Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_1 Refer to Kentucky Power's response to Commission Staff's First Request for Information (Staff's First Request), Item 2. Explain how Kentucky Power is taking into consideration the consistent decline in customer base when developing its modeling.

RESPONSE

The Company models residential customers with economic and demographic drivers that have exhibited similar declines historically. The projections for these drivers were retrieved from Moody's Analytics and result in a projected continued decline in the residential customer base.

Witness: Glenn R. Newman

DATA REQUEST

KPSC 2_2 Refer to Kentucky Power's response to Staff's First Request, Item 4.

a. Explain how Kentucky Power's forecasted modeling will differ if the cryptocurrency companies that require significant load do not fulfill their contracts.

b. Explain, if any, the financial risk(s) associated with providing energy to the cryptocurrency industry.

RESPONSE

a. When modeling, the Company always attempts to accurately account for the expected impact of customer loads. For purposes of the IRP, the Company's modeling methods would be unchanged as a result of any future load not materializing. The Company similarly does not model a scenario in which interruptible load fails to interrupt, consistent with the fact that only firm load is considered for load forecast purposes.

b. For the purpose of the IRP, the Company does not evaluate the potential financial risks associated with serving specific individual customers.

Notwithstanding, the Company recognizes that there generally is at least some financial risk with serving any particular customer and the Company takes precautions to protect against financial risk when reasonable to do so. For example, the Company requires a deposit from customers in the amount of 2/12ths of the customer's estimated annual bill to secure payment of bills in accordance with the Company's terms and conditions of service (Tariff Sheet Nos. 2-2 and 2-3). Specifically with respect to cryptocurrency customers, the Company also generally encourages the customer to participate in Rider D.R.S. (Demand Response Service) to reduce the customer's firm load in order to shave the Company's demand peaks, which affect the Company's capacity costs. If the customer participates in Rider D.R.S., that tariff also provides for the DRS Event Failure Charge, which requires the customer to pay back a portion of its DRS credit in the event that the customer fails to sufficiently curtail when called upon (Tariff Sheet No. 36-3). If those customers participate in Tariff E.D.R. (Economic Development Rider), that tariff provides for a full claw back of all demand reduction discounts received by the customer in the event that the customer discontinues service under the EDR Contract prior to the end of the contract term (Tariff Sheet No. 37-5). Finally, the Company also may require, when reasonable and appropriate to do so, that the EDR customer provide security sufficient to secure any such repayment of EDR credits.

There are also benefits to serving large industrial customers, like cryptocurrency customers, including the addition of a large load over which the Company's fixed costs may be spread. This has the effect of making those fixed costs lower than they otherwise would be absent the addition of the large industrial customer. Large industrial customers also may benefit the Company and its other customers by bringing capital investment and jobs to the service territory.

Witness: Glenn R. Newman (subpart a)

Witness: Brian K. West (subpart b)

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_3 Refer to Kentucky Power's response to Staff's First Request, Item 5. Also refer to Case No. 2023-00159, Application, Section III, Volume 1, Direct Testimony of Stevi Cobern at 10.2 Provide the demand side management/energy efficiency (DSM/EE) market potential study.

RESPONSE

Please see KPCO_R_KPSC_2_3_Attachment1 for the requested information.

Witness: Brian K. West

GDS Associates, Inc.
ENGINEERS & CONSULTANTS
gdsassociates.com

prepared for

Kentucky Power Company

KENTUCKY POWER℠

An AEP Company

2023 POTENTIAL STUDY

FINAL REPORT

June 2023

prepared by
GDS ASSOCIATES INC
BRIGHTLINE GROUP

1 EXECUTIVE SUMMARY

1.1 BACKGROUND & STUDY SCOPE

Kentucky Power Company ("Kentucky Power") commissioned GDS Associates ("GDS") and Brightline Group, collectively "the GDS Team", to assess energy savings potential in the Kentucky Power service area to help inform future planning efforts. Separate estimates of electric energy efficiency and distributed energy resource ("DER") potential were developed.

In addition, Kentucky Power also requested that GDS conduct limited primary market research to help inform key inputs in the market potential analysis. The desired final research focused on 1) collecting updated equipment penetration, saturation, and efficiency characteristics, 2) site conditions related to distributed energy resources, and 3) customer willingness to participate ("WTP")[1] in program offerings across select end-uses/measures.

1.2 TYPES OF POTENTIAL ANALYZED

This potential study provides a roadmap for both policy makers and Kentucky Power as they develop strategies and programs for energy efficiency ("EE") and distributed energy resources in the Kentucky Power service area. In addition to technical and economic potential estimates, the development of achievable and program potential estimates for a range of feasible measures is useful for program planning and modification purposes. Unlike achievable and program potential estimates, technical and economic potential estimates do not include customer acceptance considerations for measures, which are often among the most important factors when estimating the likely customer response to new programs. For this study, the GDS Team produced the following estimates of demand side management potential:

- Technical potential
- Economic potential
- Achievable potential
  - Maximum achievable potential ("MAP")
  - Realistically achievable potential ('RAP")
- Program potential
  - Based off of RAP

1.3 APPROACH SUMMARY

The purpose of this market potential study is to provide a foundation for the continuation of utility-administered energy efficiency, and determine the remaining opportunities for cost-effective energy savings, demand savings, and distributed energy resources for the Kentucky Power service area. This study has examined a full array of technologies, programs, and energy efficient building practices that are technically achievable.

The GDS Team used a bottom-up approach to estimate energy efficiency potential in the residential sector. Bottom-up approaches begin with characterizing the eligible equipment stock, estimating savings and screening for cost-effectiveness first at the measure level, then summing savings at the end-use and service area levels. In the commercial sector, the GDS Team utilized a top-down modeling approach to first estimate measure-level savings and costs as well as cost-effectiveness, and then applied cost-effective measure savings to all applicable shares of electric energy load. A top-down approach is preferred for the commercial sector because of the heterogeneous make-up of the sales forecast (wide variety of end-uses and business types). Bottom-up approaches were also used in the DER analyses for all sectors.

[1] See Appendix A for a Glossary of terms and acronyms.

1.4 STUDY LIMITATIONS AND CAVEATS

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

- Energy efficiency measure lives, savings, and costs (total measure costs, incremental costs, and incentive costs)
- Projected penetration rates for energy efficiency measures
- Projections of energy avoided costs
- Future known changes to codes and standards
- End-use saturations and fuel shares

While the GDS Team has sought to use the best and most current data available (including the use of new primary market research in key market subsegments of interest based on stakeholder feedback) there are often reasonable alternative assumptions which would yield slightly different results. For instance, the analysis assumes that many existing measures, regardless of their current efficiency levels, can be eligible for future installation and savings opportunities. Other studies may select a narrower viewpoint, limiting the amount of potential from equipment that is already considered to be energy efficient. Additionally, the models used in this analysis must make several assumptions regarding program delivery and the timing of equipment replacement that may ultimately occur more rapidly (or more slowly) than currently forecasted.

Furthermore, while the lists of energy efficiency measures examined in this study analysis represent technologies available in the market today as well as a limited number of emerging technologies not currently offered in Kentucky Power's service territory, these measure lists may not be exhaustive. The GDS Team acknowledges that new efficient technologies may become available over the course of the 20-year study timeframe that could produce efficiency gains and costs at different levels than those currently assumed.

Last, where possible, the GDS Team and Kentucky Power collaborated to ensure consistency with assumptions and methodological considerations that are expected to be employed during the program planning process. However, final program designs and implementation strategies may need additional flexibility to target specific or underserved markets, address equity concerns, or react to changing customer preferences.

1.5 POTENTIAL SAVINGS OVERVIEW

The following several sub-sections provide an overview of the energy efficiency potential as well as a summary of distributed energy resource potential. Chapters 4 through 6 of this report provide additional summary data and methodological considerations and descriptions.

1.5.1 Market Research Summary

Primary market research activities were focused on collecting updated equipment penetration, saturation, and efficiency characteristics; and customer willingness to participate in program offerings across select end-uses/measures. The resulting data was used to develop updated estimates of baseline and efficient equipment saturation estimates in the market potential study and develop expected long-term adoption rates for energy efficiency, demand response, and distributed energy resources over the study horizon. This data flowed through technical, economic and achievable potential analyses, as well as the program design analysis.

1.5.2 Energy Efficiency Potential for Residential Customers

Figure 1-1 provides the technical, economic, MAP and RAP results for the 3-year, 10-year, and 20-year timeframes. The cumulative annual 3-year technical potential is 11% of forecasted sales, and the economic potential is 9% of forecasted sales. The cumulative annual 3-year MAP is 1.8% and the RAP is 1.1%, as a

percentage of forecasted sales. Over the duration of the study timeframe the technical and economic potential rise to 39% and 32% of forecasted sales, respectively. This indicates that a large portion of the technical potential is cost-effective. The MAP and RAP rise respectively to 17% and 11% of forecasted sales over the study timeframe. The gap between economic potential and MAP/RAP represents market barriers to prospective program participants, both financial and non-financial, to achieving the full amount of economic potential.

FIGURE 1-1: OVERVIEW OF RESIDENTIAL POTENTIAL

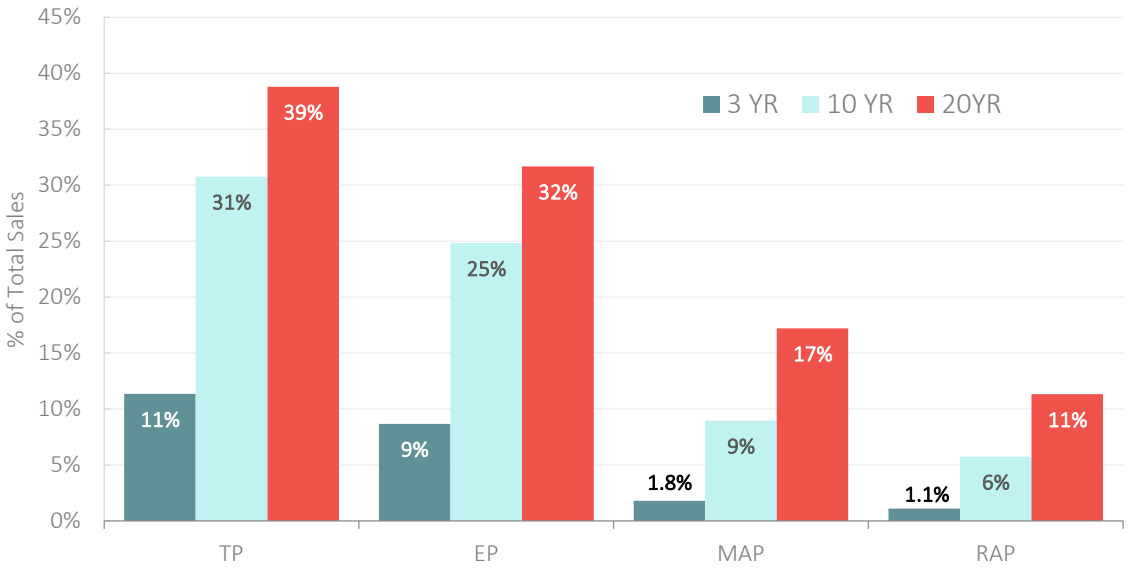


Table 1-1 provides cumulative annual technical and economic potential results across the 2024-2028 (Years 1-5) timeframe, as well as for 2033 (10th-year) and 2043 (20th-year). The technical potential is more than 331,000 MWh by 2028 and rises to more than 666,000 MWh by 2043. Economic potential rises to more than 257,000 MWh by 2028. Technical potential summer peak demand savings reaches 244 MW by 2043 and winter peak demand savings reaches approximately 92 MW by 2043.

TABLE 1-1 TECHNICAL & ECONOMIC RESIDENTIAL POTENTIAL

	2024	2025	2026	2027	2028	2033	2043
Energy (MWh)							
Technical	80,471	149,002	214,554	273,966	331,832	553,739	666,952
Economic	62,376	113,778	164,098	211,339	257,585	446,652	544,564
Summer Demand (MW)							
Technical	29.6	57.2	84.1	105.9	127.3	213.3	243.9
Economic	20.9	40.0	58.9	75.4	91.6	159.9	185.2
Winter Demand (MW)							
Technical	10.8	20.0	28.8	36.8	44.5	73.6	91.6
Economic	8.4	15.2	21.8	27.9	33.8	57.6	72.2

1.5.3 Energy Efficiency Potential for Commercial Customers

Figure 1-2 provides the technical, economic, MAP and RAP results for the 3-year, 10-year, and 20-year timeframes. The cumulative annual 3-year technical potential is 8% of forecasted commercial sales, and the economic potential is 6% of forecasted commercial sales. The cumulative annual 3-year MAP is 3.0% and the RAP is 2.3%, as a percentage of forecasted commercial sales. Over the duration of the study timeframe the

technical rises to 28% and economic potential rises to 20% of forecasted commercial sales.[2] The MAP and RAP rise respectively to 15% and 12% of forecasted sales over the study timeframe. The gap between economic potential and MAP/RAP represents market barriers to prospective program participants, both financial and non-financial, to achieving the full amount of economic potential.

FIGURE 1-2: OVERVIEW OF COMMERCIAL POTENTIAL

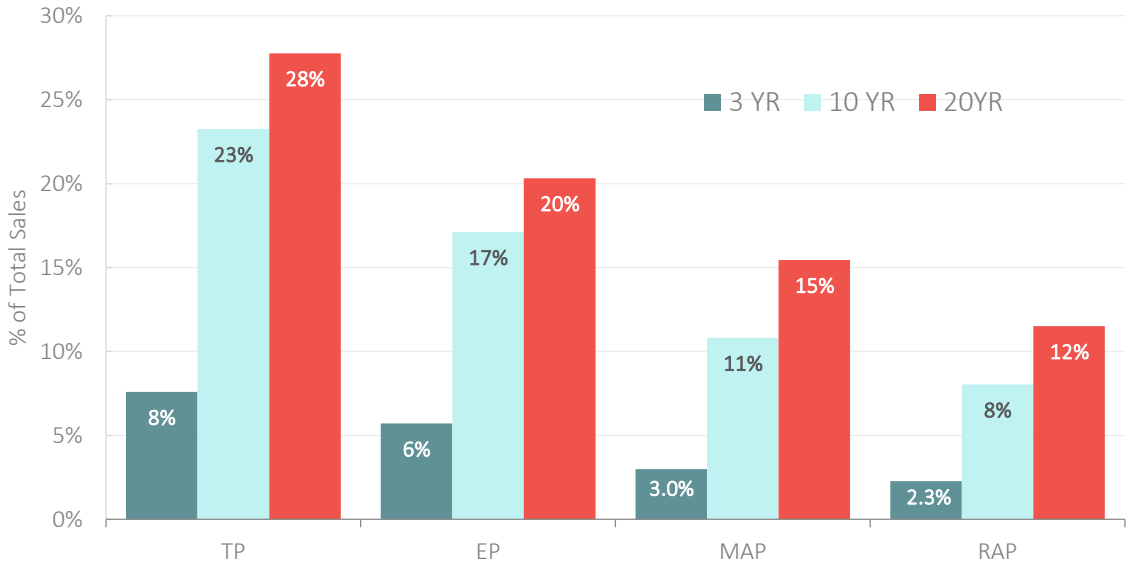


Table 1-2 provides cumulative annual technical and economic potential results across the 2024-2028 (Years 1-5) timeframe, as well as for 2033 (10th-year) and 2043 (20th-year). The technical potential is just above 232,000 MWh by 2028 and rises to more than 490,000 MWh by 2043. Economic potential rises to more than 358,000 MWh by 2043. Technical potential summer peak demand savings reaches 101 MW by 2043 and winter peak demand savings reaches approximately 48 MW by 2043.

TABLE 1-2 TECHNICAL & ECONOMIC COMMERCIAL POTENTIAL

	2024	2025	2026	2027	2028	2033	2043
Energy (MWh)							
Technical	43,541	90,256	138,295	186,119	232,533	416,505	490,105
Economic	32,833	67,950	103,914	139,507	173,783	306,552	358,764
Summer Demand (MW)							
Technical	7.7	16.3	25.3	34.6	43.7	83.1	101.4
Economic	4.8	9.9	15.3	20.8	26.1	47.2	55.8
Winter Demand (MW)							
Technical	4.5	9.3	14.2	19.0	23.6	41.4	47.9
Economic	3.7	7.7	11.7	15.7	19.6	34.5	40.6

[2] The savings as a percentage of sales noted for the commercial sector here and throughout the report are indicative of the MWh savings as a percentage of the eligible sales forecast (i.e. ineligible sales associated with customers forecasted to opt-out of energy efficiency programs are not included in the denominator). The 20-yr RAP of 12% of commercial sales drops to 5.8% as a percentage of all commercial and industrial sales.

1.5.4 Distributed Energy Resource Potential for All Customers

Table 1-3 and Table 1-4 summarize the solar photovoltaic ("PV") potential for the residential and non-residential sectors, respectively. It is notable that the non-residential sector potential sector is significantly less than residential potential. This difference is largely due to National Renewable Energy Laboratory ("NREL") coefficients.

TABLE 1-3 SUMMARY OF SOLAR PV DC CAPACITY MARKET POTENTIAL (RESIDENTIAL)

Year	Scenario	Single-Family (MW)	Mobile Home (MW)	Multifamily (MW)
2027	Technical	3.0	0.1	0.0
2033	Technical	27.3	0.7	0.4
2043	Technical	447.0	10.8	2.5
2027	BAU[3]	1.6	0.0	0.0
2033	BAU	5.9	0.1	0.0
2043	BAU	34.6	0.8	0.2

TABLE 1-4 SUMMARY OF SOLAR PV DC CAPACITY MARKET POTENTIAL (NON-RESIDENTIAL)

Year	Scenario	Non-Residential (MW)
2027	Technical	0.1
2033	Technical	0.4
2043	Technical	5.9
2027	BAU	0.0
2033	BAU	0.0
2043	BAU	0.1

Table 1-5 and Table 1-6 summarize the solar PV potential above in energy metrics. The 2043 technical market potential for solar PV represents 9.0% of the 2043 energy sales forecast for all sectors. 2043 technical market potential for solar PV in the residential sector represents 27.0% of the 2043 energy sales forecast for the residential sector.

TABLE 1-5 SUMMARY OF SOLAR PV ENERGY MARKET POTENTIAL (RESIDENTIAL)

Year	Scenario	Single-Family (MWh)	Mobile Home (MWh)	Multifamily (MWh)
2027	Technical	2,982	130	44
2033	Technical	27,000	1,175	386
2043	Technical	441,655	19,227	2,757
2027	BAU	1,617	70	15
2033	BAU	5,865	255	53
2043	BAU	34,235	1,490	227

[3] Business-as-Usual. See Section 6.1.3 for more details.

TABLE 1-6 SUMMARY OF SOLAR PV ENERGY MARKET POTENTIAL (NON-RESIDENTIAL)

Year	Scenario	Non-Residential (MWh)
2027	Technical	17,526
2033	Technical	162,771
2043	Technical	6,464,382
2027	BAU	1,235
2033	BAU	4,710
2043	BAU	43,715

1.5.5 Program Design Recommendations Summary

The GDS Team conducted research and analysis to provide a recommendation for Kentucky Power to consider as potential improvements to their electric energy efficiency program portfolio. The primary objective is to expand energy efficiency for all customers with specific emphasis on low and moderate level income residential customers. The GDS Team combined market research of regional peer electric energy efficiency programs with the realistic potential outcomes from the marker potential assessment, in addition to current industry trends and best practices.

Figure 1-3 and Figure 1-4 summarize the proposed program potential budgets and expected energy savings.

FIGURE 1-3: FIVE-YEAR ENERGY EFFICIENCY PORTFOLIO BUDGET EXPENDITURE FORECAST

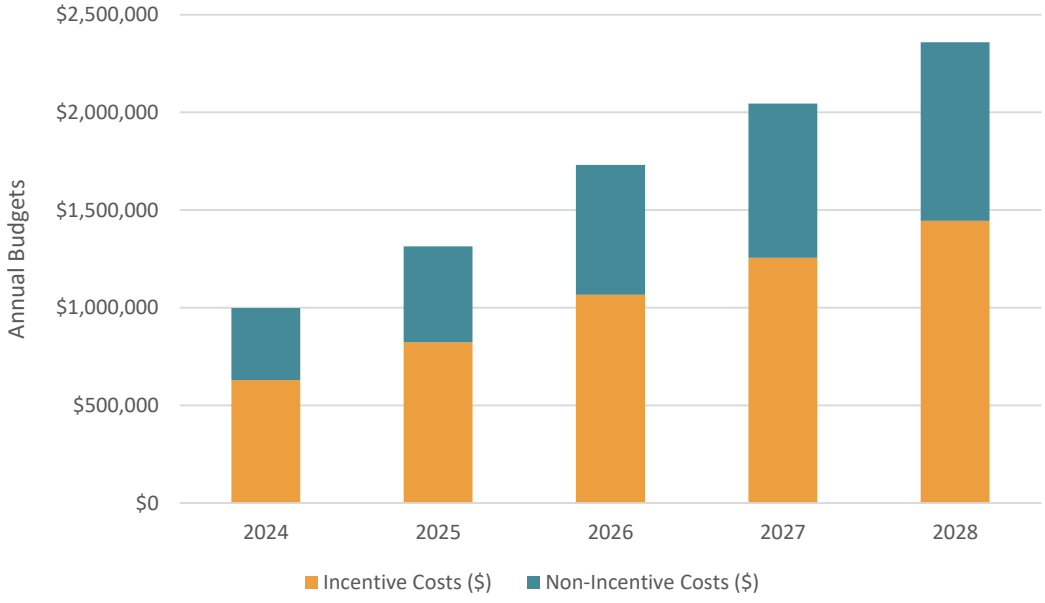


FIGURE 1-4: FIVE-YEAR ENERGY EFFICIENCY PORTFOLIO ENERGY SAVINGS (NET) FORECAST

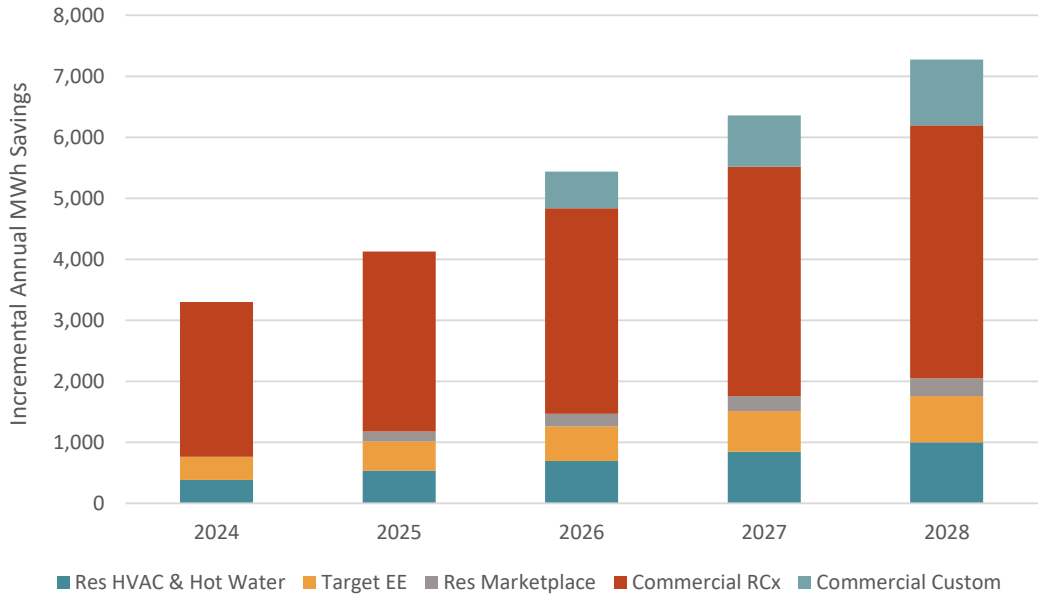


Table 1-7 below provides a comparison of the incremental annual savings and budgets in the MAP, RAP, and program potential scenarios. The Program Potential savings are on average about 29% of the RAP savings, and the Program Potential budgets are on average about 17% of the RAP budgets.

TABLE 1-7 SAVINGS AND BUDGETS COMPARISON – ACHIEVABLE AND PROGRAM POTENTIAL SCENARIOS

	2024	2025	2026	2027	2028
Energy (MWh)					
MAP	25,329	28,959	31,136	33,529	35,618
RAP	17,771	20,221	21,662	23,089	24,528
Program	3,297	4,121	5,431	6,349	7,267
Summer Demand (MW)					
MAP	5.0	5.8	6.2	7.2	7.6
RAP	3.0	3.5	3.8	4.3	4.6
Program	0.4	0.6	1.0	1.3	1.6
Budgets					
MAP	$14,743,927	$17,356,129	$19,032,236	$21,452,626	$23,375,497
RAP	$7,443,314	$8,926,621	$9,886,231	$11,093,144	$12,225,682
Program	$1,025,012	$1,330,769	$1,749,654	$2,067,654	$2,386,309

The program design recommendations include the following four programs:

- **Targeted Energy Efficiency Program** – This is a program dedicated to low-income Kentucky Power customers which are eligible for Weatherization Assistance Program. Measures include air source heat pumps, efficient water heaters and other building shell and water heating retrofit measures. The Targeted Energy Efficiency program should increase spending in the next few years, seeking to double funding by program year three through the following actions: increase payment amounts for completed energy audits with the intention to increase the number of completed audits and increase the comprehensiveness of energy audits; increase incentives for replaced and upgraded HVAC equipment. It is understood that the Targeted Energy Efficiency program has operated for several years with consistent funding. There should

be modest expectation on program growth with additional funds as program operations are not directly within Kentucky Power's influence.

- **Home Energy Improvement Program** – This program will promote energy efficiency improvements in existing homes and provide financial incentives and assessments for implementing eligible energy efficiency measures. The program provides customers, remodelers, and property owners with individual improvement options for HVAC and weatherization technologies.

- **Marketplace Program** – This is an on-line and easy-to-reach shopping platform for energy efficiency technologies found in customer homes and small businesses, such as thermostats, smart plug strips, and potentially small appliances. The Marketplace program is slated to begin in 2025.

- **Commercial Prescriptive Program** – This program provides incentives to reduce the incremental cost to upgrade to high-efficiency lighting equipment and controls over standard efficiency options for new and existing commercial customers. The program includes equipment with easily calculated savings and provides straightforward and easy participation for customers. A variety of measures are eligible for an incentive, including LEDs, lighting controls, smart thermostats, and air source heat pumps.

- **Commercial Custom Program** - This program provides a platform for comprehensive energy efficiency projects in existing and new facilities that go beyond discrete measures and common, measure-level efficiency practices. The Commercial Custom Program provides incentives for efficiency improvements not included in the Commercial Prescriptive Program. It is anticipated that this program will be introduced in the third year of the portfolio (2026) due to additional complexity.

2 MARKET RESEARCH

The initial step in the assessment of future potential is to develop a clear understanding of the current market segments, as well as a clear understanding of the market research data available in the Kentucky Power service area. In 2022 Kentucky Power requested the GDS Team to conduct market research that would inform critical elements of the market potential study. The research objectives were developed in coordination with Kentucky Power and the potential study team. Primary market research activities were focused on collecting updated equipment penetration, saturation, and efficiency characteristics; and customer willingness to participate in program offerings across select end-uses/measures.

The resulting data was used to develop updated estimates of baseline and efficient equipment saturation estimates in the market potential study and develop expected long-term adoption rates for energy efficiency, demand response, and DERs over the study horizon. The GDS Team conducted surveys of business and residential customers during December of 2022 and January of 2023 with the objectives of gathering primary data on the following topics:

- Willingness to participate in a variety of energy efficiency, demand response and distributed energy resource program scenarios.
- Baseline / Saturation of energy-using equipment
- Barriers

Survey results served as inputs for the market potential model, enabling the market potential analysis to take into consideration the specific market conditions that exist in Kentucky Power's service territory. Data collection results specific to the Kentucky Power service area are provided below.

2.1 PRIMARY DATA COLLECTION

The following subsections provide an overview of the primary data collection activities conducted by the GDS Team to support the market potential analysis of energy efficiency, demand response, and DER potential. The GDS Team conducted survey research in the residential and non-residential sectors.

2.1.1 Survey Administration

Surveys were administered in an online format through SurveyMonkey, with email recruitment followed by one reminder email. Due to a lower than ideal response rate on the residential surveys, a second sample group was emailed for both residential surveys.

Respondents who completed the survey were entered into a drawing to win an electronic gift card. $100 gift cards were awarded to twenty randomly selected residential survey respondents (10 for the baseline survey and 10 for the WTP survey) and $200 gift cards were awarded to ten randomly selected business survey respondents. Winners were given the choice of an electronic or physically mailed gift card.

2.1.2 Sampling Approach

The team developed a sampling approach with an objective of achieving industry-standard statistical significance (90% confidence, 10% relative precision, or 90/10) at the strata level for all questions. Overall, the response outcomes were positive, and the survey effort produced a robust set of primary data. The team set aggressive sampling targets, with a goal of having high levels of statistical significance for detailed sub-groups within the population. Table 2-1 sampling targets and response outcomes.

The business survey was split into two different groups, with one group seeing the baseline questions first and the other group seeing the WTP questions first, to ensure that incomplete surveys did not affect one group of questions more than another.

TABLE 2-1 SURVEY SAMPLING TARGETS AND RESPONSE SUMMARY[4]

State	Target Completes	Completes (Entire Survey)	Completes (Baseline Questions)	Completes (WTP Questions)
Nonresidential Customer Survey *Stratification: Tariff Group*				
Commercial	**70**	**102**	110	119
Residential Customer Survey *Stratification: single family / multifamily / mobile home, and income-qualified / market rate*				
Single Family	**70**	213	112	101
Multi-Family	36	68	44	24
Mobile Home	70	186	95	91
Total	210	467	251	216

2.1.3 Residential Online Survey

The residential customer research targeted homeowners and tenants in the following key segments: income-eligible and market-rate customers, and customers occupying single family, multifamily, and mobile homes. Income-eligible was defined by household size as 200% of the federal poverty threshold.

A residential online customer survey collected home characteristics, equipment penetration for key end-uses/building characteristics, including heating, cooling, water heating, insulation, smart appliances, thermostats, major appliances, and electric vehicles – and information on barriers and willingness to adopt a range of energy efficient measures at varying incentive levels. Table 2-2 provides the targeted and completed residential online surveys.

TABLE 2-2 TARGETED AND COMPLETED RESIDENTIAL SECTOR ONLINE SURVEYS

Strata	Target Sample Size	Total Completed
Single Family – Market Rate	35	156
Multifamily – Market Rate	18	52
Mobile Home – Market Rate	35	117
Single Family – IQ	35	57
Multifamily – IQ	18	16
Mobile Home - IQ	35	69

2.1.4 Business Sector Online Survey

Primary data collection was also conducted in the nonresidential sector via an online survey with business customers. The survey collected business and facility characteristics, as well as equipment penetrations for key end-uses, such as lighting, heating, cooling, water heating, refrigeration, thermostats, ventilation, data centers, smart strips, EMS, and on-site generation (including solar PV systems). The nonresidential online survey also collected information on barriers to energy efficiency and willingness-to-adopt energy efficient measures

[4] The survey was split into two groups, one which saw the baseline questions first, and one that saw the WTP questions first. Within each group, some respondents completed just the baseline questions, some completed just the WTP questions, and some completed both. This explains why the number of completes for baseline and WTP are each individually higher than the number of completes for the entire survey.

under various incentive offerings. In total, GDS collected survey data from 238 commercial customers, with 102 fully completing the survey. GDS examined the annual energy consumption data from the survey participants and developed a weighting adjustment based on the sample's customer type relative to the Kentucky Power population.

2.2 RESIDENTIAL MARKET DATA

The tables below provide some key home and equipment characteristics by market segment. The results have been weighted to align the sample distribution with that of the overall residential population home types for Kentucky Power.

Table 2-3 presents some key household and equipment characteristics for the residential sector by Kentucky Power housing type and income type. The data presented below includes the average number of units per household for occupants, water devices, plug load controls, and key appliances.

TABLE 2-3: KEY HOUSEHOLD AND EQUIPMENT CHARACTERISTICS (AVG # PER HOUSEHOLD)

	Total	Single Family	Multi-Family	Mobile Home	Market Rate	Income Qualified
Household Characteristics						
Avg. # of Occupants	2.3	2.3	1.8	2.4	2.4	2.2
Avg # of Dishwashers	0.5	0.6	0.3	0.4	0.3	0.6
Avg # of EnergyStar Dishwashers	0.4	0.5	0.2	0.2	0.2	0.4
Avg # of Smart Plugs/Outlets	0.3	0.3	0.3	0.2	0.2	0.3
Avg # of Refrigerators	1.2	1.3	1.0	1.1	1.2	1.2
Avg # of EnergyStar Refrigerators	0.8	0.9	0.6	0.7	0.7	0.8
Avg # of Stand-Alone Freezers	0.6	0.7	0.3	0.5	0.5	0.6
Avg # of EnergyStar Stand-Alone Freezers	0.3	0.4	0.2	0.3	0.3	0.3
Avg # of Thermostats	0.9	1.0	0.8	0.8	0.8	0.9

Table 2-4 provides example summary data by market segment for major residential end-uses. These data points of electric heating, water heating, and central air conditioning equipment penetrations help quantify the proportion of the population with electricity consuming major equipment types by market segment. In addition, the research also provided recent market conditions for remaining efficiency opportunities, such as the penetration of smart thermostats, which does not exceed 14% for any market segment.

TABLE 2-4: SELECT RESIDENTIAL MARKET RESEARCH RESULTS FOR KEY END-USES

End-Use	Equipment	Total	Single Family	Multi-Family	Mobile Home	Market Rate	Income Qualified
Water Heating	Electric Water Heating	81%	77%	73%	89%	83%	80%
	Heat Pump Water Heater *(as a % of electric Water Heating)*	18%	17%	33%	16%	30%	15%

End-Use	Equipment	Total	Single Family	Multi-Family	Mobile Home	Market Rate	Income Qualified
Heating	Fuel - Electricity	70%	66%	80%	75%	75%	70%
	Fuel - Natural Gas	20%	28%	17%	8%	9%	22%
	Fuel - Other	10%	7%	2%	17%	16%	8%
	Type - Non-Electric Furnace	7%	10%	2%	3%	3%	7%
	Type - Heat Pump	48%	53%	35%	45%	44%	48%
	Type - Electric Furnace	18%	13%	24%	26%	24%	18%
	Type - Other	26%	24%	39%	26%	29%	27%
Cooling	Have Central AC	74%	80%	87%	63%	60%	80%
Thermostats	Have Smart/Wi-Fi Thermostat	10%	14%	2%	5%	4%	10%
DER	Electric Vehicle	1%	0%	2%	1%	0%	1%

2.3 BUSINESS MARKET DATA

Table 2-5 provides select demographic information in the business sector.

TABLE 2-5 COMMERCIAL BUILDING CHARACTERISTICS

	Total
Own	80%
Lease	17%
Manage Building (Lease Only)	51%
Do Not Manage Building (Lease Only)	44%
% of Facilities Built Before 2001	49%
Average Size of Facility (Sq. Ft)	3,145
Occupy Building Year-Round	81%

The penetration of different lighting fixtures in Kentucky Power businesses is shown in Table 2-6. The table also includes the % of facilities with different lighting control types as well as % of lighting that is controlled. Table 2-7 provides example summary data for major end-uses.

TABLE 2-6: COMMERCIAL SECTOR LIGHTING END-USE CHARACTERISTICS

End Use	Equipment	Total
Lighting *(% of all Lighting)*	Linear Fluorescent	39%
	Linear LED	33%
	Nonlinear LED	11%
	CFL	4%
	HID	2%
	Incandescent or Halogen	11%
Lighting Controls	Occupancy Sensors	10%
	% of Lighting Controlled	5%
	Daylight Dimming	4%

End Use	Equipment	Total
	% of Lighting Controlled	1%
	Time Controls	7%
	% of Lighting Controlled	3%
	Advanced Lighting Controls	7%
	% of Lighting Controlled	5%

TABLE 2-7 COMMERCIAL SECTOR EQUIPMENT PENETRATION ACROSS KEY END-USES

End Use	Equipment	Penetration
		Total
Heating	Boiler	1%
	Furnace	15%
	Heat Pump	33%
	Electric Resistance	5%
	Unit Heater	11%
	Infrared	5%
Cooling	Packaged System AC	32%
	Split System AC	18%
	Heat Pump (Ducted)	28%
	Heat Pump (Ductless)	6%
	Window or Wall AC	11%
Thermostats	Smart Thermostats	9%
	% of Space Controlled by Smart Thermostat	58%
Ventilation	Demand Controlled Ventilation	26%
	Vent Hoods	20%
	Vent Hoods with Demand Controlled Vent.	44%
Smart Strips	Smart Strips (% of All Strips)	45%
Water Heating	Electric WH	75%
On-Site Generation	Renewable Energy Generation	0%
	Emergency/Backup Generation	100%

2.4 ADOPTION CURVE MARKET DATA

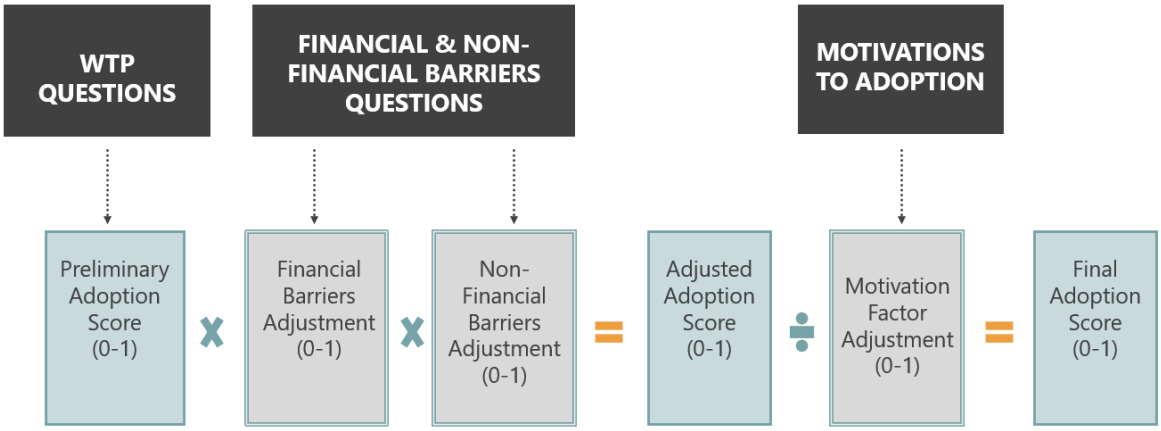
In addition to new primary research on building and energy-consuming equipment characteristics in the Kentucky Power service area, one of the major objectives of the primary research was to develop survey research that could be utilized to develop measure/program adoption curves for estimates of achievable potential. Table 2-8 describes the end-uses or categories in which adoption rate estimates were developed for energy efficiency, demand response programs, or distributed energy resources by the GDS Team.

TABLE 2-8 ADOPTION RATE CATEGORIES ANALYZED

Willingness to Participate	EE End Uses	DR Programs	DER
Residential Customers	Heating/CAC Water Heating Major Appliances Insulation/Air Sealing	Thermostat DR[5]	Solar PV (Purchase) Electric Vehicles (EVs)
Business Customers	HVAC Equipment Water Heating Equip. Refrigeration Lighting Equipment	N/A	Solar PV (Purchase and Lease)

Adoption rate calculations were based on questions which assessed (1) the respondent's willingness to adopt energy efficiency technologies or participate in demand response programs in scenarios with varying levels of program support, (2) the magnitude of the respondent's financial and non-financial barriers to adoption/participation. Adoption rates were calculated based on the equation shown below.

EQUATION 2-1 ADOPTION RATE FORMULA FOR FINAL ADOPTION SCORE



Direct willingness-to-participate questions are the starting point of measure/program-specific adoption curve calculations. For each item, respondents were asked to rate the likelihood that they would purchase the energy efficient version of the equipment, or participate in the DR program, at various incentive levels, including no incentive and an incentive that covers the full incremental (or total) cost.

Responses to financial and non-financial barrier questions were then used to adjust the preliminary adoption score. If "cost" was a consideration to prevent customers from purchasing energy efficient equipment, GDS assumed a financial barrier adjustment. The 0% incentive level was reduced by 100%, the 25% incentive level was reduced by 80%, the 50% incentive level was reduced by 60%, the 75% incentive level was reduced by 40%, and the 100% incentive level was reduced by 20%.

If another reason (i.e., lack of knowledge, uncertainty about bill savings, etc.) was a consideration to prevent customers from purchasing energy efficient equipment, GDS assumed a non-financial barrier adjustment. The 0% incentive level was reduced by 50%, the 25% incentive level was reduced by 40%, the 50% incentive level

[5] Although the market research sought to understand customer attitudes and WTP in a thermostat DR program, subsequent estimates of potential focus on EE savings and do not include DR offerings.

was reduced by 30%, the 75% incentive level was reduced by 20%, and the 100% incentive level was reduced by 10%.

Last, if the respondent indicated a strong motivation for purchasing an efficient technology or participating in a demand response program (i.e. bill savings, progress towards sustainability goals, etc.) then the adjusted adoption score was increased. The 0% incentive was increased by 25%, the adjusted adoption rate at the 25% incentive level was increased by 66%, the 50% incentive level by 150%. Respondents who indicated a strong motivation factor were typically assigned a 100% adoption score at the 75% and 100% incentive levels.

2.4.1 Residential Sector Final Adoption Scores

Table 2-9 presents the adjusted adoption scores (after financial and non-financial adjustments) for residential customers. In general, residential customers indicated a willingness to participate close to 70% to 80% at 100% incentive levels, and even some modest level of willingness to participate with 0% incentives.

TABLE 2-9 RESIDENTIAL FINAL ADOPTION SCORES BY INCENTIVE LEVEL

	Annual Incentive (% of incremental measure cost)				
	0%	25%	50%	75%	100%
HVAC	18%	36%	52%	66%	80%
Water Heat	15%	26%	39%	54%	76%
Insulation/Air Sealing	14%	23%	36%	50%	74%
Appliances	19%	32%	50%	63%	80%
Thermostat DR*	21%	33%	47%	58%	64%
Solar Purchase	6%	14%	29%	50%	75%
EVs	4%	8%	22%	35%	52%

**Thermostat DR has incentive levels of $10, $25, $50, $75 and $100/season.*

2.4.2 Business Sector Final Adoption Scores

Table 2-10 presents the adjusted adoption scores (after financial and non-financial adjustments) for Kentucky Power nonresidential customers across several end-uses.

In contrast to the residential sector energy efficiency WTP research, the nonresidential WTP survey questions incentives were described in the form of payback periods to better align with how purchasing decisions are likely to considered.

TABLE 2-10 NONRESIDENTIAL FINAL ADOPTION SCORES BY INCENTIVE LEVEL AND INVESTMENT TYPE

	Payback Performance (after incentive)				
	10 Years	5 Years	3 Years	1 Year	0 Years
HVAC	24%	38%	50%	60%	66%
Lighting	27%	43%	52%	64%	73%
Refrigeration	31%	38%	44%	53%	58%
Water Heat	30%	37%	46%	55%	62%
Solar Purchase	21%	33%	46%	56%	62%
Solar Lease*	12%	29%	46%	55%	61%

**Solar Lease did not use payback period. Instead, an estimation of the monthly lease cost was given based upon monthly average use ranges and related solar capacity sizes.*

Table 2-11 provides the final adoption scores for solar PV purchasing and/or leasing in the business sector.

TABLE 2-11 NONRESIDENTIAL DER FINAL ADOPTION SCORES

Purchased Solar	Payback Years				
	10 YR	5 YR	3 YR	1 YR	0 YR
Business	21%	33%	46%	56%	62%
Solar Lease					
	0%	25%	50%	75%	100%
Business	12%	29%	46%	55%	61%

3 BASELINE FORECAST

The load forecast is a critical input into Kentucky Power's 2023 DSM Market Potential Study, having various uses in estimation of residential and business sector potential. Therefore, GDS reviewed Kentucky Power's most recently completed load forecast results and documentation to produce the various forecast components necessary as inputs into this analysis. This chapter describes the various ways in which the study uses the forecast and presents the baseline forecast and segmentation of the C&I classes 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.

3.1 ADJUSTMENTS TO THE KENTUCKY POWER LOAD FORECAST

Before assessing the future potential for energy efficiency, demand response, or distributed energy resources in the Kentucky Power service area, a few modifications to Kentucky Power's June 2022-vintage forecast were necessary to create an adjusted baseline forecast. These modifications are addressed in more detail below.

3.1.1 Reclassification of Load

The 2022 Kentucky Power C&I sector customer database designates commercial and industrial rate code based on current tariff definition. Only using the account type/tariff definition to classify customers caused several manufacturing type premises to be classified as commercial (i.e. customers that are commercial rate codes but based on their description are manufacturing facilities), and several customers that GDS typically classifies as commercial to be classified as industrial, (i.e. a retail service building coded as an industrial account).

Additionally, the customer dataset identified each business by Standard Industry Code ("SIC"). The SIC was utilized to reclassify Kentucky Power C&I sector data. GDS mapped SIC's to a specified building type and then classified the building type as either commercial or industrial. Customers with a building type classified as "Industrial Manufacturing" were coded as Industrial customers. 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 4.5% of industrial sector sales, or 119,569 MWh, to the commercial sector. This 4.5% shift was then applied to the Kentucky Power base 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.

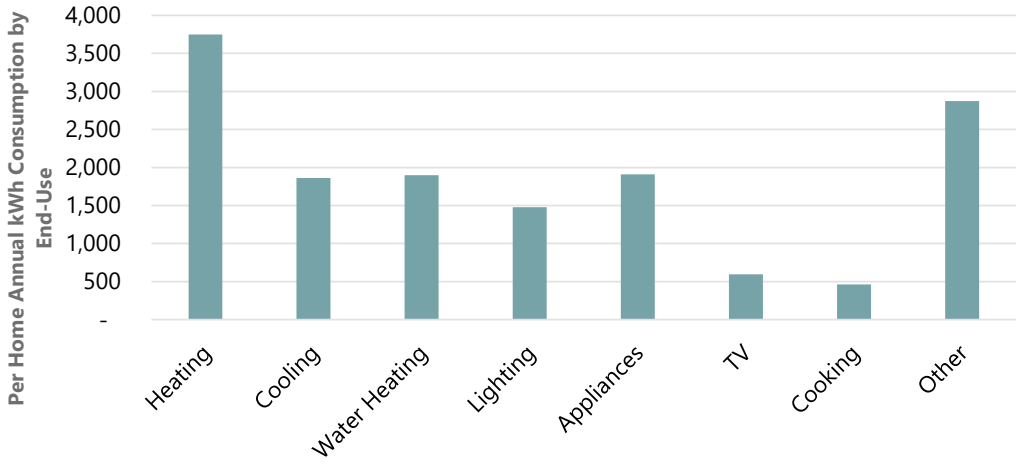
3.2 LOAD FORECAST DISAGGREGATION

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.

3.2.1 Residential Sector

The residential electric calibration effort led to an end-use intensity breakdown as shown below in Figure 3-1. Overall, the GDS Team estimated per home consumption to be 14,827 kWh per year. The "Heating" end use is the leading end-use, followed by the "Other" end use, which includes plug loads such as electronics and miscellaneous small appliances. The large share of the "Other" end use reflects the increasing prominence of electronics and other plug-in load devices within homes.

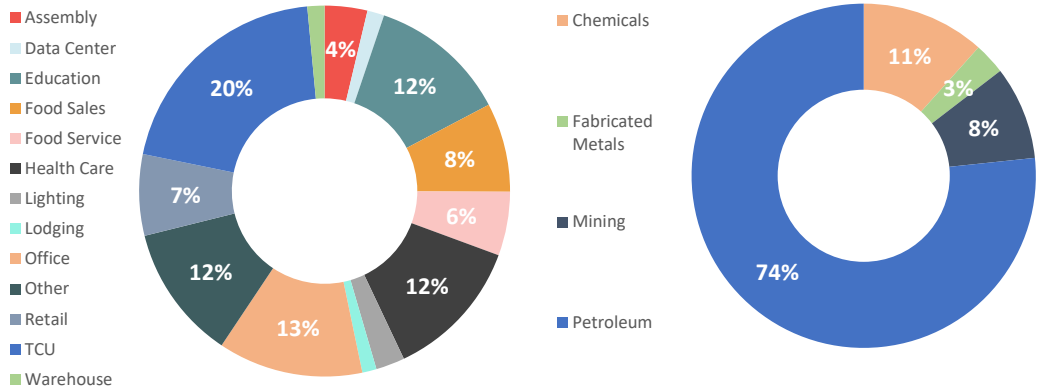
FIGURE 3-1 RESIDENTIAL ELECTRIC END-USE BREAKDOWN



3.2.2 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 Kentucky Power for the residential, commercial and industrial sectors. As noted above, the C&I forecast was adjusted from the base case by using SIC information from Kentucky Power to reclassify usage as commercial or industrial. SIC information from Kentucky Power, 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 CBECS 2012 end-use survey data. Figure 3-2 provides a breakdown of commercial electric sales by building type and industrial sales by sector.[6] The industrial sector chart includes industry types with more than 1% of total electric sales, while the remaining 3% of sales not included in the chart are spread across a myriad of industries.

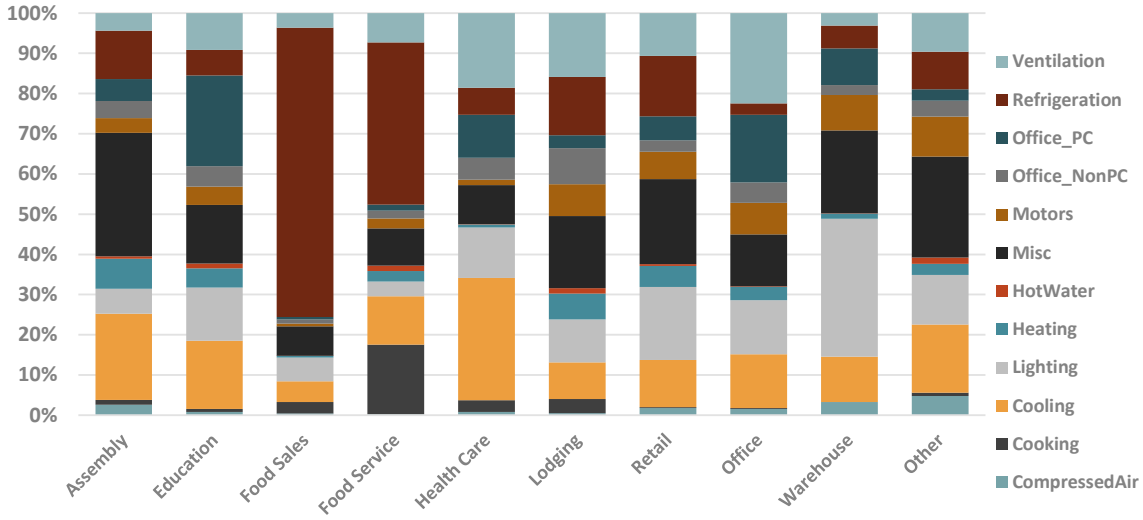
FIGURE 3-2: COMMERCIAL AND INDUSTRIAL ELECTRIC SALES BREAKDOWN BY BUILDING TYPE



6 "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.

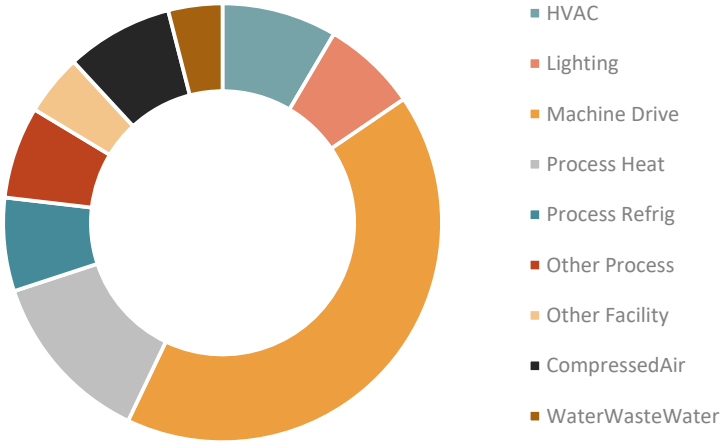
Figure 3-3 provides an illustration of the leading end-uses across all building types in the commercial sector. Lighting, space cooling, and ventilation are the primary end-uses with a significant share of load across most building types. Shares of refrigeration and office/computing are often dependent 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.

FIGURE 3-3: COMMERCIAL ELECTRIC END-USE BREAKDOWN BY BUILDING TYPE[7]



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 3-4 provides a breakdown of the sales by end-use. Overall, the weighted average industrial sales by end-use in the Kentucky Power service area was roughly 42% Machine Drive, 13% Process Heat, 9% HVAC, 8% Compressed Air, 7% Lighting, and 7% Process Refrigeration. The remaining 15% was split between Other Process and Other Facility loads.

FIGURE 3-4: INDUSTRIAL ELECTRIC END-USE BREAKDOWN BY BUILDING TYPE



[7] Data labels for segments that contribute less than 5% of the total sector sales were removed to improve figure readability.

4 ENERGY EFFICIENCY POTENTIAL ANALYSIS

4.1 ANALYSIS APPROACH

This section describes the overall methodology utilized to assess the electric energy efficiency potential in the Kentucky Power service area. The main objectives of the energy efficiency potential analysis were to estimate the technical, economic, maximum, and realistic achievable potential savings from energy efficiency in the Kentucky Power service territory; and to quantify these estimates of potential in terms of MWh and MW savings, for each level of energy efficiency potential.

4.1.1 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/top-down approach. GDS first used a bottom-up approach to estimate measure-level savings, costs, and cost-effectiveness, and then converted to a top-down approach by applying measure savings (on a percent-basis) to all applicable shares of disaggregated energy load.

4.1.2 Market Characterization

The initial step in the analysis was to gather a clear understanding of the current market segments in the Kentucky Power service area. The GDS Team coordinated with Kentucky Power to gather utility sales, 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 nonresidential sectors.

4.1.2.1 Forecast Disaggregation

As noted in Chapter 3, 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 between existing income qualified and market-rate customers as well as new construction.
- ***Commercial.*** Typically based on major EIA CBECS business types: retail, warehouse, food sales, office, lodging, health, food service, education, assembly, 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 Kentucky Power-specific segment and end-use consumption shares, derived from Kentucky Power's customer database and industry code analysis (building segmentation), and by EIA Annual Energy Outlook (AEO) 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 4-1.

TABLE 4-1: ELECTRIC END-USE LOADS

	C&I	
Residential	**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	Water / Wastewater
Light	Whole Building / Behavioral	Whole Building / Behavior
Miscellaneous		

4.1.2.2 Eligible Opt-Out Customers

In Kentucky Power's service territory, industrial customers are assumed to be eligible to opt-out of utility funded electric energy efficiency programs. As a result, GDS removed industrial sector customers and sales in the assessment of technical, economic, and achievable potential reflected in this report. As a sensitivity (included in the appendix), GDS 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.

4.1.2.3 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.

4.1.2.3.1 Residential Sector

For the residential sector, GDS relied on the primary research efforts noted in Chapter 2 of this report. The GDS-led market research results allowed for the GDS Team to characterize the baseline and efficiency saturations of the residential sector using housing-type specific data. Other data sources included ENERGY STAR unit shipment data, and the EIA Residential Energy Consumption Survey data from 2020. 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.

4.1.2.3.2 Business Sector

For the commercial sector, building stock and equipment saturation data was informed from a combination of secondary data from available regional and/or national data, as well as limited primary market research (online surveys noted in Section 2). The survey data helped inform select equipment saturation characteristics, primarily related to lighting and controls.

EIA regional data, as well as national studies on commercial energy consumption were used to inform consumption and equipment stock saturation levels.[8] These sources typically informed estimates of base equipment saturation for cooking, refrigeration, water heating, plug loads, and other miscellaneous end-uses.

[8] Examples of secondary research include: Energy Savings Potential RD&D Opportunities for Commercial Building Appliances. 2016. DOE and Energy Star Shipment Data.

For the industrial sector sensitivity, 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.

4.1.2.4 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 to recognize that the energy efficient saturation does not 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, availability and customer preferences).

Second, for measures categorized as market opportunity (i.e. replace-on-burnout), the GDS Team assumed that in some 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 some of the market is transformed, and no future savings potential exists, whereas there is also some portion of the market which is not transformed and could backslide without the intervention of a Kentucky Power program and an incentive.

4.1.3 Measure Characterization

4.1.3.1 Measure Lists

The study's sector-level energy efficiency measure lists were informed by a range of sources including the Michigan Energy Measures Database ("MEMD"), the Illinois and Indiana technical reference manuals ("TRMs"), current Kentucky Power program offerings, and commercially viable emerging technologies, among others. Measure list development was a collaborative effort in which GDS developed draft lists that were shared with Kentucky Power 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 considered 303 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 2,067 measure permutations for this study. Each permutation was screened for cost-effectiveness under the Total Resource Cost ("TRC") Test. The parameters for cost-effectiveness under the TRC Test are discussed in detail later in Section 4.1.6.

TABLE 4-2: NUMBER OF ELECTRIC MEASURES CONSIDERED FOR THE STUDY

	# of Measures	Total # of Measure Permutations
Kentucky Power		
Residential	154	811
Commercial	123	1,230
Industrial/Ag	26	26
Total	***303***	***2,067***

4.1.3.2 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

building integrated energy management systems, advanced rooftop controls, variable refrigerant flow heat pumps, ozone commercial laundry, Q-Sync motors for refrigeration, advanced lighting controls, power distribution equipment upgrades, server virtualization, and escalator motor controls. 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 20-year 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.

4.1.3.3 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 Kentucky Power to the extent possible. GDS used the most recent Kentucky Power program planning documents, the Michigan Energy Measures Database, and the Indiana and Illinois technical reference manuals 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 the Illinois TRM and the MEMD 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 MEMD, GDS estimated savings from a variety of sources, including:

- 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 the Illinois TRM and the MEMD. GDS also used the following supplementary data sources:

- IN TRM, 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 Illinois TRM and the MEMD, as well as:

- 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.

4.1.3.4 Treatment of Codes & Standards

By law, the DOE is expected to review each national appliance standard every six years and publish either a proposed rule to update the standard or determine that no change to the existing standard is needed. The analysis is not intended to predict how or when energy codes and standards will change over time. Therefore, there are only limited known improvements to federal codes and standards to reasonably account for in this analysis.

4.1.3.5 Net to Gross

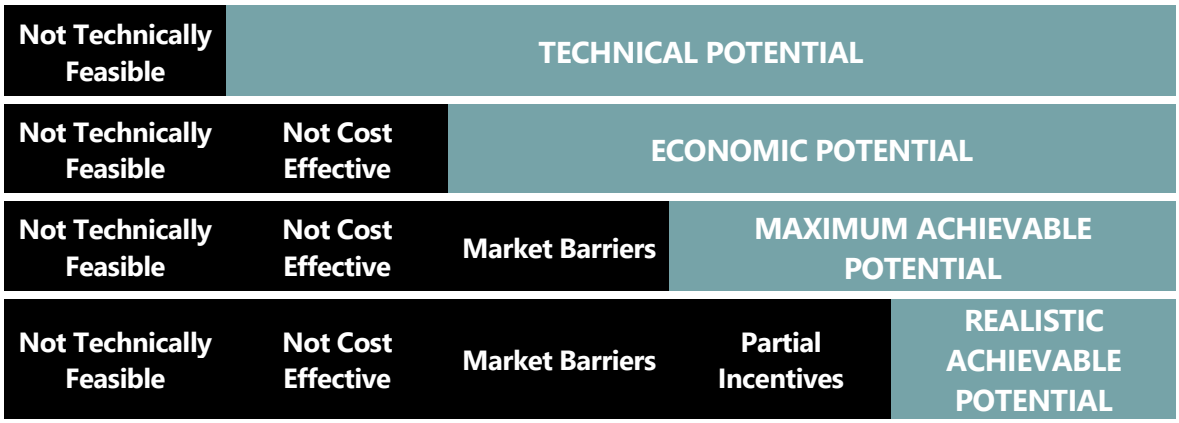
All estimates of technical, economic, and achievable potential, as well as measure level cost-effectiveness screening were conducted in terms of gross savings to reflect the absence of program design considerations in these phases of the analysis. The impacts of free-riders (participants who would have 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 program potential (Chapter 5).

4.1.4 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 can be realistically achieved through market interventions, when it can be captured, and how much it would cost to do so. Figure 4-1 illustrates the types of energy efficiency potential considered in this analysis.

FIGURE 4-1 TYPE OF ENERGY EFFICIENCY POTENTIAL[9]



9 Reproduced from "Guide to Resource Planning with Energy Efficiency." November 2007. US Environmental Protection Agency (EPA). Figure 2-1. Modified to depict the additional levels of achievable and program potential included in this study.

4.1.5 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 4-1 below. The C&I sector employs a similar analytical approach.

EQUATION 4-1 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.

4.1.5.1 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, connected thermostat, and

smart thermostat. 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 a smart thermostat are adjusted down to reflect the efficiency gains of installing an efficient air source heat pump.

4.1.6 Economic Potential

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

4.1.6.1 TRC Test & Incentive Levels

The economic potential assessment included a screen for cost-effectiveness using the TRC Test at the measure level. In the Kentucky Power territory, the TRC Test considers electric energy, capacity, and transmission & distribution (T&D) savings as benefits, and either incremental or full measure cost as the cost. Consistent with application of economic potential according to the National Action Plan for Energy Efficiency, the measure level economic screening does not consider non-incentive/measure delivery costs (e.g. admin, marketing, evaluation etc.) in determining cost-effectiveness.[10]

Apart from the low-income segment of the residential sector, all measures were required to have a TRC 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.

In the residential sector, incentives by program ranged from 50% to 100%. In the non-residential sector, incentives were assumed to represent 40% of the incremental measure cost. These incentive levels were selected so that the estimated incentive costs aligned with benchmarked data from EIA Form 861 reports filed by other national utilities related to incentive and non-incentive spending, as well as general industry experience.

4.1.6.2 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 Kentucky Power 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.

Kentucky Power provided the GDS Team with monthly 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[11] 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.

4.1.7 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,

[10] 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.*

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

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 three achievable potential scenarios:

- ***MAP*** estimates achievable potential on paying incentives equal to up to 100% of measure incremental costs and aggressive adoption rates.[12]
- ***RAP*** estimates achievable potential with Kentucky Power paying incentive levels (as a percentage of incremental measure costs) that are consistent with industry standard levels but is not constrained by any previously determined spending levels.
- ***Program potential*** provides an estimate of the savings potential that could be achieved with potential improvements to the existing electric energy efficiency program portfolio. The scenario leverages the RAP estimates as well as additional program design considerations.[13]

4.1.7.1 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 Kentucky Power-specific WTP market research. The Kentucky Power-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. This research is discussed in additional detail in Section 2.4.

One caveat to this approach is that the WTP adoption score is a simple function of incentive levels and/or payback performance. There are other factors 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. To recognize that the maximum achievable potential could increase current program awareness, we included an awareness adjustment factor to increase (by 15%) the estimated long-term adoption levels compared to the realistic achievable potential.

GDS utilized likelihood and willingness-to-participate data to estimate the long-term market adoption potential for both the maximum and realistic achievable scenarios. Table 4-3 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. Last, GDS adjusted the Kentucky Power-specific adoption curves to reflect observed differences in WTP between the income-qualified and market-rate customers.

TABLE 4-3 RESIDENTIAL LONG-TERM MARKET ADOPTION RATES AT DISCRETE INCENTIVE LEVELS

End Use	0% Incentive	25% Incentive	50% Incentive	75% Incentive	100% Incentive
Heat/Cool Equip	18%	36%	52%	66%	80%
Water Heat	15%	26%	39%	54%	76%
Shell (insulation/sealing)	14%	23%	36%	50%	74%

[12] ibid.

[13] See Chapter 5 for more information about Program Potential

End Use	0% Incentive	25% Incentive	50% Incentive	75% Incentive	100% Incentive
Appliances	19%	32%	50%	63%	80%
Thermostat DR	21%	33%	47%	58%	64%
Solar	6%	14%	29%	50%	75%
EVs	4%	8%	22%	35%	52%

Table 4-4 presents the long-term market adoption rates used in the nonresidential sector. Again, the adoption scores were primarily informed by the Kentucky Power-specific WTP research. GDS included a 20-year payback performance level to reflect reduced adoption rates for measures with extremely long payback performance levels. The 20-year payback performance was set to 2/3rd of the 10-year level. All remaining end-uses were typically mapped to the HVAC and/or Lighting end-uses.

TABLE 4-4 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	18%	27%	43%	52%	64%	73%
HVAC	16%	24%	38%	50%	60%	66%
Refrigeration	20%	31%	38%	44%	53%	58%
Water Heat	20%	30%	37%	46%	55%	62%
Other	18%	27%	43%	52%	64%	73%

GDS then estimated initial year adoption rates by reviewing the current saturation levels of efficient technologies and (if necessary) calibrating the estimates of 2023 annual potential to recent historical levels achieved by Kentucky Power's current DSM portfolio.

4.1.7.2 Non-Incentive Costs

Consistent with National Action Plan for Energy Efficiency (NAPEE) guidelines[14], utility non-incentive costs were included in the overall assessment of cost-effectiveness at the RAP scenario. Non-incentive costs were levels and set at:

- $0.0641 to $0.43 per first year kWh saved for non-low-income measures
- $0.95 per first year kWh saved for low-income program measures
- $0.080 per first year kWh saved for Commercial & Prescriptive Programs

Non-incentive costs were then escalated annually at the rate of inflation.[15]

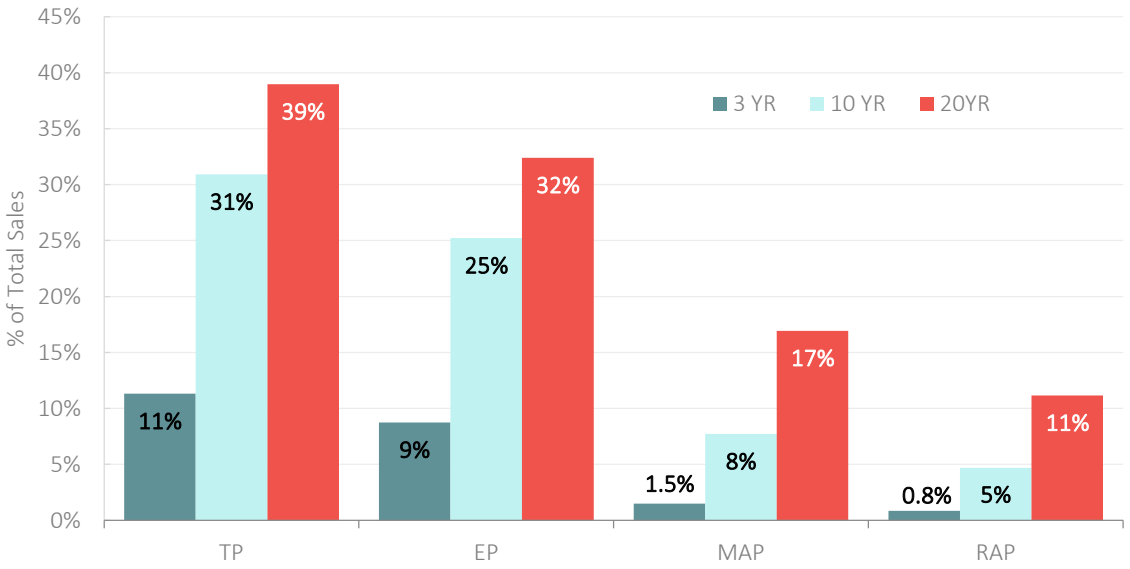
4.2 RESIDENTIAL ENERGY EFFICIENCY POTENTIAL FINDINGS

Figure 4-2 provides the technical, economic, MAP and RAP results for the 3-year, 10-year, and 20-year timeframes. The cumulative annual 3-year technical potential is 11% of forecasted sales, and the economic potential is 9% of forecasted sales. The cumulative annual 3-year MAP is 1.8% and the RAP is 1.1%, as a

[14] 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.
[15] As noted earlier in the report, measure costs and utility incentives were not escalated over the 20-year analysis timeframe to keep those costs constant in nominal dollars.

percentage of forecasted sales. Over the duration of the study timeframe the technical and economic potential rise to 39% and 32% of forecasted sales, respectively. This indicates that a large portion of the technical potential is cost-effective. The MAP and RAP rise respectively to 17% and 11% of forecasted sales over the study timeframe. The gap between economic potential and MAP/RAP represents market barriers to prospective program participants, both financial and non-financial, to achieving the full amount of economic potential.

FIGURE 4-2: OVERVIEW OF RESIDENTIAL POTENTIAL



4.2.1 Technical/Economic Potential

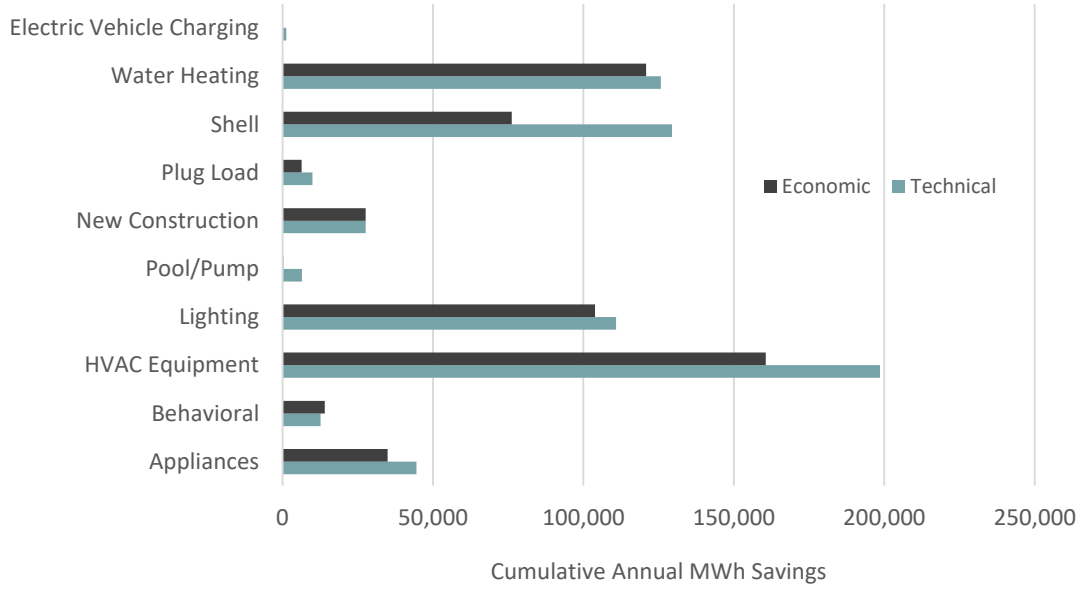
Table 4-5 provides cumulative annual technical and economic potential results across the 2024-2028 (Years 1-5) timeframe, as well as for 2033 (10th-year) and 2043 (20th-year). The technical potential is more than 331,000 MWh by 2028 and rises to more than 666,000 MWh by 2043. Economic potential rises to more than 257,000 MWh by 2028. Technical potential summer peak demand savings reaches 244 MW by 2043 and winter peak demand savings reaches approximately 92 MW by 2043.

TABLE 4-5 TECHNICAL & ECONOMIC RESIDENTIAL POTENTIAL

	2024	2025	2026	2027	2028	2033	2043
Energy (MWh)							
Technical	80,186	148,426	213,737	273,226	331,127	556,225	669,750
Economic	62,830	114,649	165,380	213,193	259,990	453,759	556,751
Summer Demand (MW)							
Technical	27.5	52.9	77.8	97.9	117.6	197.4	224.5
Economic	19.1	36.6	53.8	68.8	83.6	146.2	169.7
Winter Demand (MW)							
Technical	11.2	20.8	30.0	38.4	46.6	78.1	96.3
Economic	8.9	16.2	23.3	29.9	36.3	62.5	77.9

Figure 4-3 shows a comparison of the technical and economic potential (20-year) by end use. HVAC Equipment is the leading end-use among technical and economic potential, followed by Water Heating, Lighting, Building Shell and Appliances.

FIGURE 4-3: 20-YR RESIDENTIAL TECHNICAL & ECONOMIC POTENTIAL, BY END-USE



4.2.2 Achievable Potential

Figure 4-4 provides the MAP and RAP across the 20-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 blue and orange lines provide the corresponding cumulative annual MAP and RAP as a percent of forecasted annual sales. The MAP rises to 17% by 2043, and the RAP rises to 11%.

FIGURE 4-4: OVERVIEW OF RESIDENTIAL POTENTIAL – RAP 2043

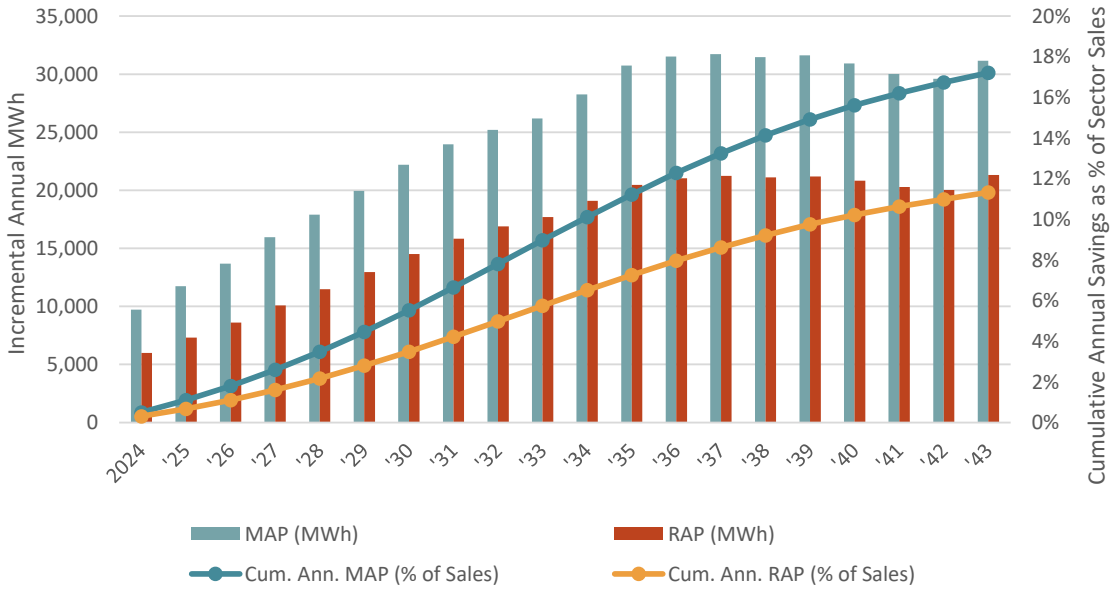


Figure 4-5 provides a breakdown of the RAP potential in 2043 across end-uses and home type/income type segments. HVAC Equipment is the leading end-use, accounting for 27% of the total. Water Heating, Shell, Lighting, Appliances, and Behavioral account for an additional 71% of the RAP. Among home types/income types, 29% of the potential is from the single-family ("SF") non-low-income ("NLI") segment, with an additional

35% of the potential from the SF-LI segment. The remaining 36% of the potential comes from the mobile home ("MH") and multifamily ("MF") segments across both all income types.

FIGURE 4-5: RESIDENTIAL POTENTIAL BY END-USE AND HOME/INCOME TYPE – RAP 2043

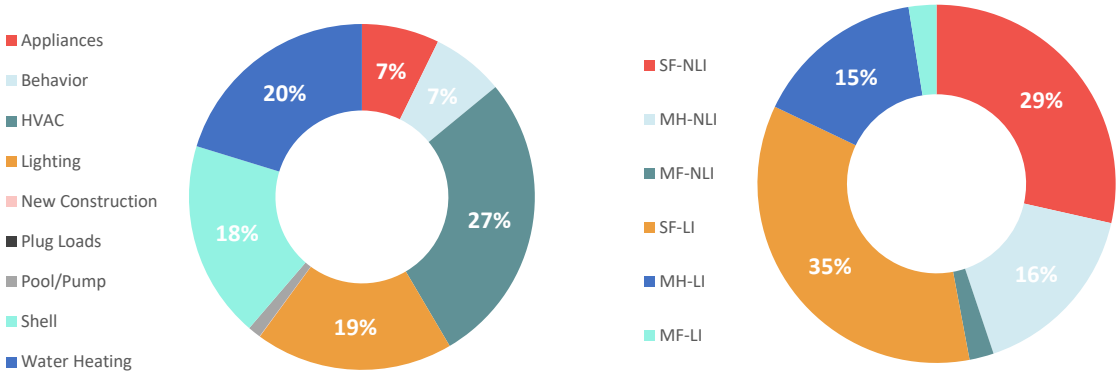


Table 4-6 provides incremental and cumulative annual energy and demand savings for MAP and RAP across the next five years as well as over the 10-yr and 20-yr time horizons. Incremental RAP energy savings range from 6,0600 MWh in 2024 to 21,000 MWh by 2043, and cumulative RAP energy savings rise to more than 194,000 MWh by 2043. Cumulative annual RAP summer peak demand reaches 68 MW by 2043 and cumulative annual RAP winter peak demand reaches 28 MW by 2043.

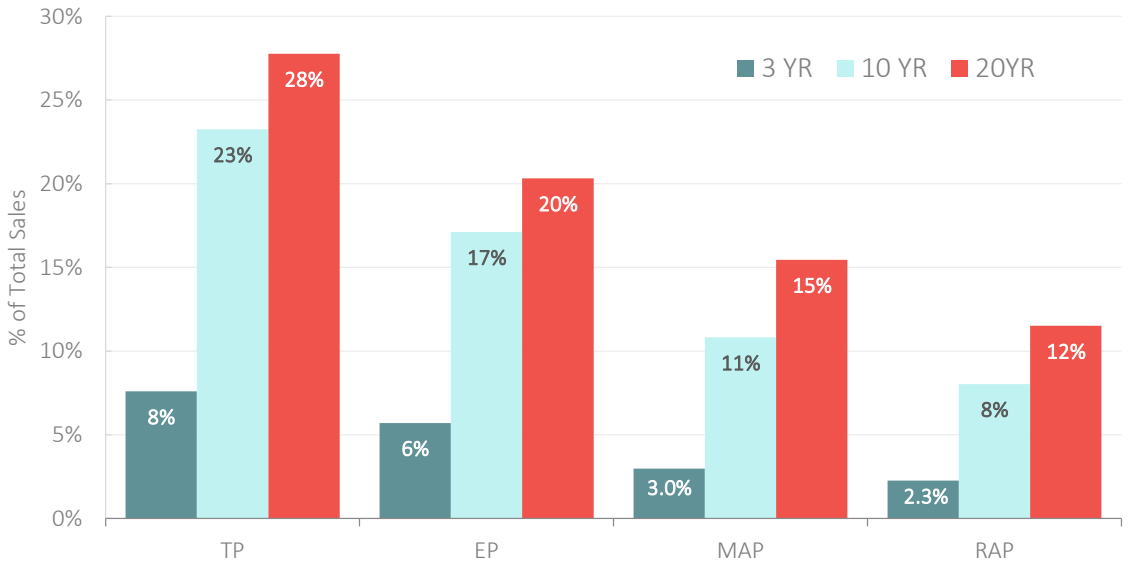
TABLE 4-6 RESIDENTIAL MAP & RAP POTENTIAL

	2024	2025	2026	2027	2038	2033	2043
Incremental Annual Energy (MWh)							
MAP	9,726	11,750	13,671	15,955	17,910	26,192	31,144
RAP	6,006	7,315	8,603	10,097	11,483	17,688	21,330
Incremental Annual Summer Peak Demand (MW)							
MAP	3.2	3.9	4.4	5.3	5.8	8.6	10.0
RAP	2.0	2.5	2.8	3.4	3.7	5.6	6.5
Incremental Annual Winter Peak Demand (MW)							
MAP	1.4	1.8	2.1	2.4	2.7	4.0	4.5
RAP	0.9	1.1	1.2	1.5	1.7	2.5	2.9
Cumulative Annual Energy (MWh)							
MAP	9,726	20,965	33,922	48,559	64,779	161,403	295,799
RAP	6,006	12,907	20,941	30,121	40,408	103,490	194,722
Cumulative Annual Summer Peak Demand (MW)							
MAP	3.2	7.1	11.4	16.2	21.5	53.6	100.3
RAP	2.0	4.4	7.2	10.3	13.7	35.3	67.9
Cumulative Annual Winter Peak Demand (MW)							
MAP	1.4	3.1	5.1	7.3	9.8	24.4	44.2
RAP	0.9	1.9	3.0	4.4	5.9	15.0	27.5

4.3 COMMERCIAL ENERGY EFFICIENCY POTENTIAL

Figure 4-6 provides the technical, economic, MAP and RAP results for the 3-year, 10-year, and 20-year timeframes. The cumulative annual 3-year technical potential is 8% of forecasted commercial sales, and the economic potential is 6% of forecasted commercial sales. The cumulative annual 3-year MAP is 3.0% and the RAP is 2.3%, as a percentage of forecasted commercial sales. Over the duration of the study timeframe the technical rises to 28% and economic potential rises to 20% of forecasted commercial sales. The MAP and RAP rise respectively to 15% and 12% of forecasted sales over the study timeframe. The gap between economic potential and MAP/RAP represents market barriers to prospective program participants, both financial and non-financial, to achieving the full amount of economic potential.

FIGURE 4-6: OVERVIEW OF COMMERCIAL POTENTIAL



4.3.1 Technical/Economic Potential

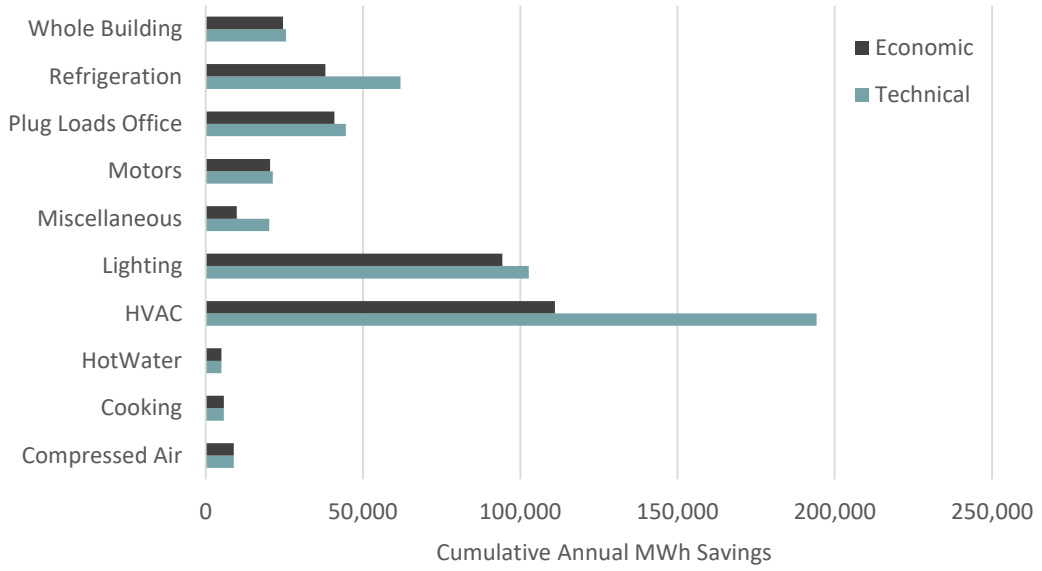
Table 4-7 provides cumulative annual technical and economic potential results across the 2024-2028 (Years 1-5) timeframe, as well as for 2033 (10th-year) and 2043 (20th-year). The technical potential is just above 230,000 MWh by 2028 and rises to more than 490,000 MWh by 2043. Economic potential rises to nearly 360,000 MWh by 2043 as well. Summer peak demand savings associated with technical potential reaches 101 MW by 2043 and winter peak demand savings reach approximately 48 MW by 2043.

TABLE 4-7 TECHNICAL & ECONOMIC COMMERCIAL POTENTIAL

	2024	2025	2026	2027	2028	2033	2043
Energy (MWh)							
Technical	43,541	90,256	138,295	186,119	232,533	416,505	490,105
Economic	32,833	67,950	103,914	139,507	173,783	306,552	358,764
Summer Demand (MW)							
Technical	7.7	16.3	25.3	34.6	43.7	83.1	101.4
Economic	4.8	9.9	15.3	20.8	26.1	47.2	55.8
Winter Demand (MW)							
Technical	4.5	9.3	14.2	19.0	23.6	41.4	47.9
Economic	3.7	7.7	11.7	15.7	19.6	34.5	40.6

Figure 4-7 shows a comparison of the technical and economic potential (20-year) by end use. HVAC and Lighting are the leading end-use among technical and economic potential. Plug Loads, Whole Building and Refrigeration savings also account for significant technical and economic potential.

FIGURE 4-7: 20-YR COMMERCIAL TECHNICAL & ECONOMIC POTENTIAL, BY END-USE



4.3.2 Achievable Potential

Figure 4-8 provides the MAP and RAP across the 20-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 commercial sector sales. The MAP rises to 15% by 2043, and the RAP rises to 12% of forecasted commercial sales.

FIGURE 4-8: OVERVIEW OF COMMERCIAL POTENTIAL – RAP 2043

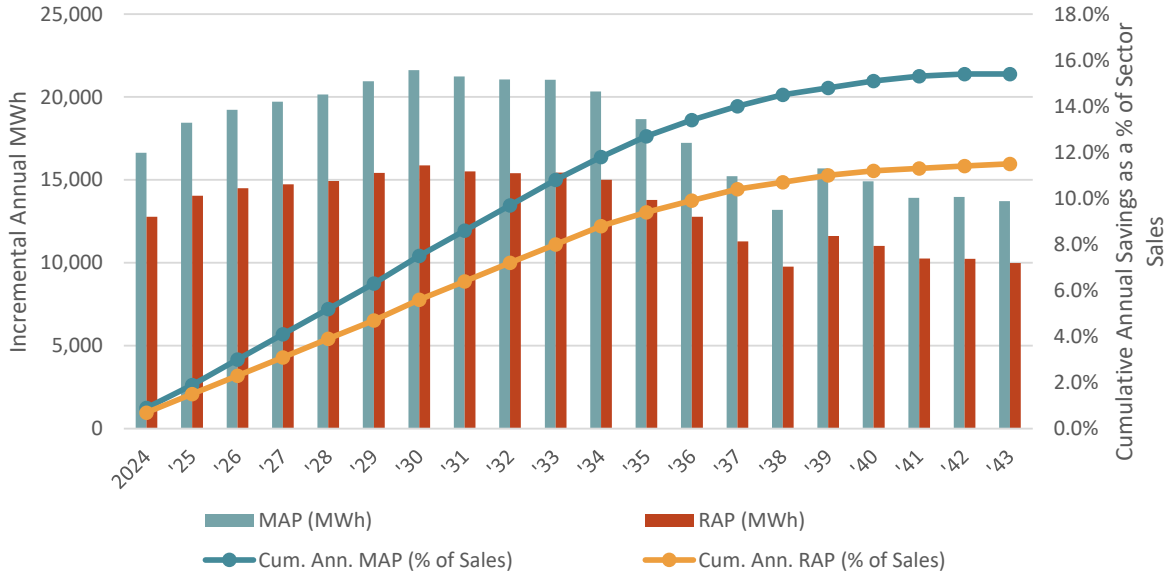


Figure 4-9 provides a breakdown of the RAP potential in 2043 across commercial end-uses and building type market segments.[16] In the RAP scenario, Lighting and HVAC account for over 50% of the potential. Across building types, Education (16%), Health (19%), Office (19%), and Retail (10%) account for about two-thirds of the potential. Assembly (3%), Food Sales (8%), Food Service (6%), Lodging (2%), and Warehouse (3%) combine for about one-quarter of the potential. The remaining "Other" building types represent 14% of the achievable potential.

FIGURE 4-9: COMMERCIAL POTENTIAL BY END-USE AND BUILDING TYPE – RAP 2043

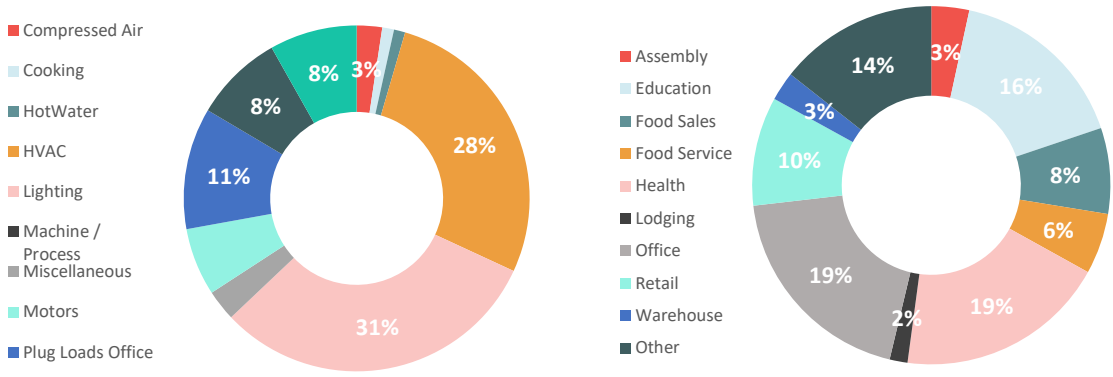


Table 4-8 provides incremental and cumulative annual commercial sector energy and demand savings for MAP and RAP across the next five years as well as over the 10-yr and 20-yr time horizons. Incremental RAP energy savings begin at roughly 12,800 MWh in 2024 followed by a steady increase over the remainder of the first decade of the timeframe, with savings trailing off in the second decade. Commercial lighting savings become increasingly difficult to sustain. Cumulative RAP energy savings rise to approximately 200,000 MWh by 2043. Cumulative annual RAP summer peak demand reaches 30 MW by 2043 and cumulative annual RAP winter peak demand reaches 23 MW by 2043.

TABLE 4-8 COMMERCIAL SECTOR MAP & RAP POTENTIAL

	2024	2025	2026	2027	2038	2033	2043
Incremental Annual Energy (MWh)							
MAP	16,637	18,442	19,227	19,716	20,158	21,046	13,717
RAP	12,770	14,038	14,506	14,729	14,933	15,448	9,986
Incremental Annual Summer Peak Demand (MW)							
MAP	2.2	2.5	2.7	2.9	3.0	3.5	2.2
RAP	1.6	1.8	1.9	2.1	2.2	2.5	1.6
Incremental Annual Winter Peak Demand (MW)							
MAP	1.9	2.1	2.2	2.3	2.3	2.3	1.6
RAP	1.5	1.6	1.7	1.7	1.7	1.7	1.1
Cumulative Annual Energy (MWh)							
MAP	16,637	35,080	54,306	73,877	93,654	193,732	272,761
RAP	12,770	26,808	41,314	55,945	70,599	143,892	203,158

[16] Segments with less than 3% of total end-use or building type share do not display a data label (%) in pie-charts to improve readability of data.

	2024	2025	2026	2027	2038	2033	2043
Cumulative Annual Summer Peak Demand (MW)							
MAP	2.2	4.7	7.3	10.2	13.1	28.9	41.9
RAP	1.6	3.4	5.4	7.4	9.5	20.7	30.1
Cumulative Annual Winter Peak Demand (MW)							
MAP	1.9	4.0	6.3	8.5	10.8	22.1	31.0
RAP	1.5	3.1	4.8	6.5	8.2	16.6	23.4

5 PROGRAM DESIGN

The GDS Team conducted research and analysis to provide a recommendation for Kentucky Power to consider as potential improvements to their electric energy efficiency program portfolio. The primary objective is to expand energy efficiency for all customers with specific emphasis on low and moderate level income residential customers. The GDS Team combined market research of regional peer electric energy efficiency programs with the realistic potential outcomes from the marker potential assessment, in addition to current industry trends and best practices. This activity was not a comprehensive portfolio optimization analysis, instead priorities focused on energy efficiency offerings for all customers. There may be additional factors beyond the scope of this analysis that would make certain considerations presented here infeasible for Kentucky Power to pursue or concepts that need to be tested with actual market conditions.

5.1 ANALYSIS APPROACH

The GDS Team sought to gather insight into the latest industry trends and best practices by reviewing literature (e.g., industry association trends report, conference papers, government agency white papers, evaluation reports, and DSM plans), as well as data associated with the program portfolios offered by peer utilities. Outcomes from the MPS market research and initial modeling outputs, as well as input from prior Kentucky Power Commission Orders were considered in the analysis.

Guiding principles for the analysis were to:

- Identify cost-effective program opportunities (>1.0 TRC) that can deliver electric energy efficiency savings identified in the market potential study;
- Look for opportunities to shape a portfolio that exhibits characteristics identified as optimal for advancing the long-term success of energy efficiency markets; and
- Consider objectives Kentucky Power highlighted in its most recent DSM Plan filings.

5.1.1 Market Research

As Kentucky Power's current program offerings are limited to a single residential low-income program coordinated through eastern Kentucky community action agencies, the GDS Team established a framework for determining new programs through industry best practices and benchmarking of regional energy-efficiency programs.

ACEEE's Utility Energy Efficiency Scorecard served as a key reference for identifying DSM program characteristics that look beyond the basic components of high impact energy savings and cost-effectiveness. ACEEE's Scorecard ranks DSM programs based on a variety of characteristics, recognizing that many factors shape the context for what a utility can offer, as well as the range of benefits a program may provide. Characteristics identified as important for utility energy efficiency portfolios include:[17]

- **Comprehensive** – serving the full spectrum of customer needs and end uses.
- **Responsive to market changes** - including emerging program areas and strategies that address major or growing end uses.
- **Innovative and engaging** - bringing in new technologies and strategies.
- **Simple, accessible, and hassle free** - to maximize customer participation.
- **Tailored** - to meet the unique needs of different customers and offering incentives at the most effective point in the supply chain for a given market.

[17] ACEEE 2020 Utility EE Scorecard, see "Practices of Leading Energy-Saving Utilities," p. 91.

The GDS Team selected several utilities for benchmarking comparison based on a combination of proximate geography and availability of granular measure-level data. For each of the comparison utilities, the GDS Team assembled data regarding program and measure offerings, incentives levels, and non-incentive program expenditures, as well as program cost-effectiveness. Data sources included DSM Plan filings, evaluation reports, program websites, and other sources where available. Energy-efficiency utility operated program research included:

- AEP Appalachian Power (West Virginia and Virginia)
- AEP Indiana Michigan (Indiana and Michigan)
- Duke Energy (Kentucky and North Carolina)
- East Kentucky Power Cooperative (Kentucky)
- Louisville Gas and Electric Company (Kentucky)
- First Energy West Penn Power (Pennsylvania)

The outcome of this market research was to identify candidate program archetypes with basic program go-to-market strategies and incentives, e.g. rebates, direct-install, marketplace, etc. for Kentucky Power's service territory.

5.1.2 Program Analysis

The GDS Team utilized a program planning tool to construct a bottom-up portfolio to estimate savings forecasts, budgets, and cost effectiveness for the proposed Kentucky Power energy efficiency programs. Forecasts and parameters at the individual measure level are derived from the realistic achievable scenario outcomes including forecasted participation, energy savings, incremental costs, and incentives. Measures with a cost effectiveness results greater than 0.85 were identified as candidate measures for program archetype assignment. Individual measure permutations are bundled together prior to assignment to candidate program archetype. Program measure forecasts and incentives are reassessed within a program archetype. Program and portfolio cost effectiveness is assessed with final measures and expected program non-incentive costs. Budgets and participation are forecasted over five years. Additional considerations are given to non-administrative, or cross-cutting costs at the portfolio level when they cannot be attributed to a single program.

The program potential scenario simulates the expected program outcomes in forecasted years by including the following factors informed by best practice research:

- **Program Net-to-Gross values** (NTG)
  - Low-income programs utilize 1.0
  - New program offerings are defaulted to 0.8
- **Incentive levels and structures**
- **Program non-incentive costs (administrative)**
- **Historical participation and spending in the Targeted Energy Efficiency program**

The GDS Team recognizes the limitations of this secondary market research and analysis, understanding there could be factors which could limit the applicability of these considerations. The GDS Team would recommend that Kentucky Power gather program costs and measure details through detailed bottom-up labor estimates or market implementation contractors and vendors to validate these findings. Additionally, markets in the Kentucky Power service territory may not react immediately and/or the program may require time to mature operations; consequently, some of these forecasts should have cost effectiveness assessed after several years.

5.2 PROGRAM POTENTIAL RESULTS

Market research and accompanying analysis result in program potential as a subset of the cost-effective realistic achievable potential. Recommendations are based on general portfolio budget constraints, Kentucky Power applicable

program concepts, and expected participation. A general 5-year portfolio plan was developed with focus on the three-year period 2024 – 2026, expecting to align with a regulatory DSM program filing period.[18]

5.2.1 Portfolio

Figure 5-1 and Figure 5-2 summarize the proposed program potential budgets and expected energy savings. It's notable that Kentucky Power's program budgets ranged between $250,000 - $300,000 from 2019 through 2022.

FIGURE 5-1: FIVE-YEAR ENERGY EFFICIENCY PORTFOLIO BUDGET EXPENDITURE FORECAST

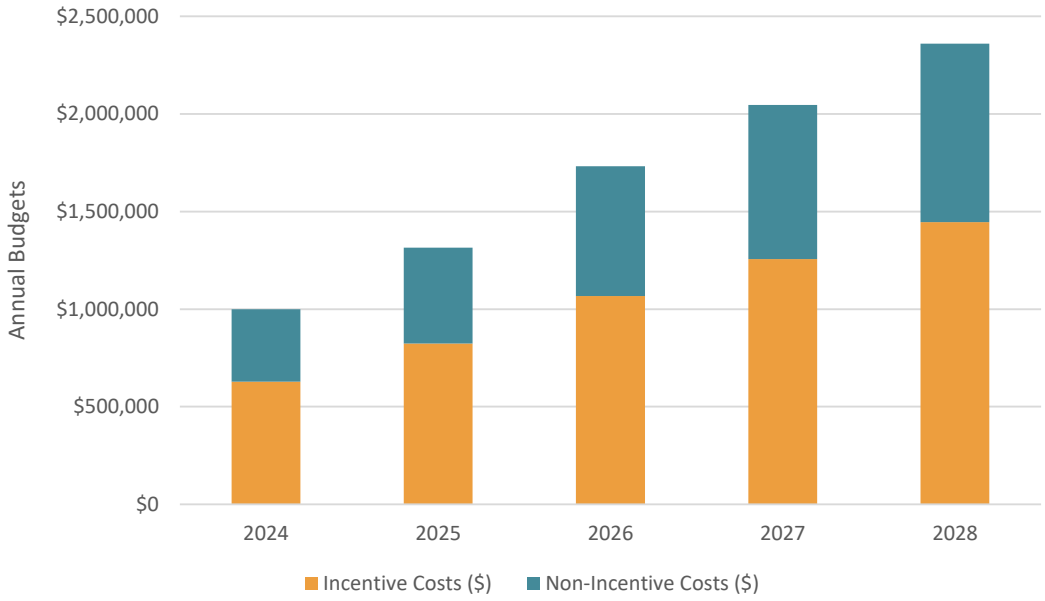
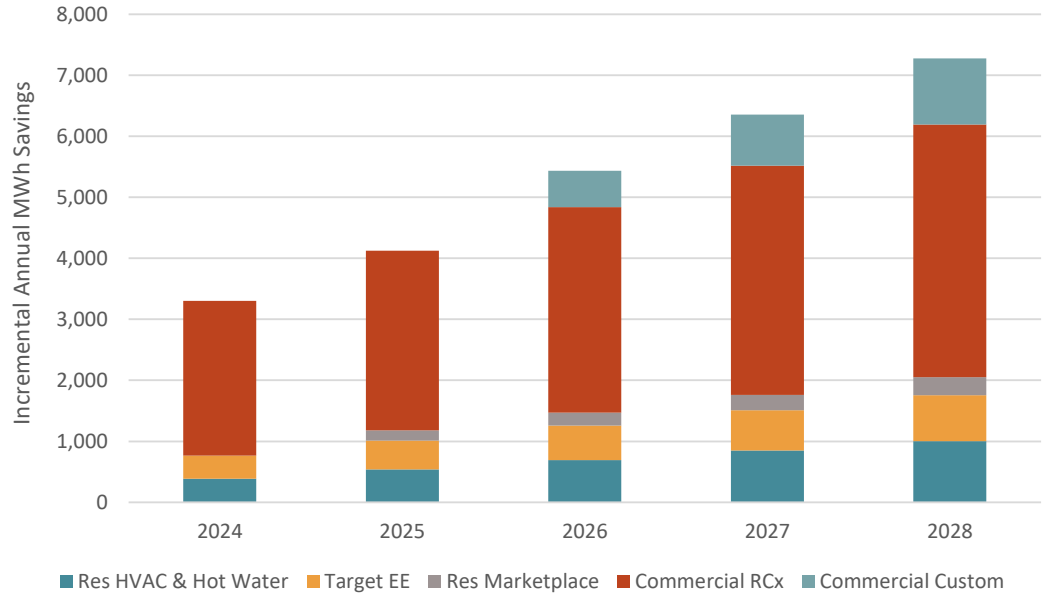


FIGURE 5-2: FIVE-YEAR ENERGY EFFICIENCY PORTFOLIO ENERGY SAVINGS FORECAST



[18] See Appendix E for annual participation data for each program.

Table 5-1 summarizes the forecasted three-year portfolio cost effectiveness outcomes.

TABLE 5-1: THREE YEAR (2024-2026) PORTFOLIO COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$9,883,554
TRC Benefits	$16,799,884
TRC Net Benefits ($)	$6,916,330
TRC Net Benefits (Ratio)	1.70[19]
Utility Cost Test (UCT)	
UCT Costs	$6,271,880
UCT Benefits	$13,529,965
UCT Net Benefits ($)	$7,258,085
UCT Net Benefits (Ratio)	2.16

Where:

- **TRC Costs** = (Admin Costs) + (Incremental and O&M Costs)
- **TRC Benefits** = (Lifetime NPV Avoided Energy Costs) + (Tax Credits)

- **UCT Costs** = (Admin Costs) + (Incentive Payments); also could be considered program budget
- **UCT Benefits** = (Lifetime NPV Avoided Energy Costs)

5.2.2 Targeted Energy Efficiency Program

The Targeted Energy Efficiency program is a program dedicated to low-income Kentucky Power customers which are eligible for Weatherization Assistance Program (WAP)[20] funds. The program promotes energy efficiency improvements in existing homes and provides financial incentives and assessments for implementing eligible energy efficiency measures. The program provides supplemental funding to the WAP for HVAC and other weatherization technologies through local community action agencies. Kentucky Power works with five (5) regional Community Action Programs as the company finds value in supporting the existing local energy-efficiency infrastructure and benefits associated with braiding United States Department of Energy (DOE) Weatherization Assistance Program (WAP) funds distributed through the Kentucky Housing Corporation (KHC)[21].

The Targeted Energy Efficiency program should increase spending in the next few years, seeking to double funding by program year three through the following actions:

- Increase payment amounts for completed energy audits with the intention to increase the number of completed audits and increase the comprehensiveness of energy audits.
- Increase incentives for replaced and upgraded HVAC equipment.

[19] Portfolio TRC cost-effectiveness reduces to 1.37 if tax-credits for residential technologies within the IRA are not considered.
[20] https://www.energy.gov/scep/wap/weatherization-assistance-program

[21] https://www.kyhousing.org/Partners/Developers/Single-Family/Weatherization-Assistance/Pages/default.aspx

It is understood that the Targeted Energy Efficiency program has operated for several years with consistent funding. There should be modest expectation on program growth with additional funds as program operations are not directly within Kentucky Power's influence.

TABLE 5-2: THREE YEAR (2024-2026) TARGETED ENERGY EFFICIENCY COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$2,187,452
TRC Benefits	$1,809,509
TRC Net Benefits ($)	($377,943)
TRC Net Benefits (Ratio)	0.83
Utility Cost Test (UCT)	
UCT Costs	$1,788,239
UCT Benefits	$972,213
UCT Net Benefits ($)	($816,026)
UCT Net Benefits (Ratio)	0.54

Included Measures:

- Air Source Heat Pump – replacement of furnace to SEER 14 heat pump,
- Air Source Heat Pump – efficiency SEER 16,
- Ductless Heat Pump – Energy Star compliant,
- Central Air Conditioner – minimum efficiency SEER 16
- Ductless Air Conditioner – Energy Star compliant,
- Energy and Home Audit reimbursement,
- Heat Pump Water Heater, and
- Incentive support for weatherization funds when not fully covered by WAP funds, including:
    - Attic Insulation
    - Hot Water Pipe Insulation, and
    - Air Sealing

5.2.3 Home Energy Improvement Program (HEIP)

The Home Energy Improvement Program (HEIP) will promote energy efficiency improvements in existing homes and provide financial incentives and assessments for implementing eligible energy efficiency measures. The program provides customers, remodelers, and property owners with individual improvement options for HVAC and weatherization technologies. The program will largely offer incentives through rebates but may consider offering supplemental targeted energy audits. Additional funding towards audits can be considered starting in year 2 or year 3 to support program marketing and awareness and identify further potential savings opportunities. The HEIP will direct customers to the Targeted Energy Efficiency program when eligible customers seek whole-home renovations.

Included Measures:

- Air Source Heat Pump – efficient SEER 16 or greater,
- Ductless Heat Pump – Energy Star compliant,
- Air Conditioning only – efficient SEER 16 or greater,
- Smart Thermostats,

- Heat Pump Water Heater,
- Attic Insulation,
- Duct Insulation, and
- Air Sealing.

Table 5-3 summarizes the forecasted three-year portfolio cost effectiveness outcomes, with the three-year sum of annual incremental net energy savings at 1,618 MWh.

TABLE 5-3: THREE-YEAR (2024-2026) HEIP COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$1,765,704
TRC Benefits	$4,692,105
TRC Net Benefits ($)	$2,926,401
TRC Net Benefits (Ratio)	2.66[22]
Utility Cost Test (UCT)	
UCT Costs	$1,334,223.55
UCT Benefits	$2,384,465
UCT Net Benefits ($)	$1,050,242
UCT Net Benefits (Ratio)	1.79

5.2.4 Marketplace Program

The Marketplace Program is an on-line and easy-to-reach shopping platform for energy efficiency technologies found in customer homes, such as thermostats, smart plugs trips, and potentially small appliances. Kentucky Power anticipates operating this program with AEP and its subsidiary operating companies for a cost-effective program delivery approach. It is anticipated that this program will be introduced in the second year of the portfolio.

Included Measures:

- Smart Thermostats – wifi-enabled,
- Air Purifiers – Energy Star,
- Clothes Washers – Energy Star, and
- Plug Strips – Tier I and II (optional).

Table 5-4 summarizes the forecasted three-year portfolio cost effectiveness outcomes, with the three-year sum of annual incremental net energy savings at 375 MWh.

[22] Portfolio TRC cost-effectiveness reduces to 1.31 if tax-credits for residential technologies within the IRA are not considered.

TABLE 5-4: THREE-YEAR (2024-2026) MARKETPLACE COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$451,340
TRC Benefits	$680,915
TRC Net Benefits ($)	$229,575
TRC Net Benefits (Ratio)	1.51
Utility Cost Test (UCT)	
UCT Costs	$281,745
UCT Benefits	$637,449
UCT Net Benefits ($)	$355,704
UCT Net Benefits (Ratio)	2.26

5.2.5 Commercial Prescriptive Program

Incentives offered through this program serve to reduce the incremental cost to upgrade to high-efficiency lighting equipment and controls over standard efficiency options for new and existing commercial customers. The program includes equipment with easily calculated savings, provides straightforward and easy participation for customers, and allows for reduced EM&V costs. The program should consider multiple participation options with energy audits and higher incentive levels available for small hard-to reach business customers.

Measure parameters may be refined during final program development, including establishing final eligibility criteria and measure-level project caps, if necessary. The incentive amounts for individual measures may be periodically adjusted to reflect current market conditions, changes in equipment costs or program economics, or to encourage participation during certain time periods, while maintaining the overall cost-effectiveness of the program. The structure of the Commercial Prescriptive Program also allows for straightforward expansion to incorporate additional cost-effective measures in the future with minimal design and implementation expenses.

Included Measures:

- LED Interior Fixtures,
- LED Exterior Fixtures,
- LED Linear Lamp Replacement,
- Lighting Controls,
- Smart Thermostats (year 2),
- Air Conditioning (year 2),
- Heat Pumps (year 2), and
- Energy Star Kitchen Equipment (year 3),

Table 5-5 summarizes the forecasted three-year portfolio cost effectiveness outcomes, with the three-year sum of annual incremental net energy savings at 8,851 MWh.

TABLE 5-5: THREE-YEAR (2024-2026) COMMERCIAL PRESCRIPTIVE COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$4,120,004
TRC Benefits	$7,275,235
TRC Net Benefits ($)	$3,155,230
TRC Net Benefits (Ratio)	1.77
Utility Cost Test (UCT)	
UCT Costs	$2,206,626
UCT Benefits	$7,275,235
UCT Net Benefits ($)	$5,068,608
UCT Net Benefits (Ratio)	3.30

5.2.6 Commercial Custom Program

This program provides a platform for comprehensive energy efficiency projects in existing and new facilities that go beyond discrete measures and common, measure-level efficiency practices. The Commercial Custom Program provides incentives for efficiency improvements not included in the Commercial Prescriptive Program. It is anticipated that this program will be introduced in the third year of the portfolio due to additional complexity.

All program incentives should be based on the calculated, verified energy savings achieved for each project. The Commercial Custom Program does not define a specific list of eligible measures and bases participation on verifiable energy savings resulting from measures or system improvements implemented. Due to the complexity and variety of measures that could potentially be included, the Commercial Custom Program requires the applicant to submit calculations using industry-accepted methods for determining energy savings and appropriate baselines. These savings could be derived from capital improvements in equipment or from retro-commissioning (RCx).

Expected End-Uses:

- HVAC,
- Refrigeration, and
- Compressed Air.

Table 5-6 summarizes the forecasted three-year portfolio cost effectiveness outcomes, with the three-year sum of annual incremental net energy savings at 600 MWh assuming a start date in the third year.

TABLE 5-6: THREE-YEAR (2024-2026) NON-RESIDENTIAL CUSTOM COST EFFECTIVENESS SUMMARY

Cost-effectiveness Parameter	Net Present Value (2023)
Total Resource Cost (TRC)	
TRC Costs	$1,359,053
TRC Benefits	$2,342,120
TRC Net Benefits ($)	$983,067
TRC Net Benefits (Ratio)	1.7
Utility Cost Test (UCT)	
UCT Costs	$661,046
UCT Benefits	$2,260,603
UCT Net Benefits ($)	$1,599,557
UCT Net Benefits (Ratio)	3.42

5.2.7 Cross-Cutting Portfolio Items

Finally, within the portfolio plan and considered within the cost-effectiveness outcomes listed above, the following cross-cutting costs should be and are included:

- Industry specific tracking, recording, and reporting information system
- A minimum of 5% for evaluation measurement and verification (EM&V) along with supporting planning activities. Within this portfolio recommendation, it is assumed that evaluation activities would occur within a three-cycle. Given the condition many programs will be new, it would be advisable to commence with process evaluation activities early in the program activity to identify improvement activities. Additionally, it would be advisable to conduct impact evaluation, included net-to-gross research, if appropriate, later in the three-year cycle to allow for program maturation.

5.3 KEY CONSIDERATIONS

The following considerations, developed with Kentucky Power, were instrumental in defining priorities for program and portfolio development and recommendations.

5.3.1 Support Community Action Groups

Kentucky Power does not desire to de-fund or reduce funding to the regional Community Action Groups, as the company finds value in supporting the existing local energy-efficiency infrastructure. These action groups and associated contractors create benefits by braiding U.S. DOE Weatherization Assistance Program (WAP) funds with supporting funds from Kentucky Power. Additionally, Kentucky Power does not desire to create a competing or parallel DSM program that could create market confusion. Consequently, Kentucky Power will first increase funding for Community Action Group efficiency programs.

5.3.2 Expand Offerings for Low- and Moderate-Income Customers

Additionally, it is recognized that additional funding for the Targeted Energy Efficiency program may not fully address the cost-effectiveness opportunity for low and moderate-income customers as program operations are not directly within Kentucky Power's influence. It is a priority to establish an easy-to-participate efficiency program directly supporting customers, remodelers, and property owners with individual improvement(s) options for HVAC and weatherization technologies. It is important for the program offering to address the large share of moderate-income residential customers that are marginally above the economic threshold for Weatherization funds. To reduce the opportunity for competition, the Home Energy Improvement Program (HEIP), should direct customers to the Targeted Energy Efficiency program when eligible customers seek whole-home renovations.

5.3.3 Add Offerings for Commercial Lighting

As noted earlier in this report, the commercial lighting end-use is the largest cost-effective opportunity for energy efficiency within Kentucky Power's service territory. A simple, easy to utilize, and cost-effective program archetype would be important to reach the largest program opportunity. Prescriptive programs have been and remain an important component of many DSM programs in North America with many of them having large shares of commercial lighting measures.

5.3.4 Monitor Inflation Reduction Act

Within the horizon of this study, it is expected that significant additional funding marked for energy efficiency and building electrification technologies for residential and non-residential customers will come through the Inflation Reduction Act[23] ("IRA"). As of the date of this report, many details of the IRA implementation are uncertain and unresolved. Of specific concern is a significant portion of funds are directed toward low-income customers (over $134 million in funds are allocated for low-income residential homes in Kentucky).[24] These funds are expected to be distributed through state energy offices, such as the Kentucky Housing Corporation, with the intention that customers can receive point-of-sale (POS) rebates. POS rebates are convenient for customers, but often introduce complexity for back-end tracking and validation systems. Additionally, all utility sponsored programs with incentives for overlapping technologies and measures will need to decide how to proceed in order to achieve maximum outcomes. In the best-case scenario, the added funds increase benefits for customers, contractors, and Kentucky Power. In worst case conditions, dual sources of incentives (Kentucky Power and IRA POS rebates) could create confusion, high free-ridership, and even fraudulent actions. It is recommended that KPCO monitor market conditions accordingly and adjust when prudent or practicable.

[23] https://www.irs.gov/inflation-reduction-act-of-2022

[24] https://www.energy.gov/articles/biden-harris-administration-announces-state-and-tribe-allocations-home-energy-rebate

6 DISTRIBUTED ENERGY RESOURCES POTENTIAL

As part of the overall potential modeling exercise, the GDS Team considered DERs as sources of behind-the-meter customer-sited solar photovoltaic generation. The DER potential study followed the same method as the energy efficiency potential study in that the DER analysis reviewed the opportunity for technical, economic, and achievable potential. We used the same forecast data as used in the energy efficiency study to assess DER potential. The analysis limited resources for this potential study to technologies that are behind-the-meter and owned by the customer and did not consider market potential for supply-side resources for the period 2024 to 2043.

6.1 APPROACH

The following section discusses the methods used to conduct the solar PV potential analysis. We detail approaches used to assess technical, economic, and achievable potential in the following steps:

- Technical and Economic Potential:
  - **Customer characterization/forecast disaggregation:** Using customer data, assess how many premises of each type and size exist in the Kentucky Power service territory. Using their historical energy usage and square footage, estimate the PV size/rooftop area capacity of each premise. Estimate how many solar PV systems are already installed in the Kentucky Power territory.
  - **Solar PV system modeling (technology):** Determine how much energy rooftop-mounted solar PV systems of different sizes and aspects generate in Kentucky, and at what times. Estimate system costs and benefits over the lifetime of the system.
- Achievable Potential:
  - **Scenarios:** Differentiate technical potential, business as usual, and a range of achievable scenarios according to varying incentive levels.
  - **Adoption rate modeling:** Based on the incentive levels and other attributes of market transformation, use Bass diffusion models to estimate the rate at which Kentucky Power customers would install solar PV systems under each scenario.

6.1.1 Technical Potential

Photovoltaic systems utilize solar panels, a packaged collection of photovoltaic cells, to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter(s), a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted and face south-west, south, and/or, south-east.

The study analyzed the potential associated with roof-mounted systems installed on residential and non-residential sector buildings. For the non-residential sector, the analysis also estimated potential for ground mounted (or covered parking) systems for a few specific business types. The analysis included battery storage as an additional configuration with each solar PV system type; however, due to the uncertainty associated with battery dispatch schedules, potential battery generation is excluded from this analysis. As noted above, this study did not explore the market potential associated with utility-scale solar PV installations.

The approach to estimating technical potential required calculating the total square footage of suitable rooftop area within the Kentucky Power territory and calculating solar PV system generation based on building and regional characteristics. Technical potential is computed using Equation 6-1.

EQUATION 6-1 SOLAR PV TECHNICAL POTENTIAL CALCULATION

$$PV\ Technical\ Potential = \Sigma(Suitable\ Rooftop\ Square\ Footage \times PV\ System\ Generation\ per\ Sq.Ft.)$$

The two key parameters in Equation 6-1 were estimated based on multiple data sources relevant to eastern Kentucky. Methods for defining these parameters are discussed below. The GDS Team estimated total rooftop square footage using the forecast disaggregation analysis to characterize the residential and non-residential building stocks. The building stocks were characterized based on relevant parameters such as number of facilities, average number of floors, average premise consumption, and premise Energy Use Intensity (EUI). The GDS Team used these parameters to estimate the total rooftop square footage.

To estimate the fraction of the total roof area that is suitable for rooftop solar PV, the GDS Team relied on research completed by the Google Sunroof National Renewable Energy Laboratory (NREL). NREL has developed estimates of the portion of total rooftops across the country that are suitable for solar PV based on analysis of LIDAR data. NREL criteria for suitable roof area include:

- **Contiguous rooftop area size:** Rooftops with fewer than 10 square meters of contiguous roof area excluded.
- **Rooftop orientation (tilt and azimuth):** Northeast through northwest orientation and roof pitches greater than 60 degrees excluded.
- **Shading:** Roof areas that had a minimum solar exposure of less than 80% relative to an unshaded roof were excluded.

6.1.1.1 Residential Premises

Each residential customer account was classified into a premise type and size tier based on provided square footage where available and based on the average area for each premise type when square footage was unavailable. Three residential housing were modeled:

- Single Family Home
- Mobile Home
- Multifamily

Single Family houses accounted for 55% of annual energy use in 2022, with Mobile Homes accounting for another 31 percent. Table 6-1 summarizes how many accounts are in each premise type and how their size and energy use compare:

TABLE 6-1 SUMMARY STATISTICS BY RESIDENTIAL PREMISE TYPE

Premise Type	Avg. Annual Energy Use (kWh)	Avg. Premise Size (sq. ft.)	Avg. Rooftop Usable Area (sq. ft.)
Single Family Houses	15,834	1,433	1,447
Mobile Home	14,821	1,001	500
Multifamily	8,582	1,957	1,976
Total	**14,879**	**1,340**	**1,190**

6.1.1.2 Non-Residential Premises

Approximate square footage for each premise was derived by first mapping the SIC code for each account to the corresponding Commercial Buildings Energy Consumption Survey (CBECS) principal building activity. Then premise annual energy usage (kWh) was divided by the per-square-foot annual electricity consumption (energy use intensity, or EUI) estimated for each CBECS building type.

6.1.1.3 Technologies

The second key parameter – PV system generation – was estimated by developing standardized solar PV system configurations. These included system sizes for residential premises ranging from 3 to 25 kW (DC) and 5 to 2,000 kW (DC) for non-residential premises. Additionally, the GDS Team selected battery system sizes for each solar PV system size to dispatch energy for 2-4 hours.

The GDS Team relied on NREL's PVWatts[25] tools to estimate system generation for both residential and non-residential sited systems. These tools model PV power density based on site specific data from NREL's National Solar Renewable Database ("NSRDB") to estimate total solar irradiance in conjunction with PV system specifications. The PV system simulations were generated based on Ashland, Kentucky. The analysis assumptions are summarized in Table 6-2.

TABLE 6-2 KEY ASSUMPTIONS IN SOLAR PV ANALYSIS

Parameter	Assumptions
Residential System Sizes (Nominal DC Capacity)	3 kW, 5 kW, 7.5 kW, 10 kW, 25 kW
Non-Residential System Sizes (Nominal DC Capacity)	5 kW, 10 kW, 15 kW, 20 kW, 25 kW, 50 kW, 100 kW, 250 kW, 500 kW, 1,000 kW, 2,000 kW
System Losses	14.08% (NREL)
Tilt	40° House / 25° Mobile Home / 15° Multi/Non-res
Azimuth	Varies by heading
Capacity Factor (weighted average)	House: 11.2% / Mobile: 20.3% / Multi/Non-res: 12.6%
DC to AC Size Ratio	1.2
Inverter Efficiency	96% (micro-inverter)
Battery Round-Trip Efficiency	85%

For the residential sector, annual PV kWh estimates were developed for rooftops with each system size oriented to each of the four cardinal directions, then measures for each system were weighted by the orientation of actual rooftops in these zip codes. The estimated annual energy output, based on a weighted average of the values is 4,884 kWh for a 5 kW system installed in zip code 41102 (capacity factor = 11.2%). The same measure development process was used for all residential system sizes and premise types.

Five residential system sizes are included, ranging from 3-25 kW. Generation (kWh) for a given system is capacity (kW) multiplied by capacity factor for that system (based on location, aspect, tilt, and other key assumptions), multiplied by 8,760 hours. The smallest residential system modeled is 3 kW, which requires just over 200 sq. ft. of panel area, and the largest 25 kW, which requires about 1,681 sq. ft. of panel area. Each system is modeled with and without battery storage. Storage systems are limited to 5% of eligible premises based on technical feasibility. Mobile Home systems are limited to 3 and 5 kW, mounted at a 25-degree tilt, and do not include battery storage due to technical and space constraints.

Multifamily and non-residential solar PV systems were modeled similarly to residential systems with a few modifications for the typical attributes of these buildings. The 3 - 25 kW systems used in the residential sector

25 PVWatts estimates solar PV energy production and costs. Developed by the National Renewable Energy Laboratory. (NREL) http://pvwatts.nrel.gov/

are supplemented by larger system sizes up to 2 MW. Array tilt is 15 degrees due to mostly flat roofs present on commercial and industrial buildings.

6.1.2 Economic Potential

Economic potential represents the generation possible given full adoption of all cost-effective technologies. For the cost effectiveness analysis of solar PV, the GDS Team used a Total Resource Cost (TRC) hurdle of 1.0 to assess the TRC and relied on the same avoided energy and capacity costs used in the energy efficiency analysis. These avoided costs serve as the benefits while the costs are represented as the installation and O&M costs of the modeled solar technologies.

To estimate economic potential for solar PV, pertinent data on system costs were gathered along with calculated generation benefits to use in the benefit-cost analysis which was conducted at the measure level. The GDS Team relied on multiple data sources to determine the solar PV system costs for varying system sizes and configurations. System component costs are based on data included the NREL Q1 2021 Benchmarking report[26] which provided detailed cost information on modules, inverters (by technology), structural and electrical balance of system, supply chain, permitting-inspection-interconnection, marketing, overhead, and profit. Cost parameters adjusted these from a national level to Kentucky-specific values by using various market data provided by Energy Sage[27]. This analysis produced an estimated installation cost per watt installed which was applied to various system sizes to estimate total installed cost. Additionally, O&M costs were included that scale with system size. Finally, we included the impact of the federal investment tax credit (ITC) which is a base tax credit for commercial and residential systems starting in 2023.

In addition to modeling solar PV system costs, the GDS Team also estimated cost impacts for solar PV systems coupled with battery storage. As these systems are far less prevalent in both residential and commercial systems at the time of reporting, fewer published data on battery costs, balance of system costs, and maintenance were available. Moreover, the battery capacity is also variable based on the service need. Ultimately, multiple data sources were used to assume an overall capital cost per kWh based on a 3- or 4-hour battery for various measure permutations. O&M costs were largely defined by a ten-year amortized battery replacement cost.

TABLE 6-3: ASSUMED SOLAR PV INSTALLATION COST (2023)

Sector	System Cost ($/ DC Watt)
Residential	$2.72
Residential (Battery)	$3.20 - $6.70
Business, roof mounted	$1.72
Business, roof mounted (Battery)	$1.98 - $3.35
Business, ground mounted	$1.72
Business, ground mounted (Battery)	$1.84
Operations & Maintenance	$16/kw/yr
Operations & Maintenance (with battery)	$29/kw/yr

[26] U.S. Solar Photovoltaic System Cost Benchmark: Q1 2021. NREL, November 2021.
[27] Energysage Solar Marketplace Intel Report, H2 2021 – H1 2022.

6.1.3 Customer Adoption

While solar PV systems are not cost-effective according to the TRC test, Kentucky Power customers might install solar PV systems at their homes and businesses anyway. Consequently, a baseline, business-as-usual (BUA) forecast was developed for integration into the IRP modeling along with expected customer adoption for maximum and realistic potential for those system configurations and premise types where technologies could pass a cost-effectiveness threshold of TRC equal to 1.0 or greater.

Adoption rates are estimated using Bass diffusion modeling, whereby a simple differential equation is used to predict how a technology will be adopted in a market over time. Key assumptions include customer payback period, rates of innovation and imitation, along with the total eventual adopters or market size. The Bass diffusion model is provided below.

$$Nt = Nt\text{-}1 + p\,(m\text{-}Nt\text{-}1) + q\,Nt\text{-}1\,/m\,(m\text{-}Nt\text{-}1)$$

Where:

Nt = number of participants in a given year
p = coefficient of innovation
m = number of eventual adopters
q = coefficient of imitation

The parameters are based upon:

- Number of eventual adopters, willingness to participate, and market adoption data collected from Kentucky Power customers during this DSM Market Potential Study
- Coefficients are based upon the NREL dGen model[28] for the state of Kentucky, EIA DGPV interconnection and Census data

The three adoption scenarios for solar PV installations are described below:

- **Business-as-Usual ("BAU")**;
  - Systems are not incentivized beyond the existing income tax credit and continue at a pace similar to the rate of adoption in 2023
  - up to 6% market adoption for the residential sector
  - up to 5% market adoption for the non-residential sector
- **Realistic Achievable Potential**;
  - Adoption rate reflects a 50% incentive
  - up to 19% market adoption for the residential sector, and
  - up to 15% market adoption for the non-residential sector, and
- **Maximum Achievable Potential**;
  - Adoption rate reflects a 100% incentive
  - up to 68% market adoption for the residential sector, and
  - up to 26% market adoption for the non-residential sector, and

6.2 DER POTENTIAL FINDINGS

This section of the report presents the Technical, Economic, Achievable (MAP and RAP) potential for solar PV.

Table 6-4 summarizes the solar PV annual potential estimates for all sectors based on direct-current (DC) capacity while Table 6-5 and Table 6-6 summarize potential for the residential and non-residential sectors,

[28] https://www.nrel.gov/analysis/dgen/

respectively. It is notable that the non-residential sector potential sector is significantly less than residential potential. This difference is largely due to NREL coefficients.

TABLE 6-4 SUMMARY OF SOLAR PV DC CAPACITY MARKET POTENTIAL (ALL SECTORS)

Year	Technical DC Capacity (MW)	Economic (MW)	MAP (MW)	RAP (MW)	BAU (MW)
2027	3.2	-	-	-	1.7
2033	29.1	-	-	-	6.3
2043	475.8	-	-	-	36.4

TABLE 6-5 SUMMARY OF SOLAR PV DC CAPACITY MARKET POTENTIAL (RESIDENTIAL)

Year	Scenario	Single-Family (MW)	Mobile Home (MW)	Multifamily (MW)
2027	Technical	3.0	0.1	0.0
2033	Technical	27.3	0.7	0.4
2043	Technical	447.0	10.8	2.5
2027	BAU	1.6	0.0	0.0
2033	BAU	5.9	0.1	0.0
2043	BAU	34.6	0.8	0.2

TABLE 6-6 SUMMARY OF SOLAR PV DC CAPACITY MARKET POTENTIAL (NON-RESIDENTIAL)

Year	Scenario	Non-Residential (MW)
2027	Technical	0.1
2033	Technical	0.4
2043	Technical	5.9
2027	BAU	0.0
2033	BAU	0.0
2043	BAU	0.1

Table 6-7, Table 6-8, and Table 6-9 summarize solar PV potential above in energy metrics. The 2043 technical market potential for solar PV represents 9.0% of the 2043 energy sales forecast for all sectors. 2043 technical market potential for solar PV in the residential sector represents 27.0% of the 2043 energy sales forecast for the residential sector.

TABLE 6-7 SUMMARY OF SOLAR PV ENERGY MARKET POTENTIAL (ALL SECTORS)

Year	Technical DC Capacity (MWh)	Economic (MWh)	MAP (MWh)	RAP (MWh)	BAU (MWh)
2027	3,173	-	-	-	1,704
2033	28,724	-	-	-	6,179
2043	470,103	-	-	-	35,996

TABLE 6-8 SUMMARY OF SOLAR PV ENERGY MARKET POTENTIAL (RESIDENTIAL)

Year	Scenario	Single-Family (MWh)	Mobile Home (MWh)	Multifamily (MWh)
2027	Technical	2,982	130	44
2033	Technical	27,000	1,175	386
2043	Technical	441,655	19,227	2,757
2027	BAU	1,617	70	15
2033	BAU	5,865	255	53
2043	BAU	34,235	1,490	227

TABLE 6-9 SUMMARY OF SOLAR PV ENERGY MARKET POTENTIAL (NON-RESIDENTIAL)

Year	Scenario	Non-Residential (MWh)
2027	Technical	17,526
2033	Technical	162,771
2043	Technical	6,464,382
2027	BAU	1,235
2033	BAU	4,710
2043	BAU	43,715

Table 6-10 summarizes the cost effectiveness results for each technology and for the TRC cost-effectiveness perspective.

TABLE 6-10 SUMMARY OF SOLAR PV COST-EFFECTIVENESS

Solar PV Technologies	TRC Test Range
Residential Roof-mounted (3 – 25 kW)	0.6
Residential Roof-mounted with Batteries (3 – 20 kW)	0.4 – 0.5
Non-residential Roof mounted (5 – 1,000 kW)	0.8
Non-residential Roof mounted with Batteries (5 – 1,000 kW)	0.5 – 0.7

It is notable that no solar PV technologies pass cost-effectiveness screening under the TRC. This test is the primary cost-effectiveness criteria used to determine whether a utility sponsored program intervention is prudent. Low avoided costs serve as the primary driver behind the cost effectiveness results. At a technology level, the introduction of battery storage reduces cost effectiveness despite potential capacity benefit gains.

APPENDIX A: GLOSSARY AND ACRONYMS

ACEEE American Council for an Energy Efficient Economy

Achievable Potential is the amount of energy that can realistically be saved given various market barriers.

AMI Advanced metering infrastructure

ASHP Air-source heat pump

BAU Business-as-Usual

Biz Business (used for potential modeling shorthand)

CBECS Commercial Buildings Energy Consumption Survey

C&I Commercial & industrial

DER Distributed energy resources

DOE Department of Energy

DSM Demand-side Management

EE Energy efficiency

EIA Energy Information Administration

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

ER Early replacement – describes a measure installed before the existing measure has failed.

HEIP Home Energy Improvement Program

HSPF Heating seasonal performance factor

HVAC Heating, Ventilation and Air Conditioning

kW kilowatt

kWh kilowatt-hour

LI low-income

Maximum Achievable Potential achievable potential with 100% incentive levels

MECS EIA Manufacturing Energy Consumption Survey

MF multifamily home

MH mobile/manufactured home

MO Market opportunity – describes a measure installed when an existing technology has failed (used interchangeably with ROB)

NLI Not-low-income

NTG Net-to-gross ratio

O&M Operation and maintenance

Program Potential a subset of the cost-effective realistic achievable potential

PV Photovoltaic

RCx Retro-commissioning

Realistic Achievable Potential achievable potential with incentive levels that are likely to be offered and optimistic long-term market adoption rates.

Retro retrofit – describes a measure installed to improve the efficiency of the existing technology/condition

ROB Replace-on-burnout – describes a measure installed when an existing technology has failed (used interchangeably with MO)

SEER Seasonal energy efficiency ratio

SF single-family home

SIC Standard Industry Code

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.

TRM Technical Reference Manual

TRC Total Resource Cost ("TRC") Test considers electric energy, capacity, and transmission & distribution (T&D) savings as benefits, and either incremental or full measure cost as the cost.

UCT Utility Cost Test

WAP Weatherization Assistance Program

WTP Willingness-to-Participate

APPENDIX B: SENSITIVITIES

The GDS Team conducted sensitivity analyses on the base achievable scenario to assess the impacts of key input assumptions on the estimates of EE potential. The GDS Team coordinated with Kentucky Power to develop appropriate and reasonable sensitivity cases. The following were ultimately selected for the sensitivity analysis:

Avoided Costs. Avoided costs are the primary benefit in assessing the cost-effectiveness of DSM measures. Higher avoided costs will likely result in additional measures passing the TRC cost-effectiveness screen, leading to greater savings potential, while lower avoided costs will decrease the cost-effectiveness of measures and lead to lower savings potential.

High Sensitivities: Increase avoided energy, generation capacity, and avoided T&D costs by 50%.
Low Sensitivities: Decrease avoided energy, generation capacity, and avoided T&D costs by 50%.
Impacted Sectors: *Residential / Business*

Large Customer Opt-Outs. The base case excludes sales and savings from all industrial customers as they are eligible to opt-out of contributing to Kentucky Power's energy efficiency funds. This sensitivity looks at the range of potential if all industrial customers were eligible to participate in future Kentucky Power C&I energy efficiency programs.

High Sensitivity: Include eligible industrial customers in analysis of future potential.
Low Sensitivity: n/a
Impacted Sectors: *Business Only*

Improved Technology Savings/Costs. This sensitivity was included to assess the impact of improved technology savings and/or reduced technology costs.

High Sensitivity: Assume program participation focuses on higher tier technologies regardless of current market acceptance; assume a 35% decrease in emerging technology/high tier equipment costs and incentives over the study horizon. For all other measures, reduced costs between 5%-20% based on current energy efficiency saturation assumptions. Shifted applicability to highest tier equipment (if cost-effective).
Low Sensitivity: n/a
Impacted Sectors: *Residential / Business*

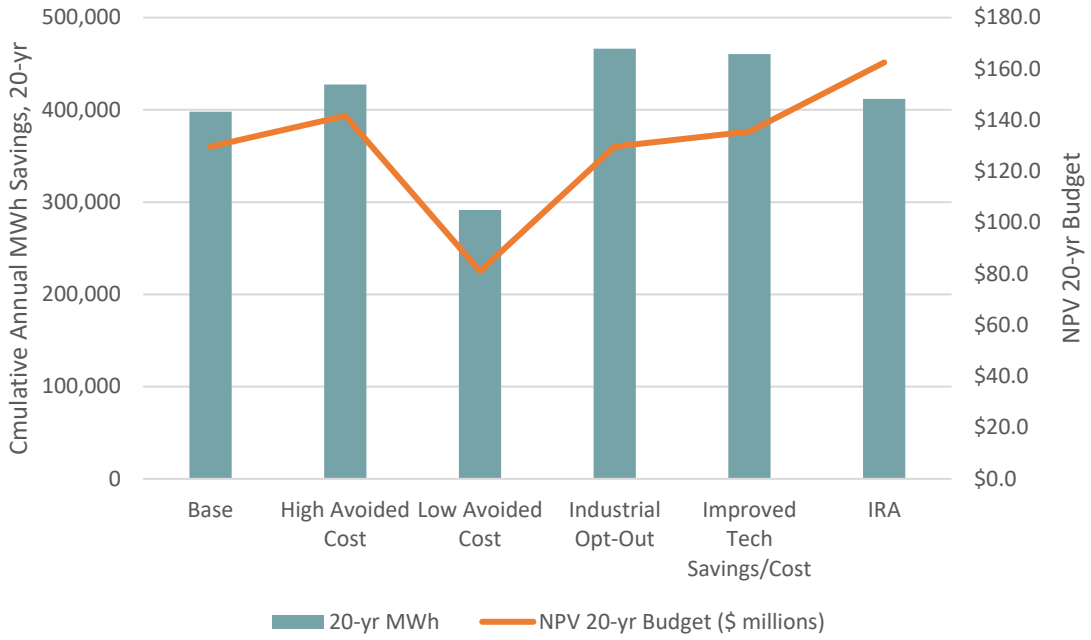
Inflation Reduction Act. This sensitivity was included to assess the impact of an optimistic assumption regarding the widespread availability of tax credits associated with the Inflation Reduction Act.

High Sensitivity: Assume that every measure in the residential sector analysis for which there are relevant credits under the Inflation Reduction Act ("IRA") would receive the maximum amount available under the IRA. This credit acts as a benefit in the TRC Test calculation and allows more measures to pass the cost-effectiveness screening. The result is that additional HVAC, Building Shell and Water Heating measures pass the screening and are included in the potential.
Low Sensitivity: n/a
Impacted Sectors: *Residential*

Figure A-1 provides the results of the sensitivity analysis compared to the base achievable potential scenario identified in the MPS. The blue bars show the 20-year cumulative annual MWh and the orange line provides the corresponding Net Present Value (NPV) of the 20-year budget (in $ millions).

The Low Avoided Cost sensitivity shows a significant drop in costs and savings compared to the Base Case. The high sensitivities are led by the Improved Tech Savings/Cost, followed by the Industrial Opt-Out, High Avoided Cost and Inflation Reduction Act sensitivities. These sensitivities help frame a proxy of the likely range of outcomes in the Realistic Achievable Scenario (Base Case).

FIGURE B-1: SENSITIVITY RESULTS – SAVINGS AND NPV COSTS



APPENDIX C: NON-ENERGY BENEFITS

Non-energy Benefits (NEBs) are benefits that derive from energy efficiency beyond energy and cost savings. NEBs cover a wide range of possible impacts, including:

- Reduced environmental emissions,
- Water savings,
- Increased jobs or job skills,
- Indoor air quality health benefits,
- Increased safety,
- Reduced utility arrearages and shut offs,
- Improved comfort,
- Greater productivity,
- Reduced non-energy operating or maintenance costs,
- Increased energy resiliency.

NEBs may be an integral part of marketing energy efficiency, indicating that these benefits are meaningful to consumers. In other cases, the benefits may be to the utility system, environment, or general economy. Jurisdictions apply NEBs to cost-effectiveness tests, typically via an adder or multiplier to traditional energy and cost savings benefits.

In some cases, jurisdictions may quantify specific NEBs, while in others, a general multiplier is used to address hard-to-quantify NEBs or in cases where quantification research would be expensive. As examples, the State of Iowa uses a general 10 percent multiplier on energy benefits for its cost-effectiveness test, the State of Vermont includes an additional low-income benefits multiplier to capture additional value for low-income program participants, and Massachusetts spends considerable evaluation dollars to quantify specific dollar values for a variety of NEBs (e.g., health and safety NEBs for C&I energy efficiency, based on value per unit of energy savings).

The approach to energy efficiency cost-effectiveness may inform the types of NEBs that are appropriate to utilize. Under the Total Resource Cost (TRC) Test, NEBs considerations can impact a wide range of energy consumer and utility benefits, but do not extend to general societal benefits. The Societal Cost Test (SCT) expands the scope of NEBs to include TRC benefits and benefits that apply to society as a whole. The Utility Cost Test (UCT) would consider NEBs associated with a utility's perspective. The Ratepayer Impact Measure (RIM) and Participant Cost Test (PCT) have narrow focuses, necessitating an inclusion of NEBs associated with their narrow perspectives.

NEB Descriptions

Below, we include brief descriptions of each type of NEB, starting with three quantifiable benefits, followed by others that are not as easily quantifiable.

Reduced Environmental Emissions

Energy efficiency reduces environmental emissions associated with energy consumption. These emissions may include carbon dioxide or emissions that fall under Clean Air Act regulations. NEB quantification could be based on avoiding the negative impacts of these emissions or on alternative compliance cost avoidance. In the Base Case, avoided environmental emissions include 5.6 million tons of CO_2, 7.5 million pounds of SOx, and 7.6 million pounds of NOx, over the lifetime of the measures installed during the study timeframe.

TABLE C-1: AVOIDED ENVIRONMENTAL EMISSIONS BASED ON ACHIEVABLE POTENTIAL SCENARIOS

	Lifetime MWh	*CO2 (tons)*	*SOx (lbs)*	*NOx (lbs)*
MAP	*9,755,158*	*8,011,301*	*10,730,674*	*11,003,819*
RAP	*6,794,313*	*5,579,744*	*7,473,745*	*7,663,985*
Program	*3,051,455*	*2,505,969*	*3,356,601*	*3,442,042*

Water Savings
For energy efficiency measures that save water, program participants may experience reduced water bills. Additionally, the water-energy nexus may allow for quantifying benefits to public water supply or treatment systems. Finally, in regions with water scarcity, water saving NEBs may provide benefits to society as a whole.

Total lifetime gallons of water saved associated with the cost-effective electric energy efficiency measures across the low, medium, and high scenarios ranged from 1.6 billion gallons to 6.1 billion gallons.

Increased Jobs or Job Skills
Implementation of energy efficiency programs creates jobs and job skills. This can be measured by the number of full-time equivalent ("FTE") employees needed to operate these programs. Using an estimated FTE cost of $150,000 in 2024, an annual inflation escalator across the study timeframe, and an assumption that 25% of non-incentive costs go towards education and outreach and other non-labor activities, we calculated an annual average of 2 FTEs in the Program Potential scenario, and an annual average of 24 FTEs and 35 FTEs in the RAP and MAP scenarios, respectively, across the 2024-2026 timeframe.

Indoor Air Quality Health Benefits
Energy efficiency measures that impact indoor air pollutants (e.g., improved ventilation or reduced infiltration, reduced carbon monoxide poisoning) can have a positive impact on participant health. NEBs related to improved health can impact the general quality of life, reduce employment absence, and reduce health care expenditures. Health and safety can also include reduced risks of heat or cold related injury or death.

Increased Safety
Energy efficiency measures can increase the safety of building occupants by avoiding potential injuries. One example is long-lived lighting measures that reduce risks associated with falling due to otherwise more frequent lamp replacement. Another example is avoiding risks associated with aging combustion equipment and fires or other negative health impacts. Additionally, new energy efficient equipment may be built to higher safety standards than older or base-standard equipment.

Reduced Utility Arrearages or Shut-Offs
By reducing energy costs, energy efficiency can make energy more affordable for limited-income households or struggling businesses. By reducing energy costs, utilities and ratepayers can avoid costs associated with arrearage management and shut-offs due to non-payment. The benefits for the program participant are maintaining valuable energy services and avoiding fees associated with arrearages and shut-offs.

Improved Comfort
Energy efficiency interventions can improve building occupant comfort, whether a home or business. While difficult to quantify the impact, home comfort has a linkage to health and general well-being and impacting the habitability and value of a home. Similar impacts to businesses can impact productivity, but generally improve employee morale and retention.

Greater Productivity
For C&I buildings or manufacturing plants, energy efficiency can improve productivity. Better lighting quality and improved comfort have an impact on employee productivity. For a manufacturing plant, energy efficient equipment can impact product quality, throughput, or innovation.

Reduced Non-Energy Operating or Maintenance Costs
The installation of new energy efficient equipment can reduce O&M costs associated with keeping equipment running. For example, an aging HVAC system may require more frequent servicing. An industrial plant may experience lower O&M or downtime.

Increased Energy Resilience
Energy efficiency can improve the resilience of communities faced with socioeconomic or natural disaster risk. Lowering energy demand can help maintain electric grid reliability to avoid or manage disruptions. Buildings may be better able to maintain building shell integrity or maintain occupant services during times of extreme weather.

While many of the above NEBs can be difficult to quantify for energy efficiency programs, some can be quantified. Those that are difficult to quantify can offer substantial value that may require assumptions regarding the relative value. The nature and scale of a NEB can vary from measure type to measure type, which can make direct application difficult. Nevertheless, there are policy options to allow for making assumptions to applying NEB values at a measure or portfolio level, allowing for capturing the value of NEBs in benefit-cost calculations.

APPENDIX D: RESIDENTIAL ENERGY EFFICIENCY DETAIL

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
1001	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	SF	NLI	MO	533	57%	303	0.03	9	$92	100%	40%	PUR-1	12%	92%	0.9	0.9	1.5
1002	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	SF	LI	MO	533	57%	303	0.03	9	$92	100%	100%	PUR-2	12%	92%	0.9	0.9	1.5
1003	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MH	NLI	MO	533	57%	303	0.03	9	$92	100%	40%	PUR-3	12%	92%	0.9	0.9	1.5
1004	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MH	LI	MO	533	57%	303	0.03	9	$92	100%	100%	PUR-4	12%	92%	0.9	0.9	1.5
1005	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MF	NLI	MO	533	57%	303	0.03	9	$92	100%	40%	PUR-5	12%	92%	0.9	0.9	1.5
1006	Appliances	ENERGY STAR Air Purifier	Residential Marketplace	MF	LI	MO	533	57%	303	0.03	9	$92	100%	100%	PUR-6	12%	92%	0.9	0.9	1.5
1007	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	SF	NLI	MO	349	10%	35	0.01	15	$28	100%	40%	REF-1	100%	70%	0.8	0.8	0.8
1008	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	SF	LI	MO	349	10%	35	0.01	15	$28	100%	100%	REF-2	100%	70%	0.8	0.8	0.8
1009	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	MH	NLI	MO	349	10%	35	0.01	15	$28	100%	40%	REF-3	100%	70%	0.8	0.8	0.8
1010	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	MH	LI	MO	349	10%	35	0.01	15	$28	100%	100%	REF-4	100%	70%	0.8	0.8	0.8
1011	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	MF	NLI	MO	349	10%	35	0.01	15	$28	100%	40%	REF-5	100%	58%	0.7	0.7	0.8
1012	Appliances	ENERGY STAR Refrigerator	Residential Marketplace	MF	LI	MO	349	10%	35	0.01	15	$28	100%	100%	REF-6	100%	58%	0.7	0.7	0.8
1013	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	SF	NLI	MO	349	15%	52	0.01	15	$112	100%	40%	REF-1	100%	70%	0.8	0.8	0.3
1014	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	SF	LI	MO	349	15%	52	0.01	15	$112	100%	100%	REF-2	100%	70%	0.8	0.8	0.3
1015	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	MH	NLI	MO	349	15%	52	0.01	15	$112	100%	40%	REF-3	100%	70%	0.8	0.8	0.3
1016	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	MH	LI	MO	349	15%	52	0.01	15	$112	100%	100%	REF-4	100%	70%	0.8	0.8	0.3
1017	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	MF	NLI	MO	349	15%	52	0.01	15	$112	100%	40%	REF-5	100%	58%	0.7	0.7	0.3
1018	Appliances	CEE Tier 2 Refrigerator	Residential Marketplace	MF	LI	MO	349	15%	52	0.01	15	$112	100%	100%	REF-6	100%	58%	0.7	0.7	0.3
1019	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	SF	NLI	MO	349	20%	70	0.01	15	$134	100%	40%	REF-1	100%	70%	0.8	0.8	0.4
1020	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	SF	LI	MO	349	20%	70	0.01	15	$134	100%	100%	REF-2	100%	70%	0.8	0.8	0.4
1021	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	MH	NLI	MO	349	20%	70	0.01	15	$134	100%	40%	REF-3	100%	70%	0.8	0.8	0.4
1022	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	MH	LI	MO	349	20%	70	0.01	15	$134	100%	100%	REF-4	100%	70%	0.8	0.8	0.4
1023	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	MF	NLI	MO	349	20%	70	0.01	15	$134	100%	40%	REF-5	100%	58%	0.7	0.7	0.4
1024	Appliances	CEE Tier 3 Refrigerator	Residential Marketplace	MF	LI	MO	349	20%	70	0.01	15	$134	100%	100%	REF-6	100%	58%	0.7	0.7	0.4
1025	Appliances	Refrigerator Recycling	No program	SF	NLI	Recycle	901	100%	901	0.11	7	$170	100%	40%	RR-1	21%	0%	0.7	0.3	1.9
1026	Appliances	Refrigerator Recycling	No program	SF	LI	Recycle	901	100%	901	0.11	7	$170	100%	100%	RR-2	21%	0%	0.8	0.6	1.9
1027	Appliances	Refrigerator Recycling	No program	MH	NLI	Recycle	901	100%	901	0.11	7	$170	100%	40%	RR-3	21%	0%	0.7	0.3	1.9
1028	Appliances	Refrigerator Recycling	No program	MH	LI	Recycle	901	100%	901	0.11	7	$170	100%	100%	RR-4	21%	0%	0.8	0.6	1.9
1029	Appliances	Refrigerator Recycling	No program	MF	NLI	Recycle	901	100%	901	0.11	7	$170	100%	40%	RR-5	4%	0%	0.6	0.2	1.9
1030	Appliances	Refrigerator Recycling	No program	MF	LI	Recycle	901	100%	901	0.11	7	$170	100%	100%	RR-6	4%	0%	0.7	0.5	1.9
1031	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	SF	NLI	MO	590	24%	140	0.02	14	$87	100%	40%	CW-1	100%	73%	0.8	0.8	1.0
1032	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	SF	LI	MO	590	24%	140	0.02	14	$87	100%	100%	CW-2	100%	73%	0.8	0.8	1.0
1033	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	MH	NLI	MO	590	24%	140	0.02	14	$87	100%	40%	CW-3	100%	73%	0.8	0.8	1.0
1034	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	MH	LI	MO	590	24%	140	0.02	14	$87	100%	100%	CW-4	100%	73%	0.8	0.8	1.0
1035	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	MF	NLI	MO	590	24%	140	0.02	14	$87	100%	40%	CW-5	67%	49%	0.6	0.6	1.0
1036	Appliances	ENERGY STAR Clothes Washer	Residential Marketplace	MF	LI	MO	590	24%	140	0.02	14	$87	100%	100%	CW-6	67%	49%	0.7	0.6	1.0
1037	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	SF	NLI	MO	590	43%	255	0.03	14	$85	100%	40%	CW-1	100%	73%	0.8	0.8	1.9
1038	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	SF	LI	MO	590	43%	255	0.03	14	$85	100%	100%	CW-2	100%	73%	0.8	0.8	1.9
1039	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	MH	NLI	MO	590	43%	255	0.03	14	$85	100%	40%	CW-3	100%	73%	0.8	0.8	1.9
1040	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	MH	LI	MO	590	43%	255	0.03	14	$85	100%	100%	CW-4	100%	73%	0.8	0.8	1.9
1041	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	MF	NLI	MO	590	43%	255	0.03	14	$85	100%	40%	CW-5	67%	49%	0.6	0.6	1.9
1042	Appliances	ENERGY STAR Clothes Washer (CEE Tier 2)	Residential Marketplace	MF	LI	MO	590	43%	255	0.03	14	$85	100%	100%	CW-6	67%	49%	0.7	0.6	1.9
1043	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	SF	NLI	MO	590	47%	276	0.04	14	$99	100%	40%	CW-1	100%	73%	0.8	0.8	1.8
1044	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	SF	LI	MO	590	47%	276	0.04	14	$99	100%	100%	CW-2	100%	73%	0.8	0.8	1.8
1045	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	MH	NLI	MO	590	47%	276	0.04	14	$99	100%	40%	CW-3	100%	73%	0.8	0.8	1.8
1046	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	MH	LI	MO	590	47%	276	0.04	14	$99	100%	100%	CW-4	100%	73%	0.8	0.8	1.8
1047	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	MF	NLI	MO	590	47%	276	0.04	14	$99	100%	40%	CW-5	67%	49%	0.6	0.6	1.8

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
1048	Appliances	ENERGY STAR Clothes Washer (CEE Tier 3)	Residential Marketplace	MF	LI	MO	590	47%	276	0.04	14	$99	100%	100%	CW-6	67%	49%	0.7	0.6	1.8
1049	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	SF	NLI	MO	307	12%	37	0.00	11	$76	100%	40%	DW-1	53%	38%	0.7	0.5	0.2
1050	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	SF	LI	MO	307	12%	37	0.00	11	$76	100%	100%	DW-2	53%	38%	0.8	0.6	0.2
1051	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	MH	NLI	MO	307	12%	37	0.00	11	$76	100%	40%	DW-3	53%	38%	0.7	0.5	0.2
1052	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	MH	LI	MO	307	12%	37	0.00	11	$76	100%	100%	DW-4	53%	38%	0.8	0.6	0.2
1053	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	MF	NLI	MO	307	12%	37	0.00	11	$76	100%	40%	DW-5	31%	18%	0.6	0.3	0.2
1054	Appliances	ENERGY STAR Dishwasher	Residential Marketplace	MF	LI	MO	307	12%	37	0.00	11	$76	100%	100%	DW-6	31%	18%	0.7	0.5	0.2
1055	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	SF	NLI	MO	1,095	12%	134	0.03	10	$10	100%	40%	DEH-1	25%	38%	0.7	0.5	7.1
1056	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	SF	LI	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-2	25%	38%	0.8	0.6	7.1
1057	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	MH	NLI	MO	1,095	12%	134	0.03	10	$10	100%	40%	DEH-3	25%	38%	0.7	0.5	7.1
1058	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	MH	LI	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-4	25%	38%	0.8	0.6	7.1
1059	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	MF	NLI	MO	1,095	12%	134	0.03	10	$10	100%	40%	DEH-5	25%	18%	0.6	0.3	7.2
1060	Appliances	ENERGY STAR Dehumidifier	Residential Marketplace	MF	LI	MO	1,095	12%	134	0.03	10	$10	100%	100%	DEH-6	25%	18%	0.7	0.5	7.2
1061	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	SF	NLI	MO	1,095	25%	188	0.04	10	$75	100%	40%	DEH-1	25%	38%	0.7	0.5	1.3
1062	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	SF	LI	MO	1,095	25%	188	0.04	10	$75	100%	100%	DEH-2	25%	38%	0.8	0.6	1.3
1063	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	MH	NLI	MO	1,095	25%	188	0.04	10	$75	100%	40%	DEH-3	25%	38%	0.7	0.5	1.3
1064	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	MH	LI	MO	1,095	25%	188	0.04	10	$75	100%	100%	DEH-4	25%	38%	0.8	0.6	1.3
1065	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	MF	NLI	MO	1,095	25%	188	0.04	10	$75	100%	40%	DEH-5	25%	18%	0.6	0.3	1.3
1066	Appliances	ENERGY STAR Most Efficient Dehumidifier	Residential Marketplace	MF	LI	MO	1,095	25%	188	0.04	10	$75	100%	100%	DEH-6	25%	18%	0.7	0.5	1.3
1067	Appliances	Dehumidifier Recycling	No program	SF	NLI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	40%	DR-1	6%	0%	0.7	0.3	16.3
1068	Appliances	Dehumidifier Recycling	No program	SF	LI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	100%	DR-2	6%	0%	0.8	0.6	16.3
1069	Appliances	Dehumidifier Recycling	No program	MH	NLI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	40%	DR-3	6%	0%	0.7	0.3	16.3
1070	Appliances	Dehumidifier Recycling	No program	MH	LI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	100%	DR-4	6%	0%	0.8	0.6	16.3
1071	Appliances	Dehumidifier Recycling	No program	MF	NLI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	40%	DR-5	6%	0%	0.6	0.2	16.4
1072	Appliances	Dehumidifier Recycling	No program	MF	LI	Recycle	1,000	100%	1,000	0.00	7	$20	100%	100%	DR-6	6%	0%	0.7	0.5	16.4
1073	Appliances	ENERGY STAR Freezer	Residential Marketplace	SF	NLI	MO	311	10%	31	0.01	21	$5	100%	40%	FREEZER-1	59%	28%	0.7	0.4	5.5
1074	Appliances	ENERGY STAR Freezer	Residential Marketplace	SF	LI	MO	311	10%	31	0.01	21	$5	100%	100%	FREEZER-2	59%	28%	0.8	0.6	5.5
1075	Appliances	ENERGY STAR Freezer	Residential Marketplace	MH	NLI	MO	311	10%	31	0.01	21	$5	100%	40%	FREEZER-3	59%	28%	0.7	0.4	5.5
1076	Appliances	ENERGY STAR Freezer	Residential Marketplace	MH	LI	MO	311	10%	31	0.01	21	$5	100%	100%	FREEZER-4	59%	28%	0.8	0.6	5.5
1077	Appliances	ENERGY STAR Freezer	Residential Marketplace	MF	NLI	MO	311	10%	31	0.01	21	$5	100%	40%	FREEZER-5	27%	22%	0.6	0.4	5.5
1078	Appliances	ENERGY STAR Freezer	Residential Marketplace	MF	LI	MO	311	10%	31	0.01	21	$5	100%	100%	FREEZER-6	27%	22%	0.7	0.5	5.5
1079	Appliances	Freezer Recycling	No program	SF	NLI	Recycle	722	100%	722	0.09	8	$170	100%	40%	FR-1	10%	0%	0.7	0.3	1.7
1080	Appliances	Freezer Recycling	No program	SF	LI	Recycle	722	100%	722	0.09	8	$170	100%	100%	FR-2	10%	0%	0.8	0.6	1.7
1081	Appliances	Freezer Recycling	No program	MH	NLI	Recycle	722	100%	722	0.09	8	$170	100%	40%	FR-3	10%	0%	0.7	0.3	1.7
1082	Appliances	Freezer Recycling	No program	MH	LI	Recycle	722	100%	722	0.09	8	$170	100%	100%	FR-4	10%	0%	0.8	0.6	1.7
1083	Appliances	Freezer Recycling	No program	MF	NLI	Recycle	722	100%	722	0.09	8	$170	100%	40%	FR-5	10%	0%	0.6	0.2	1.7
1084	Appliances	Freezer Recycling	No program	MF	LI	Recycle	722	100%	722	0.09	8	$170	100%	100%	FR-6	10%	0%	0.7	0.5	1.7
1085	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	SF	NLI	MO	769	21%	160	0.02	11	$152	100%	40%	DRYER-1	99%	64%	0.7	0.7	0.6
1086	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	SF	LI	MO	769	21%	160	0.02	11	$152	100%	100%	DRYER-2	99%	64%	0.8	0.7	0.6
1087	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	MH	NLI	MO	769	21%	160	0.02	11	$152	100%	40%	DRYER-3	99%	64%	0.7	0.7	0.6
1088	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	MH	LI	MO	769	21%	160	0.02	11	$152	100%	100%	DRYER-4	99%	64%	0.8	0.7	0.6
1089	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	MF	NLI	MO	769	21%	160	0.02	11	$152	100%	40%	DRYER-5	64%	49%	0.6	0.6	0.6
1090	Appliances	ENERGY STAR Clothes Dryer	Residential Marketplace	MF	LI	MO	769	21%	160	0.02	11	$152	100%	100%	DRYER-6	64%	49%	0.7	0.6	0.6
1091	Appliances	Heat Pump Dryer	Residential Marketplace	SF	NLI	MO	769	49%	378	0.14	11	$405	100%	40%	DRYER-1	99%	64%	0.7	0.7	0.6
1092	Appliances	Heat Pump Dryer	Residential Marketplace	SF	LI	MO	769	49%	378	0.14	11	$405	100%	100%	DRYER-2	99%	64%	0.8	0.7	0.6
1093	Appliances	Heat Pump Dryer	Residential Marketplace	MH	NLI	MO	769	49%	378	0.14	11	$405	100%	40%	DRYER-3	99%	64%	0.7	0.7	0.6
1094	Appliances	Heat Pump Dryer	Residential Marketplace	MH	LI	MO	769	49%	378	0.14	11	$405	100%	100%	DRYER-4	99%	64%	0.8	0.7	0.6
1095	Appliances	Heat Pump Dryer	Residential Marketplace	MF	NLI	MO	769	49%	378	0.14	11	$405	100%	40%	DRYER-5	64%	49%	0.6	0.6	0.6
1096	Appliances	Heat Pump Dryer	Residential Marketplace	MF	LI	MO	769	49%	378	0.14	11	$405	100%	100%	DRYER-6	64%	49%	0.7	0.6	0.6

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
2001	Behavioral	Home Energy Reports	Home Energy Reports	SF	NLI	MO	14,827	1%	148	0.02	1	$0	100%	40%	HER-1	100%	0%	0.9	0.7	1.0
2002	Behavioral	Home Energy Reports	Home Energy Reports	SF	LI	MO	14,827	1%	148	0.02	1	$0	100%	100%	HER-2	100%	0%	0.9	0.7	1.0
2003	Behavioral	Home Energy Reports	Home Energy Reports	MH	NLI	MO	14,827	1%	148	0.02	1	$0	100%	40%	HER-3	100%	0%	0.9	0.7	1.0
2004	Behavioral	Home Energy Reports	Home Energy Reports	MH	LI	MO	14,827	1%	148	0.02	1	$0	100%	100%	HER-4	100%	0%	0.9	0.7	1.0
2005	Behavioral	Home Energy Reports	Home Energy Reports	MF	NLI	MO	14,827	1%	148	0.02	1	$0	100%	40%	HER-5	100%	0%	0.9	0.7	1.0
2006	Behavioral	Home Energy Reports	Home Energy Reports	MF	LI	MO	14,827	1%	148	0.02	1	$0	100%	100%	HER-6	100%	0%	0.9	0.7	1.0
2007	Behavioral	Home Energy Management System	No program	SF	NLI	MO	14,827	3%	476	0.05	5	$90	100%	40%	HEMS-1	100%	0%	0.9	0.7	1.4
2008	Behavioral	Home Energy Management System	No program	SF	LI	MO	14,827	3%	476	0.05	5	$90	100%	100%	HEMS-2	100%	0%	0.9	0.7	1.4
2009	Behavioral	Home Energy Management System	No program	MH	NLI	MO	14,827	3%	476	0.05	5	$90	100%	40%	HEMS-3	100%	0%	0.9	0.7	1.4
2010	Behavioral	Home Energy Management System	No program	MH	LI	MO	14,827	3%	476	0.05	5	$90	100%	100%	HEMS-4	100%	0%	0.9	0.7	1.4
2011	Behavioral	Home Energy Management System	No program	MF	NLI	MO	14,827	3%	476	0.05	5	$90	100%	40%	HEMS-5	100%	0%	0.9	0.7	1.4
2012	Behavioral	Home Energy Management System	No program	MF	LI	MO	14,827	3%	476	0.05	5	$90	100%	100%	HEMS-6	100%	0%	0.9	0.7	1.4
2013	Behavioral	AMI Data Portal	No program	SF	NLI	MO	14,827	1%	148	0.03	1	$0	100%	40%	AMI-1	100%	0%	0.9	0.7	1.0
2014	Behavioral	AMI Data Portal	No program	SF	LI	MO	14,827	2%	148	0.03	1	$0	100%	100%	AMI-2	100%	0%	0.9	0.7	1.0
2015	Behavioral	AMI Data Portal	No program	MH	NLI	MO	14,827	2%	148	0.03	1	$0	100%	40%	AMI-3	100%	0%	0.9	0.7	1.0
2016	Behavioral	AMI Data Portal	No program	MH	LI	MO	14,827	2%	148	0.03	1	$0	100%	100%	AMI-4	100%	0%	0.9	0.7	1.0
2017	Behavioral	AMI Data Portal	No program	MF	NLI	MO	14,827	2%	148	0.03	1	$0	100%	40%	AMI-5	100%	0%	0.9	0.7	1.0
2018	Behavioral	AMI Data Portal	No program	MF	LI	MO	14,827	2%	148	0.03	1	$0	100%	100%	AMI-6	100%	0%	0.9	0.7	1.0
3001	HVAC Equipment	ASHP Tune Up	No program	SF	NLI	Retrofit	5,508	5%	289	0.14	3	$225	100%	40%	HP TUNE-1	49%	49%	0.7	0.6	0.3
3002	HVAC Equipment	ASHP Tune Up	Low Income	SF	LI	Retrofit	5,508	5%	474	0.50	3	$225	100%	100%	HP TUNE-2	49%	49%	0.8	0.6	0.5
3003	HVAC Equipment	ASHP Tune Up	No program	MH	NLI	Retrofit	5,508	5%	474	0.50	3	$225	100%	40%	HP TUNE-3	49%	49%	0.7	0.6	0.5
3004	HVAC Equipment	ASHP Tune Up	Low Income	MH	LI	Retrofit	5,508	5%	474	0.50	3	$225	100%	100%	HP TUNE-4	49%	49%	0.7	0.6	0.5
3005	HVAC Equipment	ASHP Tune Up	No program	MF	NLI	Retrofit	2,018	5%	289	0.14	3	$225	100%	40%	HP TUNE-5	36%	49%	0.6	0.6	0.3
3006	HVAC Equipment	ASHP Tune Up	Low Income	MF	LI	Retrofit	2,018	5%	289	0.14	3	$225	100%	100%	HP TUNE-6	36%	49%	0.6	0.6	0.3
3007	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	12%	639	0.28	16	$438	100%	40%	HP-1	49%	56%	0.7	0.6	1.2
3008	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	12%	639	0.28	16	$438	100%	100%	HP-2	49%	56%	0.8	0.6	1.2
3009	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	12%	639	0.28	16	$438	100%	40%	HP-3	49%	56%	0.7	0.6	1.2
3010	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	12%	639	0.28	16	$438	100%	100%	HP-4	49%	56%	0.7	0.6	1.2
3011	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	19%	389	0.20	16	$438	100%	40%	HP-5	36%	56%	0.7	0.6	0.8
3012	HVAC Equipment	Air Source Heat Pump 16 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	19%	389	0.20	16	$438	100%	100%	HP-6	36%	56%	0.7	0.6	0.8
3013	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	15%	827	0.41	16	$724	100%	40%	HP-1	49%	56%	0.7	0.6	1.0
3014	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	15%	827	0.41	16	$724	100%	100%	HP-2	49%	56%	0.8	0.6	1.0
3015	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	15%	827	0.41	16	$724	100%	40%	HP-3	49%	56%	0.7	0.6	1.0
3016	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	15%	827	0.41	16	$724	100%	100%	HP-4	49%	56%	0.7	0.6	1.0
3017	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	31%	633	0.27	16	$724	100%	40%	HP-5	36%	56%	0.7	0.6	0.7
3018	HVAC Equipment	Air Source Heat Pump 17 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	31%	633	0.27	16	$724	100%	100%	HP-6	36%	56%	0.7	0.6	0.7
3019	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	22%	1,200	0.49	16	$963	100%	40%	HP-1	49%	56%	0.7	0.6	1.0
3020	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	22%	1,200	0.49	16	$963	100%	100%	HP-2	49%	56%	0.8	0.6	1.0
3021	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	22%	1,200	0.49	16	$963	100%	40%	HP-3	49%	56%	0.7	0.6	1.0
3022	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	22%	1,200	0.49	16	$963	100%	100%	HP-4	49%	56%	0.7	0.6	1.0

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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	TRC Score
3023	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	34%	677	0.34	16	$963	100%	40%	HP-5	36%	56%	0.7	0.6	0.6
3024	HVAC Equipment	Air Source Heat Pump 18 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	34%	677	0.34	16	$963	100%	100%	HP-6	36%	56%	0.7	0.6	0.6
3025	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	23%	1,268	0.66	16	$1,204	100%	40%	HP-1	49%	56%	0.7	0.6	0.9
3026	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	23%	1,268	0.66	16	$1,204	100%	100%	HP-2	49%	56%	0.8	0.6	0.9
3027	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	23%	1,268	0.66	16	$1,204	100%	40%	HP-3	49%	56%	0.7	0.6	0.9
3028	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	23%	1,268	0.66	16	$1,204	100%	100%	HP-4	49%	56%	0.7	0.6	0.9
3029	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	36%	717	0.40	16	$1,204	100%	40%	HP-5	36%	56%	0.7	0.6	0.5
3030	HVAC Equipment	Air Source Heat Pump 19 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	36%	717	0.40	16	$1,204	100%	100%	HP-6	36%	56%	0.7	0.6	0.5
3031	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	24%	1,344	0.68	16	$1,444	100%	40%	HP-1	49%	56%	0.7	0.6	0.8
3032	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	24%	1,344	0.68	16	$1,444	100%	100%	HP-2	49%	56%	0.8	0.6	0.8
3033	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	24%	1,344	0.68	16	$1,444	100%	40%	HP-3	49%	56%	0.7	0.6	0.8
3034	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	24%	1,344	0.68	16	$1,444	100%	100%	HP-4	49%	56%	0.7	0.6	0.8
3035	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	37%	752	0.45	16	$1,444	100%	40%	HP-5	36%	56%	0.7	0.6	0.5
3036	HVAC Equipment	Air Source Heat Pump 20 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	37%	752	0.45	16	$1,444	100%	100%	HP-6	36%	56%	0.7	0.6	0.5
3037	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	34%	1,869	0.88	16	$1,690	100%	40%	HP-1	49%	56%	0.7	0.6	0.9
3038	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	34%	1,869	0.88	16	$1,690	100%	100%	HP-2	49%	56%	0.8	0.6	0.9
3039	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	34%	1,869	0.88	16	$1,690	100%	40%	HP-3	49%	56%	0.7	0.6	0.9
3040	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	34%	1,869	0.88	16	$1,690	100%	100%	HP-4	49%	56%	0.7	0.6	0.9
3041	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	39%	784	0.50	16	$1,690	100%	40%	HP-5	36%	56%	0.7	0.6	0.4
3042	HVAC Equipment	Air Source Heat Pump 21 SEER - Heat pump baseline	Low Income	MF	LI	MO	2,018	39%	784	0.50	16	$1,690	100%	100%	HP-6	36%	56%	0.7	0.6	0.4
3043	HVAC Equipment	Ground Source Heat Pump 20 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	16%	896	0.53	25	$11,871	100%	40%	HP-1	49%	56%	0.7	0.6	0.1
3044	HVAC Equipment	Ground Source Heat Pump 20 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	16%	896	0.53	25	$11,871	100%	100%	HP-2	49%	56%	0.8	0.6	0.1
3045	HVAC Equipment	Ground Source Heat Pump 20 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	16%	896	0.53	25	$11,871	100%	40%	HP-3	49%	56%	0.7	0.6	0.1
3046	HVAC Equipment	Ground Source Heat Pump 20 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	16%	896	0.53	25	$11,871	100%	100%	HP-4	49%	56%	0.7	0.6	0.1
3047	HVAC Equipment	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	23%	1,286	0.64	25	$11,871	100%	40%	HP-1	49%	56%	0.7	0.6	0.1
3048	HVAC Equipment	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	23%	1,286	0.64	25	$11,871	100%	100%	HP-2	49%	56%	0.8	0.6	0.1
3049	HVAC Equipment	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	23%	1,286	0.64	25	$11,871	100%	40%	HP-3	49%	56%	0.7	0.6	0.1
3050	HVAC Equipment	Ground Source Heat Pump 21.5 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	23%	1,286	0.64	25	$11,871	100%	100%	HP-4	49%	56%	0.7	0.6	0.1
3051	HVAC Equipment	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	30%	1,640	0.76	25	$11,871	100%	40%	HP-1	49%	56%	0.7	0.6	0.2
3052	HVAC Equipment	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	30%	1,640	0.76	25	$11,871	100%	100%	HP-2	49%	56%	0.8	0.6	0.2
3053	HVAC Equipment	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	30%	1,640	0.76	25	$11,871	100%	40%	HP-3	49%	56%	0.7	0.6	0.2
3054	HVAC Equipment	Ground Source Heat Pump 23.5 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	30%	1,640	0.76	25	$11,871	100%	100%	HP-4	49%	56%	0.7	0.6	0.2

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
3055	HVAC Equipment	Ground Source Heat Pump 29 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	38%	2,068	1.02	25	$11,871	100%	40%	HP-1	49%	56%	0.7	0.6	0.2
3056	HVAC Equipment	Ground Source Heat Pump 29 SEER - Heat pump baseline	Low Income	SF	LI	MO	5,508	38%	2,068	1.02	25	$11,871	100%	100%	HP-2	49%	56%	0.8	0.6	0.2
3057	HVAC Equipment	Ground Source Heat Pump 29 SEER - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	38%	2,068	1.02	25	$11,871	100%	40%	HP-3	49%	56%	0.7	0.6	0.2
3058	HVAC Equipment	Ground Source Heat Pump 29 SEER - Heat pump baseline	Low Income	MH	LI	MO	5,508	38%	2,068	1.02	25	$11,871	100%	100%	HP-4	49%	56%	0.7	0.6	0.2
3059	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	9%	485	0.25	15	$267	100%	40%	HP-1	49%	56%	0.7	0.6	1.5
3060	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Low Income	SF	LI	MO	5,508	9%	485	0.25	15	$267	100%	100%	HP-2	49%	56%	0.8	0.6	1.5
3061	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	9%	485	0.25	15	$267	100%	40%	HP-3	49%	56%	0.7	0.6	1.5
3062	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Low Income	MH	LI	MO	5,508	9%	485	0.25	15	$267	100%	100%	HP-4	49%	56%	0.7	0.6	1.5
3063	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	9%	187	0.17	15	$267	100%	40%	HP-5	36%	56%	0.7	0.6	0.7
3064	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Heat pump baseline	Low Income	MF	LI	MO	2,018	9%	187	0.17	15	$267	100%	100%	HP-6	36%	56%	0.7	0.6	0.7
3065	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	12%	653	0.44	15	$267	100%	40%	HP-1	49%	56%	0.7	0.6	2.2
3066	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Low Income	SF	LI	MO	5,508	12%	653	0.44	15	$267	100%	100%	HP-2	49%	56%	0.8	0.6	2.2
3067	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	12%	653	0.44	15	$267	100%	40%	HP-3	49%	56%	0.7	0.6	2.2
3068	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Low Income	MH	LI	MO	5,508	12%	653	0.44	15	$267	100%	100%	HP-4	49%	56%	0.7	0.6	2.2
3069	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	13%	269	0.30	15	$267	100%	40%	HP-5	36%	56%	0.7	0.6	1.0
3070	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Heat pump baseline	Low Income	MF	LI	MO	2,018	13%	269	0.30	15	$267	100%	100%	HP-6	36%	56%	0.7	0.6	1.0
3071	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	17%	960	0.60	15	$533	100%	40%	HP-1	49%	56%	0.7	0.6	1.6
3072	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Low Income	SF	LI	MO	5,508	17%	960	0.60	15	$533	100%	100%	HP-2	49%	56%	0.8	0.6	1.6
3073	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	17%	960	0.60	15	$533	100%	40%	HP-3	49%	56%	0.7	0.6	1.6
3074	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Low Income	MH	LI	MO	5,508	17%	960	0.60	15	$533	100%	100%	HP-4	49%	56%	0.7	0.6	1.6
3075	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	19%	388	0.40	15	$533	100%	40%	HP-5	36%	56%	0.7	0.6	0.7
3076	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Heat pump baseline	Low Income	MF	LI	MO	2,018	19%	388	0.40	15	$533	100%	100%	HP-6	36%	56%	0.7	0.6	0.7
3077	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	5,508	19%	1,072	0.73	15	$820	100%	40%	HP-1	49%	56%	0.7	0.6	1.2
3078	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Low Income	SF	LI	MO	5,508	19%	1,072	0.73	15	$820	100%	100%	HP-2	49%	56%	0.8	0.6	1.2
3079	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	5,508	19%	1,072	0.73	15	$820	100%	40%	HP-3	49%	56%	0.7	0.6	1.2
3080	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Low Income	MH	LI	MO	5,508	19%	1,072	0.73	15	$820	100%	100%	HP-4	49%	56%	0.7	0.6	1.2
3081	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	2,018	22%	443	0.49	15	$820	100%	40%	HP-5	36%	56%	0.7	0.6	0.6
3082	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Heat pump baseline	Low Income	MF	LI	MO	2,018	22%	443	0.49	15	$820	100%	100%	HP-6	36%	56%	0.7	0.6	0.6
3083	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	59%	6,431	0.28	16	$438	100%	40%	HP-7	20%	56%	0.7	0.6	10.2
3084	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	59%	6,431	0.28	16	$438	100%	100%	HP-8	20%	56%	0.8	0.6	10.2
3085	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	59%	6,431	0.28	16	$438	100%	40%	HP-9	20%	56%	0.7	0.6	10.2
3086	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	59%	6,431	0.28	16	$438	100%	100%	HP-10	20%	56%	0.7	0.6	10.2

Appendix D: 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	TRC Score
3087	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	59%	1,959	0.09	16	$438	100%	40%	HP-11	36%	56%	0.7	0.6	3.1
3088	HVAC Equipment	Air Source Heat Pump 16 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	59%	1,959	0.09	16	$438	100%	100%	HP-12	36%	56%	0.7	0.6	3.1
3089	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	61%	6,574	0.41	16	$724	100%	40%	HP-7	20%	56%	0.7	0.6	6.4
3090	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	61%	6,574	0.41	16	$724	100%	100%	HP-8	20%	56%	0.8	0.6	6.4
3091	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	61%	6,574	0.41	16	$724	100%	40%	HP-9	20%	56%	0.7	0.6	6.4
3092	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	61%	6,574	0.41	16	$724	100%	100%	HP-10	20%	56%	0.7	0.6	6.4
3093	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	61%	2,002	0.13	16	$724	100%	40%	HP-11	36%	56%	0.7	0.6	1.9
3094	HVAC Equipment	Air Source Heat Pump 17 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	61%	2,002	0.13	16	$724	100%	100%	HP-12	36%	56%	0.7	0.6	1.9
3095	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	67%	7,275	0.49	16	$963	100%	40%	HP-7	20%	56%	0.7	0.6	5.3
3096	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	67%	7,275	0.49	16	$963	100%	100%	HP-8	20%	56%	0.8	0.6	5.3
3097	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	67%	7,275	0.49	16	$963	100%	40%	HP-9	20%	56%	0.7	0.6	5.3
3098	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	67%	7,275	0.49	16	$963	100%	100%	HP-10	20%	56%	0.7	0.6	5.3
3099	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	67%	2,216	0.15	16	$963	100%	40%	HP-11	36%	56%	0.7	0.6	1.6
3100	HVAC Equipment	Air Source Heat Pump 18 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	67%	2,216	0.15	16	$963	100%	100%	HP-12	36%	56%	0.7	0.6	1.6
3101	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	65%	7,085	0.66	16	$1,204	100%	40%	HP-7	20%	56%	0.7	0.6	4.2
3102	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	65%	7,085	0.66	16	$1,204	100%	100%	HP-8	20%	56%	0.8	0.6	4.2
3103	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	65%	7,085	0.66	16	$1,204	100%	40%	HP-9	20%	56%	0.7	0.6	4.2
3104	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	65%	7,085	0.66	16	$1,204	100%	100%	HP-10	20%	56%	0.7	0.6	4.2
3105	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	65%	2,158	0.20	16	$1,204	100%	40%	HP-11	36%	56%	0.7	0.6	1.3
3106	HVAC Equipment	Air Source Heat Pump 19 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	65%	2,158	0.20	16	$1,204	100%	100%	HP-12	36%	56%	0.7	0.6	1.3
3107	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	64%	6,954	0.68	16	$1,444	100%	40%	HP-7	20%	56%	0.7	0.6	3.4
3108	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	64%	6,954	0.68	16	$1,444	100%	100%	HP-8	20%	56%	0.8	0.6	3.4
3109	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	64%	6,954	0.68	16	$1,444	100%	40%	HP-9	20%	56%	0.7	0.6	3.4
3110	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	64%	6,954	0.68	16	$1,444	100%	100%	HP-10	20%	56%	0.7	0.6	3.4
3111	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	64%	2,118	0.21	16	$1,444	100%	40%	HP-11	36%	56%	0.7	0.6	1.0
3112	HVAC Equipment	Air Source Heat Pump 20 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	64%	2,118	0.21	16	$1,444	100%	100%	HP-12	36%	56%	0.7	0.6	1.0
3113	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	79%	8,604	0.88	16	$1,690	100%	40%	HP-7	20%	56%	0.7	0.6	3.6
3114	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	Low Income	SF	LI	MO	10,861	79%	8,604	0.88	16	$1,690	100%	100%	HP-8	20%	56%	0.8	0.6	3.6
3115	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	79%	8,604	0.88	16	$1,690	100%	40%	HP-9	20%	56%	0.7	0.6	3.6
3116	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	Low Income	MH	LI	MO	10,861	79%	8,604	0.88	16	$1,690	100%	100%	HP-10	20%	56%	0.7	0.6	3.6
3117	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	79%	2,621	0.27	16	$1,690	100%	40%	HP-11	36%	56%	0.7	0.6	1.1
3118	HVAC Equipment	Air Source Heat Pump 21 SEER - Furnace baseline	Low Income	MF	LI	MO	3,308	79%	2,621	0.27	16	$1,690	100%	100%	HP-12	36%	56%	0.7	0.6	1.1

Appendix D: 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	TRC Score
3119	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	56%	6,058	0.40	15	$1,004	100%	40%	HP-7	20%	56%	0.7	0.6	4.0
3120	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	Low Income	SF	LI	MO	10,861	56%	6,058	0.40	15	$1,004	100%	100%	HP-8	20%	56%	0.8	0.6	4.0
3121	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	56%	6,058	0.40	15	$1,004	100%	40%	HP-9	20%	56%	0.7	0.6	4.0
3122	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	Low Income	MH	LI	MO	10,861	56%	6,058	0.40	15	$1,004	100%	100%	HP-10	20%	56%	0.7	0.6	4.0
3123	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	52%	1,732	0.27	15	$1,004	100%	40%	HP-11	36%	56%	0.7	0.6	1.2
3124	HVAC Equipment	Ductless Heat Pump 17 SEER 9.5 HSPF - Electric resistance baseline	Low Income	MF	LI	MO	3,308	52%	1,732	0.27	15	$1,004	100%	100%	HP-12	36%	56%	0.7	0.6	1.2
3125	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	57%	6,226	0.60	15	$1,004	100%	40%	HP-7	20%	56%	0.7	0.6	4.2
3126	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	Low Income	SF	LI	MO	10,861	57%	6,226	0.60	15	$1,004	100%	100%	HP-8	20%	56%	0.8	0.6	4.2
3127	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	57%	6,226	0.60	15	$1,004	100%	40%	HP-9	20%	56%	0.7	0.6	4.2
3128	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	Low Income	MH	LI	MO	10,861	57%	6,226	0.60	15	$1,004	100%	100%	HP-10	20%	56%	0.7	0.6	4.2
3129	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	55%	1,805	0.40	15	$1,004	100%	40%	HP-11	36%	56%	0.7	0.6	1.3
3130	HVAC Equipment	Ductless Heat Pump 19 SEER 9.5 HSPF - Electric resistance baseline	Low Income	MF	LI	MO	3,308	55%	1,805	0.40	15	$1,004	100%	100%	HP-12	36%	56%	0.7	0.6	1.3
3131	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	60%	6,523	0.75	15	$1,070	100%	40%	HP-7	20%	56%	0.7	0.6	4.2
3132	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	Low Income	SF	LI	MO	10,861	60%	6,523	0.75	15	$1,070	100%	100%	HP-8	20%	56%	0.8	0.6	4.2
3133	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	60%	6,523	0.75	15	$1,070	100%	40%	HP-9	20%	56%	0.7	0.6	4.2
3134	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	Low Income	MH	LI	MO	10,861	60%	6,523	0.75	15	$1,070	100%	100%	HP-10	20%	56%	0.7	0.6	4.2
3135	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	58%	1,908	0.50	15	$1,070	100%	40%	HP-11	36%	56%	0.7	0.6	1.3
3136	HVAC Equipment	Ductless Heat Pump 21 SEER 10.0 HSPF - Electric resistance baseline	Low Income	MF	LI	MO	3,308	58%	1,908	0.50	15	$1,070	100%	100%	HP-12	36%	56%	0.7	0.6	1.3
3137	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	SF	NLI	MO	10,861	61%	6,635	0.89	15	$1,557	100%	40%	HP-7	20%	56%	0.7	0.6	2.9
3138	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	Low Income	SF	LI	MO	10,861	61%	6,635	0.89	15	$1,557	100%	100%	HP-8	20%	56%	0.8	0.6	2.9
3139	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MH	NLI	MO	10,861	61%	6,635	0.89	15	$1,557	100%	40%	HP-9	20%	56%	0.7	0.6	2.9
3140	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	Low Income	MH	LI	MO	10,861	61%	6,635	0.89	15	$1,557	100%	100%	HP-10	20%	56%	0.7	0.6	2.9

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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	TRC Score
3141	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	HVAC and Water Heating - Equipment	MF	NLI	MO	3,308	59%	1,956	0.59	15	$1,557	100%	40%	HP-11	36%	56%	0.7	0.6	0.9
3142	HVAC Equipment	Ductless Heat Pump 23 SEER 10.0 HSPF - Electric resistance baseline	Low Income	MF	LI	MO	3,308	59%	1,956	0.59	15	$1,557	100%	100%	HP-12	36%	56%	0.7	0.6	0.9
3143	HVAC Equipment	AC Tune Up	No program	SF	NLI	Retrofit	1,775	5%	89	0.15	3	$225	100%	40%	AC TUNE-1	23%	44%	0.7	0.6	0.1
3144	HVAC Equipment	AC Tune Up	Low Income	SF	LI	Retrofit	1,775	5%	89	0.15	3	$225	100%	100%	AC TUNE-2	23%	44%	0.8	0.6	0.1
3145	HVAC Equipment	AC Tune Up	No program	MH	NLI	Retrofit	1,775	5%	89	0.15	3	$225	100%	40%	AC TUNE-3	23%	44%	0.7	0.6	0.1
3146	HVAC Equipment	AC Tune Up	Low Income	MH	LI	Retrofit	1,775	5%	89	0.15	3	$225	100%	100%	AC TUNE-4	23%	44%	0.7	0.6	0.1
3147	HVAC Equipment	AC Tune Up	No program	MF	NLI	Retrofit	687	5%	34	0.15	3	$225	100%	40%	AC TUNE-5	51%	44%	0.6	0.5	0.1
3148	HVAC Equipment	AC Tune Up	Low Income	MF	LI	Retrofit	687	5%	34	0.15	3	$225	100%	100%	AC TUNE-6	51%	44%	0.6	0.6	0.1
3149	HVAC Equipment	Central Air Conditioner 15 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	7%	118	0.15	18	$104	100%	40%	CAC-1	23%	50%	0.7	0.6	1.4
3150	HVAC Equipment	Central Air Conditioner 15 SEER	Low Income	SF	LI	MO	1,775	7%	118	0.15	18	$104	100%	100%	CAC-2	23%	50%	0.8	0.6	1.4
3151	HVAC Equipment	Central Air Conditioner 15 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	7%	118	0.15	18	$104	100%	40%	CAC-3	23%	50%	0.7	0.6	1.4
3152	HVAC Equipment	Central Air Conditioner 15 SEER	Low Income	MH	LI	MO	1,775	7%	118	0.15	18	$104	100%	100%	CAC-4	23%	50%	0.7	0.6	1.4
3153	HVAC Equipment	Central Air Conditioner 15 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	7%	46	0.10	18	$104	100%	40%	CAC-5	51%	50%	0.7	0.6	0.7
3154	HVAC Equipment	Central Air Conditioner 15 SEER	Low Income	MF	LI	MO	687	7%	46	0.10	18	$104	100%	100%	CAC-6	51%	50%	0.7	0.6	0.7
3155	HVAC Equipment	Central Air Conditioner 16 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	13%	222	0.28	18	$221	100%	40%	CAC-1	23%	50%	0.7	0.6	1.2
3156	HVAC Equipment	Central Air Conditioner 16 SEER	Low Income	SF	LI	MO	1,775	13%	222	0.28	18	$221	100%	100%	CAC-2	23%	50%	0.8	0.6	1.2
3157	HVAC Equipment	Central Air Conditioner 16 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	13%	222	0.28	18	$221	100%	40%	CAC-3	23%	50%	0.7	0.6	1.2
3158	HVAC Equipment	Central Air Conditioner 16 SEER	Low Income	MH	LI	MO	1,775	13%	222	0.28	18	$221	100%	100%	CAC-4	23%	50%	0.7	0.6	1.2
3159	HVAC Equipment	Central Air Conditioner 16 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	1,775	13%	222	0.28	18	$221	100%	40%	CAC-5	23%	50%	0.7	0.6	1.2
3160	HVAC Equipment	Central Air Conditioner 16 SEER	Low Income	MF	LI	MO	1,775	13%	222	0.28	18	$221	100%	100%	CAC-6	23%	50%	0.7	0.6	1.2
3161	HVAC Equipment	Central Air Conditioner 17 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	18%	313	0.40	18	$620	100%	40%	CAC-1	23%	50%	0.7	0.6	0.6
3162	HVAC Equipment	Central Air Conditioner 17 SEER	Low Income	SF	LI	MO	1,775	18%	313	0.40	18	$620	100%	100%	CAC-2	23%	50%	0.8	0.6	0.6
3163	HVAC Equipment	Central Air Conditioner 17 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	18%	313	0.40	18	$620	100%	40%	CAC-3	23%	50%	0.7	0.6	0.6
3164	HVAC Equipment	Central Air Conditioner 17 SEER	Low Income	MH	LI	MO	1,775	18%	313	0.40	18	$620	100%	100%	CAC-4	23%	50%	0.7	0.6	0.6
3165	HVAC Equipment	Central Air Conditioner 17 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	18%	121	0.27	18	$620	100%	40%	CAC-5	51%	50%	0.7	0.6	0.3
3166	HVAC Equipment	Central Air Conditioner 17 SEER	Low Income	MF	LI	MO	687	18%	121	0.27	18	$620	100%	100%	CAC-6	51%	50%	0.7	0.6	0.3
3167	HVAC Equipment	Central Air Conditioner 18 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	22%	395	0.50	18	$620	100%	40%	CAC-1	23%	50%	0.7	0.6	0.8
3168	HVAC Equipment	Central Air Conditioner 18 SEER	Low Income	SF	LI	MO	1,775	22%	395	0.50	18	$620	100%	100%	CAC-2	23%	50%	0.8	0.6	0.8
3169	HVAC Equipment	Central Air Conditioner 18 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	22%	395	0.50	18	$620	100%	40%	CAC-3	23%	50%	0.7	0.6	0.8
3170	HVAC Equipment	Central Air Conditioner 18 SEER	Low Income	MH	LI	MO	1,775	22%	395	0.50	18	$620	100%	100%	CAC-4	23%	50%	0.7	0.6	0.8
3171	HVAC Equipment	Central Air Conditioner 18 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	22%	153	0.34	18	$620	100%	40%	CAC-5	51%	50%	0.7	0.6	0.4
3172	HVAC Equipment	Central Air Conditioner 18 SEER	Low Income	MF	LI	MO	687	22%	153	0.34	18	$620	100%	100%	CAC-6	51%	50%	0.7	0.6	0.4
3173	HVAC Equipment	Central Air Conditioner 19 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	27%	476	0.61	18	$620	100%	40%	CAC-1	23%	50%	0.7	0.6	0.9
3174	HVAC Equipment	Central Air Conditioner 19 SEER	Low Income	SF	LI	MO	1,775	27%	476	0.61	18	$620	100%	100%	CAC-2	23%	50%	0.8	0.6	0.9
3175	HVAC Equipment	Central Air Conditioner 19 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	27%	476	0.61	18	$620	100%	40%	CAC-3	23%	50%	0.7	0.6	0.9
3176	HVAC Equipment	Central Air Conditioner 19 SEER	Low Income	MH	LI	MO	1,775	27%	476	0.61	18	$620	100%	100%	CAC-4	23%	50%	0.7	0.6	0.9
3177	HVAC Equipment	Central Air Conditioner 19 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	27%	184	0.40	18	$620	100%	40%	CAC-5	51%	50%	0.7	0.6	0.5
3178	HVAC Equipment	Central Air Conditioner 19 SEER	Low Income	MF	LI	MO	687	27%	184	0.40	18	$620	100%	100%	CAC-6	51%	50%	0.7	0.6	0.5
3179	HVAC Equipment	Central Air Conditioner 20 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	31%	557	0.71	18	$620	100%	40%	CAC-1	23%	50%	0.7	0.6	1.1
3180	HVAC Equipment	Central Air Conditioner 20 SEER	Low Income	SF	LI	MO	1,775	31%	557	0.71	18	$620	100%	100%	CAC-2	23%	50%	0.8	0.6	1.1

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3181	HVAC Equipment	Central Air Conditioner 20 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	31%	557	0.71	18	$620	100%	40%	CAC-3	23%	50%	0.7	0.6	1.1
3182	HVAC Equipment	Central Air Conditioner 20 SEER	Low Income	MH	LI	MO	1,775	31%	557	0.71	18	$620	100%	100%	CAC-4	23%	50%	0.7	0.6	1.1
3183	HVAC Equipment	Central Air Conditioner 20 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	31%	215	0.47	18	$620	100%	40%	CAC-5	51%	50%	0.7	0.6	0.6
3184	HVAC Equipment	Central Air Conditioner 20 SEER	Low Income	MF	LI	MO	687	31%	215	0.47	18	$620	100%	100%	CAC-6	51%	50%	0.7	0.6	0.6
3185	HVAC Equipment	Central Air Conditioner 21 SEER	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	36%	638	0.81	18	$620	100%	40%	CAC-1	23%	50%	0.7	0.6	1.3
3186	HVAC Equipment	Central Air Conditioner 21 SEER	Low Income	SF	LI	MO	1,775	36%	638	0.81	18	$620	100%	100%	CAC-2	23%	50%	0.8	0.6	1.3
3187	HVAC Equipment	Central Air Conditioner 21 SEER	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	36%	638	0.81	18	$620	100%	40%	CAC-3	23%	50%	0.7	0.6	1.3
3188	HVAC Equipment	Central Air Conditioner 21 SEER	Low Income	MH	LI	MO	1,775	36%	638	0.81	18	$620	100%	100%	CAC-4	23%	50%	0.7	0.6	1.3
3189	HVAC Equipment	Central Air Conditioner 21 SEER	HVAC and Water Heating - Equipment	MF	NLI	MO	687	36%	247	0.54	18	$620	100%	40%	CAC-5	51%	50%	0.7	0.6	0.6
3190	HVAC Equipment	Central Air Conditioner 21 SEER	Low Income	MF	LI	MO	687	36%	247	0.54	18	$620	100%	100%	CAC-6	51%	50%	0.7	0.6	0.6
3191	HVAC Equipment	Ductless AC	HVAC and Water Heating - Equipment	SF	NLI	MO	1,775	9%	167	0.20	18	$365	100%	40%	CAC-1	23%	50%	0.7	0.6	0.6
3192	HVAC Equipment	Ductless AC	Low Income	SF	LI	MO	1,775	9%	167	0.20	18	$365	100%	100%	CAC-2	23%	50%	0.8	0.6	0.6
3193	HVAC Equipment	Ductless AC	HVAC and Water Heating - Equipment	MH	NLI	MO	1,775	9%	167	0.20	18	$365	100%	40%	CAC-3	23%	50%	0.7	0.6	0.6
3194	HVAC Equipment	Ductless AC	Low Income	MH	LI	MO	1,775	9%	167	0.20	18	$365	100%	100%	CAC-4	23%	50%	0.7	0.6	0.6
3195	HVAC Equipment	Ductless AC	HVAC and Water Heating - Equipment	MF	NLI	MO	687	9%	65	0.20	18	$365	100%	40%	CAC-5	51%	50%	0.7	0.6	0.4
3196	HVAC Equipment	Ductless AC	Low Income	MF	LI	MO	687	9%	65	0.20	18	$365	100%	100%	CAC-6	51%	50%	0.7	0.6	0.4
3197	HVAC Equipment	Smart Thermostat - Heat pump baseline	HVAC and Water Heating - Equipment	SF	NLI	Retrofit	5,508	8%	441	0.13	11	$125	100%	40%	HERMOSTAT	49%	24%	0.7	0.4	2.1
3198	HVAC Equipment	Smart Thermostat - Heat pump baseline	Low Income	SF	LI	Retrofit	5,508	8%	441	0.13	11	$125	100%	100%	HERMOSTAT	49%	24%	0.8	0.6	2.1
3199	HVAC Equipment	Smart Thermostat - Heat pump baseline	HVAC and Water Heating - Equipment	MH	NLI	Retrofit	5,508	8%	441	0.13	11	$125	100%	40%	HERMOSTAT	49%	24%	0.7	0.4	2.1
3200	HVAC Equipment	Smart Thermostat - Heat pump baseline	Low Income	MH	LI	Retrofit	5,508	8%	441	0.13	11	$125	100%	100%	HERMOSTAT	49%	24%	0.7	0.5	2.1
3201	HVAC Equipment	Smart Thermostat - Heat pump baseline	HVAC and Water Heating - Equipment	MF	NLI	Retrofit	2,018	8%	161	0.04	11	$125	100%	40%	HERMOSTAT	36%	19%	0.5	0.3	0.7
3202	HVAC Equipment	Smart Thermostat - Heat pump baseline	Low Income	MF	LI	Retrofit	2,018	8%	161	0.04	11	$125	100%	100%	HERMOSTAT	36%	19%	0.5	0.4	0.7
3203	HVAC Equipment	Smart Thermostat - Furnace baseline	HVAC and Water Heating - Equipment	SF	NLI	Retrofit	11,159	8%	893	0.25	11	$125	100%	40%	HERMOSTAT	20%	24%	0.7	0.4	4.1
3204	HVAC Equipment	Smart Thermostat - Furnace baseline	Low Income	SF	LI	Retrofit	11,159	8%	893	0.25	11	$125	100%	100%	HERMOSTAT	20%	24%	0.8	0.6	4.1
3205	HVAC Equipment	Smart Thermostat - Furnace baseline	HVAC and Water Heating - Equipment	MH	NLI	Retrofit	11,159	8%	893	0.25	11	$125	100%	40%	HERMOSTAT	20%	24%	0.7	0.4	4.1
3206	HVAC Equipment	Smart Thermostat - Furnace baseline	Low Income	MH	LI	Retrofit	11,159	8%	893	0.25	11	$125	100%	100%	IERMOSTAT-	20%	24%	0.7	0.5	4.1
3207	HVAC Equipment	Smart Thermostat - Furnace baseline	HVAC and Water Heating - Equipment	MF	NLI	Retrofit	3,396	8%	272	0.06	11	$125	100%	40%	IERMOSTAT-	47%	19%	0.5	0.3	1.2
3208	HVAC Equipment	Smart Thermostat - Furnace baseline	Low Income	MF	LI	Retrofit	3,396	8%	272	0.06	11	$125	100%	100%	IERMOSTAT-	47%	19%	0.5	0.4	1.2
3209	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	HVAC and Water Heating - Equipment	SF	NLI	Retrofit	2,073	8%	166	0.05	11	$125	100%	40%	IERMOSTAT-	19%	24%	0.7	0.4	2.2
3210	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	Low Income	SF	LI	Retrofit	2,073	8%	166	0.05	11	$125	100%	100%	IERMOSTAT-	19%	24%	0.8	0.6	2.2
3211	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	HVAC and Water Heating - Equipment	MH	NLI	Retrofit	2,073	8%	166	0.05	11	$125	100%	40%	IERMOSTAT-	19%	24%	0.7	0.4	2.2
3212	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	Low Income	MH	LI	Retrofit	2,073	8%	166	0.05	11	$125	100%	100%	IERMOSTAT-	19%	24%	0.7	0.5	2.2
3213	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	HVAC and Water Heating - Equipment	MF	NLI	Retrofit	774	8%	62	0.02	11	$125	100%	40%	IERMOSTAT-	15%	19%	0.5	0.3	1.1
3214	HVAC Equipment	Smart Thermostat - Gas/CAC baseline	Low Income	MF	LI	Retrofit	774	8%	62	0.02	11	$125	100%	100%	IERMOSTAT-	15%	19%	0.5	0.4	1.1
3215	HVAC Equipment	ECM HVAC Motor	No program	SF	NLI	Retrofit	1,455	40%	582	0.27	6	$322	100%	40%	ECM-1	75%	50%	0.7	0.6	0.7
3216	HVAC Equipment	ECM HVAC Motor	No program	SF	LI	Retrofit	1,455	40%	582	0.27	6	$322	100%	100%	ECM-2	75%	50%	0.8	0.6	0.7
3217	HVAC Equipment	ECM HVAC Motor	No program	MH	NLI	Retrofit	1,455	40%	582	0.27	6	$322	100%	40%	ECM-3	75%	50%	0.7	0.6	0.7

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
3218	HVAC Equipment	ECM HVAC Motor	No program	MH	LI	Retrofit	1,455	40%	582	0.27	6	$322	100%	100%	ECM-4	75%	50%	0.7	0.6	0.7
3219	HVAC Equipment	ECM HVAC Motor	No program	MF	NLI	Retrofit	1,455	40%	582	0.27	6	$322	100%	40%	ECM-5	60%	50%	0.7	0.6	0.7
3220	HVAC Equipment	ECM HVAC Motor	No program	MF	LI	Retrofit	1,455	40%	582	0.27	6	$322	100%	100%	ECM-6	60%	50%	0.7	0.6	0.7
3221	HVAC Equipment	ENERGY STAR Room Air Conditioner	HVAC and Water Heating - Equipment	SF	NLI	MO	794	9%	73	0.07	9	$20	100%	40%	RAC-1	70%	49%	0.7	0.6	2.2
3222	HVAC Equipment	ENERGY STAR Room Air Conditioner	Low Income	SF	LI	MO	794	9%	73	0.07	9	$20	100%	100%	RAC-2	70%	49%	0.8	0.6	2.2
3223	HVAC Equipment	ENERGY STAR Room Air Conditioner	HVAC and Water Heating - Equipment	MH	NLI	MO	794	9%	73	0.07	9	$20	100%	40%	RAC-3	70%	49%	0.7	0.6	2.2
3224	HVAC Equipment	ENERGY STAR Room Air Conditioner	Low Income	MH	LI	MO	794	9%	73	0.07	9	$20	100%	100%	RAC-4	72%	49%	0.7	0.6	2.2
3225	HVAC Equipment	ENERGY STAR Room Air Conditioner	HVAC and Water Heating - Equipment	MF	NLI	MO	794	9%	73	0.07	9	$20	100%	40%	RAC-5	72%	49%	0.6	0.6	2.2
3226	HVAC Equipment	ENERGY STAR Room Air Conditioner	Low Income	MF	LI	MO	794	9%	73	0.07	9	$20	100%	100%	RAC-6	72%	49%	0.6	0.6	2.2
3227	HVAC Equipment	Room Air Conditioner Recycling	No program	SF	NLI	Recycle	196	100%	196	0.19	4	$65	100%	40%	RR-1	16%	0%	0.7	0.3	0.9
3228	HVAC Equipment	Room Air Conditioner Recycling	Low Income	SF	LI	Recycle	196	100%	196	0.19	4	$65	100%	100%	RR-2	16%	0%	0.8	0.6	0.9
3229	HVAC Equipment	Room Air Conditioner Recycling	No program	MH	NLI	Recycle	196	100%	196	0.19	4	$65	100%	40%	RR-3	16%	0%	0.7	0.3	0.9
3230	HVAC Equipment	Room Air Conditioner Recycling	Low Income	MH	LI	Recycle	196	100%	196	0.19	4	$65	100%	100%	RR-4	16%	0%	0.7	0.5	0.9
3231	HVAC Equipment	Room Air Conditioner Recycling	No program	MF	NLI	Recycle	196	100%	196	0.19	4	$65	100%	40%	RR-5	8%	0%	0.5	0.2	0.9
3232	HVAC Equipment	Room Air Conditioner Recycling	Low Income	MF	LI	Recycle	196	100%	196	0.19	4	$65	100%	100%	RR-6	8%	0%	0.5	0.3	0.9
3233	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	SF	NLI	Retrofit	2,073	5%	104	0.11	15	$1,625	100%	40%	SVS-1	19%	3%	0.7	0.3	0.1
3234	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	SF	LI	Retrofit	2,073	5%	104	0.11	15	$1,625	100%	100%	SVS-2	19%	3%	0.8	0.6	0.1
3235	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	MH	NLI	Retrofit	2,073	5%	104	0.11	15	$1,625	100%	40%	SVS-3	19%	3%	0.7	0.3	0.1
3236	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	MH	LI	Retrofit	2,073	5%	104	0.11	15	$1,625	100%	100%	SVS-4	19%	3%	0.7	0.5	0.1
3237	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	MF	NLI	Retrofit	774	5%	39	0.08	15	$1,040	100%	40%	SVS-5	15%	3%	0.5	0.2	0.1
3238	HVAC Equipment	Smart Vents/Sensors - Gas/CAC baseline	No program	MF	LI	Retrofit	774	5%	39	0.08	15	$1,040	100%	100%	SVS-6	15%	3%	0.5	0.3	0.1
3239	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	SF	NLI	Retrofit	5,508	5%	275	0.11	15	$1,625	100%	40%	SVS-7	49%	3%	0.7	0.3	0.1
3240	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	SF	LI	Retrofit	5,508	5%	275	0.11	15	$1,625	100%	100%	SVS-8	49%	3%	0.8	0.6	0.1
3241	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	MH	NLI	Retrofit	5,508	5%	275	0.11	15	$1,625	100%	40%	SVS-9	49%	3%	0.7	0.3	0.1
3242	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	MH	LI	Retrofit	5,508	5%	275	0.11	15	$1,625	100%	100%	SVS-10	49%	3%	0.7	0.5	0.1
3243	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	MF	NLI	Retrofit	2,018	5%	101	0.08	15	$1,040	100%	40%	SVS-11	36%	3%	0.5	0.2	0.1
3244	HVAC Equipment	Smart Vents/Sensors - Heat pump baseline	No program	MF	LI	Retrofit	2,018	5%	101	0.08	15	$1,040	100%	100%	SVS-12	36%	3%	0.5	0.3	0.1
3245	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	SF	NLI	Retrofit	10,861	5%	543	0.11	15	$1,625	100%	40%	SVS-13	20%	3%	0.7	0.3	0.2
3246	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	SF	LI	Retrofit	10,861	5%	543	0.11	15	$1,625	100%	100%	SVS-14	20%	3%	0.8	0.6	0.2
3247	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	MH	NLI	Retrofit	10,861	5%	543	0.11	15	$1,625	100%	40%	SVS-15	20%	3%	0.7	0.3	0.2
3248	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	MH	LI	Retrofit	10,861	5%	543	0.11	15	$1,625	100%	100%	SVS-16	20%	3%	0.7	0.5	0.2
3249	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	MF	NLI	Retrofit	3,396	5%	170	0.08	15	$1,040	100%	40%	SVS-17	47%	3%	0.5	0.2	0.1
3250	HVAC Equipment	Smart Vents/Sensors - Furnace baseline	No program	MF	LI	Retrofit	3,396	5%	170	0.08	15	$1,040	100%	100%	SVS-18	47%	3%	0.5	0.3	0.1
3251	HVAC Equipment	Energy Recovery Ventilator	No program	SF	NLI	Retrofit	5,569	40%	2,228	0.30	15	$3,000	100%	40%	ERV-1	50%	0%	0.7	0.3	0.6
3252	HVAC Equipment	Energy Recovery Ventilator	No program	SF	LI	Retrofit	5,569	40%	2,228	0.30	15	$3,000	100%	100%	ERV-2	50%	0%	0.8	0.6	0.6
3253	HVAC Equipment	Energy Recovery Ventilator	No program	MH	NLI	Retrofit	5,569	40%	2,228	0.30	15	$3,000	100%	40%	ERV-3	50%	0%	0.7	0.3	0.6
3254	HVAC Equipment	Energy Recovery Ventilator	No program	MH	LI	Retrofit	5,569	40%	2,228	0.30	15	$3,000	100%	100%	ERV-4	50%	0%	0.7	0.5	0.6
3255	HVAC Equipment	Energy Recovery Ventilator	No program	MF	NLI	Retrofit	2,461	40%	984	0.30	15	$3,000	100%	40%	ERV-5	50%	0%	0.5	0.2	0.3

Appendix D: 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	TRC Score
3256	HVAC Equipment	Energy Recovery Ventilator	No program	MF	LI	Retrofit	2,461	40%	984	0.30	15	$3,000	100%	100%	ERV-6	50%	0%	0.5	0.3	0.3
3257	HVAC Equipment	Whole House Attic Fan	No program	SF	NLI	Retrofit	2,073	18%	373	0.41	15	$711	100%	40%	WHAF-1	23%	7%	0.7	0.3	0.5
3258	HVAC Equipment	Whole House Attic Fan	No program	SF	LI	Retrofit	2,073	18%	373	0.41	15	$711	100%	100%	WHAF-2	23%	7%	0.8	0.6	0.5
3259	HVAC Equipment	Whole House Attic Fan	No program	MH	NLI	Retrofit	2,073	18%	373	0.41	15	$711	100%	40%	WHAF-3	23%	7%	0.7	0.3	0.5
3260	HVAC Equipment	Whole House Attic Fan	No program	MH	LI	Retrofit	2,073	18%	373	0.41	15	$711	100%	100%	WHAF-4	23%	7%	0.7	0.5	0.5
3261	HVAC Equipment	Whole House Attic Fan	No program	MF	NLI	Retrofit	687	18%	124	0.27	15	$711	100%	40%	WHAF-5	51%	7%	0.5	0.2	0.2
3262	HVAC Equipment	Whole House Attic Fan	No program	MF	LI	Retrofit	687	18%	124	0.27	15	$711	100%	100%	WHAF-6	51%	7%	0.5	0.3	0.2
3263	HVAC Equipment	Attic Fan	No program	SF	NLI	Retrofit	2,073	8%	166	0.18	15	$125	100%	40%	WHAF-1	23%	8%	0.7	0.3	1.3
3264	HVAC Equipment	Attic Fan	No program	SF	LI	Retrofit	2,073	8%	166	0.18	15	$125	100%	100%	WHAF-2	23%	8%	0.8	0.6	1.3
3265	HVAC Equipment	Attic Fan	No program	MH	NLI	Retrofit	2,073	8%	166	0.18	15	$125	100%	40%	WHAF-3	23%	8%	0.7	0.3	1.3
3266	HVAC Equipment	Attic Fan	No program	MH	LI	Retrofit	2,073	8%	166	0.18	15	$125	100%	100%	WHAF-4	23%	8%	0.7	0.5	1.3
3267	HVAC Equipment	Attic Fan	No program	MF	NLI	Retrofit	687	8%	55	0.12	15	$125	100%	40%	WHAF-5	51%	8%	0.5	0.2	0.6
3268	HVAC Equipment	Attic Fan	No program	MF	LI	Retrofit	687	8%	55	0.12	15	$125	100%	100%	WHAF-6	51%	8%	0.5	0.3	0.6
3269	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	SF	NLI	Retrofit	100	10%	10	0.00	19	$11	100%	40%	VENT FAN-1	75%	51%	0.7	0.6	0.7
3270	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	SF	LI	Retrofit	100	10%	10	0.00	19	$11	100%	100%	VENT FAN-2	75%	51%	0.8	0.6	0.7
3271	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	MH	NLI	Retrofit	100	10%	10	0.00	19	$11	100%	40%	VENT FAN-3	75%	51%	0.7	0.6	0.7
3272	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	MH	LI	Retrofit	100	10%	10	0.00	19	$11	100%	100%	VENT FAN-4	75%	51%	0.7	0.6	0.7
3273	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	MF	NLI	Retrofit	100	10%	10	0.00	19	$11	100%	40%	VENT FAN-5	75%	51%	0.7	0.6	0.7
3274	HVAC Equipment	ENERGY STAR Bath Vent Fan	No program	MF	LI	Retrofit	100	10%	10	0.00	19	$11	100%	100%	VENT FAN-6	75%	51%	0.7	0.6	0.7
4001	Lighting	9W LED	No program	SF	NLI	MO	32	9%	3	0.00	19	$1	100%	40%	STAN-1	3003%	59%	0.7	0.7	2.1
4002	Lighting	9W LED	No program	SF	LI	MO	32	9%	3	0.00	19	$1	100%	100%	STAN-2	3003%	59%	0.8	0.7	2.1
4003	Lighting	9W LED	No program	MH	NLI	MO	32	9%	3	0.00	19	$1	100%	40%	STAN-3	3003%	59%	0.7	0.7	2.1
4004	Lighting	9W LED	No program	MH	LI	MO	32	9%	3	0.00	19	$1	100%	100%	STAN-4	3003%	59%	0.8	0.7	2.1
4005	Lighting	9W LED	No program	MF	NLI	MO	32	9%	3	0.00	19	$1	100%	40%	STAN-5	1915%	59%	0.7	0.7	2.1
4006	Lighting	9W LED	No program	MF	LI	MO	32	9%	3	0.00	19	$1	100%	100%	STAN-6	1915%	59%	0.7	0.7	2.1
4007	Lighting	13W LED	No program	SF	NLI	MO	38	13%	5	0.00	19	$5	100%	40%	STAN-1	3003%	59%	0.7	0.7	0.9
4008	Lighting	13W LED	No program	SF	LI	MO	38	13%	5	0.00	19	$5	100%	100%	STAN-2	3003%	59%	0.8	0.7	0.9
4009	Lighting	13W LED	No program	MH	NLI	MO	38	13%	5	0.00	19	$5	100%	40%	STAN-3	3003%	59%	0.7	0.7	0.9
4010	Lighting	13W LED	No program	MH	LI	MO	38	13%	5	0.00	19	$5	100%	100%	STAN-4	3003%	59%	0.8	0.7	0.9
4011	Lighting	13W LED	No program	MF	NLI	MO	38	13%	5	0.00	19	$5	100%	40%	STAN-5	1915%	59%	0.7	0.7	0.9
4012	Lighting	13W LED	No program	MF	LI	MO	38	13%	5	0.00	19	$5	100%	100%	STAN-6	1915%	59%	0.7	0.7	0.9
4013	Lighting	LED 5W Globe	No program	SF	NLI	MO	5	20%	1	0.00	19	$3	100%	40%	REFLECTOR-1	738%	59%	0.7	0.7	0.3
4014	Lighting	LED 5W Globe	No program	SF	LI	MO	5	20%	1	0.00	19	$3	100%	100%	REFLECTOR-2	738%	59%	0.8	0.7	0.3
4015	Lighting	LED 5W Globe	No program	MH	NLI	MO	5	20%	1	0.00	19	$3	100%	40%	REFLECTOR-3	738%	59%	0.7	0.7	0.3
4016	Lighting	LED 5W Globe	No program	MH	LI	MO	5	20%	1	0.00	19	$3	100%	100%	REFLECTOR-4	738%	59%	0.8	0.7	0.3
4017	Lighting	LED 5W Globe	No program	MF	NLI	MO	5	20%	1	0.00	19	$3	100%	40%	REFLECTOR-5	471%	59%	0.7	0.7	0.3
4018	Lighting	LED 5W Globe	No program	MF	LI	MO	5	20%	1	0.00	19	$3	100%	100%	REFLECTOR-6	471%	59%	0.7	0.7	0.3
4019	Lighting	LED R30 Dimmable	No program	SF	NLI	MO	5	20%	1	0.00	19	$3	100%	40%	SPECIALTY-1	446%	59%	0.7	0.7	0.3
4020	Lighting	LED R30 Dimmable	No program	SF	LI	MO	43	26%	11	0.00	19	$4	100%	100%	SPECIALTY-2	446%	59%	0.8	0.7	2.5
4021	Lighting	LED R30 Dimmable	No program	MH	NLI	MO	43	26%	11	0.00	19	$4	100%	40%	SPECIALTY-3	446%	59%	0.7	0.7	2.5
4022	Lighting	LED R30 Dimmable	No program	MH	LI	MO	43	26%	11	0.00	19	$4	100%	100%	SPECIALTY-4	446%	59%	0.8	0.7	2.5
4023	Lighting	LED R30 Dimmable	No program	MF	NLI	MO	43	26%	11	0.00	19	$4	100%	40%	SPECIALTY-5	284%	59%	0.7	0.7	2.5
4024	Lighting	LED R30 Dimmable	No program	MF	LI	MO	43	26%	11	0.00	19	$4	100%	100%	SPECIALTY-6	284%	59%	0.7	0.7	2.5
4025	Lighting	LED Nightlights	No program	SF	NLI	MO	15	93%	14	0.00	12	$3	100%	40%	NIGHT-1	40%	59%	0.7	0.7	2.3
4026	Lighting	LED Nightlights	No program	SF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-2	40%	59%	0.8	0.7	2.3
4027	Lighting	LED Nightlights	No program	MH	NLI	MO	15	93%	14	0.00	12	$3	100%	40%	NIGHT-3	40%	59%	0.7	0.7	2.3
4028	Lighting	LED Nightlights	No program	MH	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-4	40%	59%	0.8	0.7	2.3
4029	Lighting	LED Nightlights	No program	MF	NLI	MO	15	93%	14	0.00	12	$3	100%	40%	NIGHT-5	40%	59%	0.7	0.7	2.3
4030	Lighting	LED Nightlights	No program	MF	LI	MO	15	93%	14	0.00	12	$3	100%	100%	NIGHT-6	40%	59%	0.7	0.7	2.3
4031	Lighting	Exterior LED Lamp	No program	SF	NLI	MO	127	72%	92	0.00	19	$2	100%	40%	ELL-1	503%	59%	0.7	0.7	39.4
4032	Lighting	Exterior LED Lamp	No program	SF	LI	MO	127	72%	92	0.00	19	$2	100%	100%	ELL-2	503%	59%	0.8	0.7	39.4
4033	Lighting	Exterior LED Lamp	No program	MH	NLI	MO	127	72%	92	0.00	19	$2	100%	40%	ELL-3	503%	59%	0.7	0.7	39.4
4034	Lighting	Exterior LED Lamp	No program	MH	LI	MO	127	72%	92	0.00	19	$2	100%	100%	ELL-4	289%	59%	0.8	0.7	39.4
4035	Lighting	Exterior LED Lamp	No program	MF	NLI	MO	127	72%	92	0.00	19	$2	100%	40%	ELL-5	289%	59%	0.7	0.7	39.4

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
4036	Lighting	Exterior LED Lamp	No program	MF	LI	MO	127	72%	92	0.00	19	$2	100%	100%	ELL-6	289%	59%	0.7	0.7	39.4
4037	Lighting	Linear LED	No program	SF	NLI	MO	23	44%	10	0.01	19	$7	100%	40%	LINEAR-1	509%	59%	0.7	0.7	1.9
4038	Lighting	Linear LED	No program	SF	LI	MO	23	44%	10	0.01	19	$7	100%	100%	LINEAR-2	509%	59%	0.8	0.7	1.9
4039	Lighting	Linear LED	No program	MH	NLI	MO	23	44%	10	0.01	19	$7	100%	40%	LINEAR-3	509%	59%	0.7	0.7	1.9
4040	Lighting	Linear LED	No program	MH	LI	MO	23	44%	10	0.01	19	$7	100%	100%	LINEAR-4	509%	59%	0.8	0.7	1.9
4041	Lighting	Linear LED	No program	MF	NLI	MO	23	44%	10	0.01	19	$7	100%	40%	LINEAR-5	325%	59%	0.7	0.7	1.9
4042	Lighting	Linear LED	No program	MF	LI	MO	23	44%	10	0.01	19	$7	100%	100%	LINEAR-6	325%	59%	0.7	0.7	1.9
4043	Lighting	Smart LED	No program	SF	NLI	MO	19	10%	2	0.00	19	$2	100%	40%	STAN-1	3003%	59%	0.7	0.7	0.7
4044	Lighting	Smart LED	No program	SF	LI	MO	19	10%	2	0.00	19	$2	100%	100%	STAN-2	3003%	59%	0.8	0.7	0.7
4045	Lighting	Smart LED	No program	MH	NLI	MO	19	10%	2	0.00	19	$2	100%	40%	STAN-3	3003%	59%	0.7	0.7	0.7
4046	Lighting	Smart LED	No program	MH	LI	MO	19	10%	2	0.00	19	$2	100%	100%	STAN-4	3003%	59%	0.8	0.7	0.7
4047	Lighting	Smart LED	No program	MF	NLI	MO	19	10%	2	0.00	19	$2	100%	40%	STAN-5	1915%	59%	0.7	0.7	0.7
4048	Lighting	Smart LED	No program	MF	LI	MO	19	10%	2	0.00	19	$2	100%	100%	STAN-6	1915%	59%	0.7	0.7	0.7
4049	Lighting	LED Fixture	No program	SF	NLI	MO	82	59%	49	0.06	19	$26	100%	40%	STAN-1	3003%	59%	0.7	0.7	2.4
4050	Lighting	LED Fixture	No program	SF	LI	MO	82	59%	49	0.06	19	$26	100%	100%	STAN-2	3003%	59%	0.8	0.7	2.4
4051	Lighting	LED Fixture	No program	MH	NLI	MO	82	59%	49	0.06	19	$26	100%	40%	STAN-3	3003%	59%	0.7	0.7	2.4
4052	Lighting	LED Fixture	No program	MH	LI	MO	82	59%	49	0.06	19	$26	100%	100%	STAN-4	3003%	59%	0.8	0.7	2.4
4053	Lighting	LED Fixture	No program	MF	NLI	MO	82	59%	49	0.06	19	$26	100%	40%	STAN-5	1915%	59%	0.7	0.7	2.4
4054	Lighting	LED Fixture	No program	MF	LI	MO	82	59%	49	0.06	19	$26	100%	100%	STAN-6	1915%	59%	0.7	0.7	2.4
4055	Lighting	Occupancy Sensor	No program	SF	NLI	Retrofit	124	30%	37	0.05	10	$30	100%	40%	OCC-1	1047%	31%	0.7	0.4	0.9
4056	Lighting	Occupancy Sensor	No program	SF	LI	Retrofit	124	30%	37	0.05	10	$30	100%	100%	OCC-2	1047%	31%	0.8	0.6	0.9
4057	Lighting	Occupancy Sensor	No program	MH	NLI	Retrofit	124	30%	37	0.05	10	$30	100%	40%	OCC-3	1047%	31%	0.7	0.4	0.9
4058	Lighting	Occupancy Sensor	No program	MH	LI	Retrofit	124	30%	37	0.05	10	$30	100%	100%	OCC-4	1047%	31%	0.8	0.6	0.9
4059	Lighting	Occupancy Sensor	No program	MF	NLI	Retrofit	124	30%	37	0.05	10	$30	100%	40%	OCC-5	1047%	31%	0.6	0.4	0.9
4060	Lighting	Occupancy Sensor	No program	MF	LI	Retrofit	124	30%	37	0.05	10	$30	100%	100%	OCC-6	1047%	31%	0.7	0.5	0.9
4061	Lighting	Smart Lighting Switch	No program	SF	NLI	Retrofit	124	17%	21	0.05	10	$43	100%	40%	OCC-1	1047%	31%	0.7	0.4	0.5
4062	Lighting	Smart Lighting Switch	No program	SF	LI	Retrofit	124	17%	21	0.05	10	$43	100%	100%	OCC-2	1047%	31%	0.8	0.6	0.5
4063	Lighting	Smart Lighting Switch	No program	MH	NLI	Retrofit	124	17%	21	0.05	10	$43	100%	40%	OCC-3	1047%	31%	0.7	0.4	0.5
4064	Lighting	Smart Lighting Switch	No program	MH	LI	Retrofit	124	17%	21	0.05	10	$43	100%	100%	OCC-4	1047%	31%	0.8	0.6	0.5
4065	Lighting	Smart Lighting Switch	No program	MF	NLI	Retrofit	124	17%	21	0.05	10	$43	100%	40%	OCC-5	1047%	31%	0.6	0.4	0.5
4066	Lighting	Smart Lighting Switch	No program	MF	LI	Retrofit	124	17%	21	0.05	10	$43	100%	100%	OCC-6	1047%	31%	0.7	0.5	0.5
4067	Lighting	Exterior Lighting Controls	No program	SF	NLI	Retrofit	146	44%	65	0.03	10	$30	100%	40%	ELC-1	252%	31%	0.7	0.4	1.1
4068	Lighting	Exterior Lighting Controls	No program	SF	LI	Retrofit	146	44%	65	0.03	10	$30	100%	100%	ELC-2	252%	31%	0.8	0.6	1.1
4069	Lighting	Exterior Lighting Controls	No program	MH	NLI	Retrofit	146	44%	65	0.03	10	$30	100%	40%	ELC-3	252%	31%	0.7	0.4	1.1
4070	Lighting	Exterior Lighting Controls	No program	MH	LI	Retrofit	146	44%	65	0.03	10	$30	100%	100%	ELC-4	252%	31%	0.8	0.6	1.1
4071	Lighting	Exterior Lighting Controls	No program	MF	NLI	Retrofit	146	44%	65	0.03	10	$30	100%	40%	ELC-5	252%	31%	0.6	0.4	1.1
4072	Lighting	Exterior Lighting Controls	No program	MF	LI	Retrofit	146	44%	65	0.03	10	$30	100%	100%	ELC-6	252%	31%	0.7	0.5	1.1
5001	Pool/Pump	Heat Pump Pool Heater	No program	SF	NLI	MO	2,364	52%	1,234	0.00	8	$1,250	100%	40%	HPPH-1	3%	12%	0.7	0.3	0.4
5002	Pool/Pump	Heat Pump Pool Heater	No program	SF	LI	MO	2,364	52%	1,234	0.00	8	$1,250	100%	100%	HPPH-2	3%	12%	0.8	0.6	0.4
5003	Pool/Pump	Heat Pump Pool Heater	No program	MH	NLI	MO	2,364	52%	1,234	0.00	8	$1,250	100%	40%	HPPH-3	3%	12%	0.7	0.3	0.4
5004	Pool/Pump	Heat Pump Pool Heater	No program	MH	LI	MO	2,364	52%	1,234	0.00	8	$1,250	100%	100%	HPPH-4	3%	12%	0.8	0.6	0.4
5005	Pool/Pump	Variable Speed Pool Pump	No program	SF	NLI	MO	1,167	26%	308	0.22	7	$314	100%	40%	POOL-1	10%	25%	0.7	0.4	0.4
5006	Pool/Pump	Variable Speed Pool Pump	No program	SF	LI	MO	1,167	26%	308	0.22	7	$314	100%	100%	POOL-2	10%	25%	0.8	0.6	0.4
5007	Pool/Pump	Variable Speed Pool Pump	No program	MH	NLI	MO	1,167	26%	308	0.22	7	$314	100%	40%	POOL-3	10%	25%	0.7	0.4	0.4
5008	Pool/Pump	Variable Speed Pool Pump	No program	MH	LI	MO	1,167	26%	308	0.22	7	$314	100%	100%	POOL-4	10%	25%	0.8	0.6	0.4
5009	Pool/Pump	Well Pump	No program	SF	NLI	MO	411	33%	136	0.02	20	$110	100%	40%	WELL-1	4%	25%	0.7	0.4	1.0
5010	Pool/Pump	Well Pump	No program	SF	LI	MO	411	33%	136	0.02	20	$110	100%	100%	WELL-2	4%	25%	0.8	0.6	1.0
5011	Pool/Pump	Well Pump	No program	MH	NLI	MO	411	33%	136	0.02	20	$110	100%	40%	WELL-3	4%	25%	0.7	0.4	1.0
5012	Pool/Pump	Well Pump	No program	MH	LI	MO	411	33%	136	0.02	20	$110	100%	100%	WELL-4	4%	25%	0.8	0.6	1.0
6001	New Construction	ENERGY STAR New Home	No program	SF	N/A	NC	14,827	25%	3,707	0.42	20	$1,216	100%	40%	NC-1	100%	0%	0.7	0.2	2.6
6002	New Construction	ENERGY STAR New Home	No program	MH	N/A	NC	14,827	25%	3,707	0.42	20	$1,216	100%	40%	NC-2	100%	0%	0.7	0.2	2.6
6003	New Construction	ENERGY STAR New Home	No program	MF	N/A	NC	14,827	25%	3,707	0.42	20	$1,216	100%	40%	NC-3	100%	0%	0.5	0.2	2.6

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
7001	Plug Load	Smart Power Strips - Tier 1	No program	SF	NLI	Retrofit	466	5%	57	0.01	7	$10	100%	40%	SPS-1	100%	16%	0.7	0.3	2.0
7002	Plug Load	Smart Power Strips - Tier 1	No program	SF	LI	Retrofit	466	5%	57	0.01	7	$10	100%	100%	SPS-2	100%	16%	0.8	0.6	2.0
7003	Plug Load	Smart Power Strips - Tier 1	No program	MH	NLI	Retrofit	466	5%	57	0.01	7	$10	100%	40%	SPS-3	100%	16%	0.7	0.3	2.0
7004	Plug Load	Smart Power Strips - Tier 1	No program	MH	LI	Retrofit	466	5%	57	0.01	7	$10	100%	100%	SPS-4	100%	16%	0.8	0.6	2.0
7005	Plug Load	Smart Power Strips - Tier 1	No program	MF	NLI	Retrofit	466	5%	57	0.01	7	$10	100%	40%	SPS-5	100%	16%	0.6	0.3	2.0
7006	Plug Load	Smart Power Strips - Tier 1	No program	MF	LI	Retrofit	466	5%	57	0.01	7	$10	100%	100%	SPS-6	100%	16%	0.7	0.5	2.0
7007	Plug Load	Smart Power Strips - Tier 2	No program	SF	NLI	Retrofit	466	29%	136	0.02	7	$60	100%	40%	SPS-1	100%	16%	0.7	0.3	0.8
7008	Plug Load	Smart Power Strips - Tier 2	No program	SF	LI	Retrofit	466	29%	136	0.02	7	$60	100%	100%	SPS-2	100%	16%	0.8	0.6	0.8
7009	Plug Load	Smart Power Strips - Tier 2	No program	MH	NLI	Retrofit	466	29%	136	0.02	7	$60	100%	40%	SPS-3	100%	16%	0.7	0.3	0.8
7010	Plug Load	Smart Power Strips - Tier 2	No program	MH	LI	Retrofit	466	29%	136	0.02	7	$60	100%	100%	SPS-4	100%	16%	0.8	0.6	0.8
7011	Plug Load	Smart Power Strips - Tier 2	No program	MF	NLI	Retrofit	466	29%	136	0.02	7	$60	100%	40%	SPS-5	100%	16%	0.6	0.3	0.8
7012	Plug Load	Smart Power Strips - Tier 2	No program	MF	LI	Retrofit	466	29%	136	0.02	7	$60	100%	100%	SPS-6	100%	16%	0.7	0.5	0.8
7013	Plug Load	ENERGY STAR TV	No program	SF	NLI	MO	83	20%	17	0.00	6	$0	100%	40%	TV-1	200%	46%	0.7	0.6	1.0
7014	Plug Load	ENERGY STAR TV	No program	SF	LI	MO	83	20%	17	0.00	6	$0	100%	100%	TV-2	200%	46%	0.8	0.6	1.0
7015	Plug Load	ENERGY STAR TV	No program	MH	NLI	MO	83	20%	17	0.00	6	$0	100%	40%	TV-3	200%	46%	0.7	0.6	1.0
7016	Plug Load	ENERGY STAR TV	No program	MH	LI	MO	83	20%	17	0.00	6	$0	100%	100%	TV-4	200%	46%	0.8	0.6	1.0
7017	Plug Load	ENERGY STAR TV	No program	MF	NLI	MO	83	20%	17	0.00	6	$0	100%	40%	TV-5	200%	46%	0.6	0.6	1.0
7018	Plug Load	ENERGY STAR TV	No program	MF	LI	MO	83	20%	17	0.00	6	$0	100%	100%	TV-6	200%	46%	0.7	0.6	1.0
8001	Shell	Duct Sealing - Average Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	5%	263	0.13	20	$450	100%	40%	DUCT-1	49%	76%	0.8	0.8	0.6
8002	Shell	Duct Sealing - Average Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	5%	263	0.13	20	$450	100%	100%	DUCT-2	49%	76%	0.8	0.8	0.6
8003	Shell	Duct Sealing - Average Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	5%	263	0.13	20	$450	100%	40%	DUCT-3	49%	76%	0.8	0.8	0.6
8004	Shell	Duct Sealing - Average Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	5%	263	0.13	20	$450	100%	100%	DUCT-4	49%	76%	0.8	0.8	0.6
8005	Shell	Duct Sealing - Inadequate Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	7%	367	0.11	20	$450	100%	40%	DUCT-5	49%	90%	0.9	0.9	0.8
8006	Shell	Duct Sealing - Inadequate Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	7%	367	0.11	20	$450	100%	100%	DUCT-6	49%	90%	0.9	0.9	0.8
8007	Shell	Duct Sealing - Inadequate Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	7%	367	0.11	20	$450	100%	40%	DUCT-7	49%	90%	0.9	0.9	0.8
8008	Shell	Duct Sealing - Inadequate Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	7%	367	0.11	20	$450	100%	100%	DUCT-8	49%	90%	0.9	0.9	0.8
8009	Shell	Duct Sealing/Insulation - Poor Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	9%	474	0.37	20	$450	100%	40%	DUCT-9	49%	96%	1.0	1.0	1.2
8010	Shell	Duct Sealing/Insulation - Poor Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	7%	373	0.27	20	$450	100%	100%	DUCT-10	49%	96%	1.0	1.0	0.9
8011	Shell	Duct Sealing/Insulation - Poor Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	7%	373	0.27	20	$450	100%	40%	DUCT-11	49%	96%	1.0	1.0	0.9
8012	Shell	Duct Sealing/Insulation - Poor Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	7%	373	0.27	20	$450	100%	100%	DUCT-12	49%	96%	1.0	1.0	0.9
8013	Shell	Duct Sealing - Average Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	5%	533	0.13	20	$450	100%	40%	DUCT-13	20%	76%	0.8	0.8	1.1
8014	Shell	Duct Sealing - Average Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	5%	533	0.13	20	$450	100%	100%	DUCT-14	20%	76%	0.8	0.8	1.1
8015	Shell	Duct Sealing - Average Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	5%	533	0.13	20	$450	100%	40%	DUCT-15	20%	76%	0.8	0.8	1.1
8016	Shell	Duct Sealing - Average Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	5%	533	0.13	20	$450	100%	100%	DUCT-16	20%	76%	0.8	0.8	1.1
8017	Shell	Duct Sealing - Inadequate Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	7%	744	0.11	20	$450	100%	40%	DUCT-17	20%	90%	0.9	0.9	1.4
8018	Shell	Duct Sealing - Inadequate Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	7%	744	0.11	20	$450	100%	100%	DUCT-18	20%	90%	0.9	0.9	1.4
8019	Shell	Duct Sealing - Inadequate Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	7%	744	0.11	20	$450	100%	40%	DUCT-19	20%	90%	0.9	0.9	1.4
8020	Shell	Duct Sealing - Inadequate Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	7%	744	0.11	20	$450	100%	100%	DUCT-20	20%	90%	0.9	0.9	1.4
8021	Shell	Duct Sealing/Insulation - Poor Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	9%	960	0.37	20	$450	100%	40%	DUCT-21	20%	96%	1.0	1.0	2.1
8022	Shell	Duct Sealing/Insulation - Poor Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	7%	755	0.27	20	$450	100%	100%	DUCT-22	20%	96%	1.0	1.0	1.6

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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	TRC Score
8023	Shell	Duct Sealing/Insulation - Poor Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	7%	755	0.27	20	$450	100%	40%	DUCT-23	20%	96%	1.0	1.0	1.6
8024	Shell	Duct Sealing/Insulation - Poor Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	7%	755	0.27	20	$450	100%	100%	DUCT-24	20%	96%	1.0	1.0	1.6
8025	Shell	Duct Sealing - Average Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	5%	99	0.13	20	$450	100%	40%	DUCT-25	19%	76%	0.8	0.8	0.3
8026	Shell	Duct Sealing - Average Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	5%	99	0.13	20	$450	100%	100%	DUCT-26	19%	76%	0.8	0.8	0.3
8027	Shell	Duct Sealing - Average Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	5%	99	0.13	20	$450	100%	40%	DUCT-27	19%	76%	0.8	0.8	0.3
8028	Shell	Duct Sealing - Average Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	5%	99	0.13	20	$450	100%	100%	DUCT-28	19%	76%	0.8	0.8	0.3
8029	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	7%	138	0.11	20	$450	100%	40%	DUCT-29	19%	90%	0.9	0.9	0.4
8030	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	7%	138	0.11	20	$450	100%	100%	DUCT-30	19%	90%	0.9	0.9	0.4
8031	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	7%	138	0.11	20	$450	100%	40%	DUCT-31	19%	90%	0.9	0.9	0.4
8032	Shell	Duct Sealing - Inadequate Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	7%	138	0.11	20	$450	100%	100%	DUCT-32	19%	90%	0.9	0.9	0.4
8033	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	9%	178	0.37	20	$450	100%	40%	DUCT-33	19%	96%	1.0	1.0	0.7
8034	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	7%	140	0.27	20	$450	100%	100%	DUCT-34	19%	96%	1.0	1.0	0.5
8035	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	7%	140	0.27	20	$450	100%	40%	DUCT-35	19%	96%	1.0	1.0	0.5
8036	Shell	Duct Sealing/Insulation - Poor Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	7%	140	0.27	20	$450	100%	100%	DUCT-36	19%	96%	1.0	1.0	0.5
8037	Shell	Wall Insulation - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	9%	509	0.00	20	$2,254	100%	40%	WALL-1	49%	80%	0.9	0.8	0.2
8038	Shell	Wall Insulation - Heat pump	Low Income	SF	LI	Retrofit	5,508	5%	295	0.00	20	$2,254	100%	100%	WALL-2	49%	80%	0.9	0.8	0.1
8039	Shell	Wall Insulation - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	5%	295	0.00	20	$2,254	100%	40%	WALL-3	49%	80%	0.9	0.8	0.1
8040	Shell	Wall Insulation - Heat pump	Low Income	MH	LI	Retrofit	5,508	5%	295	0.00	20	$2,254	100%	100%	WALL-4	49%	80%	0.9	0.8	0.1
8041	Shell	Wall Insulation - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	16%	559	0.00	20	$969	100%	40%	WALL-5	47%	80%	0.9	0.8	0.5
8042	Shell	Wall Insulation - Heat pump	Low Income	MF	LI	Retrofit	3,396	11%	385	0.00	20	$969	100%	100%	WALL-6	47%	80%	0.9	0.8	0.3
8043	Shell	Wall Insulation - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	8%	899	0.00	20	$2,254	100%	40%	WALL-7	20%	80%	0.9	0.8	0.3
8044	Shell	Wall Insulation - Electric furnace	Low Income	SF	LI	Retrofit	11,159	5%	521	0.00	20	$2,254	100%	100%	WALL-8	20%	80%	0.9	0.8	0.2
8045	Shell	Wall Insulation - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	5%	521	0.00	20	$2,254	100%	40%	WALL-9	20%	80%	0.9	0.8	0.2
8046	Shell	Wall Insulation - Electric furnace	Low Income	MH	LI	Retrofit	11,159	5%	521	0.00	20	$2,254	100%	100%	WALL-10	20%	80%	0.9	0.8	0.2
8047	Shell	Wall Insulation - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	12%	420	0.00	20	$969	100%	40%	WALL-11	47%	80%	0.9	0.8	0.3
8048	Shell	Wall Insulation - Electric furnace	Low Income	MF	LI	Retrofit	3,396	8%	288	0.00	20	$969	100%	100%	WALL-12	47%	80%	0.9	0.8	0.2
8049	Shell	Wall Insulation - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	3%	62	0.00	20	$2,254	100%	40%	WALL-13	19%	80%	0.9	0.8	0.1
8050	Shell	Wall Insulation - Gas Heating	Low Income	SF	LI	Retrofit	2,073	2%	39	0.00	20	$2,254	100%	100%	WALL-14	19%	80%	0.9	0.8	0.1
8051	Shell	Wall Insulation - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	2%	39	0.00	20	$2,254	100%	40%	WALL-15	19%	80%	0.9	0.8	0.1
8052	Shell	Wall Insulation - Gas Heating	Low Income	MH	LI	Retrofit	2,073	2%	39	0.00	20	$2,254	100%	100%	WALL-16	19%	80%	0.9	0.8	0.1
8053	Shell	Wall Insulation - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	8%	61	0.00	20	$969	100%	40%	WALL-17	15%	80%	0.9	0.8	0.3
8054	Shell	Wall Insulation - Gas Heating	Low Income	MF	LI	Retrofit	774	5%	39	0.00	20	$969	100%	100%	WALL-18	15%	80%	0.9	0.8	0.2
8055	Shell	Air Sealing Average Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	11%	618	0.18	20	$200	100%	40%	AIR-1	49%	76%	0.8	0.8	2.9
8056	Shell	Air Sealing Average Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	11%	618	0.18	20	$200	100%	100%	AIR-2	49%	76%	0.8	0.8	2.9
8057	Shell	Air Sealing Average Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	11%	618	0.18	20	$200	100%	40%	AIR-3	49%	76%	0.8	0.8	2.9

Appendix D: 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	TRC Score
8058	Shell	Air Sealing Average Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	11%	618	0.18	20	$200	100%	100%	AIR-4	49%	76%	0.8	0.8	2.9
8059	Shell	Air Sealing Average Sealing - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	17%	346	0.09	20	$200	100%	40%	AIR-5	36%	76%	0.8	0.8	1.6
8060	Shell	Air Sealing Average Sealing - Heat pump	Low Income	MF	LI	Retrofit	2,018	17%	346	0.09	20	$200	100%	100%	AIR-6	36%	76%	0.8	0.8	1.6
8061	Shell	Air Sealing Inadequate Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	13%	728	0.25	20	$200	100%	40%	AIR-7	49%	90%	0.9	0.9	3.5
8062	Shell	Air Sealing Inadequate Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	13%	728	0.25	20	$200	100%	100%	AIR-8	49%	90%	0.9	0.9	3.5
8063	Shell	Air Sealing Inadequate Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	13%	728	0.25	20	$200	100%	40%	AIR-9	49%	90%	0.9	0.9	3.5
8064	Shell	Air Sealing Inadequate Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	13%	728	0.25	20	$200	100%	100%	AIR-10	49%	90%	0.9	0.9	3.5
8065	Shell	Air Sealing Inadequate Sealing - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	20%	407	0.13	20	$200	100%	40%	AIR-11	36%	90%	0.9	0.9	1.9
8066	Shell	Air Sealing Inadequate Sealing - Heat pump	Low Income	MF	LI	Retrofit	2,018	20%	407	0.13	20	$200	100%	100%	AIR-12	36%	90%	0.9	0.9	1.9
8067	Shell	Air Sealing Poor Sealing - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	19%	1,025	0.39	20	$200	100%	40%	AIR-13	49%	96%	1.0	1.0	5.0
8068	Shell	Air Sealing Poor Sealing - Heat pump	Low Income	SF	LI	Retrofit	5,508	19%	1,025	0.39	20	$200	100%	100%	AIR-14	49%	96%	1.0	1.0	5.0
8069	Shell	Air Sealing Poor Sealing - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	19%	1,025	0.39	20	$200	100%	40%	AIR-15	49%	96%	1.0	1.0	5.0
8070	Shell	Air Sealing Poor Sealing - Heat pump	Low Income	MH	LI	Retrofit	5,508	19%	1,025	0.39	20	$200	100%	100%	AIR-16	49%	96%	1.0	1.0	5.0
8071	Shell	Air Sealing Poor Sealing - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	28%	573	0.19	20	$200	100%	40%	AIR-17	36%	96%	1.0	1.0	2.7
8072	Shell	Air Sealing Poor Sealing - Heat pump	Low Income	MF	LI	Retrofit	2,018	28%	573	0.19	20	$200	100%	100%	AIR-18	36%	96%	1.0	1.0	2.7
8073	Shell	Air Sealing Average Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	14%	1,527	0.21	20	$200	100%	40%	AIR-19	20%	76%	0.8	0.8	6.6
8074	Shell	Air Sealing Average Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	14%	1,527	0.21	20	$200	100%	100%	AIR-20	20%	76%	0.8	0.8	6.6
8075	Shell	Air Sealing Average Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	14%	1,527	0.21	20	$200	100%	40%	AIR-21	20%	76%	0.8	0.8	6.6
8076	Shell	Air Sealing Average Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	14%	1,527	0.21	20	$200	100%	100%	AIR-22	20%	76%	0.8	0.8	6.6
8077	Shell	Air Sealing Average Sealing - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	24%	824	0.11	20	$200	100%	40%	AIR-23	47%	76%	0.8	0.8	3.6
8078	Shell	Air Sealing Average Sealing - Electric furnace	Low Income	MF	LI	Retrofit	3,396	24%	824	0.11	20	$200	100%	100%	AIR-24	47%	76%	0.8	0.8	3.6
8079	Shell	Air Sealing Inadequate Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	16%	1,763	0.29	20	$200	100%	40%	AIR-25	20%	90%	0.9	0.9	7.8
8080	Shell	Air Sealing Inadequate Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	16%	1,763	0.29	20	$200	100%	100%	AIR-26	20%	90%	0.9	0.9	7.8
8081	Shell	Air Sealing Inadequate Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	16%	1,763	0.29	20	$200	100%	40%	AIR-27	20%	90%	0.9	0.9	7.8
8082	Shell	Air Sealing Inadequate Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	16%	1,763	0.29	20	$200	100%	100%	AIR-28	20%	90%	0.9	0.9	7.8
8083	Shell	Air Sealing Inadequate Sealing - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	28%	952	0.15	20	$200	100%	40%	AIR-29	47%	90%	0.9	0.9	4.2
8084	Shell	Air Sealing Inadequate Sealing - Electric furnace	Low Income	MF	LI	Retrofit	3,396	28%	952	0.15	20	$200	100%	100%	AIR-30	47%	90%	0.9	0.9	4.2
8085	Shell	Air Sealing Poor Sealing - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	20%	2,206	0.38	20	$200	100%	40%	AIR-31	20%	96%	1.0	1.0	9.7
8086	Shell	Air Sealing Poor Sealing - Electric furnace	Low Income	SF	LI	Retrofit	11,159	20%	2,206	0.38	20	$200	100%	100%	AIR-32	20%	96%	1.0	1.0	9.7
8087	Shell	Air Sealing Poor Sealing - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	20%	2,206	0.38	20	$200	100%	40%	AIR-33	20%	96%	1.0	1.0	9.7
8088	Shell	Air Sealing Poor Sealing - Electric furnace	Low Income	MH	LI	Retrofit	11,159	20%	2,206	0.38	20	$200	100%	100%	AIR-34	20%	96%	1.0	1.0	9.7
8089	Shell	Air Sealing Poor Sealing - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	35%	1,192	0.19	20	$200	100%	40%	AIR-35	47%	96%	1.0	1.0	5.2

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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	TRC Score
8090	Shell	Air Sealing Poor Sealing - Electric furnace	Low Income	MF	LI	Retrofit	3,396	35%	1,192	0.19	20	$200	100%	100%	AIR-36	47%	96%	1.0	1.0	5.2
8091	Shell	Air Sealing - Average Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	7%	146	0.35	20	$200	100%	40%	AIR-37	19%	76%	0.8	0.8	1.4
8092	Shell	Air Sealing - Average Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	7%	146	0.35	20	$200	100%	100%	AIR-38	19%	76%	0.8	0.8	1.4
8093	Shell	Air Sealing - Average Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	7%	146	0.35	20	$200	100%	40%	AIR-39	19%	76%	0.8	0.8	1.4
8094	Shell	Air Sealing - Average Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	7%	146	0.35	20	$200	100%	100%	AIR-40	19%	76%	0.8	0.8	1.4
8095	Shell	Air Sealing - Average Sealing - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	10%	76	0.18	20	$200	100%	40%	AIR-41	15%	76%	0.8	0.8	0.7
8096	Shell	Air Sealing - Average Sealing - Gas Heating	Low Income	MF	LI	Retrofit	774	10%	76	0.18	20	$200	100%	100%	AIR-42	15%	76%	0.8	0.8	0.7
8097	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	13%	261	0.39	20	$200	100%	40%	AIR-43	19%	90%	0.9	0.9	2.0
8098	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	13%	261	0.39	20	$200	100%	100%	AIR-44	19%	90%	0.9	0.9	2.0
8099	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	13%	261	0.39	20	$200	100%	40%	AIR-45	19%	90%	0.9	0.9	2.0
8100	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	13%	261	0.39	20	$200	100%	100%	AIR-46	19%	90%	0.9	0.9	2.0
8101	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	18%	136	0.20	20	$200	100%	40%	AIR-47	15%	90%	0.9	0.9	1.0
8102	Shell	Air Sealing - Inadequate Sealing - Gas Heating	Low Income	MF	LI	Retrofit	774	18%	136	0.20	20	$200	100%	100%	AIR-48	15%	90%	0.9	0.9	1.0
8103	Shell	Air Sealing - Poor Sealing - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	9%	181	0.31	20	$200	100%	40%	AIR-49	19%	96%	1.0	1.0	1.5
8104	Shell	Air Sealing - Poor Sealing - Gas Heating	Low Income	SF	LI	Retrofit	2,073	9%	181	0.31	20	$200	100%	100%	AIR-50	19%	96%	1.0	1.0	1.5
8105	Shell	Air Sealing - Poor Sealing - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	9%	181	0.31	20	$200	100%	40%	AIR-51	19%	96%	1.0	1.0	1.5
8106	Shell	Air Sealing - Poor Sealing - Gas Heating	Low Income	MH	LI	Retrofit	2,073	9%	181	0.31	20	$200	100%	100%	AIR-52	19%	96%	1.0	1.0	1.5
8107	Shell	Air Sealing - Poor Sealing - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	12%	94	0.16	20	$200	100%	40%	AIR-53	15%	96%	1.0	1.0	0.7
8108	Shell	Air Sealing - Poor Sealing - Gas Heating	Low Income	MF	LI	Retrofit	774	12%	94	0.16	20	$200	100%	100%	AIR-54	15%	96%	1.0	1.0	0.7
8109	Shell	Attic Insulation - Average Insulation - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	2%	118	0.08	20	$898	100%	40%	ATTIC-1	49%	73%	0.8	0.8	0.1
8110	Shell	Attic Insulation - Average Insulation - Heat pump	Low Income	SF	LI	Retrofit	5,508	2%	118	0.08	20	$898	100%	100%	ATTIC-2	49%	73%	0.8	0.8	0.1
8111	Shell	Attic Insulation - Inadequate Insulation - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	4%	222	0.14	20	$1,597	100%	40%	ATTIC-3	49%	73%	0.8	0.8	0.2
8112	Shell	Attic Insulation - Inadequate Insulation - Heat pump	Low Income	SF	LI	Retrofit	5,508	4%	222	0.14	20	$1,597	100%	100%	ATTIC-4	49%	73%	0.8	0.8	0.2
8113	Shell	Attic Insulation - Poor Insulation - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	18%	1,017	0.38	20	$1,597	100%	40%	ATTIC-5	49%	80%	0.9	0.8	0.6
8114	Shell	Attic Insulation - Poor Insulation - Heat pump	Low Income	SF	LI	Retrofit	5,508	18%	1,006	0.42	20	$1,597	100%	100%	ATTIC-6	49%	80%	0.9	0.8	0.6
8115	Shell	Attic Insulation - Average Insulation - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	2%	239	0.08	20	$898	100%	40%	ATTIC-7	20%	73%	0.8	0.8	0.3
8116	Shell	Attic Insulation - Average Insulation - Electric furnace	Low Income	SF	LI	Retrofit	11,159	2%	239	0.08	20	$898	100%	100%	ATTIC-8	20%	73%	0.8	0.8	0.3
8117	Shell	Attic Insulation - Inadequate Insulation - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	4%	450	0.14	20	$1,597	100%	40%	ATTIC-9	20%	73%	0.8	0.8	0.3
8118	Shell	Attic Insulation - Inadequate Insulation - Electric furnace	Low Income	SF	LI	Retrofit	11,159	4%	450	0.14	20	$1,597	100%	100%	ATTIC-10	20%	73%	0.8	0.8	0.3
8119	Shell	Attic Insulation - Poor Insulation - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	18%	2,060	0.38	20	$1,597	100%	40%	ATTIC-11	20%	80%	0.9	0.8	1.1
8120	Shell	Attic Insulation - Poor Insulation - Electric furnace	Low Income	SF	LI	Retrofit	11,159	18%	2,038	0.42	20	$1,597	100%	100%	ATTIC-12	20%	80%	0.9	0.8	1.1
8121	Shell	Attic Insulation - Average Insulation - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	2%	44	0.08	20	$898	100%	40%	ATTIC-13	19%	73%	0.8	0.8	0.1

Appendix D: 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	TRC Score
8122	Shell	Attic Insulation - Average Insulation - Gas Heating	Low Income	SF	LI	Retrofit	2,073	2%	44	0.08	20	$898	100%	100%	ATTIC-14	19%	73%	0.8	0.8	0.1
8123	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	4%	84	0.14	20	$1,597	100%	40%	ATTIC-15	19%	73%	0.8	0.8	0.1
8124	Shell	Attic Insulation - Inadequate Insulation - Gas Heating	Low Income	SF	LI	Retrofit	2,073	4%	84	0.14	20	$1,597	100%	100%	ATTIC-16	19%	73%	0.8	0.8	0.1
8125	Shell	Attic Insulation - Poor Insulation - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	18%	383	0.38	20	$1,597	100%	40%	ATTIC-17	19%	80%	0.9	0.8	0.3
8126	Shell	Attic Insulation - Poor Insulation - Gas Heating	Low Income	SF	LI	Retrofit	2,073	18%	379	0.42	20	$1,597	100%	100%	ATTIC-18	19%	80%	0.9	0.8	0.3
8127	Shell	Radiant Barrier - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	15%	831	0.14	25	$720	100%	40%	RB-1	49%	75%	0.8	0.8	1.2
8128	Shell	Radiant Barrier - Heat pump	Low Income	SF	LI	Retrofit	5,508	15%	831	0.14	25	$720	100%	100%	RB-2	49%	75%	0.8	0.8	1.2
8129	Shell	Radiant Barrier - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	8%	916	0.14	25	$720	100%	40%	RB-3	20%	75%	0.8	0.8	1.3
8130	Shell	Radiant Barrier - Electric furnace	Low Income	SF	LI	Retrofit	11,159	8%	916	0.14	25	$720	100%	100%	RB-4	20%	75%	0.8	0.8	1.3
8131	Shell	Radiant Barrier - Gas furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	15%	313	0.14	25	$720	100%	40%	RB-5	19%	75%	0.8	0.8	0.5
8132	Shell	Radiant Barrier - Gas furnace	Low Income	SF	LI	Retrofit	2,073	15%	313	0.14	25	$720	100%	100%	RB-6	19%	75%	0.8	0.8	0.5
8133	Shell	Cool Roof - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	1,775	1%	22	0.13	20	$509	100%	40%	COOL-1	23%	75%	0.8	0.8	0.1
8134	Shell	Cool Roof - Heat pump	Low Income	SF	LI	Retrofit	1,775	1%	22	0.13	20	$509	100%	100%	COOL-2	23%	75%	0.8	0.8	0.1
8135	Shell	Cool Roof - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	1,775	1%	22	0.13	20	$509	100%	40%	COOL-3	23%	75%	0.8	0.8	0.1
8136	Shell	Cool Roof - Electric furnace	Low Income	SF	LI	Retrofit	1,775	1%	22	0.13	20	$509	100%	100%	COOL-4	23%	75%	0.8	0.8	0.1
8137	Shell	Cool Roof - Gas furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	1,775	1%	22	0.13	20	$509	100%	40%	COOL-5	23%	75%	0.8	0.8	0.1
8138	Shell	Cool Roof - Gas furnace	Low Income	SF	LI	Retrofit	1,775	1%	22	0.13	20	$509	100%	100%	COOL-6	23%	75%	0.8	0.8	0.1
8139	Shell	ENERGY STAR Windows - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	6%	340	0.25	20	$11,300	100%	40%	WINDOW-1	49%	70%	0.8	0.8	0.0
8140	Shell	ENERGY STAR Windows - Heat pump	Low Income	SF	LI	Retrofit	5,508	6%	340	0.25	20	$11,300	100%	100%	WINDOW-2	49%	70%	0.8	0.8	0.0
8141	Shell	ENERGY STAR Windows - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	6%	340	0.25	20	$11,300	100%	40%	WINDOW-3	49%	70%	0.8	0.8	0.0
8142	Shell	ENERGY STAR Windows - Heat pump	Low Income	MH	LI	Retrofit	5,508	6%	340	0.25	20	$11,300	100%	100%	WINDOW-4	49%	70%	0.8	0.8	0.0
8143	Shell	ENERGY STAR Windows - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	9%	184	0.12	20	$7,232	100%	40%	WINDOW-5	36%	70%	0.8	0.7	0.0
8144	Shell	ENERGY STAR Windows - Heat pump	Low Income	MF	LI	Retrofit	2,018	9%	184	0.12	20	$7,232	100%	100%	WINDOW-6	36%	70%	0.8	0.8	0.0
8145	Shell	ENERGY STAR Windows - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	5%	573	0.25	20	$11,300	100%	40%	WINDOW-7	20%	70%	0.8	0.8	0.1
8146	Shell	ENERGY STAR Windows - Electric furnace	Low Income	SF	LI	Retrofit	11,159	5%	573	0.25	20	$11,300	100%	100%	WINDOW-8	20%	70%	0.8	0.8	0.1
8147	Shell	ENERGY STAR Windows - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	5%	573	0.25	20	$11,300	100%	40%	WINDOW-9	20%	70%	0.8	0.8	0.1
8148	Shell	ENERGY STAR Windows - Electric furnace	Low Income	MH	LI	Retrofit	11,159	5%	573	0.25	20	$11,300	100%	100%	WINDOW-10	20%	70%	0.8	0.8	0.1
8149	Shell	ENERGY STAR Windows - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	9%	319	0.12	20	$7,232	100%	40%	WINDOW-11	47%	70%	0.8	0.7	0.0
8150	Shell	ENERGY STAR Windows - Electric furnace	Low Income	MF	LI	Retrofit	3,396	9%	319	0.12	20	$7,232	100%	100%	WINDOW-12	47%	70%	0.8	0.8	0.0
8151	Shell	ENERGY STAR Windows - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	6%	117	0.25	20	$11,300	100%	40%	WINDOW-13	19%	70%	0.8	0.8	0.0
8152	Shell	ENERGY STAR Windows - Gas Heating	Low Income	SF	LI	Retrofit	2,073	6%	117	0.25	20	$11,300	100%	100%	WINDOW-14	19%	70%	0.8	0.8	0.0
8153	Shell	ENERGY STAR Windows - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	6%	117	0.25	20	$11,300	100%	40%	WINDOW-15	19%	70%	0.8	0.8	0.0
8154	Shell	ENERGY STAR Windows - Gas Heating	Low Income	MH	LI	Retrofit	2,073	6%	117	0.25	20	$11,300	100%	100%	WINDOW-16	19%	70%	0.8	0.8	0.0
8155	Shell	ENERGY STAR Windows - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	8%	59	0.12	20	$7,232	100%	40%	WINDOW-17	15%	70%	0.8	0.7	0.0
8156	Shell	ENERGY STAR Windows - Gas Heating	Low Income	MF	LI	Retrofit	774	8%	59	0.12	20	$7,232	100%	100%	WINDOW-18	15%	70%	0.8	0.8	0.0

Appendix D: 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	TRC Score
8157	Shell	Basement Sidewall Insulation - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	8%	438	0.97	20	$696	100%	40%	BASEMENT-1	49%	80%	0.9	0.8	1.2
8158	Shell	Basement Sidewall Insulation - Heat pump	Low Income	SF	LI	Retrofit	5,508	5%	254	0.56	20	$696	100%	100%	BASEMENT-2	49%	80%	0.9	0.8	0.7
8159	Shell	Basement Sidewall Insulation - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	5%	502	0.29	20	$696	100%	40%	BASEMENT-3	20%	80%	0.9	0.8	0.8
8160	Shell	Basement Sidewall Insulation - Electric furnace	Low Income	SF	LI	Retrofit	11,159	3%	291	0.17	20	$696	100%	100%	BASEMENT-4	20%	80%	0.9	0.8	0.5
8161	Shell	Basement Sidewall Insulation - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	-2%	-42	-0.05	20	$696	100%	40%	BASEMENT-5	19%	80%	0.9	0.8	0.2
8162	Shell	Basement Sidewall Insulation - Gas Heating	Low Income	SF	LI	Retrofit	2,073	-1%	-26	-0.03	20	$696	100%	100%	BASEMENT-6	19%	80%	0.9	0.8	0.1
8163	Shell	Floor Insulation Above Crawlspace - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	22%	1,190	1.30	25	$772	100%	40%	CRAWL-1	49%	80%	0.9	0.8	2.4
8164	Shell	Floor Insulation Above Crawlspace - Heat pump	Low Income	SF	LI	Retrofit	5,508	13%	734	0.80	25	$476	100%	100%	CRAWL-2	49%	80%	0.9	0.8	2.4
8165	Shell	Floor Insulation Above Crawlspace - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	13%	734	0.80	25	$476	100%	40%	CRAWL-3	49%	80%	0.9	0.8	2.4
8166	Shell	Floor Insulation Above Crawlspace - Heat pump	Low Income	MH	LI	Retrofit	5,508	13%	734	0.80	25	$476	100%	100%	CRAWL-4	49%	80%	0.9	0.8	2.4
8167	Shell	Floor Insulation Above Crawlspace - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	23%	2,604	0.75	25	$772	100%	40%	CRAWL-5	20%	80%	0.9	0.8	3.7
8168	Shell	Floor Insulation Above Crawlspace - Electric furnace	Low Income	SF	LI	Retrofit	11,159	14%	1,606	0.46	25	$476	100%	100%	CRAWL-6	20%	80%	0.9	0.8	3.7
8169	Shell	Floor Insulation Above Crawlspace - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	14%	1,606	0.46	25	$476	100%	40%	CRAWL-7	20%	80%	0.9	0.8	3.7
8170	Shell	Floor Insulation Above Crawlspace - Electric furnace	Low Income	MH	LI	Retrofit	11,159	14%	1,606	0.46	25	$476	100%	100%	CRAWL-8	20%	80%	0.9	0.8	3.7
8171	Shell	Floor Insulation Above Crawlspace - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	11%	221	0.12	25	$772	100%	40%	CRAWL-9	19%	80%	0.9	0.8	0.9
8172	Shell	Floor Insulation Above Crawlspace - Gas Heating	Low Income	SF	LI	Retrofit	2,073	7%	136	0.07	25	$476	100%	100%	CRAWL-10	19%	80%	0.9	0.8	0.9
8173	Shell	Floor Insulation Above Crawlspace - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	7%	136	0.07	25	$476	100%	40%	CRAWL-11	19%	80%	0.9	0.8	0.9
8174	Shell	Floor Insulation Above Crawlspace - Gas Heating	Low Income	MH	LI	Retrofit	2,073	7%	136	0.07	25	$476	100%	100%	CRAWL-12	19%	80%	0.9	0.8	0.9
8175	Shell	ENERGY STAR Door - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	5%	271	0.02	20	$1,275	100%	40%	DOOR-1	49%	75%	0.8	0.8	0.2
8176	Shell	ENERGY STAR Door - Heat pump	Low Income	SF	LI	Retrofit	5,508	5%	271	0.02	20	$1,275	100%	100%	DOOR-2	49%	75%	0.8	0.8	0.2
8177	Shell	ENERGY STAR Door - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	5%	271	0.02	20	$1,275	100%	40%	DOOR-3	49%	75%	0.8	0.8	0.2
8178	Shell	ENERGY STAR Door - Heat pump	Low Income	MH	LI	Retrofit	5,508	5%	271	0.02	20	$1,275	100%	100%	DOOR-4	49%	75%	0.8	0.8	0.2
8179	Shell	ENERGY STAR Door - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	8%	151	0.01	20	$1,275	100%	40%	DOOR-5	36%	75%	0.8	0.8	0.1
8180	Shell	ENERGY STAR Door - Heat pump	Low Income	MF	LI	Retrofit	2,018	8%	151	0.01	20	$1,275	100%	100%	DOOR-6	36%	75%	0.8	0.8	0.1
8181	Shell	ENERGY STAR Door - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	2%	184	0.01	20	$1,275	100%	40%	DOOR-7	20%	75%	0.8	0.8	0.1
8182	Shell	ENERGY STAR Door - Electric furnace	Low Income	SF	LI	Retrofit	11,159	2%	184	0.01	20	$1,275	100%	100%	DOOR-8	20%	75%	0.8	0.8	0.1
8183	Shell	ENERGY STAR Door - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	2%	184	0.01	20	$1,275	100%	40%	DOOR-9	20%	75%	0.8	0.8	0.1
8184	Shell	ENERGY STAR Door - Electric furnace	Low Income	MH	LI	Retrofit	11,159	2%	184	0.01	20	$1,275	100%	100%	DOOR-10	20%	75%	0.8	0.8	0.1
8185	Shell	ENERGY STAR Door - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	3%	106	0.01	20	$1,275	100%	40%	DOOR-11	47%	75%	0.8	0.8	0.1
8186	Shell	ENERGY STAR Door - Electric furnace	Low Income	MF	LI	Retrofit	3,396	3%	106	0.01	20	$1,275	100%	100%	DOOR-12	47%	75%	0.8	0.8	0.1
8187	Shell	ENERGY STAR Door - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	1%	18	0.02	20	$1,275	100%	40%	DOOR-13	19%	75%	0.8	0.8	0.0
8188	Shell	ENERGY STAR Door - Gas Heating	Low Income	SF	LI	Retrofit	2,073	1%	18	0.02	20	$1,275	100%	100%	DOOR-14	19%	75%	0.8	0.8	0.0
8189	Shell	ENERGY STAR Door - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	1%	18	0.02	20	$1,275	100%	40%	DOOR-15	19%	75%	0.8	0.8	0.0
8190	Shell	ENERGY STAR Door - Gas Heating	Low Income	MH	LI	Retrofit	2,073	1%	18	0.02	20	$1,275	100%	100%	DOOR-16	19%	75%	0.8	0.8	0.0

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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	TRC Score
8191	Shell	ENERGY STAR Door - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	1%	9	0.01	20	$1,275	100%	40%	DOOR-17	15%	75%	0.8	0.8	0.0
8192	Shell	ENERGY STAR Door - Gas Heating	Low Income	MF	LI	Retrofit	774	1%	9	0.01	20	$1,275	100%	100%	DOOR-18	15%	75%	0.8	0.8	0.0
8193	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	16%	854	0.35	7	$6,780	100%	40%	SWC-1	49%	70%	0.8	0.8	0.1
8194	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Low Income	SF	LI	Retrofit	5,508	16%	854	0.35	7	$6,780	100%	100%	SWC-2	49%	70%	0.8	0.8	0.1
8195	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	16%	854	0.35	7	$6,780	100%	40%	SWC-3	49%	70%	0.8	0.8	0.1
8196	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Low Income	MH	LI	Retrofit	5,508	16%	854	0.35	7	$6,780	100%	100%	SWC-4	49%	70%	0.8	0.8	0.1
8197	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	16%	313	0.23	7	$4,339	100%	40%	SWC-5	36%	70%	0.8	0.7	0.0
8198	Shell	Smart Window Coverings - Film/Transformer - Heat pump	Low Income	MF	LI	Retrofit	2,018	16%	313	0.23	7	$4,339	100%	100%	SWC-6	36%	70%	0.8	0.8	0.0
8199	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	16%	1,730	0.35	7	$6,780	100%	40%	SWC-7	20%	70%	0.8	0.8	0.1
8200	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Low Income	SF	LI	Retrofit	11,159	16%	1,730	0.35	7	$6,780	100%	100%	SWC-8	20%	70%	0.8	0.8	0.1
8201	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	16%	1,730	0.35	7	$6,780	100%	40%	SWC-9	20%	70%	0.8	0.8	0.1
8202	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Low Income	MH	LI	Retrofit	11,159	16%	1,730	0.35	7	$6,780	100%	100%	SWC-10	20%	70%	0.8	0.8	0.1
8203	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	16%	526	0.23	7	$4,339	100%	40%	SWC-11	47%	70%	0.8	0.7	0.1
8204	Shell	Smart Window Coverings - Film/Transformer - Electric furnace	Low Income	MF	LI	Retrofit	3,396	16%	526	0.23	7	$4,339	100%	100%	SWC-12	47%	70%	0.8	0.8	0.1
8205	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	16%	321	0.35	7	$6,780	100%	40%	SWC-13	19%	70%	0.8	0.8	0.0
8206	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Low Income	SF	LI	Retrofit	2,073	16%	321	0.35	7	$6,780	100%	100%	SWC-14	19%	70%	0.8	0.8	0.0
8207	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	16%	321	0.35	7	$6,780	100%	40%	SWC-15	19%	70%	0.8	0.8	0.0
8208	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Low Income	MH	LI	Retrofit	2,073	16%	321	0.35	7	$6,780	100%	100%	SWC-16	19%	70%	0.8	0.8	0.0
8209	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	16%	120	0.23	7	$4,339	100%	40%	SWC-17	15%	70%	0.8	0.7	0.0
8210	Shell	Smart Window Coverings - Film/Transformer - Gas Heating	Low Income	MF	LI	Retrofit	774	16%	120	0.23	7	$4,339	100%	100%	SWC-18	15%	70%	0.8	0.8	0.0
8211	Shell	Thin Triple Windows - electric furnace base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	7%	782	0.27	40	$6,350	100%	40%	WINDOW-1	20%	70%	0.8	0.8	0.2
8212	Shell	Thin Triple Windows - electric furnace base	Low Income	SF	LI	Retrofit	11,159	6%	626	0.22	40	$5,080	100%	100%	WINDOW-2	20%	70%	0.8	0.8	0.2
8213	Shell	Thin Triple Windows - electric furnace base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	6%	626	0.22	40	$5,080	100%	40%	WINDOW-3	20%	70%	0.8	0.8	0.2
8214	Shell	Thin Triple Windows - electric furnace base	Low Income	MH	LI	Retrofit	11,159	6%	626	0.22	40	$5,080	100%	100%	WINDOW-4	20%	70%	0.8	0.8	0.2
8215	Shell	Thin Triple Windows - electric furnace base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	17%	576	0.16	40	$3,810	100%	40%	WINDOW-5	47%	70%	0.8	0.7	0.2
8216	Shell	Thin Triple Windows - electric furnace base	Low Income	MF	LI	Retrofit	3,396	11%	384	0.11	40	$2,540	100%	100%	WINDOW-6	47%	70%	0.8	0.8	0.2
8217	Shell	Thin Triple Windows - heat pump base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	14%	746	0.28	40	$6,350	100%	40%	WINDOW-7	49%	70%	0.8	0.8	0.2
8218	Shell	Thin Triple Windows - heat pump base	Low Income	SF	LI	Retrofit	5,508	11%	597	0.22	40	$5,080	100%	100%	WINDOW-8	49%	70%	0.8	0.8	0.2
8219	Shell	Thin Triple Windows - heat pump base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	11%	597	0.22	40	$5,080	100%	40%	WINDOW-9	49%	70%	0.8	0.8	0.2
8220	Shell	Thin Triple Windows - heat pump base	Low Income	MH	LI	Retrofit	5,508	11%	597	0.22	40	$5,080	100%	100%	WINDOW-1(	49%	70%	0.8	0.8	0.2

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
8221	Shell	Thin Triple Windows - heat pump base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	26%	534	0.17	40	$3,810	100%	40%	WINDOW-1	36%	70%	0.8	0.7	0.2
8222	Shell	Thin Triple Windows - heat pump base	Low Income	MF	LI	Retrofit	2,018	18%	356	0.11	40	$2,540	100%	100%	WINDOW-1	36%	70%	0.8	0.8	0.2
8223	Shell	Thin Triple Windows - gas heat and electric cool base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	8%	156	0.06	40	$6,350	100%	40%	WINDOW-1	19%	70%	0.8	0.8	0.1
8224	Shell	Thin Triple Windows - gas heat and electric cool base	Low Income	SF	LI	Retrofit	2,073	6%	124	0.04	40	$5,080	100%	100%	WINDOW-1	19%	70%	0.8	0.8	0.1
8225	Shell	Thin Triple Windows - gas heat and electric cool base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	6%	124	0.04	40	$5,080	100%	40%	WINDOW-1	19%	70%	0.8	0.8	0.1
8226	Shell	Thin Triple Windows - gas heat and electric cool base	Low Income	MH	LI	Retrofit	2,073	6%	124	0.04	40	$5,080	100%	100%	WINDOW-1	19%	70%	0.8	0.8	0.1
8227	Shell	Thin Triple Windows - gas heat and electric cool base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	13%	98	0.03	40	$3,810	100%	40%	WINDOW-1	15%	70%	0.8	0.7	0.1
8228	Shell	Thin Triple Windows - gas heat and electric cool base	Low Income	MF	LI	Retrofit	774	8%	65	0.02	40	$2,540	100%	100%	WINDOW-1	15%	70%	0.8	0.8	0.1
8229	Shell	Advanced Walls - electric furnace base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	11,159	10%	1,116	0.23	20	$2,470	100%	40%	WALL-1	20%	80%	0.9	0.8	0.4
8230	Shell	Advanced Walls - electric furnace base	Low Income	SF	LI	Retrofit	11,159	10%	1,116	0.23	20	$2,470	100%	100%	WALL-2	20%	80%	0.9	0.8	0.4
8231	Shell	Advanced Walls - electric furnace base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	11,159	10%	1,116	0.23	20	$2,470	100%	40%	WALL-3	20%	80%	0.9	0.8	0.4
8232	Shell	Advanced Walls - electric furnace base	Low Income	MH	LI	Retrofit	11,159	10%	1,116	0.23	20	$2,470	100%	100%	WALL-4	20%	80%	0.9	0.8	0.4
8233	Shell	Advanced Walls - electric furnace base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,396	10%	340	0.23	20	$1,581	100%	40%	WALL-5	47%	80%	0.9	0.8	0.2
8234	Shell	Advanced Walls - electric furnace base	Low Income	MF	LI	Retrofit	3,396	10%	340	0.23	20	$1,581	100%	100%	WALL-6	47%	80%	0.9	0.8	0.2
8235	Shell	Advanced Walls - heat pump base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	5,508	10%	551	0.23	20	$2,470	100%	40%	WALL-7	49%	80%	0.9	0.8	0.2
8236	Shell	Advanced Walls - heat pump base	Low Income	SF	LI	Retrofit	5,508	10%	551	0.23	20	$2,470	100%	100%	WALL-8	49%	80%	0.9	0.8	0.2
8237	Shell	Advanced Walls - heat pump base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	5,508	10%	551	0.23	20	$2,470	100%	40%	WALL-9	49%	80%	0.9	0.8	0.2
8238	Shell	Advanced Walls - heat pump base	Low Income	MH	LI	Retrofit	5,508	10%	551	0.23	20	$2,470	100%	100%	WALL-10	49%	80%	0.9	0.8	0.2
8239	Shell	Advanced Walls - heat pump base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,018	10%	202	0.23	20	$1,581	100%	40%	WALL-11	36%	80%	0.9	0.8	0.2
8240	Shell	Advanced Walls - heat pump base	Low Income	MF	LI	Retrofit	2,018	10%	202	0.23	20	$1,581	100%	100%	WALL-12	36%	80%	0.9	0.8	0.2
8241	Shell	Advanced Walls - gas heat and electric cool base	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,073	10%	207	0.23	20	$2,470	100%	40%	WALL-13	19%	80%	0.9	0.8	0.3
8242	Shell	Advanced Walls - gas heat and electric cool base	Low Income	SF	LI	Retrofit	2,073	10%	207	0.23	20	$2,470	100%	100%	WALL-14	19%	80%	0.9	0.8	0.3
8243	Shell	Advanced Walls - gas heat and electric cool base	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,073	10%	207	0.23	20	$2,470	100%	40%	WALL-15	19%	80%	0.9	0.8	0.3
8244	Shell	Advanced Walls - gas heat and electric cool base	Low Income	MH	LI	Retrofit	2,073	10%	207	0.23	20	$2,470	100%	100%	WALL-16	19%	80%	0.9	0.8	0.3
8245	Shell	Advanced Walls - gas heat and electric cool base	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	774	10%	77	0.23	20	$1,581	100%	40%	WALL-17	15%	80%	0.9	0.8	0.2
8246	Shell	Advanced Walls - gas heat and electric cool base	Low Income	MF	LI	Retrofit	774	10%	77	0.23	25	$1,581	100%	100%	WALL-18	15%	80%	0.9	0.8	0.3
9001	Water Heating	Pipe Wrap	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	3%	89	0.01	15	$9	100%	40%	WRAP-1	75%	22%	0.7	0.4	6.6
9002	Water Heating	Pipe Wrap	Low Income	SF	LI	Retrofit	2,942	3%	89	0.01	15	$9	100%	100%	WRAP-2	75%	22%	0.7	0.5	6.6
9003	Water Heating	Pipe Wrap	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	3%	89	0.01	15	$9	100%	40%	WRAP-3	75%	22%	0.7	0.4	6.6
9004	Water Heating	Pipe Wrap	Low Income	MH	LI	Retrofit	2,942	3%	89	0.01	15	$9	100%	100%	WRAP-4	75%	22%	0.7	0.5	6.6
9005	Water Heating	Pipe Wrap	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	3%	89	0.01	15	$9	100%	40%	WRAP-5	64%	9%	0.5	0.2	6.6
9006	Water Heating	Pipe Wrap	Low Income	MF	LI	Retrofit	2,942	3%	89	0.01	15	$9	100%	100%	WRAP-6	64%	9%	0.5	0.3	6.6
9007	Water Heating	Bathroom Aerator 1.0 gpm	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	1%	35	0.01	10	$3	100%	40%	BATH-1	188%	49%	0.7	0.6	6.1
9008	Water Heating	Bathroom Aerator 1.0 gpm	Low Income	SF	LI	Retrofit	2,942	1%	35	0.01	10	$3	100%	100%	BATH-2	188%	49%	0.7	0.6	6.1

Appendix D: 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	TRC Score
9009	Water Heating	Bathroom Aerator 1.0 gpm	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	1%	35	0.01	10	$3	100%	40%	BATH-3	188%	49%	0.7	0.6	6.1
9010	Water Heating	Bathroom Aerator 1.0 gpm	Low Income	MH	LI	Retrofit	2,942	1%	35	0.01	10	$3	100%	100%	BATH-4	188%	49%	0.7	0.6	6.1
9011	Water Heating	Bathroom Aerator 1.0 gpm	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	1%	35	0.01	10	$3	100%	40%	BATH-5	128%	38%	0.6	0.5	6.1
9012	Water Heating	Bathroom Aerator 1.0 gpm	Low Income	MF	LI	Retrofit	2,942	1%	35	0.01	10	$3	100%	100%	BATH-6	128%	38%	0.6	0.5	6.1
9013	Water Heating	Kitchen Flip Aerator 1.5 gpm	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	3,045	5%	141	0.03	10	$3	100%	40%	KITCH-1	75%	49%	0.7	0.6	24.3
9014	Water Heating	Kitchen Flip Aerator 1.5 gpm	Low Income	SF	LI	Retrofit	3,045	5%	141	0.03	10	$3	100%	100%	KITCH-2	75%	49%	0.7	0.6	24.3
9015	Water Heating	Kitchen Flip Aerator 1.5 gpm	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	3,045	5%	141	0.03	10	$3	100%	40%	KITCH-3	75%	49%	0.7	0.6	24.3
9016	Water Heating	Kitchen Flip Aerator 1.5 gpm	Low Income	MH	LI	Retrofit	3,045	5%	141	0.03	10	$3	100%	100%	KITCH-4	75%	49%	0.7	0.6	24.3
9017	Water Heating	Kitchen Flip Aerator 1.5 gpm	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	3,045	5%	141	0.03	10	$3	100%	40%	KITCH-5	64%	38%	0.6	0.5	24.2
9018	Water Heating	Kitchen Flip Aerator 1.5 gpm	Low Income	MF	LI	Retrofit	3,045	5%	141	0.03	10	$3	100%	100%	KITCH-6	64%	38%	0.6	0.5	24.2
9019	Water Heating	Low Flow Showerhead 1.5 gpm	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	11%	217	0.02	10	$7	100%	40%	LFSH-1	150%	61%	0.7	0.7	14.7
9020	Water Heating	Low Flow Showerhead 1.5 gpm	Low Income	SF	LI	Retrofit	2,942	11%	217	0.02	10	$7	100%	100%	LFSH-2	150%	61%	0.7	0.7	14.7
9021	Water Heating	Low Flow Showerhead 1.5 gpm	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	11%	217	0.02	10	$7	100%	40%	LFSH-3	150%	61%	0.7	0.7	14.7
9022	Water Heating	Low Flow Showerhead 1.5 gpm	Low Income	MH	LI	Retrofit	2,942	11%	217	0.02	10	$7	100%	100%	LFSH-4	150%	61%	0.7	0.7	14.7
9023	Water Heating	Low Flow Showerhead 1.5 gpm	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	11%	217	0.02	10	$7	100%	40%	LFSH-5	113%	51%	0.7	0.6	14.7
9024	Water Heating	Low Flow Showerhead 1.5 gpm	Low Income	MF	LI	Retrofit	2,942	11%	217	0.02	10	$7	100%	100%	LFSH-6	113%	51%	0.7	0.6	14.7
9025	Water Heating	Thermostatic Restrictor Shower Valve	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	2%	77	0.01	10	$30	100%	40%	TRSV-1	150%	10%	0.7	0.3	1.2
9026	Water Heating	Thermostatic Restrictor Shower Valve	Low Income	SF	LI	Retrofit	2,942	2%	77	0.01	10	$30	100%	100%	TRSV-2	150%	10%	0.7	0.5	1.2
9027	Water Heating	Thermostatic Restrictor Shower Valve	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	2%	77	0.01	10	$30	100%	40%	TRSV-3	150%	10%	0.7	0.3	1.2
9028	Water Heating	Thermostatic Restrictor Shower Valve	Low Income	MH	LI	Retrofit	2,942	2%	77	0.01	10	$30	100%	100%	TRSV-4	150%	10%	0.7	0.5	1.2
9029	Water Heating	Thermostatic Restrictor Shower Valve	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	2%	77	0.01	10	$30	100%	40%	TRSV-5	113%	9%	0.5	0.2	1.2
9030	Water Heating	Thermostatic Restrictor Shower Valve	Low Income	MF	LI	Retrofit	2,942	2%	77	0.01	10	$30	100%	100%	TRSV-6	113%	9%	0.5	0.3	1.2
9031	Water Heating	Heat Pump Water Heater-electric resistance heat	HVAC and Water Heating - Equipment	SF	NLI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	40%	HPWH-1	75%	15%	0.7	0.3	1.1
9032	Water Heating	Heat Pump Water Heater-electric resistance heat	Low Income	SF	LI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	100%	HPWH-2	75%	15%	0.7	0.5	1.1
9033	Water Heating	Heat Pump Water Heater-electric resistance heat	HVAC and Water Heating - Equipment	MH	NLI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	40%	HPWH-3	75%	15%	0.7	0.3	1.1
9034	Water Heating	Heat Pump Water Heater-electric resistance heat	Low Income	MH	LI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	100%	HPWH-4	75%	15%	0.7	0.5	1.1
9035	Water Heating	Heat Pump Water Heater-electric resistance heat	HVAC and Water Heating - Equipment	MF	NLI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	40%	HPWH-5	64%	31%	0.5	0.4	1.0
9036	Water Heating	Heat Pump Water Heater-electric resistance heat	Low Income	MF	LI	MO	2,942	68%	2,011	0.10	13	$1,199	100%	100%	HPWH-6	64%	31%	0.5	0.4	1.0
9037	Water Heating	Smart Water Heater - Tank Controls and Sensors	No program	SF	NLI	MO	2,942	15%	441	0.02	13	$120	100%	40%	HPWH-1	75%	15%	0.7	0.3	2.0
9038	Water Heating	Smart Water Heater - Tank Controls and Sensors	Low Income	SF	LI	MO	2,942	15%	441	0.02	13	$120	100%	100%	HPWH-2	75%	15%	0.7	0.5	2.0
9039	Water Heating	Smart Water Heater - Tank Controls and Sensors	No program	MH	NLI	MO	2,942	15%	441	0.02	13	$120	100%	40%	HPWH-3	75%	15%	0.7	0.3	2.0
9040	Water Heating	Smart Water Heater - Tank Controls and Sensors	Low Income	MH	LI	MO	2,942	15%	441	0.02	13	$120	100%	100%	HPWH-4	75%	15%	0.7	0.5	2.0
9041	Water Heating	Smart Water Heater - Tank Controls and Sensors	No program	MF	NLI	MO	2,942	15%	441	0.02	13	$120	100%	40%	HPWH-5	64%	31%	0.5	0.4	2.0
9042	Water Heating	Smart Water Heater - Tank Controls and Sensors	Low Income	MF	LI	MO	2,942	15%	441	0.02	13	$120	100%	100%	HPWH-6	64%	31%	0.5	0.4	2.0
9043	Water Heating	Water Heater Wrap	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	3%	80	0.01	5	$20	100%	40%	WRAP-1	75%	12%	0.7	0.3	1.1
9044	Water Heating	Water Heater Wrap	Low Income	SF	LI	Retrofit	2,942	3%	80	0.01	5	$20	100%	100%	WRAP-2	75%	12%	0.7	0.5	1.1

Appendix D: 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 permultation, 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), manufactured (MH) 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. **TRC 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	TRC Score
9045	Water Heating	Water Heater Wrap	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	3%	80	0.01	5	$20	100%	40%	WRAP-3	75%	12%	0.7	0.3	1.1
9046	Water Heating	Water Heater Wrap	Low Income	MH	LI	Retrofit	2,942	3%	80	0.01	5	$20	100%	100%	WRAP-4	75%	12%	0.7	0.5	1.1
9047	Water Heating	Water Heater Wrap	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	3%	80	0.01	5	$20	100%	40%	WRAP-5	64%	4%	0.5	0.2	1.1
9048	Water Heating	Water Heater Wrap	Low Income	MF	LI	Retrofit	2,942	3%	80	0.01	5	$20	100%	100%	WRAP-6	64%	4%	0.5	0.3	1.1
9049	Water Heating	Drain water Heat Recovery	No program	SF	NLI	Retrofit	2,942	14%	601	0.01	30	$744	100%	40%	DWHR-1	75%	10%	0.7	0.3	0.8
9050	Water Heating	Drain water Heat Recovery	No program	SF	LI	Retrofit	2,942	14%	601	0.01	30	$744	100%	100%	DWHR-2	75%	10%	0.7	0.5	0.8
9051	Water Heating	Drain water Heat Recovery	No program	MH	NLI	Retrofit	2,942	14%	601	0.01	30	$744	100%	40%	DWHR-3	75%	10%	0.7	0.3	0.8
9052	Water Heating	Drain water Heat Recovery	No program	MH	LI	Retrofit	2,942	14%	601	0.01	30	$744	100%	100%	DWHR-4	75%	10%	0.7	0.5	0.8
9053	Water Heating	Drain water Heat Recovery	No program	MF	NLI	Retrofit	2,942	14%	601	0.01	30	$744	100%	40%	DWHR-5	64%	10%	0.5	0.2	0.8
9054	Water Heating	Drain water Heat Recovery	No program	MF	LI	Retrofit	2,942	14%	601	0.01	30	$744	100%	100%	DWHR-6	64%	10%	0.5	0.3	0.8
9055	Water Heating	Shower Timer	Weatherization and WH non-equipment measures	SF	NLI	Retrofit	2,942	0%	13	0.00	2	$5	100%	40%	ST-1	150%	1%	0.7	0.3	0.3
9056	Water Heating	Shower Timer	Low Income	SF	LI	Retrofit	2,942	0%	13	0.00	2	$5	100%	100%	ST-2	150%	1%	0.7	0.5	0.3
9057	Water Heating	Shower Timer	Weatherization and WH non-equipment measures	MH	NLI	Retrofit	2,942	0%	13	0.00	2	$5	100%	40%	ST-3	150%	1%	0.7	0.2	0.3
9058	Water Heating	Shower Timer	Low Income	MH	LI	Retrofit	2,942	0%	13	0.00	2	$5	100%	100%	ST-4	150%	1%	0.7	0.5	0.3
9059	Water Heating	Shower Timer	Weatherization and WH non-equipment measures	MF	NLI	Retrofit	2,942	0%	13	0.00	2	$5	100%	40%	ST-5	113%	7%	0.5	0.2	0.3
9060	Water Heating	Shower Timer	Low Income	MF	LI	Retrofit	2,942	0%	13	0.00	2	$5	100%	100%	ST-6	113%	7%	0.5	0.3	0.3
10001	Electric Vehicle Charging	L2 ESVE	No program	SF	NLI	Retrofit	2,733	31%	836	0.00	10	$900	100%	40%	EV-1	2%	20%	0.5	0.3	0.4
10002	Electric Vehicle Charging	L2 ESVE	No program	SF	LI	Retrofit	2,734	31%	836	0.00	10	$900	100%	100%	EV-2	2%	20%	0.5	0.4	0.4
10003	Electric Vehicle Charging	L2 ESVE	No program	MH	NLI	Retrofit	2,733	31%	836	0.00	10	$900	100%	40%	EV-3	2%	20%	0.5	0.3	0.4
10004	Electric Vehicle Charging	L2 ESVE	No program	MH	LI	Retrofit	2,734	31%	836	0.00	10	$900	100%	100%	EV-4	2%	20%	0.5	0.4	0.4
10005	Electric Vehicle Charging	L2 ESVE	No program	MF	NLI	Retrofit	2,736	31%	836	0.00	10	$900	100%	40%	EV-5	2%	20%	0.5	0.3	0.4
10006	Electric Vehicle Charging	L2 ESVE	No program	MF	LI	Retrofit	2,737	31%	836	0.00	10	$900	100%	100%	EV-6	2%	20%	0.5	0.4	0.4

APPENDIX E: COMMERCIAL & INDUSTRIAL ENERGY EFFICIENCY DETAIL

Appendix E: C&I 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Assembly	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
2	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Assembly	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
3	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Assembly	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
4	CompressedAir	AODD Pump Controls	Biz-Custom	Assembly	Retro	103,919	35%	36,372	4.50	4.34	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.2
5	CompressedAir	No Loss Condensate Drain	Biz-Custom	Assembly	Retro	103,919	2%	2,320	0.29	0.28	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
6	CompressedAir	Efficient Air Nozzles	Biz-Custom	Assembly	Retro	1,480	50%	740	0.09	0.09	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.0
7	CompressedAir	Compressed Air - Custom	Biz-Custom	Assembly	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
8	Cooking	Commercial Griddles	Biz-Prescriptive	Assembly	ROB	15,825	12%	1,910	0.47	0.20	12	$0	100%		1	14%	17%	0.7	0.6	0.0
9	Cooking	Convection Ovens	Biz-Prescriptive	Assembly	ROB	9,839	11%	1,065	0.26	0.11	12	$0	100%		2	18%	53%	0.7	0.6	0.0
10	Cooking	Combination Ovens	Biz-Prescriptive	Assembly	ROB	23,958	38%	9,058	2.21	0.96	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.3
11	Cooking	Commercial Fryers	Biz-Prescriptive	Assembly	ROB	18,955	17%	3,274	0.80	0.35	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
12	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Assembly	ROB	17,846	55%	9,863	2.41	1.05	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
13	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Assembly	ROB	13,697	68%	9,314	2.28	0.99	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.7
14	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Assembly	ROB	4,383	60%	2,630	0.64	0.28	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.1
15	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Assembly	ROB	39,306	44%	17,369	2.35	2.71	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.3
16	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Assembly	ROB	26,901	32%	8,586	1.16	1.34	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.0
17	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Assembly	ROB	606	15%	89	0.04	0.00	15	$153	100%	40%	1	21%	10%	0.8	0.3	0.4
18	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Assembly	ROB	606	19%	118	0.06	0.00	15	$215	100%	40%	1	21%	10%	0.8	0.3	0.4
19	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Assembly	ROB	606	31%	188	0.09	0.00	15	$399	100%	40%	1	21%	10%	0.8	0.3	0.4
20	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Assembly	ROB	665	8%	51	0.02	0.00	15	$59	100%	40%	2	21%	10%	0.8	0.4	0.7
21	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Assembly	ROB	665	12%	80	0.04	0.00	15	$97	100%	40%	2	21%	10%	0.8	0.4	0.6
22	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Assembly	ROB	665	22%	149	0.07	0.00	15	$204	100%	40%	2	21%	10%	0.8	0.3	0.6
23	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Assembly	Retro	732	7%	51	0.02	0.00	3	$5	100%	40%	3	42%	50%	0.8	0.6	1.9
24	Cooling	Air Side Economizer	Biz-Custom	Assembly	Retro	606	20%	121	0.06	0.00	15	$153	100%	40%	4	42%	25%	0.8	0.4	0.6
25	Cooling	Advanced Rooftop Controls	Biz-Custom	Assembly	Retro	6,773	56%	3,779	1.82	0.04	15	$2,950	100%	40%	5	42%	20%	0.8	0.5	1.0
26	Cooling	HVAC Occupancy Controls	Biz-Custom	Assembly	Retro	633	20%	127	0.06	0.00	15	$537	100%	40%	6	42%	10%	0.8	0.2	0.2
27	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Assembly	ROB	627	13%	78	0.04	0.00	15	$115	100%	40%	7	23%	10%	0.8	0.3	0.5
28	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Assembly	ROB	627	22%	139	0.07	0.00	15	$514	100%	40%	7	23%	10%	0.8	0.3	0.2
29	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Assembly	ROB	627	33%	209	0.10	0.00	15	$631	100%	40%	7	23%	10%	0.8	0.3	0.3
30	Cooling	Smart Thermostat	Biz-Prescriptive	Assembly	ROB	2,510	14%	355	0.17	0.00	11	$175	100%	40%	8	23%	10%	0.8	0.5	1.2
31	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Assembly	ROB	810	7%	59	0.03	0.00	8	$84	100%	40%	9	0%	20%	0.8	0.4	0.3
32	Cooling	Air Cooled Chiller	Biz-Custom	Assembly	ROB	641	9%	58	0.03	0.00	23	$126	100%	40%	10	31%	10%	0.8	0.3	0.5
33	Cooling	Water Cooled Chiller	Biz-Custom	Assembly	ROB	322	23%	73	0.04	0.00	23	$126	100%	40%	11	3%	10%	0.8	0.3	0.6
34	Cooling	Window Film	Biz-Custom	Assembly	Retro	6,000	4%	264	0.13	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
35	Cooling	Triple Pane Windows	Biz-Custom	Assembly	Retro	6,000	6%	360	0.17	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
36	Cooling	Energy Recovery Ventilator	Biz-Custom	Assembly	Retro	665	10%	64	0.03	0.00	15	$1,050	100%	40%	13	100%	2%	0.8	0.2	0.0
37	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Assembly	ROB	2,068	3%	70	0.01	0.02	15	$135	100%	40%	1	29%	10%	0.8	0.3	0.4
38	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Assembly	ROB	2,068	11%	235	0.04	0.05	15	$446	100%	40%	1	29%	10%	0.8	0.3	0.4
39	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Assembly	ROB	2,068	17%	345	0.06	0.08	15	$446	100%	40%	1	29%	10%	0.8	0.3	0.6
40	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,318	6%	140	0.02	0.03	15	$100	100%	40%	2	18%	10%	0.8	0.5	1.1
41	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,318	11%	260	0.04	0.06	15	$171	100%	40%	2	18%	10%	0.8	0.5	1.1

Appendix E: C&I 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 permultation, 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
42	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,398	6%	154	0.02	0.03	15	$100	100%	40%	3	18%	10%	0.8	0.5	1.2
43	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,398	12%	282	0.05	0.06	15	$182	100%	40%	3	18%	10%	0.8	0.5	1.2
44	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,506	7%	169	0.03	0.04	15	$100	100%	40%	4	18%	10%	0.8	0.5	1.3
45	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Assembly	ROB	2,506	12%	307	0.05	0.07	15	$202	100%	40%	4	18%	10%	0.8	0.5	1.1
46	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Assembly	ROB	1,604	3%	54	0.01	0.01	25	$108	100%	40%	5	6%	20%	0.8	0.4	0.5
47	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Assembly	ROB	1,604	7%	109	0.02	0.02	25	$108	100%	40%	5	6%	20%	0.8	0.4	1.1
48	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Assembly	ROB	2,523	7%	175	0.03	0.04	8	$84	100%	40%	6	0%	20%	0.8	0.5	0.9
49	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Assembly	ROB	3,027	67%	2,027	0.27	0.32	15	$1,115	100%	40%	1	100%	0%	0.7	0.5	1.3
50	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Assembly	Retro	3,027	2%	61	0.01	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	0.9
51	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Assembly	ROB	18,059	54%	9,789	1.33	1.53	5	$60	100%	40%	3	20%	85%	0.9	0.9	45.3
52	HotWater	Faucet Aerator	Biz-Prescriptive	Assembly	Retro	3,027	67%	2,027	0.27	0.32	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	1.3
53	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Assembly	ROB	1,868	20%	380	0.05	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
54	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Assembly	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
55	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Assembly	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
56	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Assembly	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
57	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Assembly	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
58	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Assembly	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
59	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Assembly	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
60	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Assembly	Retro	124	68%	84	0.01	0.01	15	$27	100%	40%	1	8%	75%	0.8	0.8	2.1
61	Lighting_Int	LED interior directional	Biz-Prescriptive	Assembly	Retro	89	74%	66	0.01	0.01	15	$59	100%	40%	2	0%	75%	0.8	0.8	0.8
62	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Assembly	Retro	80	45%	36	0.00	0.00	15	$2	100%	40%	3	55%	45%	0.8	0.7	12.9
63	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Assembly	Retro	181	50%	91	0.01	0.01	15	$70	100%	40%	3	55%	45%	0.8	0.6	0.9
64	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Assembly	Retro	359	61%	218	0.03	0.03	15	$44	100%	40%	4	21%	35%	0.8	0.6	3.4
65	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Assembly	Retro	1,687	68%	1,147	0.15	0.15	15	$330	100%	40%	5	14%	35%	0.8	0.6	2.4
66	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Assembly	Retro	67	100%	67	0.01	0.01	11	$4	100%	40%	6	55%	0%	0.8	0.7	8.8
67	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Assembly	Retro	390	30%	117	0.01	0.02	10	$58	100%	40%	7	91%	20%	0.8	0.6	1.0
68	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Assembly	Retro	1	49%	1	0.00	0.00	15	$1	100%	40%	7	91%	20%	0.8	0.5	0.8
69	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Assembly	Retro	305	30%	91	0.01	0.01	15	$54	100%	40%	7	91%	20%	0.8	0.5	1.1
70	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Assembly	Retro	69	43%	29	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
71	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Assembly	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
72	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Assembly	Retro	9,932	50%	4,966	0.61	0.59	20	$1,180	100%	40%	2	12%	10%	0.8	0.6	3.5
73	Misc	High Efficiency Hand Dryers	Biz-Custom	Assembly	Retro	262	83%	217	0.03	0.03	10	$483	100%	40%	3	5%	10%	0.8	0.3	0.2
74	Misc	Ozone Commercial Laundry	Biz-Custom	Assembly	Retro	2,984	25%	746	0.09	0.09	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
75	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Assembly	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
76	Misc	Miscellaneous Custom	Biz-Custom	Assembly	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	35%	10%	0.8	0.3	0.3
77	Motors	Cogged V-Belt	Biz-Custom	Assembly	Retro	17,237	3%	534	0.08	0.07	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.0
78	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Assembly	Retro	3,805	34%	1,290	0.19	0.17	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.3
79	Motors	Power Drive Systems	Biz-Custom	Assembly	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.3
80	Motors	Switch Reluctance Motors	Biz-Custom	Assembly	Retro	33,406	31%	10,222	1.50	1.32	15	$528	100%	40%	2	100%	1%	0.8	0.6	13.3
81	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Assembly	Retro	551	40%	223	0.03	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0

Appendix E: C&I Measure Assumptions

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Measure #: Each measure permultation, 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
82	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Assembly	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
83	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Assembly	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
84	Office_PC	Energy Star Server	Biz-Custom	Assembly	ROB	1,621	23%	368	0.05	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.2
85	Office_PC	Server Virtualization	Biz-Custom	Assembly	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
86	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Assembly	Retro	86,783	18%	15,778	1.95	1.88	15	$480	100%	40%	3	65%	20%	0.8	0.7	21.9
87	Office_PC	High Efficiency CRAC unit	Biz-Custom	Assembly	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
88	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Assembly	Retro	764	47%	358	0.04	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
89	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Assembly	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
90	Refrigeration	Strip Curtains	Biz-Prescriptive	Assembly	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	11%	30%	0.7	0.6	0.0
91	Refrigeration	Bare Suction Line	Biz-Custom	Assembly	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
92	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Assembly	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	7%	25%	0.7	0.4	0.4
93	Refrigeration	Saturated Suction Controls	Biz-Custom	Assembly	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
94	Refrigeration	Compressor Retrofit	Biz-Custom	Assembly	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	25%	25%	0.7	0.4	0.2
95	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Assembly	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	7%	80%	0.9	0.8	3.5
96	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Assembly	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	7%	25%	0.7	0.5	3.1
97	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Assembly	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	9%	25%	0.7	0.4	0.8
98	Refrigeration	Refrigeration Economizer	Biz-Custom	Assembly	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	34%	10%	0.7	0.4	0.8
99	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Assembly	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	12%	25%	0.7	0.5	2.1
100	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Assembly	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	3%	25%	0.7	0.4	0.5
101	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Assembly	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	2%	80%	0.9	0.8	3.5
102	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Assembly	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	2%	2%	0.7	0.4	0.8
103	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Assembly	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	11%	54%	0.7	0.6	0.3
104	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Assembly	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	11%	54%	0.7	0.6	0.1
105	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Assembly	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	4%	25%	0.7	0.6	7.3
106	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Assembly	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	4%	25%	0.7	0.5	1.2
107	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Assembly	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	4%	54%	0.7	0.6	0.4
108	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Assembly	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	4%	54%	0.7	0.6	0.1
109	Refrigeration	Refrigeration - Custom	Biz-Custom	Assembly	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
110	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Assembly	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
111	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Assembly	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	7%	44%	0.7	0.6	1.6
112	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Assembly	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	2%	30%	0.7	0.4	0.2
113	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Assembly	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	7%	35%	0.7	0.5	3.4
114	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Assembly	Retro	1,698	20%	340	0.05	0.05	15	$227	100%	40%	1	100%	32%	0.8	0.5	1.7
115	Ventilation	Demand Control Ventilation	Biz-Custom	Assembly	Retro	2,166	43%	940	0.14	0.13	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.9
116	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Assembly	Retro	19,919	82%	16,287	2.44	2.17	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.7
117	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Assembly	Retro	21,909	83%	18,277	2.74	2.43	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	3.0
118	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Assembly	Retro	23,903	82%	19,579	2.94	2.61	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.2
119	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Assembly	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
120	WholeBldg_HVAC	GREM Controls	Biz-Custom	Assembly	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
121	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Assembly	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.8

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
122	WholeBldg	WholeBlg - Com RET	Biz-Custom	Assembly	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
123	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Assembly	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	1.0
124	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Education	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.2
125	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Education	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
126	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Education	ROB	1,583	21%	329	0.03	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
127	CompressedAir	AODD Pump Controls	Biz-Custom	Education	Retro	103,919	35%	36,372	3.45	4.08	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	14.9
128	CompressedAir	No Loss Condensate Drain	Biz-Custom	Education	Retro	103,919	2%	2,320	0.22	0.26	13	$700	100%	40%	4	100%	5%	0.8	0.6	1.9
129	CompressedAir	Efficient Air Nozzles	Biz-Custom	Education	Retro	1,480	50%	740	0.07	0.08	15	$50	100%	40%	5	5%	20%	0.8	0.6	9.7
130	CompressedAir	Compressed Air - Custom	Biz-Custom	Education	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.2
131	Cooking	Commercial Griddles	Biz-Prescriptive	Education	ROB	15,825	12%	1,910	0.02	0.07	12	$0	100%		1	14%	17%	0.7	0.6	0.0
132	Cooking	Convection Ovens	Biz-Prescriptive	Education	ROB	9,839	11%	1,065	0.01	0.04	12	$0	100%		2	18%	53%	0.7	0.6	0.0
133	Cooking	Combination Ovens	Biz-Prescriptive	Education	ROB	23,958	38%	9,058	0.10	0.35	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.2
134	Cooking	Commercial Fryers	Biz-Prescriptive	Education	ROB	18,955	17%	3,274	0.04	0.13	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.2
135	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Education	ROB	17,846	55%	9,863	0.11	0.38	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.3
136	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Education	ROB	13,697	68%	9,314	0.10	0.36	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.3
137	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Education	ROB	4,383	60%	2,630	0.03	0.10	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.0
138	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Education	ROB	39,306	44%	17,369	1.78	2.76	15	$662	100%	40%	6	26%	61%	0.7	0.7	17.9
139	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Education	ROB	26,901	32%	8,586	0.88	1.36	15	$995	100%	40%	6	26%	61%	0.7	0.7	5.9
140	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Education	ROB	509	15%	75	0.04	0.00	15	$153	100%	40%	1	24%	10%	0.8	0.3	0.4
141	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Education	ROB	509	19%	99	0.05	0.00	15	$215	100%	40%	1	24%	10%	0.8	0.3	0.4
142	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Education	ROB	509	31%	158	0.08	0.00	15	$399	100%	40%	1	24%	10%	0.8	0.3	0.3
143	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Education	ROB	559	8%	43	0.02	0.00	15	$59	100%	40%	2	24%	10%	0.8	0.3	0.6
144	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Education	ROB	559	12%	67	0.04	0.00	15	$97	100%	40%	2	24%	10%	0.8	0.3	0.5
145	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Education	ROB	559	22%	125	0.07	0.00	15	$204	100%	40%	2	24%	10%	0.8	0.3	0.5
146	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Education	Retro	615	7%	43	0.02	0.00	3	$5	100%	40%	3	49%	50%	0.8	0.6	1.6
147	Cooling	Air Side Economizer	Biz-Custom	Education	Retro	509	20%	102	0.05	0.00	15	$153	100%	40%	4	49%	25%	0.8	0.4	0.5
148	Cooling	Advanced Rooftop Controls	Biz-Custom	Education	Retro	6,304	56%	3,518	1.86	0.02	15	$2,950	100%	40%	5	49%	20%	0.8	0.4	0.9
149	Cooling	HVAC Occupancy Controls	Biz-Custom	Education	Retro	532	20%	106	0.06	0.00	15	$537	100%	40%	6	49%	10%	0.8	0.2	0.2
150	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Education	ROB	527	13%	66	0.03	0.00	15	$115	100%	40%	7	0%	10%	0.8	0.3	0.4
151	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Education	ROB	527	22%	117	0.06	0.00	15	$514	100%	40%	7	0%	10%	0.8	0.2	0.2
152	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Education	ROB	527	33%	176	0.09	0.00	15	$631	100%	40%	7	0%	10%	0.8	0.3	0.2
153	Cooling	Smart Thermostat	Biz-Prescriptive	Education	ROB	2,109	14%	299	0.16	0.00	11	$175	100%	40%	8	0%	10%	0.8	0.5	1.0
154	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Education	ROB	680	7%	49	0.03	0.00	8	$84	100%	40%	9	0%	20%	0.8	0.4	0.3
155	Cooling	Air Cooled Chiller	Biz-Custom	Education	ROB	539	9%	49	0.03	0.00	23	$126	100%	40%	10	46%	10%	0.8	0.3	0.4
156	Cooling	Water Cooled Chiller	Biz-Custom	Education	ROB	271	23%	62	0.03	0.00	23	$126	100%	40%	11	5%	10%	0.8	0.3	0.5
157	Cooling	Window Film	Biz-Custom	Education	Retro	6,000	4%	264	0.14	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
158	Cooling	Triple Pane Windows	Biz-Custom	Education	Retro	6,000	6%	360	0.19	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
159	Cooling	Energy Recovery Ventilator	Biz-Custom	Education	Retro	559	18%	103	0.05	0.00	15	$1,049	100%	40%	13	100%	2%	0.8	0.2	0.1
160	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Education	ROB	2,383	3%	73	0.01	0.02	15	$135	100%	40%	1	0%	10%	0.8	0.3	0.4
161	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Education	ROB	2,383	11%	257	0.05	0.07	15	$446	100%	40%	1	0%	10%	0.8	0.3	0.4
162	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Education	ROB	2,383	15%	368	0.07	0.09	15	$520	100%	40%	1	0%	10%	0.8	0.3	0.5

Appendix E: C&I 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
163	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,682	6%	158	0.03	0.04	15	$100	100%	40%	2	28%	10%	0.8	0.5	1.2
164	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,682	11%	296	0.05	0.08	15	$171	100%	40%	2	28%	10%	0.8	0.5	1.3
165	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,772	6%	173	0.03	0.04	15	$100	100%	40%	3	27%	10%	0.8	0.5	1.3
166	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,772	11%	318	0.06	0.08	15	$182	100%	40%	3	27%	10%	0.8	0.5	1.3
167	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,886	7%	188	0.03	0.05	15	$100	100%	40%	4	27%	10%	0.8	0.5	1.4
168	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Education	ROB	2,886	12%	345	0.06	0.09	15	$202	100%	40%	4	27%	10%	0.8	0.5	1.3
169	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Education	ROB	1,810	3%	58	0.01	0.01	25	$108	100%	40%	5	6%	20%	0.8	0.4	0.6
170	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Education	ROB	1,810	6%	104	0.02	0.03	25	$108	100%	40%	5	6%	20%	0.8	0.4	1.1
171	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Education	ROB	2,912	5%	158	0.03	0.04	8	$84	100%	40%	6	0%	20%	0.8	0.5	0.9
172	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Education	ROB	5,042	67%	3,377	0.35	0.54	15	$1,115	100%	40%	1	100%	23%	0.7	0.5	2.1
173	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Education	Retro	5,042	2%	101	0.01	0.02	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.4
174	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Education	ROB	18,059	54%	9,789	1.00	1.56	5	$60	100%	40%	3	20%	85%	0.9	0.9	44.4
175	HotWater	Faucet Aerator	Biz-Prescriptive	Education	Retro	5,042	67%	3,377	0.35	0.54	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	2.1
176	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Education	ROB	1,868	20%	380	0.04	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
177	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Education	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
178	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Education	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
179	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Education	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
180	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Education	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
181	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Education	Retro	3,235	60%	1,953	0.00	0.22	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
182	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Education	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
183	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Education	Retro	180	68%	121	0.01	0.01	15	$27	100%	40%	1	3%	75%	0.8	0.8	3.0
184	Lighting_Int	LED interior directional	Biz-Prescriptive	Education	Retro	129	74%	95	0.01	0.01	15	$59	100%	40%	2	0%	75%	0.8	0.8	1.1
185	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Education	Retro	116	45%	52	0.00	0.01	15	$2	100%	40%	3	84%	45%	0.8	0.7	18.1
186	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Education	Retro	262	50%	131	0.01	0.02	15	$70	100%	40%	3	84%	45%	0.8	0.6	1.2
187	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Education	Retro	520	61%	316	0.03	0.04	15	$44	100%	40%	4	7%	35%	0.8	0.7	4.7
188	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Education	Retro	2,440	68%	1,660	0.16	0.20	15	$330	100%	40%	5	5%	35%	0.8	0.6	3.3
189	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Education	Retro	97	100%	97	0.01	0.01	11	$4	100%	40%	6	84%	0%	0.8	0.7	12.4
190	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Education	Retro	564	30%	169	0.02	0.02	10	$58	100%	40%	7	97%	20%	0.8	0.6	1.4
191	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Education	Retro	2	49%	1	0.00	0.00	15	$1	100%	40%	7	97%	20%	0.8	0.5	1.1
192	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Education	Retro	440	30%	132	0.01	0.02	15	$78	100%	40%	7	97%	20%	0.8	0.5	1.1
193	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Education	Retro	66	43%	28	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
194	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Education	Retro	385	61%	237	0.02	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
195	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Education	Retro	9,932	50%	4,966	0.47	0.56	20	$1,180	100%	40%	2	6%	10%	0.8	0.6	3.4
196	Misc	High Efficiency Hand Dryers	Biz-Custom	Education	Retro	2,093	83%	1,737	0.16	0.20	10	$483	100%	40%	3	5%	10%	0.8	0.6	1.7
197	Misc	Ozone Commercial Laundry	Biz-Custom	Education	Retro	2,984	25%	746	0.07	0.08	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
198	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Education	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	0.9
199	Misc	Miscellaneous Custom	Biz-Custom	Education	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	10%	10%	0.8	0.3	0.3
200	Motors	Cogged V-Belt	Biz-Custom	Education	Retro	17,237	3%	534	0.11	0.05	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.0
201	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Education	Retro	3,805	34%	1,290	0.27	0.13	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.4

Appendix E: C&I Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
202	Motors	Power Drive Systems	Biz-Custom	Education	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.4
203	Motors	Switch Reluctance Motors	Biz-Custom	Education	Retro	33,406	31%	10,222	2.15	1.01	15	$528	100%	40%	2	100%	1%	0.8	0.6	13.5
204	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Education	Retro	551	40%	223	0.02	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0
205	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Education	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
206	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Education	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	0.9
207	Office_PC	Energy Star Server	Biz-Custom	Education	ROB	1,621	23%	368	0.03	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.2
208	Office_PC	Server Virtualization	Biz-Custom	Education	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
209	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Education	Retro	86,783	18%	15,778	1.50	1.77	15	$480	100%	40%	3	65%	20%	0.8	0.7	21.4
210	Office_PC	High Efficiency CRAC unit	Biz-Custom	Education	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
211	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Education	Retro	764	47%	358	0.03	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.8
212	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Education	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.6
213	Refrigeration	Strip Curtains	Biz-Prescriptive	Education	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	11%	30%	0.7	0.6	0.0
214	Refrigeration	Bare Suction Line	Biz-Custom	Education	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
215	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Education	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	7%	25%	0.7	0.4	0.4
216	Refrigeration	Saturated Suction Controls	Biz-Custom	Education	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
217	Refrigeration	Compressor Retrofit	Biz-Custom	Education	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	25%	25%	0.7	0.4	0.2
218	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Education	Retro	2,884	55%	1,586	0.23	0.17	15	$305	100%	40%	6	7%	80%	0.9	0.8	3.5
219	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Education	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	7%	25%	0.7	0.5	3.1
220	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Education	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	9%	25%	0.7	0.4	0.8
221	Refrigeration	Refrigeration Economizer	Biz-Custom	Education	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	35%	10%	0.7	0.4	0.8
222	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Education	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	12%	75%	0.8	0.8	2.1
223	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Education	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	3%	25%	0.7	0.4	0.5
224	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Education	Retro	2,884	55%	1,586	0.23	0.17	15	$305	100%	40%	12	2%	80%	0.9	0.8	3.5
225	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Education	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	2%	2%	0.7	0.4	0.8
226	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Education	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	12%	54%	0.7	0.6	0.3
227	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Education	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	12%	54%	0.7	0.6	0.1
228	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Education	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	4%	75%	0.8	0.8	7.3
229	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Education	Retro	2,922	50%	1,453	0.21	0.16	12	$686	100%	40%	16	4%	25%	0.7	0.5	1.2
230	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Education	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	4%	54%	0.7	0.6	0.4
231	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Education	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	4%	54%	0.7	0.6	0.1
232	Refrigeration	Refrigeration - Custom	Biz-Custom	Education	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
233	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Education	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
234	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Education	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	4%	44%	0.7	0.6	1.6
235	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Education	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	3%	30%	0.7	0.4	0.2
236	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Education	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	7%	35%	0.7	0.5	3.4
237	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Education	Retro	2,223	20%	445	0.07	0.06	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.2
238	Ventilation	Demand Control Ventilation	Biz-Custom	Education	Retro	2,166	43%	940	0.15	0.13	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.9
239	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Education	Retro	19,919	82%	16,287	2.54	2.30	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.7
240	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Education	Retro	21,909	83%	18,277	2.86	2.58	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	3.0
241	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Education	Retro	23,903	82%	19,579	3.06	2.76	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.2
242	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Education	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.8

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
243	WholeBldg_HVAC	GREM Controls	Biz-Custom	Education	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
244	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Education	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.9
245	WholeBldg	WholeBlg - Com RET	Biz-Custom	Education	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.5
246	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Education	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	1.0
247	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Food Sales	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.4
248	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Food Sales	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
249	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Food Sales	ROB	1,583	21%	329	0.05	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.6
250	CompressedAir	AODD Pump Controls	Biz-Custom	Food Sales	Retro	103,919	35%	36,372	5.62	4.17	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.5
251	CompressedAir	No Loss Condensate Drain	Biz-Custom	Food Sales	Retro	103,919	2%	2,320	0.36	0.27	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
252	CompressedAir	Efficient Air Nozzles	Biz-Custom	Food Sales	Retro	1,480	50%	740	0.11	0.08	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.2
253	CompressedAir	Compressed Air - Custom	Biz-Custom	Food Sales	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
254	Cooking	Commercial Griddles	Biz-Prescriptive	Food Sales	ROB	15,825	12%	1,910	0.39	0.24	12	$0	100%		1	14%	17%	0.7	0.6	0.0
255	Cooking	Convection Ovens	Biz-Prescriptive	Food Sales	ROB	9,839	11%	1,065	0.22	0.13	12	$0	100%		2	18%	53%	0.7	0.6	0.0
256	Cooking	Combination Ovens	Biz-Prescriptive	Food Sales	ROB	23,958	38%	9,058	1.84	1.14	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.2
257	Cooking	Commercial Fryers	Biz-Prescriptive	Food Sales	ROB	18,955	17%	3,274	0.66	0.41	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
258	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Food Sales	ROB	17,846	55%	9,863	2.00	1.25	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
259	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Food Sales	ROB	13,697	68%	9,314	1.89	1.18	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.6
260	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Food Sales	ROB	4,383	60%	2,630	0.53	0.33	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.0
261	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Food Sales	ROB	39,306	44%	17,369	2.34	2.62	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.2
262	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Food Sales	ROB	26,901	32%	8,586	1.16	1.29	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.0
263	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Food Sales	ROB	789	15%	116	0.08	0.00	15	$153	100%	40%	1	20%	10%	0.8	0.3	0.6
264	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Food Sales	ROB	789	19%	153	0.10	0.00	15	$215	100%	40%	1	20%	10%	0.8	0.3	0.6
265	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Food Sales	ROB	789	31%	244	0.16	0.00	15	$399	100%	40%	1	20%	10%	0.8	0.3	0.5
266	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Food Sales	ROB	866	8%	67	0.04	0.00	15	$59	100%	40%	2	20%	10%	0.8	0.4	1.0
267	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Food Sales	ROB	866	12%	104	0.07	0.00	15	$97	100%	40%	2	20%	10%	0.8	0.4	0.9
268	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Food Sales	ROB	866	22%	194	0.13	0.00	15	$204	100%	40%	2	20%	10%	0.8	0.4	0.8
269	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Food Sales	Retro	953	7%	67	0.04	0.00	3	$5	100%	40%	3	40%	50%	0.8	0.6	2.7
270	Cooling	Air Side Economizer	Biz-Custom	Food Sales	Retro	789	20%	158	0.10	0.00	15	$153	100%	40%	4	40%	25%	0.8	0.4	0.9
271	Cooling	Advanced Rooftop Controls	Biz-Custom	Food Sales	Retro	6,900	56%	3,850	2.52	0.00	15	$2,950	100%	40%	5	40%	20%	0.8	0.5	1.1
272	Cooling	HVAC Occupancy Controls	Biz-Custom	Food Sales	Retro	824	20%	165	0.11	0.00	15	$537	100%	40%	6	40%	10%	0.8	0.3	0.3
273	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Food Sales	ROB	817	13%	102	0.07	0.00	15	$115	100%	40%	7	20%	10%	0.8	0.4	0.8
274	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Food Sales	ROB	817	22%	182	0.12	0.00	15	$514	100%	40%	7	20%	10%	0.8	0.3	0.3
275	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Food Sales	ROB	817	33%	272	0.18	0.00	15	$631	100%	40%	7	20%	10%	0.8	0.3	0.4
276	Cooling	Smart Thermostat	Biz-Prescriptive	Food Sales	ROB	3,267	14%	463	0.30	0.00	11	$175	100%	40%	8	20%	10%	0.8	0.6	1.7
277	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Food Sales	ROB	1,054	7%	77	0.05	0.00	8	$84	100%	40%	9	40%	20%	0.8	0.4	0.5
278	Cooling	Air Cooled Chiller	Biz-Custom	Food Sales	ROB	835	9%	75	0.05	0.00	23	$126	100%	40%	10	0%	10%	0.8	0.3	0.7
279	Cooling	Water Cooled Chiller	Biz-Custom	Food Sales	ROB	419	23%	95	0.06	0.00	23	$126	100%	40%	11	0%	10%	0.8	0.3	0.9
280	Cooling	Window Film	Biz-Custom	Food Sales	Retro	6,000	4%	264	0.17	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.6
281	Cooling	Triple Pane Windows	Biz-Custom	Food Sales	Retro	6,000	6%	360	0.24	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.7
282	Cooling	Energy Recovery Ventilator	Biz-Custom	Food Sales	Retro	866	20%	176	0.12	0.00	15	$1,048	100%	40%	13	100%	2%	0.8	0.2	0.1

Appendix E: C&I 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 permultation, 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
283	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Food Sales	ROB	1,996	4%	75	0.02	0.02	15	$135	100%	40%	1	25%	10%	0.8	0.3	0.4
284	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Food Sales	ROB	1,996	12%	242	0.05	0.06	15	$446	100%	40%	1	25%	10%	0.8	0.3	0.4
285	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Food Sales	ROB	1,996	18%	366	0.08	0.10	15	$520	100%	40%	1	25%	10%	0.8	0.3	0.6
286	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,227	6%	138	0.03	0.04	15	$100	100%	40%	2	17%	10%	0.8	0.5	1.1
287	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,227	11%	256	0.06	0.07	15	$171	100%	40%	2	17%	10%	0.8	0.5	1.2
288	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,306	7%	154	0.03	0.04	15	$100	100%	40%	3	16%	10%	0.8	0.5	1.2
289	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,306	12%	278	0.06	0.07	15	$182	100%	40%	3	16%	10%	0.8	0.5	1.2
290	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,421	7%	170	0.04	0.05	15	$100	100%	40%	4	16%	10%	0.8	0.5	1.4
291	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Food Sales	ROB	2,421	13%	307	0.07	0.08	15	$202	100%	40%	4	16%	10%	0.8	0.5	1.2
292	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Food Sales	ROB	1,590	4%	57	0.01	0.02	25	$108	100%	40%	5	8%	20%	0.8	0.4	0.6
293	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Food Sales	ROB	1,590	8%	128	0.03	0.03	25	$108	100%	40%	5	8%	20%	0.8	0.4	1.4
294	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Food Sales	ROB	2,431	9%	215	0.05	0.06	8	$84	100%	40%	6	10%	20%	0.8	0.6	1.2
295	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Food Sales	ROB	4,687	67%	3,139	0.42	0.47	15	$1,115	100%	40%	1	100%	0%	0.7	0.5	2.0
296	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Food Sales	Retro	4,687	2%	94	0.01	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.3
297	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Food Sales	ROB	18,059	54%	9,789	1.32	1.48	5	$60	100%	40%	3	20%	85%	0.9	0.9	45.1
298	HotWater	Faucet Aerator	Biz-Prescriptive	Food Sales	Retro	4,687	67%	3,139	0.42	0.47	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	2.0
299	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Food Sales	ROB	1,868	20%	380	0.05	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
300	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Food Sales	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
301	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Food Sales	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
302	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Food Sales	Retro	1,589	60%	959	0.00	0.12	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
303	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Food Sales	Retro	1,742	66%	1,154	0.00	0.15	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
304	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Food Sales	Retro	3,235	60%	1,953	0.00	0.25	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
305	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Food Sales	Retro	1,589	60%	959	0.00	0.12	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
306	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Food Sales	Retro	306	68%	206	0.03	0.02	9	$27	100%	40%	1	2%	75%	0.8	0.8	3.4
307	Lighting_Int	LED interior directional	Biz-Prescriptive	Food Sales	Retro	220	74%	162	0.02	0.02	9	$59	100%	40%	2	0%	75%	0.8	0.8	1.2
308	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Food Sales	Retro	197	45%	88	0.01	0.01	9	$2	100%	40%	3	85%	45%	0.8	0.7	20.7
309	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Food Sales	Retro	445	50%	223	0.03	0.03	9	$70	100%	40%	3	85%	45%	0.8	0.6	1.4
310	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Food Sales	Retro	883	61%	537	0.07	0.06	9	$44	100%	40%	4	6%	35%	0.8	0.7	5.4
311	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Food Sales	Retro	4,147	68%	2,821	0.34	0.33	9	$330	100%	40%	5	4%	35%	0.8	0.7	3.8
312	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Food Sales	Retro	164	100%	164	0.02	0.02	11	$4	100%	40%	6	85%	0%	0.8	0.7	21.3
313	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Food Sales	Retro	959	30%	288	0.03	0.03	10	$58	100%	40%	7	97%	20%	0.8	0.6	2.4
314	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Food Sales	Retro	4	49%	2	0.00	0.00	15	$1	100%	40%	7	97%	20%	0.8	0.6	1.9
315	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Food Sales	Retro	749	30%	225	0.03	0.03	15	$133	100%	40%	7	97%	20%	0.8	0.5	1.1
316	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Food Sales	Retro	64	43%	28	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
317	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Food Sales	Retro	385	61%	237	0.05	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
318	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Food Sales	Retro	9,932	50%	4,966	1.01	0.63	20	$1,180	100%	40%	2	1%	10%	0.8	0.6	3.7
319	Misc	High Efficiency Hand Dryers	Biz-Custom	Food Sales	Retro	3,819	83%	3,170	0.64	0.40	10	$483	100%	40%	3	5%	10%	0.8	0.7	3.3
320	Misc	Ozone Commercial Laundry	Biz-Custom	Food Sales	Retro	2,984	25%	746	0.15	0.09	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
321	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Food Sales	ROB	3,096	3%	85	0.02	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
322	Misc	Miscellaneous Custom	Biz-Custom	Food Sales	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	29%	10%	0.8	0.3	0.4

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
323	Motors	Cogged V-Belt	Biz-Custom	Food Sales	Retro	19,471	3%	604	0.00	0.14	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.1
324	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Food Sales	Retro	3,805	34%	1,290	0.00	0.29	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.2
325	Motors	Power Drive Systems	Biz-Custom	Food Sales	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.2
326	Motors	Switch Reluctance Motors	Biz-Custom	Food Sales	Retro	37,735	31%	11,547	0.00	2.63	15	$528	100%	40%	2	100%	1%	0.8	0.6	14.8
327	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Food Sales	Retro	551	40%	223	0.05	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0
328	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Food Sales	Retro	1,086	10%	109	0.02	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
329	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Food Sales	Retro	1,126	15%	169	0.03	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
330	Office_PC	Energy Star Server	Biz-Custom	Food Sales	ROB	1,621	23%	368	0.07	0.05	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.3
331	Office_PC	Server Virtualization	Biz-Custom	Food Sales	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.1
332	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Food Sales	Retro	86,783	18%	15,778	3.20	1.99	15	$480	100%	40%	3	65%	20%	0.8	0.7	23.2
333	Office_PC	High Efficiency CRAC unit	Biz-Custom	Food Sales	ROB	541	30%	162	0.03	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.8
334	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Food Sales	Retro	764	47%	358	0.07	0.05	15	$82	100%	40%	4	65%	20%	0.8	0.6	3.1
335	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Food Sales	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.8
336	Refrigeration	Strip Curtains	Biz-Prescriptive	Food Sales	Retro	412	50%	206	0.03	0.02	4	$10	100%	40%	1	16%	30%	0.7	0.6	4.4
337	Refrigeration	Bare Suction Line	Biz-Custom	Food Sales	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	1%	50%	0.7	0.6	3.5
338	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Food Sales	Retro	1,112	25%	278	0.03	0.03	15	$431	100%	40%	3	11%	25%	0.7	0.4	0.4
339	Refrigeration	Saturated Suction Controls	Biz-Custom	Food Sales	Retro	831	50%	416	0.05	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
340	Refrigeration	Compressor Retrofit	Biz-Custom	Food Sales	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	37%	25%	0.7	0.4	0.2
341	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Food Sales	Retro	2,884	55%	1,586	0.19	0.19	15	$305	100%	40%	6	10%	80%	0.9	0.8	3.5
342	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Food Sales	Retro	2,236	32%	716	0.09	0.08	15	$155	100%	40%	7	10%	25%	0.7	0.5	3.1
343	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Food Sales	Retro	2,960	50%	1,480	0.18	0.17	15	$1,170	100%	40%	8	14%	25%	0.7	0.4	0.8
344	Refrigeration	Refrigeration Economizer	Biz-Custom	Food Sales	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	52%	10%	0.7	0.4	0.8
345	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Food Sales	Retro	579	59%	338	0.04	0.04	10	$80	100%	40%	10	8%	75%	0.8	0.8	2.1
346	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Food Sales	Retro	1,584	36%	578	0.07	0.07	12	$686	100%	40%	11	2%	25%	0.7	0.4	0.5
347	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Food Sales	Retro	2,884	55%	1,586	0.19	0.19	15	$305	100%	40%	12	1%	80%	0.9	0.8	3.5
348	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Food Sales	Retro	641	38%	242	0.03	0.03	10	$102	100%	40%	13	1%	2%	0.7	0.5	1.1
349	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Food Sales	ROB	2,140	29%	629	0.08	0.07	12	$1,239	100%	40%	14	8%	54%	0.7	0.6	0.3
350	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Food Sales	ROB	1,410	20%	281	0.03	0.03	12	$1,211	100%	40%	14	8%	54%	0.7	0.6	0.1
351	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Food Sales	Retro	2,016	68%	1,361	0.17	0.16	10	$91	100%	40%	15	3%	75%	0.8	0.8	7.2
352	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Food Sales	Retro	2,922	50%	1,453	0.18	0.17	12	$686	100%	40%	16	3%	25%	0.7	0.5	1.2
353	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Food Sales	ROB	6,374	20%	1,275	0.16	0.15	12	$1,651	100%	40%	17	3%	54%	0.7	0.6	0.4
354	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Food Sales	ROB	4,522	7%	305	0.04	0.04	12	$1,521	100%	40%	17	3%	54%	0.7	0.6	0.1
355	Refrigeration	Refrigeration - Custom	Biz-Custom	Food Sales	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
356	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Food Sales	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
357	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Food Sales	ROB	6,993	10%	721	0.09	0.09	10	$222	100%	40%	20	0%	44%	0.7	0.6	1.6
358	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Food Sales	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	0%	30%	0.7	0.4	0.2
359	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Food Sales	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	5%	35%	0.7	0.5	3.4
360	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Food Sales	Retro	2,658	20%	532	0.08	0.08	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.8
361	Ventilation	Demand Control Ventilation	Biz-Custom	Food Sales	Retro	2,166	43%	940	0.14	0.13	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.9
362	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Food Sales	Retro	19,919	82%	16,287	2.37	2.30	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.7
363	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Food Sales	Retro	21,909	83%	18,277	2.67	2.58	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	3.0

Appendix E: C&I Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
364	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Food Sales	Retro	23,903	82%	19,579	2.85	2.76	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.2
365	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Food Sales	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
366	WholeBldg_HVAC	GREM Controls	Biz-Custom	Food Sales	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
367	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Food Sales	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.7
368	WholeBldg	WholeBlg - Com RET	Biz-Custom	Food Sales	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
369	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Food Sales	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	0.9
370	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Food Service	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
371	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Food Service	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
372	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Food Service	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
373	CompressedAir	AODD Pump Controls	Biz-Custom	Food Service	Retro	103,919	35%	36,372	4.72	4.02	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.0
374	CompressedAir	No Loss Condensate Drain	Biz-Custom	Food Service	Retro	103,919	2%	2,320	0.30	0.26	13	$700	100%	40%	4	100%	5%	0.8	0.6	1.9
375	CompressedAir	Efficient Air Nozzles	Biz-Custom	Food Service	Retro	1,480	50%	740	0.10	0.08	15	$50	100%	40%	5	5%	20%	0.8	0.6	9.9
376	CompressedAir	Compressed Air - Custom	Biz-Custom	Food Service	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.2
377	Cooking	Commercial Griddles	Biz-Prescriptive	Food Service	ROB	15,825	12%	1,910	0.27	0.31	12	$0	100%		1	14%	17%	0.7	0.6	0.0
378	Cooking	Convection Ovens	Biz-Prescriptive	Food Service	ROB	9,839	11%	1,065	0.15	0.17	12	$0	100%		2	18%	53%	0.7	0.6	0.0
379	Cooking	Combination Ovens	Biz-Prescriptive	Food Service	ROB	23,958	38%	9,058	1.29	1.49	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.2
380	Cooking	Commercial Fryers	Biz-Prescriptive	Food Service	ROB	18,955	17%	3,274	0.47	0.54	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
381	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Food Service	ROB	17,846	55%	9,863	1.40	1.62	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
382	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Food Service	ROB	13,697	68%	9,314	1.33	1.53	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.6
383	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Food Service	ROB	4,383	60%	2,630	0.37	0.43	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.0
384	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Food Service	ROB	39,306	44%	17,369	2.93	2.72	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.8
385	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Food Service	ROB	26,901	32%	8,586	1.45	1.35	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.2
386	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Food Service	ROB	680	15%	100	0.05	0.00	15	$153	100%	40%	1	22%	10%	0.8	0.3	0.5
387	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Food Service	ROB	680	19%	132	0.07	0.00	15	$215	100%	40%	1	22%	10%	0.8	0.3	0.5
388	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Food Service	ROB	680	31%	211	0.11	0.00	15	$399	100%	40%	1	22%	10%	0.8	0.3	0.4
389	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Food Service	ROB	747	8%	57	0.03	0.00	15	$59	100%	40%	2	22%	10%	0.8	0.4	0.8
390	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Food Service	ROB	747	12%	90	0.05	0.00	15	$97	100%	40%	2	22%	10%	0.8	0.4	0.7
391	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Food Service	ROB	747	22%	167	0.08	0.00	15	$204	100%	40%	2	22%	10%	0.8	0.4	0.6
392	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Food Service	Retro	822	7%	58	0.03	0.00	3	$5	100%	40%	3	44%	50%	0.8	0.6	2.1
393	Cooling	Air Side Economizer	Biz-Custom	Food Service	Retro	680	20%	136	0.07	0.00	15	$153	100%	40%	4	44%	25%	0.8	0.4	0.7
394	Cooling	Advanced Rooftop Controls	Biz-Custom	Food Service	Retro	7,672	56%	4,281	2.18	0.04	15	$2,950	100%	40%	5	44%	20%	0.8	0.5	1.1
395	Cooling	HVAC Occupancy Controls	Biz-Custom	Food Service	Retro	711	20%	142	0.07	0.00	15	$537	100%	40%	6	44%	10%	0.8	0.3	0.2
396	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Food Service	ROB	705	13%	88	0.04	0.00	15	$115	100%	40%	7	25%	10%	0.8	0.3	0.6
397	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Food Service	ROB	705	22%	157	0.08	0.00	15	$514	100%	40%	7	25%	10%	0.8	0.3	0.2
398	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Food Service	ROB	705	33%	235	0.12	0.00	15	$631	100%	40%	7	25%	10%	0.8	0.3	0.3
399	Cooling	Smart Thermostat	Biz-Prescriptive	Food Service	ROB	2,818	14%	399	0.20	0.00	11	$175	100%	40%	8	25%	10%	0.8	0.5	1.4
400	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Food Service	ROB	909	7%	66	0.03	0.00	8	$84	100%	40%	9	31%	20%	0.8	0.4	0.4
401	Cooling	Air Cooled Chiller	Biz-Custom	Food Service	ROB	720	9%	65	0.03	0.00	23	$126	100%	40%	10	0%	10%	0.8	0.3	0.6
402	Cooling	Water Cooled Chiller	Biz-Custom	Food Service	ROB	362	23%	82	0.04	0.00	23	$126	100%	40%	11	0%	10%	0.8	0.3	0.7

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
403	Cooling	Window Film	Biz-Custom	Food Service	Retro	6,000	4%	264	0.13	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
404	Cooling	Triple Pane Windows	Biz-Custom	Food Service	Retro	6,000	6%	360	0.18	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
405	Cooling	Energy Recovery Ventilator	Biz-Custom	Food Service	Retro	747	0%	0	0.00	0.00	15	$1,047	100%		13	100%	2%	0.8	0.7	0.0
406	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Food Service	ROB	2,040	4%	72	0.01	0.01	15	$135	100%	40%	1	31%	10%	0.8	0.3	0.4
407	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Food Service	ROB	2,040	12%	238	0.04	0.05	15	$446	100%	40%	1	31%	10%	0.8	0.3	0.4
408	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Food Service	ROB	2,040	17%	354	0.06	0.07	15	$520	100%	40%	1	31%	10%	0.8	0.3	0.5
409	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,283	6%	139	0.02	0.03	15	$100	100%	40%	2	19%	10%	0.8	0.5	1.0
410	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,283	11%	259	0.04	0.05	15	$171	100%	40%	2	19%	10%	0.8	0.5	1.1
411	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,362	7%	154	0.03	0.03	15	$100	100%	40%	3	18%	10%	0.8	0.5	1.1
412	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,362	12%	280	0.05	0.06	15	$182	100%	40%	3	18%	10%	0.8	0.5	1.1
413	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,473	7%	170	0.03	0.03	15	$100	100%	40%	4	18%	10%	0.8	0.5	1.3
414	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Food Service	ROB	2,473	12%	307	0.05	0.06	15	$202	100%	40%	4	18%	10%	0.8	0.5	1.1
415	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Food Service	ROB	1,599	3%	55	0.01	0.01	25	$108	100%	40%	5	6%	20%	0.8	0.4	0.6
416	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Food Service	ROB	1,599	7%	116	0.02	0.02	25	$108	100%	40%	5	6%	20%	0.8	0.4	1.2
417	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Food Service	ROB	2,487	8%	191	0.03	0.04	8	$84	100%	40%	6	0%	20%	0.8	0.5	1.0
418	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Food Service	ROB	5,521	67%	3,698	0.62	0.58	15	$1,115	100%	40%	1	100%	33%	0.7	0.5	2.4
419	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Food Service	Retro	5,521	2%	110	0.02	0.02	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.6
420	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Food Service	ROB	18,059	54%	9,789	1.65	1.54	5	$60	100%	40%	3	20%	85%	0.9	0.9	46.4
421	HotWater	Faucet Aerator	Biz-Prescriptive	Food Service	Retro	5,521	67%	3,698	0.62	0.58	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	2.4
422	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Food Service	ROB	1,868	20%	380	0.06	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.1
423	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Food Service	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
424	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Food Service	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
425	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Food Service	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
426	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Food Service	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
427	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Food Service	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
428	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Food Service	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
429	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Food Service	Retro	320	68%	216	0.03	0.03	9	$27	100%	40%	1	10%	75%	0.8	0.8	3.7
430	Lighting_Int	LED interior directional	Biz-Prescriptive	Food Service	Retro	230	74%	170	0.03	0.02	9	$59	100%	40%	2	0%	75%	0.8	0.8	1.3
431	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Food Service	Retro	206	45%	92	0.01	0.01	9	$2	100%	40%	3	47%	45%	0.8	0.7	22.5
432	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Food Service	Retro	467	50%	234	0.04	0.03	9	$70	100%	40%	3	47%	45%	0.8	0.6	1.5
433	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Food Service	Retro	926	61%	563	0.09	0.07	9	$44	100%	40%	4	25%	35%	0.8	0.7	5.9
434	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Food Service	Retro	4,346	68%	2,957	0.45	0.39	9	$330	100%	40%	5	17%	35%	0.8	0.7	4.1
435	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Food Service	Retro	172	100%	172	0.03	0.02	11	$4	100%	40%	6	47%	0%	0.8	0.7	23.2
436	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Food Service	Retro	1,005	30%	301	0.05	0.04	10	$58	100%	40%	7	90%	20%	0.8	0.6	2.6
437	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Food Service	Retro	4	49%	2	0.00	0.00	15	$1	100%	40%	7	90%	20%	0.8	0.6	2.1
438	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Food Service	Retro	785	30%	235	0.04	0.03	15	$139	100%	40%	7	90%	20%	0.8	0.5	1.2
439	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Food Service	Retro	66	43%	28	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
440	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Food Service	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
441	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Food Service	Retro	9,932	50%	4,966	0.64	0.55	20	$1,180	100%	40%	2	2%	10%	0.8	0.6	3.5
442	Misc	High Efficiency Hand Dryers	Biz-Custom	Food Service	Retro	1,909	83%	1,585	0.21	0.18	10	$483	100%	40%	3	5%	10%	0.8	0.6	1.6
443	Misc	Ozone Commercial Laundry	Biz-Custom	Food Service	Retro	2,984	25%	746	0.10	0.08	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2

Appendix E: C&I 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	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
444	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Food Service	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	0.9
445	Misc	Miscellaneous Custom	Biz-Custom	Food Service	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	32%	10%	0.8	0.3	0.3
446	Motors	Cogged V-Belt	Biz-Custom	Food Service	Retro	17,237	3%	534	0.06	0.09	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.0
447	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Food Service	Retro	3,805	34%	1,290	0.16	0.23	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.4
448	Motors	Power Drive Systems	Biz-Custom	Food Service	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.4
449	Motors	Switch Reluctance Motors	Biz-Custom	Food Service	Retro	33,406	31%	10,222	1.23	1.81	15	$528	100%	40%	2	100%	1%	0.8	0.6	13.6
450	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Food Service	Retro	551	40%	223	0.03	0.02	6	$0	100%		1	30%	90%	0.9	0.9	0.0
451	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Food Service	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
452	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Food Service	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
453	Office_PC	Energy Star Server	Biz-Custom	Food Service	ROB	1,621	23%	368	0.05	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.2
454	Office_PC	Server Virtualization	Biz-Custom	Food Service	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
455	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Food Service	Retro	86,783	18%	15,778	2.05	1.74	15	$480	100%	40%	3	65%	20%	0.8	0.7	21.7
456	Office_PC	High Efficiency CRAC unit	Biz-Custom	Food Service	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
457	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Food Service	Retro	764	47%	358	0.05	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
458	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Food Service	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.6
459	Refrigeration	Strip Curtains	Biz-Prescriptive	Food Service	Retro	88	50%	44	0.01	0.00	4	$10	100%	40%	1	6%	30%	0.7	0.5	0.9
460	Refrigeration	Bare Suction Line	Biz-Custom	Food Service	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
461	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Food Service	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	4%	25%	0.7	0.4	0.4
462	Refrigeration	Saturated Suction Controls	Biz-Custom	Food Service	Retro	831	50%	416	0.06	0.04	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
463	Refrigeration	Compressor Retrofit	Biz-Custom	Food Service	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	13%	25%	0.7	0.4	0.2
464	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Food Service	Retro	2,884	55%	1,586	0.23	0.17	15	$305	100%	40%	6	4%	80%	0.9	0.8	3.5
465	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Food Service	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	4%	25%	0.7	0.5	3.1
466	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Food Service	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	5%	25%	0.7	0.4	0.8
467	Refrigeration	Refrigeration Economizer	Biz-Custom	Food Service	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	18%	10%	0.7	0.4	0.8
468	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Food Service	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	18%	75%	0.8	0.8	2.1
469	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Food Service	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	5%	25%	0.7	0.4	0.5
470	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Food Service	Retro	2,884	55%	1,586	0.23	0.17	15	$305	100%	40%	12	3%	80%	0.9	0.8	3.5
471	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Food Service	Retro	641	38%	242	0.03	0.03	10	$102	100%	40%	13	3%	2%	0.7	0.5	1.2
472	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Food Service	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	18%	54%	0.7	0.6	0.3
473	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Food Service	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	18%	54%	0.7	0.6	0.1
474	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Food Service	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	6%	75%	0.8	0.8	7.3
475	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Food Service	Retro	2,922	50%	1,453	0.21	0.16	12	$686	100%	40%	16	6%	25%	0.7	0.5	1.2
476	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Food Service	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	6%	54%	0.7	0.6	0.4
477	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Food Service	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	6%	54%	0.7	0.6	0.1
478	Refrigeration	Refrigeration - Custom	Biz-Custom	Food Service	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
479	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Food Service	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
480	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Food Service	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	5%	44%	0.7	0.6	1.6
481	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Food Service	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	0%	30%	0.7	0.4	0.2
482	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Food Service	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	11%	35%	0.7	0.5	3.4
483	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Food Service	Retro	2,669	20%	534	0.08	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.5	1.9

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
484	Ventilation	Demand Control Ventilation	Biz-Custom	Food Service	Retro	2,166	43%	940	0.14	0.12	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.9
485	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Food Service	Retro	19,919	82%	16,287	2.46	2.16	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.7
486	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Food Service	Retro	21,909	83%	18,277	2.76	2.42	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	3.0
487	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Food Service	Retro	23,903	82%	19,579	2.95	2.59	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.2
488	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Food Service	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
489	WholeBldg_HVAC	GREM Controls	Biz-Custom	Food Service	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
490	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Food Service	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.8
491	WholeBldg	WholeBlg - Com RET	Biz-Custom	Food Service	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.5
492	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Food Service	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	1.0
493	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Health	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
494	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Health	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
495	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Health	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
496	CompressedAir	AODD Pump Controls	Biz-Custom	Health	Retro	103,919	35%	36,372	4.54	3.95	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.3
497	CompressedAir	No Loss Condensate Drain	Biz-Custom	Health	Retro	103,919	2%	2,320	0.29	0.25	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
498	CompressedAir	Efficient Air Nozzles	Biz-Custom	Health	Retro	1,480	50%	740	0.09	0.08	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.0
499	CompressedAir	Compressed Air - Custom	Biz-Custom	Health	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
500	Cooking	Commercial Griddles	Biz-Prescriptive	Health	ROB	15,825	12%	1,910	0.58	0.19	12	$0	100%		1	14%	17%	0.7	0.6	0.0
501	Cooking	Convection Ovens	Biz-Prescriptive	Health	ROB	9,839	11%	1,065	0.32	0.11	12	$0	100%		2	18%	53%	0.7	0.6	0.0
502	Cooking	Combination Ovens	Biz-Prescriptive	Health	ROB	23,958	38%	9,058	2.73	0.91	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.3
503	Cooking	Commercial Fryers	Biz-Prescriptive	Health	ROB	18,955	17%	3,274	0.99	0.33	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
504	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Health	ROB	17,846	55%	9,863	2.98	0.99	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
505	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Health	ROB	13,697	68%	9,314	2.81	0.94	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.7
506	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Health	ROB	4,383	60%	2,630	0.79	0.27	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.1
507	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Health	ROB	39,306	44%	17,369	1.76	2.02	15	$662	100%	40%	6	26%	61%	0.7	0.7	17.3
508	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Health	ROB	26,901	32%	8,586	0.87	1.00	15	$995	100%	40%	6	26%	61%	0.7	0.7	5.7
509	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Health	ROB	1,260	15%	185	0.05	0.01	15	$153	100%	40%	1	25%	10%	0.8	0.4	0.8
510	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Health	ROB	1,260	19%	245	0.07	0.01	15	$215	100%	40%	1	25%	10%	0.8	0.4	0.8
511	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Health	ROB	1,260	31%	390	0.11	0.01	15	$399	100%	40%	1	25%	10%	0.8	0.4	0.7
512	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Health	ROB	1,385	8%	107	0.03	0.00	15	$59	100%	40%	2	25%	10%	0.8	0.5	1.2
513	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Health	ROB	1,385	12%	166	0.05	0.01	15	$97	100%	40%	2	25%	10%	0.8	0.5	1.2
514	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Health	ROB	1,385	22%	309	0.09	0.01	15	$204	100%	40%	2	25%	10%	0.8	0.5	1.0
515	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Health	Retro	1,523	7%	107	0.03	0.00	3	$5	100%	40%	3	50%	50%	0.8	0.6	3.6
516	Cooling	Air Side Economizer	Biz-Custom	Health	Retro	1,260	20%	252	0.07	0.01	15	$153	100%	40%	4	50%	25%	0.8	0.5	1.1
517	Cooling	Advanced Rooftop Controls	Biz-Custom	Health	Retro	8,760	56%	4,888	1.36	0.17	15	$2,950	100%	40%	5	50%	20%	0.8	0.5	1.1
518	Cooling	HVAC Occupancy Controls	Biz-Custom	Health	Retro	1,317	20%	263	0.07	0.01	15	$537	100%	40%	6	50%	10%	0.8	0.3	0.3
519	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Health	ROB	1,305	13%	163	0.05	0.01	15	$115	100%	40%	7	0%	10%	0.8	0.5	1.0
520	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Health	ROB	1,305	22%	290	0.08	0.01	15	$514	100%	40%	7	0%	10%	0.8	0.3	0.4
521	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Health	ROB	1,305	33%	435	0.12	0.01	15	$631	100%	40%	7	0%	10%	0.8	0.3	0.5
522	Cooling	Smart Thermostat	Biz-Prescriptive	Health	ROB	5,222	14%	739	0.21	0.03	11	$175	100%	40%	8	0%	10%	0.8	0.6	2.3

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
523	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Health	ROB	1,684	7%	122	0.03	0.00	8	$84	100%	40%	9	0%	20%	0.8	0.5	0.6
524	Cooling	Air Cooled Chiller	Biz-Custom	Health	ROB	1,334	9%	120	0.03	0.00	23	$126	100%	40%	10	45%	10%	0.8	0.4	0.9
525	Cooling	Water Cooled Chiller	Biz-Custom	Health	ROB	670	23%	152	0.04	0.01	23	$126	100%	40%	11	5%	10%	0.8	0.4	1.2
526	Cooling	Window Film	Biz-Custom	Health	Retro	6,000	4%	264	0.07	0.01	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
527	Cooling	Triple Pane Windows	Biz-Custom	Health	Retro	6,000	6%	360	0.10	0.01	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.5
528	Cooling	Energy Recovery Ventilator	Biz-Custom	Health	Retro	1,385	62%	862	0.24	0.03	15	$1,046	100%	40%	13	100%	2%	0.8	0.4	0.6
529	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Health	ROB	2,727	4%	110	0.01	0.03	15	$135	100%	40%	1	0%	10%	0.8	0.3	0.6
530	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Health	ROB	2,727	13%	343	0.03	0.08	15	$446	100%	40%	1	0%	10%	0.8	0.3	0.6
531	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Health	ROB	2,727	19%	529	0.05	0.12	15	$520	100%	40%	1	0%	10%	0.8	0.4	0.7
532	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,030	6%	192	0.02	0.04	15	$100	100%	40%	2	17%	10%	0.8	0.5	1.4
533	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,030	12%	353	0.03	0.08	15	$171	100%	40%	2	17%	10%	0.8	0.5	1.5
534	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,142	7%	215	0.02	0.05	15	$100	100%	40%	3	17%	10%	0.8	0.5	1.6
535	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,142	12%	386	0.04	0.09	15	$182	100%	40%	3	17%	10%	0.8	0.5	1.6
536	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,309	7%	239	0.02	0.06	15	$100	100%	40%	4	17%	10%	0.8	0.5	1.8
537	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Health	ROB	3,309	13%	428	0.04	0.10	15	$202	100%	40%	4	17%	10%	0.8	0.5	1.6
538	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Health	ROB	2,208	4%	82	0.01	0.02	25	$108	100%	40%	5	0%	20%	0.8	0.4	0.8
539	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Health	ROB	2,208	9%	195	0.02	0.05	25	$108	100%	40%	5	0%	20%	0.8	0.5	1.9
540	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Health	ROB	3,316	10%	336	0.03	0.08	8	$84	100%	40%	6	0%	20%	0.8	0.6	1.8
541	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Health	ROB	6,995	67%	4,684	0.47	0.54	15	$1,115	100%	40%	1	100%	29%	0.7	0.5	2.8
542	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Health	Retro	6,995	2%	140	0.01	0.02	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.9
543	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Health	ROB	18,059	54%	9,789	0.99	1.14	5	$60	100%	40%	3	20%	85%	0.9	0.9	42.8
544	HotWater	Faucet Aerator	Biz-Prescriptive	Health	Retro	6,995	67%	4,684	0.47	0.54	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	2.8
545	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Health	ROB	1,868	20%	380	0.04	0.04	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
546	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Health	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
547	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Health	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
548	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Health	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
549	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Health	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
550	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Health	Retro	3,235	60%	1,953	0.00	0.22	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
551	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Health	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
552	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Health	Retro	349	68%	236	0.03	0.02	9	$27	100%	40%	1	3%	75%	0.8	0.8	3.9
553	Lighting_Int	LED interior directional	Biz-Prescriptive	Health	Retro	251	74%	185	0.02	0.02	9	$59	100%	40%	2	0%	75%	0.8	0.8	1.4
554	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Health	Retro	225	45%	101	0.01	0.01	9	$2	100%	40%	3	80%	45%	0.8	0.7	23.7
555	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Health	Retro	509	50%	255	0.03	0.02	9	$70	100%	40%	3	80%	45%	0.8	0.6	1.6
556	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Health	Retro	1,009	61%	613	0.08	0.06	9	$44	100%	40%	4	9%	35%	0.8	0.7	6.2
557	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Health	Retro	4,737	68%	3,223	0.41	0.31	9	$330	100%	40%	5	6%	35%	0.8	0.7	4.3
558	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Health	Retro	187	100%	187	0.02	0.02	11	$4	100%	40%	6	80%	0%	0.8	0.7	24.4
559	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Health	Retro	1,095	30%	329	0.04	0.03	10	$58	100%	40%	7	96%	20%	0.8	0.7	2.8
560	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Health	Retro	4	49%	2	0.00	0.00	15	$1	100%	40%	7	96%	20%	0.8	0.6	2.2
561	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Health	Retro	855	30%	257	0.03	0.02	15	$151	100%	40%	7	96%	20%	0.8	0.5	1.1
562	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Health	Retro	70	43%	30	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
563	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Health	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3

Appendix E: C&I 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
564	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Health	Retro	9,932	50%	4,966	0.62	0.54	20	$1,180	100%	40%	2	3%	10%	0.8	0.6	3.5
565	Misc	High Efficiency Hand Dryers	Biz-Custom	Health	Retro	1,909	83%	1,585	0.20	0.17	10	$483	100%	40%	3	5%	10%	0.8	0.6	1.6
566	Misc	Ozone Commercial Laundry	Biz-Custom	Health	Retro	2,984	25%	746	0.09	0.08	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
567	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Health	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
568	Misc	Miscellaneous Custom	Biz-Custom	Health	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	1%	10%	0.8	0.3	0.3
569	Motors	Cogged V-Belt	Biz-Custom	Health	Retro	17,237	3%	534	0.07	0.06	15	$384	100%	40%	1	50%	10%	0.8	0.5	0.9
570	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Health	Retro	3,805	34%	1,290	0.16	0.13	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.1
571	Motors	Power Drive Systems	Biz-Custom	Health	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.1
572	Motors	Switch Reluctance Motors	Biz-Custom	Health	Retro	33,406	31%	10,222	1.28	1.05	15	$528	100%	40%	2	100%	1%	0.8	0.6	12.8
573	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Health	Retro	551	40%	223	0.03	0.02	6	$0	100%		1	5%	90%	0.9	0.9	0.0
574	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Health	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
575	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Health	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
576	Office_PC	Energy Star Server	Biz-Custom	Health	ROB	1,621	23%	368	0.05	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.3
577	Office_PC	Server Virtualization	Biz-Custom	Health	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
578	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Health	Retro	86,783	18%	15,778	1.97	1.71	15	$480	100%	40%	3	65%	20%	0.8	0.7	22.0
579	Office_PC	High Efficiency CRAC unit	Biz-Custom	Health	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
580	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Health	Retro	764	47%	358	0.04	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
581	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Health	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
582	Refrigeration	Strip Curtains	Biz-Prescriptive	Health	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	5%	30%	0.7	0.6	0.0
583	Refrigeration	Bare Suction Line	Biz-Custom	Health	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.6
584	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Health	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	4%	25%	0.7	0.4	0.4
585	Refrigeration	Saturated Suction Controls	Biz-Custom	Health	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
586	Refrigeration	Compressor Retrofit	Biz-Custom	Health	Retro	813	20%	163	0.03	0.02	15	$477	100%	40%	5	12%	25%	0.7	0.4	0.2
587	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Health	Retro	2,884	55%	1,586	0.25	0.18	15	$305	100%	40%	6	3%	80%	0.9	0.8	3.5
588	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Health	Retro	2,236	32%	716	0.11	0.08	15	$155	100%	40%	7	3%	25%	0.7	0.5	3.1
589	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Health	Retro	2,960	50%	1,480	0.23	0.17	15	$1,170	100%	40%	8	5%	25%	0.7	0.4	0.9
590	Refrigeration	Refrigeration Economizer	Biz-Custom	Health	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	17%	10%	0.7	0.4	0.8
591	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Health	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	17%	25%	0.7	0.5	2.1
592	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Health	Retro	1,584	36%	578	0.09	0.07	12	$686	100%	40%	11	5%	25%	0.7	0.4	0.5
593	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Health	Retro	2,884	55%	1,586	0.25	0.18	15	$305	100%	40%	12	3%	80%	0.9	0.8	3.5
594	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Health	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	3%	2%	0.7	0.4	0.8
595	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Health	ROB	2,140	29%	629	0.10	0.07	12	$1,239	100%	40%	14	17%	54%	0.7	0.6	0.3
596	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Health	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	17%	54%	0.7	0.6	0.1
597	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Health	Retro	2,016	68%	1,361	0.21	0.16	10	$91	100%	40%	15	6%	25%	0.7	0.6	7.4
598	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Health	Retro	2,922	50%	1,453	0.23	0.17	12	$686	100%	40%	16	6%	25%	0.7	0.5	1.2
599	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Health	ROB	6,374	20%	1,275	0.20	0.15	12	$1,651	100%	40%	17	6%	54%	0.7	0.6	0.4
600	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Health	ROB	4,522	7%	305	0.05	0.03	12	$1,521	100%	40%	17	6%	54%	0.7	0.6	0.1
601	Refrigeration	Refrigeration - Custom	Biz-Custom	Health	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
602	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Health	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
603	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Health	ROB	6,993	10%	721	0.11	0.08	10	$222	100%	40%	20	6%	44%	0.7	0.6	1.6
604	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Health	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	3%	30%	0.7	0.4	0.2

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
605	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Health	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	10%	35%	0.7	0.5	3.5
606	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Health	Retro	2,639	20%	528	0.07	0.06	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.6
607	Ventilation	Demand Control Ventilation	Biz-Custom	Health	Retro	2,166	43%	940	0.12	0.11	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.7
608	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Health	Retro	19,919	82%	16,287	2.09	1.88	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.6
609	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Health	Retro	21,909	83%	18,277	2.35	2.11	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	2.9
610	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Health	Retro	23,903	82%	19,579	2.51	2.26	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.1
611	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Health	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
612	WholeBldg_HVAC	GREM Controls	Biz-Custom	Health	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
613	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Health	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.6
614	WholeBldg	WholeBlg - Com RET	Biz-Custom	Health	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
615	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Health	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	0.9
616	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Lodging	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.4
617	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Lodging	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
618	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Lodging	ROB	1,583	21%	329	0.04	0.05	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.6
619	CompressedAir	AODD Pump Controls	Biz-Custom	Lodging	Retro	103,919	35%	36,372	4.51	5.04	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.5
620	CompressedAir	No Loss Condensate Drain	Biz-Custom	Lodging	Retro	103,919	2%	2,320	0.29	0.32	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
621	CompressedAir	Efficient Air Nozzles	Biz-Custom	Lodging	Retro	1,480	50%	740	0.09	0.10	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.2
622	CompressedAir	Compressed Air - Custom	Biz-Custom	Lodging	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
623	Cooking	Commercial Griddles	Biz-Prescriptive	Lodging	ROB	15,825	12%	1,910	0.60	0.19	12	$0	100%		1	14%	17%	0.7	0.6	0.0
624	Cooking	Convection Ovens	Biz-Prescriptive	Lodging	ROB	9,839	11%	1,065	0.34	0.10	12	$0	100%		2	18%	53%	0.7	0.6	0.0
625	Cooking	Combination Ovens	Biz-Prescriptive	Lodging	ROB	23,958	38%	9,058	2.86	0.89	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.3
626	Cooking	Commercial Fryers	Biz-Prescriptive	Lodging	ROB	18,955	17%	3,274	1.04	0.32	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
627	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Lodging	ROB	17,846	55%	9,863	3.12	0.97	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.5
628	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Lodging	ROB	13,697	68%	9,314	2.95	0.91	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.7
629	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Lodging	ROB	4,383	60%	2,630	0.83	0.26	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.1
630	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Lodging	ROB	39,306	44%	17,369	1.79	2.76	15	$662	100%	40%	6	26%	61%	0.7	0.7	17.9
631	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Lodging	ROB	26,901	32%	8,586	0.89	1.37	15	$995	100%	40%	6	26%	61%	0.7	0.7	5.9
632	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Lodging	ROB	837	15%	123	0.04	0.00	15	$153	100%	40%	1	13%	10%	0.8	0.3	0.6
633	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Lodging	ROB	837	19%	163	0.05	0.00	15	$215	100%	40%	1	13%	10%	0.8	0.3	0.5
634	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Lodging	ROB	837	31%	259	0.08	0.01	15	$399	100%	40%	1	13%	10%	0.8	0.3	0.5
635	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Lodging	ROB	919	8%	71	0.02	0.00	15	$59	100%	40%	2	13%	10%	0.8	0.4	0.8
636	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Lodging	ROB	919	12%	110	0.04	0.00	15	$97	100%	40%	2	13%	10%	0.8	0.4	0.8
637	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Lodging	ROB	919	22%	205	0.07	0.00	15	$204	100%	40%	2	13%	10%	0.8	0.4	0.7
638	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Lodging	Retro	1,011	7%	71	0.02	0.00	3	$5	100%	40%	3	26%	50%	0.8	0.6	2.4
639	Cooling	Air Side Economizer	Biz-Custom	Lodging	Retro	837	20%	167	0.05	0.00	15	$153	100%	40%	4	26%	25%	0.8	0.4	0.8
640	Cooling	Advanced Rooftop Controls	Biz-Custom	Lodging	Retro	8,760	56%	4,888	1.58	0.10	15	$2,950	100%	40%	5	26%	20%	0.8	0.5	1.2
641	Cooling	HVAC Occupancy Controls	Biz-Custom	Lodging	Retro	874	20%	175	0.06	0.00	15	$537	100%	40%	6	26%	10%	0.8	0.3	0.2
642	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Lodging	ROB	867	13%	108	0.03	0.00	15	$115	100%	40%	7	0%	10%	0.8	0.4	0.7
643	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Lodging	ROB	867	22%	193	0.06	0.00	15	$514	100%	40%	7	0%	10%	0.8	0.3	0.3

Appendix E: C&I 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
644	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Lodging	ROB	867	33%	289	0.09	0.01	15	$631	100%	40%	7	0%	10%	0.8	0.3	0.3
645	Cooling	Smart Thermostat	Biz-Prescriptive	Lodging	ROB	3,466	14%	491	0.16	0.01	11	$175	100%	40%	8	0%	10%	0.8	0.6	1.5
646	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Lodging	ROB	1,118	7%	81	0.03	0.00	8	$84	100%	40%	9	15%	20%	0.8	0.4	0.4
647	Cooling	Air Cooled Chiller	Biz-Custom	Lodging	ROB	886	9%	80	0.03	0.00	23	$126	100%	40%	10	42%	10%	0.8	0.3	0.6
648	Cooling	Water Cooled Chiller	Biz-Custom	Lodging	ROB	445	23%	101	0.03	0.00	23	$126	100%	40%	11	5%	10%	0.8	0.3	0.8
649	Cooling	Window Film	Biz-Custom	Lodging	Retro	6,000	4%	264	0.09	0.01	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
650	Cooling	Triple Pane Windows	Biz-Custom	Lodging	Retro	6,000	6%	360	0.12	0.01	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.5
651	Cooling	Energy Recovery Ventilator	Biz-Custom	Lodging	Retro	919	0%	0	0.00	0.00	15	$1,045	100%		13	100%	2%	0.8	0.7	0.0
652	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Lodging	ROB	3,034	3%	100	0.01	0.02	15	$135	100%	40%	1	0%	10%	0.8	0.3	0.5
653	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Lodging	ROB	3,034	11%	341	0.04	0.07	15	$446	100%	40%	1	0%	10%	0.8	0.3	0.6
654	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Lodging	ROB	3,034	16%	498	0.05	0.10	15	$520	100%	40%	1	0%	10%	0.8	0.4	0.7
655	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,404	6%	205	0.02	0.04	15	$100	100%	40%	2	9%	10%	0.8	0.5	1.5
656	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,404	11%	381	0.04	0.08	15	$171	100%	40%	2	9%	10%	0.8	0.5	1.6
657	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,520	6%	225	0.02	0.05	15	$100	100%	40%	3	9%	10%	0.8	0.5	1.6
658	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,520	12%	411	0.05	0.08	15	$182	100%	40%	3	9%	10%	0.8	0.5	1.6
659	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,676	7%	246	0.03	0.05	15	$100	100%	40%	4	9%	10%	0.8	0.6	1.8
660	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Lodging	ROB	3,676	12%	449	0.05	0.09	15	$202	100%	40%	4	9%	10%	0.8	0.5	1.6
661	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Lodging	ROB	2,343	3%	78	0.01	0.02	25	$108	100%	40%	5	14%	20%	0.8	0.4	0.8
662	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Lodging	ROB	2,343	7%	153	0.02	0.03	25	$108	100%	40%	5	14%	20%	0.8	0.5	1.5
663	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Lodging	ROB	3,703	7%	245	0.03	0.05	8	$84	100%	40%	6	15%	20%	0.8	0.6	1.3
664	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Lodging	ROB	6,347	67%	4,250	0.44	0.68	15	$1,115	100%	40%	1	100%	26%	0.7	0.5	2.6
665	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Lodging	Retro	6,347	2%	127	0.01	0.02	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.8
666	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Lodging	ROB	18,059	54%	9,789	1.01	1.56	5	$60	100%	40%	3	20%	85%	0.9	0.9	44.4
667	HotWater	Faucet Aerator	Biz-Prescriptive	Lodging	Retro	6,347	67%	4,250	0.44	0.68	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	2.6
668	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Lodging	ROB	1,868	20%	380	0.04	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
669	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Lodging	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
670	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Lodging	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
671	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Lodging	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
672	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Lodging	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
673	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Lodging	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
674	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Lodging	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
675	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Lodging	Retro	356	68%	241	0.02	0.03	8	$27	100%	40%	1	9%	75%	0.8	0.8	3.5
676	Lighting_Int	LED interior directional	Biz-Prescriptive	Lodging	Retro	256	74%	189	0.02	0.02	8	$59	100%	40%	2	0%	75%	0.8	0.8	1.3
677	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Lodging	Retro	229	45%	103	0.01	0.01	8	$2	100%	40%	3	46%	45%	0.8	0.7	21.7
678	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Lodging	Retro	519	50%	260	0.03	0.03	8	$70	100%	40%	3	46%	45%	0.8	0.6	1.5
679	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Lodging	Retro	1,029	61%	626	0.06	0.08	8	$44	100%	40%	4	26%	35%	0.8	0.7	5.6
680	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Lodging	Retro	4,832	68%	3,288	0.32	0.42	8	$330	100%	40%	5	17%	35%	0.8	0.7	4.0
681	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Lodging	Retro	191	100%	191	0.02	0.02	11	$4	100%	40%	6	46%	0%	0.8	0.7	24.6
682	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Lodging	Retro	1,117	30%	335	0.03	0.04	10	$58	100%	40%	7	89%	20%	0.8	0.7	2.8
683	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Lodging	Retro	4	49%	2	0.00	0.00	15	$1	100%	40%	7	89%	20%	0.8	0.6	2.2
684	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Lodging	Retro	872	30%	262	0.03	0.03	15	$154	100%	40%	7	89%	20%	0.8	0.5	1.1

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
685	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Lodging	Retro	67	43%	29	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
686	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Lodging	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
687	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Lodging	Retro	9,932	50%	4,966	0.62	0.69	20	$1,180	100%	40%	2	4%	10%	0.8	0.6	3.6
688	Misc	High Efficiency Hand Dryers	Biz-Custom	Lodging	Retro	262	83%	217	0.03	0.03	10	$483	100%	40%	3	5%	10%	0.8	0.3	0.2
689	Misc	Ozone Commercial Laundry	Biz-Custom	Lodging	Retro	2,984	25%	746	0.09	0.10	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
690	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Lodging	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
691	Misc	Miscellaneous Custom	Biz-Custom	Lodging	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	43%	10%	0.8	0.3	0.3
692	Motors	Cogged V-Belt	Biz-Custom	Lodging	Retro	29,207	3%	905	0.11	0.10	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.6
693	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Lodging	Retro	3,805	34%	1,290	0.16	0.14	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.1
694	Motors	Power Drive Systems	Biz-Custom	Lodging	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.1
695	Motors	Switch Reluctance Motors	Biz-Custom	Lodging	Retro	56,602	31%	17,320	2.20	1.92	15	$528	100%	40%	2	100%	1%	0.8	0.7	21.8
696	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Lodging	Retro	551	40%	223	0.03	0.03	6	$0	100%		1	5%	90%	0.9	0.9	0.0
697	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Lodging	Retro	1,086	10%	109	0.01	0.02	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
698	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Lodging	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
699	Office_PC	Energy Star Server	Biz-Custom	Lodging	ROB	1,621	23%	368	0.05	0.05	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.3
700	Office_PC	Server Virtualization	Biz-Custom	Lodging	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
701	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Lodging	Retro	86,783	18%	15,778	1.96	2.18	15	$480	100%	40%	3	65%	20%	0.8	0.7	22.3
702	Office_PC	High Efficiency CRAC unit	Biz-Custom	Lodging	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.8
703	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Lodging	Retro	764	47%	358	0.04	0.05	15	$82	100%	40%	4	65%	20%	0.8	0.6	3.0
704	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Lodging	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
705	Refrigeration	Strip Curtains	Biz-Prescriptive	Lodging	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	10%	30%	0.7	0.6	0.0
706	Refrigeration	Bare Suction Line	Biz-Custom	Lodging	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
707	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Lodging	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	7%	25%	0.7	0.4	0.4
708	Refrigeration	Saturated Suction Controls	Biz-Custom	Lodging	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
709	Refrigeration	Compressor Retrofit	Biz-Custom	Lodging	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	23%	25%	0.7	0.4	0.2
710	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Lodging	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	6%	80%	0.9	0.8	3.5
711	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Lodging	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	6%	25%	0.7	0.5	3.1
712	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Lodging	Retro	2,960	50%	1,480	0.20	0.16	15	$1,170	100%	40%	8	9%	25%	0.7	0.4	0.8
713	Refrigeration	Refrigeration Economizer	Biz-Custom	Lodging	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	32%	10%	0.7	0.4	0.8
714	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Lodging	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	11%	25%	0.7	0.5	2.1
715	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Lodging	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	3%	25%	0.7	0.4	0.5
716	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Lodging	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	2%	80%	0.9	0.8	3.5
717	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Lodging	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	2%	2%	0.7	0.4	0.8
718	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Lodging	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	11%	54%	0.7	0.6	0.3
719	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Lodging	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	11%	54%	0.7	0.6	0.1
720	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Lodging	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	4%	25%	0.7	0.6	7.3
721	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Lodging	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	4%	25%	0.7	0.5	1.2
722	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Lodging	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	4%	54%	0.7	0.6	0.4
723	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Lodging	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	4%	54%	0.7	0.6	0.1
724	Refrigeration	Refrigeration - Custom	Biz-Custom	Lodging	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3

Appendix E: C&I Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
725	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Lodging	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
726	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Lodging	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	10%	44%	0.7	0.6	1.6
727	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Lodging	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	4%	30%	0.7	0.4	0.2
728	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Lodging	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	7%	35%	0.7	0.5	3.4
729	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Lodging	Retro	2,639	20%	528	0.06	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.6
730	Ventilation	Demand Control Ventilation	Biz-Custom	Lodging	Retro	2,166	43%	940	0.11	0.12	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.8
731	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Lodging	Retro	19,919	82%	16,287	1.95	2.14	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.7
732	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Lodging	Retro	21,909	83%	18,277	2.19	2.40	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	2.9
733	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Lodging	Retro	23,903	82%	19,579	2.34	2.57	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.1
734	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Lodging	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	15%	10%	0.8	0.6	1.7
735	WholeBldg_HVAC	GREM Controls	Biz-Custom	Lodging	Retro	7,167	19%	1,382	0.21	0.17	5	$260	100%	40%	2	85%	20%	0.8	0.6	1.4
736	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Lodging	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.7
737	WholeBldg	WholeBlg - Com RET	Biz-Custom	Lodging	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
738	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Lodging	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	0.9
739	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Retail	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
740	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Retail	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
741	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Retail	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
742	CompressedAir	AODD Pump Controls	Biz-Custom	Retail	Retro	103,919	35%	36,372	3.91	4.19	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.1
743	CompressedAir	No Loss Condensate Drain	Biz-Custom	Retail	Retro	103,919	2%	2,320	0.25	0.27	13	$700	100%	40%	4	100%	5%	0.8	0.6	1.9
744	CompressedAir	Efficient Air Nozzles	Biz-Custom	Retail	Retro	1,480	50%	740	0.08	0.09	15	$50	100%	40%	5	5%	20%	0.8	0.6	9.9
745	CompressedAir	Compressed Air - Custom	Biz-Custom	Retail	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.2
746	Cooking	Commercial Griddles	Biz-Prescriptive	Retail	ROB	15,825	12%	1,910	0.47	0.20	12	$0	100%		1	14%	17%	0.7	0.6	0.0
747	Cooking	Convection Ovens	Biz-Prescriptive	Retail	ROB	9,839	11%	1,065	0.26	0.11	12	$0	100%		2	18%	53%	0.7	0.6	0.0
748	Cooking	Combination Ovens	Biz-Prescriptive	Retail	ROB	23,958	38%	9,058	2.21	0.96	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.3
749	Cooking	Commercial Fryers	Biz-Prescriptive	Retail	ROB	18,955	17%	3,274	0.80	0.35	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
750	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Retail	ROB	17,846	55%	9,863	2.41	1.05	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
751	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Retail	ROB	13,697	68%	9,314	2.28	0.99	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.7
752	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Retail	ROB	4,383	60%	2,630	0.64	0.28	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.1
753	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Retail	ROB	39,306	44%	17,369	2.27	2.25	15	$662	100%	40%	6	26%	61%	0.7	0.7	17.9
754	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Retail	ROB	26,901	32%	8,586	1.12	1.11	15	$995	100%	40%	6	26%	61%	0.7	0.7	5.9
755	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Retail	ROB	652	15%	96	0.04	0.00	15	$153	100%	40%	1	15%	10%	0.8	0.3	0.5
756	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Retail	ROB	652	19%	127	0.05	0.00	15	$215	100%	40%	1	15%	10%	0.8	0.3	0.4
757	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Retail	ROB	652	31%	202	0.08	0.00	15	$399	100%	40%	1	15%	10%	0.8	0.3	0.4
758	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Retail	ROB	716	8%	55	0.02	0.00	15	$59	100%	40%	2	15%	10%	0.8	0.4	0.7
759	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Retail	ROB	716	12%	86	0.03	0.00	15	$97	100%	40%	2	15%	10%	0.8	0.4	0.7
760	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Retail	ROB	716	22%	160	0.07	0.00	15	$204	100%	40%	2	15%	10%	0.8	0.3	0.6
761	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Retail	Retro	788	7%	55	0.02	0.00	3	$5	100%	40%	3	29%	50%	0.8	0.6	2.0
762	Cooling	Air Side Economizer	Biz-Custom	Retail	Retro	652	20%	130	0.05	0.00	15	$153	100%	40%	4	29%	25%	0.8	0.4	0.6

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
763	Cooling	Advanced Rooftop Controls	Biz-Custom	Retail	Retro	6,683	56%	3,729	1.52	0.06	15	$2,950	100%	40%	5	29%	20%	0.8	0.4	0.9
764	Cooling	HVAC Occupancy Controls	Biz-Custom	Retail	Retro	681	20%	136	0.06	0.00	15	$537	100%	40%	6	29%	10%	0.8	0.3	0.2
765	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Retail	ROB	675	13%	84	0.03	0.00	15	$115	100%	40%	7	18%	10%	0.8	0.3	0.5
766	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Retail	ROB	675	22%	150	0.06	0.00	15	$514	100%	40%	7	18%	10%	0.8	0.3	0.2
767	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Retail	ROB	675	33%	225	0.09	0.00	15	$631	100%	40%	7	18%	10%	0.8	0.3	0.3
768	Cooling	Smart Thermostat	Biz-Prescriptive	Retail	ROB	2,702	14%	383	0.16	0.01	11	$175	100%	40%	8	18%	10%	0.8	0.5	1.3
769	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Retail	ROB	872	7%	63	0.03	0.00	8	$84	100%	40%	9	18%	20%	0.8	0.4	0.3
770	Cooling	Air Cooled Chiller	Biz-Custom	Retail	ROB	690	9%	62	0.03	0.00	23	$126	100%	40%	10	32%	10%	0.8	0.3	0.5
771	Cooling	Water Cooled Chiller	Biz-Custom	Retail	ROB	347	23%	79	0.03	0.00	23	$126	100%	40%	11	4%	10%	0.8	0.3	0.6
772	Cooling	Window Film	Biz-Custom	Retail	Retro	6,000	4%	264	0.11	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
773	Cooling	Triple Pane Windows	Biz-Custom	Retail	Retro	6,000	6%	360	0.15	0.01	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
774	Cooling	Energy Recovery Ventilator	Biz-Custom	Retail	Retro	716	42%	298	0.12	0.00	15	$1,044	100%	40%	13	100%	2%	0.8	0.2	0.2
775	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Retail	ROB	1,847	4%	66	0.01	0.01	15	$135	100%	40%	1	28%	10%	0.8	0.3	0.4
776	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Retail	ROB	1,847	12%	218	0.03	0.05	15	$446	100%	40%	1	28%	10%	0.8	0.3	0.4
777	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Retail	ROB	1,847	18%	326	0.04	0.07	15	$520	100%	40%	1	28%	10%	0.8	0.3	0.5
778	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,064	6%	127	0.02	0.03	15	$100	100%	40%	2	16%	10%	0.8	0.4	0.9
779	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,064	11%	235	0.03	0.05	15	$171	100%	40%	2	16%	10%	0.8	0.5	1.0
780	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,137	7%	140	0.02	0.03	15	$100	100%	40%	3	15%	10%	0.8	0.5	1.1
781	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,137	12%	255	0.03	0.06	15	$182	100%	40%	3	15%	10%	0.8	0.5	1.0
782	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,239	7%	155	0.02	0.03	15	$100	100%	40%	4	15%	10%	0.8	0.5	1.2
783	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Retail	ROB	2,239	13%	280	0.04	0.06	15	$202	100%	40%	4	15%	10%	0.8	0.5	1.0
784	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Retail	ROB	1,455	4%	51	0.01	0.01	25	$108	100%	40%	5	7%	20%	0.8	0.4	0.5
785	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Retail	ROB	1,455	8%	110	0.01	0.02	25	$108	100%	40%	5	7%	20%	0.8	0.4	1.1
786	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Retail	ROB	2,250	8%	182	0.02	0.04	8	$84	100%	40%	6	10%	20%	0.8	0.5	1.0
787	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Retail	ROB	4,687	67%	3,139	0.41	0.41	15	$1,115	100%	40%	1	100%	23%	0.7	0.5	1.9
788	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Retail	Retro	4,687	2%	94	0.01	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.3
789	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Retail	ROB	18,059	54%	9,789	1.28	1.27	5	$60	100%	40%	3	20%	85%	0.9	0.9	44.2
790	HotWater	Faucet Aerator	Biz-Prescriptive	Retail	Retro	4,687	67%	3,139	0.41	0.41	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	1.9
791	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Retail	ROB	1,868	20%	380	0.05	0.05	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
792	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Retail	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
793	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Retail	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
794	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Retail	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
795	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Retail	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
796	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Retail	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
797	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Retail	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
798	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Retail	Retro	238	68%	161	0.02	0.02	12	$27	100%	40%	1	4%	75%	0.8	0.8	3.3
799	Lighting_Int	LED interior directional	Biz-Prescriptive	Retail	Retro	171	74%	126	0.01	0.01	12	$59	100%	40%	2	0%	75%	0.8	0.8	1.2
800	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Retail	Retro	153	45%	68	0.01	0.01	12	$2	100%	40%	3	75%	45%	0.8	0.7	20.0
801	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Retail	Retro	346	50%	173	0.02	0.02	12	$70	100%	40%	3	75%	45%	0.8	0.6	1.4
802	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Retail	Retro	687	61%	417	0.04	0.04	12	$44	100%	40%	4	12%	35%	0.8	0.7	5.2
803	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Retail	Retro	3,225	68%	2,194	0.23	0.23	12	$330	100%	40%	5	8%	35%	0.8	0.7	3.7

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
804	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Retail	Retro	128	100%	128	0.01	0.01	11	$4	100%	40%	6	75%	0%	0.8	0.7	16.4
805	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Retail	Retro	746	30%	224	0.02	0.02	10	$58	100%	40%	7	95%	20%	0.8	0.6	1.9
806	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Retail	Retro	3	49%	1	0.00	0.00	15	$1	100%	40%	7	95%	20%	0.8	0.6	1.5
807	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Retail	Retro	582	30%	175	0.02	0.02	15	$103	100%	40%	7	95%	20%	0.8	0.5	1.1
808	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Retail	Retro	67	43%	29	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
809	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Retail	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
810	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Retail	Retro	9,932	50%	4,966	0.53	0.57	20	$1,180	100%	40%	2	0%	10%	0.8	0.6	3.5
811	Misc	High Efficiency Hand Dryers	Biz-Custom	Retail	Retro	1,909	83%	1,585	0.17	0.18	10	$483	100%	40%	3	5%	10%	0.8	0.6	1.6
812	Misc	Ozone Commercial Laundry	Biz-Custom	Retail	Retro	2,984	25%	746	0.08	0.09	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
813	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Retail	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
814	Misc	Miscellaneous Custom	Biz-Custom	Retail	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	39%	10%	0.8	0.3	0.3
815	Motors	Cogged V-Belt	Biz-Custom	Retail	Retro	14,670	3%	455	0.06	0.05	15	$384	100%	40%	1	50%	10%	0.8	0.4	0.8
816	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Retail	Retro	3,805	34%	1,290	0.18	0.13	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.1
817	Motors	Power Drive Systems	Biz-Custom	Retail	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.1
818	Motors	Switch Reluctance Motors	Biz-Custom	Retail	Retro	28,430	31%	8,700	1.22	0.88	15	$528	100%	40%	2	100%	1%	0.8	0.6	11.0
819	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Retail	Retro	551	40%	223	0.02	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0
820	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Retail	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
821	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Retail	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
822	Office_PC	Energy Star Server	Biz-Custom	Retail	ROB	1,621	23%	368	0.04	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.2
823	Office_PC	Server Virtualization	Biz-Custom	Retail	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
824	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Retail	Retro	86,783	18%	15,778	1.70	1.82	15	$480	100%	40%	3	65%	20%	0.8	0.7	21.7
825	Office_PC	High Efficiency CRAC unit	Biz-Custom	Retail	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
826	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Retail	Retro	764	47%	358	0.04	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
827	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Retail	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.6
828	Refrigeration	Strip Curtains	Biz-Prescriptive	Retail	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	6%	30%	0.7	0.6	0.0
829	Refrigeration	Bare Suction Line	Biz-Custom	Retail	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
830	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Retail	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	4%	25%	0.7	0.4	0.4
831	Refrigeration	Saturated Suction Controls	Biz-Custom	Retail	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
832	Refrigeration	Compressor Retrofit	Biz-Custom	Retail	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	13%	25%	0.7	0.4	0.2
833	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Retail	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	4%	80%	0.9	0.8	3.5
834	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Retail	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	4%	25%	0.7	0.5	3.1
835	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Retail	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	5%	25%	0.7	0.4	0.8
836	Refrigeration	Refrigeration Economizer	Biz-Custom	Retail	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	18%	10%	0.7	0.4	0.8
837	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Retail	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	18%	75%	0.8	0.8	2.1
838	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Retail	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	5%	25%	0.7	0.4	0.5
839	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Retail	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	3%	80%	0.9	0.8	3.5
840	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Retail	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	3%	2%	0.7	0.4	0.8
841	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Retail	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	17%	54%	0.7	0.6	0.3
842	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Retail	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	17%	54%	0.7	0.6	0.1
843	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Retail	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	6%	75%	0.8	0.8	7.3
844	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Retail	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	6%	25%	0.7	0.5	1.2

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
845	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Retail	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	6%	54%	0.7	0.6	0.4
846	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Retail	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	6%	54%	0.7	0.6	0.1
847	Refrigeration	Refrigeration - Custom	Biz-Custom	Retail	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
848	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Retail	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
849	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Retail	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	3%	44%	0.7	0.6	1.6
850	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Retail	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	3%	30%	0.7	0.4	0.2
851	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Retail	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	11%	35%	0.7	0.5	3.4
852	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Retail	Retro	2,798	20%	560	0.08	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.6	2.7
853	Ventilation	Demand Control Ventilation	Biz-Custom	Retail	Retro	2,166	43%	940	0.13	0.11	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.8
854	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Retail	Retro	19,919	82%	16,287	2.20	1.91	15	$4,130	100%	40%	3	10%	32%	0.8	0.6	2.7
855	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Retail	Retro	21,909	83%	18,277	2.47	2.14	15	$4,190	100%	40%	4	10%	32%	0.8	0.6	2.9
856	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Retail	Retro	23,903	82%	19,579	2.64	2.29	15	$4,230	100%	40%	5	10%	32%	0.8	0.6	3.1
857	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Retail	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
858	WholeBldg_HVAC	GREM Controls	Biz-Custom	Retail	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
859	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Retail	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.7
860	WholeBldg	WholeBlg - Com RET	Biz-Custom	Retail	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
861	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Retail	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	0.9
862	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Office	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
863	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Office	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
864	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Office	ROB	1,583	21%	329	0.05	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.6
865	CompressedAir	AODD Pump Controls	Biz-Custom	Office	Retro	103,919	35%	36,372	5.33	4.22	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.4
866	CompressedAir	No Loss Condensate Drain	Biz-Custom	Office	Retro	103,919	2%	2,320	0.34	0.27	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
867	CompressedAir	Efficient Air Nozzles	Biz-Custom	Office	Retro	1,480	50%	740	0.11	0.09	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.1
868	CompressedAir	Compressed Air - Custom	Biz-Custom	Office	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
869	Cooking	Commercial Griddles	Biz-Prescriptive	Office	ROB	15,825	12%	1,910	0.97	0.24	12	$0	100%		1	14%	17%	0.7	0.6	0.0
870	Cooking	Convection Ovens	Biz-Prescriptive	Office	ROB	9,839	11%	1,065	0.54	0.13	12	$0	100%		2	18%	53%	0.7	0.6	0.0
871	Cooking	Combination Ovens	Biz-Prescriptive	Office	ROB	23,958	38%	9,058	4.60	1.14	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.5
872	Cooking	Commercial Fryers	Biz-Prescriptive	Office	ROB	18,955	17%	3,274	1.66	0.41	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.5
873	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Office	ROB	17,846	55%	9,863	5.01	1.24	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.6
874	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Office	ROB	13,697	68%	9,314	4.73	1.17	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	5.4
875	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Office	ROB	4,383	60%	2,630	1.34	0.33	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.2
876	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Office	ROB	39,306	44%	17,369	2.91	2.59	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.6
877	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Office	ROB	26,901	32%	8,586	1.44	1.28	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.1
878	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Office	ROB	788	15%	116	0.07	0.00	15	$153	100%	40%	1	26%	10%	0.8	0.3	0.6
879	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Office	ROB	788	19%	153	0.09	0.00	15	$215	100%	40%	1	26%	10%	0.8	0.3	0.6
880	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Office	ROB	788	31%	244	0.14	0.00	15	$399	100%	40%	1	26%	10%	0.8	0.3	0.5
881	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Office	ROB	865	8%	67	0.04	0.00	15	$59	100%	40%	2	26%	10%	0.8	0.4	0.9
882	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Office	ROB	865	12%	104	0.06	0.00	15	$97	100%	40%	2	26%	10%	0.8	0.4	0.9
883	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Office	ROB	865	22%	193	0.11	0.00	15	$204	100%	40%	2	26%	10%	0.8	0.4	0.8

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
884	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Office	Retro	952	7%	67	0.04	0.00	3	$5	100%	40%	3	51%	50%	0.8	0.6	2.5
885	Cooling	Air Side Economizer	Biz-Custom	Office	Retro	788	20%	158	0.09	0.00	15	$153	100%	40%	4	51%	25%	0.8	0.4	0.8
886	Cooling	Advanced Rooftop Controls	Biz-Custom	Office	Retro	6,782	56%	3,785	2.15	0.02	15	$2,950	100%	40%	5	51%	20%	0.8	0.5	1.0
887	Cooling	HVAC Occupancy Controls	Biz-Custom	Office	Retro	823	20%	165	0.09	0.00	15	$537	100%	40%	6	51%	10%	0.8	0.3	0.2
888	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Office	ROB	816	13%	102	0.06	0.00	15	$115	100%	40%	7	7%	10%	0.8	0.4	0.7
889	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Office	ROB	816	22%	181	0.10	0.00	15	$514	100%	40%	7	7%	10%	0.8	0.3	0.3
890	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Office	ROB	816	33%	272	0.15	0.00	15	$631	100%	40%	7	7%	10%	0.8	0.3	0.3
891	Cooling	Smart Thermostat	Biz-Prescriptive	Office	ROB	3,264	14%	462	0.26	0.00	11	$175	100%	40%	8	7%	10%	0.8	0.6	1.6
892	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Office	ROB	1,053	7%	76	0.04	0.00	8	$84	100%	40%	9	7%	20%	0.8	0.4	0.4
893	Cooling	Air Cooled Chiller	Biz-Custom	Office	ROB	834	9%	75	0.04	0.00	23	$126	100%	40%	10	32%	10%	0.8	0.3	0.7
894	Cooling	Water Cooled Chiller	Biz-Custom	Office	ROB	419	23%	95	0.05	0.00	23	$126	100%	40%	11	4%	10%	0.8	0.3	0.9
895	Cooling	Window Film	Biz-Custom	Office	Retro	6,000	4%	264	0.15	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
896	Cooling	Triple Pane Windows	Biz-Custom	Office	Retro	6,000	6%	360	0.20	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
897	Cooling	Energy Recovery Ventilator	Biz-Custom	Office	Retro	865	103%	894	0.51	0.00	15	$1,043	100%	40%	13	100%	2%	0.8	0.4	0.7
898	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Office	ROB	1,962	4%	74	0.01	0.02	15	$135	100%	40%	1	6%	10%	0.8	0.3	0.4
899	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Office	ROB	1,962	12%	238	0.05	0.05	15	$446	100%	40%	1	6%	10%	0.8	0.3	0.4
900	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Office	ROB	1,962	18%	362	0.07	0.08	15	$520	100%	40%	1	6%	10%	0.8	0.3	0.5
901	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,187	6%	136	0.03	0.03	15	$100	100%	40%	2	17%	10%	0.8	0.5	1.0
902	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,187	12%	252	0.05	0.06	15	$171	100%	40%	2	17%	10%	0.8	0.5	1.1
903	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,265	7%	151	0.03	0.03	15	$100	100%	40%	3	16%	10%	0.8	0.5	1.2
904	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,265	12%	274	0.05	0.06	15	$182	100%	40%	3	16%	10%	0.8	0.5	1.2
905	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,379	7%	168	0.03	0.04	15	$100	100%	40%	4	16%	10%	0.8	0.5	1.3
906	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Office	ROB	2,379	13%	302	0.06	0.07	15	$202	100%	40%	4	16%	10%	0.8	0.5	1.2
907	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Office	ROB	1,565	4%	56	0.01	0.01	25	$108	100%	40%	5	4%	20%	0.8	0.4	0.6
908	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Office	ROB	1,565	8%	127	0.02	0.03	25	$108	100%	40%	5	4%	20%	0.8	0.4	1.3
909	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Office	ROB	2,388	9%	215	0.04	0.05	8	$84	100%	40%	6	10%	20%	0.8	0.6	1.2
910	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Office	ROB	4,536	67%	3,038	0.51	0.45	15	$1,115	100%	40%	1	100%	13%	0.7	0.5	1.9
911	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Office	Retro	4,536	2%	91	0.02	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	1.3
912	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Office	ROB	18,059	54%	9,789	1.64	1.46	5	$60	100%	40%	3	20%	85%	0.9	0.9	46.1
913	HotWater	Faucet Aerator	Biz-Prescriptive	Office	Retro	4,536	67%	3,038	0.51	0.45	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	1.9
914	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Office	ROB	1,868	20%	380	0.06	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.1
915	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Office	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
916	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Office	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
917	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Office	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
918	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Office	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
919	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Office	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
920	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Office	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
921	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Office	Retro	179	68%	121	0.02	0.02	15	$27	100%	40%	1	3%	75%	0.8	0.8	3.2
922	Lighting_Int	LED interior directional	Biz-Prescriptive	Office	Retro	128	74%	95	0.02	0.01	15	$59	100%	40%	2	0%	75%	0.8	0.8	1.1
923	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Office	Retro	115	45%	51	0.01	0.01	15	$2	100%	40%	3	80%	45%	0.8	0.7	19.3

Appendix E: C&I Measure Assumptions

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Measure #: Each measure permultation, 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
924	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Office	Retro	260	50%	130	0.02	0.02	15	$70	100%	40%	3	80%	45%	0.8	0.6	1.3
925	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Office	Retro	516	61%	314	0.05	0.05	15	$44	100%	40%	4	9%	35%	0.8	0.7	5.0
926	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Office	Retro	2,423	68%	1,649	0.27	0.24	15	$330	100%	40%	5	6%	35%	0.8	0.6	3.5
927	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Office	Retro	96	100%	96	0.02	0.01	11	$4	100%	40%	6	80%	0%	0.8	0.7	13.2
928	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Office	Retro	560	30%	168	0.03	0.02	10	$58	100%	40%	7	96%	20%	0.8	0.6	1.5
929	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Office	Retro	2	49%	1	0.00	0.00	15	$1	100%	40%	7	96%	20%	0.8	0.5	1.2
930	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Office	Retro	438	30%	131	0.02	0.02	15	$77	100%	40%	7	96%	20%	0.8	0.5	1.2
931	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Office	Retro	70	43%	30	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.3
932	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Office	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
933	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Office	Retro	9,932	50%	4,966	0.73	0.58	20	$1,180	100%	40%	2	7%	10%	0.8	0.6	3.5
934	Misc	High Efficiency Hand Dryers	Biz-Custom	Office	Retro	262	83%	217	0.03	0.03	10	$483	100%	40%	3	5%	10%	0.8	0.3	0.2
935	Misc	Ozone Commercial Laundry	Biz-Custom	Office	Retro	2,984	25%	746	0.11	0.09	10	$20,310	100%	40%	4	1%	2%	0.8	0.2	1.2
936	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Office	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
937	Misc	Miscellaneous Custom	Biz-Custom	Office	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	31%	10%	0.8	0.3	0.3
938	Motors	Cogged V-Belt	Biz-Custom	Office	Retro	9,092	3%	282	0.04	0.04	15	$384	100%	40%	1	50%	10%	0.8	0.3	0.5
939	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Office	Retro	3,805	34%	1,290	0.16	0.17	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.2
940	Motors	Power Drive Systems	Biz-Custom	Office	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.2
941	Motors	Switch Reluctance Motors	Biz-Custom	Office	Retro	17,620	31%	5,392	0.69	0.71	15	$528	100%	40%	2	100%	1%	0.8	0.6	7.0
942	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Office	Retro	551	40%	223	0.03	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0
943	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Office	Retro	1,086	10%	109	0.02	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
944	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Office	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
945	Office_PC	Energy Star Server	Biz-Custom	Office	ROB	1,621	23%	368	0.05	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.3
946	Office_PC	Server Virtualization	Biz-Custom	Office	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
947	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Office	Retro	86,783	18%	15,778	2.31	1.83	15	$480	100%	40%	3	65%	20%	0.8	0.7	22.2
948	Office_PC	High Efficiency CRAC unit	Biz-Custom	Office	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.8
949	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Office	Retro	764	47%	358	0.05	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
950	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Office	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
951	Refrigeration	Strip Curtains	Biz-Prescriptive	Office	Retro	0	0%	0	0.00	0.00	4	$0	100%	0%	1	10%	30%	0.7	0.6	0.0
952	Refrigeration	Bare Suction Line	Biz-Custom	Office	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
953	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Office	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	7%	25%	0.7	0.4	0.4
954	Refrigeration	Saturated Suction Controls	Biz-Custom	Office	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
955	Refrigeration	Compressor Retrofit	Biz-Custom	Office	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	22%	25%	0.7	0.4	0.2
956	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Office	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	6%	80%	0.9	0.8	3.5
957	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Office	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	6%	25%	0.7	0.5	3.1
958	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Office	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	8%	25%	0.7	0.4	0.8
959	Refrigeration	Refrigeration Economizer	Biz-Custom	Office	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	31%	10%	0.7	0.4	0.8
960	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Office	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	20%	25%	0.7	0.5	2.1
961	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Office	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	6%	25%	0.7	0.4	0.5
962	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Office	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	3%	80%	0.9	0.8	3.5
963	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Office	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	3%	2%	0.7	0.4	0.8
964	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Office	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	19%	54%	0.7	0.6	0.3
965	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Office	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	19%	54%	0.7	0.6	0.1

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
966	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Office	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	7%	25%	0.7	0.6	7.3
967	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Office	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	7%	25%	0.7	0.5	1.2
968	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Office	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	6%	54%	0.7	0.6	0.4
969	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Office	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	6%	54%	0.7	0.6	0.1
970	Refrigeration	Refrigeration - Custom	Biz-Custom	Office	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
971	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Office	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
972	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Office	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	9%	44%	0.7	0.6	1.6
973	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Office	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	9%	30%	0.7	0.4	0.2
974	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Office	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	12%	35%	0.7	0.5	3.4
975	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Office	Retro	2,644	20%	529	0.09	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.5	1.8
976	Ventilation	Demand Control Ventilation	Biz-Custom	Office	Retro	2,166	43%	940	0.16	0.12	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.9
977	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Office	Retro	19,919	82%	16,287	2.82	2.08	15	$4,130	100%	40%	3	5%	32%	0.8	0.6	2.8
978	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Office	Retro	21,909	83%	18,277	3.17	2.33	15	$4,190	100%	40%	4	5%	32%	0.8	0.6	3.1
979	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Office	Retro	23,903	82%	19,579	3.39	2.50	15	$4,230	100%	40%	5	5%	32%	0.8	0.6	3.3
980	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Office	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.8
981	WholeBldg_HVAC	GREM Controls	Biz-Custom	Office	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
982	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Office	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.9
983	WholeBldg	WholeBlg - Com RET	Biz-Custom	Office	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.5
984	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Office	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	1.0
985	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Warehouse	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
986	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Warehouse	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
987	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Warehouse	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
988	CompressedAir	AODD Pump Controls	Biz-Custom	Warehouse	Retro	103,919	35%	36,372	4.91	3.96	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.3
989	CompressedAir	No Loss Condensate Drain	Biz-Custom	Warehouse	Retro	103,919	2%	2,320	0.31	0.25	13	$700	100%	40%	4	100%	5%	0.8	0.6	2.0
990	CompressedAir	Efficient Air Nozzles	Biz-Custom	Warehouse	Retro	1,480	50%	740	0.10	0.08	15	$50	100%	40%	5	5%	20%	0.8	0.6	10.0
991	CompressedAir	Compressed Air - Custom	Biz-Custom	Warehouse	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
992	Cooking	Commercial Griddles	Biz-Prescriptive	Warehouse	ROB	15,825	12%	1,910	0.47	0.20	12	$0	100%		1	14%	17%	0.7	0.6	0.0
993	Cooking	Convection Ovens	Biz-Prescriptive	Warehouse	ROB	9,839	11%	1,065	0.26	0.11	12	$0	100%		2	18%	53%	0.7	0.6	0.0
994	Cooking	Combination Ovens	Biz-Prescriptive	Warehouse	ROB	23,958	38%	9,058	2.21	0.96	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.3
995	Cooking	Commercial Fryers	Biz-Prescriptive	Warehouse	ROB	18,955	17%	3,274	0.80	0.35	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
996	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Warehouse	ROB	17,846	55%	9,863	2.41	1.05	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
997	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Warehouse	ROB	13,697	68%	9,314	2.28	0.99	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.7
998	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Warehouse	ROB	4,383	60%	2,630	0.64	0.28	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.1
999	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Warehouse	ROB	39,306	44%	17,369	2.34	2.62	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.2
1000	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Warehouse	ROB	26,901	32%	8,586	1.16	1.29	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.0
1001	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Warehouse	ROB	365	15%	54	0.03	0.00	15	$153	100%	40%	1	31%	10%	0.8	0.3	0.3
1002	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Warehouse	ROB	365	19%	71	0.05	0.00	15	$215	100%	40%	1	31%	10%	0.8	0.3	0.3
1003	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Warehouse	ROB	365	31%	113	0.07	0.00	15	$399	100%	40%	1	31%	10%	0.8	0.3	0.2
1004	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Warehouse	ROB	401	8%	31	0.02	0.00	15	$59	100%	40%	2	31%	10%	0.8	0.3	0.4

Appendix E: C&I Measure Assumptions

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1005	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Warehouse	ROB	401	12%	48	0.03	0.00	15	$97	100%	40%	2	31%	10%	0.8	0.3	0.4
1006	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Warehouse	ROB	401	22%	90	0.06	0.00	15	$204	100%	40%	2	31%	10%	0.8	0.3	0.4
1007	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Warehouse	Retro	441	7%	31	0.02	0.00	3	$5	100%	40%	3	62%	50%	0.8	0.6	1.2
1008	Cooling	Air Side Economizer	Biz-Custom	Warehouse	Retro	365	20%	73	0.05	0.00	15	$153	100%	40%	4	62%	25%	0.8	0.4	0.4
1009	Cooling	Advanced Rooftop Controls	Biz-Custom	Warehouse	Retro	6,263	56%	3,495	2.28	0.00	15	$2,950	100%	40%	5	62%	20%	0.8	0.4	1.0
1010	Cooling	HVAC Occupancy Controls	Biz-Custom	Warehouse	Retro	381	20%	76	0.05	0.00	15	$537	100%	40%	6	62%	10%	0.8	0.2	0.1
1011	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Warehouse	ROB	378	13%	47	0.03	0.00	15	$115	100%	40%	7	38%	10%	0.8	0.3	0.3
1012	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Warehouse	ROB	378	22%	84	0.05	0.00	15	$514	100%	40%	7	38%	10%	0.8	0.2	0.1
1013	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Warehouse	ROB	378	33%	126	0.08	0.00	15	$631	100%	40%	7	38%	10%	0.8	0.2	0.2
1014	Cooling	Smart Thermostat	Biz-Prescriptive	Warehouse	ROB	1,512	14%	214	0.14	0.00	11	$175	100%	40%	8	38%	10%	0.8	0.4	0.8
1015	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Warehouse	ROB	488	7%	35	0.02	0.00	8	$84	100%	40%	9	0%	20%	0.8	0.4	0.2
1016	Cooling	Air Cooled Chiller	Biz-Custom	Warehouse	ROB	386	9%	35	0.02	0.00	23	$126	100%	40%	10	0%	10%	0.8	0.3	0.3
1017	Cooling	Water Cooled Chiller	Biz-Custom	Warehouse	ROB	194	23%	44	0.03	0.00	23	$126	100%	40%	11	0%	10%	0.8	0.3	0.4
1018	Cooling	Window Film	Biz-Custom	Warehouse	Retro	6,000	4%	264	0.17	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.6
1019	Cooling	Triple Pane Windows	Biz-Custom	Warehouse	Retro	6,000	6%	360	0.23	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
1020	Cooling	Energy Recovery Ventilator	Biz-Custom	Warehouse	Retro	401	0%	0	0.00	0.00	15	$1,042	100%		13	100%	2%	0.8	0.7	0.0
1021	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Warehouse	ROB	1,755	3%	53	0.01	0.01	15	$135	100%	40%	1	13%	10%	0.8	0.3	0.3
1022	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Warehouse	ROB	1,755	11%	189	0.04	0.04	15	$446	100%	40%	1	13%	10%	0.8	0.3	0.3
1023	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Warehouse	ROB	1,755	15%	269	0.06	0.06	15	$520	100%	40%	1	13%	10%	0.8	0.3	0.4
1024	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	1,975	6%	117	0.03	0.03	15	$100	100%	40%	2	7%	10%	0.8	0.4	0.9
1025	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	1,975	11%	218	0.05	0.05	15	$171	100%	40%	2	7%	10%	0.8	0.4	1.0
1026	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	2,041	6%	127	0.03	0.03	15	$100	100%	40%	3	7%	10%	0.8	0.4	1.0
1027	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	2,041	11%	234	0.05	0.05	15	$182	100%	40%	3	7%	10%	0.8	0.5	1.0
1028	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	2,125	6%	138	0.03	0.03	15	$100	100%	40%	4	7%	10%	0.8	0.5	1.1
1029	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Warehouse	ROB	2,125	12%	254	0.06	0.06	15	$202	100%	40%	4	7%	10%	0.8	0.4	1.0
1030	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Warehouse	ROB	1,331	3%	43	0.01	0.01	25	$108	100%	40%	5	0%	20%	0.8	0.4	0.4
1031	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Warehouse	ROB	1,331	6%	75	0.02	0.02	25	$108	100%	40%	5	0%	20%	0.8	0.4	0.8
1032	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Warehouse	ROB	2,144	5%	114	0.02	0.03	8	$84	100%	40%	6	0%	20%	0.8	0.5	0.6
1033	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Warehouse	ROB	3,027	67%	2,027	0.27	0.31	15	$1,115	100%	40%	1	100%	0%	0.7	0.5	1.3
1034	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Warehouse	Retro	3,027	2%	61	0.01	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	0.9
1035	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Warehouse	ROB	18,059	54%	9,789	1.32	1.48	5	$60	100%	40%	3	20%	85%	0.9	0.9	45.1
1036	HotWater	Faucet Aerator	Biz-Prescriptive	Warehouse	Retro	3,027	67%	2,027	0.27	0.31	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	1.3
1037	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Warehouse	ROB	1,868	20%	380	0.05	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
1038	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Warehouse	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
1039	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Warehouse	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
1040	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Warehouse	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
1041	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Warehouse	Retro	1,742	66%	1,154	0.00	0.14	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3
1042	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Warehouse	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
1043	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Warehouse	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1044	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Warehouse	Retro	170	68%	115	0.02	0.01	15	$27	100%	40%	1	4%	75%	0.8	0.8	2.9
1045	Lighting_Int	LED interior directional	Biz-Prescriptive	Warehouse	Retro	122	74%	90	0.01	0.01	15	$59	100%	40%	2	0%	75%	0.8	0.8	1.0
1046	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Warehouse	Retro	110	45%	49	0.01	0.01	15	$2	100%	40%	3	76%	45%	0.8	0.7	17.6
1047	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Warehouse	Retro	248	50%	124	0.02	0.01	15	$70	100%	40%	3	76%	45%	0.8	0.6	1.2
1048	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Warehouse	Retro	492	61%	299	0.04	0.03	15	$44	100%	40%	4	11%	35%	0.8	0.7	4.6
1049	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Warehouse	Retro	2,310	68%	1,571	0.22	0.17	15	$330	100%	40%	5	7%	35%	0.8	0.6	3.2
1050	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Warehouse	Retro	91	100%	91	0.01	0.01	11	$4	100%	40%	6	76%	0%	0.8	0.7	12.0
1051	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Warehouse	Retro	534	30%	160	0.02	0.02	10	$58	100%	40%	7	95%	20%	0.8	0.6	1.4
1052	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Warehouse	Retro	2	49%	1	0.00	0.00	15	$1	100%	40%	7	95%	20%	0.8	0.5	1.1
1053	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Warehouse	Retro	417	30%	125	0.02	0.01	15	$74	100%	40%	7	95%	20%	0.8	0.5	1.1
1054	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Warehouse	Retro	63	43%	27	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
1055	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Warehouse	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
1056	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Warehouse	Retro	9,932	50%	4,966	0.67	0.54	20	$1,180	100%	40%	2	0%	10%	0.8	0.6	3.5
1057	Misc	High Efficiency Hand Dryers	Biz-Custom	Warehouse	Retro	262	83%	217	0.03	0.02	10	$483	100%	40%	3	5%	10%	0.8	0.3	0.2
1058	Misc	Ozone Commercial Laundry	Biz-Custom	Warehouse	Retro	2,984	25%	746	0.10	0.08	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
1059	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Warehouse	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
1060	Misc	Miscellaneous Custom	Biz-Custom	Warehouse	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	65%	10%	0.8	0.3	0.3
1061	Motors	Cogged V-Belt	Biz-Custom	Warehouse	Retro	20,965	3%	650	0.10	0.10	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.2
1062	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Warehouse	Retro	3,805	34%	1,290	0.19	0.20	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.4
1063	Motors	Power Drive Systems	Biz-Custom	Warehouse	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.4
1064	Motors	Switch Reluctance Motors	Biz-Custom	Warehouse	Retro	40,630	31%	12,433	1.86	1.91	15	$528	100%	40%	2	100%	1%	0.8	0.7	16.5
1065	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Warehouse	Retro	551	40%	223	0.03	0.02	6	$0	100%		1	5%	90%	0.9	0.9	0.0
1066	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Warehouse	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
1067	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Warehouse	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
1068	Office_PC	Energy Star Server	Biz-Custom	Warehouse	ROB	1,621	23%	368	0.05	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.3
1069	Office_PC	Server Virtualization	Biz-Custom	Warehouse	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
1070	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Warehouse	Retro	86,783	18%	15,778	2.13	1.72	15	$480	100%	40%	3	65%	20%	0.8	0.7	22.1
1071	Office_PC	High Efficiency CRAC unit	Biz-Custom	Warehouse	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
1072	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Warehouse	Retro	764	47%	358	0.05	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
1073	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Warehouse	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
1074	Refrigeration	Strip Curtains	Biz-Prescriptive	Warehouse	Retro	207	50%	103	0.01	0.01	4	$10	100%	40%	1	13%	30%	0.7	0.6	2.2
1075	Refrigeration	Bare Suction Line	Biz-Custom	Warehouse	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
1076	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Warehouse	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	9%	25%	0.7	0.4	0.4
1077	Refrigeration	Saturated Suction Controls	Biz-Custom	Warehouse	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
1078	Refrigeration	Compressor Retrofit	Biz-Custom	Warehouse	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	29%	25%	0.7	0.4	0.2
1079	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Warehouse	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	8%	80%	0.9	0.8	3.5
1080	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Warehouse	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	8%	25%	0.7	0.5	3.1
1081	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Warehouse	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	11%	25%	0.7	0.4	0.8
1082	Refrigeration	Refrigeration Economizer	Biz-Custom	Warehouse	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	41%	10%	0.7	0.4	0.8
1083	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Warehouse	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	9%	25%	0.7	0.5	2.1
1084	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Warehouse	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	3%	25%	0.7	0.4	0.5
1085	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Warehouse	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	1%	80%	0.9	0.8	3.5
1086	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Warehouse	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	1%	2%	0.7	0.4	0.8

Appendix E: C&I 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	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1087	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Warehouse	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	9%	54%	0.7	0.6	0.3
1088	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Warehouse	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	9%	54%	0.7	0.6	0.1
1089	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Warehouse	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	3%	25%	0.7	0.6	7.3
1090	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Warehouse	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	3%	25%	0.7	0.5	1.2
1091	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Warehouse	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	3%	54%	0.7	0.6	0.4
1092	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Warehouse	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	3%	54%	0.7	0.6	0.1
1093	Refrigeration	Refrigeration - Custom	Biz-Custom	Warehouse	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
1094	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Warehouse	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
1095	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Warehouse	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	0%	44%	0.7	0.6	1.6
1096	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Warehouse	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	9%	30%	0.7	0.4	0.2
1097	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Warehouse	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	6%	35%	0.7	0.5	3.4
1098	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Warehouse	Retro	2,298	20%	460	0.05	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.4
1099	Ventilation	Demand Control Ventilation	Biz-Custom	Warehouse	Retro	2,166	43%	940	0.11	0.13	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.8
1100	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Warehouse	Retro	19,919	82%	16,287	1.83	2.34	15	$4,130	100%	40%	3	10%	32%	0.8	0.6	2.7
1101	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Warehouse	Retro	21,909	83%	18,277	2.05	2.62	15	$4,190	100%	40%	4	10%	32%	0.8	0.6	3.0
1102	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Warehouse	Retro	23,903	82%	19,579	2.20	2.81	15	$4,230	100%	40%	5	10%	32%	0.8	0.6	3.1
1103	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Warehouse	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
1104	WholeBldg_HVAC	GREM Controls	Biz-Custom	Warehouse	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
1105	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Warehouse	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.6
1106	WholeBldg	WholeBlg - Com RET	Biz-Custom	Warehouse	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
1107	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Warehouse	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	0.9
1108	CompressedAir	Compressed Air Leak Repair	Biz-Custom	Other	Retro	6	17%	1	0.00	0.00	5	$0	100%	40%	1	100%	39%	0.8	0.6	3.3
1109	CompressedAir	Retro-commissioning_Compressed Air Optimization	Biz-Custom RCx	Other	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	1	100%	20%	0.8	0.6	1.2
1110	CompressedAir	Efficient Air Compressors (VSD)	Biz-Custom	Other	ROB	1,583	21%	329	0.04	0.04	13	$127	100%	40%	2	100%	20%	0.8	0.6	1.5
1111	CompressedAir	AODD Pump Controls	Biz-Custom	Other	Retro	103,919	35%	36,372	4.38	4.31	10	$1,150	100%	40%	3	100%	50%	0.8	0.7	15.2
1112	CompressedAir	No Loss Condensate Drain	Biz-Custom	Other	Retro	103,919	2%	2,320	0.28	0.27	10	$700	100%	40%	4	100%	5%	0.8	0.6	1.6
1113	CompressedAir	Efficient Air Nozzles	Biz-Custom	Other	Retro	1,480	50%	740	0.09	0.09	15	$50	100%	40%	5	5%	20%	0.8	0.6	9.9
1114	CompressedAir	Compressed Air - Custom	Biz-Custom	Other	Retro	5	20%	1	0.00	0.00	10	$0	100%	40%	6	100%	20%	0.8	0.6	2.3
1115	Cooking	Commercial Griddles	Biz-Prescriptive	Other	ROB	15,825	12%	1,910	0.32	0.24	12	$0	100%		1	14%	17%	0.7	0.6	0.0
1116	Cooking	Convection Ovens	Biz-Prescriptive	Other	ROB	9,839	11%	1,065	0.18	0.14	12	$0	100%		2	18%	53%	0.7	0.6	0.0
1117	Cooking	Combination Ovens	Biz-Prescriptive	Other	ROB	23,958	38%	9,058	1.53	1.16	12	$4,300	100%	40%	2	18%	53%	0.7	0.6	1.2
1118	Cooking	Commercial Fryers	Biz-Prescriptive	Other	ROB	18,955	17%	3,274	0.55	0.42	12	$1,500	100%	40%	3	27%	24%	0.7	0.5	1.3
1119	Cooking	Commercial Steam Cookers	Biz-Prescriptive	Other	ROB	17,846	55%	9,863	1.67	1.26	12	$4,150	100%	40%	4	6%	45%	0.7	0.6	1.4
1120	Cooking	Insulated Holding Cabinets (Full Size)	Biz-Prescriptive	Other	ROB	13,697	68%	9,314	1.57	1.19	12	$1,200	100%	40%	5	3%	16%	0.7	0.5	4.5
1121	Cooking	Insulated Holding Cabinets (Half-Size)	Biz-Prescriptive	Other	ROB	4,383	60%	2,630	0.44	0.34	12	$1,500	100%	40%	5	3%	16%	0.7	0.4	1.0
1122	Cooking	Dishwasher Low Temp Door (Energy Star)	Biz-Prescriptive	Other	ROB	39,306	44%	17,369	2.34	2.62	15	$662	100%	40%	6	26%	61%	0.7	0.7	18.2
1123	Cooking	Dishwasher High Temp Door (Energy Star)	Biz-Prescriptive	Other	ROB	26,901	32%	8,586	1.16	1.29	15	$995	100%	40%	6	26%	61%	0.7	0.7	6.0
1124	Cooling	Air Conditioner - 17 IEER (5-20 Tons)	Biz-Prescriptive	Other	ROB	660	15%	97	0.05	0.00	15	$153	100%	40%	1	29%	10%	0.8	0.3	0.5
1125	Cooling	Air Conditioner - 18 IEER (5-20 Tons)	Biz-Prescriptive	Other	ROB	660	19%	128	0.06	0.00	15	$215	100%	40%	1	29%	10%	0.8	0.3	0.5

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1126	Cooling	Air Conditioner - 21 IEER (5-20 Tons)	Biz-Prescriptive	Other	ROB	660	31%	204	0.10	0.00	15	$399	100%	40%	1	29%	10%	0.8	0.3	0.4
1127	Cooling	Air Conditioner - 14.3 IEER (20+ Tons)	Biz-Prescriptive	Other	ROB	725	8%	56	0.03	0.00	15	$59	100%	40%	2	29%	10%	0.8	0.4	0.7
1128	Cooling	Air Conditioner - 15 IEER (20+ Tons)	Biz-Prescriptive	Other	ROB	725	12%	87	0.04	0.00	15	$97	100%	40%	2	29%	10%	0.8	0.4	0.7
1129	Cooling	Air Conditioner - 17 IEER (20+ Tons)	Biz-Prescriptive	Other	ROB	725	22%	162	0.08	0.00	15	$204	100%	40%	2	29%	10%	0.8	0.3	0.6
1130	Cooling	Comprehensive Rooftop Unit Quality Maintenance (AC Tune-up)	Biz-Custom	Other	Retro	797	7%	56	0.03	0.00	3	$5	100%	40%	3	57%	50%	0.8	0.6	2.0
1131	Cooling	Air Side Economizer	Biz-Custom	Other	Retro	660	20%	132	0.06	0.00	15	$153	100%	40%	4	57%	25%	0.8	0.4	0.7
1132	Cooling	Advanced Rooftop Controls	Biz-Custom	Other	Retro	6,773	56%	3,779	1.76	0.04	15	$2,950	100%	40%	5	57%	20%	0.8	0.5	1.0
1133	Cooling	HVAC Occupancy Controls	Biz-Custom	Other	Retro	689	20%	138	0.06	0.00	15	$537	100%	40%	6	57%	10%	0.8	0.3	0.2
1134	Cooling	Air Conditioner - 16 SEER (<5 Tons)	Biz-Prescriptive	Other	ROB	683	13%	85	0.04	0.00	15	$115	100%	40%	7	0%	10%	0.8	0.3	0.6
1135	Cooling	Air Conditioner - 18 SEER(<5 Tons)	Biz-Prescriptive	Other	ROB	683	22%	152	0.07	0.00	15	$514	100%	40%	7	0%	10%	0.8	0.3	0.2
1136	Cooling	Air Conditioner - 21 SEER(<5 Tons)	Biz-Prescriptive	Other	ROB	683	33%	228	0.11	0.00	15	$631	100%	40%	7	0%	10%	0.8	0.3	0.3
1137	Cooling	Smart Thermostat	Biz-Prescriptive	Other	ROB	2,733	14%	387	0.18	0.00	11	$175	100%	40%	8	0%	10%	0.8	0.5	1.3
1138	Cooling	PTAC - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Other	ROB	881	7%	64	0.03	0.00	8	$84	100%	40%	9	0%	20%	0.8	0.4	0.3
1139	Cooling	Air Cooled Chiller	Biz-Custom	Other	ROB	698	9%	63	0.03	0.00	23	$126	100%	40%	10	38%	10%	0.8	0.3	0.5
1140	Cooling	Water Cooled Chiller	Biz-Custom	Other	ROB	351	23%	80	0.04	0.00	23	$126	100%	40%	11	4%	10%	0.8	0.3	0.7
1141	Cooling	Window Film	Biz-Custom	Other	Retro	6,000	4%	264	0.12	0.00	10	$154	100%	40%	12	100%	25%	0.8	0.5	0.5
1142	Cooling	Triple Pane Windows	Biz-Custom	Other	Retro	6,000	6%	360	0.17	0.00	25	$700	100%	40%	12	100%	2%	0.8	0.3	0.6
1143	Cooling	Energy Recovery Ventilator	Biz-Custom	Other	Retro	725	0%	0	0.00	0.00	15	$1,041	100%		13	100%	2%	0.8	0.7	0.0
1144	Heating	Heat Pump - 16 SEER (<5 Tons)	Biz-Prescriptive	Other	ROB	2,224	3%	75	0.01	0.02	15	$135	100%	40%	1	0%	10%	0.8	0.3	0.4
1145	Heating	Heat Pump - 18 SEER(<5 Tons)	Biz-Prescriptive	Other	ROB	2,224	11%	253	0.04	0.06	15	$446	100%	40%	1	0%	10%	0.8	0.3	0.4
1146	Heating	Heat Pump - 21 SEER(<5 Tons)	Biz-Prescriptive	Other	ROB	2,224	17%	372	0.06	0.08	15	$520	100%	40%	1	0%	10%	0.8	0.3	0.5
1147	Heating	Heat Pump - 15.0 IEER COP 3.6 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,492	6%	151	0.02	0.03	15	$100	100%	40%	2	17%	10%	0.8	0.5	1.1
1148	Heating	Heat Pump - 16.0 IEER COP 3.8 (65,000-134,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,492	11%	280	0.04	0.06	15	$171	100%	40%	2	17%	10%	0.8	0.5	1.2
1149	Heating	Heat Pump - 14.5 IEER COP 3.5 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,578	6%	166	0.03	0.04	15	$100	100%	40%	3	17%	10%	0.8	0.5	1.2
1150	Heating	Heat Pump - 15.5 IEER COP 3.7 (135,000-239,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,578	12%	303	0.05	0.07	15	$182	100%	40%	3	17%	10%	0.8	0.5	1.2
1151	Heating	Heat Pump - 12 IEER 3.4 COP (>239,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,694	7%	182	0.03	0.04	15	$100	100%	40%	4	17%	10%	0.8	0.5	1.4
1152	Heating	Heat Pump - 13 IEER 3.6 COP (>239,000 Btu/hr)	Biz-Prescriptive	Other	ROB	2,694	12%	331	0.05	0.07	25	$202	100%	40%	4	17%	10%	0.8	0.5	1.8
1153	Heating	Geothermal HP - 17 EER < 135kbtu	Biz-Prescriptive	Other	ROB	1,726	3%	58	0.01	0.01	25	$108	100%	40%	5	0%	20%	0.8	0.4	0.6
1154	Heating	Geothermal HP - 19 EER < 135kbtu	Biz-Prescriptive	Other	ROB	1,726	7%	118	0.02	0.03	25	$108	100%	40%	5	0%	20%	0.8	0.4	1.2
1155	Heating	PTHP - 7,000 to 15,000 Btuh - lodging	Biz-Prescriptive	Other	ROB	2,712	7%	190	0.03	0.04	8	$84	100%	40%	6	0%	20%	0.8	0.5	1.0
1156	HotWater	Heat Pump Water Heater	Biz-Prescriptive	Other	ROB	3,027	67%	2,027	0.27	0.31	15	$1,115	100%	40%	1	100%	20%	0.7	0.5	1.3
1157	HotWater	Hot Water Pipe Insulation	Biz-Prescriptive	Other	Retro	3,027	2%	61	0.01	0.01	20	$60	100%	40%	2	100%	80%	0.9	0.8	0.9
1158	HotWater	Low Flow Pre-Rinse Sprayers	Biz-Prescriptive	Other	ROB	18,059	54%	9,789	1.32	1.48	5	$60	100%	40%	3	20%	85%	0.9	0.9	45.1
1159	HotWater	Faucet Aerator	Biz-Prescriptive	Other	Retro	3,027	67%	2,027	0.27	0.31	15	$1,115	100%	40%	4	20%	85%	0.9	0.9	1.3
1160	HotWater	ENERGY STAR Commercial Washing Machines	Biz-Prescriptive	Other	ROB	1,868	20%	380	0.05	0.06	11	$200	100%	40%	5	25%	33%	0.7	0.5	1.0
1161	Lighting_Ext	LED wallpack (existing W<250)	Biz-Prescriptive	Other	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	1	17%	69%	0.8	0.8	1.2
1162	Lighting_Ext	LED parking lot fixture (existing W<250)	Biz-Prescriptive	Other	Retro	856	66%	567	0.00	0.07	12	$248	100%	40%	2	17%	69%	0.8	0.8	1.2
1163	Lighting_Ext	LED parking lot fixture (existing W≥250)	Biz-Prescriptive	Other	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	3	17%	69%	0.8	0.8	0.6
1164	Lighting_Ext	LED parking garage fixture (existing W<250)	Biz-Prescriptive	Other	Retro	1,742	66%	1,154	0.00	0.13	6	$248	100%	40%	4	17%	69%	0.8	0.8	1.3

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1165	Lighting_Ext	LED parking garage fixture (existing W≥250)	Biz-Prescriptive	Other	Retro	3,235	60%	1,953	0.00	0.23	6	$756	100%	40%	5	17%	69%	0.8	0.8	0.7
1166	Lighting_Ext	LED outdoor pole decorative fixture (existing W≥250)	Biz-Prescriptive	Other	Retro	1,589	60%	959	0.00	0.11	12	$756	100%	40%	6	17%	69%	0.8	0.8	0.6
1167	Lighting_Int	LED downlight fixture	Biz-Prescriptive	Other	Retro	194	68%	131	0.02	0.02	15	$27	100%	40%	1	2%	75%	0.8	0.8	3.3
1168	Lighting_Int	LED interior directional	Biz-Prescriptive	Other	Retro	140	74%	103	0.01	0.01	15	$59	100%	40%	2	0%	75%	0.8	0.8	1.2
1169	Lighting_Int	LED T8 tube replacement	Biz-Prescriptive	Other	Retro	125	45%	56	0.01	0.01	15	$2	100%	40%	3	86%	45%	0.8	0.7	20.1
1170	Lighting_Int	LED troffer, 2'X2' and 2'X4'	Biz-Prescriptive	Other	Retro	283	50%	142	0.02	0.02	15	$70	100%	40%	3	86%	45%	0.8	0.6	1.4
1171	Lighting_Int	LED low bay fixture	Biz-Prescriptive	Other	Retro	561	61%	341	0.04	0.04	15	$44	100%	40%	6	6%	35%	0.8	0.7	5.2
1172	Lighting_Int	LED high bay fixture	Biz-Prescriptive	Other	Retro	2,636	68%	1,793	0.22	0.23	15	$330	100%	40%	5	4%	35%	0.8	0.7	3.7
1173	Lighting_Int	DeLamp Fluorescent Fixture Average Lamp Wattage 28W	Biz-Prescriptive	Other	Retro	104	100%	104	0.01	0.01	11	$4	100%	40%	6	86%	0%	0.8	0.7	13.7
1174	Lighting_Int	Daylighting Controls	Biz-Prescriptive	Other	Retro	609	30%	183	0.02	0.02	10	$58	100%	40%	7	97%	20%	0.8	0.6	1.6
1175	Lighting_Int	Network Lighting Controls - Wireless (WiFi)	Biz-Prescriptive	Other	Retro	2	49%	1	0.00	0.00	15	$1	100%	40%	7	97%	20%	0.8	0.5	1.2
1176	Lighting_Int	Occupancy Sensors	Biz-Prescriptive	Other	Retro	476	30%	143	0.02	0.02	15	$84	100%	40%	7	97%	20%	0.8	0.5	1.1
1177	Lighting_Int	LED Exit Sign - 4 Watt Fixture (2 lamp)	Biz-Prescriptive	Other	Retro	66	43%	28	0.00	0.00	5	$33	100%	40%	8	1%	80%	0.9	0.8	0.2
1178	Misc	Vending Machine Controller - Non-Refrigerated	Biz-Custom	Other	Retro	385	61%	237	0.03	0.03	5	$230	100%	40%	1	5%	30%	0.8	0.4	0.3
1179	Misc	Kitchen Exhaust Hood Demand Ventilation Control System	Biz-Custom	Other	Retro	9,932	50%	4,966	0.60	0.59	20	$1,180	100%	40%	2	11%	10%	0.8	0.6	3.5
1180	Misc	High Efficiency Hand Dryers	Biz-Custom	Other	Retro	262	83%	217	0.03	0.03	10	$483	100%	40%	3	5%	10%	0.8	0.3	0.2
1181	Misc	Ozone Commercial Laundry	Biz-Custom	Other	Retro	2,984	25%	746	0.09	0.09	10	$20,310	100%	40%	4	0%	2%	0.8	0.2	1.2
1182	Misc	ENERGY STAR Uninterrupted Power Supply	Biz-Custom	Other	ROB	3,096	3%	85	0.01	0.01	15	$59	100%	40%	5	0%	70%	0.8	0.8	1.0
1183	Misc	Miscellaneous Custom	Biz-Custom	Other	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	6	19%	10%	0.8	0.3	0.3
1184	Motors	Cogged V-Belt	Biz-Custom	Other	Retro	17,237	3%	534	0.08	0.07	15	$384	100%	40%	1	50%	10%	0.8	0.5	1.0
1185	Motors	Pump and Fan Variable Frequency Drive Controls (Pumps)	Biz-Custom	Other	Retro	3,805	34%	1,290	0.19	0.16	15	$168	100%	40%	2	100%	10%	0.8	0.6	5.2
1186	Motors	Power Drive Systems	Biz-Custom	Other	Retro	4	23%	1	0.00	0.00	15	$0	100%	40%	2	100%	10%	0.8	0.6	5.2
1187	Motors	Switch Reluctance Motors	Biz-Custom	Other	Retro	33,406	31%	10,222	1.48	1.26	15	$528	100%	40%	2	100%	1%	0.8	0.6	13.2
1188	Office_NonPC	Energy Star Printer/Copier/Fax	Biz-Custom	Other	Retro	551	40%	223	0.03	0.03	6	$0	100%		1	30%	90%	0.9	0.9	0.0
1189	Office_NonPC	Smart Power Strip – Commercial Use	Biz-Custom	Other	Retro	1,086	10%	109	0.01	0.01	7	$50	100%	40%	2	60%	35%	0.8	0.6	0.8
1190	Office_NonPC	Plug Load Occupancy Sensor	Biz-Custom	Other	Retro	1,126	15%	169	0.02	0.02	8	$70	100%	40%	2	60%	20%	0.8	0.6	1.0
1191	Office_PC	Energy Star Server	Biz-Custom	Other	ROB	1,621	23%	368	0.04	0.04	8	$118	100%	40%	3	65%	25%	0.8	0.6	1.2
1192	Office_PC	Server Virtualization	Biz-Custom	Other	ROB	2	45%	1	0.00	0.00	8	$0	100%	40%	3	65%	25%	0.8	0.6	1.0
1193	Office_PC	Electrically Commutated Plug Fans in data centers	Biz-Custom	Other	Retro	86,783	18%	15,778	1.90	1.87	15	$480	100%	40%	3	65%	20%	0.8	0.7	21.9
1194	Office_PC	High Efficiency CRAC unit	Biz-Custom	Other	ROB	541	30%	162	0.02	0.02	15	$63	100%	40%	4	65%	20%	0.8	0.6	1.7
1195	Office_PC	Computer Room Air Conditioner Economizer	Biz-Custom	Other	Retro	764	47%	358	0.04	0.04	15	$82	100%	40%	4	65%	20%	0.8	0.6	2.9
1196	Office_PC	Data Center Hot/Cold Aisle Configuration	Biz-Custom	Other	Retro	4	25%	1	0.00	0.00	15	$0	100%	40%	5	3%	10%	0.8	0.6	1.7
1197	Refrigeration	Strip Curtains	Biz-Prescriptive	Other	Retro	37	50%	18	0.00	0.00	4	$10	100%	40%	1	10%	30%	0.7	0.5	0.4
1198	Refrigeration	Bare Suction Line	Biz-Custom	Other	Retro	23	93%	21	0.00	0.00	15	$4	100%	40%	2	0%	50%	0.7	0.6	3.5
1199	Refrigeration	Floating Head Pressure Controls	Biz-Prescriptive	Other	Retro	1,112	25%	278	0.04	0.03	15	$431	100%	40%	3	7%	25%	0.7	0.4	0.4
1200	Refrigeration	Saturated Suction Controls	Biz-Custom	Other	Retro	831	50%	416	0.06	0.05	15	$559	100%	40%	4	2%	10%	0.7	0.4	0.5
1201	Refrigeration	Compressor Retrofit	Biz-Custom	Other	Retro	813	20%	163	0.02	0.02	15	$477	100%	40%	5	23%	25%	0.7	0.4	0.2
1202	Refrigeration	Electronically Commutated (EC) Walk-In Evaporator Fan Motor	Biz-Custom	Other	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	6	6%	80%	0.9	0.8	3.5
1203	Refrigeration	Evaporator Fan Motor Controls	Biz-Custom	Other	Retro	2,236	32%	716	0.10	0.08	15	$155	100%	40%	7	6%	25%	0.7	0.5	3.1
1204	Refrigeration	Variable Speed Condenser Fan	Biz-Custom	Other	Retro	2,960	50%	1,480	0.21	0.16	15	$1,170	100%	40%	8	9%	25%	0.7	0.4	0.8
1205	Refrigeration	Refrigeration Economizer	Biz-Custom	Other	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	9	32%	10%	0.7	0.4	0.8
1206	Refrigeration	Anti-Sweat Heater Controls MT	Biz-Custom	Other	Retro	579	59%	338	0.05	0.04	10	$80	100%	40%	10	11%	25%	0.7	0.5	2.1
1207	Refrigeration	Display Case Door Retrofit, Medium Temp	Biz-Prescriptive	Other	Retro	1,584	36%	578	0.08	0.06	12	$686	100%	40%	11	3%	25%	0.7	0.4	0.5

Appendix E: C&I 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 permultation, 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. **Building Type:** Each measure is 1 of 12 building types. **Replacement Type:** Market opportunity/replace-on-burnout (ROB), Retro (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 businesses 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. **TRC Score:** benefit-cost ratio in the measure-level screening (greater than 1.0 is cost-effective).

Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1208	Refrigeration	Electronically Commutated (EC) Reach-In Evaporator Fan Motor	Biz-Custom	Other	Retro	2,884	55%	1,586	0.22	0.17	15	$305	100%	40%	12	2%	80%	0.9	0.8	3.5
1209	Refrigeration	Q-Sync Motor for Walk-In and Reach-in Evaporator Fan Motor	Biz-Custom	Other	Retro	441	34%	149	0.02	0.02	10	$90	100%	40%	13	2%	2%	0.7	0.4	0.8
1210	Refrigeration	Energy Star Reach-In Refrigerator, Glass Doors	Biz-Prescriptive	Other	ROB	2,140	29%	629	0.09	0.07	12	$1,239	100%	40%	14	11%	54%	0.7	0.6	0.3
1211	Refrigeration	Energy Star Reach-In Refrigerator, Solid Doors	Biz-Prescriptive	Other	ROB	1,410	20%	281	0.04	0.03	12	$1,211	100%	40%	14	11%	54%	0.7	0.6	0.1
1212	Refrigeration	Anti-Sweat Heater Controls LT	Biz-Custom	Other	Retro	2,016	68%	1,361	0.19	0.15	10	$91	100%	40%	15	4%	25%	0.7	0.6	7.3
1213	Refrigeration	Display Case Door Retrofit, Low Temp	Biz-Prescriptive	Other	Retro	2,922	50%	1,453	0.20	0.16	12	$686	100%	40%	16	4%	25%	0.7	0.5	1.2
1214	Refrigeration	Energy Star Reach-In Freezer, Glass Doors	Biz-Prescriptive	Other	ROB	6,374	20%	1,275	0.18	0.14	12	$1,651	100%	40%	17	4%	54%	0.7	0.6	0.4
1215	Refrigeration	Energy Star Reach-In Freezer, Solid Doors	Biz-Prescriptive	Other	ROB	4,522	7%	305	0.04	0.03	12	$1,521	100%	40%	17	4%	54%	0.7	0.6	0.1
1216	Refrigeration	Refrigeration - Custom	Biz-Custom	Other	Retro	7	2%	0	0.00	0.00	10	$0	100%	40%	18	70%	25%	0.7	0.4	0.3
1217	Refrigeration	Retro-commissioning_Refrigerator Optimization	Biz-Custom RCx	Other	Retro	5	21%	1	0.00	0.00	5	$0	100%	40%	19	70%	25%	0.7	0.5	1.2
1218	Refrigeration	Energy Star Ice Machine	Biz-Prescriptive	Other	ROB	6,993	10%	721	0.10	0.08	10	$222	100%	40%	20	8%	44%	0.7	0.6	1.6
1219	Refrigeration	ESTAR Refrigerated Vending Machine	Biz-Prescriptive	Other	ROB	1,278	12%	153	0.02	0.02	14	$500	100%	40%	21	5%	30%	0.7	0.4	0.2
1220	Refrigeration	LED Refrigerated Display Case Lighting Average 6W/LF	Biz-Prescriptive	Other	Retro	115	74%	84	0.01	0.01	9	$11	100%	40%	22	7%	35%	0.7	0.5	3.4
1221	Ventilation	Pump and Fan Variable Frequency Drive Controls (Fans)	Biz-Custom	Other	Retro	2,627	20%	525	0.08	0.07	15	$227	100%	40%	1	100%	32%	0.8	0.5	2.6
1222	Ventilation	Demand Control Ventilation	Biz-Custom	Other	Retro	2,166	43%	940	0.14	0.12	15	$168	100%	40%	2	100%	32%	0.8	0.6	3.8
1223	Ventilation	High Volume Low Speed Fan, 20	Biz-Custom	Other	Retro	19,919	82%	16,287	2.39	2.12	15	$4,130	100%	40%	3	10%	32%	0.8	0.6	2.7
1224	Ventilation	High Volume Low Speed Fan, 22	Biz-Custom	Other	Retro	21,909	83%	18,277	2.69	2.37	15	$4,190	100%	40%	4	10%	32%	0.8	0.6	3.0
1225	Ventilation	High Volume Low Speed Fan, 24	Biz-Custom	Other	Retro	23,903	82%	19,579	2.88	2.54	15	$4,230	100%	40%	5	10%	32%	0.8	0.6	3.2
1226	WholeBldg_HVAC	HVAC - Energy Management System	Biz-Custom	Other	Retro	13	8%	1	0.00	0.00	15	$0	100%	40%	1	100%	10%	0.8	0.6	1.7
1227	WholeBldg_HVAC	GREM Controls	Biz-Custom	Other	Retro	0	0%	0	0.00	0.00	5	$260	100%		2	100%	20%	0.8	0.7	0.0
1228	WholeBldg_HVAC	Retro-commissioning_Bld Optimization	Biz-Custom RCx	Other	Retro	7	15%	1	0.00	0.00	15	$0	100%	40%	3	100%	0%	0.8	0.6	5.7
1229	WholeBldg	WholeBlg - Com RET	Biz-Custom	Other	Retro	7	15%	1	0.00	0.00	12	$0	100%	40%	1	80%	0%	0.8	0.6	1.4
1230	WholeBldg	Power Distribution Equipment Upgrades (Transformers)	Biz-Custom	Other	Retro	1,150	1%	6	0.00	0.00	30	$8	100%	40%	2	100%	20%	0.8	0.4	1.0
1231	WaterWasteWater	Water Supply & Wastewater treatment pumps and process efficiency	Biz-Custom	Industrial	Retro	5	20%	1	0.00	0.00	11	$0	100%	0%	1	100%	25%	0.8	0.5	1.2
1232	CompressedAir	Efficient Air Compressor Equipment	Biz-Custom	Industrial	ROB	9	11%	1	0.00	0.00	13	$0	100%	0%	1	100%	25%	0.8	0.5	1.5
1233	CompressedAir	Efficient Air Compressor Controls	Biz-Custom	Industrial	Retro	15	7%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	1.5
1234	HVAC	Efficient HVAC Equipment	Biz-Custom	Industrial	ROB	8	13%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	4.3
1235	HVAC	Efficient HVAC O&M	Biz-Custom	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	2.0
1236	Lighting	Efficient Lighting Equipment	Biz-Prescriptive	Industrial	Retro	2	50%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	4.2
1237	Lighting	Efficient Lighting O&M	Biz-Custom	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.7	2.6
1238	Machine Drive	Efficient MachDr Equipment	Biz-Custom	Industrial	ROB	5	20%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	4.0
1239	Machine Drive	Efficient MachDr O&M	Biz-Custom	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	1.8
1240	Process Heat	Efficient ProcHeat Equipment	Biz-Custom	Industrial	ROB	10	10%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	4.0
1241	Process Heat	Efficient ProcHeat O&M	Biz-Custom	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	2.2
1242	Process Refrig	Efficient ProcRefrig Equipment	Biz-Custom	Industrial	ROB	6	17%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	3.8
1243	Process Refrig	Efficient ProcRefrig O&M	Biz-Custom	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	1.6
1244	Other Process	Efficient Other Facility Process Equipment	Biz-Custom	Industrial	ROB	4	25%	1	0.00	0.00	11	$0	100%	0%	1	100%	25%	0.8	0.5	1.5
1245	Other Process	Efficient Other Facility Process O&M	Biz-Custom	Industrial	Retro	14	7%	1	0.00	0.00	11	$0	100%	0%	2	100%	25%	0.8	0.5	1.8
1246	WholeBldg	Power Distribution (Transformers)	Biz-Custom	Industrial	Retro	179	1%	1	0.00	0.00	30	$1	100%	0%	1	100%	25%	0.8	0.4	0.9

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Measure #	End-Use	Measure Name	Program	Building Type	Replacement Type	Base Annual Electric kWh Usage	% Elec Savings	Per Unit Elec Savings (kWh)	Per Unit Summer kW Savings	Per Unit Winter kW Savings	EE EUL	Measure Cost	MAP Incentive (%)	RAP Incentive (%)	End Use Measure Group	Base Saturation	EE Saturation	MAP Adoption Rate	RAP Adoption Rate	TRC Score
1247	WholeBldg	Strategic Energy Management	Biz-Custom SEM	Industrial	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.7	2.0
1248	Motors	Efficient Motor Pmp Equipment - Q1 Cost	Biz-Agriculture	Agriculture	ROB	8	13%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.7	65.1
1249	Motors	Efficient Motor Pmp Equipment - Q2 Cost	Biz-Agriculture	Agriculture	ROB	8	13%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.7	32.5
1250	Motors	Efficient Motor Pmp Equipment - Q3 Cost	Biz-Agriculture	Agriculture	ROB	8	13%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	13.0
1251	Motors	Efficient Motor Pmp O&M	Biz-Agriculture	Agriculture	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.8	0.6	1.7
1252	Refrigeration	Efficient Refrigeration Equipment	Biz-Agriculture	Agriculture	ROB	6	16%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.7	0.5	3.5
1253	Refrigeration	Refrigeration Equipment O&M	Biz-Agriculture	Agriculture	Retro	33	3%	1	0.00	0.00	3	$0	100%	0%	2	100%	25%	0.7	0.5	1.5
1254	Lighting	Efficient Lighting	Biz-Agriculture	Agriculture	Retro	2	42%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	3.8
1255	Ventilation	Efficient Ventilation	Biz-Agriculture	Agriculture	Retro	2	53%	1	0.00	0.00	10	$0	100%	0%	1	100%	25%	0.8	0.5	1.5
1256	HVAC	HVAC	Biz-Agriculture	Agriculture	ROB	8	13%	1	0.00	0.00	15	$0	100%	0%	1	100%	25%	0.8	0.6	3.4

APPENDIX F: PROGRAM PARTICIPATION TABLES

APPENDIX F: PROGRAM POTENTIAL ASSUMPTIONS

TABLE F-1 RESIDENTIAL PROGRAM MEASURE REBATES AND PARTICIPATION

	Rebate	Unit	2024	2025	2026	2027	2028
HEIP							
Residential Air Source Heat Pump	$ 500.00	per system	68	95	122	149	176
Residential Central Air Conditioner	$ 250.00	per system	32	45	58	70	83
Residential Ductless AC	$ 200.00	per system	9	13	16	20	23
Residential Ductless Heat Pump	$ 400.00	per system	80	111	143	175	207
Residential ENERGY STAR Room Air Conditioner	$ 20.00	per system	230	322	414	505	597
Residential Heat Pump Water Heater	$ 500.00	per system	5	7	9	10	12
Residential Attic Insulation	$ 230.00	per home (avg.)	6	8	10	12	14
Residential Air Sealing	$ 70.00	per home (avg.)	5	7	9	11	13
Residential Duct Sealing/Insulation	$ 150.00	per home (avg.)	1	2	2	3	3
Residential Floor Insulation Above Crawlspace	$ 220.00	per home (avg.)	6	8	10	13	15
Residential Smart Thermostat	$ 50.00	per thermostat	166	233	299	365	432
Market Placeholder							
Residential Smart Thermostat	$ 50.00	per thermostat	-	113	142	170	198
Residential Low Income Smart Thermostat	$ 75.00	per thermostat	-	209	261	314	366
Residential ENERGY STAR Air Purifier	$ 30.00	per Purifier	-	74	92	110	129
Residential ENERGY STAR Clothes Washer	$ 50.00	per washer	-	156	195	233	272

TABLE F-2 LOW INCOME PROGRAM MEASURE REBATES AND PARTICIPATION

	Rebate	Unit	2024	2025	2026	2027	2028
Targeted Energy Efficiency							
Air Source Heat Pump 14 SEER – Electric Furnace Baseline	$ 3,000.00	per system	40	51	61	71	81
Residential Heat Pump Water Heater	$ 2,000.00	per system	53	66	79	92	105
Residential Ductless Heat Pump	$ 520.00	per system	48	61	73	85	97
Residential Air Sealing	$ 70.00	per home	3	4	5	6	6
Residential Attic Insulation	$ 500.00	per home	28	35	41	48	55
Residential Bathroom Aerator 1.0 gpm	$ 1.00	per aerator	75	93	112	131	149
Residential Duct Sealing/Insulation	$ 150.00	per home	49	62	74	86	98
Residential ENERGY STAR Room Air Conditioner	$ 25.00	per system	38	48	57	67	76
Residential Floor Insulation Above Crawlspace	$ 160.00	per home	7	9	11	13	14
Residential Water Heater Wrap	$ 6.67	per heater	42	40	48	56	64
Residential Air Source Heat Pump – Code Baseline	$ 2,500.00	per system	10	13	15	18	20

TABLE F-3 COMMERCIAL PROGRAM MEASURE REBATES AND PARTICIPATION

	Rebate	Unit	2024	2025	2026	2027	2028
Commercial Prescriptive							
Commercial Air Conditioner	$ 40.00	per ton	-	5	20	22	25
Commercial Combination Ovens	$ 1,430.00	per oven	-	-	2	2	2
Commercial Fryers	$ 500.00	per fryer	-	-	2	2	2
Commercial Steam Cookers	$ 1,380.00	per cooker	-	-	1	1	1
Commercial Dishwasher	$ 220.00	per washer	-	-	1	1	1
Commercial Smart Thermostat	$ 50.00	per thermostat	-	44	50	56	62
Packaged Terminal Heat Pumps	$ 250.00	per ton	-	3	3	4	4
Geothermal Heat Pump	$ 1,000.00	per system	-	2	3	3	3
Commercial Air Source Heat Pump	$ 1,000.00	per system	-	10	12	13	14
Commercial Heat Pump Water Heater	$ 500.00	per system	-	6	7	7	8
LED Downlight Fixture	$ 9.00	per fixture	610	701	792	884	975
LED High Bay Fixture	$ 75.00	per fixture	79	90	102	114	126
LED Low Bay Fixture	$ 10.00	per fixture	498	573	647	722	797
LED Exterior Area Lighting	$ 75.00	per fixture	721	829	937	1,045	1,153
LED Refrigerated Display Case Lighting	$ 3.67	per foot	2,613	3,005	3,397	3,789	4,181
LED Linear Tube Replacement	$ 3.00	per lamp	18,133	20,852	23,572	26,292	29,012
LED Troffer	$ 20.00	per fixture	593	681	770	859	948
LED Wallpack	$ 75.00	per fixture	483	555	628	700	773
Network Lighting Controls	$ 0.20	per watt reduced	181,614	208,856	236,098	263,340	290,582
Occupancy Sensors	$ 30.00	per control	872	1,002	1,133	1,264	1,394
Daylighting Controls	$ 20.00	per control	793	911	1,030	1,149	1,268
Commercial Custom							
Cooling	$ 0.14	per kwh	-	-	127,047	177,866	228,685
Refrigeration	$ 0.14	per kwh	-	-	201,616	282,262	362,908
Compressed Air	$ 0.14	per kwh	-	-	24,538	34,353	44,168
Motors	$ 0.14	per kwh	-	-	69,811	97,736	125,661
Ventilation	$ 0.14	per kwh	-	-	254,679	356,550	458,422
Miscellaneous	$ 0.14	per kwh	-	-	30,854	43,195	55,537
Whole Building HVAC Controls	$ 0.14	per kwh	-	-	41,232	57,725	74,218

GDS Associates, Inc.
ENGINEERS & CONSULTANTS

2023 POTENTIAL STUDY

FINAL REPORT

June
2023

prepared by
GDS ASSOCIATES INC
BRIGHTLINE GROUP

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_4 Explain in detail the demand side management/energy efficiency (DSM/EE) programs being considered in the market potential study. Include in the response if the same, or similar, programs are being used by other American Electric Power (AEP) affiliates.

RESPONSE

Kentucky Power's consultant for the market potential study (MPS), GDS Associates, compared energy efficiency programs from neighboring investor-owned utilities such as Appalachian Power Company (an AEP affiliate), Indiana Michigan Power Company (an AEP affiliate), Kentucky Utilities, and Louisville Gas & Electric, as well as East Kentucky Power Cooperative. Based on this diverse pool of utility programs and market research obtained during the MPS process, GDS recommended the following DSM/EE programs for Kentucky Power's service territory:

- The Home Energy Improvement program which would offer rebates to residential customers for installing Heating, Ventilation, and Air Conditioning (HVAC) and weatherization measures.
- Online Marketplace which would allow instant rebates for purchasing energy efficiency measures online.
- Targeted Energy Efficiency program expansion of the eligible measures.
- Commercial Prescriptive program designed to offer incentives to commercial customers for installing efficient lighting, HVAC equipment and kitchen appliances.
- Commercial Custom program which could offer additional rebates to commercial customers for less common energy efficiency measures such as variable frequency drives on motors or whole building HVAC controls.

Witness: Brian K. West

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DATA REQUEST

KPSC 2_5 Refer to Kentucky Power's response to Staff's First Request, Item 10 and Item 12. Explain if any of the distribution or transmission projects are included in Case No. 2023-00059.

RESPONSE

Costs from the following distribution projects from Attachment 1 to the Company's response to KPSC 1-10 are included in the Company's test year cost of service in Case No. 2023-00159.

Project			
Kewanee – D-line 34.5KV Robinson Creek Circuit to Fords Branch Creek Circuit	2024	New Distribution Services	Reduce CMI, Reliability improvement.
Kewanee – D-line 34.5KV Shelby Circuit Tie to Fords Branch Shelby Circuit	2024	New Distribution Services	Reduce CMI, Reliability improvement.

Costs from the following transmission projects from Attachment 1 to the Company's response to KPSC 1-12 are included in the Company's test year cost of service in Case No. 2023-00159.

Project	**Case No.**
Kewanee-Enterprise Park	2020-00062
Garrett Area Improvement	2021-00346
Wooton-Stinnett	2022-00118
New Camp Loop (Belfry)	2023-00040

Witness: Brian K. West

Kentucky Power Company
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DATA REQUEST

KPSC 2_6 Refer to the IRP, Volume A, Section 7.5.1, page 175. Explain if the 50 MW battery will deliver 50 MW continuously for four hours. If not, explain how the battery will run.

RESPONSE

For this IRP, the 50MW battery was modeled to allow for continuous energy delivery for up to four hours at maximum output. However, it was available to deploy at any specific output level or length of time.

Witness: Thomas Haratym, CRA

Kentucky Power Company
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DATA REQUEST

KPSC 2_7 Refer to Kentucky Power's response to Staff's First Request, Items 4 and 6a. Provide an annual demand and energy forecast for the cryptocurrency industry in Kentucky Power's service territory.

RESPONSE

KPCO_R_KPSC_2_7_ConfidentialAttachment1 provides the cryptocurrency industry load included in the Company's IRP forecast.

Witness: Glenn R. Newman

Kentucky Power Company
KPSC Case No. 2023-00092
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DATA REQUEST

KPSC 2_8 Refer to Kentucky Power's response to Staff's First Request, Item 7.

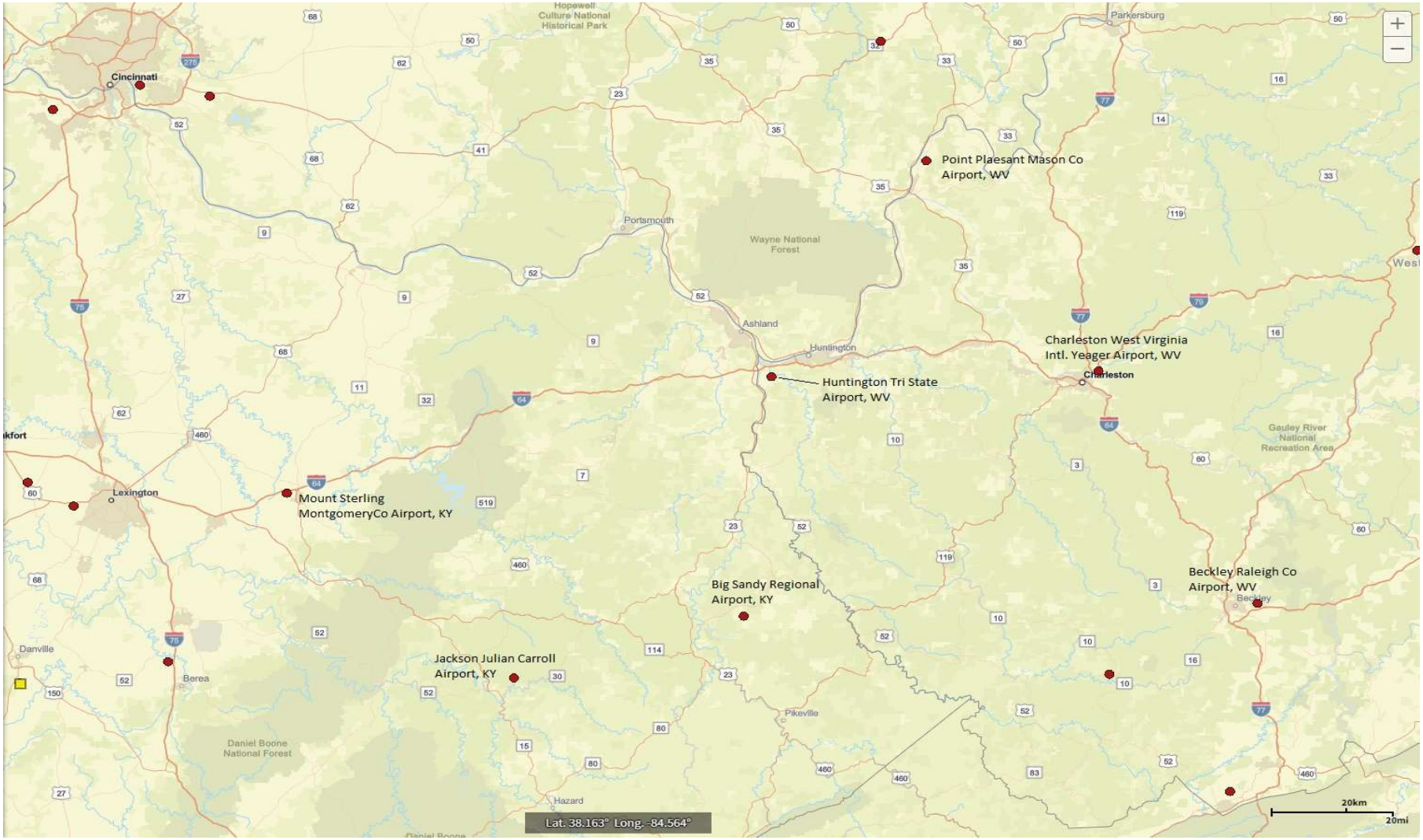
a. Provide a map and description of the region used by Kentucky Power to obtain heating and cooling degree days for its energy models.

b. Confirm that Kentucky Power did not use weather data obtained from weather stations inside or adjacent to Kentucky Power's service territory that provide local specific weather forecasts. If Kentucky Power did, explain why.

RESPONSE

a. and b. KPCO_R_KPSC_2_8 Attachment1 provides a map with NOAA weather stations around Kentucky Power's service territory. The Company uses historical data from the Huntington West Virginia National Weather Service site for heating and cooling degree-days. The Company uses National Weather Service/NOAA weather as the source for weather data as it is deemed to be accurate and reliable. The Huntington location provides the best and most accurate weather information because it is the major National Weather Service site nearest to the Kentucky Power Service area region. Although the Huntington weather station is not in Kentucky Power service area, portions of the Kentucky Power service area are in the Huntington-Ashland Metropolitan Statistical Area (MSA) and is deemed to be representative of the weather in the entire service area.

Witness: Glenn R. Newman


Hopewell Culture National Historical Park
Parkersburg
Cincinnati
Point Pleasant Mason Co Airport, WV
Portsmouth
Wayne National Forest
Ashland
Huntington
Charleston West Virginia Intl. Yeager Airport, WV
Charleston
Huntington Tri State Airport, WV
Gauley River National Recreation Area
Lexington
Mount Sterling MontgomeryCo Airport, KY
Big Sandy Regional Airport, KY
Beckley Raleigh Co Airport, WV
Beckley
Danville
Berea
Jackson Julian Carroll Airport, KY
Pikeville
Daniel Boone National Forest
Hazard
Lat. 38.163° Long. -84.564°
20km
20mi

Kentucky Power Company
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DATA REQUEST

KPSC 2_9 Refer to Kentucky Power's response to Staff's First Request, Item 17. Confirm that if Kentucky Power were to build a natural gas combustion cycle (NGCC) unit, that Kentucky Power would be the sole ownership of the unit.

RESPONSE

The Company has not made the determinations necessary to either confirm or not confirm the statement in the request.

Partial ownership of a NGCC unit was not modeled for this IRP, and the Company is not aware of current opportunities for partial ownership of a NGCC unit. For the same reasons, the Company cannot rule out the possibility of partial ownership of a NGCC unit at this time.

Witness: Brian K. West

Kentucky Power Company
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DATA REQUEST

KPSC 2_10 Refer to Kentucky Power's response to Staff's First Request, Item 22a. Confirm that the most reasonable location to place the wind generation is outside Kentucky Power's service territory.

RESPONSE

The Company's IRP does not include an assumption regarding the location of generic wind resources. However, the Company anticipates that any wind resource responses to an RFP will likely be at locations outside Kentucky.

Witness: Gregory J. Soller

Kentucky Power Company
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DATA REQUEST

KPSC 2_11 Refer to Kentucky Power's response to Staff's First Request, Item 22c. Explain if it is Kentucky Power's preference to own or sign a Purchase Power Agreement (PPA) for wind generation.

RESPONSE

The Company has not made a determination at this time about whether to contract for or own wind generation.

Witness: Brian K. West

Kentucky Power Company
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DATA REQUEST

KPSC 2_12 Refer to Kentucky Power's response to Staff's First Request, Item 25. Explain why the Short-Term Market Purchase (STMP) resource is reliable source to determine avoided cost rates.

RESPONSE

The STMP resource was not specifically used to determine avoided cost in the Company's analysis; however, it was available for economic selection against all other resources in the model. As discussed in the response to KPSC 1_25 and in Section 5.7 of the IRP Report, beginning on page 110 of 1182, the STMP is based on an outlook for capacity price levels in the PJM Reliability Pricing Mechanism (RPM) and represents the opportunity cost of capacity in the region.

Witness: Thomas Haratym, CRA

DATA REQUEST

KPSC 2_13 Refer to Kentucky Power's response to Staff's First Request, Item 37c. Confirm that it is Kentucky Power's stance that because they are meeting PJM's summer capacity obligations, it will rely on PJM for its winter load obligation and will not have a winter capacity deficit.

RESPONSE

Kentucky Power confirms that it will not have a winter capacity deficit during the planning period encompassing its present IRP. For purposes of the Company's present IRP, the Company modeled its PJM summer capacity obligation, consistent with the Company's membership in PJM, its compliance with capacity requirements through the FRR option, and the current absence of a winter capacity obligation. Kentucky Power's IRP analysis also included a winter capacity obligation scenario.

The Company further notes that KRS 278.030(2) requires every utility to "furnish adequate, efficient and reasonable service …" KRS 278.010(14) defines "adequate service" to mean:

> having sufficient capacity to meet the maximum estimated requirements of the customer to be served during the year following the commencement of permanent service and to meet the maximum estimated requirements of other actual customers to be supplied from the same lines or facilities during such year and to assure such customers of reasonable continuity of service.

Although KRS 278.010(14) appears to narrowly relate to a utility having the capability to provide sufficient service to specific customers or facilities, and not more broadly to generation resource adequacy within its overall service territory, Kentucky Power is compliant with both the Fixed Resource Requirement (FRR) rules of PJM as well as any service adequacy requirements under Kentucky law. Load Serving Entities (LSE) in PJM, including Kentucky Power, are parties to the Reliability Assurance Agreement (RAA). The RAA is intended to ensure adequate capacity resources will be planned and made available to provide reliable service to all loads in the PJM region, including those in Kentucky Power's service territory, during all periods of the year and all conditions (including emergencies). The RAA also ensures coordination of the planning of resources to support reliability in PJM. To support these objectives, PJM operates a capacity market – the Reliability Pricing Model (RPM) – and supports the FRR alternative to that market under which LSEs may self-supply their capacity.

Under this system, so long as LSEs act in accordance with and satisfy their resource adequacy obligations to PJM, PJM is then able to support resource adequacy for all service territories in its footprint. To support year-round resource adequacy, PJM ensures that LSEs self-supply (for FRR entities) or procure through PJM's annual auctions (for RPM entities) sufficient capacity to meet the peak capacity needs of the PJM footprint as a whole, which occurs in the summer. Planning for the overall system peak in the summer allows PJM to provide adequate resources to meet the needs of all PJM LSEs during all periods of the year when the load in its footprint is equal to or less than the overall system peak.

This approach is reflected in the FRR provisions of the RAA. As described in the RAA, an LSE is eligible to participate in FRR if it has sufficient capacity to meet the unforced capacity obligation for all of its retail load for the applicable planning year. See RAA Schedule 8.1.B. That unforced capacity obligation is defined as the "weather adjusted coincident *summer* peak" for the LSE's retail load. See RAA Schedule 8.A.

Witness: Alex E. Vaughan (factual aspects)

Respondent: Counsel (legal aspects)

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DATA REQUEST

KPSC 2_14 Refer to Kentucky Power's response to Staff's First Request, Item 39b.

Kentucky Power states that "the NGCC was not economic versus the alternative resources within the model." Explain if the NGCC is considered more capacity efficient than the alternative options in the model.

RESPONSE

The Company is unfamiliar with term "capacity efficient."

The NGCC does operate at a higher thermal efficiency, or lower heat rate compared to a NGCT. Consequentially, an NGCC would be expected to operate at a higher capacity factor. The NGCC was not, however, the best economic alternative (generally, the cost to construct and the cost to operate, balanced against the operating margins) within the model compared to other resources including wind, solar and NGCT resources. The modeling did, however, suggest that a natural gas resource is beneficial to the portfolio at least for its capacity value.

Witness: Thomas Haratym, CRA

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DATA REQUEST

KPSC 2_15 Refer to Kentucky Power's response to Staff's First Request, Item 41. Kentucky Power states in its response that "Currently Kentucky Power does not have a PJM winter capacity requirement." Also refer to the Application, Volume A, Section 7.4.3.1, page 167. Kentucky Power states "All portfolio builds exhibit capacity shortfall for winter due to the winter peaking nature of the Kentucky Power system." Reconcile the discrepancy that Kentucky Power has a winter capacity deficit.

RESPONSE

There is no discrepancy as posed by the question. As a member of PJM, the Company is obligated to meet its PJM coincident summer peak capacity obligation and does not presently have a PJM coincident winter peak capacity requirement. The Company's peak winter load is met through the Company's participation in PJM as an FRR entity. Please refer to the Company's responses to KPSC 2_13 and KPSC 1_45(c).

Witness: Gregory J. Soller

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DATA REQUEST

KPSC 2_16 Refer to Kentucky Power's response to Staff's First Request, Item 42b. Provide, if possible, the uniform costs associated with the wind and solar facilities.

RESPONSE

To clarify, the "uniform" aspect refers to a single set of costs applied for resources built both in and surrounding Kentucky Power territory.

Please see Section 5.4, beginning on page 93 of 1,182, and Exhibit D on page 218 of 1,182 of the IRP report for a summary of these costs.

Witness: Thomas Haratym, CRA

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DATA REQUEST

KPSC 2_17 Refer to Kentucky Power's response to Staff's First Request, Item 46. Kentucky Power states that building gas generation takes approximately six years to complete. In its Preferred Plan Kentucky Power is anticipating having an NGCT built by 2029. Based on Kentucky Power's response, explain if a 2029 date for an NGCT is still reasonable considering the Commission has not received a certificate of public convenience and necessity (CPCN).

RESPONSE

The estimated 2029 in-service date was an estimate based on reasonable assumptions and information available to the Company. The actual in-service date could vary from the estimate. An in-service date of 2029 is still possible and reasonable. The Company estimated that the RFP process and regulatory review and approval efforts, including with this Commission and the PJM interconnection process, would take approximately two years. The construction of a new NGCT was estimated to take approximately four years for engineering, procurement and construction. Alternatively, other natural gas resources either currently available or that might otherwise be in development could be submitted as responses to an RFP that could also support a 2029 date.

Witness: Brian K. West

Kentucky Power Company
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DATA REQUEST

KPSC 2_18 Refer to Kentucky Power's response to Staff's First Request, Item 51b.Explain Kentucky Power's plan if PJM does not have 407 MW of capacity available in 2028.

RESPONSE

The IRP assumes capacity will be available in the PJM market throughout the IRP planning period. The Company notes that for the capacity year 2024/25 PJM market's overall capacity was approximately 209,801 MW. The Company will continue to prudently plan its resources and take into consideration updates in forecasted availability of capacity in the market (including the PJM capacity market and other capacity resources).

Nevertheless, if the PJM market experienced a capacity shortage that resulted in 407 MW of capacity not being available from the PJM market in 2028, the Company has other options. For example, the Company would fulfill the 407 MW requirement through bilateral contracts, either with one or more of its affiliates or with an unaffiliated third party, or through acquisition, development, or construction of supply side or demand side capacity resources

Witness: Brian K. West

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DATA REQUEST

KPSC 2_19 Refer to Kentucky Power's response to Staff's First Request, Item 51c. Explain how Kentucky Power plan's on recovering the $15,668,228 from capacity purchases in 2028.

RESPONSE

The $15,668,228 of capacity purchases included in KPCO_R_KPSC_1_51_Attachment1, are high-level estimates assumed for purposes of this IRP and modeled as described in Section 5.7 of the IRP. The Company's approved mechanism for recovery of purchased power is through Tariff Purchase Power Adjustment. Capacity purchases are recovered within element "N" of the PPA formula found on Tariff Sheet 35-1:

> *"The annual purchase power adjustment factor will be computed using the following formula:*
>
> *1. Annual Purchase Power Net Costs (PPANC)*
>
> *PPANC = N+CSIRP+OATT+RKP+RP-BPP*
>
> *Where: BPP = The annual amount of purchase power costs included in base rates, $98,165,699.*
>
> *a. N = The annual cost of power purchased by the Company through new Purchase Power Agreements and purchased power expense from avoided cost payments to net metering customers under tariff N.M.S. II. All new purchase power agreements shall be approved by the Commission to the extent required by KRS 278.300."*

A breakdown of element "N" is found on Forms 3.0a and 3.0 within the Company's annual PPA filing in the post-case files of Case No. 2020-00174.

Witness: Brian K. West

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DATA REQUEST

KPSC 2_20 Refer to the IRP, Volume A, Section 3.2, page 56. Also refer to Kentucky Power's Response to Staff's First Request, 04_KPCO_R_KPSC_1_8_Attachment1.xlsx, Tab Existing Resources.

a. Confirm that the 100 MW Spicewood solar facility was manually included with Kentucky Power's other existing resources instead of having the AURORA model select the solar facility as a potential resource addition. If not, explain why it was not.

b. Explain why the Spicewood solar facility capacity credits begin at 44 MW and decline to 22 MW.

RESPONSE

a. Confirmed.

b. The Spicewood solar facility capacity credit is determined by the PJM Effective Load Carrying Capability (ELCC) credit. PJM runs models as part of its resource adequacy analysis from which the ELCC credit is identified and published for renewable and storage resources. The ELCC quantifies resource adequacy (capacity) value at peak times. As the percent of solar resources relative to total PJM resources increases, the ability for the solar resources to support peak loads in PJM is reduced which is reflected as a declining ELCC credit. The impact of the ELCC on the relative capacity value of the resources in the IRP model, and changes in the capacity contribution of different technologies, are further discussed in section 6.3.3 of the IRP on page 120 of 1,182.

Witness: Gregory J. Soller

Witness: Thomas Haratym, CRA

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DATA REQUEST

KPSC 2_21 Refer to the IRP, Volume A, Section 3.2, page 56. Also refer to Kentucky Power's response to Staff's First Request, 04_KPCO_R_KPSC_1_8_Attachment1.xlsx, Tab Capacity Charts and Reserves and Tab Existing Resources. Explain why the Spicewood solar facility is listed on the Tab Existing Resources and the Tab Capacity Charts and Reserves as a new resource. Explain whether this discrepancy exists for all portfolios.

RESPONSE

The 100 MW Spicewood solar facility is included in all portfolios as a future Going In Resource. It is not the result of selection through the model's economic analysis, but instead an assumption in the analysis. The Spicewood solar facility is included in the report to reflect all future resources, regardless of whether they are part of the economic selection or a Going In assumption.

Witness: Thomas Haratym, CRA

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DATA REQUEST

KPSC 2_22 Refer to the IRP, Volume A, Exhibit C-5, page 201. Also refer to Case No. 2022-00387, Kentucky Power's response to Commission Staff's Second Request for Information, Item 4a-4b. Explain the reason the IRP does not contain the most up to date forecasting even though it was filed after Case No. 2022-00387.

RESPONSE

Please see response to KPSC 2_23, part a.

Witness: Gregory J. Soller

DATA REQUEST

KPSC 2_23 Refer to the IRP, Volume A, Exhibit C-5, page 201. Also refer to Case No.2022-00387, Kentucky Power's response to Commission Staff's First Request for Information (Staff's First Request), Item 4, Attachments 1–3.

a. Explain the difference between the load forecasts in IRP, Volume A, Exhibit C-5 and Case No. 2022-00387, Kentucky Power's response to Staff's First Request, Item 4, Attachment 1, and Attachment 2.

b. Provide a breakdown of all load additions contained in Attachment 1, Load Additions Tab. Include in the response a distinction between each entity's firm and interruptible load. Additionally, if not already included in the Load Additions Tab, include the anticipated additional Ebon International firm load requirement, and interruptible capacity and energy usage.

c. Explain how the anticipated load in the Load Additions Tab was included in the forecast based upon the most recent data provided in Attachment 3.

RESPONSE

a. The seasonal peak demands shown in both IRP, Volume A, Exhibit C-5, page 201 and Case No.2022-00387, Kentucky Power's response to Commission Staff's First Request for Information (Staff's First Request), Item 4, Attachment 1 are identical and originate from the Company's load forecast completed in June 2022. The table in IRP, Volume A, Exhibit C-5, page 201 also depicts annual peak demands, energy requirements, load factors and growth rates associated with the June 2022 load forecast. Kentucky Power's response to Commission Staff's First Request for Information (Staff's First Request), Item 4, Attachment 2 represents energy sales, losses, internal energy and seasonal peak demands produced from an updated load forecast completed in September 2022 which was after modeling for the IRP had commenced.

Attachment 3 to KPSC 1-4 in Case No. 2022-00387 provides the Company's estimated available capacity and estimated load obligation. The estimated load obligation reflects the obligation coincident with PJM. The projected loads for DY 22/23 through DY 26/27 were developed using PJM planning parameters. For DY 27/28 through DY 31/32 the Company used the Company's forecast coincident with PJM as one of the parameters to determine load obligation. The Company used the June 2022 Load Forecast to estimate the future coincident peaks.

b. The load additions in Attachment 1, Load Additions Tab reflect the anticipated annual load addition for Ebon. The Company notes that by its August 28, 2023 Order in Case No. 2022-00387, the Commission denied the special contract with Ebon. Therefore, the Company understands this request to be moot.

c. Please see the Company's response to subpart a. The load obligation through DY 26/27 is based on PJM planning parameters that do not specifically include Ebon. For the load obligation beyond DY 27/28, Ebon is accounted for in the load obligation as it relies on the Company's load forecast.

Witness: Glenn R. Newman

DATA REQUEST

KPSC 2_24 Refer to the IRP, Volume A, Exhibit C-5, page 201. Also refer to Case No. 2022-00387, Kentucky Power's response to Staff's First Request, Item 7, Attachment KPCO_R_KPSC_1_7_Attachment1.xlsx.

a. Explain why Kentucky Power interrupts customers during PJM Interconnection LLC's (PJM) estimated peak hours.

b. Explain why the 25 MW firm capacity from the Ebon International special contract does not appear to be included in the Company's capacity obligation.

c. Explain how the AURORA model accounts for interruptible customers' firm load for estimating demand peaks and how the model accounts for these customers' total energy needs.

RESPONSE

a. The Company has three Rider D.R.S. customers that can contractually be interrupted at the estimated time of the PJM RTO peaks. The effect of the Company interrupting a customer at the time of the estimated PJM peak hours is that the Company's peak will be lowered. The lower peak will result in lower Peak Load Contribution (PLC), a key factor in determining the Company's capacity obligation.

The Company has five customers on Tariff C.S.-I.R.P. that can be interrupted at the time of a PJM-called event. Past performance of the customers at the time of the PJM five coincident peaks determines a PLC load for these customers. This PLC load can be used as a supply side value to help meet the Company's capacity obligation in PJM.

b. The Company's capacity obligation is not reflected in either of the attachments or exhibits referenced in the question. Notwithstanding, by its August 28, 2023 Order in Case No. 2022-00387, the Commission denied the special contract with Ebon. Therefore, the Company understands this request to be moot.

c. The interruptible customer load is modeled as a conservation resource that AURORA effectively subtracts from the Company's peak PJM coincident load obligation, resulting in a peak native load that is net of the resource. For energy, the AURORA model was dispatched to serve the Company's native load in all hours that include the interruptible customer loads.

Witness: Glenn R. Newman (subpart b)

Witness: Brian K. West (subpart a)

Witness: Thomas Haratym, CRA (subpart c)

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DATA REQUEST

KPSC 2_25 Refer to the IRP, Volume A, Exhibit C-5, page 201 and to Case No. 2022-00387, Kentucky Power's response to Staff's First Request, Item 4, Attachments 1-3. Explain why Kentucky Power plans for PJM summer capacity obligations when Kentucky Power has a higher winter peak load.

RESPONSE

Please refer to the Company's response to KPSC 2_13.

Witness: Alex E. Vaughan

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DATA REQUEST

KPSC 2_26 Refer to the IRP, Volume A, Exhibit C-2A, page 198.

a. Explain why Total Sales-for-Resale is not included in total internal energy forecast and the peak demand forecast beyond 2025.

b. Explain the advance notice requirement for Vanceburg and Olive Hill if the cities choose to terminate Kentucky Power's franchise and intend to leave Kentucky Power's system. Also include in the response whether Vanceburg or Olive Hill have provided that notice. If not, explain why it is reasonable to exclude that load from a long- range forecast and resource planning study.

RESPONSE

a. Total Sales-for-Resale is not included in total internal energy forecast and the peak demand forecast beyond 2025 because the Company's contracts with wholesale customers Vanceburg and Olive Hill terminate on May 31, 2025.

b. Both FERC Rate Schedules (Olive Hill and Vanceburg wholesale agreements) were established with a specific term ending May 31, 2025, and at the end of the term, Kentucky Power's obligation to serve under the existing Rate Schedules and the Customer's obligation to take service from the Company under the Rate Schedules terminates. The Rate Schedules did not provide for extensions of the existing Rate Schedules, rather, the parties agreed, in advance, that a new agreement would need to be negotiated and entered into for any new delivery period extending beyond the last day of the term of the existing Rate Schedules. There is no advance notice requirement. The existing Rate Schedules contain express language stating that the parties may commence negotiations for a new agreement covering a new delivery period eight years prior to the end of the Delivery Period for the existing Rate Schedules, absent a written agreement to the contrary. Kentucky Power's obligation to serve under the Rate Schedules expires May 31, 2025, so the long range forecasts and resource planning for Kentucky Power is adjusted (reduced) accordingly, as forecasting for and planning for wholesale load that Kentucky Power does not have an obligation to serve would not be prudent.

Witness: Glenn R. Newman

Witness: Brian K. West

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_27 Refer to the IRP, Volume A, page 15 and Exhibit C-5 page 201. Exhibit C-5 and the Preferred Plan do not include anticipated load additions. Explain whether the hourly local marginal pricing (LMP) that Kentucky Power pays for energy could be affected by the additions of the anticipated load.

RESPONSE

The IRP analyzed a PJM zonal energy price, and did not analyze Locational Marginal Prices (LMPs). The Company notes, however, that the addition of load, by itself alone, has little to do with the realized market price for energy. PJM market prices are highly correlated with natural gas prices because generally speaking, the marginal unit that sets the system energy price in PJM are natural gas-fired generating units. When gas prices rise, PJM energy prices also rise. Some things that may cause gas prices to rise are weather forecasts that indicate a potential rise in the need for heating or electricity demand, a downward trend of natural gas storage compared to prior periods for the supply of the overall market, flat or declining natural gas production, and robust demand for natural gas in the global markets.

Witness: Thomas Haratym, CRA

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_28 Explain if a higher hourly LMP would affect the resource choices made by the AURORA model and the timing of the additions of those resources into the resource portfolio.

RESPONSE

Please see the Company's response KPCO_R_KPSC_2_27. A change in IRP zonal energy price could be one factor, however there are other drivers that might also impact resource selection. The impact on the portfolio will depend on the drivers of the increased LMP. For example, the ECR scenario resulted in higher overall zonal energy price driven by higher gas and carbon pricing. The timing and quantity of resources in the ECR portfolio relative to other portfolios is shown in section 7.3, beginning on page 155 of 1182, of the IRP Report.

Witness: Thomas Haratym, CRA

DATA REQUEST

KPSC 2_29 Refer to Kentucky Power's response to Staff's First Request, Item 14.

a. Explain the number of starts and total energy output for the natural gas combustion turbine (NGCT) supporting the variable operations and maintenance (VOM) calculation.

b. Explain whether one or both of the NGCT units will have dual-fuel (black start) capability. If so, explain whether this capability was included in the modeling. Include in the response an explanation of why the lack of dual fuel capability does not lessen the reliability of the system.

c. Explain whether having a NGCT capable of burning fuel oil would impair its ability to burn hydrogen in the future.

RESPONSE

a. The number of starts corresponds to the number of instances AURORA deemed the unit economic to dispatch in a given year. The total energy output corresponds to the number of MWh the unit generated during a given year. To arrive at the VOM calculation in Item 14, the total start costs from AURORA were divided by the total MWhs of energy output. This value was then added to baseline VOM costs modeled in AURORA.

b. Dual fuel capability means the CTs can operate using different fuels such as fuel oil instead of natural gas. A black start generator is an auxiliary power generation unit which provides the power plants with the initial power backup during a blackout without depending on any external electric source. Black start capability is not necessarily dependent on the dual fuel capability of the NGCT. The NGCTs modeled do have ability to have dual fuel capability (fuel flexibility). Black start capability specifically was not included in the modeling. Different alternatives to a CT resource could be considered to mitigate potential reliability risks of the system. However, for this IRP, specific assumptions to any such alternatives were not modeled. Other than capacity accreditation, the IRP model does not make distinctions based on power supply reliability. The resource selection in the proposed case can be satisfied with a gas unit that has dual capability, which would enhance reliability.

c. A NGCT capable of burning fuel oil would not impair its ability to burn hydrogen in the future.

Witness: Gregory J. Soller (subparts b and c)

Witness: Thomas Haratym, CRA (subpart a)

Kentucky Power Company
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Dated July 24, 2023

DATA REQUEST

KPSC 2_30 Refer to Kentucky Power's response to Staff's First Request, Item 19b, Item20 and KPCO_R_KPSC_1_20_ConfidentialAttachment1.xlsx, Tab G2.

a. Confirm that all costs associated with extending the life of Big Sandy Unit 1 were included in the AURORA model.

b. According to Kentucky Power, Big Sandy Unit 1 has a useful life of 2041. Explain why the projections end in 2037.

c. Given the relative costs of extending Big Sandy Unit 1 through 2041 and the projected capacity factors, explain if the AURORA model contain a factor allowing the early retirement of Big Sandy Unit 1.

RESPONSE

a. All estimated costs associated with the continued operation of Big Sandy were included in the modeling.

b. The reporting period for the IRP ends in 2037 and therefore the referenced "projections" in the question end in 2037. However, the economic viability of each resource option is considered across its entire lifespan if the lifespan goes beyond the IRP 15 year reporting period (until 2041 in the case of Big Sandy).

c. The model allows for retirement of Big Sandy in 2031 or 2041. The model did not include an option for earlier retirement. When selected by the model, the resource was modeled to continue operations until 2041 (and not to 2031).

Witness: Gregory J. Soller (subpart a)

Witness: Thomas Haratym, CRA (subparts b and c)

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_31 Refer to Kentucky Power's response to Staff's First Request, Item 20 and KPCO_R_KPSC_1_20_ConfidentialAttachment1.xlsx, Tab G2. Provide a comparison of capacity factors between the Big Sandy Unit 1 and each of the two NGCTs in the Preferred Plan. Explain how and when the AURORA model chooses to dispatch the units.

RESPONSE

Please see file KPCO_R_KPSC_2_31_Attachment1.

AURORA dispatches each unit when its variable cost is less than the market price. Start costs and other operating constraints are also factored into the dispatch decision. The market price represents market conditions in PJM AEP zone.

Witness: Thomas Haratym, CRA

	Big Sandy 1 - Gas	Area 1001 Gas CT 2029
2023	72%	
2024	79%	
2025	71%	
2026	63%	
2027	62%	
2028	31%	
2029	50%	58%
2030	34%	39%
2031	20%	36%
2032	18%	31%
2033	23%	28%
2034	18%	26%
2035	15%	26%
2036	23%	30%
2037	18%	28%

Note: CT units selected in 2029 dispatched identically in the model

Kentucky Power Company
KPSC Case No. 2023-00092
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Dated July 24, 2023

DATA REQUEST

KPSC 2_32 Refer to Kentucky Power's response to Staff's First Request, Item 21.

a. Given that the 50 MW lithium-ion battery is charged with grid supplied energy, explain how and when the AURORA model chooses to charge the battery.

b. Explain how and when the AURORA model chooses to dispatch the 50 MW lithium-ion battery.

RESPONSE

a. and b. At the beginning of each week, AURORA determines a charging and generation schedule for each storage project for the coming week. This schedule is based on cycle efficiency and an hourly zonal price forecast for the week. Within each day across the week, AURORA identifies the combination of hours in which it is cost-effective to store and to generate without violation of the project storage constraints. AURORA assures that revenue during the generation hours exceeds the cost of charging energy adjusted for cycle efficiency. Once the hourly schedule for the week has been determined, it is locked in and used to modify zonal load for the hours being dispatched as the simulation proceeds through the week. In any individual dispatch hour, the actual hourly cost of recharge energy or the revenue from hourly generation is based on the zonal price determined by the full dispatch for that hour.

Witness: Thomas Haratym, CRA

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_33 Refer to Kentucky Power's response to Staff's First Request, Item 22d.

a. Explain why modeling variable O&M costs as fixed O&M costs does not distort the winter generation resources selected in the AURORA model.
b. Explain why modeling variable O&M costs as fixed O&M costs means that the AURORA model selects and dispatches wind resources uneconomically, relative to other generation resources.

RESPONSE

a. The Company has been unable to find any basis to make an assumption that O&M costs for this resource are variable in all cases. The assumption to model O&M as a fixed cost is applied as a cost for all seasons, not just winter. As discussed in KPSC 1_22, O&M costs were assumed to be covered as part of an annual full-service agreement arrangement. This service agreement is represented in the IRP through a fixed operating cost. Please see EIA report "Capital Cost and Performance Characteristic Estimates for Utility Scale Electric Power Generating Technologies" (February 2020) for more detail (section 20.4). The absence of an assumption that O&M costs are variable does not distort the analysis due to the full service agreement being in place throughout the entire year.

b. The Company does not take the position that "modeling variable O&M costs as fixed O&M costs means that the AURORA model selects and dispatches wind resources uneconomically, relative to other generation resources." The AURORA model selects and dispatches wind resources economically, relative to other generation resources. Please refer to the Company's response to subpart a. for an explanation of the assumptions of O&M costs included in the modeling.

Witness: Thomas Haratym, CRA

Kentucky Power Company
KPSC Case No. 2023-00092
Commission Staff's Second Set of Data Requests
Dated July 24, 2023

DATA REQUEST

KPSC 2_34 Refer to the IRP, Volume A, Section 5.4.1, page 174. Also refer to Kentucky Power's response to Staff's First Request, Item 23.

a. Confirm the solar facility in Hazard, Kentucky is the 250 MW of solar energy in the Preferred Plan. If yes, explain if and when Kentucky Power will be filing for a certificate of public use and necessity (CPCN) for the Hazard, Kentucky solar facility.

b. Provide the generation Request for Proposal (RFP) solicitation for the Hazard, Kentucky solar facility. Also, include an explanation of the determination that was made that a company owned solar facility was more cost effective than a solar power purchase agreement.

RESPONSE

a. The Company is not able to confirm. The solar facility in Hazard, Kentucky is planned as a 100 MW facility. An additional 150 MW of new generic solar was selected by the model for a total addition of 250 MW of solar resources in 2027. Please also see the Company's response to subpart (b).

b. The Company has not yet made a specific determination about the process for developing the Hazard, KY solar facility. The Company is still in the initial phases of planning this project, and it has not issued an RFP specifically for the 100 MW Hazard, KY solar facility. At this stage, the Company has only executed a lease option for approximately 2,195 total acres upon which the facility would be constructed. In addition, the Company submitted a Generation Interconnection Agreement request with PJM in September 2021 for a 100 MW solar project. However, this interconnection agreement request has not yet been approved by PJM. Once the interconnection agreement request has been approved by PJM, the Company would issue an RFP, timely file any necessary CPCN application with this Commission, and take any other necessary steps to bring the facility to fruition.

Witness: Brian K. West (subpart a and b)

Witness: Thomas Haratym, CRA (subpart a)

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E-Signature 1: Tomasz Haratym (TH)
September 07, 2023 06:56:02 -8:00 [B6E0969F284C] [38.122.101.202]
THaratym@crai.com (Principal) (Personally Known)

E-Signature Notary: Marilyn Michelle Caldwell (MMC)
September 07, 2023 06:56:02 -8:00 [D37D679763F9] [167.239.221.101]
mmcaldwell@aep.com
I, Marilyn Michelle Caldwell, did witness the participants named above electronically sign this document.

VERIFICATION

The undersigned, Tomasz J. Haratym, being duly sworn, deposes and says he is the Associate Principal, for Charles River Associates, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Tomasz Haratym

Tomasz J. Haratym

Commonwealth of Kentucky)
)
County of Boyd)

Case No. 2023-00092

Subscribed and sworn to before me, a Notary Public in and before said County and State, by Tomasz J. Haratym, on September 7, 2023.

Notary Public

MARILYN MICHELLE CALDWELL
ONLINE NOTARY PUBLIC
STATE AT LARGE KENTUCKY
Commission # KYNP71841
My Commission Expires May 05, 2027

Notarial act performed by audio-visual communication

My Commission Expires May 5, 2027

Notary ID Number KYNP71841

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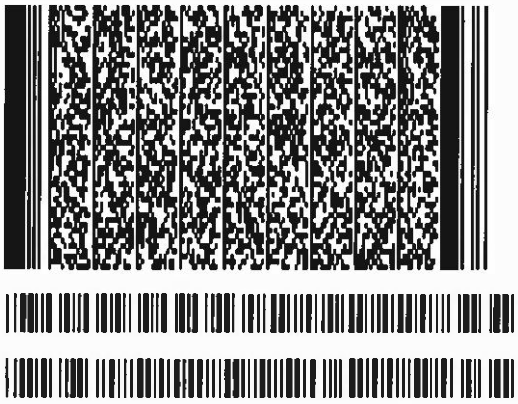
E-Signature Summary

E-Signature 1: Reid Newman (RN)
September 05, 2023 13:13:34 -8:00 [99AD28FB0DE7] [167.239.221.104]
rnewman@aep.com (Principal) (Personally Known)

E-Signature Notary: Marilyn Michelle Caldwell (MMC)
September 05, 2023 13:13:34 -8:00 [11793C1E05F8] [167.239.221.101]
mmcaldwell@aep.com
I, Marilyn Michelle Caldwell, did witness the participants named above electronically sign this document.



VERIFICATION

The undersigned, Glenn R. Newman, being duly sworn, deposes and says he is the Manager of Economic Forecasting for American Electric Power Service Corporation, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Reid Newman

Glenn R. Newman

Commonwealth of Kentucky)
)
County of Boyd)

Case No. 2023-00092

Subscribed and sworn to before me, a Notary Public in and before said County and State, by Glenn R. Newman, on September 5, 2023 .

Notary Public

MARILYN MICHELLE CALDWELL
ONLINE NOTARY PUBLIC
STATE AT LARGE KENTUCKY
Commission # KYNP71841
My Commission Expires May 05, 2027

Notarial act performed by audio-visual communication

My Commission Expires _____

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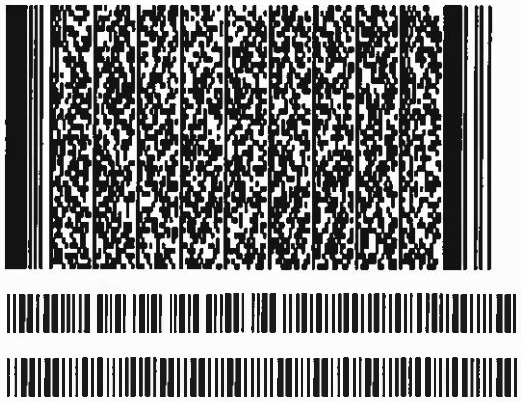
E-Signature Summary

E-Signature 1: Gregory J. Soller (GJS)
August 31, 2023 08:15:45 -8:00 [36816C35689F] [167.239.221.106]
gsoller@aep.com (Principal) (Personally Known)

E-Signature Notary: Marilyn Michelle Caldwell (MMC)
August 31, 2023 08:15:45 -8:00 [C5DFC300B166] [167.239.221.101]
mmcaldwell@aep.com
I, Marilyn Michelle Caldwell, did witness the participants named above electronically sign this document.



VERIFICATION

The undersigned, Gregory J. Soller, being duly sworn, deposes and says he is the Resource Planning Manager for American Electric Power Service Corporation, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Gregory J. Soller

Gregory J. Soller

Commonwealth of Kentucky)
)
County of Boyd)

Case No. 2023-00092

Subscribed and sworn to before me, a Notary Public in and before said County and State, by Gregory J. Soller, on August 31, 2023.

MARILYN MICHELLE CALDWELL
ONLINE NOTARY PUBLIC
STATE AT LARGE KENTUCKY
Commission # KYNP71841
My Commission Expires May 05, 2027

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Notary Public

My Commission Expires May 5, 2027

Notary ID Number KYNP71841

VERIFICATION

The undersigned, Alex E. Vaughan, being duly sworn, deposes and says he is the Managing Director for Renewables and Fuel Strategy for American Electric Power Service Corporation, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Alex E. Vaughan

State of Ohio)
) Case No. 2023-00092
Franklin County)

Subscribed and sworn to before me, a Notary Public in and before said County and State, by Alex E. Vaughan, on 8/30/23.

Notary Public

Paul D. Flory
Attorney At Law
Notary Public, State of Ohio
My commission has no expiration date
Sec. 147.03R.C.

My Commission Expires Never

Notary ID Number No ID

VERIFICATION

The undersigned, Brian K. West, being duly sworn, deposes and says he is the Vice President, Regulatory & Finance for Kentucky Power, that he has personal knowledge of the matters set forth in the foregoing responses and the information contained therein is true and correct to the best of his information, knowledge, and belief.

Brian K. West

Commonwealth of Kentucky)
) Case No. 2023-00092
County of Boyd)

Subscribed and sworn to before me, a Notary Public in and before said County and State, by Brian K. West, on August 31, 2023.

Marilyn Michelle Caldwell
Notary Public

My Commission Expires May 5, 2027

Notary ID Number KYNP71841