45%	55%	0.5
8143	Shell	Thin Triple Windows - Gas heating	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,442	15%	369	0.67	40	$12,964	80%	80%	WIND-3	87%	70%	45%	55%	0.3
8144	Shell	Thin Triple Windows - Gas heating	Residential Emerging Markets Pilot	MF	N/A	Retrofit	878	27%	236	0.43	40	$8,297	80%	80%	WIND-6	87%	70%	45%	55%	0.3
9001	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Prescriptive	SF	N/A	MO	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-1	6%	1%	96%	44%	3.6
9002	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Prescriptive	SF	N/A	NC	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-4	6%	0%	96%	44%	3.6
9003	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Instant Rebate	SF	N/A	MO	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-1	6%	1%	96%	44%	3.7
9004	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Instant Rebate	SF	N/A	NC	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-4	6%	0%	96%	44%	3.7
9005	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Prescriptive	MF	N/A	MO	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-7	6%	1%	96%	44%	3.6
9006	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Prescriptive	MF	N/A	NC	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-10	6%	0%	96%	44%	3.6
9007	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Instant Rebate	MF	N/A	MO	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-7	6%	1%	96%	44%	3.7
9008	Water Heating	Heat Pump Water Heater-electric resistance heat	Residential Instant Rebate	MF	N/A	NC	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-10	6%	0%	96%	44%	3.7

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Measure #	End-Use	Measure Name	Program	Home Type	Income Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	UCT Score
9009	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Prescriptive	SF	N/A	MO	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-2	4%	1%	96%	44%	3.6
9010	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Prescriptive	SF	N/A	NC	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-5	4%	0%	96%	44%	3.6
9011	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Instant Rebate	SF	N/A	MO	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-2	4%	1%	96%	44%	3.7
9012	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Instant Rebate	SF	N/A	NC	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-5	4%	0%	96%	44%	3.7
9013	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Prescriptive	MF	N/A	MO	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-8	4%	1%	96%	44%	3.6
9014	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Prescriptive	MF	N/A	NC	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-11	4%	0%	96%	44%	3.6
9015	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Instant Rebate	MF	N/A	MO	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-8	4%	1%	96%	44%	3.7
9016	Water Heating	Heat Pump Water Heater-heat pump heat	Residential Instant Rebate	MF	N/A	NC	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-11	4%	0%	96%	44%	3.7
9017	Water Heating	Heat Pump Water Heater-gas heat	Residential Prescriptive	SF	N/A	MO	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-3	28%	1%	96%	44%	3.6
9018	Water Heating	Heat Pump Water Heater-gas heat	Residential Prescriptive	SF	N/A	NC	2,942	85%	2,505	0.34	13	$1,199	100%	42%	HPWH-6	28%	0%	96%	44%	3.6
9019	Water Heating	Heat Pump Water Heater-gas heat	Residential Instant Rebate	SF	N/A	MO	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-3	28%	1%	96%	44%	3.7
9020	Water Heating	Heat Pump Water Heater-gas heat	Residential Instant Rebate	SF	N/A	NC	2,942	87%	2,557	0.35	13	$1,199	100%	42%	HPWH-6	28%	0%	96%	44%	3.7
9021	Water Heating	Heat Pump Water Heater-gas heat	Residential Prescriptive	MF	N/A	MO	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-9	28%	1%	96%	44%	3.6
9022	Water Heating	Heat Pump Water Heater-gas heat	Residential Prescriptive	MF	N/A	NC	3,045	82%	2,505	0.34	13	$1,199	100%	42%	HPWH-12	28%	0%	96%	44%	3.6
9023	Water Heating	Heat Pump Water Heater-gas heat	Residential Instant Rebate	MF	N/A	MO	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-9	28%	1%	96%	44%	3.7
9024	Water Heating	Heat Pump Water Heater-gas heat	Residential Instant Rebate	MF	N/A	NC	3,045	84%	2,557	0.35	13	$1,199	100%	42%	HPWH-12	28%	0%	96%	44%	3.7
9025	Water Heating	Smart Water Heater - Tank Controls and Sensors - electric resistance heat	Residential Emerging Markets Pilot	SF	N/A	MO	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-1	6%	1%	47%	55%	2.6
9026	Water Heating	Smart Water Heater - Tank Controls and Sensors - electric resistance heat	Residential Emerging Markets Pilot	SF	N/A	NC	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-4	6%	0%	47%	55%	2.6
9027	Water Heating	Smart Water Heater - Tank Controls and Sensors - electric resistance heat	Residential Emerging Markets Pilot	MF	N/A	MO	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-7	6%	1%	47%	55%	2.7
9028	Water Heating	Smart Water Heater - Tank Controls and Sensors - electric resistance heat	Residential Emerging Markets Pilot	MF	N/A	NC	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-10	6%	0%	47%	55%	2.7
9029	Water Heating	Smart Water Heater - Tank Controls and Sensors - heat pump heat	Residential Emerging Markets Pilot	SF	N/A	MO	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-2	4%	1%	47%	55%	2.6
9030	Water Heating	Smart Water Heater - Tank Controls and Sensors - heat pump heat	Residential Emerging Markets Pilot	SF	N/A	NC	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-5	4%	0%	47%	55%	2.6
9031	Water Heating	Smart Water Heater - Tank Controls and Sensors - heat pump heat	Residential Emerging Markets Pilot	MF	N/A	MO	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-8	4%	1%	47%	55%	2.7
9032	Water Heating	Smart Water Heater - Tank Controls and Sensors - heat pump heat	Residential Emerging Markets Pilot	MF	N/A	NC	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-11	4%	0%	47%	55%	2.7
9033	Water Heating	Smart Water Heater - Tank Controls and Sensors - gas heat	Residential Emerging Markets Pilot	SF	N/A	MO	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-3	28%	1%	47%	55%	2.6
9034	Water Heating	Smart Water Heater - Tank Controls and Sensors - gas heat	Residential Emerging Markets Pilot	SF	N/A	NC	2,942	15%	441	0.02	13	$120	100%	80%	HPWH-6	28%	0%	47%	55%	2.6
9035	Water Heating	Smart Water Heater - Tank Controls and Sensors - gas heat	Residential Emerging Markets Pilot	MF	N/A	MO	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-9	28%	1%	47%	55%	2.7
9036	Water Heating	Smart Water Heater - Tank Controls and Sensors - gas heat	Residential Emerging Markets Pilot	MF	N/A	NC	3,045	15%	457	0.02	13	$120	100%	80%	HPWH-12	28%	0%	47%	55%	2.7
9037	Water Heating	Thermostatic Restrictor Shower Valve	Residential Emerging Markets Pilot	SF	N/A	Retrofit	2,942	2%	65	0.00	10	$30	80%	80%	TRSV-1	73%	14%	32%	55%	1.2