REPORT

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Reimagine tomorrow.

Duke Energy South Carolina EE and DSM Market Potential Study

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1 Executive Summary

In November, 2019, Duke Energy retained Nexant, Inc., to determine the potential energy and demand savings that could be achieved by energy efficiency (EE) and demand-side management (DSM) programs in the Duke Energy Carolinas (DEC) and Duke Energy Progress (DEP) service territories. This report describes the potential for DSM savings among these two service territories in South Carolina. The main objectives of the study include:

- Providing a market potential study, which estimates the technical, economic and realistic achievable market potential energy savings over the short term (5 year projection), medium term (10 year projection), and long term (25 year projection).
- Estimating the potential energy and demand savings for Duke Energy's South Carolina service territory.
- Developing of savings estimates with a focus on different perspectives: compliance and system planning.

1.1 Methodology

This study utilized Nexant's Microsoft Excel-based modeling tool, TEAPot (Technical, Economic, and Achievable Potential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The assessment started with the current Duke Energy load and sales forecasts, which were disaggregated into customer-class and end use components. Opportunities for reducing electricity consumption among Duke Energy customers and their end uses were developed by examining the full range of commercially available energy efficiency measures and practices. Nexant examined measures for each end use, taking into account fuel shares, current market saturations, technical feasibility, and costs. Measure savings impacts were applied to each customer class, segment, and end use to estimate EE and DSM potential at the end use, customer class, and system levels.

1.2 Savings Potential

Technical potential as a share of 2044 electricity sales indicates the theoretical upper limit on savings from EE is approximately 32% in the DEC territory and 33% in the DEP territory. These estimates of cumulative technical potential ignore measure costs and focus on energy savings wherever technically feasible. Cumulative economic potential reflects current trends of declining avoided energy costs for utilities, with 13% savings in DEC and 12% savings in DEP. Economic potential is attributable to measures that are cost effective using the Total Resource Cost test (TRC), in keeping with the rules of the SC Public Utilities Commission. The results of economic screening indicate that many measures currently offered by Duke Energy through EE and DSM programs may not continue to be cost-effective from the standpoint of the TRC. Economic screening also demonstrates that Duke Energy programs currently offer all measures identified as cost-effective.

These baseline conditions and market trends, coupled with projected achievable participation for cost-effective measures, produced estimates of annual achievable program energy savings that average approximately 0.82% of annual Base Sales in DEC and 0.81% of annual Base Sales in DEP over the 25-year period covered in this study.

Nexant examined three scenarios for achievable potential: base, enhanced, and an avoided energy cost sensitivity. These scenarios provide a sensitivity for EE costs and benefits to understand how these market conditions and trends affect the costs and benefits of utility-sponsored programs over the study's time horizon of twenty-five years:

- Base scenario – aligns with existing program portfolio, and includes existing EE programs and measures currently offered by DEC or DEP
- Enhanced scenario – includes the base scenario, but with increased program spending (via incentives) designed to attract new customers into the market for EE technology and program participation
- Avoided Energy Cost Sensitivity scenario – covers the base scenario, but with a sensitivity analysis around enhanced EE benefits, such as may occur if avoided energy costs were higher than current values. Higher benefits for EE may lead to additional cost-effective measures and increased achievable potential

1.2.1 Energy Efficiency Potential

The estimated technical and economic potential scenarios for DEC are summarized in Table 1-1, which lists cumulative energy and demand savings for each type of potential. Savings percentages are presented as a share of end year sales over 25 years. These projected sales values were adjusted to remove opt-out customers.

Table 1-1: DEC Energy Efficiency Technical and Economic Potential

	Energy Efficiency Potential (2020-2044)			
	Energy (GWh)	% of End Year Sales	Demand (MW)	
			Summer	Winter
Technical Potential	4,338	32%	1,504	312
Economic Potential	1,773	13%	376	170

Table 1-2 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) DEC portfolio EE program potential for the base, enhanced, and avoided energy cost sensitivity scenarios. Impacts are presented as the average of annual impacts achieved over the stated time horizon (5 years, 10 years, or 25 years).

Table 1-2: DEC Energy Efficiency Achievable Program Potential

Scenario Milestones	Energy (GWh)	Demand (MW)		Average Annual % of Base Sales[1]
		Summer	Winter	
DEC Achievable Program Potential – Base Scenario				
5-yr sum of annuals (2024)	513	179	48	0.91%
10-yr sum of annuals (2029)	986	347	90	0.87%
25-Yr sum of annuals (2044)	2,461	882	224	0.82%
DEC Achievable Program Potential – Enhanced Scenario				
5-yr sum of annuals	554	185	51	0.98%
10-yr sum of annuals	1,054	358	97	0.93%
25-yr sum of annuals	2,574	901	235	0.85%
DEC Achievable Program Potential – Avoided Energy Cost Sensitivity Scenario				
5-yr sum of annuals	518	180	48	0.92%
10-yr sum of annuals	995	349	91	0.88%
25-yr sum of annuals	2,477	886	225	0.82%

Technical and economic for DEP are presented in Table 1-3. As above, cumulative energy impacts are presented as a share of end year sales for 2024, 2029, and 2044 and sales are adjusted to remove opt-out customers.

[1] Average annual energy savings as percentage of annual base sales per period.

Table 1-3: DEP Energy Efficiency Technical and Economic Potential

	Energy Efficiency Potential (2020-2044)			
	Energy (GWh)	% of End Year Sales	Demand (MW)	
			Summer	Winter
Technical Potential	1,482	33%	640	86
Economic Potential	566	12%	202	37

Table 1-4 presents achievable program potential in terms of the sum of annual incremental energy for the stated time horizon. The table also presents demand savings and average annual percentage of base sales.

Table 1-4: DEP Energy Efficiency Achievable Program Potential

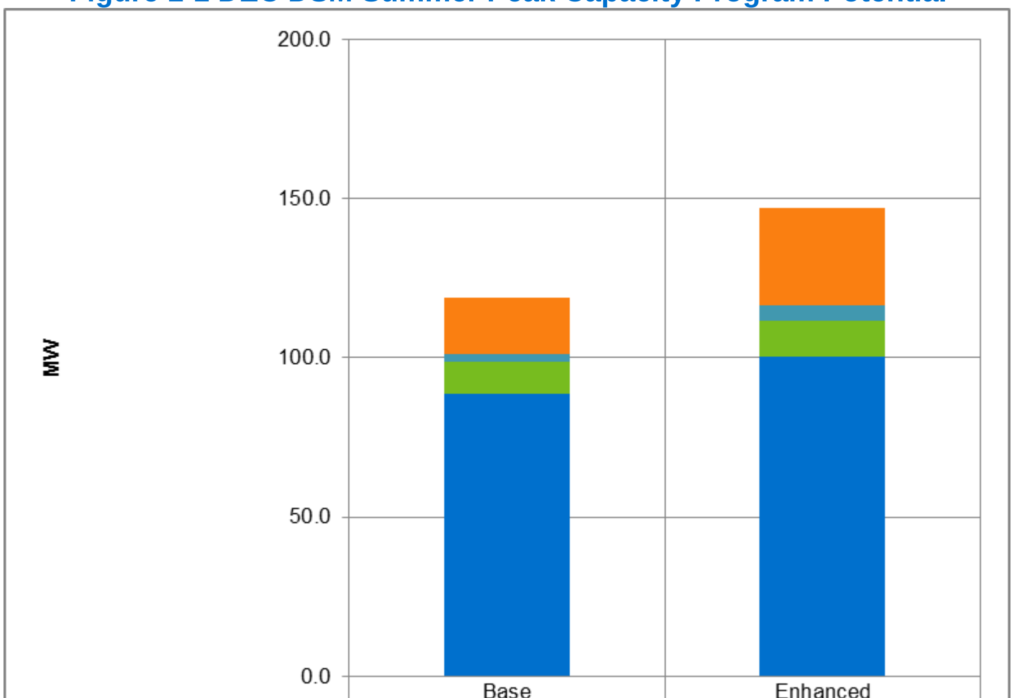
Scenario Milestones	Energy (GWh)	Demand (MW)		Average Annual % of Base Sales[2]
		Summer	Winter	
DEP Achievable Program Potential – Base Scenario				
5-yr sum of annuals (2024)	164	73	11	0.89%
10-yr sum of annuals (2029)	317	141	23	0.85%
25-Yr sum of annuals (2044)	811	368	56	0.81%
DEP Achievable Program Potential – Enhanced Scenario				
5-yr sum of annuals	176	75	13	0.96%
10-yr sum of annuals	337	146	24	0.91%
25-yr sum of annuals	843	375	59	0.85%
DEP Achievable Program Potential – Avoided Energy Cost Sensitivity Scenario				
5-yr sum of annuals	176	78	13	0.96%
10-yr sum of annuals	342	151	24	0.92%
25-yr sum of annuals	873	394	61	0.88%

[2] Average annual energy savings as percentage of annual Base Sales per period.

1.2.2 Demand-side Management Potential

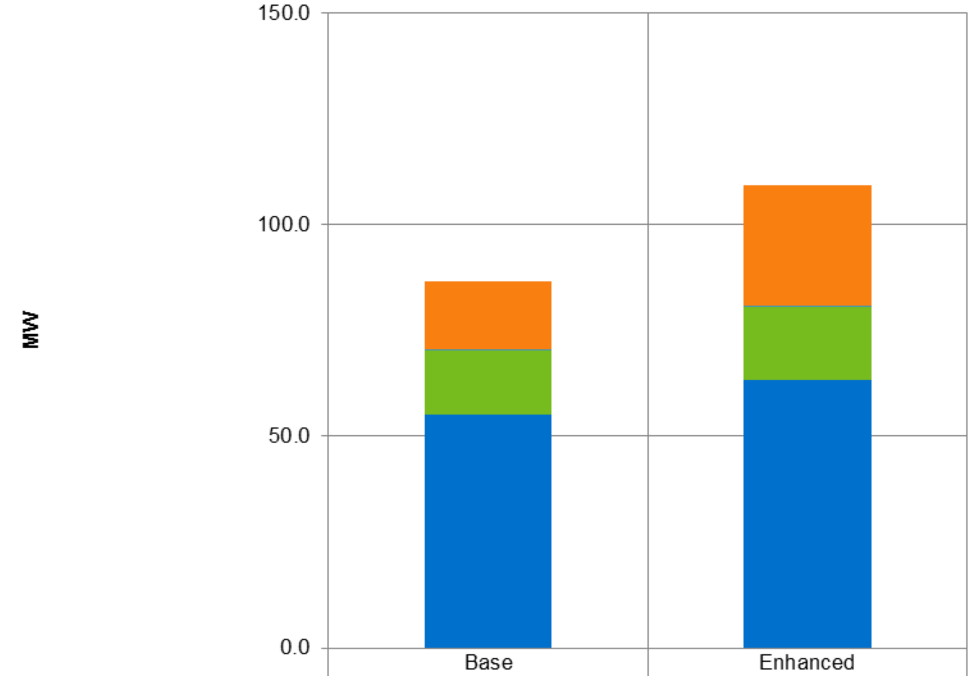
DSM opportunities were analyzed for DEC's South Carolina service territory to determine the amount of summer and winter peak capacity that could be reduced through DSM initiatives from a technical, economic, and program potential perspective. While technical and economic potential are theoretical upper limits, for program-based DSM, participation rates are calculated as a function of the incentives offered to each customer group. For a given incentive level and participation rate, the cost-effectiveness of each customer segment is evaluated to determine whether the aggregate DSM potential from that segment should be included in the achievable potential. Figure 1-1 and Figure 1-2 summarize the summer peak and winter peak DSM potential estimated for two program scenarios that affect DSM results. The avoided energy cost sensitivity scenario did not consider changes to capacity costs, so the results are the same as for the base scenario.

Figure 1-1 DEC DSM Summer Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	17.5	30.4
Small and Medium Business	2.7	4.9
Residential Multi-Family	10.0	11.4
Residential Single Family	88.6	100.3

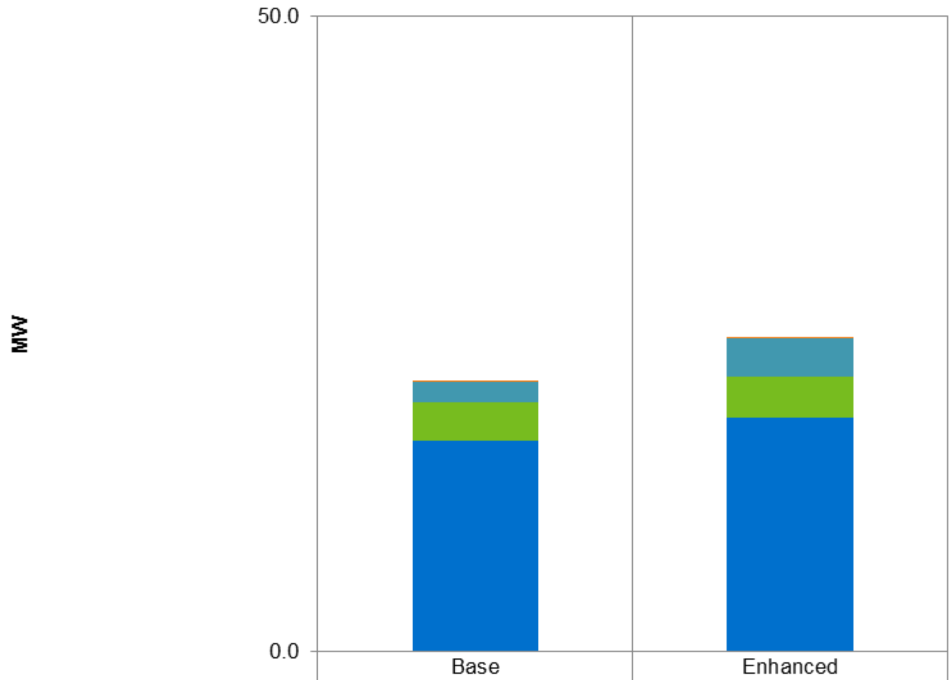
Figure 1-2 DEC DSM Winter Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	16.1	28.5
Small and Medium Business	0.2	0.3
Residential Multi-Family	15.0	17.2
Residential Single Family	55.2	63.4

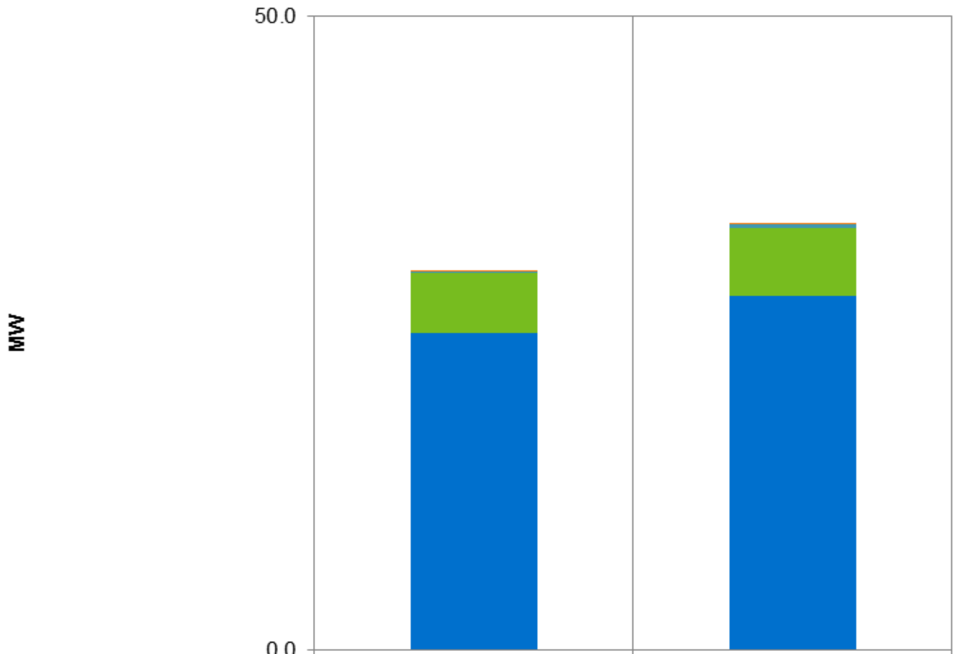
Figure 1-3 and Figure 1-4 summarize the summer peak and winter peak DSM potential estimated for the two program scenarios that affect DSM results.

Figure 1-3 DEP DSM Summer Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	0.0	0.1
Small and Medium Business	1.6	3.0
Residential Multi-Family	3.0	3.3
Residential Single Family	16.6	18.4

Figure 1-4 DEP DSM Winter Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	0.0	0.1
Small and Medium Business	0.1	0.2
Residential Multi-Family	4.8	5.4
Residential Single Family	25.0	28.0

2 Introduction

This section describes the objectives and deliverables Nexant generated to provide Duke Energy with an Energy Efficiency and Demand-side Management Market Potential Study covering the years 2020 – 2044. Section 2.1 describes the goals and study output, while Section 2.2 presents an overview and background for market potential studies.

2.1 Objectives and Deliverables

In November, 2019, Duke Energy retained Nexant, Inc., to determine the potential energy and demand savings that could be achieved by energy efficiency (EE) and demand-side management (DSM) programs in Duke Energy's South Carolina service territory (DEC and DEP). The main objectives of the study included:

- Providing a market potential study (MPS), which estimates the technical, economic and realistic achievable market potential energy savings over the short term (5 year projection), medium term (10 year projection), and long term (25 year projection).
- Estimating the potential savings of both energy and demand savings for Duke Energy's South Carolina service territory.
- Development of savings estimates with a focus on two different perspectives: compliance and system planning.

In developing the market potential for DEC and DEP, the following deliverables were developed by Nexant as part of the project and are addressed in this report:

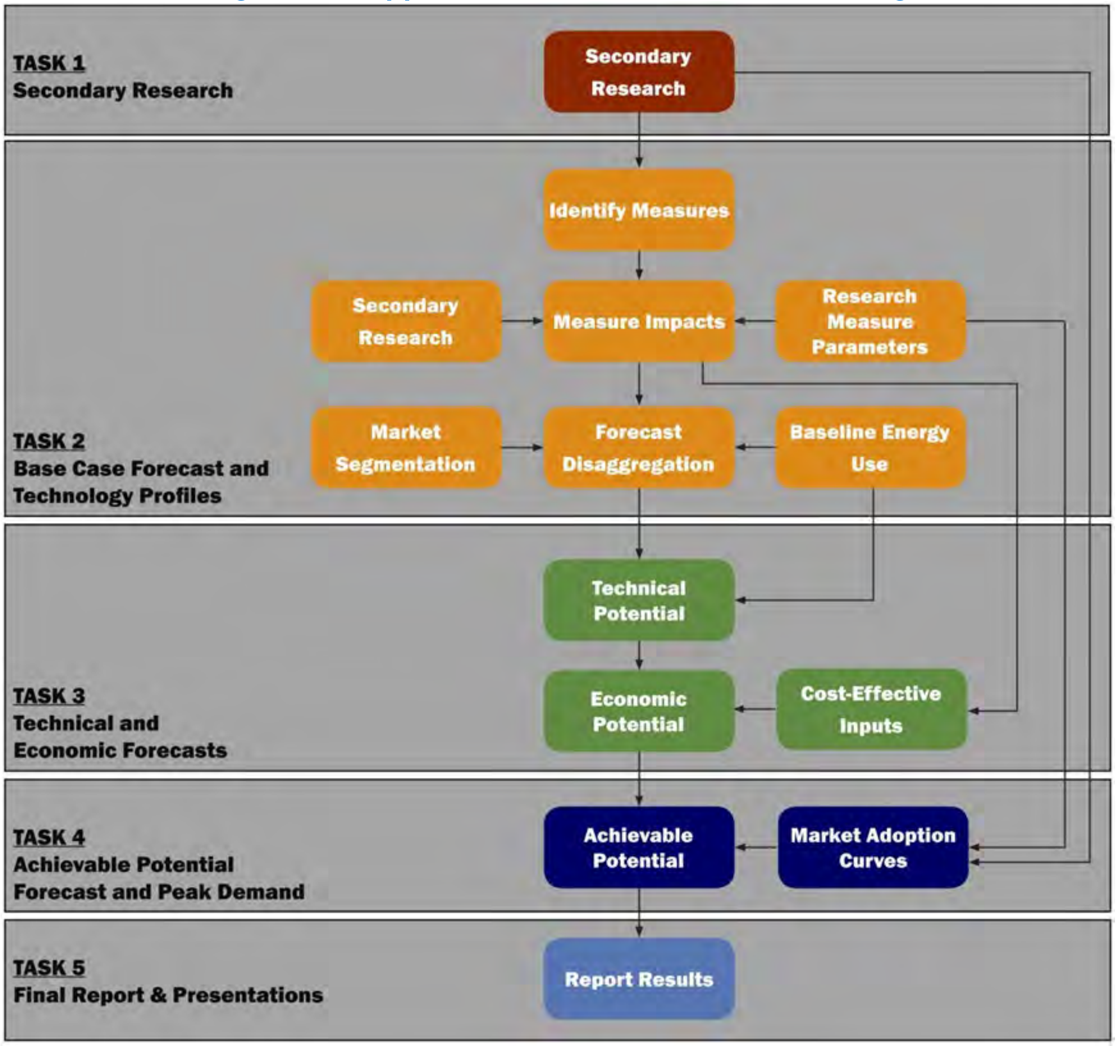
- Project plan.
- Measure list and detailed assumption workbooks.
- Summary of major assumptions utilized.
- Disaggregated baseline by year, state, sector, end use, technology saturations, and energy and demand consumptions.
- List of cost-effective energy efficiency measures and DSM technologies and products.
- Market potential energy savings for technical, economic and realistic program achievable potential scenarios for short, medium and long term periods.
- Supporting calculation spreadsheets.

2.2 Methodology

Energy efficiency and market potential studies involve a number of analytical steps to produce estimates of each type of energy efficiency potential: technical, economic, and achievable. A market potential study is an assessment of current market conditions and trends, as observed with available secondary data sources. All components of the study, such as baseline energy consumption, expected utility sales forecasts, and available EE and DSM measures, among others, are determined on the basis of available data. A market potential study is therefore a discrete estimate of EE and DSM potential based on current market conditions and savings opportunities. An MPS does not contemplate potential changes in utility rates, changes in technology costs, nor changes in underlying economic conditions that provide a context for current consumption trends. This study considers existing technology and market trends as observed with currently available data and does not speculate on the potential impact of unknown, emerging technologies that are not yet market-ready.

This study utilized Nexant's Microsoft Excel-based modeling tool, TEAPot (Technical, Economic, and Achievable Potential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The model provides transparency into the assumptions and calculations for estimating market potential. Nexant's TEA-POT model is continuously refined to accommodate and advance industry best practices, with the most recent upgrade occurring in 2019. The methodology for the energy efficiency potential assessment is based on a hybrid "top-down/bottom-up" approach.

Figure 2-1: Approach to Market Potential Modeling



As illustrated in Figure 2-1, the assessment started with the current load forecast, then disaggregated it into its constituent customer-class and end use components. Nexant examined the effect of energy efficiency measures and practices on each end use, taking into account fuel shares, current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end use, customer class, and system levels.

The market potential in South Carolina territory can be characterized by levels of opportunity. The ceiling or theoretical maximum is based on commercialized technologies and behavioral measures, whereas the realistic savings that may be achieved through DSM programs reflect real world market constraints such as utility budgets, customer perspectives and energy efficiency policy. This analysis defines these levels of energy efficiency potential according to the Environmental Protection Agency's (EPA) National Action Plan for Energy Efficiency (NAPEE) as illustrated in Figure 2-2.

Figure 2-2: Energy Efficiency Potential

EPA – National Guide for Resource Planning

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by efficiency, regardless of cost and other barriers that may prevent the installation or adoption of an energy efficiency measure. Technical potential is only constrained by factors such as technical feasibility and applicability of measures.
- Economic Potential is the amount of energy and capacity that could be reduced by efficiency measures that pass a cost-effectiveness test. The Total Resource Cost (TRC) Test estimates the measure costs to both the utility and customer.
- Achievable Potential is the energy savings that can feasibly be achieved in the market with consideration of market barriers and customer adoption of DSM technologies, and the influence of incentive levels on adoption rates. For this study, achievable potential is organized into generalized utility program offerings, and therefore referred to as Achievable Program Potential.
- Program Potential delivered by programs is often less than achievable potential due to real-world constraints, such as utility program budgets, effectiveness of outreach, and market delays. In this study, Duke Energy is currently offering all measure identified as cost effective, so achievable potential and program potential are practically the same.

This study explored technical, economic, and achievable program potential over a 25-year period from January, 2020, to December, 2044. The quantification of these three levels of energy efficiency potential is an iterative process reflecting assumptions on cost effectiveness that drill down the opportunity from the theoretical maximum to realistic program savings. The California Standard Practice Manual (SPM) provides the methodology for estimating cost effectiveness of energy efficiency measures, bundles, programs or portfolios based on a series of tests representing the perspectives of the utility, customers, and societal stakeholders. In this potential study, individual measures were screened for cost-effectiveness using the total resource cost (TRC) from the Standard Practice Manual.

Naturally occurring conservation is captured by this analysis in the load forecast. Effects of energy codes and equipment standards were considered by incorporating changes to codes and standards and marginal efficiency shares in the development of the base-case forecasts. Additionally the model accounted for known or planned future federal code changes that will impact efficiencies, and therefore overall potential energy savings, of specific measures and end uses such as motors and lighting.

Nexant estimated program savings potential based on a combination of market research, analysis, and a review of Duke Energy's existing programs, all in coordination with Duke Energy. The programs that Nexant examined included both energy efficiency (EE) and demand-side management (DSM) programs; therefore, this report is organized to offer detail on both types of programs.

The remainder of the report provides detailed methodologies for each step in the potential analysis process, together with the results and analyses, according to the following sections:

- Market Characterization
- DSM Measure List
- Technical Potential
- Economic Potential
- Program Potential
- Conclusions and Recommendations

3 End Use Market Characterization

The base year energy use and sales forecast provided the reference point to determine potential savings. The end use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy savings scenarios.

3.1 Customer Segmentation

In order to estimate energy efficiency (EE) and demand side management (DSM) potential, the sales forecast and peak load forecasts were segmented by customer characteristics. Assessing the savings potential required an understanding of which types of EE and DSM measures apply to the wide array of electricity customers. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific energy efficiency technologies or to provide DSM grid services.

Customer segmentation also addressed the business need to deliver cost-effective EE and DSM programs. Significant cost efficiency can be achieved through strategic EE and DSM program designs that recognize and address the similarities of EE and DSM potential that exists within each customer group. Nexant segmented DEC and DEP customers according to the following:

1) By Sector – how much of the Duke Energy's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End Use – within a home or business, what equipment is using electricity during the peak? How much energy does this end-use consume over the course of a year?

This analysis identified the segments of customers ineligible for EE and DSM, such as Opt Out commercial and industrial customers.

Table 3-1 summarizes the segmentation within each sector. Residential customer segments were further segmented by fuel type (electric, natural gas, or unknown) and by annual consumption deciles within each sub-segment for the EE and DSM analysis. The goal of this further segmentation was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of EE and DSM programs.

Table 3-1: Customer Segments and Sub-Sectors

Residential	Commercial		Industrial	
Single Family	Assembly	Lodging/ Hospitality	Chemicals and plastics	Primary resource industries
Multi Family	College and University	Miscellaneous	Construction	Stone, clay, glass, and concrete
Mobile Home	Data Center	Offices	Electrical and electronic equipment	Textiles and leather
	Grocery	Restaurant	Lumber, furniture, pulp, and paper	Transportation equipment
	Healthcare	Retail	Metal products and machinery	Water and wastewater
	Hospitals	Schools K-12	Miscellaneous manufacturing	
	Institutional	Warehouse		

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end uses describe energy savings potential that are consistent with those typically studied in national or regional surveys. These end uses are listed in Table 3-2.

Table 3-2: End Uses

Residential End Uses	Commercial End Uses	Industrial End Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors, pumps
Lighting	Interior lighting	Motors, fans, blowers
Cooking	Exterior lighting	Process-specific
Refrigerators	Cooking	Lighting
Freezers	Refrigeration	HVAC
Clothes washers	Office equipment	Other
Clothes dryers	Miscellaneous	
Dishwashers		
Plug load		
Miscellaneous		

For the DSM assessment, the end uses targeted were limited to end-uses with controllable load for residential customers and small/medium businesses (small C&I). For large commercial and industrial (large C&I) customers who would potentially reduce large amounts of electricity consumption for a limited time, all load during peak hours was included. For residential customers, AC/heating loads, as well as pool pumps and electric water heaters for certain program potential scenarios, were studied. For small C&I customers, the analysis was limited to AC/heating loads.

3.2 Forecast Disaggregation

Although the primary focus of the EE potential study was the electricity consumption forecast and the primary focus of the DSM potential study was the peak load forecasts, the accuracy of the demand impacts and cost-effectiveness screening in the EE potential study is enhanced by a detailed approach to peak load disaggregation. Therefore, during the development of all the baselines, the energy efficiency and DSM teams coordinated with each other, to ensure consistent assumptions and to avoid double counting of potential.

Additionally, a common understanding of the assumptions and granularity in the baseline load forecast was developed with input with Duke Energy. Key discussion topics reviewed with Duke Energy included:

- How are Duke Energy's current program offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to accounts that are not eligible for EE and DSM programs or have opted-out of the EE and DSM riders?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end use load shares accounted for in the 25 year peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the DEC and DEP electricity consumption forecasts into electricity consumption load shares by customer class and end use. The baseline customer segmentation represents the South Carolina electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020–2044, and based it on data provided by Duke Energy. The data addressed current baseline consumption, system load and sales forecasts.

3.2.2 Peak Demand (kW) Forecast

A fundamental component of DSM potential was establishing a baseline forecast of what loads or operational requirements would be absent existing dispatchable DSM. This baseline was necessary to assess how DSM can assist in meeting specific planning and operational requirements. Nexant used Duke Energy's summer and winter peak demand forecast, which was developed for system planning purposes.

3.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end uses by sector (Table 3-2). To develop this list, Nexant began with Duke Energy's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as Duke Energy's residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant augmented the Duke Energy data with data available from public sources, such as the Energy Information Agency's (EIA) recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end use, Nexant applied estimates of end-use saturation, energy fuel share, and equipment-type saturation to the average energy consumption for each sector. The following data sources and adjustments were used in developing the base year 2019 sales by end use:

Residential sector:

- The disaggregation was based on DEC and DEP rate class load shares and intensities; adjustments were made for dwelling type.
- Adjustments were made to the baseline intensity to account for differences in end use saturation, fuel source, and equipment saturation as follows:
  - Duke Energy rate class load share is based on average per customer.
  - Nexant estimates of end use consumption calibrated to disaggregated Duke Energy forecast conversions to usage data provided from individual customer accounts.
  - Outcome is designed to reflect customers' fuel-specific and equipment-specific savings opportunities.

Commercial sector:

- The disaggregation was based on DEC and DEP rate class load shares, intensities, and EIA Commercial Buildings Energy Consumption Survey (CBECS) data.
- Segment data from EIA, DEC and DEP.
- Adjustments were made to the baseline intensity for end use saturation, fuel source, and equipment saturation as follows:
  - Duke Energy rate class load share is based on average per customer.
  - Nexant estimates of end use consumption calibrated to disaggregated Duke Energy forecast conversions to usage data provided from individual customer accounts.
  - Outcome reflects customers' fuel-specific and equipment-specific savings opportunities.

Industrial sector:

- The disaggregation was based on DEC and DEP rate class load shares, intensities, and EIA Manufacturers Energy Consumption Survey (MECS) data.
- Segment data from EIA, DEC and DEP.

- Adjustments were made to the baseline intensity for end use saturation, fuel source, and equipment saturation as follows:
  - Duke Energy rate class load share based on EIA MECS and end use forecasts from DEC and DEP.
  - Nexant estimates of end use consumption calibrated to disaggregated Duke Energy forecast conversions to usage data provided from individual customer accounts.
  - Outcome reflects customers' fuel-specific and equipment-specific savings opportunities.

3.3 Analysis of Customer Segmentation

Customer segmentation is important to ensure that an MPS examines EE and DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across Duke Energy's customer base. Duke Energy provided Nexant with data concerning the premises type and load characteristics for all customers for the MPS analysis. Nexant examined the received data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for commercial and residential accounts, but the overall logic was consistent with the concept of expressing the accounts in terms that were relevant to EE and DSM opportunities. The following three sections describe the segmentation analysis and results for commercial and industrial C&I accounts (Section 3.3.1) and residential accounts (Section 3.3.2).

3.3.1 Commercial and Industrial Accounts

Nexant segmented C&I accounts according to two approaches: North American Industry Classification System (NAICS) codes and peak energy demand.

3.3.1.1 North American Industry Classification System Codes

The approach to examining DEC and DEP's C&I accounts was based on the NAICS codes, which Duke Energy provided as part of the customer data. Nexant further classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities; therefore, small farms with relatively low energy demand were included in this group, regardless of their rate schedule classification. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole.

3.3.1.2 Peak Energy Demand Categories

Nexant also classified C&I accounts according to their maximum energy demand in kilowatts. Customers' maximum instantaneous demand is a basic driver of demand-response potential. Nexant created five customer groups for the C&I sector based on maximum energy demand (Table 3-3 and Table 3-4).

Table 3-3: Number of DEC Commercial Accounts by Demand Segment

< 30 kW	30 – 70 kW	75 – 500 kW	500 kW – 1 MW	> 1 MW	Total
215,608	25,429	17,317	1,760	1,416	261,530

Table 3-4: Number of DEP Commercial Accounts by Demand Segment

< 30 kW	30 – 70 kW	75 – 500 kW	500 kW – 1 MW	> 1 MW	Total
159,860	14,805	11,455	1,283	963	188,366

Table 3-5 and Table 3-6 present the percentage of customers, annual consumption, and maximum demand for each demand segment. All consumption and demand values are based on the period January 2018–January 2019.

Table 3-5: Summary of DEC Commercial and Industrial Market Characteristics

Attribute	< 30 kW	30 – 70 kW	75 – 500 kW	500 kW – 1 MW	> 1 MW
Customer #	85.39%	7.79%	5.68%	0.57%	0.58%
Consumption	5.64%	4.59%	14.66%	6.83%	68.28%
Demand	6.28%	7.03%	19.36%	8.09%	59.23%

Table 3-6: Summary of DEP Commercial and Industrial Market Characteristics

Attribute	< 30 kW	30 – 70 kW	75 – 500 kW	500 kW – 1 MW	> 1 MW
Customer #	82.38%	8.41%	7.97%	0.64%	0.61%
Consumption	7.08%	4.94%	17.22%	6.35%	64.42%
Demand	1.17%	7.37%	22.80%	7.71%	60.95%

Figure 3-1and Figure 3-2 presents a graphical summary of these data. The lower demand segment contains the most customers, but the larger demand segments make up the highest shares of consumption and demand.

Figure 3-1: DEC Market Composition by Demand Segment

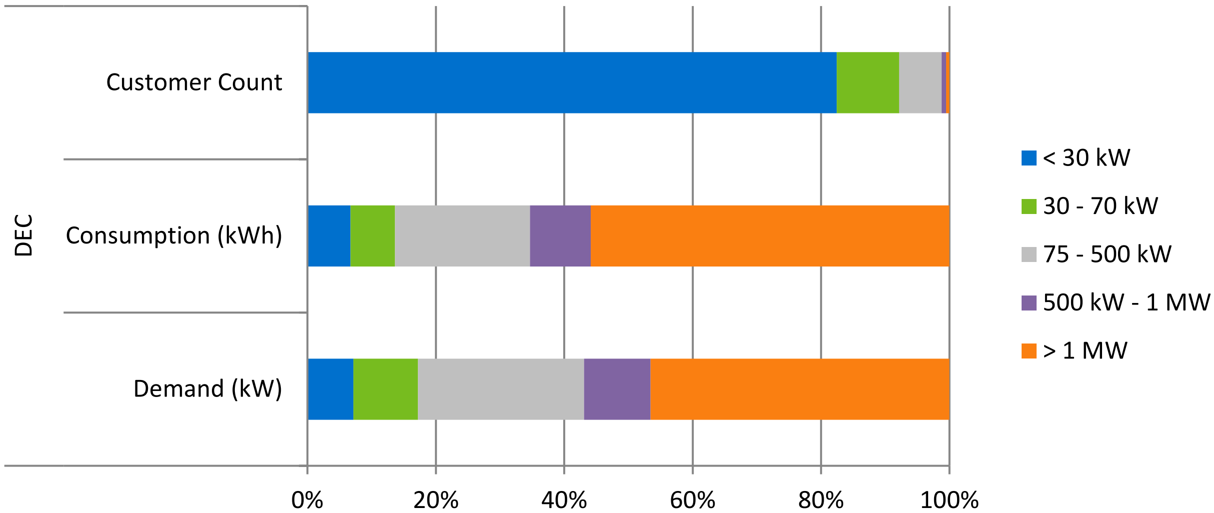
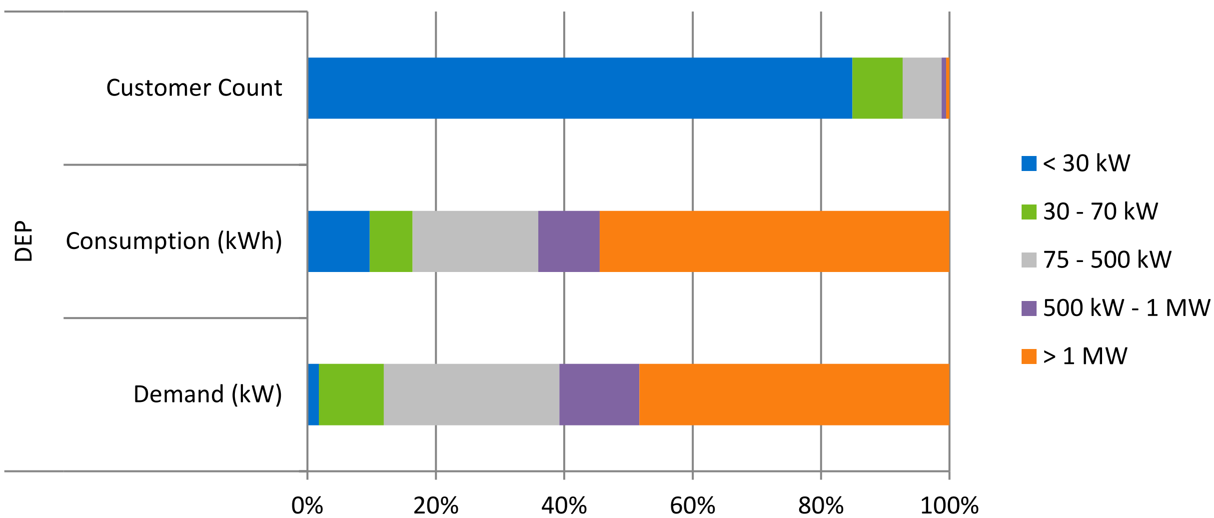


Figure 3-2: DEP Market Composition by Demand Segment



Based on the analysis, Nexant described commercial and industrial DSM potential according to the economic segments summarized in Table 3-1. For details concerning customer demand characteristics according to these commercial and industrial segments, see Appendix C.

3.3.2 Residential Accounts

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant segmented the residential sector according to two fields provided in the Duke Energy data: customer dwelling type (single family, multi-family or mobile home), and space heat fuel source (electric, gas, and “unknown”). The resulting distribution of customers and total electricity consumption by each segment is presented below in Table 3-7 and Table 3-8. Figure 3-3 and Figure 3-4 present this information graphically.

Table 3-7: DEC Residential Customer Market Composition by Space Heat Fuel Source

Attribute	Electricity	Gas
Customer Count	42.66%	57.34%
Total kWh Consumption	46.27%	53.73%

Table 3-8: DEP Residential Customer Market Composition by Space Heat Fuel Source

Attribute	Electricity	Gas
Customer Count	67.06%	32.94%
Total kWh Consumption	69.73%	30.27%

Figure 3-3: DEC Residential Market Segmentation by Space Heat Fuel Source

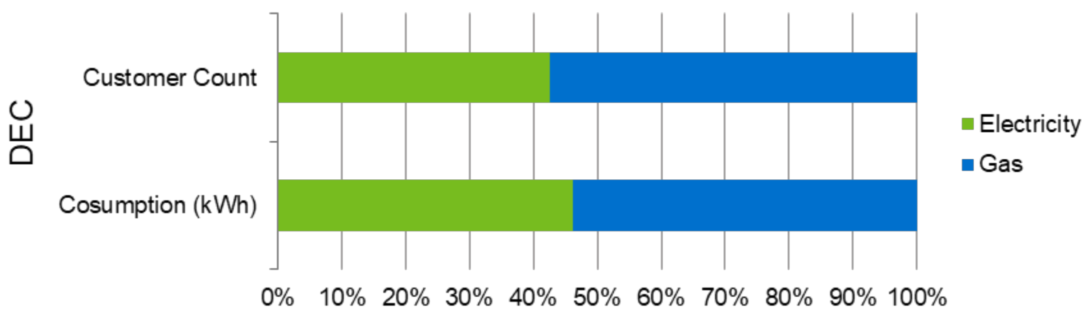
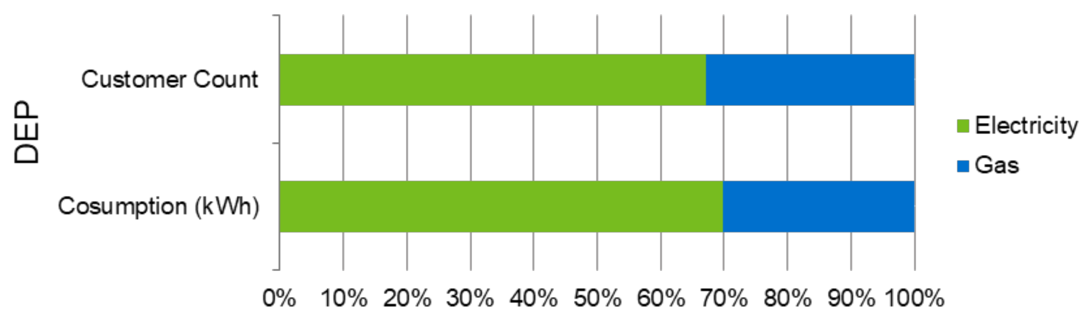


Figure 3-4: DEP Residential Market Segmentation by Space Heat Fuel Source



Segmentation according to dwelling unit type is presented in Table 3-9, Table 3-10, and is presented graphically in Figure 3-5 and Figure 3-6Figure 3-6: DEP Residential Market Characteristics by Type of Dwelling Unit.

Table 3-9: DEC Residential Market Characteristics by Type of Dwelling Unit

Attribute	Single Family	Multi-Family	Mobile Home
Customer Count	88.20%	8.60%	3.20%
Total kWh Consumption	90.68%	5.75%	3.56%

Table 3-10: DEP Residential Market Characteristics by Type of Dwelling Unit

Attribute	Single Family	Multi-Family	Mobile Home
Customer Count	85.75%	10.97%	3.28%
Total kWh Consumption	89.31%	7.13%	3.56%

Figure 3-5: DEC Residential Market Characteristics by Type of Dwelling Unit

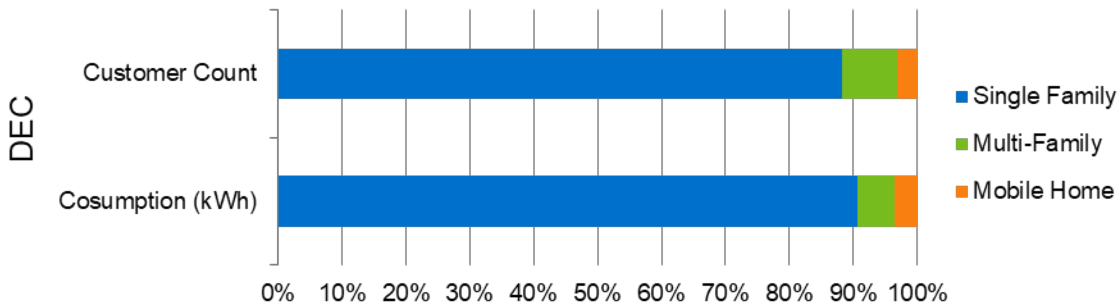
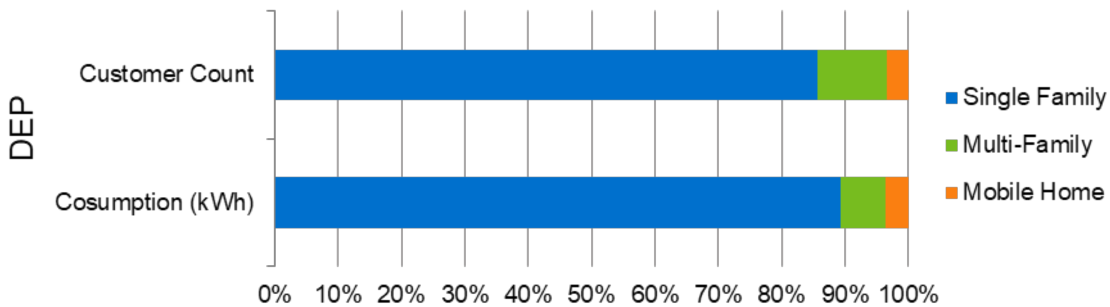


Figure 3-6: DEP Residential Market Characteristics by Type of Dwelling Unit



For the DSM analysis, residential accounts were also segmented based on their rate class, so that Nexant could separately analyze customers on a time-of-use rate and customers enrolled in an electric heating rate where available. For the remainder of this report, the residential rate classes for DEC are defined as:

- RS – Residential Service;
- RE – Residential Service, Electric Water Heater and Space Heating; and
- RT – Residential Time-of-Use.

DEP does not have a rate specifically for customers with electric end-uses. Therefore, the residential rate classes for DEP are defined as:

- RES – Residential Service (electric and non-electric heating); and
- TOU – Residential Time-of-Use.

3.4 DEC Base Year 2019 Disaggregated Load

The DEC's disaggregated loads for the base year 2019 by sector and end use are summarized in Figure 3-7, Figure 3-8 and Figure 3-9. Load disaggregation is based on Duke Energy end use forecast data. These forecasts are based in part on the Energy Information Administration (EIA) research activities in the residential, commercial, and manufacturing sectors. The following secondary data sources were used by Nexant to disaggregate each sector's loads:

- Residential load disaggregation is based on Duke Energy's estimates of residential end use load shares; this information in turn is derived from the EIA Residential End Use Consumption Survey (RECS), vintage 2015.
- Commercial load disaggregation is based on the Commercial Building Energy Consumption Survey (CBECS), 2012 vintage.
- Industrial load disaggregation is based on Manufacturers' Energy Consumption Survey (MECS), vintage 2014

The data provided by these products represents the best available secondary data sources for end use consumption within each economic sector.

Figure 3-7: DEC Residential Baseline Load Shares

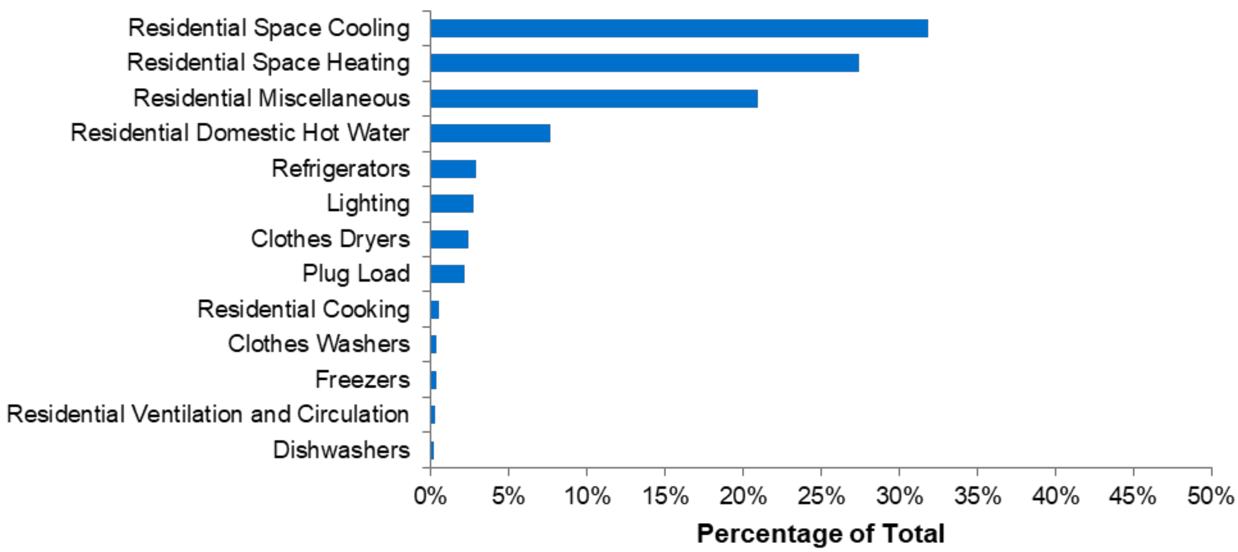


Figure 3-8: DEC Commercial Baseline Load Shares

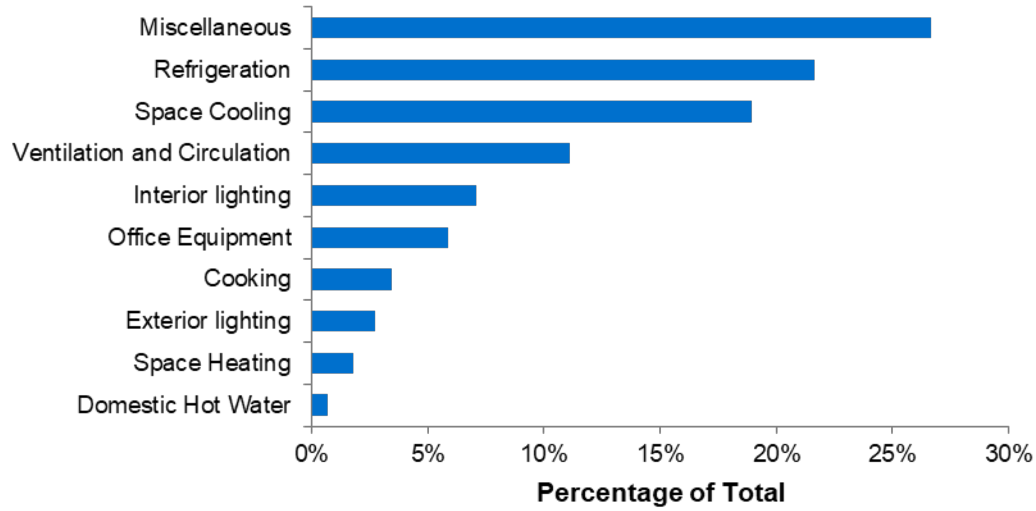
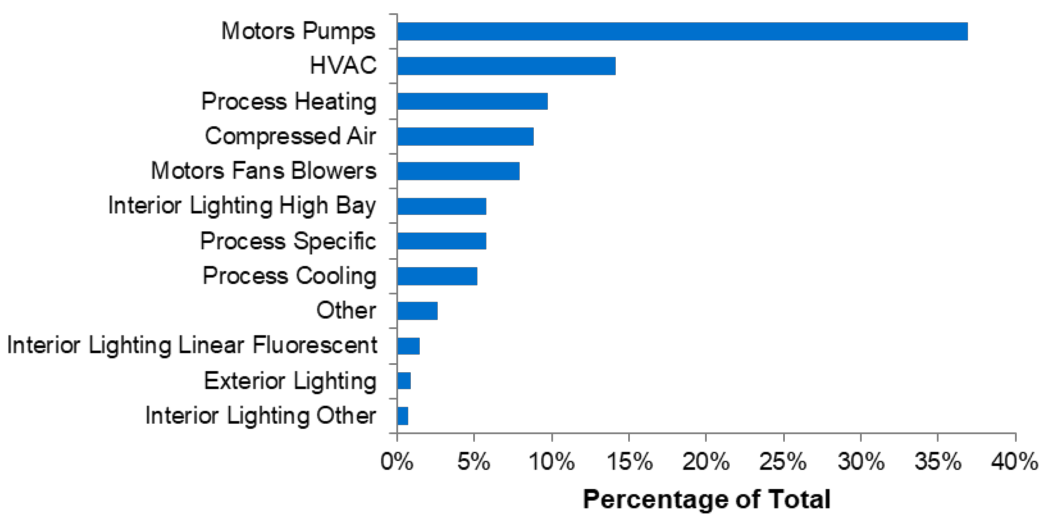


Figure 3-9: DEC Industrial Baseline Load Shares



In the base year 2019, the DEC top load share categories are:

- ***Residential:*** space cooling, space heating, and miscellaneous.
- ***Commercial:*** miscellaneous, refrigeration, and space cooling.
- ***Industrial:*** motors pumps, HVAC, and process heating.

3.5 DEP Base Year 2019 Disaggregated Load

The DEP's disaggregated loads for the base year 2019 by sector and end use are summarized in Figure 3-10, Figure 3-11, and Figure 3-12.

Figure 3-10: DEP Residential Baseline Load Shares

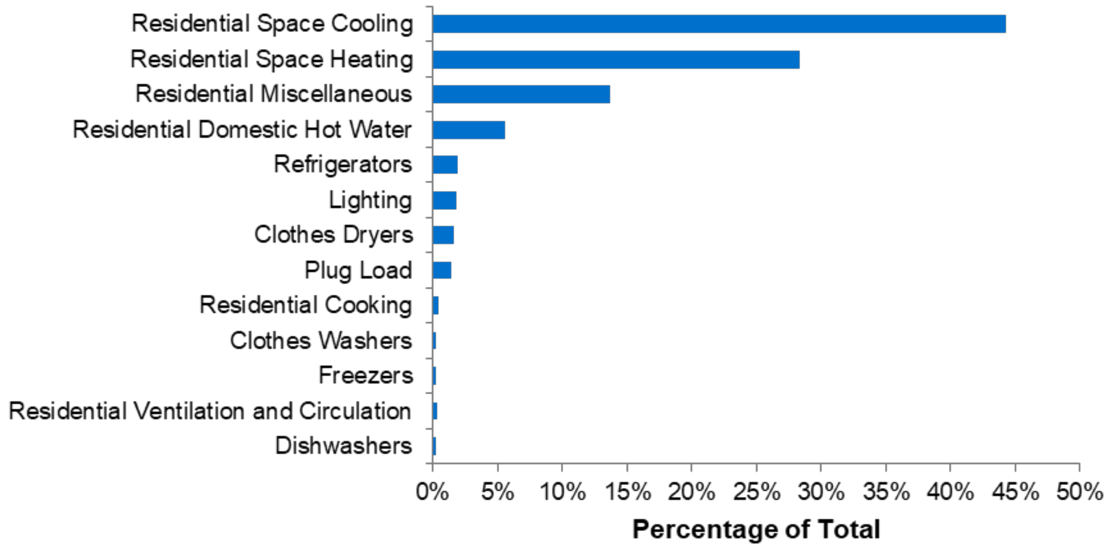


Figure 3-11: DEP Commercial Baseline Load Shares

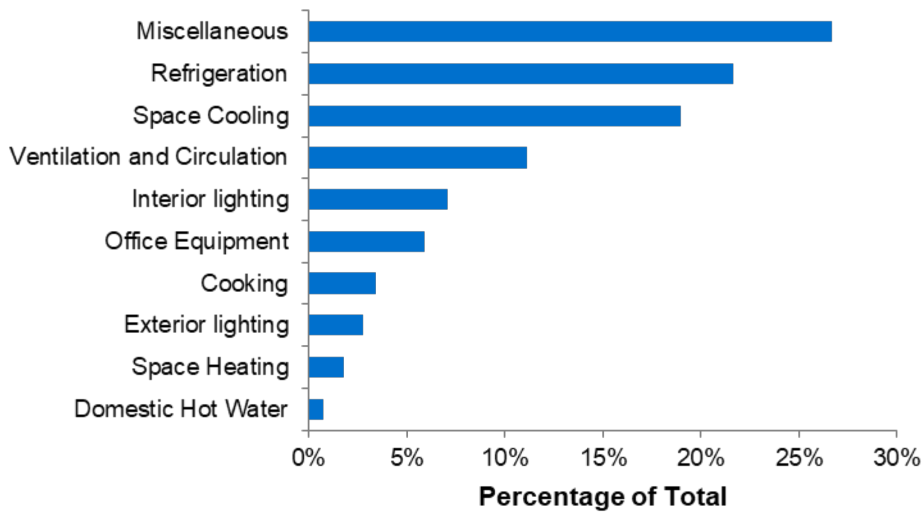
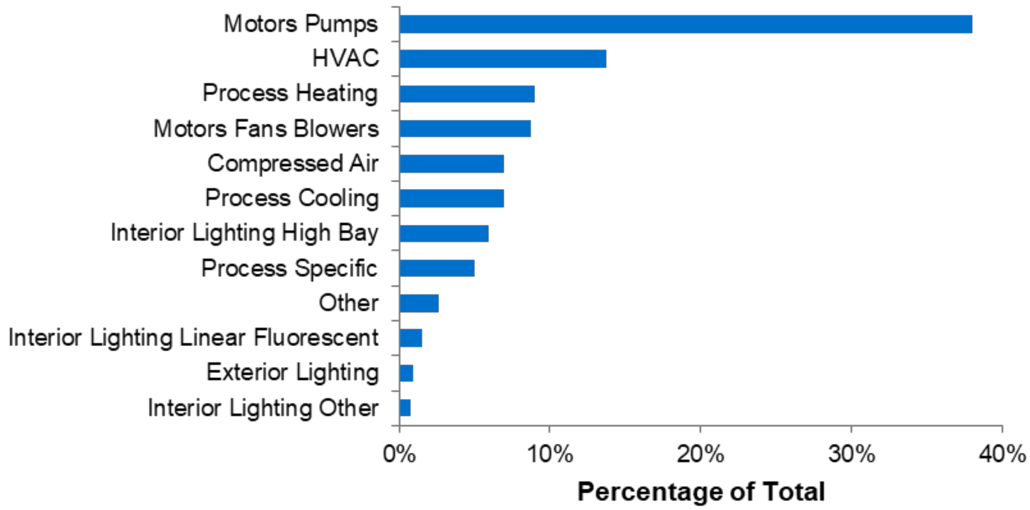


Figure 3-12: DEP Industrial Baseline Load Shares



In the base year 2019, the DEP top load share categories are:

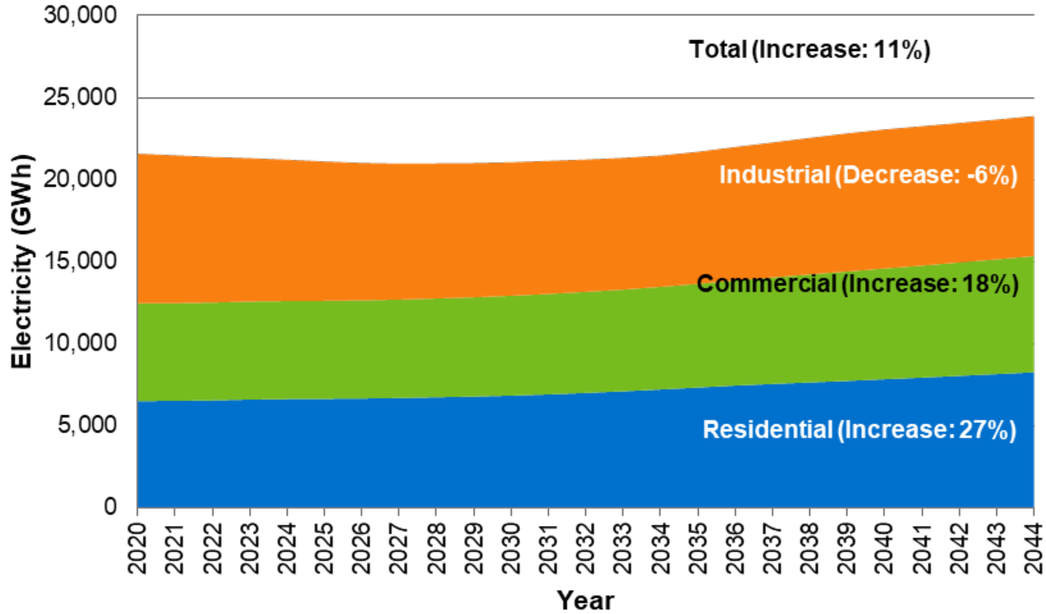
- ***Residential:*** space cooling, space heating, and miscellaneous.
- ***Commercial:*** miscellaneous, refrigeration, and space cooling.
- ***Industrial:*** motors pumps, HVAC, and process heating.

3.6 DEC System Load Forecast 2020 - 2044

3.6.1 DEC System Energy Sales

The DEC electricity use is forecasted to increase by 2,296 GWh (a change of 11%) from 2020 to 2044, to a total of 23,874 GWh in 2044 (see Figure 3-13). The residential sector is expected to account for the largest share of the increase, growing by 1,755 GWh to reach 8,263 GWh (an increase of 27%) over the 25 year period. The commercial sector is expected to increase by 1,105 GWh to reach 7,078 GWh (a change of 18%) over the 25 year period. The industrial sector is forecasted to decrease by 564 GWh (a decrease of 6%) from 2020 to 2044, to 8,532 GWh in 2044. In 2044 the industrial sector accounts for 36% (8,532 GWh) of total electricity sales, the residential sector 35% (8,263 GWh) and the commercial sector 30% (7,078 GWh). Nexant worked with Duke Energy to ensure the forecasts did not include the expected future impacts of planned EE and DSM technologies.

Figure 3-13: DEC Electricity Sales Forecast by Sector for 2020 - 2044[3]



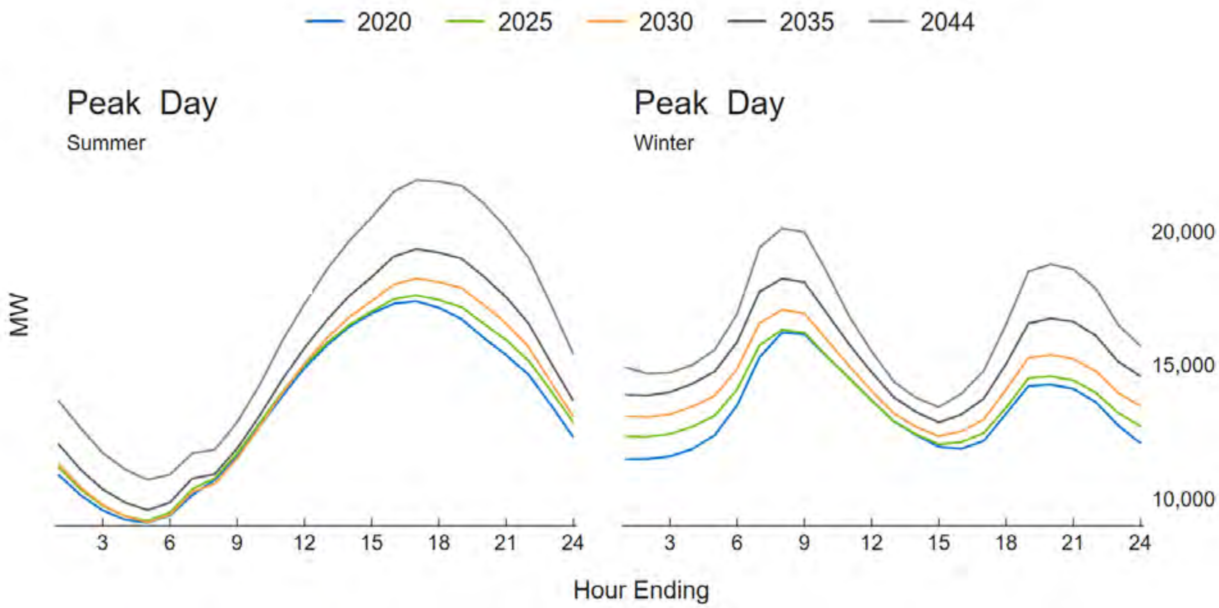
3.6.2 DEC System Demand

Estimating technical potential for DSM resources requires not only knowing how much load is available to be curtailed or shifted, but also understanding when it is needed. Because the benefits of DSM stem from avoiding costly investments to meet peak loads, load reductions will not have any value unless they occur during hours of peak system usage. Therefore, the first order of business in estimating the market potential for DSM is to establish when load reductions will most likely be needed throughout the year.

The primary data source used to determine when DSM resources will be needed was the DEC system load forecast. This forecast contains forecasted loads for all 8,760 hours of each year in the study period (2020-2044). Figure 3-14 represents an initial inspection of the data. Each figure shows the expected average load profiles for two distinct types of days – peak summer days and peak winter days. Summer was defined as April-October, while the peak days refer to day with the maximum demand during the year and season.

[3] Sales forecast based on DEC(SC) 2019 forecast—the current forecast at the time of Nexant's analysis.

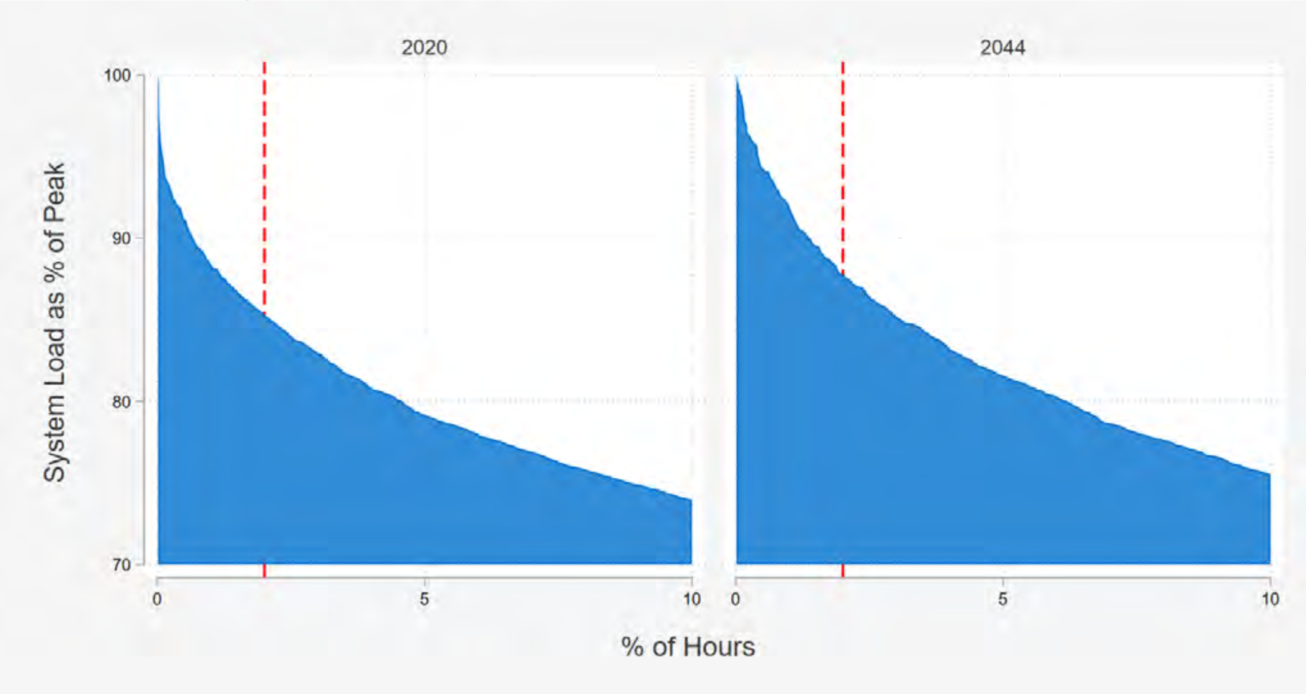
Figure 3-14 DEC System Load Forecast (2020 - 2044)



Several patterns are apparent from examining the figure above. First and foremost, forecasted loads keep constant over time. In addition, the summer loads have a similar maximum to winter loads. Thus the potential study focuses on the current summer peak hour, 4-5 pm, and the current winter peak hour, 7-8 am.

Though useful for assessing patterns in system loads, Figure 3-14 does not provide very much information about the concentration of peak loads. A useful tool to examine peak load concentration is a load duration curve, which is presented for 2020 and 2044 in Figure 3-15. This curve shows the top 10% of hourly loads as a percentage of the system's peak hourly usage, sorted from highest to lowest.

Figure 3-15 DEC Forecasted Load Duration Curve (2020 v 2044)



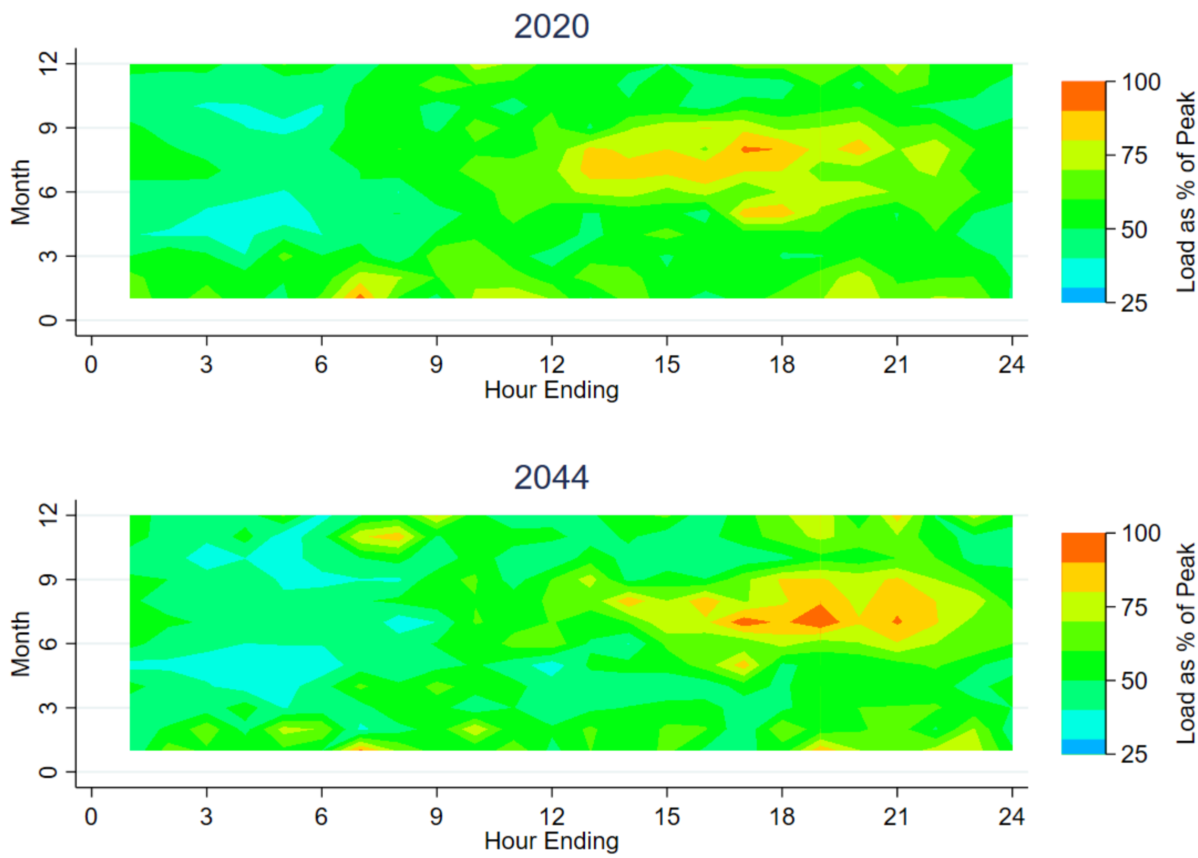
The x-axis in Figure 3-15 is depicted as the cumulative percentage of hours. The red line drawn at 2% serves as a helpful reference point for interpretation by showing the amount of peak capacity needed to serve the 2% of hours with the highest usage.[4] The DEC system currently uses 15% of peak capacity to serve only 2% of hours, and is projected to use 13% of peak capacity to serve 2% of hours by 2044. This means that overall DEC's peak is expected to become slightly less concentrated over time, and so resources such as DSM will have to be dispatched for a larger number of hours to provide the same benefit that they do now.

Another valuable tool for studying peak loads is a contour plot. Often referred to as "heat maps", these plots show frequencies or intensities of a particular variable for different combinations of two other variables. Figure 3-16 contains the same hourly data as a percentage of peak system load that is presented in Figure 3-15; however, it shows the months and hours when each hourly load occurs for all hours instead of only the top 10% of hours.

The results in Figure 3-16 show the highest hours of usage are concentrated in summer evening hours. Actual weather patterns reflect year to year variation in loads and, depending on the extreme temperatures for a year, winter peaks can still be of concern. Another consideration is market prices, which can be high in winter if natural gas is used both for heating and electricity generation.

[4] Another interpretation of the load duration curve data would be the amount that peak load capacity could be reduced by shaving demand during 2% of the hours throughout the year.

Figure 3-16: Forecasted Patterns in DEC System Load (2020 vs 2044)

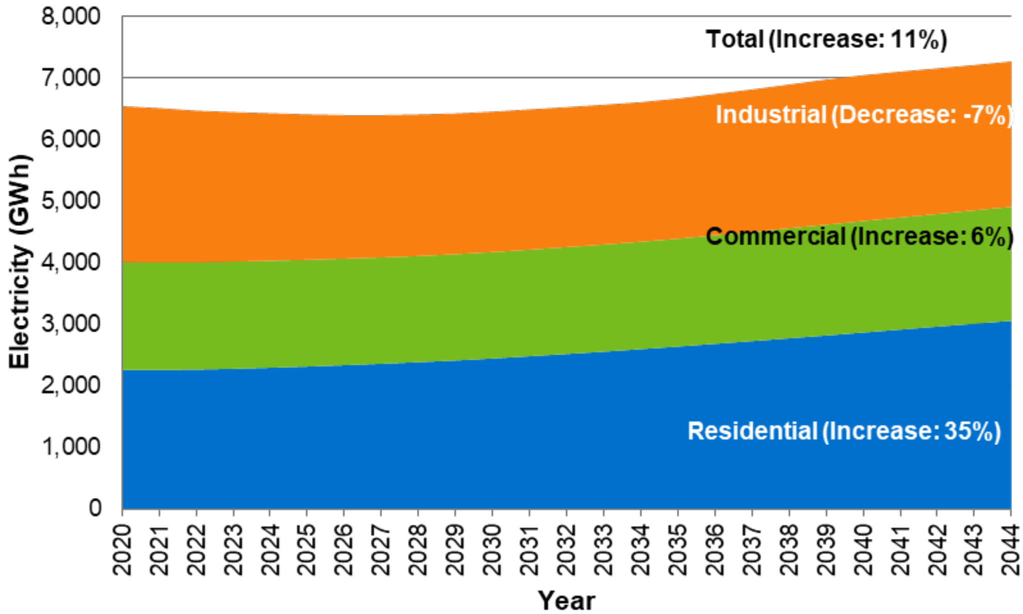


3.7 DEP System Load Forecast 2020 - 2044

3.7.1 DEP System Energy Sales

The DEP electricity use is forecasted to increase by 726 GWh (a change of 11%) from 2020 to 2044, to a total of 7,266 GWh in 2044 (see Figure 3-17). The residential sector is expected to account for the largest share of the increase, growing by 800 GWh to reach 3,056 GWh (an increase of 35%) over the 25 year period. The commercial sector is expected to increase by 98 GWh to reach 1,851 GWh (a change of 6%) over the 25 year period. The industrial sector is forecasted to decrease by 172 GWh (a decrease of 7%) from 2020 to 2044, to 2,359 GWh in 2044. In 2044 the residential sector accounts for 42% (3,056 GWh) of total electricity sales, the commercial sector 25% (1,851 GWh) and the industrial sector 32% (2,359 GWh). Nexant worked with Duke Energy to ensure the forecasts did not include the expected future impacts of planned EE and DSM technologies.

Figure 3-17: DEP Electricity Sales Forecast by Sector for 2020 - 2044[5]

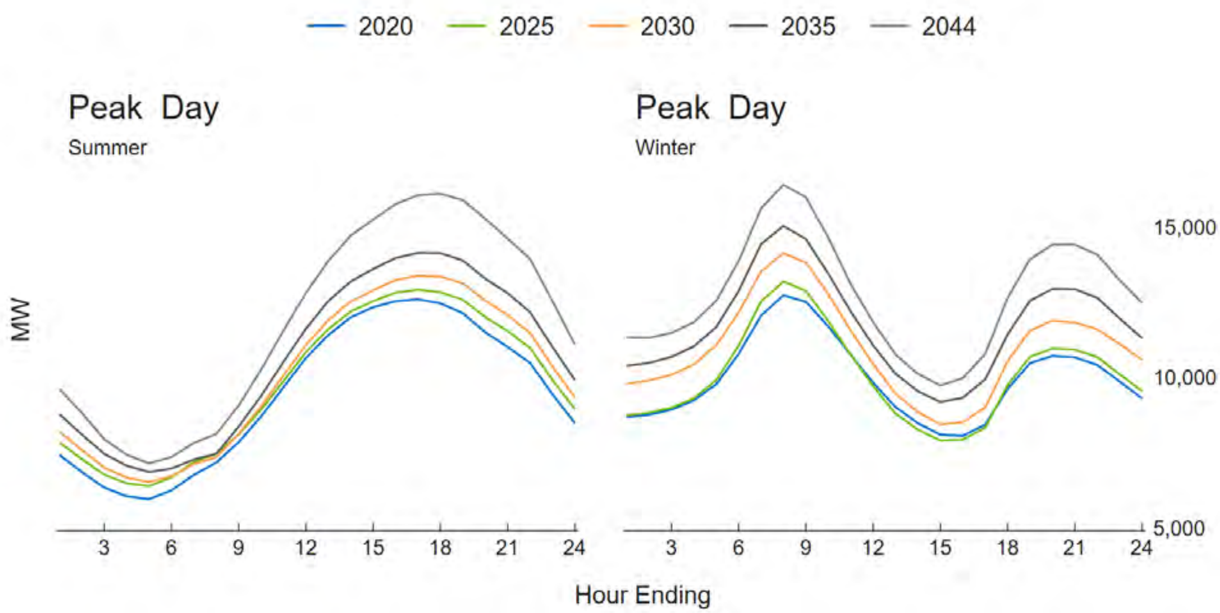


3.7.2 DEP System Demand

As with DEC, the primary data source used to determine when DSM resources will be needed was the DEP system load forecast. This forecast contains forecasted loads for all 8,760 hours of each year in the study period (2020-2044). Figure 3-18 represents an initial inspection of the data. Each figure shows the expected average load profiles for two distinct types of days – peak summer days and peak winter days. Summer was again defined as April-October, while the peak days refer to day with the maximum demand during the year and season.

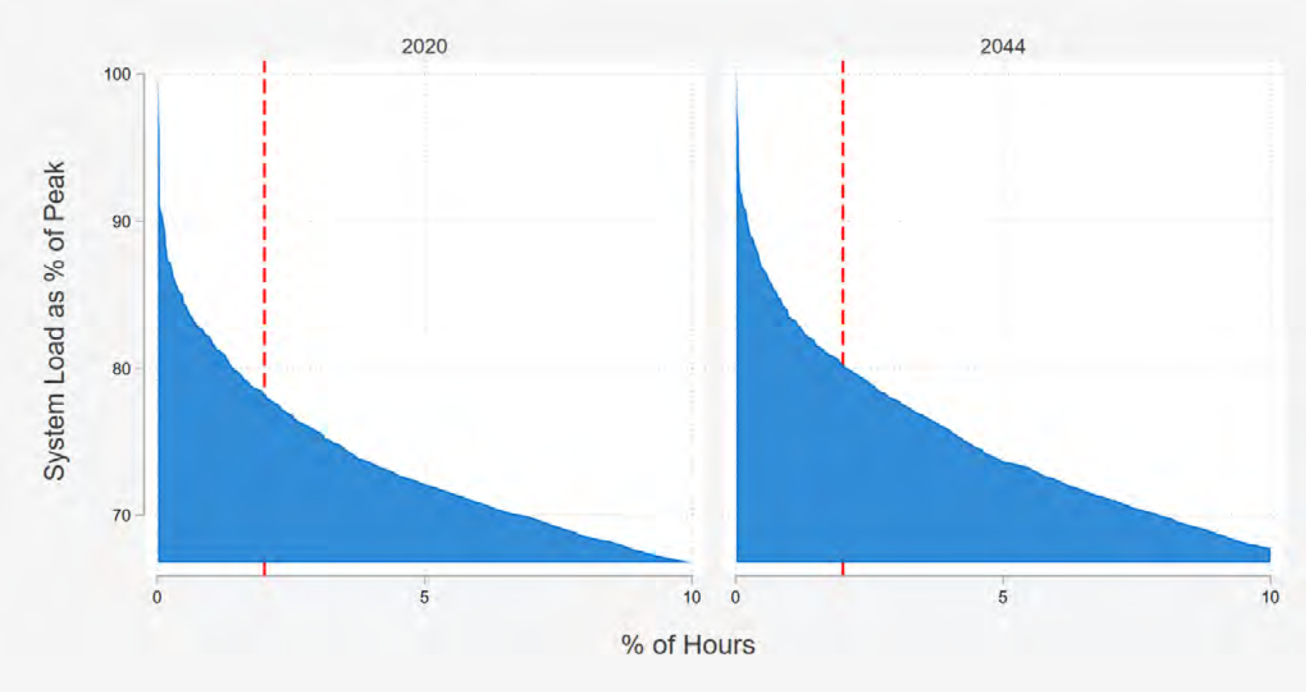
[5] Sales forecast based on DEP(SC) 2019 forecast—the current forecast at the time of Nexant's analysis.

Figure 3-18: DEP System Load Forecast (2020 - 2044)



Several patterns are apparent from examining the figure above. First and foremost, forecasted loads.shapes are relatively unchanged over time as the total magnitude of projected load increases. In addition, the summer loads have a similar maximum to winter loads. Thus the potential study focuses on the current summer peak hour, 4-5 pm, and the current winter peak hour, 7-8 am. The DEP load duration curve is presented for 2020 and 2044 in Figure 3-19. This curve shows the top 10% of hourly loads as a percentage of the system's peak hourly usage, sorted from highest to lowest.

Figure 3-19: DEP Forecasted Load Duration Curve (2020 v 2044)



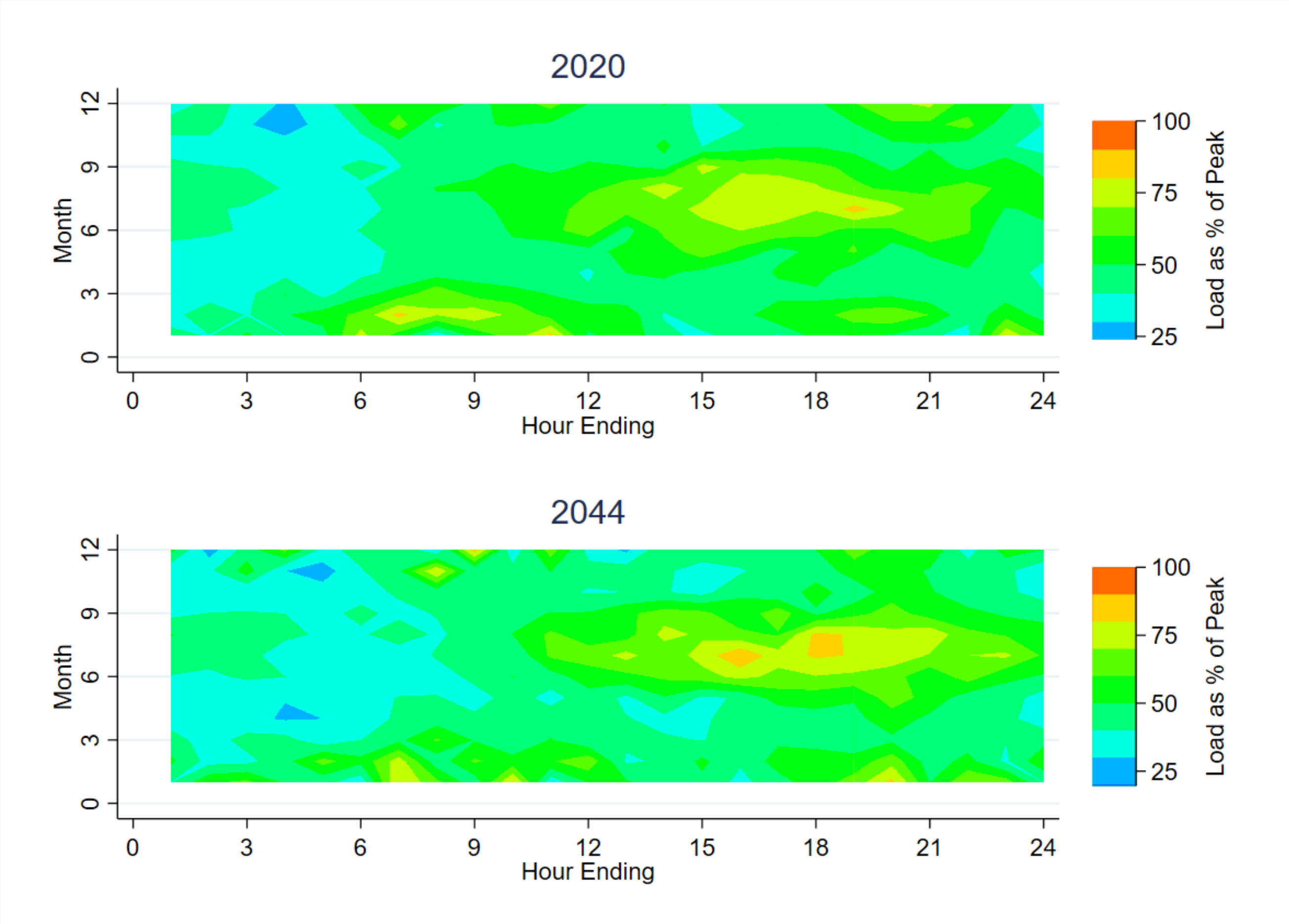
The x-axis in Figure 3-19 is depicted as the cumulative percentage of hours. The red line drawn at 2% serves as a helpful reference point for interpretation by showing the amount of peak capacity needed to serve the 2% of hours with the highest usage.[6] The DEP system currently uses 22% of peak capacity to serve only 2% of hours, and is projected to be 20% by 2044. Therefore, DEP is much "peakier" than DEC, although both utilities expect their peak hours to become less concentrated over time.

Another valuable tool for studying peak loads is a contour plot. Often referred to as "heat maps", these plots show frequencies or intensities of a particular variable for different combinations of two other variables. Figure 3-20 contains the same hourly data as a percentage of peak system load that is presented in Figure 3-19; however, it shows the months and hours when each hourly load occurs for all hours instead of only the top 10% of hours.

The results in Figure 3-20 show the highest hours of usage are concentrated in summer evening hours and winter morning hours. In winter, we see the peak is particularly concentrated during the 7-8 AM window when a high residential heating load is expected.

[6] Another interpretation of the load duration curve data would be the amount that peak load capacity could be reduced by shaving demand during 2% of the hours throughout the year.

Figure 3-20: Forecasted Patterns in DEP System Load (2020 vs 2044)



3.8 Customer Opt-Outs

Duke Energy's energy efficiency programs in South Carolina include an "opt-out" provision approved by the South Carolina Utilities Commission. This provision allows all industrial customers and commercial class customers with annual energy consumption exceeding one million kWh to opt out, which exempts the customer from cost recovery mechanism but also eliminates that customer's eligibility for participation in the program.

In order to incorporate the impact of opt-outs into the study, Duke provided Nexant with current opt-out information in South Carolina, which showed an opt-out rate of approximately 34% of commercial kWh sales and 91.44% of industrial kWh sales in the DEC service territory; whereas DEP data indicate 26% of commercial kWh sales and 95.23% of industrial kWh have opted out. Nexant incorporated this opt-out rate into the model by reducing the non-residential sales estimates by the appropriate percentage for each service territory and applying the applicable energy efficiency technologies and market adoption rates to the remaining sales forecast.

4 Measure List

Nexant maintains a database of energy efficiency measures for use in MPS studies. Measure data are developed and refined as new information on, or methods for, estimating measure impacts become available. The current list of savings opportunities, or "measures," incorporates the measure list that used in the 2016 MPS study Nexant conducted on behalf of Duke Energy Carolinas but added new measures where conditions changed. An example of measure list updates is that Nexant consolidated the lighting opportunities by excluding all CFLs and Metal Halides but keeping the LEDs to better reflect market trends. This section describes how the measure data is developed and applied in the study for energy efficiency and DSM services and products.

The EE measure data used in the 2016 MPS study included a list of proposed measures provided by Duke Energy, which included all Duke Energy measures currently offered by existing programs at that time, as well as measures Duke Energy developed with its own gap analysis of program offerings. Nexant reviewed the Duke Energy list to develop an initial qualitative screening for applicability in the South Carolina territories. Nexant also reviewed the Duke Energy program measure lists against the Nexant EE measure library to ensure that the study covered a robust and comprehensive set of measures, and supplemented the list with Nexant-identified measures where appropriate.

The final measure list included energy efficiency technologies and products that enable DSM opportunities. DSM initiatives that do not rely on installing a specific technology or measure (such as a voluntary curtailment program) are not reflected in the measure list. See Appendix B for the final measure list.

4.1 Energy Efficiency Measures

Nexant's measure data represents savings opportunities for all electricity end uses and customer types. EE program measure offers are typically more specific than those required to assess EE potential. For example, Duke Energy programs have multiple instances of LED lamps with varying characteristics (candelabra base, globe base, A-line, etc.). Although these distinctions are important during program delivery, this level of granularity is not necessary to identify the market potential for EE savings.

Nexant used a qualitative screening approach to address the applicability of measures to the South Carolina service territories. The qualitative screening criteria that Nexant used included: difficult to quantify savings, no longer current practice, better measure available, immature or unproven technology, limited applicability, poor customer acceptance, health and environmental concerns, and end-use service degradation.

Nexant updated its online measure database to support this study. Nexant's database was contains the following information for each measure:

- Classification of measure by type, end use, and subsector
- Description of the base-case and the efficiency-case scenarios
- Measure life
- Savings algorithms and calculations per subsector, taking weather zones and subsectors into consideration
- Input values for variables used to calculate energy savings
- Measure costs
- Output to be used as input in Nexant's TEA-POT model.

Detailed measure assumptions in this database are provided to Duke Energy in supplemental electronic files, MS Excel format. As shown in Table 4-1, the study included 329 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end uses, and construction types resulted in 8,994 measure permutations. Appendix B includes the final measure list used for the study.

Table 4-1: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	88	1,121
Commercial	142	5,138
Industrial	99	2,735

4.2 DSM Services and Products

Nexant and Duke Energy worked together to determine which DSM products and services were included in the MPS, and addressed the following:

- **Direct load control.** Customers receive incentive payments for allowing the utility a degree of control over equipment, such as air conditioners or water heaters. This includes both switch-based programs and smart thermostat programs.
- **Emergency load response.** Customers receive payments for committing to reduce load if called upon to do so by the grid operator
- **Economic load response:** Utilities provide customers with incentives to reduce energy consumption when marginal generation costs are higher than the incentive amount required to achieve the needed energy reduction
- **Base interruptible DSM**. Customers receive a discounted rate for agreeing to reduce load to a firm service level upon request

5 Technical Potential

Technical potential is based on base year load shares and reference case load forecasts for 2020 to 2044. This information, along with data on measures available to capture savings opportunities, provide inputs for estimating technical potential. The technical potential scenario estimates the savings potential when all technically feasible energy efficiency measures are fully implemented, while accounting for equipment turnover. This savings potential can be considered the maximum reduction attainable with available technology and current market conditions (e.g. currently available technology, building stock, customer preferences as reflected in Duke Energy forecasted sales). EE and DSM potential scenarios that account for measures' costs and benefits and market adoption are discussed in subsequent report sections for economic potential and achievable potential, respectively.

5.1 Approach and Context

Technical potential represents a straightforward application of EE and DSM measures to the baseline market context for Duke Energy Carolinas. Technical potential is determined by two main considerations: the energy intensity of baseline consumption, and the savings opportunities represented by EE and DSM measures. Baseline conditions for electricity consumption are based on historic and current economic conditions, the current configuration of the power system, policy context, and customer preferences.

Current and projected sales and load are based on the current and projected numbers of accounts served by economic sector. The types of loads present at these accounts is reflective of customers' economic sector, segment, and final demand for electricity services. Final demand for electricity is reflective of numerous, complex factors such as the set of available technologies that produce electricity end uses (e.g. HVAC for heating, cooling, and ultimately: comfort); the cost of technologies that produce electricity end uses; the price of electricity and other energy sources; customer demand for electricity services; and, behavioral or other contextual factors that collectively drive customer decisions about energy consumption.

5.1.1 Energy Efficiency

Energy efficiency technical potential provides a theoretical maximum for electricity savings. Technical potential ignores all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt energy efficiency, except insofar as these trends are captured in Duke Energy's baseline sales and load forecasts. For an electricity potential study, technical potential refers to delivering less electricity to the same end uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

Technical potential results from the application of EE measures to the disaggregated South Carolina electricity sales forecasts. Nexant applied estimated energy savings from equipment or nonequipment measures to all electricity end uses and customers. Since technical potential does not consider the costs or time required to achieve these electricity savings, the estimates provide an upper limit on savings potential. Nexant reported technical potential as a single numerical value for the DEC service territory and for the DEP service territory.

The core equation used in the residential sector energy efficiency technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2, below.

Equation 5-1: Core Equation for Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Number of Households} \times \text{Base Case Equipment Energy Use Intensity (kWh/unit)} \times \text{Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Base Case Equipment Energy 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 energy-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.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology.

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

Equation 5-2: Core Equation for Nonresidential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Stock Sq. Footage by Building Type by EDC} \times \text{Base Case Equipment Energy Use Intensity (kWh/unit)} \times \text{Equipment Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Total Stock Square Footage by Building Type = the forecasted square footage level for a given building type (e.g., square feet of office buildings).

Base Case Equipment Energy Use Intensity = the electricity used per square foot per year by each base-case equipment type in each market segment.

Equipment Saturation Share = the fraction of total end use energy consumption associated with the efficient technology in a given market segment. For example, for room air conditioners, the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with room air conditioner equipment.

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

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (i.e., it may not be possible to install VFDs on all motors in a given market segment).

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

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported technical potential over a defined time period, based on currently known DSM measures and observed electricity consumption patterns.

Addressing Naturally-Occurring Energy Efficiency

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring efficiency were considered separately in the potential estimates. Nexant worked with Duke Energy's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts incorporated the impacts of known code changes. While some code changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence. Given the uncertainty associated with the implementation of the EISA backstop and current market trends, Nexant adjusted the future lighting baseline to the EISA-compliant standard.

- **Baseline Measure Adoption:** Sales forecasts typically exclude the projected impacts of future DSM efforts, but account for baseline efficiency penetration (this can be a delicate process given that some of these adopters are likely programmatic free-riders).

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical and economic scenarios, where adoption was assumed to be 100%, and was particularly important in the achievable potential analysis, where Nexant estimated the measure adoption and associated savings that can be expected to occur above baseline measure adoption rates.

5.1.2 DSM

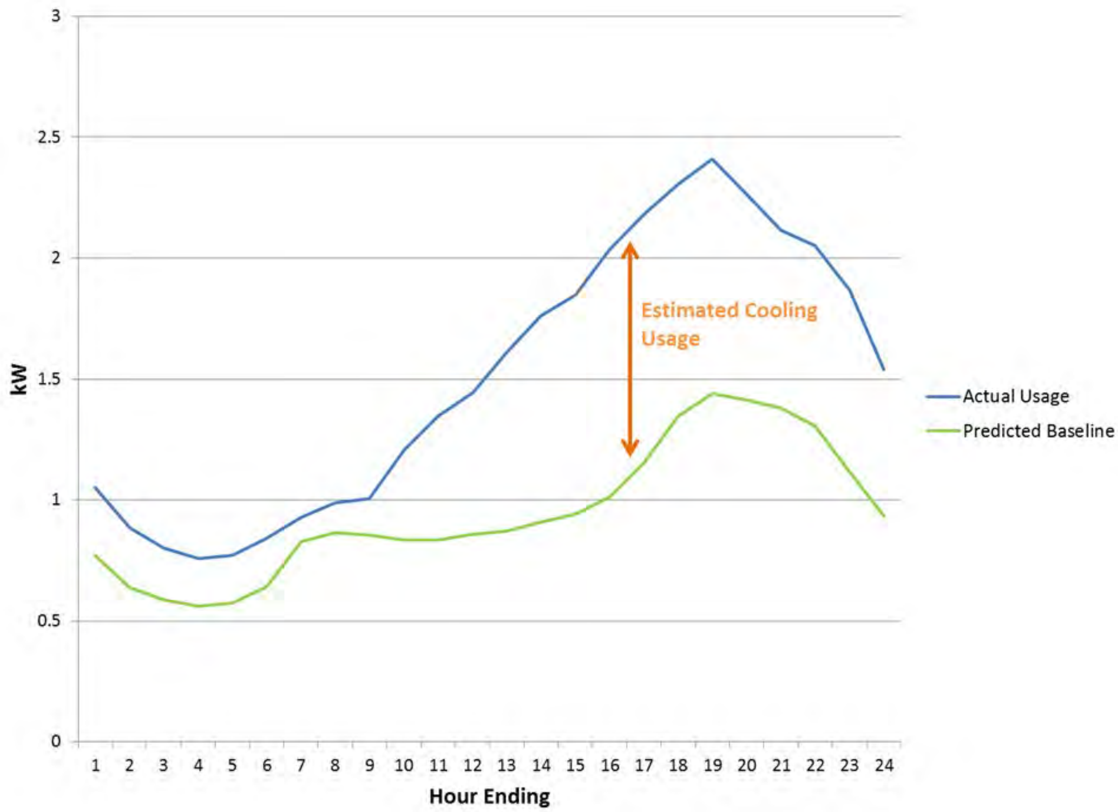
The concept of technical potential differs when applied to DSM. Technical potential for DSM is effectively the magnitude of loads that can be managed during conditions when grid operators need peak capacity, ancillary services, or when wholesale energy prices are high. The goal of a DSM technical potential analysis is to identify the accounts and end uses that consume electricity during those times, and determine which end uses can be reduced. For residential and small C&I accounts where DSM generally takes the form of direct utility control, technical potential for DSM is limited by the loads that can be controlled remotely at scale. Large C&I accounts generally do not provide the utility with direct control over end-uses. However, for enough money, businesses will forego virtually all electricity consumption temporarily. Therefore all end uses are considered for large C&I technical potential.

To determine what curtailable load is available during system peaks, Nexant analyzed interval data for all large C&I customers and relied on average load shapes from load research samples as the starting point for analysis of residential and smaller C&I customers. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8,760 hours in a year. This was needed because the loads available at times when different grid applications are needed can vary substantially. In the context of this study, DSM capacity is defined as the amount of curtailable load that is available during the system peak hour for the summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, all large C&I load is considered dispatchable, while residential and small C&I DSM capacity is based on specific end uses. "Dispatchable" loads are those that can be directly and centrally controlled by a utility (subject to customers' permission) For this study, Nexant assumed that summer DSM capacity for residential customers would be comprised of AC, pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter capacity, residential DSM capacity was based on electric heating loads and water heaters. For small C&I customers, winter capacity was based on heating load.

AC and heating load profiles were generated for residential and small C&I customers using the load research sample provided by Duke. The aggregate load profile for each customer class was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, then by subtracting this baseline load from the load that occurred on days when temperatures were more extreme. This methodology is illustrated by Figure 5-1.

Figure 5-1: Methodology for Estimating Cooling Loads



This method was only able to produce estimates for average AC/heating load profiles for the residential and small C&I sector as a whole (the load research samples provided were at an aggregate level), so each segment's relative contribution to the total cooling and heating load for residential and small C&I sectors were based on the segment's size and the segment's end use saturation. Segment size was determined using 2018 billing data.

Profiles for residential pool pump loads were estimated by utilizing end use load data from CPS Energy's Home Manager Program. This data was validated against end use data provided by Duke Energy Florida. Consumption associated with these end uses is fairly similar across different geographic regions; so data from CPS Energy's territory in San Antonio were considered a valid proxy. The only difference was that pool pump loads were assumed to be zero in the winter season for DEC and DEP, whereas these loads are fairly constant year round for CPS Energy. . Water heater load profiles were completed based on end-use metered data from OpenEI, which provided end use data for each weather station in the Carolinas. The water heater data was then averaged using the same weather stations and weights as the weather data used in the analysis.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season. System peak hours were identified using 2018 system load data. The 2018 summer peak for DEC territory occurred July 11th during hour ending 17. The 2018 summer peak for DEP territory occurred June 19th during hour ending 17. The 2018 winter peak for DEC territory occurred January 5th during hour ending 8. The 2018 winter peak for DEP territory occurred January 2nd during hour ending 8.

5.2 DEC Energy Efficiency Technical Potential

This section provides the results of the DEC and DEP energy efficiency technical potential for each of the three segments.

5.2.1 Summary

Table 5-1 summarizes the energy efficiency technical potential by sector and levelized cost associated with the identified potential. Nexant calculated levelized cost as the discounted sum of incremental cost over the study period divided by the discounted sum of lifetime energy savings over the period.

Table 5-1: DEC Energy Efficiency Technical Potential by Sector

Sector	Technical Potential (2020-2044)				
	Energy (GWh)	% of 2044 Base Sales	Demand (MW)		Levelized Cost ($/kWh)
			Summer	Winter	
Residential	2,989	36%	1,271	223	$0.26
Commercial	1,136	24%	203	60	$0.29
Industrial	212	29%	30	29	$0.20
Total	**4,338**	**32%**	**1,504**	**312**	**$0.27**

5.2.2 Sector Details

Figure 5-2 summarizes the DEC residential sector energy efficiency technical potential by end use.

Figure 5-2: DEC Residential EE Technical Potential– Cumulative 2044 by End-Use

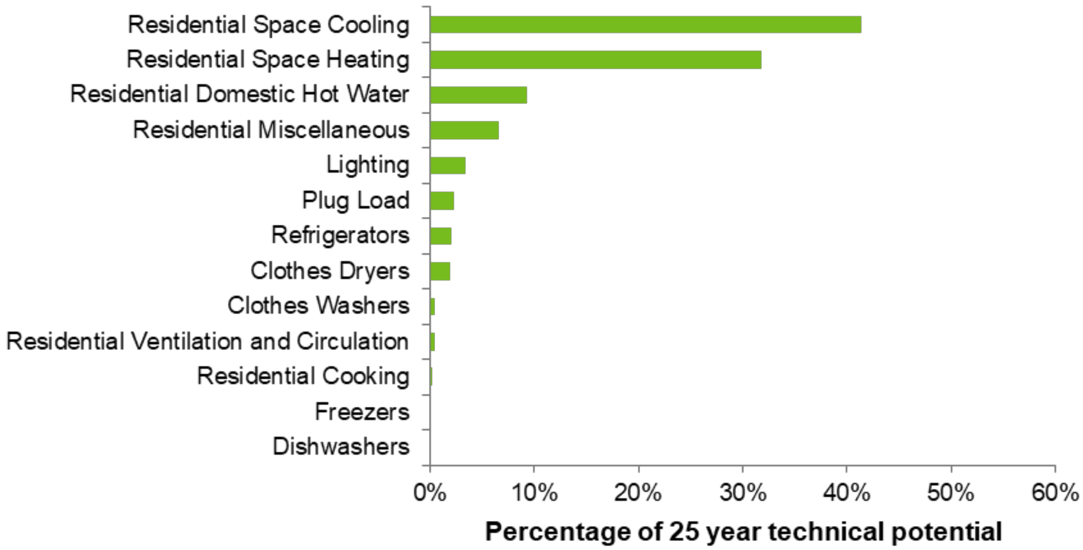


Figure 5-3 summarizes the DEC commercial sector EE technical potential by end use.

Figure 5-3: DEC Commercial EE Technical Potential – Cumulative 2044 by End-Use

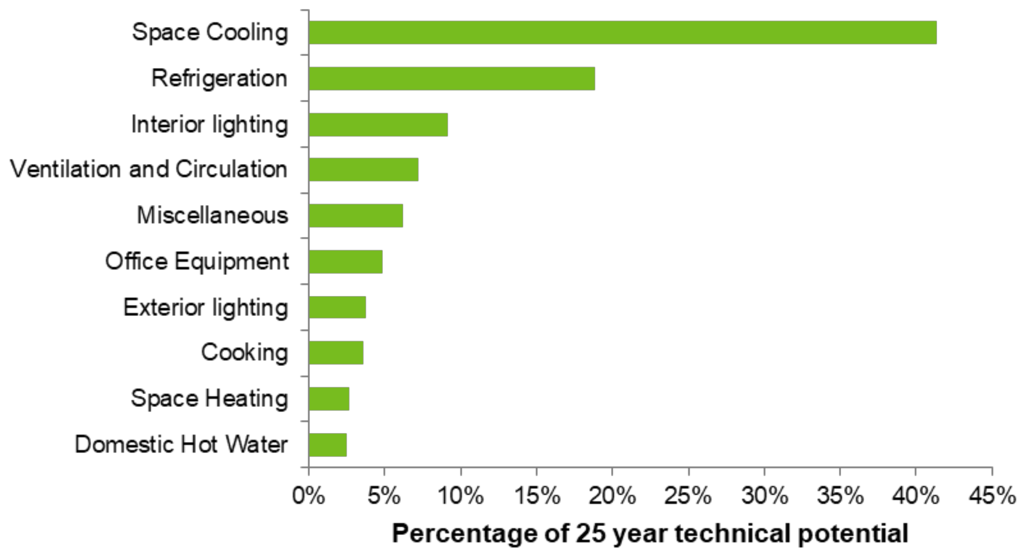


Figure 5-4 provides a summary of DEC energy efficiency technical potential contributions by commercial facility types analyzed in this study.

Figure 5-4: DEC Commercial EE Technical Potential by Segment

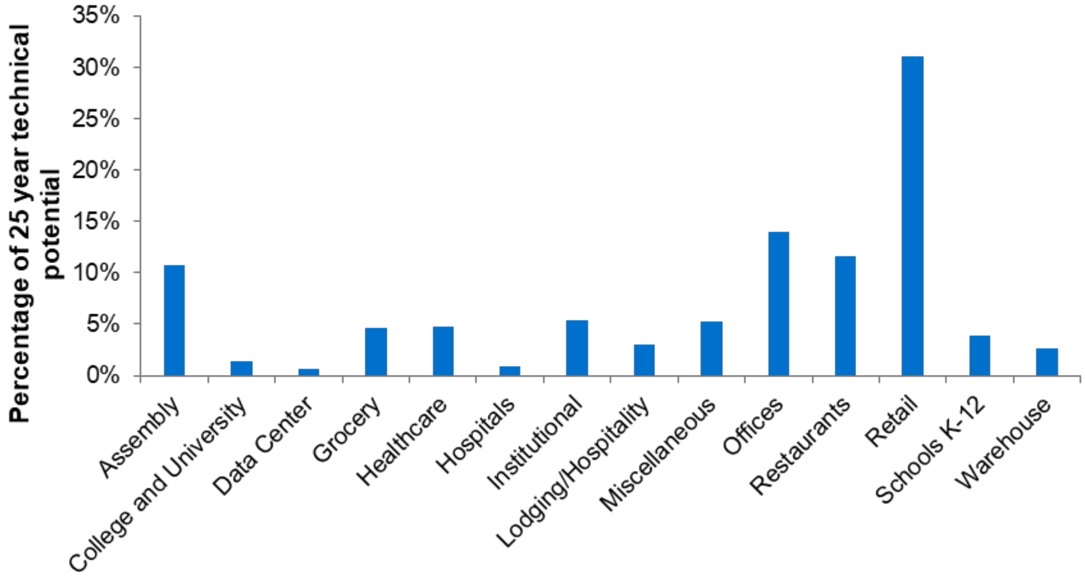


Figure 5-5 summarizes the DEC industrial sector energy efficiency technical potential by end use.

Figure 5-5: DEC Industrial EE Technical Potential – Cumulative 2044 by End-Use

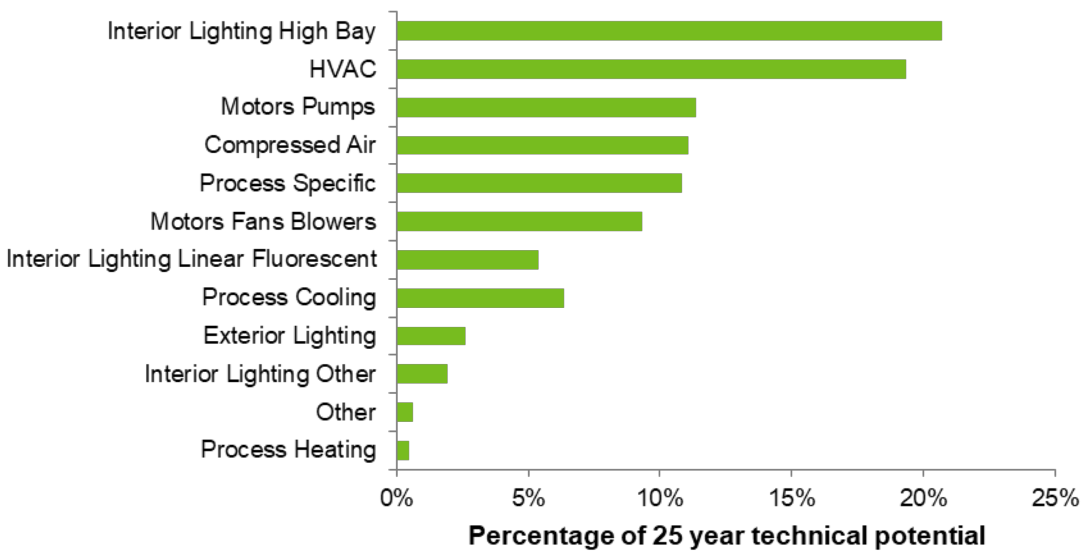
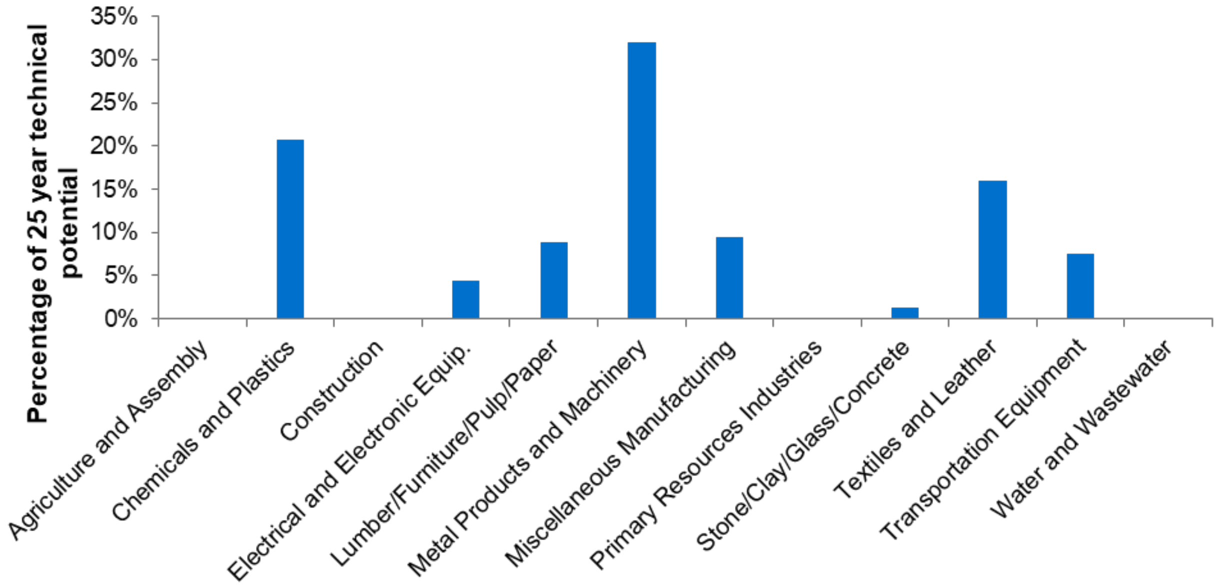


Figure 5-6 provides a summary of DEC energy efficiency technical potential contributions by industrial facility types analyzed in this study.

Figure 5-6: DEC Industrial EE Technical Potential by Segment



5.3 DEP Energy Efficiency Technical Potential

This section provides the results of the DEP energy efficiency technical potential for each of the three segments.

5.3.1 Summary

Table 5-2 summarizes the DEP energy efficiency technical potential by sector and levelized cost associated with the identified potential. Nexant calculated levelized cost as the sum of incremental cost over the study period divided by the discounted sum of lifetime energy savings over the period.

Table 5-2: DEP Energy Efficiency Technical Potential by Sector

Sector	Technical Potential (2020-2044)				
	Energy (GWh)	% of 2044 Base Sales	Demand (MW)		Levelized Cost ($/kWh)
			Summer	Winter	
Residential	1,106	36%	575	64	$0.23
Commercial	343	25%	61	18	$0.29
Industrial	32	29%	4	4	$0.15
Total	**1,482**	**33%**	**640**	**86**	**$0.24**

5.3.2 Sector Details

Figure 5-7 summarizes the DEP residential sector EE technical potential by end use.

Figure 5-7: DEP Residential EE Technical Potential – Cumulative 2044 by End-Use

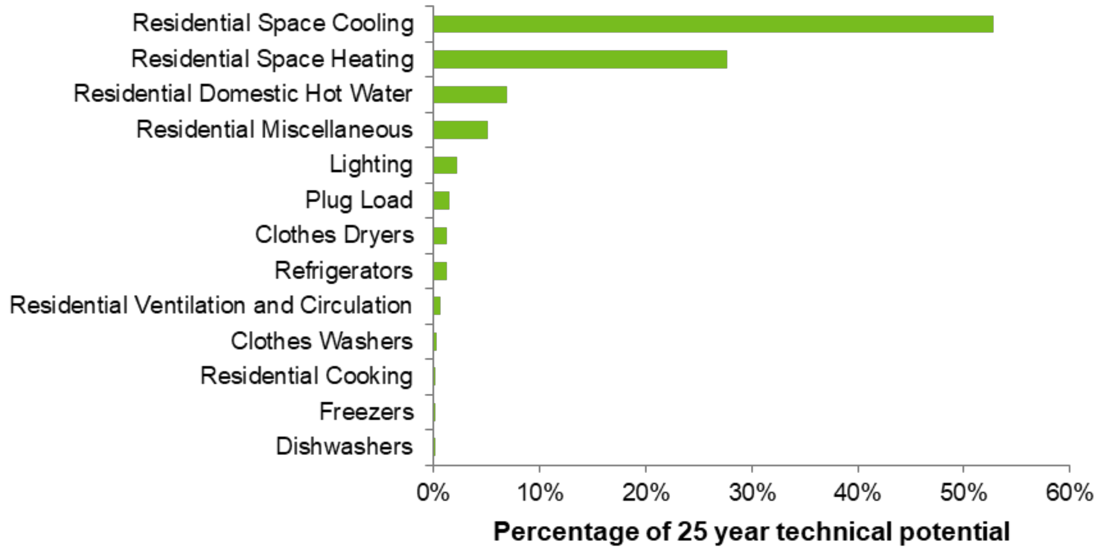


Figure 5-8 summarizes the DEP commercial sector energy efficiency technical potential by end use.

Figure 5-8: DEP Commercial EE Technical Potential – Cumulative 2044 by End-Use

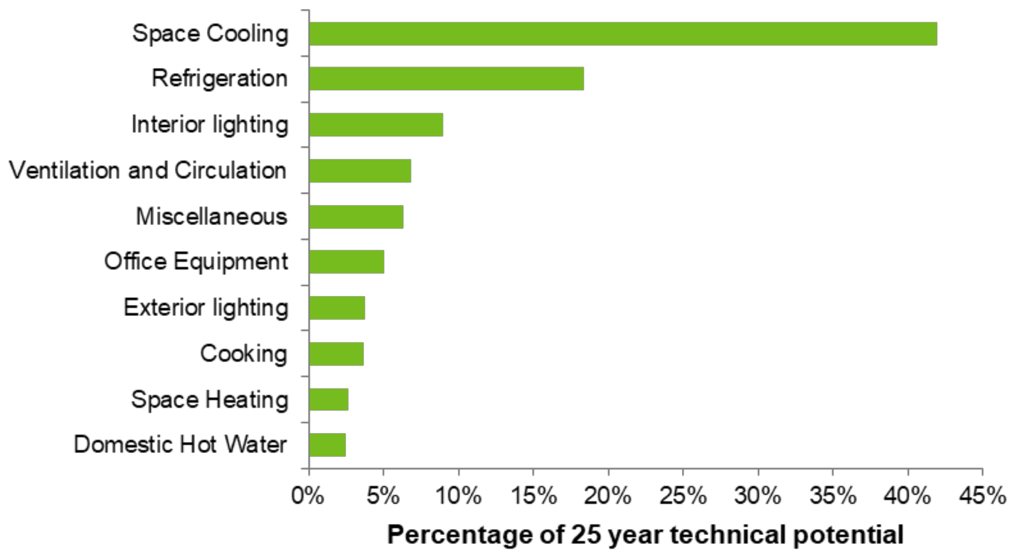


Figure 5-9 provides a summary of DEP energy efficiency technical potential contributions by commercial facility types analyzed in this study.

Figure 5-9: DEP Commercial EE Technical Potential by Segment

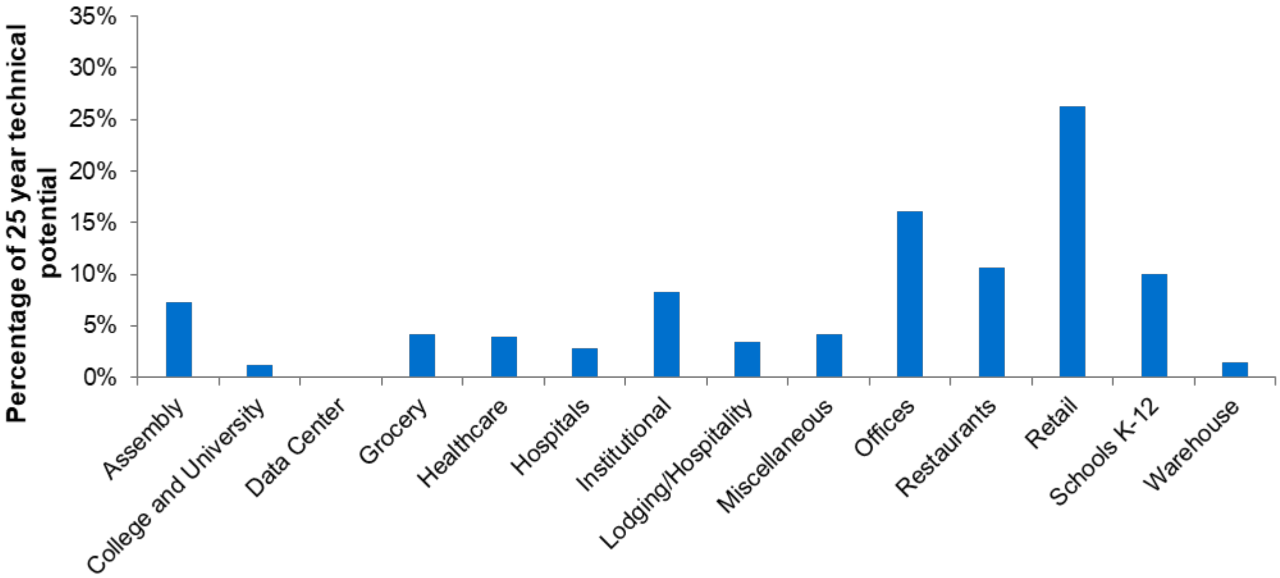


Figure 5-10 summarizes the DEP industrial sector energy efficiency technical potential by end use.

Figure 5-10: DEP Industrial EE Technical Potential – Cumulative 2044 by End-Use

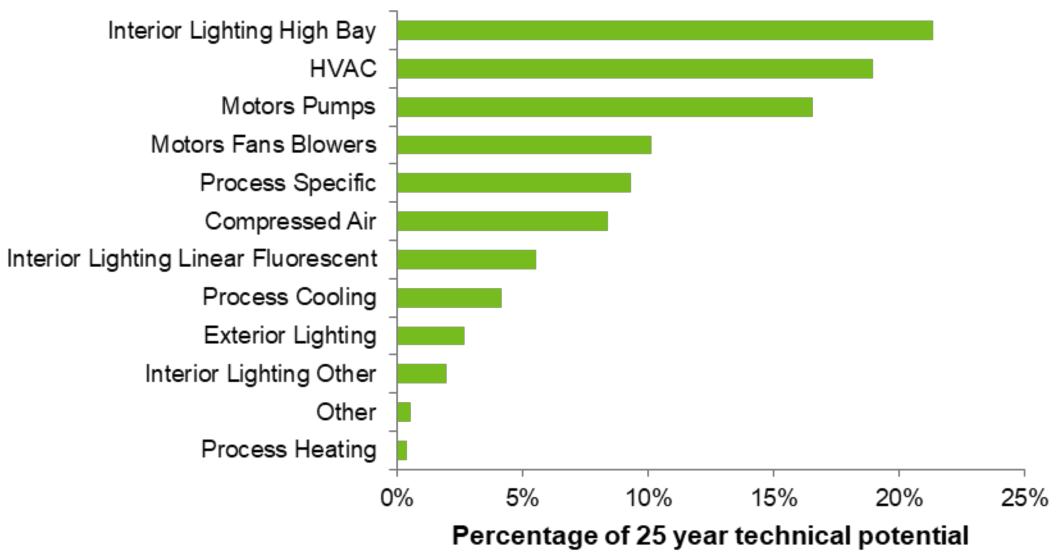
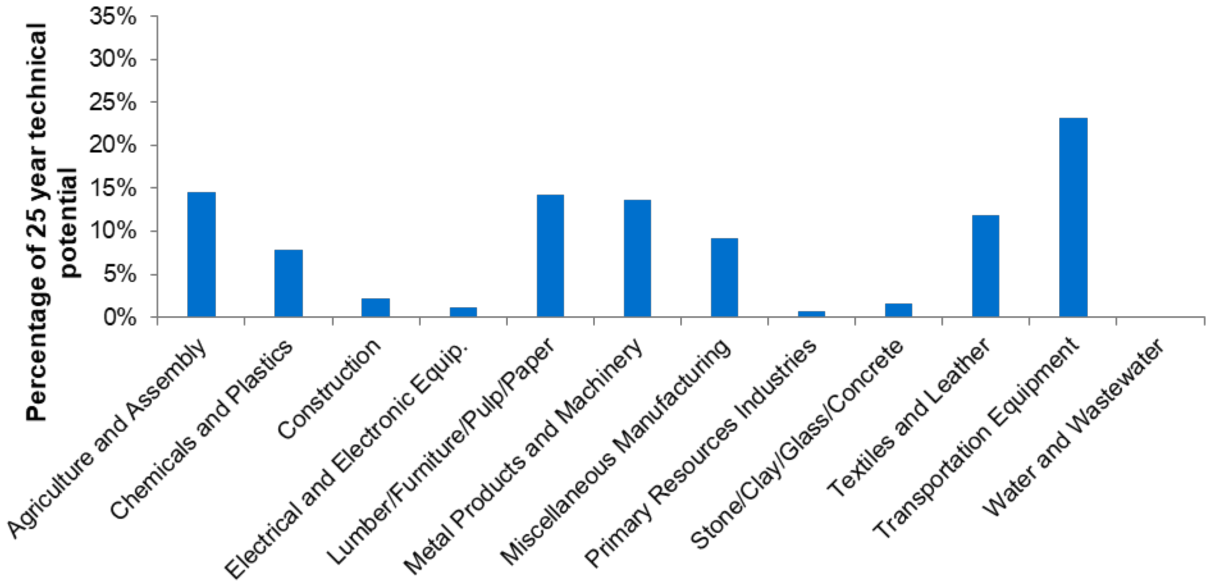


Figure 5-11 provides a summary of DEP energy efficiency technical potential contributions by industrial facility types analyzed in this study.

Figure 5-11: DEP Industrial EE Technical Potential by Segment



5.4 DEC Controllable Peak Load, by Customer Type

Technical potential for DSM is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end uses that can participate in Duke Energy's current and planned DSM programs in which the utility uses specialized devices to control loads (i.e. direct load control programs). This includes AC/heating loads for residential and small C&I customers, and also water heater and pool pump loads for residential customers. The study excluded DSM programs that explicitly target behavior (i.e., they are not automated or dispatchable).
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment. This reflects the behavioral nature of most large C&I programs and the fact that for a large enough payment and small enough number of events, large C&I customers would be willing to reduce their usage to zero.

Table 5-3 summarizes the seasonal DSM technical potential by sector:

Table 5-3: DEC DSM Technical Potential by Sector

Sector	Annual Technical Potential	
	Summer (Agg MW)	Winter (Agg MW)
Residential	984	1,093
Small C&I	129	121
Large C&I	122	138
Total	1,235	1,352

5.4.1 Residential and Small C&I Customers

Residential technical potential is summarized in Table 5-4. The potential is broken down by end use and building type. A more detailed breakdown of the AC and heating loads by customer segment is provided in the economic potential section, along with the cost-effectiveness of each customer segment.

Table 5-4: DEC Residential Demand Technical Potential

Rate Classes	Season	End Uses	Single Family Residential		Multi Family Residential		Total
			Avg. kw	Agg. MW	Avg. kw	Agg. MW	Agg. MW
RS	Summer	AC Cooling	2.22	467.2	2.22	28.0	**495.2**
	Winter	Heating					
	Summer/Winter	Water Heater	0.30 / 0.82	51.6 / 141.6	0.30 / 0.82	2.8 / 7.6	**54.4 / 149.2**
	Summer	Pool Pump	1.00	17.4			**17.4**
RE	Summer	AC Cooling	1.65	287.5	1.65	71.4	**358.9**
	Winter	Heating	3.69	657.2	3.69	163.3	**820.6**
	Summer/Winter	Water Heater	0.30 / 0.82	35.9 / 98.6	0.30 / 0.82	8.9 / 24.5	**44.9 / 123.1**
	Summer	Pool Pump	1.00	12.1			**12.1**
RT	Summer	AC Cooling	3.32	1.0			**1.0**
	Winter	Heating	3.88	0.1			**0.1**
	Summer/Winter	Water Heater	0.30 / 0.82	0.06 / 0.17			**0.06 / 0.17**
	Summer	Pool Pump	1.00	0.02			**0.02**

Small Business technical potential is provided in Table 5-5.

Table 5-5: DEC Small C&I Demand Technical Potential

Segment	AC Cooling		Heating	
	Avg. kw	Agg. MW	Avg. kw	Agg. MW
Assembly	2.79	20.76	15.58	5.50
Colleges and Universities	5.62	1.38	35.79	0.73
Data Centers	3.77	0.41	24.71	0.12
Grocery	5.43	2.80	32.75	7.61
Healthcare	4.23	7.72	27.53	4.60
Hospitals	5.92	0.57	37.85	0.13
Institutional	1.67	3.58	12.59	1.27
Lodging (Hospitality)	2.77	1.32	22.04	2.12
Miscellaneous	0.74	7.80	5.28	11.06
Office	1.68	23.51	11.85	16.36
Restaurants	9.68	16.62	46.00	8.43
Retail	1.93	34.93	12.39	31.02
Schools K-12	2.78	1.67	22.13	0.65
Warehouse	1.74	1.17	11.87	0.40
Agriculture & Forestry	1.26	0.01	6.22	0.05
Chemicals & Plastics	4.07	0.68	27.56	4.60
Construction	1.79	0.01	0.88	0.00
Electrical & Electronic Equipment	2.30	0.19	14.46	1.19
Lumber, Furniture, Pulp and Paper	2.84	0.65	18.24	4.17
Metal Products & Machinery	3.79	1.60	24.82	10.50
Misc. Manufacturing	3.03	0.62	19.61	3.99
Primary Resource Industries	-	-	-	-
Stone, Clay, Glass and Concrete	4.52	0.23	33.96	1.76
Textiles & Leather	5.31	0.46	38.41	3.35
Transportation Equipment	1.35	0.13	11.15	1.11
Water and Wastewater	-	-	-	-
Total		**128.82**		**120.73**

5.4.2 Large C&I Customers

Technical potential for C&I customers, broken down by customer segments, is given in Table 5-6. In DEC's territory, nonresidential customers either qualified as small C&I customers or were large enough to qualify as large C&I customers. Much of the technical potential for large C&I customers comes from a handful of industries, particularly textiles & leathers, chemicals/plastics and metal products and machinery.

Table 5-6: DEC Large C&I Demand Technical Potential

Segment	1 MW and Up	
	Summer (MW)	Winter (MW)
Agriculture and Assembly	0.0	0.0
Chemicals and Plastics	19.6	16.9
College and University	0.0	0.0
Construction	0.0	0.0
Data Center	0.3	0.7
Electrical and Electronic Equip.	0.2	0.3
Grocery	0.0	0.0
Healthcare	0.0	0.0
Hospitals	0.0	0.0
Institutional	0.0	0.0
Lodging/Hospitality	1.9	1.4
Lumber/Furniture/Pulp/Paper	6.9	14.5
Metal Products and Machinery	10.2	8.3
Miscellaneous	11.5	42.4
Miscellaneous Manufacturing	0.7	0.5
Office	0.0	0.0
Primary Resources Industries	0.0	0.0
Restaurants	0.0	0.0
Retail	0.0	0.0
Schools K-12	0.0	0.0
Stone/Clay/Glass/Concrete	2.6	0.3
Textiles and Leather	67.8	53.0
Transportation Equipment	0.0	0.0
Warehouse	0.0	0.0
Water and Wastewater	0.0	0.0
Total	**121.9**	**138.2**

5.5 DEP Controllable Peak Load, by Customer Type

Technical potential for DSM is defined for each class of customers as follows: Residential and Small C&I Customers, and Large C&I Customers.

Table 5-7 summarizes the seasonal DSM technical potential by sector:

Table 5-7: DEP DSM Technical Potential by Sector

Sector	Annual Technical Potential	
	Summer (Agg MW)	Winter (Agg MW)
Residential	289	361
Small C&I	141	145
Large C&I	2	2
Total	432	508

5.5.1 Residential and Small C&I Customers

Residential technical potential is summarized in Table 5-8. The potential is broken down by end use and building type. A more detailed breakdown of the AC and heating loads by customer segment is provided in the economic potential section, along with the cost-effectiveness of each customer segment.

Table 5-8: DEP Residential Demand Technical Potential

Rate Classes	Season	End Uses	Single Family Residential		Multi Family Residential		Total
			Avg. kw	Agg. MW	Avg. kw	Agg. MW	Agg. MW
RES	Summer	AC Cooling	1.96	203.7	1.96	34.0	**261.8**
	Winter	Heating	3.06	231.0	3.06	45.5	**276.5**
	Summer/Winter	Water Heater	0.32 / 0.79	27.1 / 66.9	0.32 / 0.79	4.1 / 10.1	**31.2 / 77.0**
	Summer	Pool Pump	1.00	14.1			**14.1**
TOU	Summer	AC Cooling	3.31	5.2	3.31	0.03	**5.3**
	Winter	Heating	5.71	7.0	5.71	0.05	**7.0**
	Summer/Winter	Water Heater	0.32 / 0.79	0.37 / 0.91	0.32 / 0.79	0.002 / 0.006	**0.37 / 0.91**
	Summer	Pool Pump	1.00	0.19			**0.19**

Small Business technical potential is provided in Table 5-9.

Table 5-9: DEP Small C&I Demand Technical Potential

Segment	MGS		SGS		SGS-TOU	
	AC Cooling	Heating	AC Cooling	Heating	AC Cooling	Heating
	Agg. MW	Agg. MW	Agg. MW	Agg. MW	Agg. MW	Agg. MW
Assembly	11.34	3.74	2.88	2.00	0.04	0.00
Colleges and Universities	1.49	0.73	0.11	0.16	0.05	0.01
Data Centers	-	-	0.04	0.02	0.01	0.00
Grocery	1.88	3.90	0.69	3.25	0.10	0.10
Healthcare	7.23	3.93	1.38	1.67	0.13	0.03
Hospitals	1.27	0.25	0.16	0.08	0.02	0.00
Institutional	5.22	1.47	1.65	1.13	0.14	0.02
Lodging (Hospitality)	1.71	2.17	0.24	0.75	0.13	0.08
Miscellaneous	3.63	3.40	1.65	4.25	0.06	0.03
Office	17.15	8.95	11.32	15.69	0.22	0.05
Restaurants	10.12	4.28	2.71	2.55	0.36	0.07
Retail	13.85	9.69	6.96	11.97	0.69	0.20
Schools K-12	20.82	5.84	0.60	0.48	0.14	0.02
Warehouse	0.58	0.14	0.31	0.21	0.01	0.00
Agriculture & Forestry	0.58	2.52	-	-	-	-
Chemicals & Plastics	0.35	1.56	0.01	0.16	0.01	0.03
Construction	0.09	0.43	-	-	0.01	0.01
Electrical & Electronic Equipment	0.27	1.30	0.00	0.04	0.00	0.00
Lumber, Furniture, Pulp and Paper	2.94	13.19	0.01	0.18	0.00	0.01
Metal Products & Machinery	1.66	7.57	0.04	0.54	0.08	0.15
Misc. Manufacturing	0.61	3.83	0.01	0.25	0.03	0.07
Primary Resource Industries	0.02	0.12	0.00	0.05	-	-
Stone, Clay, Glass and Concrete	0.10	0.30	0.03	0.36	0.01	0.02
Textiles & Leather	2.87	12.41	0.03	0.61	0.03	0.07
Transportation Equipment	1.74	5.52	0.00	0.05	0.00	0.00
Water and Wastewater	-	-	-	-	-	-
Total	**107.51**	**97.25**	**30.85**	**46.47**	**2.26**	**0.97**

5.5.2 Large C&I Customers

Technical potential for C&I customers, broken down by customer segments, is given in Table 5-10. In DEP's territory, nonresidential customers either qualified as small C&I customers or were large enough to qualify as large C&I customers. Many of the segments are zero due to customers opting out of DSM programs.

Table 5-10: DEP Large C&I Demand Technical Potential

Segment	1 MW and Up	
	Summer (MW)	Winter (MW)
Agriculture and Assembly	0.0	0.0
Chemicals and Plastics	0.0	0.0
College and University	0.0	0.0
Construction	0.0	0.0
Data Center	0.0	0.0
Electrical and Electronic Equip.	0.0	0.0
Grocery	0.0	0.0
Healthcare	0.0	0.0
Hospitals	0.0	0.0
Institutional	0.0	0.0
Lodging/Hospitality	0.0	0.0
Lumber/Furniture/Pulp/Paper	0.0	0.0
Metal Products and Machinery	0.0	0.0
Miscellaneous	0.0	0.0
Miscellaneous Manufacturing	0.0	0.0
Office	0.0	0.0
Primary Resources Industries	0.0	0.0
Restaurants	0.0	0.0
Retail	0.0	0.0
Schools K-12	0.0	0.0
Stone/Clay/Glass/Concrete	0.0	0.0
Textiles and Leather	0.0	0.0
Transportation Equipment	2.0	1.5
Warehouse	0.0	0.0
Water and Wastewater	0.0	0.0
Total	**2.0**	**1.5**

6 Economic Potential

Economic potential compares the expected costs and benefits of energy and demand savings provided by EE and DSM measures and applies the total resource cost (TRC) test to determine whether measures meet the scenario screening criterion of a benefit-cost ratio greater than 1. The economic potential is the sum of the energy savings associated with all measure permutations passing the economic screening.

The benefits of EE and DSM measures under the TRC test are primarily associated with avoided utility costs. These include avoided energy generation costs, avoided transmission and distribution costs, and avoided costs associated with lower peak capacity demands. Regarding peak capacity avoided costs, Nexant notes that DEC and DEP system characteristics have changed; the system is now a winter-peaking system, that is to say the highest period of generation capacity utilization now occurs in the winter months. Previously DEC and DEP were still considered summer-peaking.

6.1 EE and DSM Cost-Effective Screening Criteria

Based on discussions with Duke Energy, the total resource cost (TRC) test was used for the economic screening of energy efficiency measures in the MPS. The TRC is calculated by comparing the total avoided electricity production and the avoided delivery costs from installing a measure, to that measure's incremental cost. The incremental cost is relative to the cost of the measure's appropriate baseline technology. DSM program delivery and administrative costs, which are included in program-level TRC calculations, were not included in the measure-level economic screening conducted in this study.

For EE screening, the TRC test is applied to each energy efficiency measure based on installation of the measure in Year 1 of the study (i.e. avoided cost benefits begin in Year 1 and extend through the useful life of the measure; incremental costs are also incurred in Year 1). By using DSMore outputs for lifetime avoided cost benefits, the screening aligns with Duke Energy's avoided cost forecast and allows for a direct comparison of measure costs with these avoided cost benefits. The screening included measures with a TRC ratio of 1.0 or higher for determining economic potential.

For DSM screening, Nexant also used the TRC perspective, with the assumption that the incremental cost of implementing DSM is equivalent to the utility program costs. DSM participants do not incur any equipment costs to join a DSM program, so it is necessary to include a proxy participant cost for the TRC test. In accordance with how cost-effectiveness is generally modeled for DSM, Nexant used customer incentives as a proxy for the participant cost. The logic is that since consuming electricity benefits electric customers, reducing demand reduces those benefits. If a utility asks consumers to voluntarily reduce their peak demand, then doing so brings a cost to those customers, and any rational customer will wish to be compensated. Therefore, the incentive serves as a proxy for what the participant gives up by reducing peak demand in terms of comfort, production, etc.

However, cost-effectiveness screening for DSM potential is inherently of limited usefulness. Economic potential only answers the question, “Is a customer segment worth pursuing based on the marginal net benefits they provide?” However, because DSM capacity is determined by participation levels, which is in turn a function of the incentive level, a full cost-effectiveness screening cannot be performed without considering incentive levels, which is a key variable for the various scenarios of the program potential. As such, cost-effectiveness screening for the economic potential only considers non-incentive costs. In other words, customer segments are screened based on whether the marginal cost-effectiveness of enrolling a customer of that segment provides positive net benefits when only considering marketing, equipment, installation, and program operation costs.

For this analysis, the non-incentive costs for each sector is detailed in Table 6-1. These values are based on the costs assumed for a similar DSM potential study conducted for SMUD, and represent reasonable cost estimates in today’s dollars with current technology. Another key assumption that is part of the program potential analysis is the degree to which these costs are expected to decline in future years. However, economic potential screening is conducted using today’s technology costs.

Table 6-1: Non-Incentive Costs

	One-Time				Recurring (per year)
	Equipment	Installation	Acquisition Marketing	Other	Maintenance Marketing
Residential ($/customer)	$ 250.00	$ 200.00	$ 2.50	$ 4.50	$ 1.20
Small C&I ($/customer)	$ 300.00	$ 300.00	$ 20.00	$ 4.50	$ 1.20
Large C&I ($/MW)	$ 150.00		$ 10.00		

The cost of enrolling customers from each customer segment is compared to the marginal benefits provided by enrolling customers in that segment. Because DSM programs are called relatively infrequently, very little benefit is derived from avoided energy costs, to the point where they are insignificant. Instead, DSM derives its value from avoided generation capacity and avoided transmission and distribution capacity.

Forecasts of these values were provided by Duke Energy, and formed the basis for the benefit calculations. Because these values were given as annual values, while this study aims to evaluate DSM capacity for summer and winter separately, the annual avoided capacity values were allocated between summer and winter. To that end, capacity values were allocated between summer and winter seasons based on Duke Energy’s recommendations. For DEC, 10% was allocated to summer and 90% to winter. For DEP, 0% was allocated to summer and 100% to winter. Duke Energy indicated these changes were required by recent orders from the North Carolina Public Utilities Commission (NCPUC).

6.2 DEC Energy Efficiency Economic Potential

This section provides the results of the DEC energy efficiency economic potential for each of the three sectors.

6.2.1 Summary

Table 6-2 summarizes the DEC's energy efficiency economic potential by sector and levelized cost associated with the identified potential:

Table 6-2: DEC EE Economic Potential by Sector

Sector	Economic Potential (2020-2044)				
	Energy (GWh)	% of 2044 Base Sales	Demand (MW)		Levelized Cost ($/kWh)
			Summer	Winter	
Residential	993	12%	245	110	$0.05
Commercial	617	13%	109	38	$0.03
Industrial	162	22%	23	22	$0.02
Total	1,773	13%	376	170	$0.04

6.2.2 Sector Details

Figure 6-1 summarizes the DEC residential sector energy efficiency economic potential by end use.

Figure 6-1: DEC Residential EE Economic Potential – Cumulative 2044 by End-Use

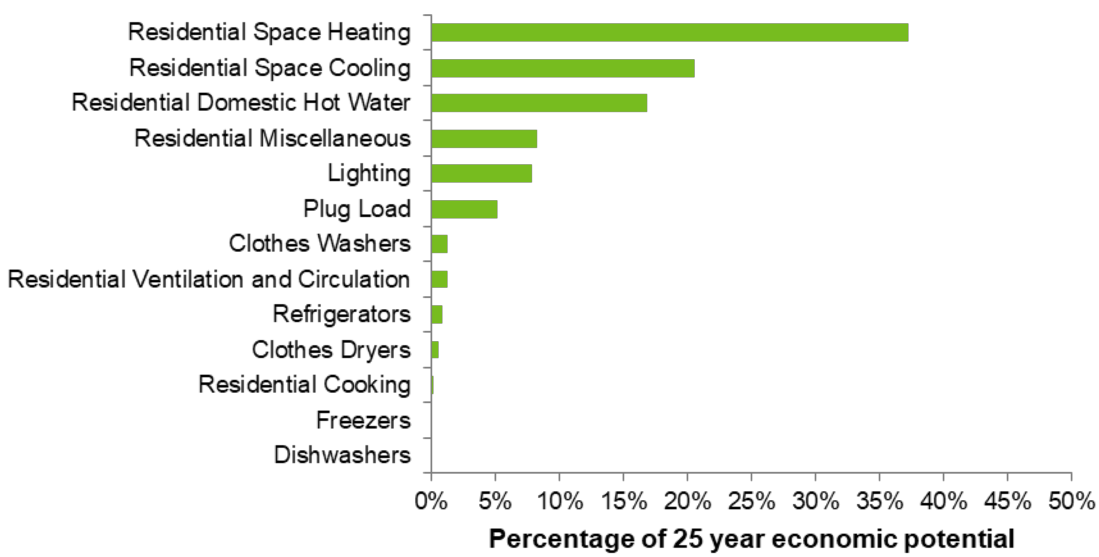


Figure 6-2 summarizes the DEC commercial sector EE economic potential by end use.

Figure 6-2: DEC Commercial EE Economic Potential – Cumulative 2044 by End-Use

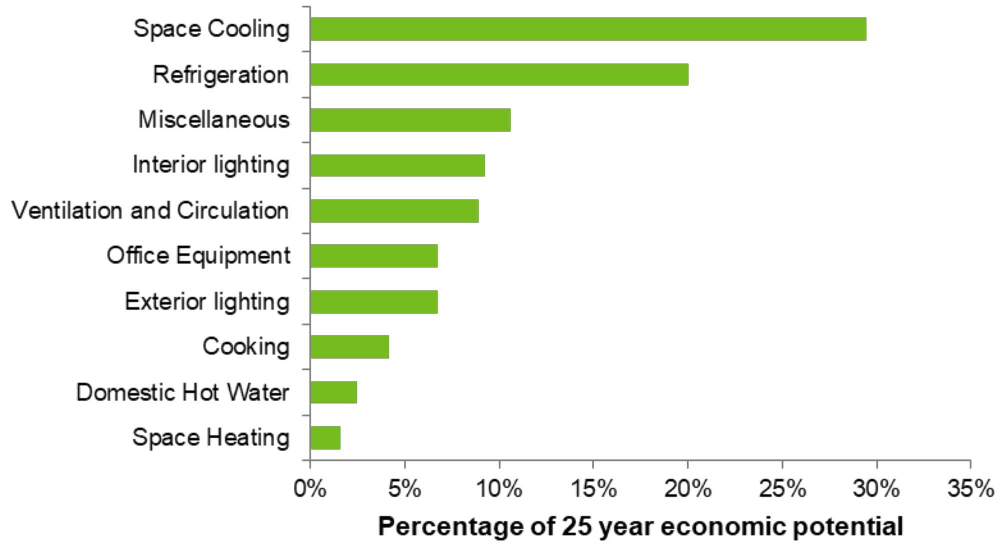


Figure 6-3 provides a summary of DEC energy efficiency economic potential contributions by commercial facility types analyzed in this study.

Figure 6-3: DEC Commercial EE Economic Potential by Segment

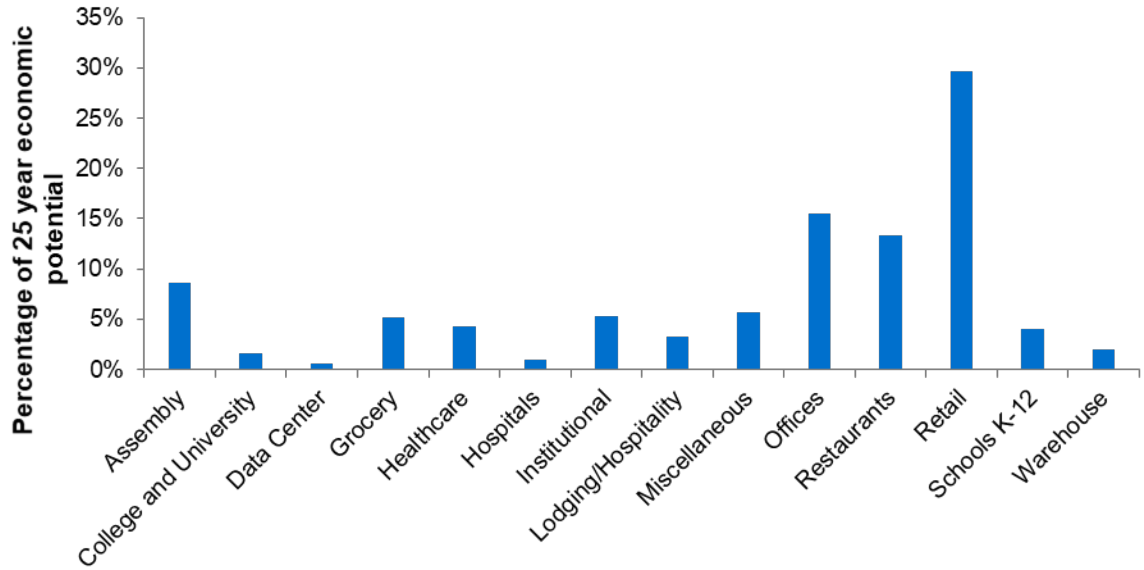


Figure 6-4 summarizes the DEC industrial sector energy efficiency economic potential by end use.

Figure 6-4: DEC Industrial EE Economic Potential – Cumulative 2044 by End-Use

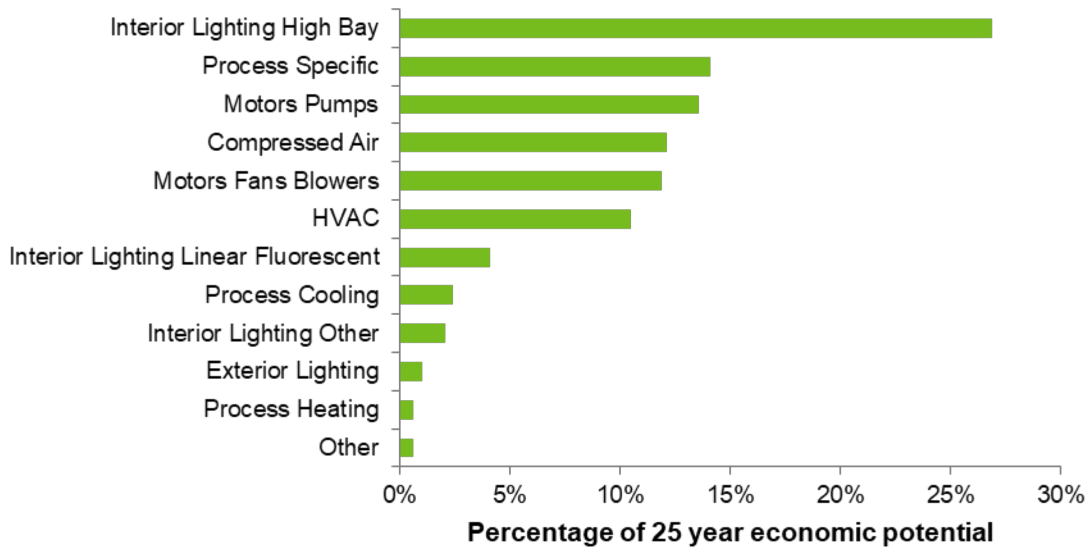
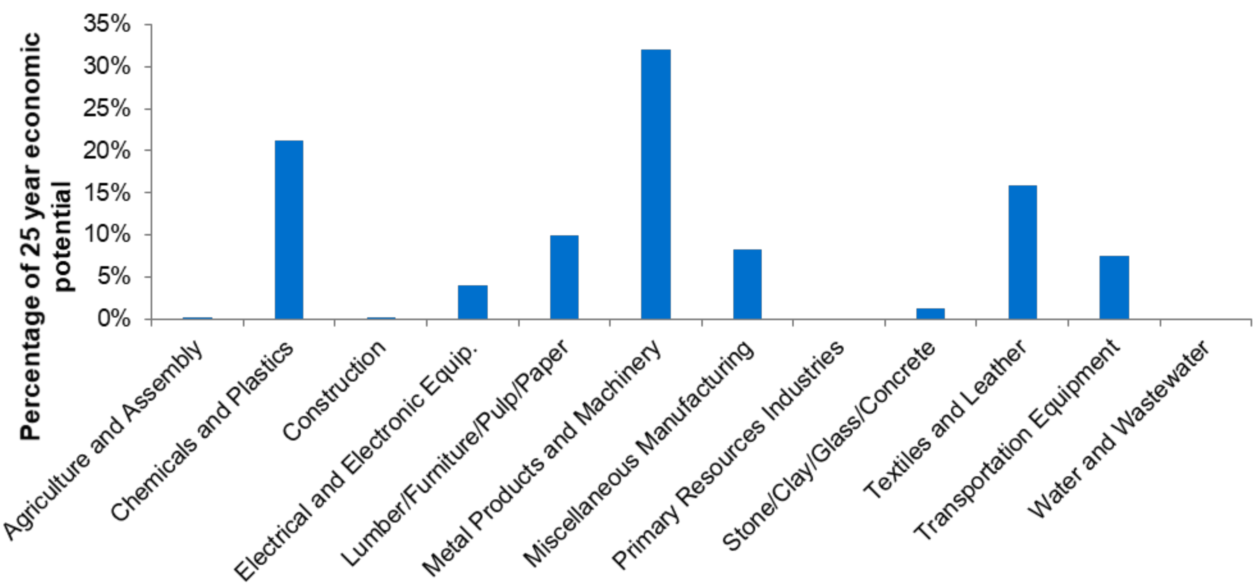


Figure 6-5 provides a summary of DEC energy efficiency technical potential contributions by industrial facility types analyzed in this study.

Figure 6-5: DEC Industrial EE Economic Potential by Segment



6.3 DEP Energy Efficiency Economic Potential

This section provides the results of the DEP energy efficiency economic potential for each of the three sectors.

6.3.1 Summary

Table 6-3 summarizes the DEP energy efficiency economic potential by sector and levelized cost associated with the identified potential:

Table 6-3: DEP EE Economic Potential by Sector

Sector	Economic Potential (2020-2044)				
	Energy (GWh)	% of 2044 Base Sales	Demand (MW)		Levelized Cost ($/kWh)
			Summer	Winter	
Residential	374	12%	170	23	$0.04
Commercial	167	12%	29	11	$0.02
Industrial	26	23%	4	4	$0.02
Total	566	12%	202	37	$0.03

6.3.2 Sector Details

Figure 6-6 summarizes the DEP residential sector energy efficiency economic potential by end use.

Figure 6-6: DEP Residential EE Economic Potential – Cumulative 2044 by End-Use

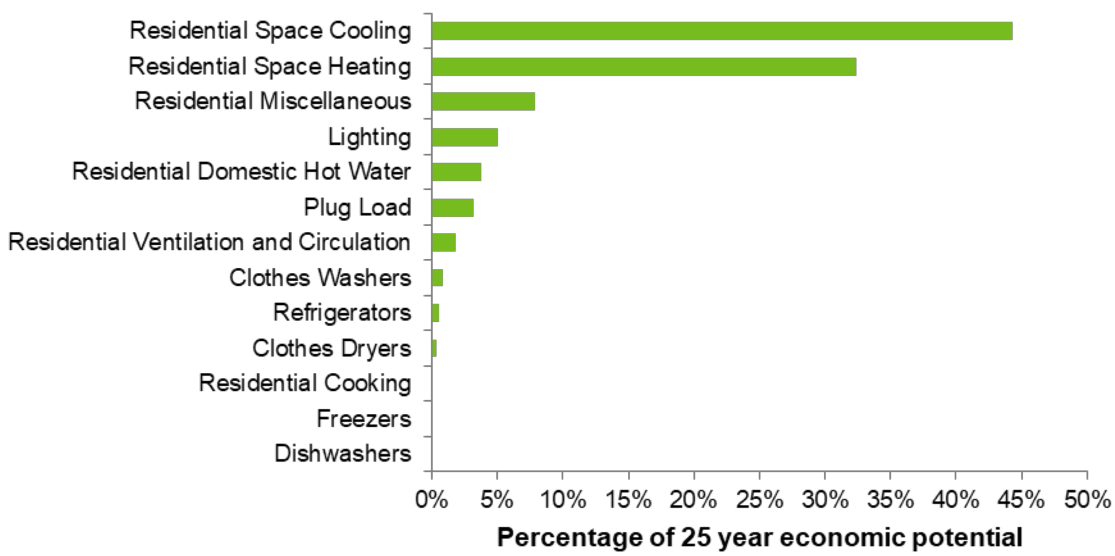


Figure 6-7 summarizes the DEP commercial sector energy efficiency economic potential by end use.

Figure 6-7: DEP Commercial EE Economic Potential – Cumulative 2044 by End-Use

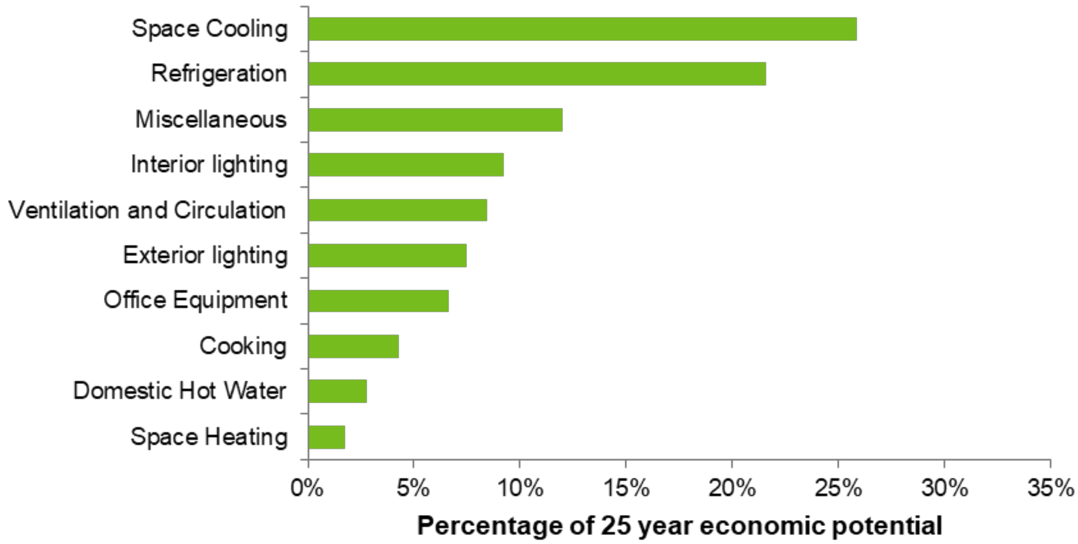


Figure 6-8 provides a summary of energy efficiency economic potential contributions by commercial facility types analyzed in this study.

Figure 6-8: DEP Commercial EE Economic Potential by Segment

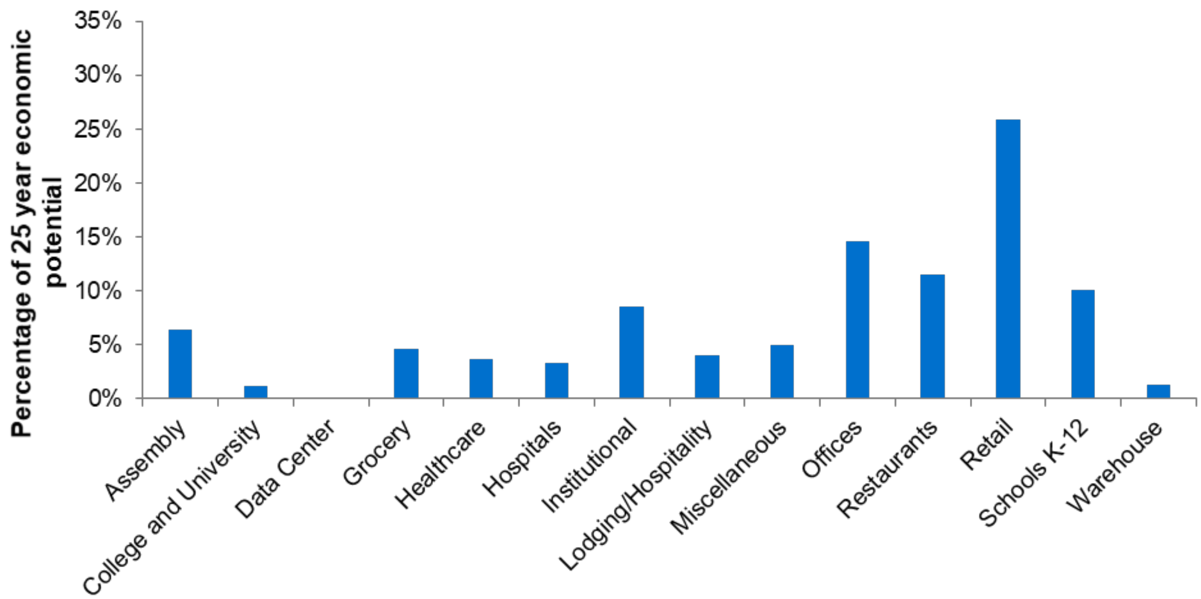


Figure 6-9 summarizes the DEP industrial sector energy efficiency economic potential by end use.

Figure 6-9: DEP Industrial EE Economic Potential – Cumulative 2044 by End-Use

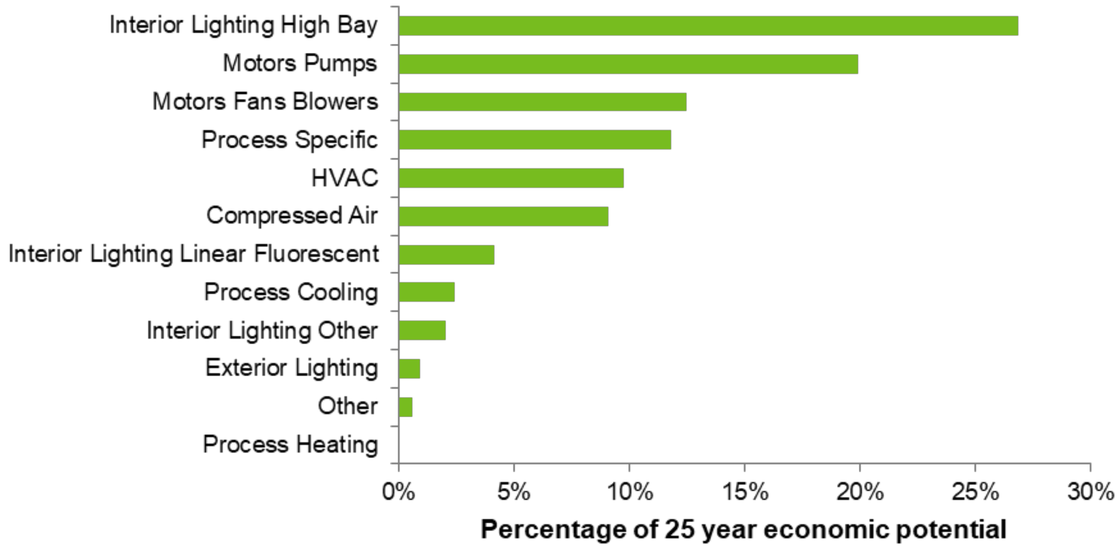
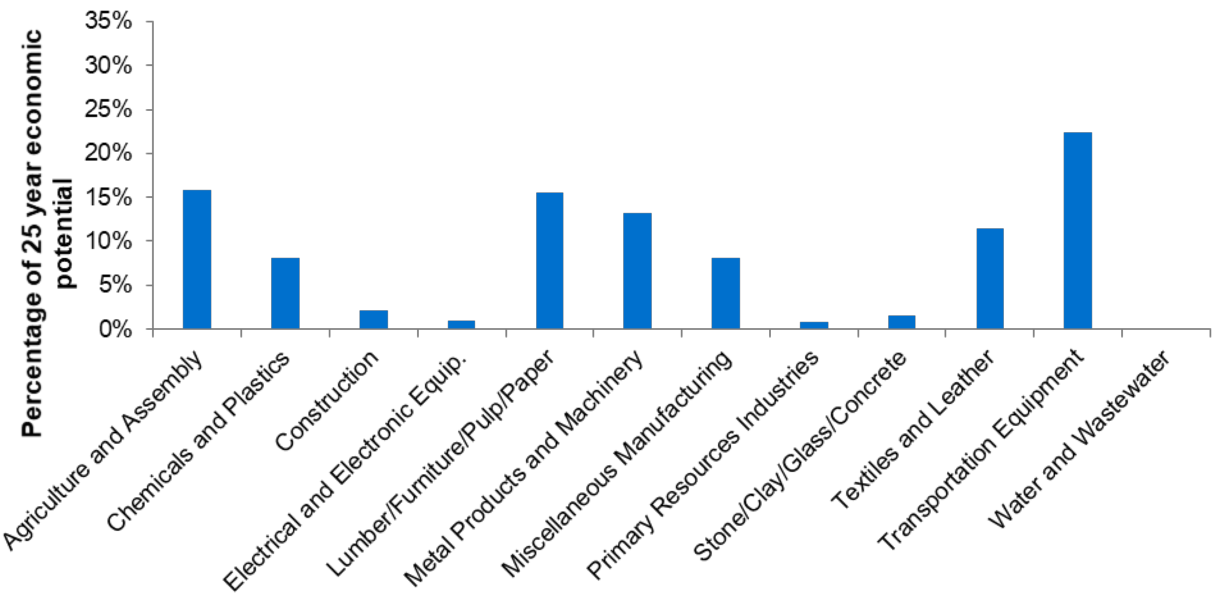


Figure 6-10 provides a summary of DEP energy efficiency technical potential contributions by industrial facility types analyzed in this study.

Figure 6-10: DEP Industrial EE Economic Potential by Segment



6.4 DEC DSM Economic Potential

Cost effectiveness screening for economic potential revealed that the vast majority of the technical potential presented in the prior chapter is cost-effective on a marginal basis. Summary results for the economic potential for DEC are presented in Table 6-4. Comparing these numbers to the DEC technical potential by sector in Table 5-3 shows that the only significant amount of technical potential that is uneconomic is summer capacity from the residential sector.

While some segments of the Large C&I and Small C&I sectors are also uneconomic, they do not add up to a significant amount of capacity.

Table 6-4: DEC DSM Economic Potential by Sector

Sector	Annual Economic Potential	
	Summer (Agg MW)	Winter (Agg MW)
Residential	930	1,093
SMB	121	121
Large C&I	122	138
Total	1,173	1,352

Results for single family residential customer segments are presented in Table 6-5, which summarizes the aggregate capacity each customer segment would be able to provide during summer and winter peaks, along with the benefits associated with that capacity, based on avoided generation and T&D costs. The net benefits per customer are presented on the right side of the table. Customer segments that do not pass the cost effectiveness screen have negative net benefits in red font. For single family residential customers, there are two segments that do not pass the screen in the summer. In the winter, the Residential Time-of-Use (TOU) rate class does not pass for any segments due to the relatively small number of customers on the TOU rate, which leads to minimal load that can be curtailed during peak hours.

Table 6-5: DEC Residential Single Family Economic Potential Results

	Single Family	Summer			Winter		
	Usage bin	# of accounts	Agg. MW	Total Net Benefit per Customer	# of accounts	Agg. MW	Total Net Benefit per Customer
RS	1	25,559	14.4	($67)	-	-	$0
	2	25,559	27.4	$297	-	-	$0
	3	25,559	33.7	$473	-	-	$0
	4	25,559	38.5	$608	-	-	$0
	5	25,559	43.0	$734	-	-	$0
	6	25,559	47.1	$850	-	-	$0
	7	25,559	51.9	$983	-	-	$0
	8	25,559	57.4	$1,138	-	-	$0
	9	25,559	65.5	$1,366	-	-	$0
	10	25,559	88.5	$2,010	-	-	$0
RE	1	17,798	11.1	($24)	17,798	26.5	$1,296
	2	17,798	17.4	$228	17,798	41.3	$2,279
	3	17,798	20.5	$356	17,798	48.7	$2,775
	4	17,798	23.2	$462	17,798	54.8	$3,179
	5	17,798	25.8	$568	17,798	60.4	$3,553
	6	17,798	28.4	$673	17,798	66.0	$3,930
	7	17,798	31.4	$794	17,798	72.5	$4,359
	8	17,798	35.1	$942	17,798	79.5	$4,830
	9	17,798	40.3	$1,152	17,798	90.7	$5,575
	10	17,798	54.3	$1,717	17,798	116.8	$7,314
RT	1	30	0.0	$297	30	-	($471)
	2	30	0.1	$835	30	-	($471)
	3	30	0.1	$1,075	30	-	($471)
	4	30	0.1	$1,257	30	-	($471)
	5	30	0.1	$1,497	30	-	($471)
	6	30	0.1	$1,783	30	-	($471)
	7	30	0.1	$1,671	30	-	($471)
	8	30	0.1	$2,180	30	-	($471)
	9	30	0.1	$2,975	30	-	($471)
	10	30	0.2	$5,041	30	-	($471)
Total AC/Heating Economic Potential (only included if economic)			730.1			657.2	
Additional Potential from WH and PP			117.2			240.2	
Total Potential			**847.3**			**897.4**	

Similar tables are presented for multifamily residential, small C&I, and large C&I customers. With the exception of several smaller multi-family residential customer segments, nearly all of the multi-family residential customers are economic. Almost all small C&I industries are economic and all of the Large C&I customers are economic.

Table 6-6: DEC Residential Multifamily Economic Potential Results

	Multifamily				Winter		
	Usage bin	# of accounts	Agg. MW	Total Net Benefit per Customer	# of accounts	Agg. MW	Total Net Benefit per Customer
RS	1	1,370	0.9	($19)	-	-	$0
	2	1,370	1.5	$302	-	-	$0
	3	1,370	1.9	$518	-	-	$0
	4	1,370	2.3	$709	-	-	$0
	5	1,370	2.6	$870	-	-	$0
	6	1,370	2.9	$1,052	-	-	$0
	7	1,370	3.3	$1,238	-	-	$0
	8	1,370	3.5	$1,369	-	-	$0
	9	1,370	3.9	$1,548	-	-	$0
	10	1,370	5.4	$2,371	-	-	$0
RE	1	4,423	2.6	($49)	4,423	6.4	$1,244
	2	4,423	3.9	$168	4,423	9.2	$2,006
	3	4,423	4.7	$298	4,423	11.1	$2,504
	4	4,423	5.5	$417	4,423	12.7	$2,946
	5	4,423	6.3	$551	4,423	14.2	$3,331
	6	4,423	7.0	$667	4,423	15.9	$3,800
	7	4,423	7.9	$810	4,423	18.0	$4,352
	8	4,423	9.0	$988	4,423	20.3	$4,974
	9	4,423	10.5	$1,223	4,423	23.7	$5,890
	10	4,423	14.0	$1,794	4,423	31.7	$8,041
RT	1	-	-	$0	-	-	$0
	2	-	-	$0	-	-	$0
	3	-	-	$0	-	-	$0
	4	-	-	$0	-	-	$0
	5	-	-	$0	-	-	$0
	6	-	-	$0	-	-	$0
	7	-	-	$0	-	-	$0
	8	-	-	$0	-	-	$0
	9	-	-	$0	-	-	$0
	10	-	-	$0	-	-	$0
Total AC/Heating Economic Potential (only included if economic)			71.4			163.3	
Additional Potential from WH and PP			11.7			32.1	
Total Potential			**83.1**			**195.4**	

Table 6-7: DEC Small C&I Economic Potential Results

SMB	Summer			Winter		
Segment	# Accounts	Agg. MW	Total Net Benefit per Customer	# Accounts	Agg. MW	Total Net Benefit per Customer
Assembly	7,432	20.8	$1,364	353	5.5	$17,842
Colleges and Universities	245	1.4	$3,391	20	0.7	$41,818
Data Centers	108	0.4	$2,064	5	0.1	$28,666
Grocery	516	2.8	$3,255	232	7.6	$38,211
Healthcare	1,823	7.7	$2,396	167	4.6	$32,022
Hospitals	96	0.6	$3,607	4	0.1	$44,258
Institutional	2,144	3.6	$558	101	1.3	$14,291
Lodging (Hospitality)	479	1.3	$1,344	96	2.1	$25,503
Miscellaneous	10,588	7.8	($111)	2,093	11.1	$5,629
Office	13,978	23.5	$567	1,381	16.4	$13,414
Restaurants	1,718	16.6	$6,300	183	8.4	$53,929
Retail	18,091	34.9	$746	2,503	31.0	$14,059
Schools K-12	601	1.7	$1,354	29	0.7	$25,615
Warehouse	674	1.2	$611	34	0.4	$13,438
Agriculture & Forestry	8	0.0	$262	8	0.0	$6,743
Chemicals & Plastics	167	0.7	$2,278	167	4.6	$32,057
Construction	4	0.0	$648	4	0.0	$408
Electrical & Electronic Equipment	82	0.2	$1,013	82	1.2	$16,514
Lumber, Furniture, Pulp and Paper	229	0.6	$1,395	229	4.2	$20,998
Metal Products & Machinery	423	1.6	$2,075	423	10.5	$28,798
Misc. Manufacturing	203	0.6	$1,536	203	4.0	$22,619
Primary Resource Industries	-	-	$0	-	-	$0
Stone, Clay, Glass and Concrete	52	0.2	$2,602	52	1.8	$39,643
Textiles & Leather	87	0.5	$3,168	87	3.3	$44,918
Transportation Equipment	100	0.1	$329	100	1.1	$12,587
Water and Wastewater	-	-	$0	-	-	$0
Total		**121.0**			**120.7**	

Table 6-8: DEC Large C&I (1 MW and Up) Economic Potential Results

Large C&I			Summer		Winter			
Segment	MW of Tech Potential for cost calc (max of winter and summer)	Total Cost	Agg. MW	Total Benefit	Agg. MW	Total Benefit	Total Aggregate Net Benefit	Total Net Benefit per MW
Agriculture and Assembly	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Chemicals and Plastics	19.6	$ 3,143.30	19.6	$ 14,084,719	16.9	$ 8,906,112	$ 22,987,687	$ 1,170,118.85
College and University	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Construction	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Data Center	0.7	$ 104.60	0.3	$ 19,174	0.7	$ 775,488	$ 794,557	$ 1,215,365.06
Electrical and Electronic Equip.	0.3	$ 44.85	0.2	$ 13,852	0.3	$ 332,515	$ 346,322	$ 1,235,453.09
Grocery	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Healthcare	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Hospitals	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Institutional	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Lodging/Hospitality	1.9	$ 305.30	1.9	$ 1,368,031	1.4	$ 731,063	$ 2,098,788	$ 1,099,906.31
Lumber/Furniture/Pulp/Paper	14.5	$ 2,313.22	6.9	$ 404,593	14.5	$ 17,149,555	$ 17,551,835	$ 1,214,021.32
Metal Products and Machinery	10.2	$ 1,631.68	10.2	$ 7,311,355	8.3	$ 4,397,435	$ 11,707,158	$ 1,147,985.72
Miscellaneous	42.4	$ 6,781.44	11.5	$ 675,870	42.4	$ 50,275,754	$ 50,944,843	$ 1,201,982.88
Miscellaneous Manufacturing	0.7	$ 115.58	0.7	$ 517,918	0.5	$ 250,020	$ 767,822	$ 1,062,876.21
Office	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Primary Resources Industries	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Restaurants	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Retail	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Schools K-12	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Stone/Clay/Glass/Concrete	2.6	$ 411.22	2.6	$ 1,842,636	0.3	$ 162,069	$ 2,004,295	$ 779,838.71
Textiles and Leather	67.8	$ 10,855.02	67.8	$ 48,639,999	53.0	$ 27,991,525	$ 76,620,668	$ 1,129,367.43
Transportation Equipment	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Warehouse	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Water and Wastewater	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Total	**160.7**		**121.9**		**138.2**			

6.5 DEP DSM Economic Potential

Cost effectiveness screening for economic potential revealed that the vast majority of the technical potential presented in the prior chapter is cost-effective on a marginal basis. Summary results for the economic potential for DEC are presented in Table 6-9. Comparing these numbers to the DEC technical potential by sector in Table 5-7 shows that the only significant amount of technical potential that is uneconomic is summer capacity from the residential sector. This can be attributed to DEP allocating 100% of avoided generation capacity benefits to the winter. All of the segments that have capacity in Small and Large C&I are economic.

Table 6-9: DEP DSM Economic Potential by Sector

Sector	Annual Economic Potential	
	Summer (Agg MW)	Winter (Agg MW)
Residential	166	361
Small C&I	141	145
Large C&I	2	2
Total	308	507

Results for single family residential customer segments are presented in Table 6-10. This table summarizes the aggregate capacity each customer segment would be able to provide during summer and winter peaks, along with the net benefits associated with that capacity, based on avoided generation and T&D costs. The segments are binned by consumption decile. Because DEP does not have an electric heating rate, the number of customers assumed to have electric heating for each rate was based on the same end-use saturation studies used for the energy efficiency analysis.

Customer segments that do not pass the cost effectiveness screen have negative net benefits in red font. For single family residential customers, there are several customer segments that are uneconomic to pursue for DSM implementation: customers that fall in the lower half of electricity consumption in the RES rate and the first two consumption deciles of the TOU rate.

Table 6-10: DEP Residential Single Family Economic Potential Results

	Single Family	Summer			Winter		
	Usage bin	Cooling Customer Counts	Agg. MW	Total Net Benefit per Customer	Heating Customer Counts	Agg. MW	Total Net Benefit per Customer
RES	1	11,747	5.9	($354)	7,556	8.4	$419
	2	11,747	11.3	($246)	7,556	14.4	$1,045
	3	11,747	14.1	($188)	7,556	17.0	$1,325
	4	11,747	16.3	($145)	7,556	19.1	$1,546
	5	11,747	18.2	($106)	7,556	21.3	$1,776
	6	11,747	20.3	($65)	7,556	23.4	$1,995
	7	11,747	22.6	($19)	7,556	25.7	$2,238
	8	11,747	25.5	$38	7,556	28.3	$2,513
	9	11,747	29.3	$115	7,556	32.0	$2,911
	10	11,747	40.1	$332	7,556	41.4	$3,893
TOU	1	160	0.2	($167)	122	0.3	$1,535
	2	160	0.3	($29)	122	0.4	$2,314
	3	160	0.4	$61	122	0.5	$3,031
	4	160	0.4	$113	122	0.6	$3,304
	5	160	0.5	$235	122	0.6	$3,445
	6	160	0.5	$302	122	0.7	$3,912
	7	160	0.6	$369	122	0.7	$4,311
	8	160	0.6	$454	122	0.8	$4,961
	9	160	0.8	$653	122	0.9	$5,680
	10	160	1.0	$998	122	1.4	$8,370
Total AC/Heating Economic Potential (only included if economic)			99.6			237.9	
Additional Potential from WH and PP			41.8			67.8	
Total Potential			**141.4**			**305.7**	

Similar tables are presented for multifamily residential, Small C&I, and large C&I customers. With the exception of several smaller multi-family residential customer segments, nearly all of these customers are economic.

Table 6-11: DEP Residential Multifamily Economic Potential Results

	Multifamily	Summer			Winter		
	Usage bin	Cooling Customer Counts	Agg. MW	Total Net Benefit per Customer	Heating Customer Counts	Agg. MW	Total Net Benefit per Customer
RES	1	1,776	1.1	($325)	1,489	0.8	($66)
	2	1,776	1.8	($239)	1,489	1.3	$209
	3	1,776	2.2	($184)	1,489	1.6	$388
	4	1,776	2.6	($130)	1,489	2.4	$802
	5	1,776	2.9	($89)	1,489	3.3	$1,275
	6	1,776	3.4	($25)	1,489	4.1	$1,704
	7	1,776	3.8	$38	1,489	5.0	$2,212
	8	1,776	4.3	$102	1,489	6.3	$2,899
	9	1,776	5.0	$194	1,489	8.2	$3,925
	10	1,776	7.0	$449	1,489	12.7	$6,316
TOU	1	-	-	$0	-	-	$0
	2	-	-	$0	-	-	$0
	3	-	-	$0	-	-	$0
	4	-	-	$0	-	-	$0
	5	-	-	$0	-	-	$0
	6	-	-	$0	-	-	$0
	7	-	-	$0	-	-	$0
	8	-	-	$0	-	-	$0
	9	-	-	$0	-	-	$0
	10	-	-	$0	-	-	$0
Total AC/Heating Economic Potential (only included if economic)			20.2			44.7	
Additional Potential from WH and PP			4.1			10.1	
Total Potential			**24.3**			**54.9**	

Table 6-12: DEP Small C&I Economic Potential Results

SMB	Summer			Winter		
Segment	# Accounts	Agg. MW	Total Net Benefit per Customer	# Accounts	Agg. MW	Total Net Benefit per Customer
Assembly	2,776	14.3	$569	132	5.7	$34,085
Colleges and Universities	86	1.6	$3,839	7	0.9	$99,327
Data Centers	24	0.0	($177)	1	0.0	$16,643
Grocery	242	2.7	$1,953	109	7.2	$52,286
Healthcare	748	8.7	$2,107	69	5.6	$64,824
Hospitals	68	1.4	$4,341	2	0.3	$105,813
Institutional	1,482	7.0	$474	70	2.6	$29,403
Lodging (Hospitality)	229	2.1	$1,499	46	3.0	$51,394
Miscellaneous	1,671	5.3	$112	330	7.7	$17,891
Office	9,416	28.7	$78	930	24.7	$20,531
Restaurants	887	13.2	$2,859	95	6.9	$57,544
Retail	4,924	21.5	$388	681	21.9	$24,965
Schools K-12	719	21.6	$6,411	35	6.3	$142,853
Warehouse	255	0.9	$198	13	0.4	$21,431
Agriculture & Forestry	3	0.6	$39,890	3	2.5	$598,157
Chemicals & Plastics	9	0.4	$8,576	9	1.7	$147,881
Construction	4	0.1	$4,795	4	0.4	$87,564
Electrical & Electronic Equipme	14	0.3	$3,960	14	1.3	$75,389
Lumber, Furniture, Pulp and Pap	28	3.0	$23,972	28	13.4	$376,733
Metal Products & Machinery	40	1.8	$9,847	40	8.3	$165,328
Misc. Manufacturing	19	0.7	$7,438	19	4.2	$172,721
Primary Resource Industries	2	0.0	$0	2	0.2	$65,968
Stone, Clay, Glass and Concrete	9	0.1	$2,963	9	0.7	$59,407
Textiles & Leather	23	2.9	$29,648	23	13.1	$459,012
Transportation Equipment	18	1.7	$22,291	18	5.6	$247,916
Water and Wastewater	-	-	$0	-	-	$0
Total		**140.6**			**144.7**	

Table 6-13: DEP Large C&I (1 MW and Up) Economic Potential Results

Large C&I			Summer		Winter			
Segment	MW of Tech Potential for cost calc (max of winter and summer)	Total Cost	Agg. MW	Total Benefit	Agg. MW	Total Benefit	Total Aggregate Net Benefit	Total Net Benefit per MW
Agriculture and Assembly	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Chemicals and Plastics	0.0	$ -	-	$ -	-	$ -	$ -	$ -
College and University	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Construction	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Data Center	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Electrical and Electronic Equip.	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Grocery	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Healthcare	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Hospitals	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Institutional	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Lodging/Hospitality	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Lumber/Furniture/Pulp/Paper	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Metal Products and Machinery	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Miscellaneous	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Miscellaneous Manufacturing	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Office	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Primary Resources Industries	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Restaurants	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Retail	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Schools K-12	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Stone/Clay/Glass/Concrete	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Textiles and Leather	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Transportation Equipment	2.0	$ 323.14	2.0	$ 475,003	1.5	$ 860,985	$ 1,335,666	$ 661,351.61
Warehouse	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Water and Wastewater	0.0	$ -	-	$ -	-	$ -	$ -	$ -
Total	**2.0**		**2.0**		**1.5**			

6.6 Utility Cost Test Sensitivity

At Duke Energy's request, Nexant conducted a sensitivity analysis for economic potential, using the utility cost test criterion to screen measures. Nexant used current measure incentive rates, or proxy rates for non-program or non-cost effective measures in similar end uses to current program measures. The utility cost test compares the cost for a utility to provide incentives and administer a program against the avoided cost benefits of energy efficiency. The UCT does not consider customers' perspectives when comparing cost and benefits. The results of this sensitivity indicate an increase of economic potential by 74%, 49%, and 11% for the residential, commercial, and industrial sectors in DEC. The results indicate an increase of economic potential by 24%, 54%, and 2% for the residential, commercial, and industrial sectors in DEP. For DSM, the UCT and TRC yield the same results, as incentives are used as a proxy participant cost for TRC for DSM analysis.

7 Program Potential

Program potential is the subset of economic potential describing EE and DSM measure adoption by customers participating in utility-sponsored programs operating within the subject market or jurisdiction. Customers may not choose to implement all cost-effective EE and DSM measures, for a variety of reasons, some of which may include: customer preferences or opportunity costs; time and effort required to acquire and install new measures (transaction costs); or, high measure costs and lack of capital. Many customers may not meet these “market requirements” for EE and DSM; yet, others may face market barriers such as: lack of knowledge about electricity consumption and associated technology; principal-agent issues, a.k.a. “split incentive,” problems; externalities; or, imperfect marketplace competition that potentially limits availability of some measures, increases measure costs, or affects customers’ incomes.

Program potential is based on estimating the share of customers that may choose to participate in utility-sponsored programs. The primary source of data on for such estimates is the programs themselves. Duke Energy has been offering EE and DSM programs to customers for over ten years. Program participation data collected by Duke Energy over the years can be used to estimate the share of customers within their territory that seeks to adopt EE and DSM under the portfolio of offered programs.

7.1 Program Potential Scenario Descriptions

Nexant met with program staff to identify current program and measure offerings, as well as measures that are planned to be added to the program in the next one to two years. Duke Energy provided Nexant this information to ensure Nexant’s MPS measures were appropriately mapped to existing programs, and captured the measure offerings currently being contemplated by Duke Energy. This effort was used to develop a base case scenario for program potential.

Nexant also worked with Duke Energy to define an enhanced scenario and an avoided cost sensitivity scenario. The results of TRC screening for economic potential showed that numerous residential equipment measures, such as high efficiency HVAC equipment, were not cost effective. Recent market trends towards more efficient LED lighting and declining utility avoided costs of energy also lead to fewer commercial measures passing the TRC screening. Nexant has also observed this trend in other jurisdictions and recent studies.

Nexant also defined an enhanced scenario to explore whether additional potential would be present with higher utility program spending. Utility-sponsored programs generally reduce costs or barriers in an effort to increase market adoption of EE and DSM. A program can do this in a variety of ways: increased incentives, improved marketing, etc. Nexant’s model describes program spending categorically, as either incentive costs or administrative costs. Program design improvements and strategic management are an important part of the EE and DSM program lifecycle. Duke Energy conducts rigorous program evaluation activities designed to improve program impacts and processes. Nexant's review of historic program evaluation, measurement, and verification (EM&V) and recent program activities is included in Appendix E. While program design and optimization is outside the scope of this MPS, Nexant's enhanced scenario describes the expected market response to higher incentives that reduce participant costs for EE and DSM.

The avoided cost sensitivity scenario therefore provides an opportunity to explore what magnitude of change in avoided energy costs would be necessary to significantly increase EE and DSM potential (e.g. produce more EE measures with a passing TRC score).

7.2 Summary of Current Programs

Nexant reviewed existing Duke Energy programs to identify the objectives, target markets, existing measures, and delivery mechanisms for each. This review included recent program evaluation reports and publicly available program information on Duke's website or in program marketing literature. Nexant coordinated multiple meetings with Duke Energy product development and program staff to clarify our understanding of current and proposed initiatives and details of South Carolina market conditions.

Nexant assigned each EE measure to one or more program offerings across the residential, commercial, and industrial customer segments, and DSM opportunities were classified into specific offerings across the customer segments. Nexant did not identify any measure gaps in Duke Energy's EE portfolio.

Based on Nexant's measure database and review of Duke Energy programs, Duke Energy is offering (or will offer in the next one to two years) all cost-effective EE measures through one of their current programs. Table 7-1 presents a summary of Duke Energy's residential programs.

Table 7-1: Residential EE Program Offerings

Program	Description	Targeted Segments	Delivery Approach
Smart $aver	Contractor-driven program addressing need for HVAC equipment, water heating equipment, building envelope, and pool measures	All residential building types	*Marketing strategy:* target customer segment *Customer experience:* technical assistance *Incentive type:* customer rebate
Audits and EE Kits	Focuses on energy efficiency education, and installation of highly cost-effective measures.	All residential building types; note: decision-maker varies by building type	*Marketing strategy:* mass marketing *Customer experience:* direct install & behavior *Incentive type:* giveaway
EE Products (Online Store)	Designed to deliver energy efficiency upgrades on typical residential appliances that can be self-installed by residential customers.	All residential building types	*Marketing strategy:* mass marketing & joint marketing *Customer experience:* self-directed, online store *Incentive type:* midstream rebate (discount)
Income Qualified	Leverages existing resources and outreach for low income community to support energy efficiency.	All residential building types, demographic limitations	*Marketing strategy:* target customer segment *Customer experience:* technical assistance & direct install *Incentive type:* direct install
New Construction	Targets energy efficiency whole building measures and individual high cost measures for new homes.	All residential building types (new construction)	*Marketing strategy:* joint marketing *Customer experience:* technical assistance *Incentive type:* customer rebate
Behavioral	Provides customers with data on their home energy consumption and tips to reduce energy use. Information provided through periodic usage reports as well as direct feedback with real-time usage information for their home.	All residential building types	*Marketing strategy:* opt-out; direct marketing *Customer experience:* behavioral *Incentive type:* social

Table 7-2 summarizes Duke Energy's Commercial and Industrial program offerings. Duke Energy offers both sectors a wide variety of measure options and participation channels.

Table 7-2: Non-Residential EE Program Offerings

Program	Description	Targeted Segments	Delivery Approach
Smart $aver-Prescriptive	Reduced costs and increases efficiency of commercial and industrial equipment.	All non-residential building types	*Marketing strategy:* target customer segment *Customer experience:* self-directed *Incentive type:* customer rebate
Smart $aver – Custom	Non-typical or variable savings; larger projects.	All non-residential building types	*Marketing strategy:* target customer segment *Customer experience:* technical assistance *Incentive type:* customer rebate
Small Business Energy Saver	Free audit and aggressively discounted measures; lowers customers' participation burden with a direct install approach.	Non-residential small business customers (less than 200 kW demand)	*Marketing strategy:* target customer segment *Customer experience:* direct install *Incentive type:* upstream incentive/mark-down
New Construction	Influences the design and construction phase of the commercial real estate market. Offers design assistance and cash incentives for a package of whole-building energy opportunities.	All non-residential building types	*Marketing strategy:* target customer segment *Customer experience:* technical assistance *Incentive type:* customer rebate
Pay-for-Performance	Offering measures are similar to Smart $aver-Custom Program with part of the incentives paid a year later to customers.	All non-residential building types	*Marketing strategy:* target customer segment *Customer experience:* technical assistance *Incentive type:* customer rebate

Duke Energy has been offering DSM services for over 10 years, and the program offers cover a variety of approaches for load management such as direct utility control; contractual programs for guaranteed load drop and emergency load management; and, load control programs that incentivize economic load response. These programs are described in Table 7-3.

Table 7-3: Proposed DSM Program Offerings

Type of DSM	Sector	Technology
Utility controlled loads	Residential	▪ Central AC switches ▪ Smart thermostat ▪ Water heater switches ▪ Home gateway (control HVAC, water heater, pool pumps, power strips) ▪ Pool pumps
	Non-Residential	▪ Lighting controls (EMS or lighting ballasts) ▪ HVAC controls (EMS) ▪ Pump loads ▪ Auto DSM for process loads ▪ Battery storage ▪ Backup generation
Contractual	Non-Residential	▪ Interruptible rates – Firm service levels ▪ Guaranteed Load Drop ▪ Emergency Load Response ▪ Economic Load Response

7.3 Approach and Assumptions of Program Potential

Program potential describes a subset of customers expected to take advantage of Duke Energy EE and DSM programs. Data concerning individual customer purchases of EE and DSM equipment are not widely available and may be sparse in their coverage of EE and DSM measure opportunities. EPA's ENERGY STAR program estimates the market penetration of certified products, and EIA's periodic market assessments provide the primary basis for understanding current market penetration of EE technology.

In addition to these sources, Duke Energy conducts residential appliance saturation surveys (RASS) to better understand the energy consumption of residential customers in the Duke Energy service territory. Commercial and industrial building and equipment baselines are limited to the modeling and analysis available from EIA. Nexant makes use of this available data when conducting a market potential study.

Nexant applies widely accepted economic theory and practice to make projections for future program adoption within this market setting, and on the basis of these available data sources. Duke Energy's historic program participation data provides the best insight into how customers in South Carolina will respond to utility-sponsored EE and DSM program offers. Nexant's projections are grounded in observed participation trends and vetted modeling frameworks that describe product diffusion.

7.3.1 Market Adoption Rates

Utility-sponsored DSM programs offer incentives for energy efficiency measures that are designed to lower customers' costs and increase the rate at which the market adopts energy efficiency technologies. Nexant analyzed Duke Energy's EE and DSM program participation data to estimate the market penetration for EE measures offered over the past ten years in South Carolina by Duke Energy. Nexant's estimates of market penetration follow economic and marketing theory on product diffusion, or "diffusion of innovations."

Nexant used EPA ENERGY STAR data, EIA end use intensity estimates, and Duke Energy program participation data to derive estimates of baseline market saturation and savings opportunities. Participation in Duke Energy's most recent program year prior to the MPS (2019) is taken as the baseline cumulative program saturation, which describes that share of customers that have previously participated in Duke Energy programs. Projections of future participation and the ultimate maximum market saturation are determined by the historic rate of program participation and the imposed functional form of market adoption under theories of product diffusion.

We apply a structured model of market adoption, referred to as the Bass diffusion model. The Bass model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. It was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to conservation and demand management (CDM) in the energy industry[2]. Nexant used historic Duke Energy program participation data to develop and apply Bass Model diffusion parameters in the South Carolina jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept of cumulative market saturation is illustrated in Figure 7-1.

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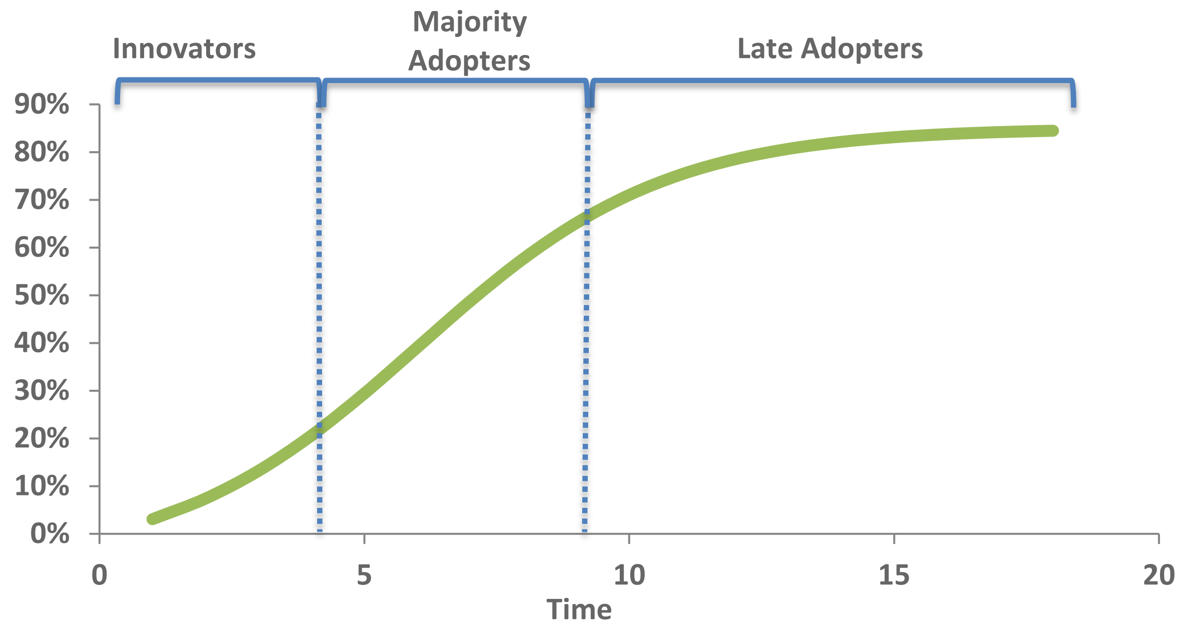
[1] Bass, F. 2004. Comments on "A New Product Growth for Model Consumer Durables the Bass Model" (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

[2] Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 7-1: Bass Model Cumulative Market Penetration



The Bass Diffusion model is a mathematical description of how the rate of new product diffusion in a market changes over time. Figure 1 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt} =$ the rate of adoption for any discrete time period, *t*

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

$S(t-1) =$ the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

7.3.2 Scenario Analysis

Section 7.2 described Duke Energy's current or proposed program offers for South Carolina. Nexant estimated market potential for these program offerings under three program potential scenarios, each of which is summarized below:

- Base scenario – aligns with existing program portfolio, and includes existing EE programs and measures currently offered by DEC or DEP
- Enhanced scenario – Include the base scenario, but with increased program spending (via incentives) designed to attract new customers into the market for EE technology and program participation.[3]
- Avoided Energy Cost Sensitivity scenario – covers the base scenario, but with a sensitivity analysis around enhanced EE benefits, such as may occur if avoided energy costs were higher than current values.

Duke Energy currently offers customers a wide array of cost-effective opportunities for implementing energy efficiency. Residential offers are packaged into discrete products and services, but nearly any intervention that can be shown to generate cost-effective savings is available to commercial and industrial customers that have not opted-out of EE programs.

Furthermore, Duke Energy has offered EE and DSM programs in South Carolina since 2008, during which time they have followed best practices for managing the EE and DSM program life cycle. These practices include periodic assessments of market potential; strategic program design that includes a variety of program implementation approaches; rigorous program evaluations of impacts and processes; and, iterating over the EE and DSM program life cycle to continually improve programs.

Nexant developed Base and Enhanced scenarios in conjunction with Duke Energy to examine the underlying drivers of EE and DSM economic potential in South Carolina. The avoided energy cost sensitivity scenario look at sensitivities associated with the costs and benefits of investments in EE and DSM technology, recognizing the work Duke Energy is doing to separately focus on adaptive management approaches of the EE and DSM program lifecycle framework.

7.4 DSM Market Potential Methodology

7.4.1 Estimation of Participation Rates for DSM Programs

While economic potential merely considers whether a given customer segment is worth pursuing based on the marginal net benefits provided by those customers, achievable potential takes into account the estimated participation rate and how that affects the overall cost-effectiveness of the customer segment.

[3] Incentive rates were doubled, but subject to a maximum rate of 75% of measure incremental cost.

The magnitude of DSM resources that can be acquired is fundamentally the result of customer preferences, program or offer characteristics (including incentive levels), and how programs are marketed. How predisposed are specific customers to participate in DSM? What are details of specific offers and how do they influence enrollment rates? What is the level of marketing intensity and what marketing tactics are employed?

For program-based DSM, participation rates are calculated as a function of the incentives offered to each customer group. For a given incentive level and participation rate, the cost-effectiveness of each customer segment is evaluated to determine whether the aggregate DSM potential from that segment should be included in the achievable potential.

The following subsections describe how marketing/incentive level, participation rates, and technology costs are handled by this study.

7.4.2 Marketing and Incentive Levels for Programs

Several underlying assumptions are used to define the marketing level for program potential. The number of marketing attempts and the method of outreach are described in Table 7-4. Nexant assumed that Duke's existing marketing methods would remain constant for all three scenarios.

The specific tactics included in the table are not prescriptive but are instead designed to provide concrete details about the assumptions used in the study. There is a wide range of strategies and tactics that can attain the same enrollment levels and the best approach for a jurisdiction is best developed through testing and optimizing the mix of marketing tactics and incentives.

Table 7-4: Marketing Inputs for Residential Program Enrollment Model

		Input
Marketing Components	Number of marketing attempts (Direct mail)	3
	Outreach mode	Direct Mail + Phone
	Installation required (%)	40%

The incentive level and marketing inputs for each scenario determine the participation rate, assuming that the incentive is uniform across all customer segments within a given customer class. For the base scenario, Nexant assumed the existing incentives for DSM programs would continue to be used. For the enhanced scenario, Nexant assumed that the existing incentive levels for each program would double.

7.4.3 Participation Rates

The participation models for the residential and nonresidential customer segments use a bottom up approach to estimate participation rates. These estimates have been crosschecked with mature programs in other utilities and Duke Energy jurisdictions to ensure that the estimated participation rates are reasonable.

Many DSM potential studies rely on top down approaches which benchmark programs against enrollment rates that have been attained by mature programs. However, aggregated program results often do not provide enough detail to calibrate achievable market potential. In many cases, programs are not marketed to all customers, either because it is not cost-effective to market to all customers or budgets are capped by regulators. Enrollment rates are a function of specific offers and the extensiveness of marketing over many years. They also vary based on the degree to which DSM resources are utilized and tend to be higher when payments are high but actual events are infrequent, particularly among large C&I customers.

For residential customers, the Nexant approach to estimate participation rates involves five steps. The initial step required some modification due to the data provided (or lack thereof).

1) Estimate an econometric choice model based on who has and has not enrolled in DSM programs. The goal is to estimate the pre-disposition or propensity of different customers to participate in DSM based on their characteristics. Because micro-level acquisition marketing data were not provided, Nexant relied on differences in participation rates by usage level, electric heating and income level. This information is based on prior micro-level analysis of program participation by Nexant and supplemented by outbound acquisition marketing that Nexant implements for load control programs.
2) Incorporate information about how different offer characteristics influence enrollment likelihood. What is the incremental effect of incentives? How do requirements for on-site installation affect enrollment rates? The two questions above have been analyzed using California specific data for residential customers. In each case, regression coefficients describe the incremental effect of each of the above factors on participation rates.
3) Incorporate information about how marketing tactics and intensity of marketing influence participation rates. What is the effect of incremental acquisition attempts? Is there a bump in enrollment rates when phone and/or door-to-door recruitment is added to direct mail recruitment? This relies on data from side-by-side testing designed to explicitly quantify the effect of marketing tactics on enrollment rates.
4) Calibrate the models to reflect actual enrollment rates attained with mature programs. To calibrate the models, the constant is adjusted so that the model produces exactly the enrollment rates observed by mature programs used for benchmarking.
5) Predict participation rates using specific tactics and incentive levels for programs with and without installation requirements. The enrollment estimates were produced for low, medium, and high marketing levels, where specific marketing tactics are specified for each scenario. All estimates reflect enrollment rates for eligible customers.

For small C&I customers (1 MW or less), a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger nonresidential customers, and were scaled accordingly based on existing participation seen in DEC and DEP small C&I DSM programs.

For large nonresidential customers, enrollment levels were predicted as a function of load rather than the number of customers, since large customers tend to have relatively high participation rates and commit to relatively large demand reductions on a percentage basis. For these customers, publicly available data on DSM programs offered by California utilities were used to model program participation rates. Participation data were combined with data from the utilities on customer size and industry to generate a breakdown of participation rates, which is summarized in Table 7-5.

Table 7-5: Large Nonresidential Participation Rates by Size and Industry

Industry	Annual Max Demand (Non-coincident)				Total
	100kw - 300kW*	300 - 500kW	500kW - 1MW	1 MW or more	
Agriculture, Mining & Construction	19.8%	43.2%	57.9%	60.7%	**44.6%**
Manufacturing	24.2%	44.8%	52.3%	74.0%	**64.6%**
Wholesale, Transport & Other Utilities	27.9%	50.1%	55.7%	60.8%	**49.7%**
Retail Stores	28.1%	53.0%	53.8%	48.0%	**42.7%**
Offices, Hotels, Finance, Services	13.0%	26.9%	34.3%	40.2%	**30.0%**
Schools	15.0%	30.5%	40.3%	52.5%	**35.7%**
Institutional/Government	13.7%	34.1%	42.8%	62.3%	**40.4%**
Other or Unknown	9.4%	25.3%	29.6%	29.5%	**18.6%**
Total	**19.7%**	**40.8%**	**45.6%**	**60.8%**	**45.4%**

These programs have been marketed to every large nonresidential customer in California, which is why California specific data reflect a saturated market and a good representation of the total potential. The main gap in applying these participation rates is the ability to use back-up generation for DSM. California does not allow the use of backup generation for DSM while South Carolina does.

For each large nonresidential customer segment, participation was estimated as a function of incentive level and number of dispatch hours, based on publicly available information on program capacity, dispatch events, and incentive budgets.

Finally, these models were calibrated to reflect actual enrollment from DEC marketing initiatives for the Power Manager® (residential) and PowerShare® (nonresidential) programs and DEP marketing initiatives for EnergyWise® and DEP's DSM Automation Program.

7.5 DEC Energy Efficiency Program Potential

This section provides the results of the DEC EE achievable program potential for each of the three segments.

7.5.1 Summary

Table 7-6 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) DEC portfolio EE program potential for the base, enhanced incentive, and the avoided energy cost sensitivity scenarios. Impacts are presented as both **cumulative impacts**, which represent the savings that occur in the respective year based on measures installed in that year and measures installed in prior years that have not reached the end of their useful life and **the sum of annual impacts**, which represent the total annual incremental savings achieved over the stated time horizon (5 years, 10 years, or 25 years). The cumulative impacts view is important when using MPS results for resource planning purposes because it accounts for how the incremental addition of EE savings will impact the overall system load and load impacts likely to occur as measures reach the end of their useful lives. The sum of annual impacts view aligns with how utilities report their EE achievements in annual cost recovery filings, which is to show the annual incremental additions each year.

Table 7-6: DEC EE Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	**% of Load**	**Total Potential**	**% of Load**	**Total Potential**	**% of Load**
5-yr (2024) impacts						
Cumulative MWh	186,315	1.65%	227,310	2.01%	192,125	1.70%
Cumulative MW Summer	49		55		50	
Cumulative MW Winter	19		22		19	
Sum of Annual MWh	512,733	4.53%	554,328	4.90%	518,478	4.58%
Sum of Annual MW Summer	179		185		180	
Sum of Annual MW Winter	48		51		48	
10-yr (2029) impacts						
Cumulative MWh	233,720	2.04%	292,996	2.55%	241,883	2.11%
Cumulative MW Summer	57		66		59	
Cumulative MW Winter	22		27		23	
Sum of Annual MWh	985,808	8.59%	1,053,562	9.18%	995,316	8.68%
Sum of Annual MW Summer	347		358		349	
Sum of Annual MW Winter	90		97		91	
25-yr (2044) impacts						
Cumulative MWh	182,370	1.35%	216,277	1.58%	187,859	1.37%
Cumulative MW Summer	52		58		53	
Cumulative MW Winter	15		19		15	
Sum of Annual MWh	2,460,578	18.01%	2,574,167	18.84%	2,476,921	18.13%
Sum of Annual MW Summer	882		901		886	
Sum of Annual MW Winter	224		235		226	

Figure 7-2, Figure 7-3, and Figure 7-4 show DEC achievable energy savings potential by sector for each scenario.

Figure 7-2: DEC 2024 Achievable Program Potential by Sector – Base Scenario

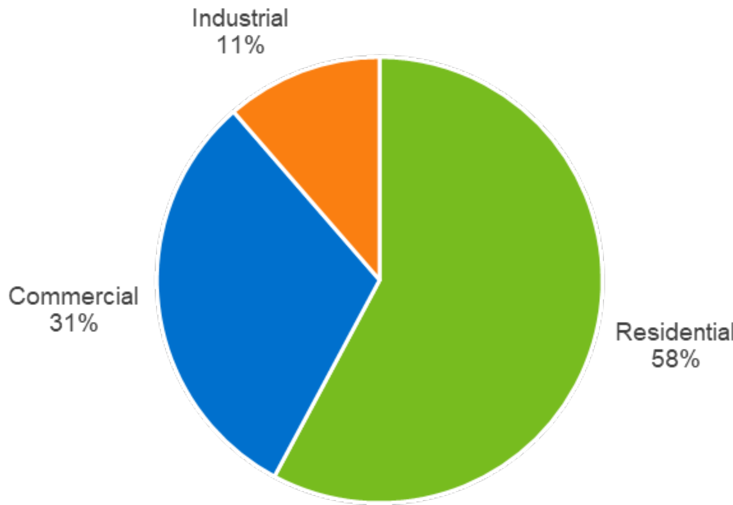


Figure 7-3: DEC 2024 Achievable Program Potential by Sector – Enhanced Scenario

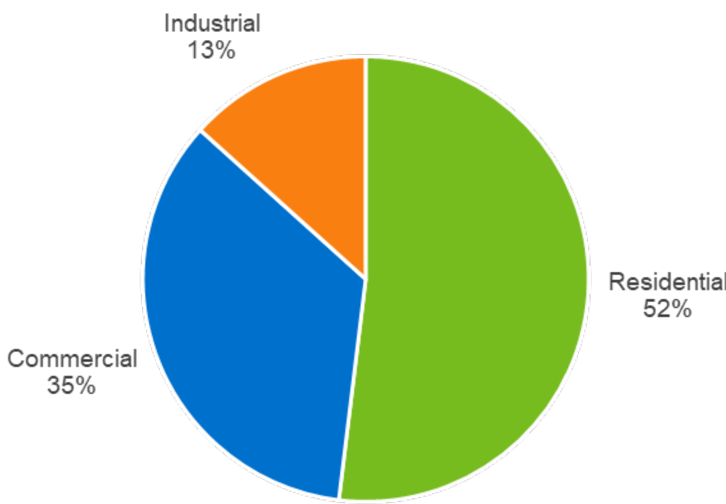
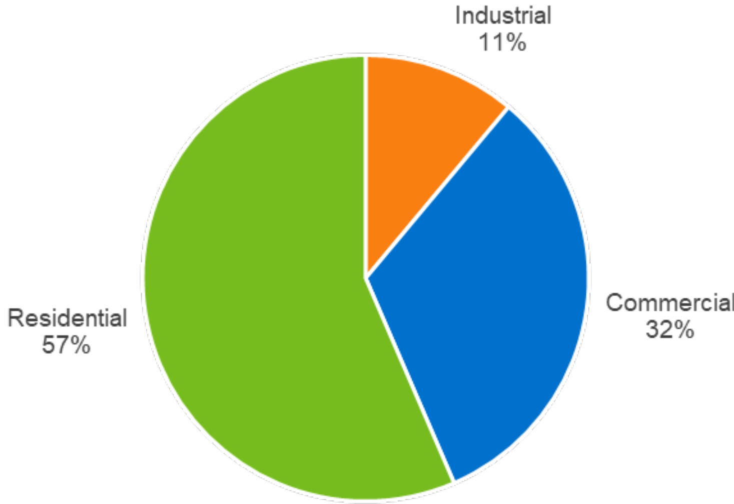


Figure 7-4: DEC 2024 Achievable Program Potential by Sector – Avoided Energy Cost Sensitivity Scenario



Participant and program costs associated with achievable program potential scenarios include the following:

- **Program incentives:** Financial incentives paid by energy-efficiency programs to subsidize purchases of energy-efficiency measures.
- **Program administration costs:** Administrative, marketing, promotional, and other costs associated with managing programs designed to achieve energy-efficiency savings.
- **Total program acquisition costs:** Total incentive and non-incentive program costs per sum of annual incremental energy savings achieved.
- **Participant costs:** Incremental costs to purchase, install, and maintain energy-efficiency measures.

Table 7-7 lists estimated participant and program costs associated with the theoretically achievable scenarios over the first 5 program years.

Table 7-7: DEC Participation and Program Costs by Scenario (cumulative through 2024)

Program Sector	Program Incentives ($M)	Program Admin ($M)	Participant Costs ($M)	Levelized Cost[4] ($/kWh)
Base Scenario				
Residential	$2.71	$29.60	$2.22	$0.06
Non-Residential	$4.77	$3.56	$8.27	$0.03
Total	$7.48	$33.16	$10.49	$0.05
Enhanced Scenario				
Residential	$4.83	$31.66	$1.94	$0.06
Non-Residential	$12.80	$4.96	$5.33	$0.03
Total	$17.63	$36.62	$7.27	$0.05
Avoided Energy Cost Sensitivity Scenario				
Residential	$2.87	$29.86	$2.65	$0.06
Non-Residential	$5.55	$3.89	$9.54	$0.03
Total	$8.42	$33.75	$12.19	$0.05

7.5.2 Residential Program Details

Table 7-8 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) cumulative residential energy efficiency program potential for the base, enhanced, and avoided energy cost sensitivity scenarios. Impacts are presented as both **cumulative impacts**, which represent the savings that occur in the respective year based on measures installed in that year and measures installed in prior years that have not reached the end of their useful life and **the sum of annual impacts**, which represent the total annual incremental savings achieved over the stated time horizon (5 years, 10 years, or 25 years):

[4] Levelized cost presented from the TRC perspective as the sum of incremental measure costs and program admin costs divided by the discounted sum of lifetime energy savings. Program potential costs include both incremental measure costs and program delivery and administrative costs.

Table 7-8: DEC EE Residential Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Res Load	Total Potential	% of Res Load	Total Potential	% of Res Load
5-yr (2024) impacts						
Cumulative MWh	109,707	1.65%	119,800	1.81%	110,269	1.66%
Cumulative MW Summer	38		40		38	
Cumulative MW Winter	12		13		12	
Sum of Annual MWh	435,403	6.57%	445,805	6.72%	435,892	6.57%
Sum of Annual MW Summer	168		170		168	
Sum of Annual MW Winter	41		42		41	
10-yr (2029) impacts						
Cumulative MWh	115,041	1.70%	126,374	1.86%	115,710	1.70%
Cumulative MW Summer	40		43		41	
Cumulative MW Winter	12		13		12	
Sum of Annual MWh	852,325	12.57%	866,178	12.78%	852,924	12.58%
Sum of Annual MW Summer	328		332		329	
Sum of Annual MW Winter	79		81		79	
25-yr (2044) impacts						
Cumulative MWh	105,962	1.28%	108,864	1.32%	106,009	1.28%
Cumulative MW Summer	41		42		41	
Cumulative MW Winter	9		10		9	
Sum of Annual MWh	2,221,488	26.88%	2,238,067	27.08%	2,222,105	26.89%
Sum of Annual MW Summer	849		854		850	
Sum of Annual MW Winter	204		207		205	

Figure 7-5, Figure 7-6, and Figure 7-7 illustrate the relative contributions to the overall residential program potential by program for the base and enhanced scenarios.

Figure 7-5: DEC Residential 5-Yr Cumulative Potential by Program – Base Scenario

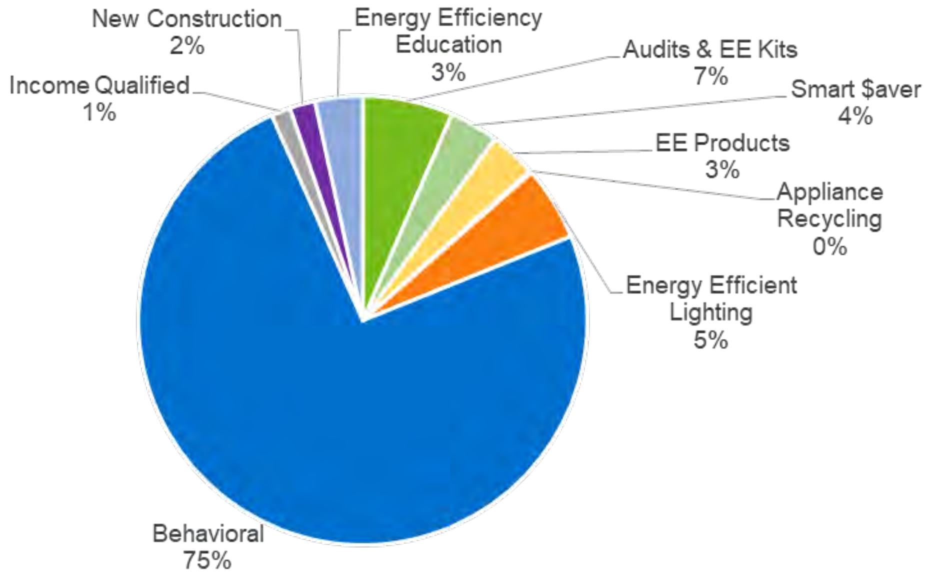


Figure 7-6: DEC Residential 5-Yr Cumulative Potential by Program – Enhanced Scenario

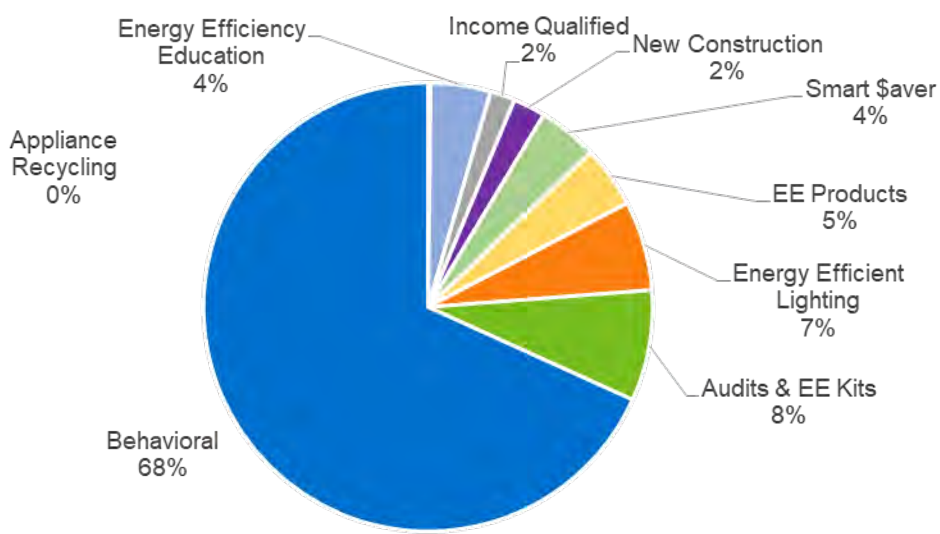
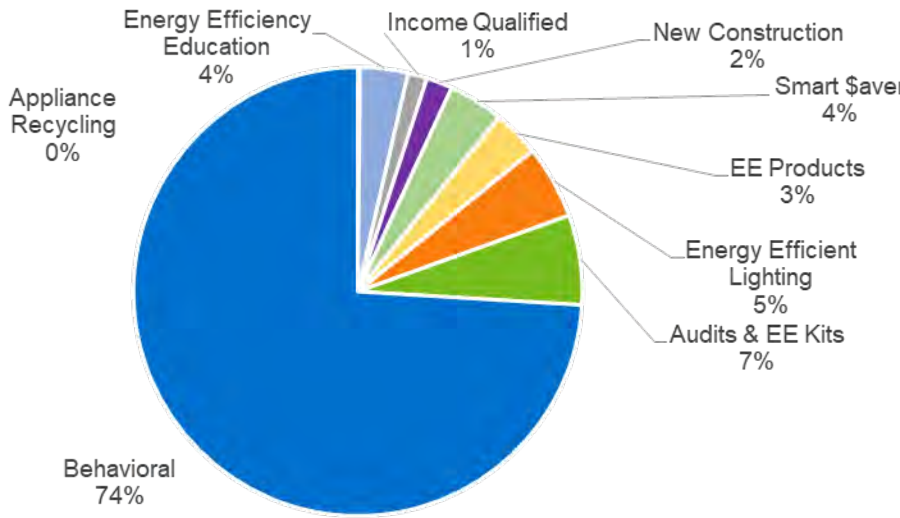


Figure 7-7: DEC Residential 5-Yr Cumulative Potential by Program – Avoided Energy Cost Sensitivity Scenario



Detailed program results for the short-term residential EE programs are provided in Table 7-9:

Table 7-9: DEC Residential Program Potential (cumulative through 2024)

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE. Education
5-yr (2024) impacts – Base scenario									
MWh savings (cumulative)	7,124	3,866	3,708	162	5,867	81,658	1,532	2,028	3,764
Summer MW savings (cumulative)	0.66	0.99	1.56	0.13	0.22	31.81	0.30	0.68	1.43
Winter MW savings (cumulative)	1.88	0.32	0.21	0.00	1.03	7.39	0.32	0.23	0.34
Program costs (cumulative) ($M)	$0.96	$2.13	$0.70	$0.09	$0.94	$23.93	$1.13	$0.98	$1.44
Levelized Cost ($/kWh)	$0.02	$0.11	$0.05	$0.10	$0.02	$0.07	$0.10	$0.09	$0.07
5-yr (2024) impacts – Enhanced scenario									
MWh savings (cumulative)	9,567	5,125	5,339	233	7,725	81,712	2,139	2,803	5,157
Summer MW savings (cumulative)	0.89	1.27	2.25	0.18	0.29	31.83	0.42	0.93	1.96
Winter MW savings (cumulative)	2.52	0.44	0.30	0.01	1.36	7.40	0.44	0.32	0.47
Program costs (cumulative) ($M)	$1.30	$3.39	$1.40	$0.15	$1.22	$23.93	$1.59	$1.54	$1.98
Levelized Cost ($/kWh)	$0.02	$0.11	$0.05	$0.10	$0.02	$0.07	$0.10	$0.09	$0.07

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE. Education
5-yr (2024) impacts – Avoided Energy Cost Sensitivity scenario									
MWh savings (cumulative)	7,124	4,391	3,704	162	5,832	81,650	1,530	2,066	3,810
Summer MW savings (cumulative)	0.66	1.30	1.56	0.13	0.22	31.81	0.30	0.70	1.45
Winterr MW savings (cumulative)	1.88	0.34	0.21	0.00	1.03	7.39	0.32	0.23	0.35
Program costs (cumulative) ($M)	$0.96	$2.51	$0.70	$0.09	$0.94	$23.92	$1.13	$1.02	$1.47
Levelized Cost ($/kWh)	$0.02	$0.12	$0.05	$0.10	$0.02	$0.07	$0.10	$0.09	$0.07

To analyze the costs and benefits of the program potential scenarios, Nexant used a number of common test perspectives in the MPS, consistent with the California Standard Practice Manual5:

- Total resource cost (TRC): Calculated by comparing the total avoided electricity production and the avoided delivery costs from installing a measure, to that measure's incremental cost. The incremental cost is relative to the cost of the measure's appropriate baseline technology.
- Utility cost test (UCT): Calculated by comparing total avoided electricity production and avoided delivery costs from installing a measure, to the utility's cost of delivering a program containing that measure. Costs include incentive and non-incentive costs.
- Participant cost test (PCT): Calculated by dividing electricity bill savings for each installed measure, by the incremental cost of that measure. The incremental cost is relative to the cost of the measure's appropriate baseline technology.
- Ratepayer Impact Measure (RIM): Calculated by comparing the total avoided electricity production and the avoided delivery costs from installing a measure, to the utility's revenue impacts from lost sales and program delivery.

Nexant shows achievable program potential estimates and benefits cost ratios according to current administrative cost data provided to Nexant by Duke Energy. Detailed program design is not part of this scope of work, and Nexant has no examined the components of the

[5] California Standard Practice Manual: Economic Analysis of Demand-Side Program and Projects. California Public Utilities Commission. San Francisco, CA. October 2001.

administrative costs provided by Duke Energy and applied by Nexant on a dollar-per-kilowatt-hour basis.

Table 7-10 provides the net benefits and benefit-to-cost ratios by sector for each scenario:

Table 7-10: DEC Cost-Benefit Results – Residential Programs (cumulative through 2024)

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE.Education
5-yr (2024) impacts – Base scenario									
TRC – Net Benefits($M)	$2.58	-$0.91	$0.68	$0.00	$2.27	$6.95	-$0.25	$0.08	-$0.11
TRC – B/C ratio	3.70	0.73	1.51	0.99	3.41	1.29	0.78	1.06	0.92
UCT – Net Benefits ($M)	$2.58	$0.33	$1.31	$0.02	$2.27	$6.95	-$0.25	$0.41	-$0.11
UCT – B/C ratio	3.70	1.15	2.88	1.21	3.41	1.29	0.78	1.42	0.92
PCT – Net Benefits ($M)	$5.04	$1.60	$1.53	$0.07	$4.49	$27.50	$0.95	$1.12	$2.23
PCT – B/C ratio	N/A	2.30	3.44	4.27	N/A	N/A	N/A	4.37	N/A
RIM – Net Benefits ($M)	-$1.43	-$2.56	-$0.85	-$0.07	-$2.22	-$20.55	-$1.20	-$1.04	-$2.39
RIM – B/C ratio	0.71	0.49	0.70	0.62	0.59	0.60	0.42	0.57	0.36
5-yr (2024) impacts – Enhanced scenario									
TRC – Net Benefits($M)	$3.44	-$1.19	$0.98	$0.00	$3.00	$6.99	-$0.36	$0.11	-$0.15
TRC – B/C ratio	3.65	0.74	1.51	0.99	3.47	1.29	0.78	1.06	0.92
UCT – Net Benefits ($M)	$3.44	-$0.07	$1.50	$0.01	$3.00	$6.99	-$0.36	$0.40	-$0.15
UCT – B/C ratio	3.65	0.98	2.08	1.09	3.47	1.29	0.78	1.26	0.92
PCT – Net Benefits ($M)	$6.73	$2.72	$2.60	$0.11	$5.91	$27.54	$1.33	$1.74	$3.12
PCT – B/C ratio	N/A	3.44	6.01	8.55	N/A	N/A	N/A	6.97	N/A
RIM – Net Benefits ($M)	-$1.92	-$3.97	-$1.61	-$0.12	-$2.91	-$20.55	-$1.69	-$1.63	-$3.27
RIM – B/C ratio	0.71	0.46	0.64	0.58	0.59	0.60	0.42	0.54	0.36

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE Education
5-yr (2024) impacts – Avoided Energy Cost Sensitivity scenario									
TRC – Net Benefits($M)	$3.30	-$0.65	$1.07	$0.01	$1.84	$12.72	-$0.07	$0.36	$0.72
TRC – B/C ratio	4.45	0.84	1.81	1.11	2.97	1.53	0.94	1.26	1.49
UCT – Net Benefits ($M)	$3.30	$1.01	$1.70	$0.03	$1.84	$12.72	-$0.07	$0.71	$0.72
UCT – B/C ratio	4.45	1.40	3.43	1.36	2.97	1.53	0.94	1.70	1.49
PCT – Net Benefits ($M)	$4.01	$1.63	-$0.63	-$0.02	$4.45	$27.49	$0.95	$1.14	$2.31
PCT – B/C ratio	N/A	1.98	0.00	0.00	N/A	N/A	N/A	4.25	N/A
RIM – Net Benefits ($M)	-$0.71	-$2.27	$1.70	$0.03	-$2.61	-$14.78	-$1.03	-$0.78	-$1.58
RIM – B/C ratio	0.86	0.61	3.43	1.36	0.52	0.71	0.51	0.69	0.58

7.5.3 Non-Residential Program Details

Table 7-11 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) cumulative residential energy efficiency program potential for the base, enhanced, and avoided energy cost sensitivity scenarios, presented as both cumulative and sum of annual impacts:

Table 7-11: DEC EE Non-Residential Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load
5-yr (2024) impacts						
Cumulative MWh	76,608	1.64%	107,510	2.30%	81,856	1.75%
Cumulative MW Summer	11		15		12	
Cumulative MW Winter	7		9		7	
Sum of Annual MWh	77,330	1.65%	108,523	2.32%	82,586	1.76%
Sum of Annual MW Summer	11		15		12	
Sum of Annual MW Winter	7		9		7	
10-yr (2029) impacts						
Cumulative MWh	118,679	2.53%	166,622	3.55%	126,173	2.69%
Cumulative MW Summer	17		23		18	
Cumulative MW Winter	10		14		11	
Sum of Annual MWh	133,483	2.84%	187,384	3.99%	142,392	3.03%
Sum of Annual MW Summer	19		26		20	
Sum of Annual MW Winter	11		16		12	

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load
25-yr (2044) impacts						
Cumulative MWh	76,408	1.41%	107,413	1.99%	81,850	1.52%
Cumulative MW Summer	11		16		12	
Cumulative MW Winter	6		9		6	
Sum of Annual MWh	239,090	4.43%	336,100	6.22%	254,816	4.72%
Sum of Annual MW Summer	33		47		36	
Sum of Annual MW Winter	20		28		21	

Figure 7-8, Figure 7-9 and Figure 7-10 illustrate the relative contributions to the overall non-residential program potential by program for the base, enhanced, and avoided energy cost sensitivity scenarios.

Figure 7-8: Non-Residential 5-Yr Cumulative Potential by Program – Base Scenario

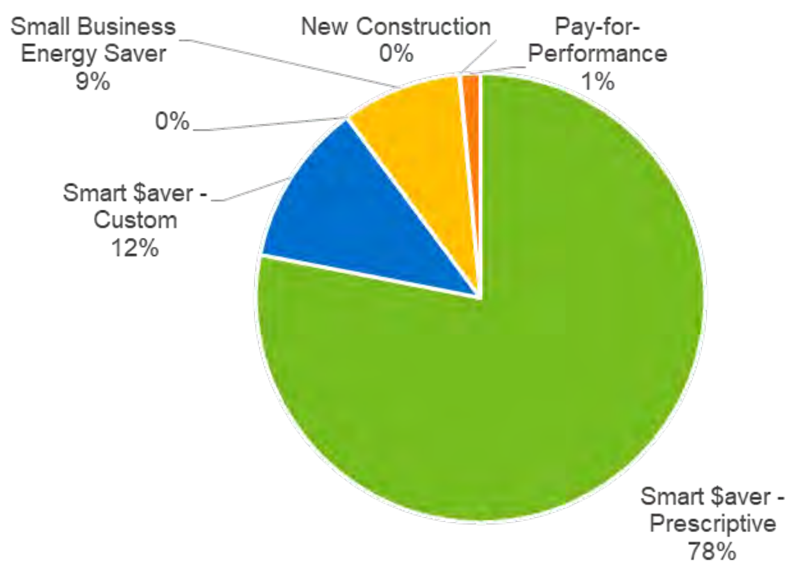


Figure 7-9: Non-Residential 5-Yr Cumulative Potential by Program – Enhanced Scenario

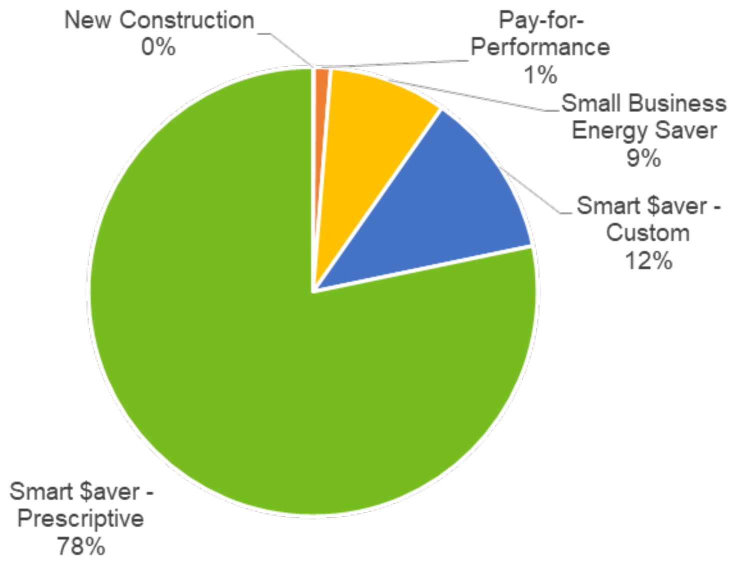
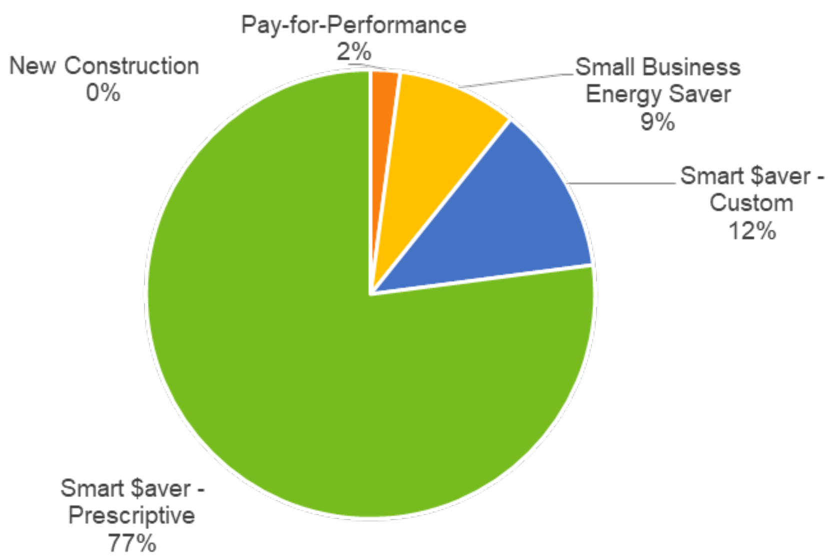


Figure 7-10: Non-Residential 5-Yr Cumulative Potential by Program – Avoided Energy Cost Sensitivity Scenario



Detailed program results for the short-term non-residential EE programs are provided in Table 7-12:

Table 7-12: DEC Non-Residential Program Potential (cumulative through 2024)

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Base Scenario					
MWh savings (cumulative)	59,810	9,021	6,612	49	1,116
Summer MW savings (cumulative)	8.36	1.12	0.95	0.01	0.18
Winter MW savings (cumulative)	5.09	0.72	0.67	0.01	0.06
Program costs (cumulative) ($M)	$6.38	$1.06	$0.62	$0.00	$0.26
Levelized Cost ($/kWh)	$0.03	$0.03	$0.02	$0.02	$0.07
5-yr (2024) impacts – Enhanced Scenario					
MWh savings (cumulative)	84,153	12,902	9,096	71	1,288
Summer MW savings (cumulative)	11.64	1.60	1.30	0.01	0.21
Winter MW savings (cumulative)	7.12	1.04	0.93	0.01	0.08
Program costs (cumulative) ($M)	$14.41	$1.96	$1.04	$0.01	$0.35
Levelized Cost ($/kWh)	$0.03	$0.03	$0.02	$0.02	$0.06

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Avoided Energy Cost Sensitivity Scenario					
MWh savings (cumulative)	63,093	9,970	7,058	1	1,734
Summer MW savings (cumulative)	9.00	1.29	1.03	0.00	0.30
Winter MW savings (cumulative)	5.34	0.78	0.69	0.00	0.06
Program costs (cumulative) ($M)	$7.01	$1.25	$0.74	$0.00	$0.45
Levelized Cost ($/kWh)	$0.03	$0.03	$0.02	$0.08	$0.08

Table 7-14 provides the net benefits and benefit-to-cost ratios by sector for each scenario:

Table 7-13: DEC Cost-Benefit Results – Non-Residential Programs (through 2024)

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Base Scenario					
TRC – Net Benefits($M)	$8.18	$1.17	$1.39	$0.01	-$0.08
TRC – B/C ratio	1.6	1.73	2.49	3.70	0.76
UCT – Net Benefits ($M)	$15.53	$1.70	$1.69	-$0.01	-$0.01
UCT – B/C ratio	3.44	2.60	3.72	0.73	0.97
PCT – Net Benefits ($M)	$19.49	$2.80	$2.50	$0.02	$0.22
PCT – B/C ratio	3.65	6.29	9.15	43.14	3.93
RIM – Net Benefits ($M)	-$11.31	-$1.63	-$1.11	-$0.03	-$0.30
RIM – B/C ratio	0.66	0.63	0.68	0.41	0.46

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Enhanced Scenario					
TRC – Net Benefits($M)	$11.57	$1.67	$1.86	$0.02	-$0.07
TRC – B/C ratio	1.60	1.74	2.44	3.70	0.82
UCT – Net Benefits ($M)	$16.29	$1.99	$2.11	$0.00	-$0.03
UCT – B/C ratio	2.13	2.01	3.03	0.96	0.91
PCT – Net Benefits ($M)	$32.95	$4.44	$3.56	$0.03	$0.32
PCT – B/C ratio	7.98	15.15	15.15	69.02	9.10
RIM – Net Benefits ($M)	-$21.38	-$2.77	-$1.71	-$0.03	-$0.39
RIM – B/C ratio	0.59	0.59	0.65	0.47	0.45
5-yr (2024) impacts – Avoided Energy Cost Sensitivity Scenario					
TRC – Net Benefits($M)	$15.99	$1.95	$2.09	$0.00	-$0.15
TRC – B/C ratio	2.05	2.01	2.90	0.96	0.77
UCT – Net Benefits ($M)	$24.28	$2.64	$2.45	-$0.02	$0.06
UCT – B/C ratio	4.46	3.12	4.33	0.04	1.13
PCT – Net Benefits ($M)	$20.38	$2.92	$2.61	$0.00	$0.25
PCT – B/C ratio	3.46	5.23	8.22	3.74	2.20
RIM – Net Benefits ($M)	-$4.38	-$0.98	-$0.52	-$0.02	-$0.40
RIM – B/C ratio	0.88	0.80	0.86	0.03	0.56

7.6 DEP Energy Efficiency Program Potential

This section provides the results of the DEP energy efficiency economic potential for each of the three segments.

7.6.1 Summary

Table 7-14 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) DEP portfolio EE program potential for the base, enhanced and avoided energy cost sensitivity scenarios. Impacts are presented as both **cumulative impacts**, which represent the savings that occur in the respective year based on measures installed in that year and measures installed in prior years that have not reached the end of their useful life and **the sum of annual**

impacts, which represent the total annual incremental savings achieved over the stated time horizon (5 years, 10 years, or 25 years).

Table 7-14: DEP EE Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Load	Total Potential	% of Load	Total Potential	% of Load
5-yr (2024) impacts						
Cumulative MWh	55,891	1.51%	67,892	1.84%	61,330	1.66%
Cumulative MW Summer	18		21		20	
Cumulative MW Winter	4		5		5	
Sum of Annual MWh	163,649	4.43%	175,992	4.77%	176,431	4.78%
Sum of Annual MW Summer	73		76		78	
Sum of Annual MW Winter	11		13		13	
10-yr (2029) impacts						
Cumulative MWh	69,648	1.83%	87,095	2.29%	77,173	2.03%
Cumulative MW Summer	22		25		25	
Cumulative MW Winter	5		6		6	
Sum of Annual MWh	316,678	8.35%	336,647	8.87%	341,584	9.00%
Sum of Annual MW Summer	141		146		151	
Sum of Annual MW Winter	23		24		24	
25-yr (2044) impacts						
Cumulative MWh	56,234	1.26%	65,677	1.47%	61,766	1.36%
Cumulative MW Summer	21		23		23	
Cumulative MW Winter	4		5		4	
Sum of Annual MWh	810,612	17.87%	843,191	18.58%	872,787	19.23%
Sum of Annual MW Summer	368		375		394	
Sum of Annual MW Winter	56		59		61	

Figure 7-11, Figure 7-12, and Figure 7-13 show DEP achievable energy savings potential by sector for each scenario. The commercial sector accounts for more than half of the energy-savings potential, and almost two-thirds of the peak reduction potential. The industrial sector accounts for the majority of the remaining potential for electricity sales, while the residential sector accounts for the majority of the remaining peak demand reduction.

Figure 7-11: DEP 2024 Achievable Program Potential by Sector – Base Scenario

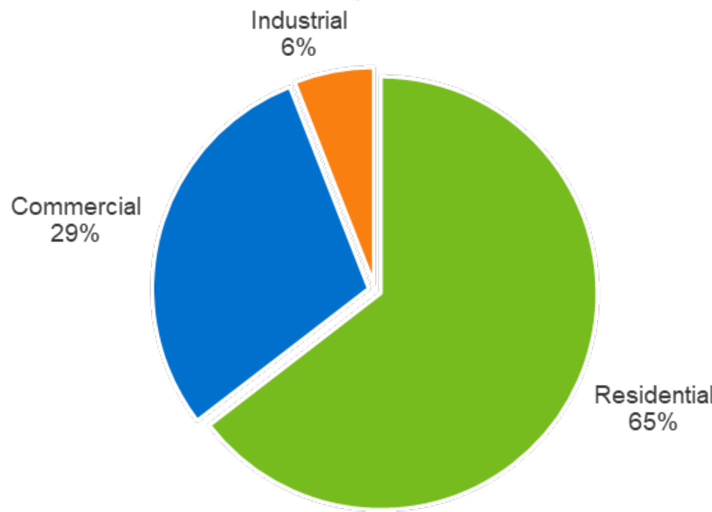


Figure 7-12: DEP 2024 Achievable Program Potential by Sector – Enhanced Scenario

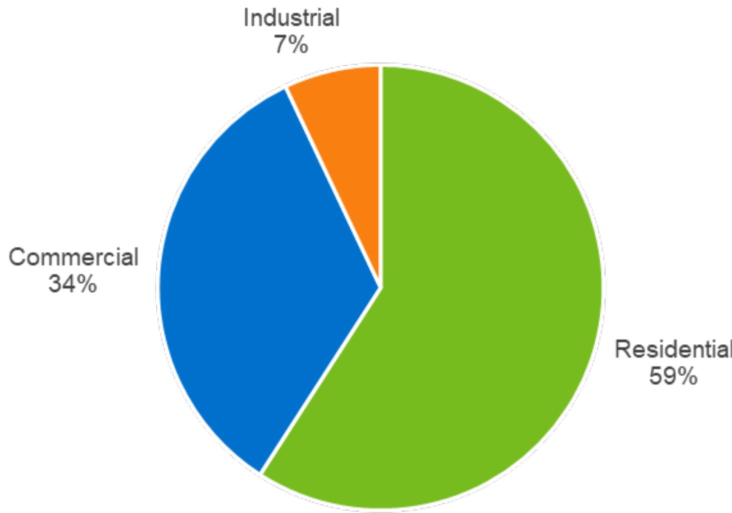
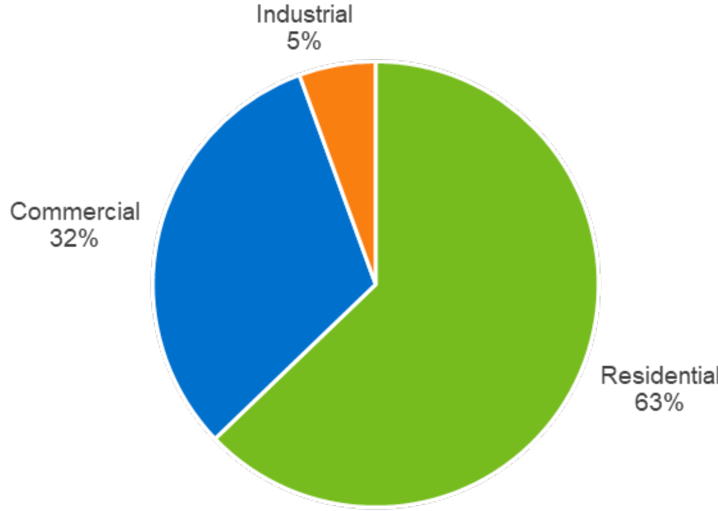


Figure 7-13: DEP 2024 Achievable Program Potential by Sector – Avoided Energy Cost Sensitivity Scenario



Participant and program costs associated with achievable program potential scenarios include the following:

- **Program incentives:** Financial incentives paid by energy-efficiency programs to subsidize purchases of energy-efficiency measures.
- **Program administration costs:** Administrative, marketing, promotional, and other costs associated with managing programs designed to achieve energy-efficiency savings.
- **Total program acquisition costs:** Total incentive and non-incentive program costs per sum of annual incremental energy savings achieved.
- **Participant costs:** Incremental costs to purchase, install, and maintain energy-efficiency measures.

Table 7-15 lists estimated participant and program costs associated with the theoretically achievable scenarios over the first 5 program years.

Table 7-15: DEP Participation and Program Costs by Scenario (cumulative through 2024)

Program Sector	Program Incentives ($M)	Program Admin ($M)	Participant Costs ($M)	Levelized Cost ($/kWh)
Base Scenario				
Residential	$0.87	$9.94	$0.82	$0.06
Non-Residential	$1.01	$0.89	$1.75	$0.03
Total	$1.88	$10.83	$2.57	$0.05
Enhanced Scenario				
Residential	$1.86	$10.85	$0.61	$0.05
Non-Residential	$2.09	$1.25	$0.86	$0.02
Total	$3.95	$10.32	$1.47	$0.04
Avoided Energy Cost Sensitivity Scenario				
Residential	$0.96	$10.65	$0.99	$0.06
Non-Residential	$1.45	$1.03	$2.50	$0.03
Total	$2.41	$11.68	$3.49	$0.05

7.6.2 Residential Program Details

Table 7-16 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) cumulative residential energy efficiency program potential for the base, enhanced, and avoided energy cost sensitivity scenarios:

Table 7-16: DEP EE Residential Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Res Load	Total Potential	% of Res Load	Total Potential	% of Res Load
5-yr (2024) impacts						
Cumulative MWh	36,711	1.60%	40,777	1.78%	39,161	1.71%
Cumulative MW Summer	16		18		17	
Cumulative MW Winter	3		3		3	
Sum of Annual MWh	144,216	6.28%	148,522	6.47%	154,008	6.71%
Sum of Annual MW Summer	70		72		75	
Sum of Annual MW Winter	10		11		11	

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Res Load	Total Potential	% of Res Load	Total Potential	% of Res Load
10-yr (2029) impacts						
Cumulative MWh	40,054	1.66%	45,233	1.88%	43,118	1.79%
Cumulative MW Summer	18		20		20	
Cumulative MW Winter	3		3		3	
Sum of Annual MWh	283,419	11.76%	289,625	12.02%	303,322	12.58%
Sum of Annual MW Summer	137		140		146	
Sum of Annual MW Winter	20		20		21	
25-yr (2044) impacts						
Cumulative MWh	38,405	1.26%	40,419	1.32%	41,277	1.35%
Cumulative MW Summer	19		20		20	
Cumulative MW Winter	3		3		3	
Sum of Annual MWh	752,244	24.65%	760,597	24.93%	805,984	26.37%
Sum of Annual MW Summer	360		364		385	
Sum of Annual MW Winter	52		53		56	

Figure 7-14, Figure 7-15, and Figure 7-16 illustrate the relative contributions to the overall residential program potential by program for the base, enhanced, and avoided energy cost sensitivity scenarios.

Figure 7-14: DEP Residential 5-Yr Cumulative Potential by Program – Base Scenario

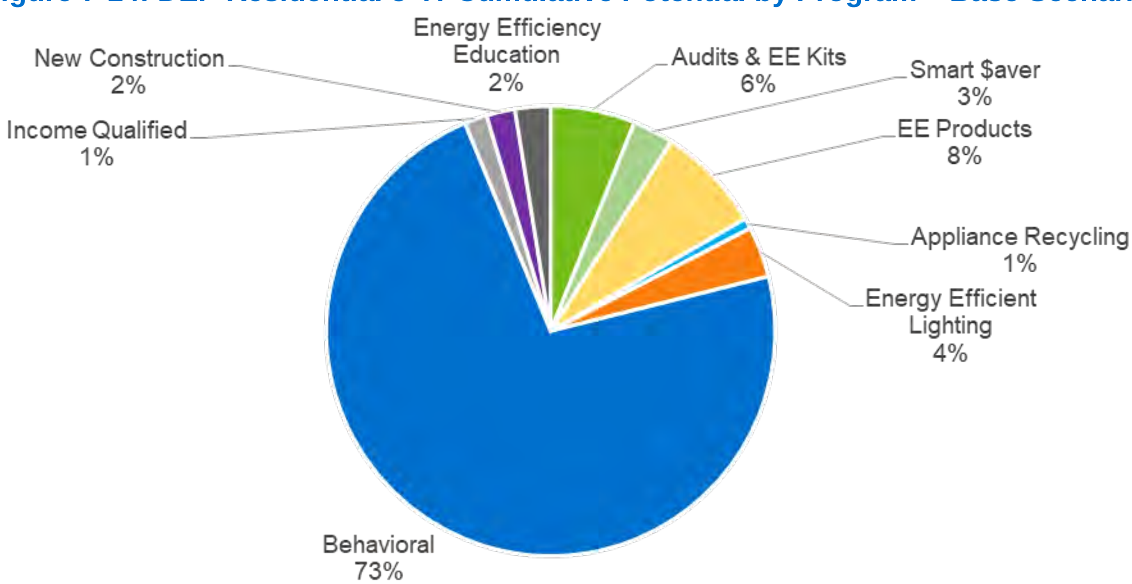


Figure 7-15: DEP Residential 5-Yr Cumulative Potential by Program – Enhanced Scenario

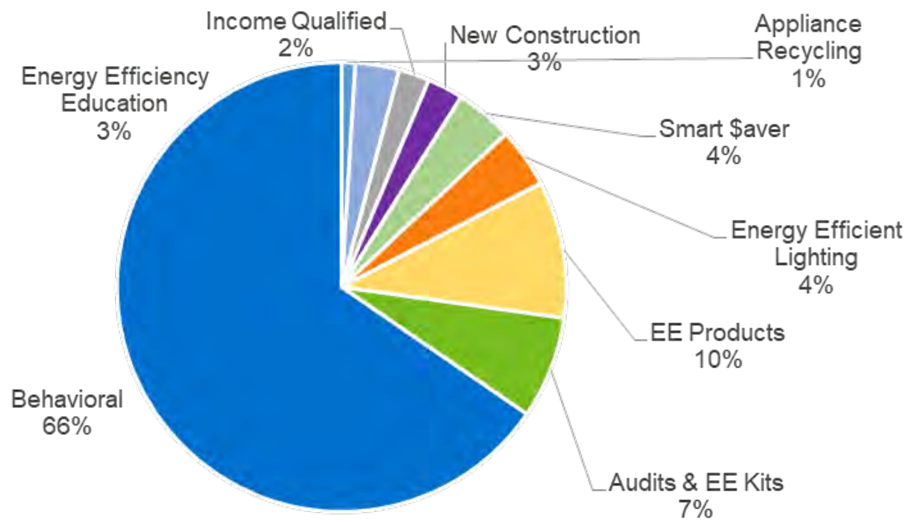
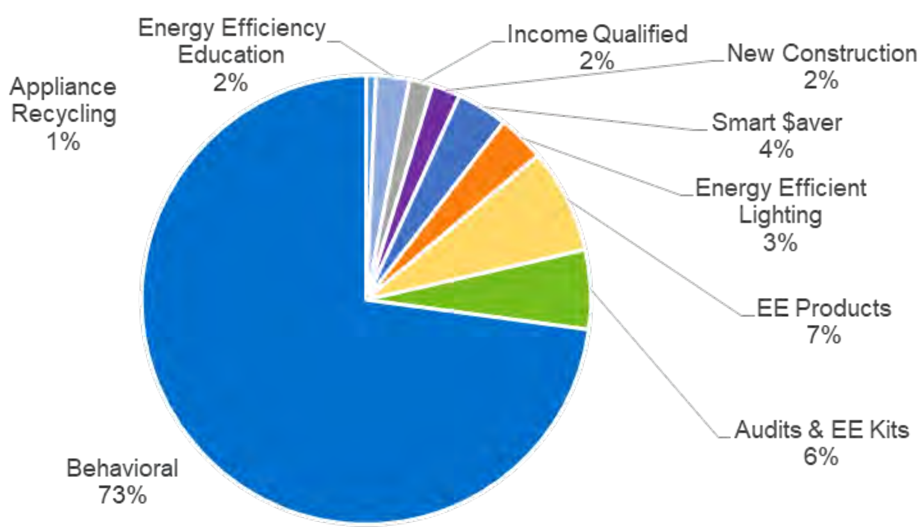


Figure 7-16: DEP Residential 5-Yr Cumulative Potential by Program – Avoided Energy Cost Sensitivity Scenario



Detailed program results for the short-term residential energy efficiency programs are provided in Table 7-17.

Table 7-17: DEP Residential Program Potential (cumulative through 2024)

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE. Education
5-yr (2024) impacts – Base scenario									
MWh savings (cumulative)	2,235	1,085	2,805	279	1,342	26,674	597	755	939
Summer MW savings (cumulative)	0.21	0.43	1.54	0.26	0.05	12.96	0.18	0.34	0.45
Winter MW savings (cumulative)	0.60	0.05	0.10	0.00	0.23	1.81	0.10	0.07	0.06
Program costs (cumulative) ($M)	$0.30	$0.58	$0.49	$0.20	$0.21	$7.91	$0.43	$0.31	$0.40
Levelized Cost ($/kWh)	$0.02	$0.09	$0.05	$0.11	$0.02	$0.07	$0.10	$0.07	$0.06
5-yr (2024) impacts – Enhanced scenario									
MWh savings (cumulative)	3,001	1,687	4,012	401	1,753	26,683	902	1,052	1,286
Summer MW savings (cumulative)	0.28	0.59	2.22	0.37	0.07	12.97	0.28	0.47	0.61
Winter MW savings (cumulative)	0.80	0.10	0.14	0.00	0.31	1.81	0.15	0.09	0.09
Program costs (cumulative) ($M)	$0.40	$1.05	$0.95	$0.32	$0.28	$7.91	$0.63	$0.48	$0.68
Levelized Cost ($/kWh)	$0.02	$0.09	$0.05	$0.11	$0.02	$0.07	$0.10	$0.07	$0.06

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE. Education
5-yr (2024) impacts – Avoided Energy Cost Sensitivity scenario									
MWh savings (cumulative)	2,235	1,430	2,952	278	1,331	28,541	656	800	939
Summer MW savings (cumulative)	0.21	0.49	1.64	0.26	0.05	13.84	0.21	0.36	0.45
Winter MW savings (cumulative)	0.60	0.10	0.10	0.00	0.23	1.94	0.11	0.07	0.06
Program costs (cumulative) ($M)	$0.30	$0.77	$0.52	$0.20	$0.21	$8.45	$0.46	$0.34	$0.36
Levelized Cost ($/kWh)	$0.02	$0.10	$0.05	$0.11	$0.02	$0.07	$0.10	$0.07	$0.08

Table 7-18 provides the net benefits and benefit-to-cost ratios by sector for each scenario.

Table 7-18: Cost-Benefit Results – Residential Programs (cumulative through 2024)

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE Education
5-yr (2024) impacts – Base scenario									
TRC – Net Benefits($M)	$0.58	-$0.38	$0.07	-$0.14	$0.39	-$2.45	-$0.18	-$0.07	-$0.12
TRC – B/C ratio	2.97	0.55	1.08	0.44	2.80	0.69	0.57	0.82	0.69
UCT – Net Benefits ($M)	$0.58	-$0.11	$0.48	-$0.09	$0.39	-$2.45	-$0.18	$0.01	-$0.12
UCT – B/C ratio	2.97	0.82	1.99	0.55	2.80	0.69	0.57	1.04	0.69
PCT – Net Benefits ($M)	$1.33	$59	$1.39	$0.14	$1.10	$9.63	$0.40	$0.47	$0.78
PCT – B/C ratio	N/A	3.13	4.43	3.79	N/A	N/A	N/A	6.38	N/A
RIM – Net Benefits ($M)	-$0.75	-$0.97	-$1.32	-$0.28	-$0.72	-$12.08	-$0.58	-$0.54	-$0.91
RIM – B/C ratio	0.54	0.33	0.42	0.28	0.46	0.31	0.30	0.38	0.23

	Audits & EE Kits	Smart $aver	EE Products	Appliance Recycling	Energy Efficient Lighting	Behavioral	Income Qualified	New Const.	EE Education
5-yr (2024) impacts – Enhanced scenario									
TRC – Net Benefits($M)	$0.77	-$0.56	$0.11	-$0.20	$0.51	-$2.44	-$0.26	-$0.10	-$0.17
TRC – B/C ratio	2.93	0.59	1.09	0.44	2.85	0.69	0.58	0.81	0.69
UCT – Net Benefits ($M)	$0.77	-$0.26	$0.44	-$0.16	$0.51	-$2.44	-$0.26	-$0.03	-$0.17
UCT – B/C ratio	2.93	0.75	1.47	0.49	2.85	0.69	0.58	0.94	0.69
PCT – Net Benefits ($M)	$1.78	$1.11	$2.25	$0.23	$1.44	$9.64	$0.60	$0.70	$1.29
PCT – B/C ratio	N/A	4.70	7.78	7.59	N/A	N/A	N/A	10.15	N/A
RIM – Net Benefits ($M)	-$1.01	-$1.67	-$2.14	-$0.43	-$0.93	-$12.08	-$0.86	-$0.80	-$0.42
RIM – B/C ratio	0.54	0.32	0.39	0.27	0.46	0.31	0.30	0.36	0.47
5-yr (2024) impacts – Avoided Energy Cost Sensitivity scenario									
TRC – Net Benefits($M)	$0.79	-$0.30	$0.35	-$0.11	$0.56	$0.59	-$0.12	$0.01	-$0.09
TRC – B/C ratio	3.69	0.74	1.36	0.55	3.62	1.07	0.74	1.03	0.76
UCT – Net Benefits ($M)	$0.79	$0.09	$0.81	-$0.06	$0.56	$0.59	-$0.12	$0.11	-$0.09
UCT – B/C ratio	3.69	1.11	2.54	0.68	3.62	1.07	0.74	1.32	0.76
PCT – Net Benefits ($M)	$1.33	$0.76	-$0.46	-$0.05	$1.10	$6.27	$0.44	$0.49	$0.61
PCT – B/C ratio	N/A	2.98	0.00	0.00	N/A	2.56	N/A	5.99	N/A
RIM – Net Benefits ($M)	-$0.54	-$1.05	$0.81	-$0.06	-$0.54	-$9.70	-$0.56	-$0.48	-$0.70
RIM – B/C ratio	0.67	0.45	2.54	0.68	0.59	0.48	0.38	0.48	0.28

7.6.3 Non-Residential Program Details

Table 7-19 summarizes the short-term (5-year), medium term (10-year) and long-term (25-year) cumulative residential energy efficiency program potential for the base, enhanced and avoided energy cost sensitivity scenarios:

Table 7-19: DEP EE Non-Residential Program Potential

	Base Scenario		Enhanced Scenario		Avoided Energy Cost Sensitivity	
	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load	Total Potential	% of Non-Res Load
5-yr (2024) impacts						
Cumulative MWh	19,180	1.37%	27,115	1.94%	22,169	1.58%
Cumulative MW Summer	2		3		3	
Cumulative MW Winter	1		2		2	
Sum of Annual MWh	19,433	1.39%	27,470	1.96%	22,423	1.60%
Sum of Annual MW Summer	3		4		3	
Sum of Annual MW Winter	1		2		2	
10-yr (2029) impacts						
Cumulative MWh	29,594	2.14%	41,862	3.02%	34,055	2.46%
Cumulative MW Summer	4		5		5	
Cumulative MW Winter	2		3		3	
Sum of Annual MWh	33,259	2.40%	47,022	3.39%	38,262	2.76%
Sum of Annual MW Summer	4		6		5	
Sum of Annual MW Winter	3		4		3	
25-yr (2044) impacts						
Cumulative MWh	17,829	1.20%	25,258	1.70%	20,489	1.38%
Cumulative MW Summer	2		3		3	
Cumulative MW Winter	1		2		1	
Sum of Annual MWh	58,368	3.94%	82,594	5.57%	66,803	4.51%
Sum of Annual MW Summer	8		11		9	
Sum of Annual MW Winter	4		6		5	

Figure 7-17, Figure 7-18, and Figure 7-19 illustrate the relative contributions to the overall non-residential program potential by program for the base, enhanced, and avoided energy cost sensitivity scenarios.

Figure 7-17: DEP Non-Residential 5-Yr Cumulative Potential by Program – Base Scenario

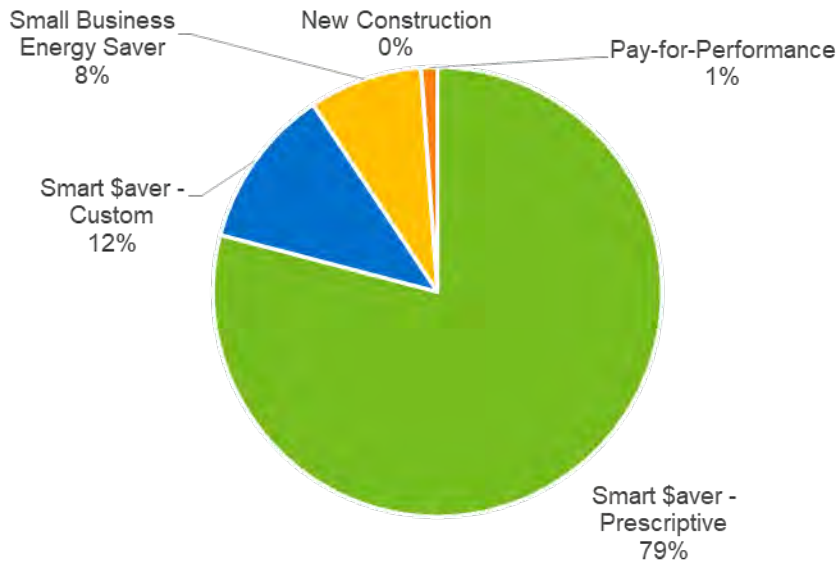


Figure 7-18: DEP Non-Residential 5-Yr Cumulative Potential by Program – Enhanced Scenario

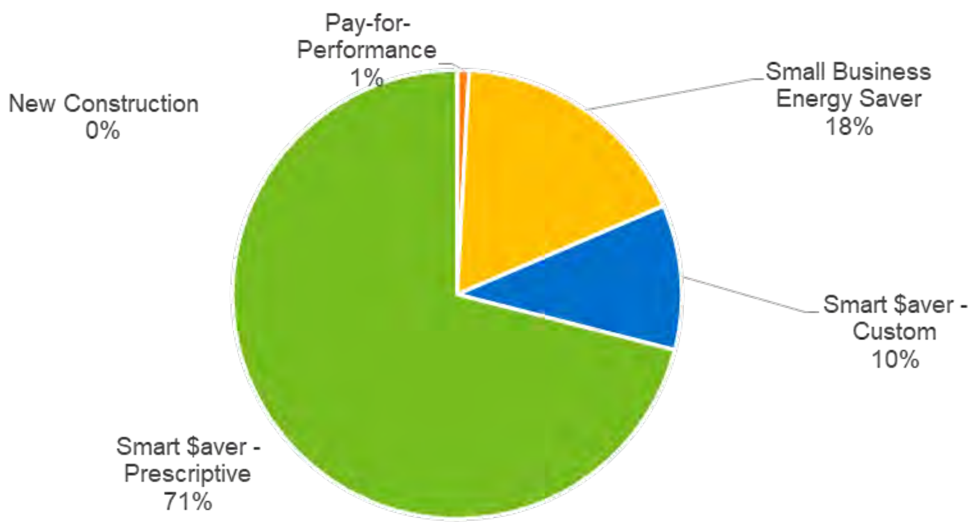
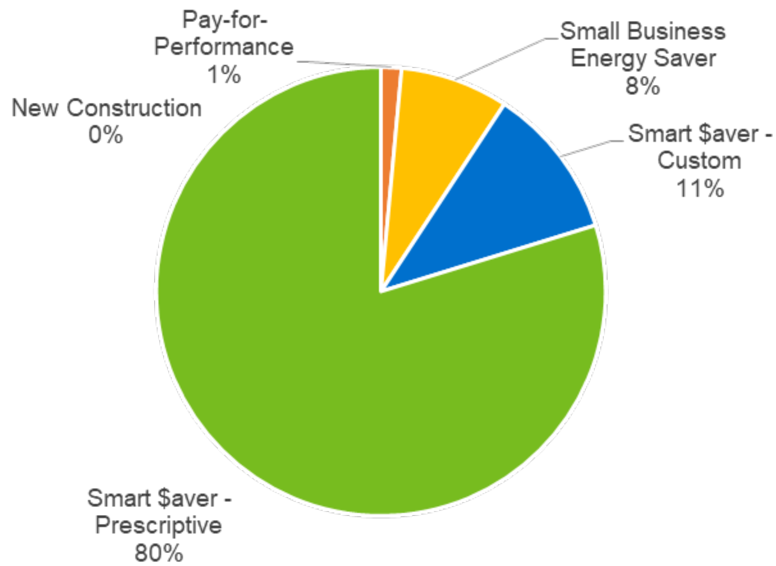


Figure 7-19: DEP Non-Residential 5-Yr Cumulative Potential by Program – Avoided Energy Cost Sensitivity Scenario



Detailed program results for the DEP short-term non-residential EE programs are provided in Table 7-20:

Table 7-20: DEP Non-Residential Program Potential (cumulative through 2024)

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
			5-yr (2024) impacts – Base Scenario		
MWh savings (cumulative)	15,166	2,221	1,564	8	221
Summer MW savings (cumulative)	1.97	0.25	0.22	0.00	0.03
Winter MW savings (cumulative)	1.15	0.15	0.14	0.00	0.01
Program costs (cumulative) ($M)	$1.46	$0.25	$0.14	$0.00	$0.05
Levelized Cost ($/kWh)	$0.03	$0.03	$0.02	$0.02	$0.06

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Enhanced Scenario					
MWh savings (cumulative)	21,532	3,164	2,163	11	245
Summer MW savings (cumulative)	2.78	0.36	0.30	0.00	0.04
Winter MW savings (cumulative)	1.68	0.21	0.20	0.00	0.01
Program costs (cumulative) ($M)	$2.63	$0.45	$0.20	$0.00	$0.06
Levelized Cost ($/kWh)	$0.02	$0.02	$0.02	$0.02	$0.06
5-yr (2024) impacts – Avoided Energy Cost Sensitivity Scenario					
MWh savings (cumulative)	17,686	2,431	1,726	0.4	326
Summer MW savings (cumulative)	2.48	0.29	0.25	0.00	0.05
Winter MW savings (cumulative)	1.38	0.16	0.15	0.00	0.01
Program costs (cumulative) ($M)	$1.93	$0.29	$0.18	$0.00	$0.08
Levelized Cost ($/kWh)	$0.03	$0.03	$0.03	$0.06	$0.07

Table 7-21 provides the net benefits and benefit-to-cost ratios by sector for each scenario:

Table 7-21: Cost-Benefit Results – Non-Residential Programs (cumulative through 2024)

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Base Scenario					
TRC – Net Benefits($M)	$1.62	$0.17	$0.24	$0.00	-$0.03
TRC – B/C ratio	1.54	1.47	2.18	2.76	0.59
UCT – Net Benefits ($M)	$3.18	$0.28	$0.31	-$0.02	-$0.01
UCT – B/C ratio	3.18	2.13	3.17	0.11	0.71
PCT – Net Benefits ($M)	$5.89	$0.81	$0.68	$0.00	$0.05
PCT – B/C ratio	4.77	8.38	11.43	38.06	6.30
RIM – Net Benefits ($M)	-$4.27	-$0.64	-$0.43	-$0.02	-$0.08
RIM – B/C ratio	0.52	0.45	0.51	0.09	0.31
5-yr (2024) impacts – Enhanced Scenario					
TRC – Net Benefits($M)	$2.45	$0.24	$0.34	$0.00	-$0.02
TRC – B/C ratio	1.73	1.48	2.38	2.76	0.63
UCT – Net Benefits ($M)	$3.20	$0.31	$0.38	-$0.02	-$0.02
UCT – B/C ratio	2.22	1.69	2.90	0.15	0.68
PCT – Net Benefits ($M)	$9.82	$1.25	$0.97	$0.00	$0.07
PCT – B/C ratio	14.11	20.25	23.14	60.90	13.79
RIM – Net Benefits ($M)	-$7.37	-$1.01	-$0.64	-$0.02	-$0.09
RIM – B/C ratio	0.44	0.43	0.48	0.12	0.31

	Prescriptive	Custom	Small Business Energy Saver	New Construction	Pay-for-Performance
5-yr (2024) impacts – Avoided Energy Cost Sensitivity Scenario					
TRC – Net Benefits($M)	$2.97	$0.35	$0.38	$0.00	-$0.04
TRC – B/C ratio	1.71	1.82	2.42	0.90	0.64
UCT – Net Benefits ($M)	$5.23	$0.49	$0.47	-$0.02	-$0.01
UCT – B/C ratio	3.7	2.72	3.62	0.01	0.84
PCT – Net Benefits ($M)	$6.58	$0.85	$0.73	$0.00	$0.06
PCT – B/C ratio	3.92	7.12	9.26	6.50	3.78
RIM – Net Benefits ($M)	-$3.61	-$0.50	-$0.34	-$0.02	-$0.10
RIM – B/C ratio	0.66	0.61	0.65	0.01	0.39

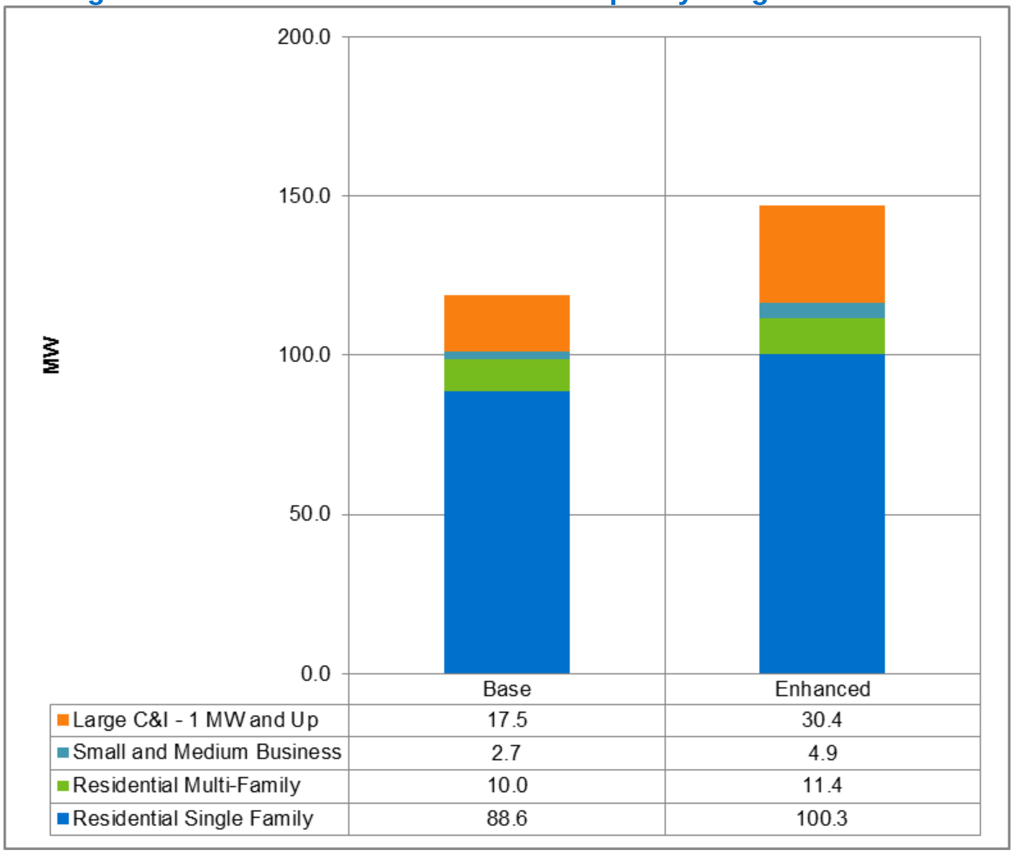
7.7 DEC DSM Program Potential

This section presents the estimated overall potential for the base, enhanced and avoided cost sensitivity scenarios. The results are provided separately for summer and winter peaking capacity. The results are further broken down by customer segment. All results presented reflect the projected achievable DSM potential by 2044.

7.7.1 DEC Summer Peaking Capacity

Figure 7-20 presents the overall summer peak capacity results for each scenario, broken down by customer class. The capacity is what is expected to be available during the peak hour of system demand. Overall, the estimated magnitude of peak capacity ranges from 119 MW to 147 MW across the three scenarios considered. The base scenario equates to 0.7% of Duke South Carolina's summer peak load. The bulk of the capacity is coming from residential customers. Variation in the peak capacity across the various scenarios can be attributed to differences in incentive levels. DSM is not affected by the avoided energy cost sensitivity scenario.

Figure 7-20 DEC DSM Summer Peak Capacity Program Potential



Because the achievable potential is driven by marketing intensity, incentive levels, and technology costs, it is possible to yield non-linear changes in participation level. This can be seen in the program participation results in Table 7-22 DEC DSM Program Participation Rates by Scenario and Customer Class.

Table 7-22 DEC DSM Program Participation Rates by Scenario and Customer Class

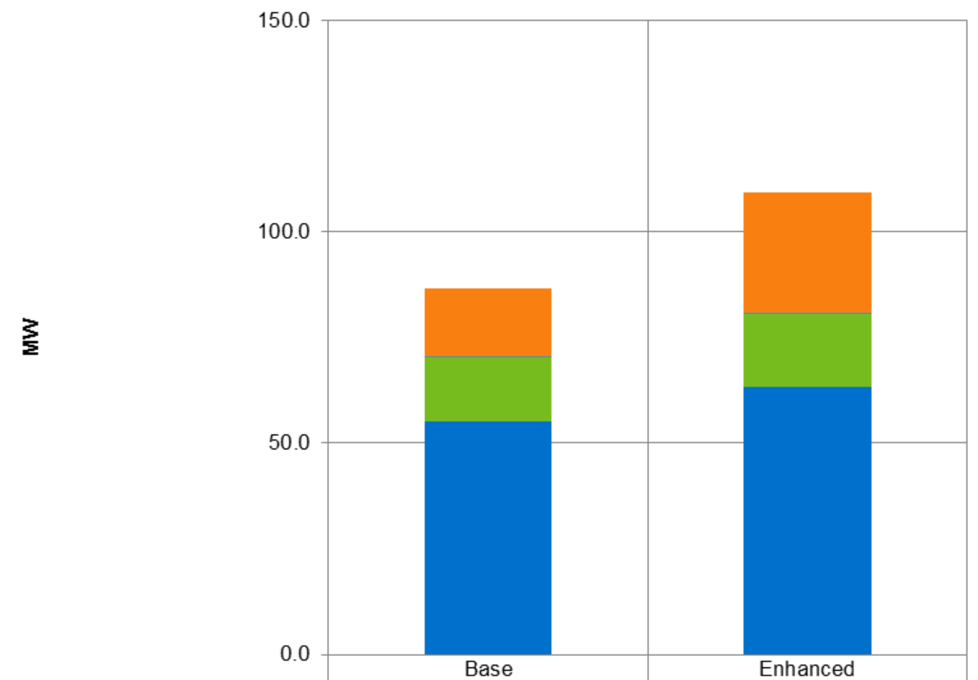
Customer Class	Base		Enhanced		Avoided Cost		Units
	Summer	Winter	Summer	Winter	Summer	Winter	
Residential Single Family	9.7%	7.0%	13.2%	9.4%	9.7%	7.0%	% of Customers
Residential Multi-Family	9.7%	7.0%	12.1%	10.5%	9.7%	7.0%	% of Customers
Small and Medium Business	2.2%	0.1%	4.4%	0.3%	2.2%	0.1%	% of Customers
Large C&I - 1 MW and Up	10.7%	10.7%	21.5%	21.5%	10.7%	10.7%	% of Load

7.7.2 DEC Winter Peaking Capacity

Figure 7-21 presents the overall winter peak capacity results for each scenario, broken down by customer class. The capacity is what is expected to be available during the peak hour of system demand. Overall, the estimated magnitude of peak capacity ranges from 86 MW to 109 MW across the three scenarios considered. The base scenario equates to 0.4% of Duke South Carolina's winter peak load. The bulk of the capacity is coming from residential customers.

Variation in the peak capacity across the various scenarios can be attributed to differences in incentive levels. DSM is not affected by the avoided energy cost sensitivity scenario.

Figure 7-21 DEC DSM Winter Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	16.1	28.5
Small and Medium Business	0.2	0.3
Residential Multi-Family	15.0	17.2
Residential Single Family	55.2	63.4

7.7.3 Segment specific results

A total of 111 different customer segments were individually analyzed. This includes 30 segments each for residential single family and multi-family homes (60), 26 small and medium business industries, and 25 industry types for distinct large commercial and industrial customer size categories. The section presents the segment-level results, focusing on the customer segments that are most attractive to pursue, allowing for prioritization and targeted marketing of those customer segments.

These results are fairly similar across the various scenarios that were studied, with only the absolute magnitude of the results changing. For the sake of simplicity, only the results for the base scenario are presented in this section.

Table 7-23 shows residential single family customer segments, ranked in terms of the benefit/cost ratio of their achievable peak capacity. Residential customers who rank in the top decile of consumption provide the greatest benefit/cost ratio. This is not surprising since they tend to have the greatest load available for load reduction, making it possible to enroll significant capacity per marginal dollar spent on acquisition marketing, equipment, and installation costs.

Table 7-24 shows the residential multi-family customer segments; Table 7-25 and Table 7-26 show the segment specific program potential results for each C&I customer class.

Table 7-23: DEC Residential Single Family Segment Specific Program Potential

Single Family		Summer				Winter			
	Usage bin	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer
RS	1	25,559	13.6%	-	$0	-	11.62%	-	
	2	25,559	13.6%	3.7	$476	-	11.6%	-	
	3	25,559	9.9%	3.4	$648	-	8.4%	-	
	4	25,559	9.9%	3.8	$783	-	8.4%	-	
	5	25,559	9.9%	4.3	$910	-	8.4%	-	
	6	25,559	14.0%	6.7	$1,034	-	12.1%	-	
	7	25,559	14.0%	7.3	$1,169	-	12.1%	-	
	8	25,559	14.0%	8.1	$1,325	-	12.1%	-	
	9	25,559	15.2%	10.0	$1,555	-	13.1%	-	
	10	25,559	15.2%	13.5	$2,205	-	13.1%	-	
RE	1	17,798	10.1%	-	$0	17,798	8.6%	2.3	$ 1,472
	2	17,798	10.1%	1.8	$401	17,798	8.6%	3.6	$ 2,463
	3	17,798	9.1%	1.9	$528	17,798	7.6%	3.8	$ 2,959
	4	17,798	9.1%	2.1	$634	17,798	7.6%	4.2	$ 3,366
	5	17,798	9.1%	2.4	$741	17,798	7.6%	4.7	$ 3,743
	6	17,798	8.8%	2.5	$845	17,798	7.4%	4.9	$ 4,121
	7	17,798	8.8%	2.8	$967	17,798	7.4%	5.4	$ 4,553
	8	17,798	8.8%	3.1	$1,117	17,798	7.4%	5.9	$ 5,028
	9	17,798	11.6%	4.7	$1,335	17,798	9.9%	9.0	$ 5,788
	10	17,798	11.6%	6.3	$1,904	17,798	9.9%	11.6	$ 7,539
RT	1	30	13.6%	0.0	$476	30	11.62%	-	$ -
	2	30	13.6%	0.0	$1,019	30	11.6%	-	$ -
	3	30	9.9%	0.0	$1,254	30	8.4%	-	$ -
	4	30	9.9%	0.0	$1,437	30	8.4%	-	$ -
	5	30	9.9%	0.0	$1,679	30	8.4%	-	$ -
	6	30	14.0%	0.0	$1,975	30	12.1%	-	$ -
	7	30	14.0%	0.0	$1,862	30	12.1%	-	$ -
	8	30	14.0%	0.0	$2,375	30	12.1%	-	$ -
	9	30	15.2%	0.0	$3,177	30	13.1%	-	$ -
	10	30	15.2%	0.0	$5,259	30	13.1%	-	$ -
Total AC/Heating Economic Potential (only included if economic)				88.6				55.2	
Additional Potential from WH and PP									
Total Potential				**88.6**				**55.2**	

Table 7-24: DEC Residential Multi-Family Segment Specific Program Potential

Multi-family		Summer				Winter			
	Usage bin	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer
RS	1	1,370	11.6%	-	$0	-	9.89%	-	
	2	1,370	11.6%	0.2	$478	-	9.9%	-	
	3	1,370	11.6%	0.2	$696	-	9.8%	-	
	4	1,370	11.6%	0.3	$888	-	9.8%	-	
	5	1,370	11.6%	0.3	$1,051	-	9.8%	-	
	6	1,370	7.8%	0.2	$1,223	-	6.5%	-	
	7	1,370	7.8%	0.3	$1,412	-	6.5%	-	
	8	1,370	7.8%	0.3	$1,543	-	6.5%	-	
	9	1,370	8.3%	0.3	$1,725	-	6.9%	-	
	10	1,370	8.3%	0.5	$2,555	-	6.9%	-	
RE	1	4,423	9.8%	-	$0	4,423	8.2%	0.5	$ 1,419
	2	4,423	9.8%	0.4	$339	4,423	8.2%	0.8	$ 2,187
	3	4,423	11.2%	0.5	$474	4,423	9.5%	1.1	$ 2,692
	4	4,423	11.2%	0.6	$594	4,423	9.5%	1.2	$ 3,138
	5	4,423	11.2%	0.7	$729	4,423	9.5%	1.4	$ 3,525
	6	4,423	12.2%	0.9	$848	4,423	10.4%	1.7	$ 4,000
	7	4,423	12.2%	1.0	$992	4,423	10.4%	1.9	$ 4,557
	8	4,423	12.2%	1.1	$1,171	4,423	10.4%	2.1	$ 5,183
	9	4,423	9.4%	1.0	$1,402	4,423	7.9%	1.9	$ 6,099
	10	4,423	9.4%	1.3	$1,977	4,423	7.9%	2.5	$ 8,265
RT	1	-	11.6%	-	$0	-	9.89%	-	$ -
	2	-	11.6%	-	$0	-	9.9%	-	$ -
	3	-	11.6%	-	$0	-	9.8%	-	$ -
	4	-	11.6%	-	$0	-	9.8%	-	$ -
	5	-	11.6%	-	$0	-	9.8%	-	$ -
	6	-	7.8%	-	$0	-	6.5%	-	$ -
	7	-	7.8%	-	$0	-	6.5%	-	$ -
	8	-	7.8%	-	$0	-	6.5%	-	$ -
	9	-	8.3%	-	$0	-	6.9%	-	$ -
	10	-	8.3%	-	$0	-	6.9%	-	$ -
Total AC/Heating Economic Potential (only included if economic)				10.0				15.0	
Additional Potential from WH and PP									
Total Potential				**10.0**				**15.0**	

Table 7-25: DEC Small C&I Segment Specific Program Potential

SMB	Summer				Winter			
Segment	# Accounts	Participation	Agg. MW	Net Benefit per Enrollee	# Accounts	Participation	Agg. MW	Net Benefit per Enrollee
Assembly	7,432	0.63%	0.1	($1,598)	353	0.03%	0.0	($50,971)
Colleges & Universities	245	0.63%	0.0	$351	20	0.03%	0.0	($27,109)
Data Centers	108	3.37%	0.0	$1,652	5	0.17%	0.0	$14,676
Grocery	516	6.35%	0.2	$2,768	232	0.33%	0.0	$31,633
Healthcare	1,823	0.71%	0.1	($261)	167	0.03%	0.0	($28,699)
Hospitals	96	0.63%	0.0	$558	4	0.03%	0.0	($27,783)
Institutional	2,144	0.63%	0.0	($2,373)	101	0.03%	0.0	($53,780)
Lodging (Hospitality)	479	0.71%	0.0	($1,327)	96	0.03%	0.0	($34,470)
Miscellaneous	10,588	0.68%	-	$0	2,093	0.03%	0.0	($56,301)
Office	13,978	0.71%	0.2	($2,019)	1,381	0.03%	0.0	($46,485)
Restaurants	1,718	0.71%	0.1	$3,493	183	0.03%	0.0	($8,098)
Retail	18,091	6.35%	2.2	$663	2,503	0.33%	0.1	$7,921
Schools K-12	601	0.45%	0.0	($2,909)	29	0.02%	0.0	($71,784)
Warehouse	674	3.37%	0.0	$255	34	0.17%	0.0	$864
Agriculture & Forestry	8	3.56%	0.0	($213)	8	0.18%	0.0	($4,267)
Chemicals & Plastics	167	1.98%	0.0	$669	167	0.10%	0.0	$11,176
Construction	4	3.56%	0.0	$323	4	0.18%	0.0	($10,503)
Electrical & Electronic Equip	82	1.98%	0.0	($174)	82	0.10%	0.0	($4,051)
Lumber, Furniture, Pulp & P	229	1.98%	0.0	$87	229	0.10%	0.0	$341
Metal Products & Machinery	423	1.98%	0.0	$555	423	0.10%	0.0	$7,983
Misc. Manufacturing	203	1.98%	0.0	$184	203	0.10%	0.0	$1,930
Primary Resource Industries	-	3.56%	-	$0	-	0.18%	-	$0
Stone, Clay, Glass & Concre	52	1.98%	0.0	$783	52	0.10%	0.0	$18,608
Textiles & Leather	87	1.98%	0.0	$1,207	87	0.10%	0.0	$23,776
Transportation Equipment	100	3.37%	0.0	($340)	100	0.17%	0.0	$790
Water & Wastewater	-	3.37%	-	$0	-	0.17%	-	$0
Total			**2.7**				**0.2**	

Table 7-26: DEC Large C&I (≥1 MW) Segment Specific Program Potential

Large C&I - 1 MW and Up				Summer		Winter			
Segment	MW of Tech Potential for cost calc (max of winter and summer)	Participation	Total Cost	Agg. MW	Total Benefit	Agg. MW	Total Benefit	Total Aggregate Net Benefit	Total Net Benefit per Enrolled MW
Agriculture and Assembly	0.0	9.92%	$ -	-	$ -	-	$ -	$0	$0
Chemicals and Plastics	19.6	15.81%	$102,836.53	3.1	########	2.7	$ 1,408,138	$3,532,225	$1,137,171
College and University	0.0	12.48%	$ -	-	$ -	-	$ -	$0	$0
Construction	0.0	15.81%	$ -	-	$ -	-	$ -	$0	$0
Data Center	0.7	9.92%	$ 2,150.26	0.0	$ 1,903	0.1	$ 76,954	$76,706	$1,182,380
Electrical and Electronic Equip.	0.3	15.81%	$ 1,467.36	0.0	$ 2,190	0.0	$ 52,574	$53,296	$1,202,506
Grocery	0.0	5.21%	$ -	-	$ -	-	$ -	$0	$0
Healthcare	0.0	3.61%	$ -	-	$ -	-	$ -	$0	$0
Hospitals	0.0	12.48%	$ -	-	$ -	-	$ -	$0	$0
Institutional	0.0	12.48%	$ -	-	$ -	-	$ -	$0	$0
Lodging/Hospitality	1.9	3.61%	$ 2,296.36	0.1	$ 49,409	0.1	$ 26,404	$73,516	$1,066,745
Lumber/Furniture/Pulp/Paper	14.5	15.81%	$ 75,679.51	1.1	$ 63,970	2.3	$ 2,711,502	$2,699,792	$1,181,074
Metal Products and Machinery	10.2	15.81%	$ 53,382.28	1.6	########	1.3	$ 695,275	$1,797,885	$1,115,038
Miscellaneous	42.4	2.77%	$ 39,167.71	0.3	$ 18,697	1.2	$ 1,390,801	$1,370,331	$1,168,737
Miscellaneous Manufacturing	0.7	15.81%	$ 3,781.46	0.1	$ 81,888	0.1	$ 39,530	$117,636	$1,029,929
Office	0.0	3.61%	$ -	-	$ -	-	$ -	$0	$0
Primary Resources Industries	0.0	9.92%	$ -	-	$ -	-	$ -	$0	$0
Restaurants	0.0	2.77%	$ -	-	$ -	-	$ -	$0	$0
Retail	0.0	5.21%	$ -	-	$ -	-	$ -	$0	$0
Schools K-12	0.0	6.79%	$ -	-	$ -	-	$ -	$0	$0
Stone/Clay/Glass/Concrete	2.6	15.81%	$ 13,453.61	0.4	$ 291,338	0.0	$ 25,625	$303,509	$746,891
Textiles and Leather	67.8	15.81%	$355,134.43	10.7	########	8.4	$ 4,425,717	$11,761,012	$1,096,420
Transportation Equipment	0.0	9.92%	$ -	-	$ -	-	$ -	$0	$0
Warehouse	0.0	9.92%	$ -	-	$ -	-	$ -	$0	$0
Water and Wastewater	0.0	9.92%	$ -	-	$ -	-	$ -	$0	$0
Total				**17.5**		**16.1**			

7.7.4 Key Findings

The overall DSM potential is estimated to be 119 MW of summer peak capacity in the base scenario, and is as high as 147 MW under the assumption doubling the incentive rates. In the winter, DSM capacity is estimated to be 87 MW in the base scenario and as high as 109 MW in the enhanced scenario. These estimates are based on an in-depth, bottom-up assessment of load reduction potential of all customer segments, and includes an analysis of program-based DSM.

The extent to whether these potential figures can be attained in a cost-effective manner by 2044 depends on the ability to implement programs that target all possible end-uses and cost-effective customer segments. These predictions also rely upon certain assumptions around the future value of capacity, as well as technology cost reductions.

The customer segment-level analysis of the program-based DSM potential sheds light on which customer segments can provide the greatest magnitude of capacity, as well as which customer segments are most cost-effective to pursue. Unsurprisingly, the most attractive customer segments from a benefit/cost perspective are customers who have more load available for reduction during peak hours: larger residential customers who live in single-family homes, and multi-family homes. In general, these customers are more capable of shifting load with little inconvenience/cost, and therefore tend to have higher participation levels in DSM programs as well as greater willingness to shed a higher percentage of their load.

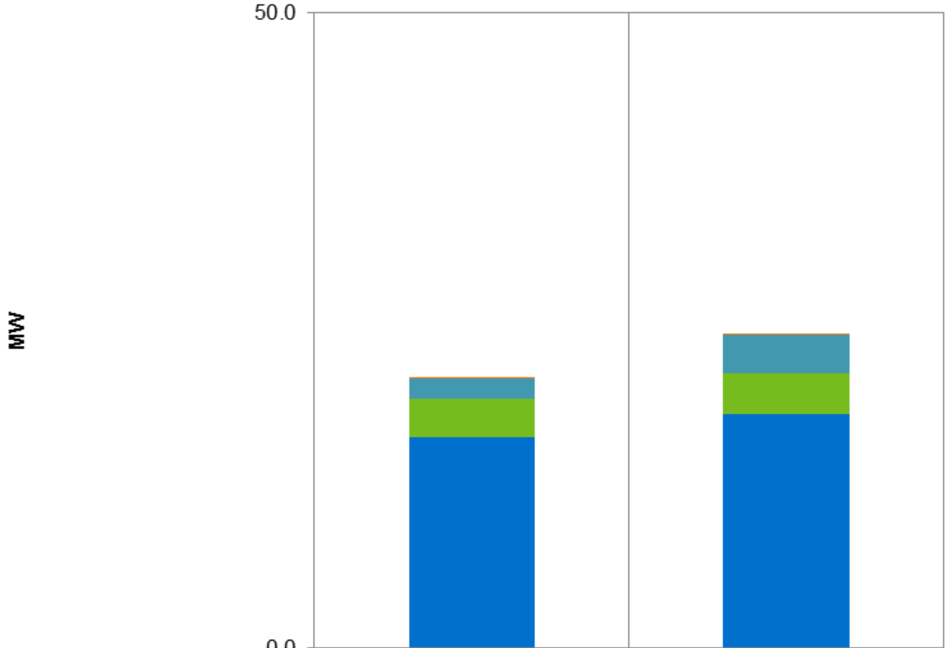
7.8 DEP DSM Program Potential

This section presents the estimated overall potential for the base, enhanced and avoided cost scenarios. The results are provided separately for summer and winter peaking capacity. The results are further broken down by customer segment. All results presented reflect the projected achievable DSM potential by 2044.

7.8.1 DEP Summer Peaking Capacity

Figure 7-22 presents the overall summer peak capacity results for each scenario, broken down by customer class. The capacity is what is expected to be available during the peak hour of system demand. Overall, the estimated magnitude of peak capacity ranges from 21 MW to 25 MW across the three scenarios considered. The base scenario equates to 0.2% of Duke South Carolina’s summer peak load. The bulk of the capacity is coming from residential customers. Variation in the peak capacity across the various scenarios can be attributed to differences in incentive levels. DSM is not affected by the avoided energy cost sensitivity scenario.

Figure 7-22 DEP DSM Summer Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	0.0	0.1
Small and Medium Business	1.6	3.0
Residential Multi-Family	3.0	3.3
Residential Single Family	16.6	18.4

Because the achievable potential is driven by marketing intensity, incentive levels, and technology costs, it is possible to yield non-linear changes in participation level. This can be seen in the program participation results in Table 7-22 DEC DSM Program Participation Rates by Scenario and Customer Class.

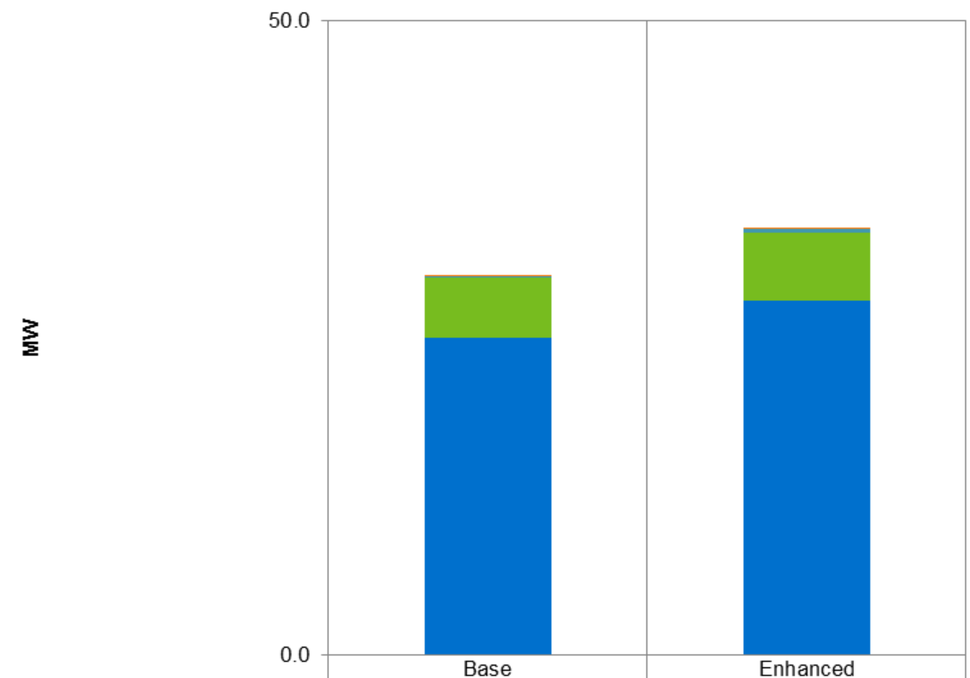
Table 7-27 DEP DSM Program Participation Rates by Scenario and Customer Class

Customer Class	Base		Enhanced		Avoided Cost		Units
	Summer	Winter	Summer	Winter	Summer	Winter	
Residential Single Family	10.5%	7.0%	13.8%	9.5%	10.5%	7.0%	% of Customers
Residential Multi-Family	10.5%	7.0%	15.3%	10.5%	10.5%	7.0%	% of Customers
Small and Medium Business	1.5%	0.1%	3.6%	0.2%	1.5%	0.1%	% of Customers
Large C&I - 1 MW and Up	2.1%	2.1%	4.3%	4.3%	2.1%	2.1%	% of Load

7.8.2 DEP Winter Peaking Capacity

Figure 7-17 presents the overall winter peak capacity results for each scenario, broken down by customer class. The capacity is what is expected to be available during the peak hour of system demand. Overall, the estimated magnitude of peak capacity ranges from 30 MW to 34 MW across the three scenarios considered. The base scenario equates to 0.2% of Duke South Carolina's summer peak load. The bulk of the capacity is coming from residential customers. Variation in the peak capacity across the various scenarios can be attributed to differences in incentive levels. DSM is not affected by the avoided energy cost sensitivity scenario.

Figure 7-23 DEP DSM Winter Peak Capacity Program Potential



	Base	Enhanced
Large C&I - 1 MW and Up	0.0	0.1
Small and Medium Business	0.1	0.2
Residential Multi-Family	4.8	5.4
Residential Single Family	25.0	28.0

7.8.3 Segment specific results

A total of 91 different customer segments were individually analyzed. This includes 10 different consumption deciles each for two different geographic regions for residential single family and multi-family homes (40), 26 different industries of small and medium businesses, and 25 industry types for large commercial and industrial customer size categories. The section presents the segment-level results, focusing on the customer segments that are most attractive to pursue, allowing for prioritization and targeted marketing of those customer segments.

These results are fairly similar across the various scenarios that were studied, with only the absolute magnitude of the results changing. For the sake of simplicity, only the results for the base scenario are presented in this section.

Table 7-28 shows residential single family customer segments, ranked in terms of the benefit/cost ratio of their achievable peak capacity. Residential customers who rank in the top decile of consumption provide the greatest benefit/cost ratio. This is not surprising since they tend to have the greatest load available for load reduction, making it possible to enroll significant capacity per marginal dollar spent on acquisition marketing, equipment, and installation costs.

Table 7-29 shows the residential multi-family customer segments; Table 7-30 and Table 7-31 show the segment specific program potential results for each C&I customer class.

Table 7-28: DEP Residential Single Family Segment Specific Program Potential

	Single Family	Summer				Winter			
	Usage bin	**# of accounts**	**Participation**	**Agg. MW**	**Total Net Benefit per Customer**	**# of accounts**	**Participation**	**Agg. MW**	**Total Net Benefit per Customer**
RES	1	11,747	12.7%	-	$0	7,556	8.57%	0.7	$ 597
	2	11,747	12.7%	-	$0	7,556	8.6%	1.2	$ 1,228
	3	11,747	11.5%	-	$0	7,556	7.6%	1.3	$ 1,506
	4	11,747	11.5%	-	$0	7,556	7.6%	1.5	$ 1,729
	5	11,747	11.5%	-	$0	7,556	7.6%	1.6	$ 1,962
	6	11,747	11.1%	-	$0	7,556	7.4%	1.7	$ 2,181
	7	11,747	11.1%	-	$0	7,556	7.4%	1.9	$ 2,425
	8	11,747	11.1%	2.8	$220	7,556	7.4%	2.1	$ 2,702
	9	11,747	14.4%	4.3	$303	7,556	9.9%	3.2	$ 3,112
	10	11,747	14.4%	5.8	$522	7,556	9.9%	4.1	$ 4,102
TOU	1	160	16.7%	-	$0	122	11.6%	0.0	$ 1,729
	2	160	16.7%	-	$0	122	11.6%	0.1	$ 2,514
	3	160	12.4%	0.0	$245	122	8.4%	0.0	$ 3,228
	4	160	12.4%	0.0	$298	122	8.4%	0.0	$ 3,503
	5	160	12.4%	0.1	$421	122	8.4%	0.1	$ 3,645
	6	160	17.2%	0.1	$494	122	12.1%	0.1	$ 4,125
	7	160	17.2%	0.1	$562	122	12.1%	0.1	$ 4,527
	8	160	17.2%	0.1	$647	122	12.1%	0.1	$ 5,182
	9	160	18.5%	0.1	$849	122	13.1%	0.1	$ 5,907
	10	160	18.5%	0.2	$1,196	122	13.1%	0.2	$ 8,618
Total AC/Heating Economic Potential (only included if economic)				13.7				20.2	
Additional Potential from WH and PP				2.9				4.7	
Total Potential				**16.6**				**25.0**	

Table 7-29: DEP Residential Multi-Family Segment Specific Program Potential

	Multi-family	Summer				Winter			
	Usage bin	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer	# of accounts	Participation	Agg. MW	Total Net Benefit per Customer
RES	1	1,776	12.3%	-	$0	1,489	8.24%	-	$ -
	2	1,776	12.3%	-	$0	1,489	8.2%	0.1	$ 384
	3	1,776	14.0%	-	$0	1,489	9.5%	0.2	$ 569
	4	1,776	14.0%	-	$0	1,489	9.5%	0.2	$ 986
	5	1,776	14.0%	-	$0	1,489	9.5%	0.3	$ 1,463
	6	1,776	15.1%	-	$0	1,489	10.4%	0.4	$ 1,897
	7	1,776	15.1%	0.6	$226	1,489	10.4%	0.5	$ 2,409
	8	1,776	15.1%	0.7	$291	1,489	10.4%	0.7	$ 3,101
	9	1,776	11.8%	0.6	$379	1,489	7.9%	0.7	$ 4,127
	10	1,776	11.8%	0.8	$636	1,489	7.9%	1.0	$ 6,536
TOU									
Total AC/Heating Economic Potential (only included if economic)				2.7				4.1	
Additional Potential from WH and PP				0.3				0.7	
Total Potential				**3.0**				**4.8**	

Table 7-30: DEP Small C&I Segment Specific Program Potential

SMB	Summer				Winter			
Segment	# Accounts	Participation	Agg. MW	Net Benefit per Enrollee	# Accounts	Participation	Agg. MW	Net Benefit per Enrollee
Assembly	2,776	0.22%	0.0	($8,547)	132	0.02%	0.0	($92,226)
Colleges & Universities	86	0.22%	0.0	($5,795)	7	0.02%	0.0	($31,224)
Data Centers	24	2.30%	-	$0	1	0.12%	0.0	($1,976)
Grocery	242	6.03%	0.2	$761	109	0.25%	0.0	$42,311
Healthcare	748	0.25%	0.0	($5,915)	69	0.02%	0.0	($46,807)
Hospitals	68	0.22%	0.0	($5,372)	2	0.02%	0.0	($38,425)
Institutional	1,482	0.22%	0.0	($8,627)	70	0.02%	0.0	($96,650)
Lodging (Hospitality)	229	0.25%	0.0	($6,584)	46	0.02%	0.0	($57,916)
Miscellaneous	1,671	0.24%	0.0	($8,061)	330	0.02%	0.0	($94,752)
Office	9,416	0.25%	0.1	($7,624)	930	0.02%	0.0	($87,669)
Restaurants	887	0.25%	0.0	($5,282)	95	0.02%	0.0	($54,612)
Retail	4,924	6.03%	1.3	$178	681	0.25%	0.1	$16,121
Schools K-12	719	0.14%	0.0	($9,067)	35	0.01%	0.0	($61,339)
Warehouse	255	2.30%	0.0	($518)	13	0.12%	0.0	$1,720
Agriculture & Forestry	3	2.50%	0.0	$10,400	3	0.12%	0.0	$557,390
Chemicals & Plastics	9	1.07%	0.0	($205)	9	0.06%	0.0	$109,522
Construction	4	2.50%	0.0	$9	4	0.12%	0.0	$67,934
Electrical & Electronic Equip	14	1.07%	0.0	($1,311)	14	0.06%	0.0	$40,031
Lumber, Furniture, Pulp & P	28	1.07%	0.0	$4,117	28	0.06%	0.0	$328,900
Metal Products & Machinery	40	1.07%	0.0	$223	40	0.06%	0.0	$126,247
Misc. Manufacturing	19	1.07%	0.0	($2,565)	19	0.06%	0.0	$133,334
Primary Resource Industries	2	2.50%	-	$0	2	0.12%	0.0	$0
Stone, Clay, Glass & Concre	9	1.07%	0.0	($1,534)	9	0.06%	0.0	$24,711
Textiles & Leather	23	1.07%	0.0	$5,812	23	0.06%	0.0	$407,773
Transportation Equipment	18	2.30%	0.0	$9,726	18	0.12%	0.0	$220,529
Water & Wastewater	-	2.30%	-	$0	-	0.12%	-	$0
Total			**1.6**				**0.1**	

Table 7-31: DEP Large C&I (300-500 kW) Segment Specific Program Potential

Large C&I - 1 MW and Up			Summer	Winter			
Segment	MW of Tech Potential for cost calc (max of winter and summer)	Participation	Total Benefit	Agg. MW	Total Benefit	Total Aggregate Net Benefit	Total Net Benefit per Enrolled MW
Agriculture and Assembly	0.0	1.65%	$ -	-	$ -	$0	$0
Chemicals and Plastics	0.0	3.23%	$ -	-	$ -	$0	$0
College and University	0.0	2.29%	$ -	-	$ -	$0	$0
Construction	0.0	3.23%	$ -	-	$ -	$0	$0
Data Center	0.0	1.65%	$ -	-	$ -	$0	$0
Electrical and Electronic Equip.	0.0	3.23%	$ -	-	$ -	$0	$0
Grocery	0.0	0.67%	$ -	-	$ -	$0	$0
Healthcare	0.0	0.41%	$ -	-	$ -	$0	$0
Hospitals	0.0	2.29%	$ -	-	$ -	$0	$0
Institutional	0.0	2.29%	$ -	-	$ -	$0	$0
Lodging/Hospitality	0.0	0.41%	$ -	-	$ -	$0	$0
Lumber/Furniture/Pulp/Paper	0.0	3.23%	$ -	-	$ -	$0	$0
Metal Products and Machinery	0.0	3.23%	$ -	-	$ -	$0	$0
Miscellaneous	0.0	0.29%	$ -	-	$ -	$0	$0
Miscellaneous Manufacturing	0.0	3.23%	$ -	-	$ -	$0	$0
Office	0.0	0.41%	$ -	-	$ -	$0	$0
Primary Resources Industries	0.0	1.65%	$ -	-	$ -	$0	$0
Restaurants	0.0	0.29%	$ -	-	$ -	$0	$0
Retail	0.0	0.67%	$ -	-	$ -	$0	$0
Schools K-12	0.0	0.97%	$ -	-	$ -	$0	$0
Stone/Clay/Glass/Concrete	0.0	3.23%	$ -	-	$ -	$0	$0
Textiles and Leather	0.0	3.23%	$ -	-	$ -	$0	$0
Transportation Equipment	2.0	1.65%	$ 7,843	0.0	$ 14,217	$20,738	$621,862
Warehouse	0.0	1.65%	$ -	-	$ -	$0	$0
Water and Wastewater	0.0	1.65%	$ -	-	$ -	$0	$0
Total				**0.0**			

7.8.4 Key Findings

The overall DSM potential is estimated to be 21 MW of summer peak capacity in the base scenario, and is as high as 25 MW under the assumption of incentive levels double that of existing incentives. In the winter, DSM potential is estimated to be 30 MW of capacity in the base scenario and 34 MW in the enhanced scenario. These estimates are based on an in-depth, bottom-up assessment of load reduction potential of all customer segments, and includes an analysis of program-based DSM.

The extent to whether these potential figures can be attained in a cost-effective manner by 2044 depends on the ability to implement programs that target all possible end-uses and cost-effective customer segments. These predictions also rely upon certain assumptions around the future value of capacity, as well as technology cost reductions.

The customer segment-level analysis of the program-based DSM potential sheds light on which customer segments can provide the greatest magnitude of capacity, as well as which customer segments are most cost-effective to pursue. Unsurprisingly, the most attractive customer segments from a benefit/cost perspective are customers who have more load available for reduction during peak hours: larger residential customers who live in single-family and multi-family homes. In general, these customers are more capable of shifting load with little inconvenience/cost, and therefore tend to have higher participation levels in DSM programs as well as greater willingness to shed a higher percentage of their load.

8 Appendices

Appendix A Glossary

Within the body of this report, there are several technical terms that require explanation. Additionally, some of the terms may appear to be similar at first review; however, have very different means. Terms such as “reported” and “verified” can easily be confused by the reader and are thus defined as following:

Baseline: Conditions as they exist at the time the study is performed. This includes estimates and forecasts of sales as they exist today; likewise, estimates of currently-installed EE and DSM technology efficiency.

Free-rider: A program participant who would have acquired in the energy efficiency measure in the absence of a program.

Gross Savings: Total amount of a parameter of interest (kWh or kW) saved by a project/program.

Levelized Cost: The cost of the energy efficiency investment on a per kilowatt hour basis levelized over the life of the program.

Net Savings: Total amount of a parameter of interest (kWh, kW) saved by a program that is directly related to the program. It takes into account the realization rate, as well as results of the attribution analysis (free-riders), to provide a value of energy savings directly related to the program influence. Net Savings is calculated by multiplying the gross verified savings by the net-to-gross (NTG) ratio.

Participant Cost: The cost to the participant to participate in an energy efficiency program.

Program: A group of projects with similar technology characteristics that are installed in similar applications.

Turnover: A DSM measure is not implemented until the existing technology it is replacing fails or burns out. An example would be a unitary air conditioning rooftop unit being purchased after the failure of the existing rooftop unit at the end of its useful life.

Appendix B MPS Measure List

For information on how Nexant developed this list, please see Section 4.

B.1 Residential Measures

Residential Measures	
1.5 GPM Bathroom Faucet Aerators	Energy Star Qualified Airtight Can Lights
1.5 GPM Kitchen Faucet Aerators	Energy Star Qualified LED, Recessed Lighting
1.60 GPM Low-Flow Showerhead	Energy Star Refrigerator
Air Sealing	Energy Star Room AC - 12 SEER
Air Source Heat Pump Maintenance	Energy Star Set-Top Receiver
ASHP from Electric Resistance	Energy Star Television
ASHP, 2 Tons, 18 SEER, 9.5 HSPF	Energy Star Windows
Basement or Crawlspace Wall Insulation R-15	Exterior Wall Insulation on Wall Above Grade R-13
Behavior Modification Home Energy Reports	Floor Insulation R-30
Behavior Modification Home Energy Reports - Active Engagement	Freezer Recycling
CEE Tier 2 Clothes Washer	Green Roof
Ceiling Insulation R-49	Heat Pump Clothes Dryer
Central AC Maintenance	Heat Pump Pool Heater
Dehumidifier Recycling	Heat Pump Water Heater 50 Gallons
Drain Water Heat Recovery	Heat Pump Water Heater 80 Gallons
Dual Speed Pool Pump Motors	High Efficiency Bathroom Exhaust Fan
Duct Insulation	Holiday Lights
Duct Sealing	Home Energy Management System
Ductless Mini-Split HP, 2 Tons 15 SEER, 9 HSPF	Hot Water Pipe Insulation
ECM Motor	Indoor Daylight Sensor
Electric Vehicle Supply Equipment (EVSE)	Insulating Tank Wrap on Water Heater
Energy Efficiency Education in Schools	LED Nightlight
Energy Star Air Purifier	Occupancy Sensors, Switch Mounted
Energy Star ASHP, 2 Tons, 15 SEER, 8.5 HSPF	Outdoor Lighting Timer
Energy Star ASHP, 2 Tons, 16 SEER, 9.0 HSPF	Outdoor Motion Sensor
Energy Star Ceiling Fan	Pre-Pay Program
Energy Star Central AC - 15 SEER	Programmable Thermostat
Energy Star Central AC - 16 SEER	Properly Sized CAC
Energy Star Central AC - 18 SEER	RealTime Information Monitoring
Energy Star Central AC - 20 SEER	Refrigerator Recycling
Energy Star Clothes Dryer	Residential New Construction Tier 1 (10% more efficient)
Energy Star Clothes Washer	Residential New Construction Tier 2 (20% more efficient)

Energy Star Dehumidifier	Residential New Construction Tier 3 (30% more efficient)
Energy Star Desktop Computer	Residential Whole House Fan
Energy Star Dishwasher	Room AC Recycling
Energy Star Doors	Smart Strip Entertainment
Energy Star DVD Blu-Ray Player	Smart Strip Home Office
Energy Star GSHP, 2 Tons, 17.1 SEER, 3.60 COP	Smart Thermostat
Energy Star LED, 13 W	Solar Attic Fan
Energy Star LED, 19 W	Solar Thermal Water Heating System
Energy Star LED, 6 W	Thermostatic Shower Restriction Valve
Energy Star LED, 9 W	Variable Speed Pool Pump Motors
Energy Star Manufactured Home	Water Heater Thermostat Setback
Energy Star Monitor	Window Shade Film

B.2 Commercial Measures

Commercial Measures	
Business Energy Report	HE DX 11.25-20.0 Tons Other Heat
Energy Star LED Lamp, 13W	HE DX 5.4-11.25 Tons Elect Heat
1.5 GPM Faucet Aerators	HE DX 5.4-11.25 Tons Other Heat
1.5HP Open Drip-Proof(ODP) Motor	HE DX Less than 5.4 Tons Elect Heat
1.75 GPM Low-Flow Showerhead	HE DX Less than 5.4 Tons Other Heat
10HP Open Drip-Proof(ODP) Motor	HE Water Cooled Chiller - Centrifugal Compressor - 200 Tons
20HP Open Drip-Proof(ODP) Motor	HE Water Cooled Chiller - Centrifugal Compressor - 500 Tons
2x4 LED Troffer	HE Water Cooled Chiller - Rotary or Screw Compressor - 175 Tons
4' 4-Lamp High Bay T5 Fixture (28W)	HE Water Cooled Chiller - Rotary or Screw Compressor - 50 Tons
Advanced Rooftop Controller	Heat Pump Water Heater 50 Gallons
Air Compressor Optimization	High Efficiency Air Compressor
Anti-Sweat Heater Controls (Cooler)	High Efficiency CRAC Unit
Auto Closer on Refrigerator Door	High Efficiency Refrigeration Compressor - Discus
Auto Off Time Switch	High Efficiency Refrigeration Compressor - Scroll
Beverage Vending Machine Controls	High Performance Medium Bay T8 Fixture
Bi-Level Lighting Control	High Speed Fans
Business Energy Report - Active Engagement	Hot Water Pipe Insulation
Ceiling Insulation R40	Hotel Key Card Room Energy Control System
Chilled Water Reset	Indoor Daylight Sensor
CO Sensors for Parking Garage Exhaust	Induction High Bay Lighting
Data Center Server Consolidation	Insulating Tank Wrap on Water Heater
Demand Controlled Circulating Systems	LED Canopy Lighting (Exterior)
Demand Controlled Ventilation	LED Display Lighting
Demand Defrost	LED Exit Sign
Door Gasket (Cooler)	LED Exterior Wall Packs
Door Gasket (Freezer)	LED High Bay
Drain Water Heat Recovery	LED Linear - Lamp Replacement
Dual Entropy Economizer	LEED New Construction Whole Building
Ductless Mini-Split AC, 4 Ton, 16 SEER	Light Tube
Ductless Mini-Split HP, 4 Ton, 16 SEER, 9 HSPF	Lighting Energy Management System
DX Coil Cleaning	Low-Flow Pre-Rinse Sprayers
Efficient New Construction Lighting	Network PC Power Management
Electric Resistance Water Heater	Occupancy Sensors, Ceiling Mounted
Energy Recovery Ventilation System	Occupancy Sensors, Switch Mounted
Energy Star Combination Oven	Outdoor Motion Sensor
Energy Star Commercial Clothes Washer	Packaged Terminal AC
Energy Star Convection Oven	Packaged Terminal HP

Energy Star Copiers	Photocell Dimming Control (Exterior)
Energy Star Dishwasher	Photocell Dimming Control (Interior)
Energy Star Fax	Programmable Thermostat
Energy Star Fryer	PSC to ECM Evaporator Fan Motor (Reach-In)
Energy Star Glass-Door Freezer	PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)
Energy Star Glass-Door Refrigerator	RealTime Information Monitoring
Energy Star Griddle	Reduced Wattage (25W) T8 Fixture
Energy Star Hot Food Holding Cabinet	Reduced Wattage (28W) T8 Fixture
Energy Star Ice Machines (Self Contained Units)	Reduced Wattage (28W) T8 Relamping
Energy Star LED Lamp, 9W	Reflective Roof Treatment
Energy Star Monitors	Refrigerated Display Case LED Lighting
Energy Star PCs-Desktop	Refrigerated Display Case Lighting Controls
Energy Star Printers	Refrigeration Commissioning
Energy Star Qualified LED Shelf-Mounted Task Lighting	Retro-Commissioning (Existing Construction)
Energy Star Qualified LED, Recessed Lighting	Small Buildings Retro-Commissioning
Energy Star Room AC - 12 SEER	Smart Strip Plug Outlet
Energy Star Scanners	Smart Thermostat
Energy Star Servers	Solar Thermal Water Heating System
Energy Star Solid-Door Freezer	Solid State Cooking Hood Controls
Energy Star Solid-Door Refrigerator	SP to ECM Evaporator Fan Motor (Walk-In, Refrigerator)
Energy Star Steamer	Strip Curtains - Freezers
Energy Star Uninterruptable Power Supply	Strip Curtains - Refrigerators
Energy Star Vending Machine	Suction Pipe Insulation - Freezers
Energy Star Water Coolers	Suction Pipe Insulation - Refrigerators
Energy Star Windows	Time Clock Control
Escalator Motor Efficiency Controller	VAV System
Exterior Bi-Level Lighting Control	Vertical Night Covers
Facility Commissioning	VFD on Chilled Water Pumps
Facility Energy Management System	VFD on HVAC Fan
Fan Thermostat Controller	VFD on HVAC Pump
Floating Head Pressure Controller	VSD Controlled Compressor
Green Roof	Water Heater Setback
HE Air Cooled Chiller - All Compressor Types - 100 Tons	Water Source Heat Pump
HE DX 11.25-20.0 Tons Elect Heat	Window Shade Film

B.3 Industrial Measures

Industrial Measures	
1.5HP Open Drip-Proof(ODP) Motor	High Bay Occupancy Sensors, Ceiling Mounted
10HP Open Drip-Proof(ODP) Motor	High Efficiency Refrigeration Compressor - Discus
20HP Open Drip-Proof(ODP) Motor	High Efficiency Refrigeration Compressor - Scroll
2x4 LED Troffer	High Efficiency Welder
3-phase High Frequency Battery Charger - 1 shift	High Performance Medium Bay T8 Fixture
4' 4-Lamp High Bay T5 Fixture (28W)	High Speed Fans
Air Compressor Optimization	High Volume Low Speed Fan (HVLS)
Auto Closer on Refrigerator Door	Indoor Daylight Sensor
Auto Off Time Switch	Induction High Bay Lighting
Bi-Level Lighting Control	Injection Mold and Extruder Barrel Wraps
Ceiling Insulation R40	Insulated Pellet Dryer Tanks and Ducts
Chilled Water Reset	LED Canopy Lighting (Exterior)
Cogged Belt on 15HP ODP Motor	LED Exit Sign
Cogged Belt on 40HP ODP Motor	LED Exterior Wall Packs
Compressed Air Storage Tank	LED Display Lighting
Demand Controlled Ventilation	LEED New Construction Whole Building
Demand Defrost	LED Linear - Lamp Replacement
Dew Point Sensor Control for Desicant CA Dryer	Low Energy Livestock Waterer
Drip Irrigation Nozzles	Low Pressure Sprinkler Nozzles
Dual Entropy Economizer	Low Pressure-drop Filters
DX Coil Cleaning	Occupancy Sensors, Ceiling Mounted
Efficient Compressed Air Nozzles	Outdoor Motion Sensor
Efficient New Construction Lighting	Packaged Terminal AC
Electric Actuators	Photocell Dimming Control (Exterior)
Energy Efficient Laboratory Fume Hood	Photocell Dimming Control (Interior)
Energy Efficient Transformers	Process Cooling Ventilation Reduction
Energy Recovery Ventilation System	Programmable Thermostat
Energy Star LED Lamp, 13W	Reduced Wattage (25W) T8 Fixture
Energy Star Qualified LED Shelf-Mounted Task Lighting	Reduced Wattage (28W) T8 Fixture
Energy Star Qualified LED, Recessed Lighting	Reduced Wattage (28W) T8 Relamping
Energy Star Room AC - 12 SEER	Reflective Roof Treatment
Energy Star Windows	Refrigeration Commissioning
Exterior Bi-Level Lighting Control	Retro-Commissioning
Facility Commissioning	Small Buildings Retro-Commissioning
Facility Energy Management System	Smart Thermostat
Fan Thermostat Controller	Synchronous Belt on 15HP ODP Motor
Floating Head Pressure Controller	Synchronous Belt on 5HP ODP Motor
Grain Bin Aeration Control System	Synchronous Belt on 75HP ODP Motor

HE Air Cooled Chiller - All Compressor Types - 100 Tons	Time Clock Control
HE Air Cooled Chiller - All Compressor Types - 300 Tons	VAV System
HE DX 11.25-20.0 Tons Elect Heat	VFD on Air Compressor
HE DX 11.25-20.0 Tons Other Heat	VFD on Chilled Water Pumps
HE DX 5.4-11.25 Tons Elect Heat	VFD on HVAC Fan
HE DX 5.4-11.25 Tons Other Heat	VFD on HVAC Pump
HE DX Less than 5.4 Tons Elect Heat	VFD on Process Pump
HE DX Less than 5.4 Tons Other Heat	VSD Controlled Compressor
HE Water Cooled Chiller - Centrifugal Compressor - 200 Tons	Water Source Heat Pump
HE Water Cooled Chiller - Centrifugal Compressor - 500 Tons	Window Shade Film
HE Water Cooled Chiller - Rotary or Screw Compressor - 175 Tons	LED High Bay
HE Water Cooled Chiller - Rotary or Screw Compressor - 50 Tons	

Appendix C Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end uses. The two end uses, Air Conditioning and Heating, were studied for both residential and large C&I customers; however, in residential sector, another two end uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential

Air Conditioning

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load research sample in South Carolina Service territories forthe years 2013 and 2014. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2018
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among April to October). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

The Figure 8-1 and Figure 8-2 displays the comparison of cooling load shape on summer peak weekday and average weekdays in SC DEC and DEP territories. By comparing these two load shapes in the Figure 8-1, peak hours in DEC territory could be identified as around 4:00 pm to 8:00 pm in summer time. As cooling load is highly sensitive to weather, the maximum usage per customer during summer peaks is almost 3 times greater than average usage in the same time on normal days for all the rate classes. The least consumption occurs between 6:00 am to 8:00 am in the morning, when houses are cooled down over night and before heated by direct sunshine. The customers in “TOU” rate class have the highest average cooling consumption, followed by the customers in “RS” rate class as second, and the customers in “RE” as the third. Same trends are examined in the Figure 8-2, and the customers in “TOU” rate class consumes more energy on cooling than those customers in “RES” rate class.

Figure 8-1: Average Cooling Load Shapes for DEC Customers

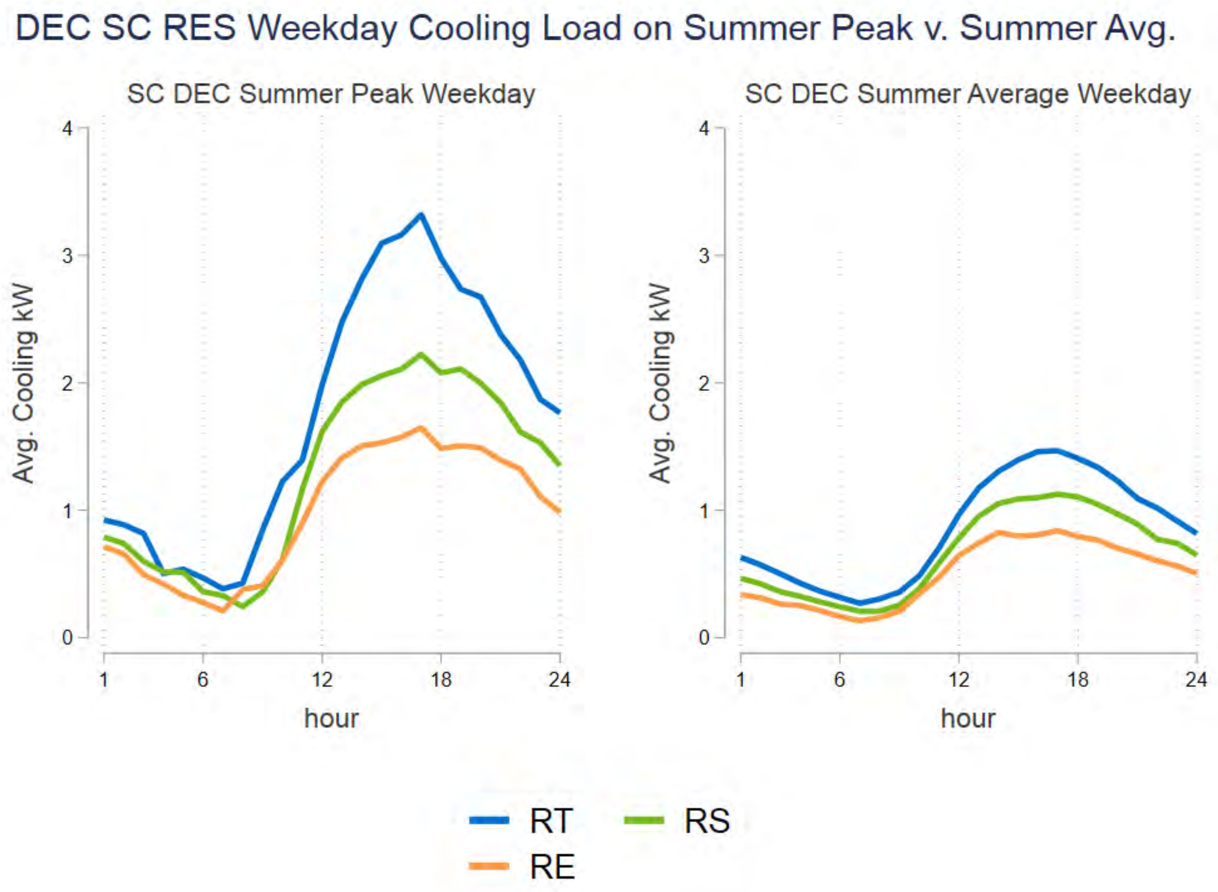
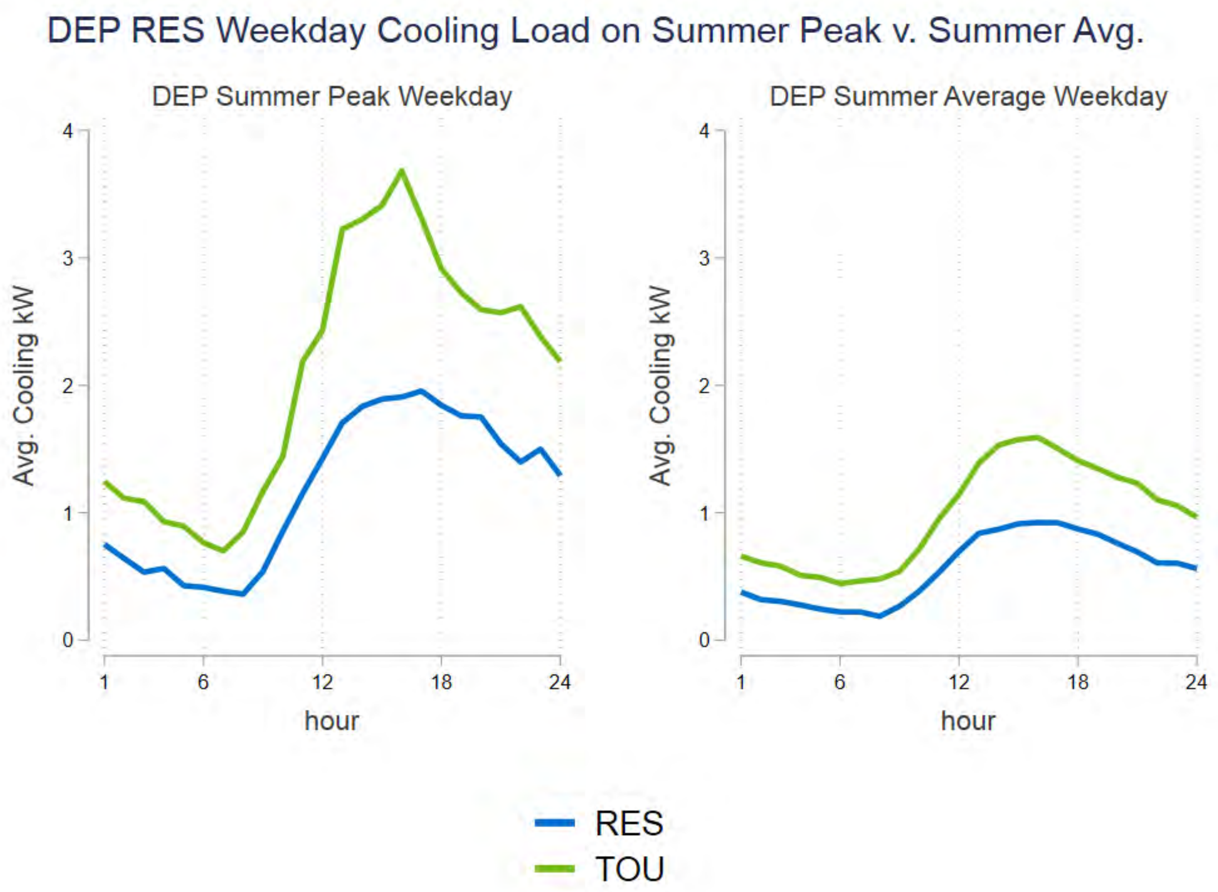


Figure 8-2: Average Cooling Load Shapes for DEP Customers



Space Heating

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same hourly load research profile in 2018, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2018
$Load_t$	Load occurred in each hour

HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

The Figure 8-3 and Figure 8-4 capture hourly peak usage and average usage for SC DEC and DEP territories. The load shape on winter average weekdays shows that space heating consumes more energy after midnight to early morning. Customers in “RS” rate class are assumed not to consume energy on heating end use, as almost all of them are using gas as their heating source.

Figure 8-3: Average Heating Load Shapes for DEC Customers

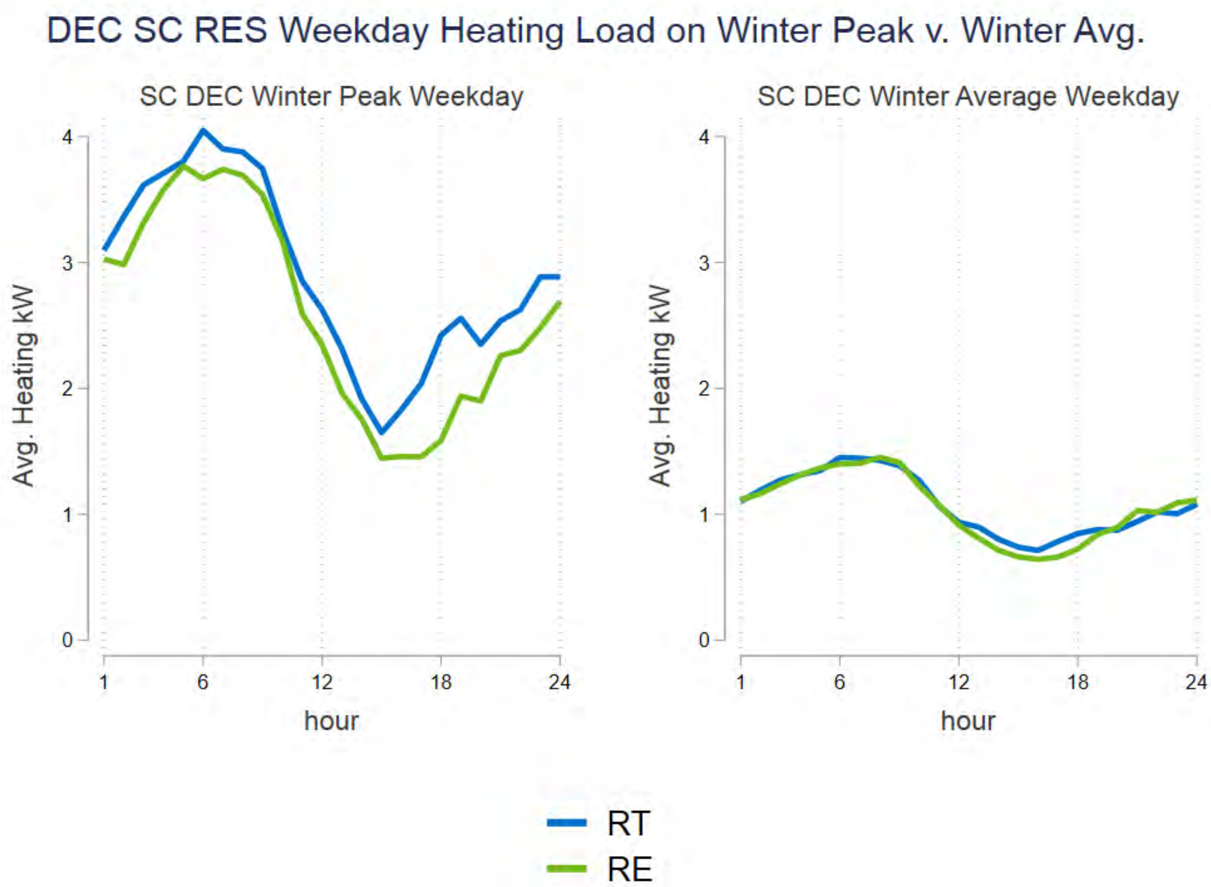


Figure 8-4: Average Heating Load Shapes for DEP Customers

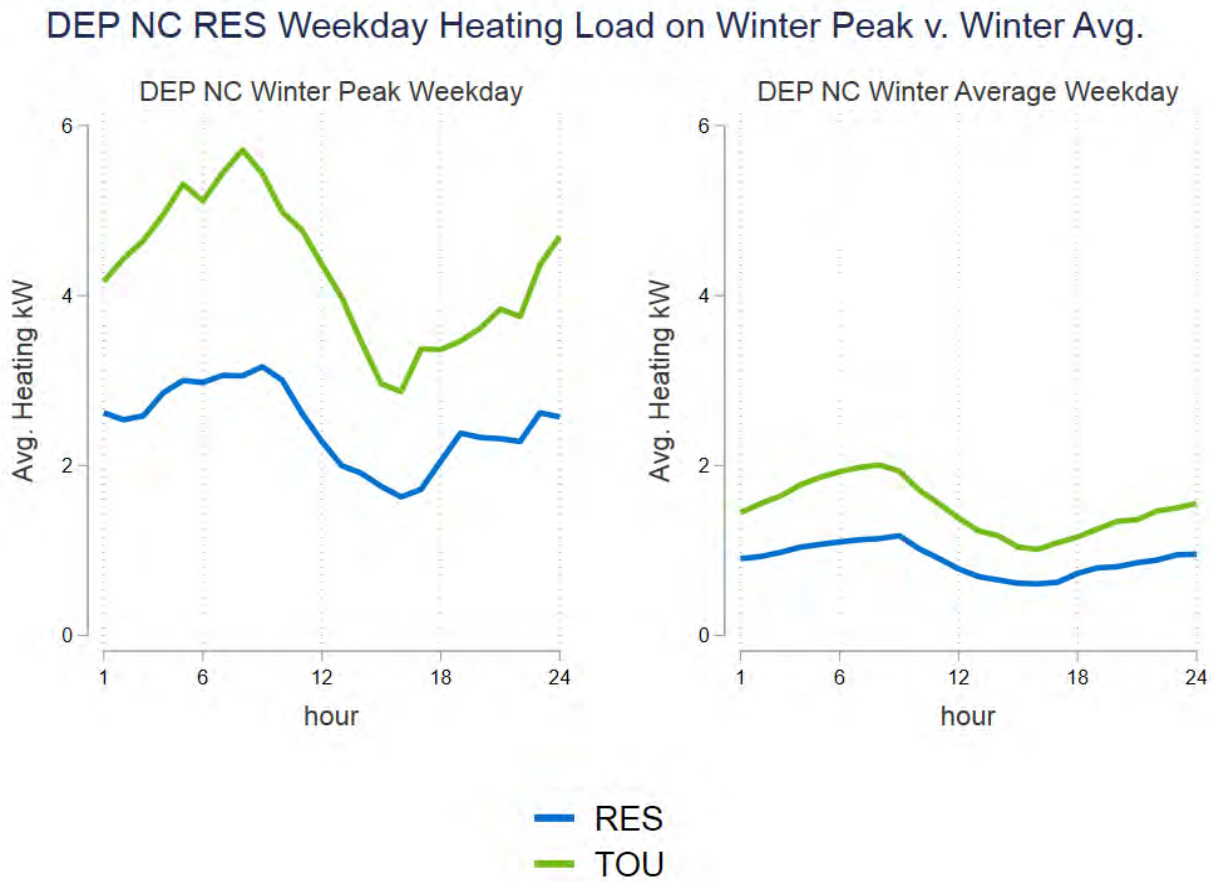


Table 8-3 and Table 8-4 show the technical potentials by rate class on peak day for those two territories.

Table 8-1: DEC Technical DSM Potential for Residential Heating

DEC Residential					
Hour Ending	MW		Hour Ending	MW	
	RE	RT		RE	RT
1	673	1	**13**	437	1
2	663	1	**14**	390	1
3	737	1	**15**	321	1
4	795	1	**16**	324	1
5	837	1	**17**	324	1
6	815	1	**18**	353	1
7	831	1	**19**	431	1
8	821	1	**20**	422	1

9	786	1	**21**	502	1
10	705	1	**22**	511	1
11	576	1	**23**	551	1
12	522	1	**24**	598	1

Table 8-2: DEP Technical DSM Potential for Residential Heating

DEP Residential					
Hour Ending	MW		Hour Ending	MW	
	RES	TOU		RES	TOU
1	260	5	**13**	210	5
2	258	5	**14**	196	4
3	265	6	**15**	177	4
4	289	6	**16**	166	4
5	306	7	**17**	180	4
6	301	6	**18**	205	4
7	312	7	**19**	232	4
8	316	7	**20**	230	4
9	320	7	**21**	232	5
10	301	6	**22**	228	5
11	269	6	**23**	263	5
12	238	5	**24**	264	6

Water Heaters

Interval load data by end-use are not available for individual customers in Duke territory, so the analyses of water heaters was completed based on end-use metered data from https://openei.org. The water heater data are from the same cities and use the same weights as the weather stations used in this analysis. The monthly average was used corresponding to the system peak load of each jurisdiction.

Figure 8-5: Average Water Heaters Load Shapes for DEC Customers

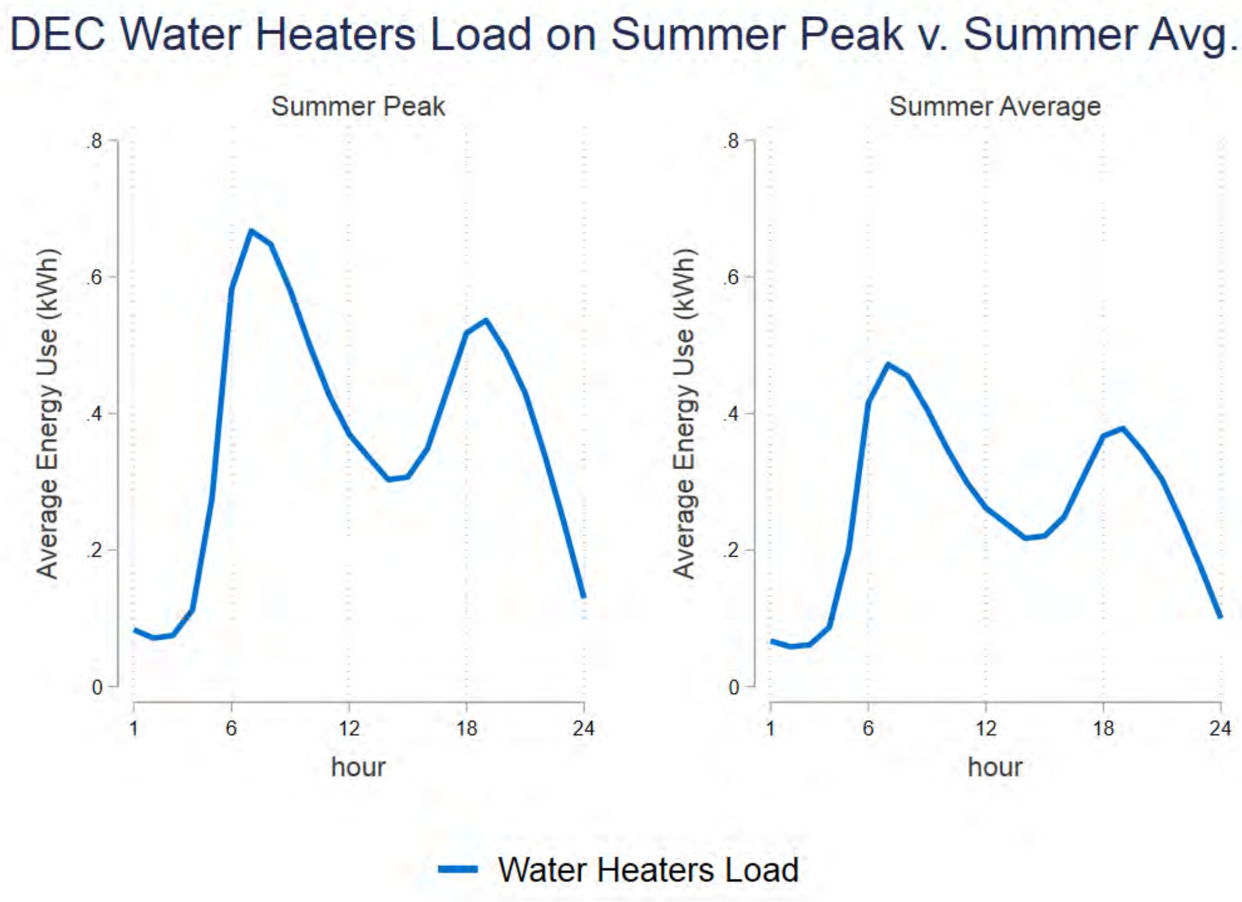
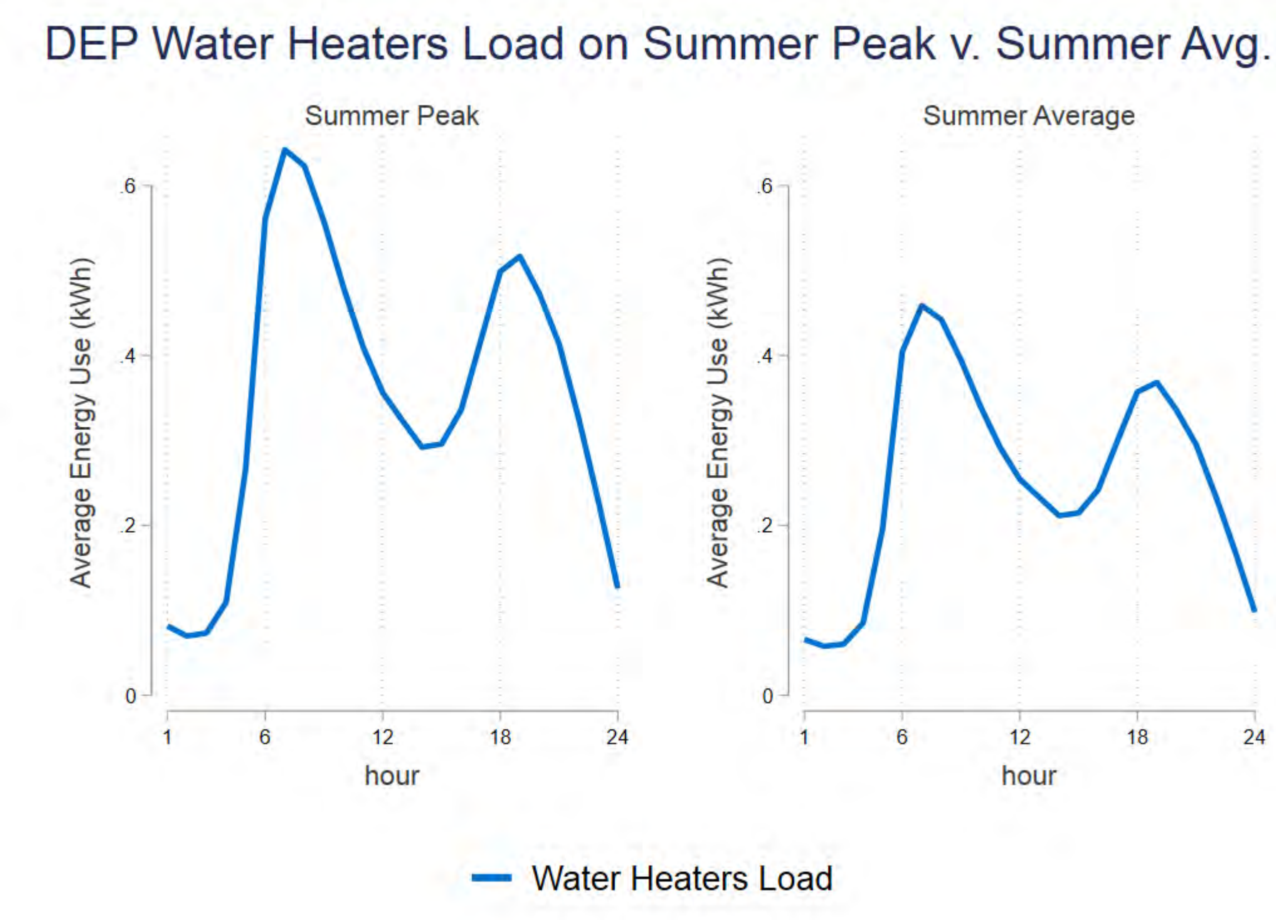


Figure 8-6: Average Water Heaters Load Shapes for DEP Customers

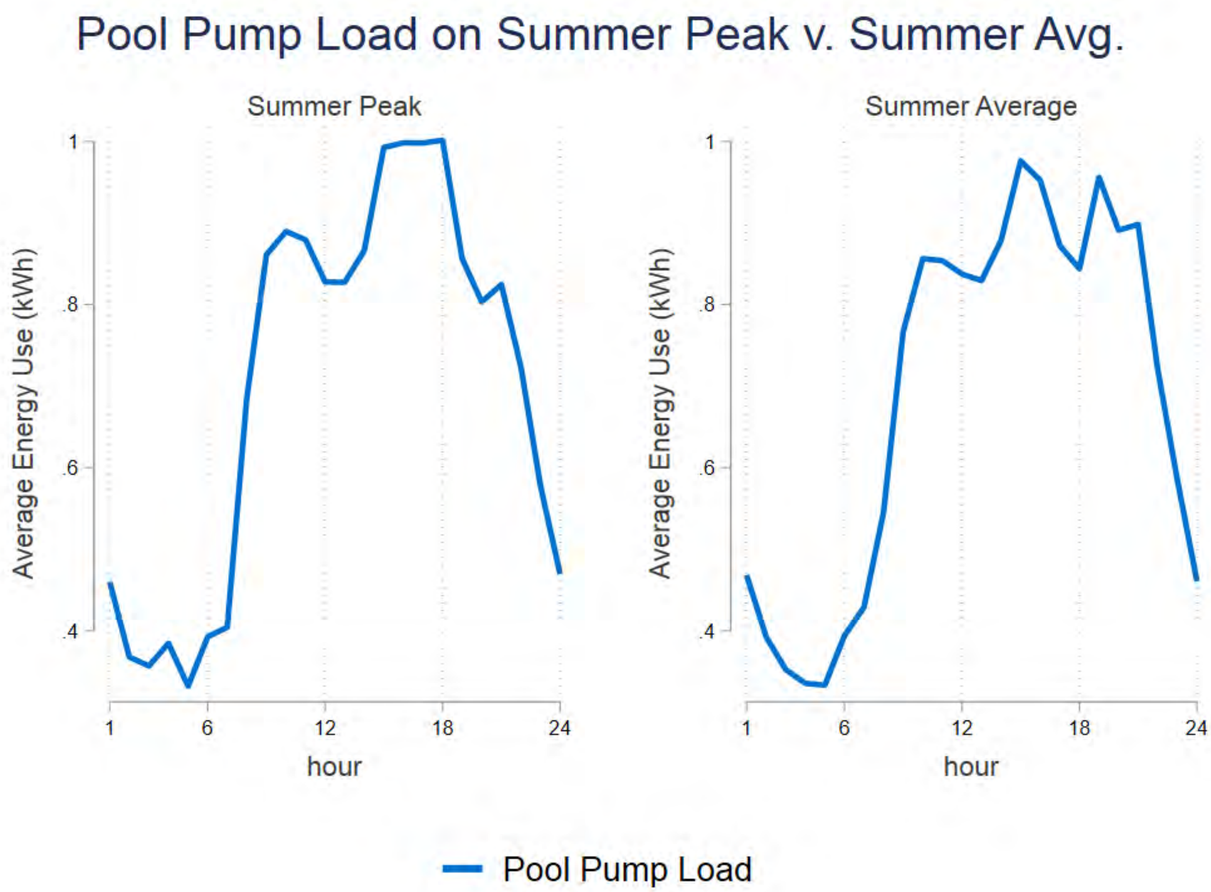


It is apparent from the Figure 8-6 that there is not much difference from peak usage and average usage, which proves that water heater loads has low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 am – 7:00 am and 5:00 pm – 8:00 pm.

Pool Pumps

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in Duke jurisdictions.

Figure 8-7: Average Pool Pumps Load Shapes for DEC Customers



According to the Figure 8-4, the peak hours for pool pumps are 3:00 pm to 6:00 pm, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2018) for all non-residential customers. Customers were categorized into one of 23 industry segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential as well as examine the weather-sensitivity of each segment by comparing peak usage to the average usage in each season. For example, the chemicals and lumber segments are more weather sensitive in DEP than textiles and miscellaneous.

Figure 8-8: Aggregate Load Shapes for DEC Large C&I Customers

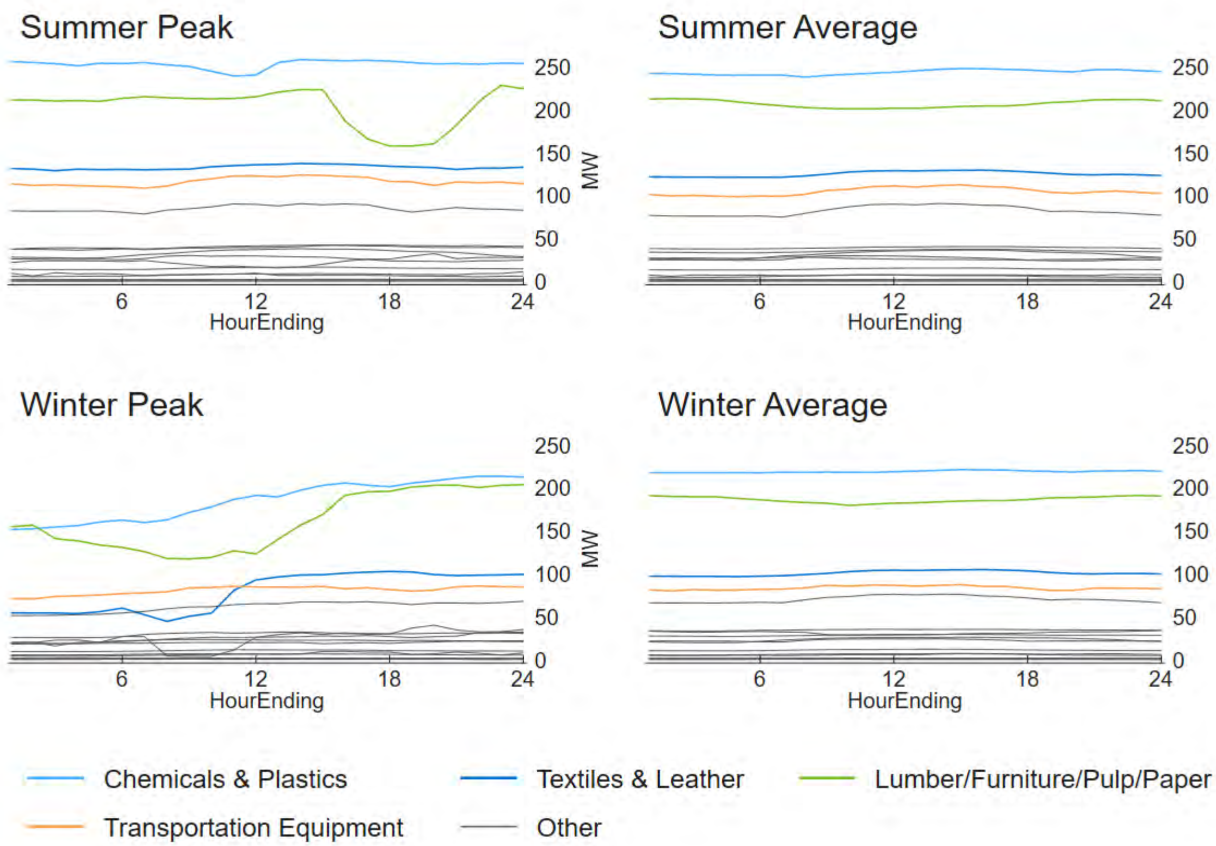
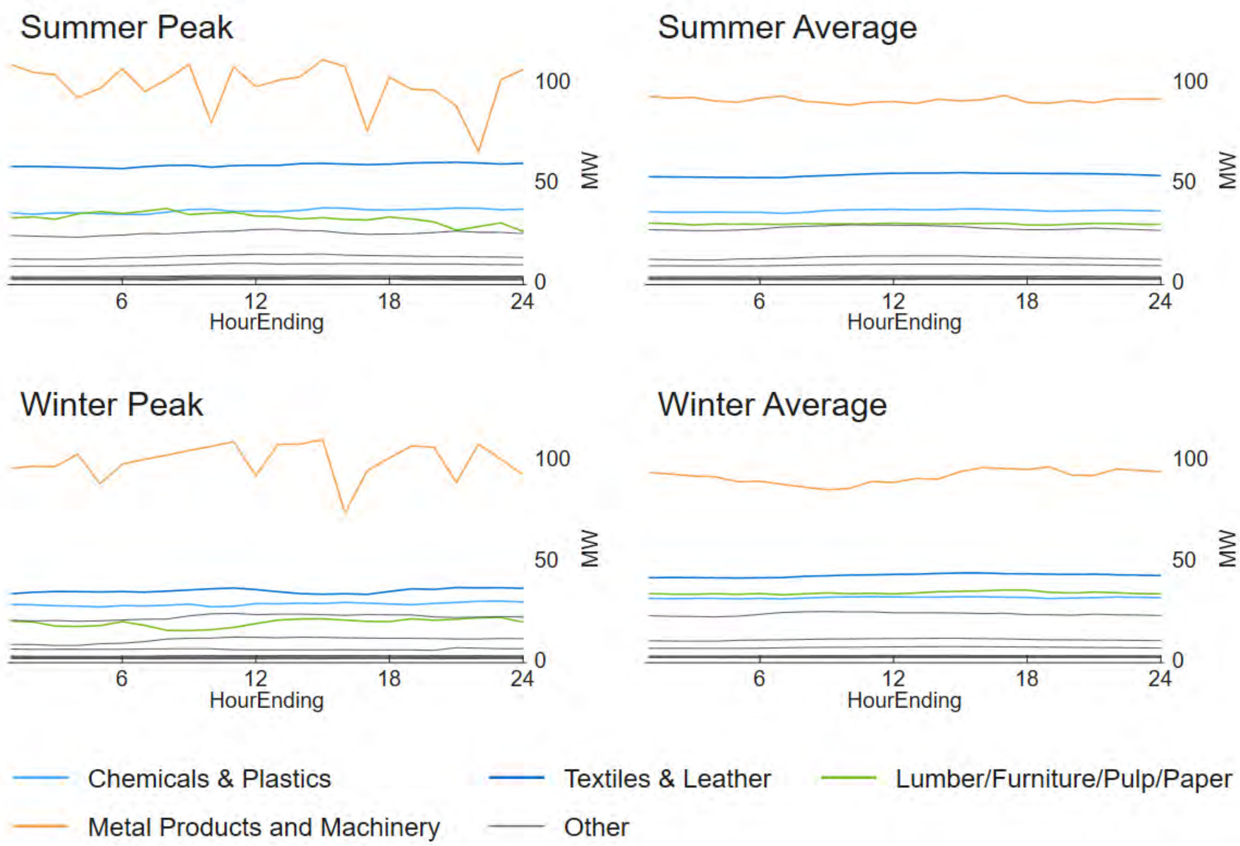


Figure 8-9: Aggregate Load Shapes for DEP Large C&I Customers



Appendix D Combined Heat and Power Potential

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data for climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Table 8-3, on the following page, present the values for thermal factors used to estimate technical potential.

Table 8-3: CHP Thermal Factors by Segment and Prime Mover

Application	Microturbines 250-500 kW	Fuel Cells 250-500 kW	Reciprocating IC Engines 0.5 - 1 MW	Reciprocating IC Engines 1 - 5 MW	Gas Turbines 5 - 20 MW	Gas Turbines >= 20 MW
Assembly	0.83	0.86	0.92	1.05	1.05	1.28
College and University	0.52	0.54	0.57	0.66	0.66	0.80
Data Center	0.55	0.57	0.61	0.69	0.69	0.85
Grocery	0.12	0.13	0.14	0.15	0.15	0.19
Healthcare	0.38	0.39	0.42	0.48	0.48	0.59
Hospitals	0.70	0.72	0.76	0.87	0.87	1.07
Institutional	0.51	0.53	0.56	0.64	0.64	0.79
Lodging/Hospitality	0.35	0.36	0.39	0.44	0.44	0.54
Miscellaneous	0.33	0.34	0.36	0.42	0.42	0.51
Office	0.37	0.38	0.41	0.46	0.46	0.57
Restaurants	0.33	0.34	0.37	0.42	0.42	0.51
Retail	0.40	0.41	0.43	0.50	0.50	0.61
Schools K-12	0.57	0.58	0.62	0.71	0.71	0.87
Warehouse	0.33	0.33	0.36	0.41	0.41	0.50
Agriculture and Assembly	1.20	1.24	1.32	1.51	1.51	1.85
Chemicals and Plastics	0.74	0.76	0.81	0.93	0.93	1.14
Construction	1.48	1.52	1.63	1.85	1.85	2.27
Electrical and Electronic Equip.	0.29	0.29	0.31	0.36	0.36	0.44
Lumber/Furniture/Pulp/Paper	1.09	1.12	1.19	1.36	1.36	1.67
Metal Products and Machinery	0.29	0.29	0.31	0.36	0.36	0.44
Miscellaneous Manufacturing	1.48	1.52	1.63	1.85	1.85	2.27
Primary Resources Industries	0.38	0.39	0.42	0.48	0.48	0.59
Stone/Clay/Glass/Concrete	2.45	2.52	2.69	3.07	3.07	3.76
Textiles and Leather	0.85	0.87	0.93	1.06	1.06	1.30
Transportation Equipment	0.48	0.49	0.53	0.60	0.60	0.74
Water and Wastewater	0.33	0.34	0.36	0.42	0.42	0.51

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

D.1 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DSM, and CHP systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DSM curtailment. Therefore, after development of the independent models, the interaction between EE, DSM, and CHP was incorporated as follows:

- The EE technical potential was assumed to be implemented first, CHP technical potential.
- For CHP systems, the EE technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.

For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DSM capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DSM. Therefore, CHP technical potential should not be combined with DSM potential but used as independent estimates. Table 8-4 presents technical potential for CHP in the DEC jurisdiction.

Table 8-4: DEC Technical Potential for CHP

Sector	Segment	Total		
		# of Sites	MW Potentials	MWh Potentials
Commercial	Assembly	4	1	4,080
Commercial	College and University	0	0	0
Commercial	Data Center	0	0	0
Commercial	Grocery	0	0	0
Commercial	Healthcare	0	0	0
Commercial	Hospitals	3	1	6,562
Commercial	Institutional	0	0	0
Commercial	Lodging/Hospitality	2	1	5,047
Commercial	Miscellaneous	2	2	9,651
Commercial	Office	5	3	18,254
Commercial	Restaurants	0	0	0
Commercial	Retail	13	6	21,721
Commercial	Schools K-12	3	1	3,451
Commercial	Warehouse	2	1	4,304
Industrial	Agriculture and Assembly	0	0	0
Industrial	Chemicals and Plastics	0	0	0
Industrial	Construction	0	0	0
Industrial	Electrical and Electronic Equip.	1	1	3,120
Industrial	Lumber/Furniture/Pulp/Paper	0	0	0
Industrial	Metal Products and Machinery	0	0	0
Industrial	Miscellaneous Manufacturing	13	7	33,617
Industrial	Primary Resources Industries	0	0	0
Industrial	Stone/Clay/Glass/Concrete	0	0	0
Industrial	Textiles and Leather	0	0	0
Industrial	Transportation Equipment	0	0	0
Industrial	Water and Wastewater	0	0	0
Total		**48**	**23**	**109,806**

The CHP technical potential for DEPSC is presented below in Table 8-5.

Table 8-5: DEP Technical Potential for CHP

Sector	Segment	Total		
		# of Sites	MW Potentials	MWh Potentials
Commercial	Assembly	0	0	0
Commercial	College and University	0	0	0
Commercial	Data Center	0	0	0
Commercial	Grocery	0	0	0
Commercial	Healthcare	0	0	0
Commercial	Hospitals	3	2	9,911
Commercial	Institutional	0	0	0
Commercial	Lodging/Hospitality	0	0	0
Commercial	Miscellaneous	0	0	0
Commercial	Office	0	0	0
Commercial	Restaurants	0	0	0
Commercial	Retail	1	0	1,212
Commercial	Schools K-12	2	1	2,119
Commercial	Warehouse	0	0	0
Industrial	Agriculture and Assembly	0	0	0
Industrial	Chemicals and Plastics	0	0	0
Industrial	Construction	0	0	0
Industrial	Electrical and Electronic Equip.	0	0	0
Industrial	Lumber/Furniture/Pulp/Paper	0	0	0
Industrial	Metal Products and Machinery	0	0	0
Industrial	Miscellaneous Manufacturing	1	1	3,950
Industrial	Primary Resources Industries	0	0	0
Industrial	Stone/Clay/Glass/Concrete	0	0	0
Industrial	Textiles and Leather	0	0	0
Industrial	Transportation Equipment	0	0	0
Industrial	Water and Wastewater	0	0	0
Total		**7**	**4**	**17,192**

D.2 CHP Economic Potential

Nexant conducted cost research for CHP prime movers and used research on the technology type to identify the appropriate technologies for each segment. CHP costs and utility avoided energy costs are used to estimates TRC ratios for CHP technologies of a given size at each eligible Duke Energy account. These estimates are based on 2018 billing data provided by Duke Energy to Nexant. Economic Potential for DEC is presented below in Table 8-6.

Table 8-6: DEC Economic Potential for CHP

Sector	Segment	Total		
		# of Sites	MW Potentials	MWh Potentials
Commercial	Assembly	4	1	5,134
Commercial	College and University	0	0	0
Commercial	Data Center	0	0	0
Commercial	Grocery	0	0	0
Commercial	Healthcare	0	0	0
Commercial	Hospitals	3	1	7,615
Commercial	Institutional	0	0	0
Commercial	Lodging/Hospitality	0	0	0
Commercial	Miscellaneous	1	1	7,018
Commercial	Office	1	1	9,009
Commercial	Restaurants	0	0	0
Commercial	Retail	0	0	0
Commercial	Schools K-12	0	0	0
Commercial	Warehouse	0	0	0
Industrial	Agriculture and Assembly	0	0	0
Industrial	Chemicals and Plastics	0	0	0
Industrial	Construction	0	0	0
Industrial	Electrical and Electronic Equip.	1	1	3,565
Industrial	Lumber/Furniture/Pulp/Paper	0	0	0
Industrial	Metal Products and Machinery	0	0	0
Industrial	Miscellaneous Manufacturing	13	7	38,874
Industrial	Primary Resources Industries	0	0	0
Industrial	Stone/Clay/Glass/Concrete	0	0	0
Industrial	Textiles and Leather	0	0	0
Industrial	Transportation Equipment	0	0	0
Industrial	Water and Wastewater	0	0	0
Total		**23**	**12**	**71,214**

Economic potential for CHP in the DEP service territory is presented below in Table 8-7.

Table 8-7: DEP Economic Potential for CHP

Sector	Segment	Total		
		# of Sites	MW Potentials	MWh Potentials
Commercial	Assembly	0	0	0
Commercial	College and University	0	0	0
Commercial	Data Center	0	0	0
Commercial	Grocery	0	0	0
Commercial	Healthcare	0	0	0
Commercial	Hospitals	3	2	11,502
Commercial	Institutional	0	0	0
Commercial	Lodging/Hospitality	0	0	0
Commercial	Miscellaneous	0	0	0
Commercial	Office	0	0	0
Commercial	Restaurants	0	0	0
Commercial	Retail	0	0	0
Commercial	Schools K-12	0	0	0
Commercial	Warehouse	0	0	0
Industrial	Agriculture and Assembly	0	0	0
Industrial	Chemicals and Plastics	0	0	0
Industrial	Construction	0	0	0
Industrial	Electrical and Electronic Equip.	0	0	0
Industrial	Lumber/Furniture/Pulp/Paper	0	0	0
Industrial	Metal Products and Machinery	0	0	0
Industrial	Miscellaneous Manufacturing	1	1	4,568
Industrial	Primary Resources Industries	0	0	0
Industrial	Stone/Clay/Glass/Concrete	0	0	0
Industrial	Textiles and Leather	0	0	0
Industrial	Transportation Equipment	0	0	0
Industrial	Water and Wastewater	0	0	0
Total		**4**	**3**	**16,070**

D.3 CHP Achievable Potential

This analysis describes the physical and economic factors that may contribute to facilities' energy savings through the installation of CHP technologies. The data available for characterizing CHP opportunities are limited to representative values for each commercial and industrial segment. These value represent general segment characteristics, and describe the order of magnitude for likely drivers of CHP potential in each segment.

The question of which specific facilities are more or less likely to adopt CHP potential bears further research. CHP installations are large projects that are inherently site-specific. Assuming CHP is technical feasible and economic at a given location, there are other important considerations for whether CHP should actually go forward. Nexant's understanding is that Duke Energy is currently working through a variety of channels to gauge customer interest in CHP technology. Without further research on the topic, we identified project payback period as a potential criterion for screening eligible. Based on our estimates of cost for CHP prime movers and technical feasibility, we find that payback periods range from 4.5 to 35 years among Duke Energy customers.

Similar studies of CHP potential recently performed by Nexant have used jurisdictional rules for screening achievable potential: a payback period of 2 years or less for larger commercial and industrial customers. Based on this information, Nexant finds that CHP achievable potential is likely to be relatively low without additional research on key drivers that can be used to target facilities, or without outreach to potential facilities.

Appendix E Qualitative Analysis of Duke Energy Programs

E.1 Residential

Smart$aver

In 2019, Smart $aver program costs exceeded Duke Energy's avoided costs for the associated savings generated by the program. The program offers tiered incentive rates for higher efficiency HVAC units. The Smart $aver program generates high participant satisfaction, especially with contractors. Trade ally participants report that Smart $aver influenced them to recommend and implement qualified measures, and to increased their knowledge of EE technologies. Trade allies are the program's most successful marketing channel. That said, Smart $aver does not appear to serve as a strong gateway program; while many participants indicated purchasing other products or services to save energy in the home, they did not assign influence to the Smart $aver program for those subsequent energy upgrades.

Trade allies reported interest in additional sales training. The program now has an online portal for trade allies, and 71% of trade allies reported problems such as data entry and upload problems. Trade allies are looking for additional information on why rebates requests are rejected; they indicate the application process is time-consuming, as is resolving application issues. That said, 75% of Trade Allies reported the portal issues have improved with time.

Overall EM&V findings suggest looking for improvements to the trade ally experience, as they are the primary drivers of the program. Key areas for improvement include the application process and portal, program training, and the quality installation process and requirements. Other suggestions include cooperative marketing with trade allies, which Duke Energy is currently doing with the "Find it Duke," contractor referral. The program is also marketed through a variety of channels: TV, radio, social media, and email messaging. One other suggestions was to provide trade allies with some compensation for time spent on the rebate process, and project portal submissions. Lastly, nearly 60% of program data for the quality install measure had demonstrable issues such as mathematical errors, non-qualifying capacities, rule-of-thumb CFM estimates.

DEP Neighborhood Energy Saver (NES)

Nexant reviewed the EM&V report dated January 17, 2017. The Neighborhood Energy Saver program provides one-on-one energy education, onsite energy assessments, and packages of no-cost energy efficiency measures to customers in income-qualified neighborhoods. Neighborhoods are eligible if 50% of households in the community have incomes equal or less than 150% of the Federal poverty level. The program provides equipment and education at no cost, and when possible, works with community leaders to maximize the number of customers participating in each neighborhood.

EM&V recommendations include expanding lighting offerings to specialty sockets, and evaluating the potential costs and savings of ENERGY STAR appliances. In terms of the program itself, EM&V

recommends adjusting the low-income threshold to 200% of the Federal poverty level. Duke Energy's 2019 year-end program summary indicates the 2019 program has already moved to this lower threshold for eligibility. Procedural EM&V findings include improving onsite data collection, which has been done by transitioning to a tablet-based onsite data collection system.

Currently the program activities are ongoing, having completed eight neighborhoods in 2019. The program's events included support from community groups and speakers such as elected officials, community leaders, and community action agency representatives. The program's marketing approach is grassroots, interacting with individual customers. Participation is driven through a neighborhood kick-off event that includes community leaders and officials.

Energy Efficiency Education Program

The Energy Efficiency Education program is available to students in K-12 enrolled in public and private schools in the DEC service territory. The program provides principals and teachers with an innovative curriculum around energy use and waste; the centerpiece of the program is a live theatrical production with professional actors. Teachers receive supporting education material for their classrooms, and students have take-home assignments. Students are encouraged to complete a request form for their families to receive an Energy Efficiency Starter Kit.

Nexant reviewed the program's 2017 – 2018 EM&V report. Conclusions in the report describe that teachers appreciate the theatrical performances from the standpoint of engaging students, but it is less clear whether the performances are linked to classroom learning, awareness of EE at home, or a change in behavior. Many parents surveyed were not aware the performance occurred; although roughly half of parents reported changes in their children's energy use behavior, those changes were limited. Another EM&V conclusion identified opportunities to increase parental awareness of the kits. Lastly, findings indicate nearly all respondents installed at least one kit measure, and about 20% indicated making additional energy saving improvements. Lastly, the education program could serve as a gateway program by referring customers with a demonstrated interest in energy efficiency to additional program offers.

My Home Energy Report

The My Home Energy Report is an opt-out program that delivers personalized energy reports to customers. The reports compare household consumption to other similar households and to an efficient household. The report also offers tips for saving energy and advertises other Duke Energy Program offerings. The program also includes an online portal that allows customers to learn more about their energy and use opportunities to lower it. The portal allows customers to set and track goals, and receive more targeted tips. Some customers are excluded from the program to serve as a control group for measuring program energy impacts.

The 2019 EM&V Report suggests continued commitment to simultaneous assignment of treatment and control groups. The report also suggests looking for ways to increase customer awareness of the Interactive Portal component of the program. This recommendation appears to have been implemented, according to Duke Energy's 2019 year-end program summary: an on-report marketing campaign in 2019 led to an increase in 56,900 Interactive Portal enrollments.

Home Energy House Call

The Residential Energy Assessment Program, also known as "Home Energy House Call," provides participants with a customized energy report that includes low- and no-cost recommendations for lowering energy bills. Customers receive an EE started kit with LEDs, low-flow showerhead, two faucet aerators, weather stripping, and outlet seals. These can be installed at no charge by the auditor. The auditors encourage behavioral changes to reduce consumption and recommends higher-cost energy-saving investments to customers.

Nexant reviewed the 2018 evaluation report for this program, which highlights the following recommendations: energy auditors should install all possible kit measures; educate customers on the benefits of early light bulb replacement; add tools for auditors to cross-market other Duke Energy programs, such as promotional materials or technology-assisted referrals that correspond to report recommendations.

According to Duke Energy's 2019 year-end program summary, the in-home audits are conducted by Building Performance Institute (BPI) certified energy specialists. The specialists conducts a 60 to 90 minute home walkthrough to assess the customers home and energy use to identify savings opportunities. This program is widely marketed through Duke Energy's website, online advertisements, paid search campaigns, Facebook, email, bill inserts, bill messages, direct mail, and customer segmentation to reach customers with a high propensity to participate. Program changes in 2019 focused on cross-promotion of other programs and integrated in-field referral for FindItDuke, thus responding to EM&V recommendations.

Energy Efficient Appliances

The Energy Efficient Appliances and Devices program offers a variety of measures such as lighting, pool pumps, heat pump water heaters, and water measures. This program includes the Free LED program offer gives away 15 LEDs per account. Customers have multiple ways to track their order. The program also includes the Duke Energy Savings Store ("Store"), which offers specialty bulbs. The program added smart thermostats to the Store in 2018. Most recently, in 2019, the program added LED fixtures and small appliances such as dehumidifiers and air purifiers. The Store platform also provides educational information that can assist with purchase decisions.

The EEAD program includes a retail lighting component that reduces prices at retail locations, and the Save Energy and Water Kit Program. The SEWK markets to customers by business reply card and direct email. The kit offers a free aerator, insulating pipe tape, shower heads, and bathroom aerators.

The EEAD program also offers rebates on high efficiency pool pumps, which is marketed through Trade Allies. New swimming pools are eligible. High efficiency heat pump water heaters are also available and marketed through Trade Allies.

Nexant reviewed the 2018 EM&V report for the Online Savings Store, which recommends that Duke Energy adjust for the 2020 EISA standards in terms of lighting install rates. Overall, evaluators found the program was running smoothly and demonstrated high customer satisfaction. The EM&V also recommended adding additional non-lighting measures to the store, which Duke Energy has done.

Duke Energy will discontinue the Free LED program in 2020 due to EISA standards. Regarding specialty lighting included in the Store, Duke Energy is enhancing the website to provide additional information that raises customer awareness of specialty lighting offers.

The pool pump and water heater measures are marketed through trade allies; Duke Energy is investigating ways to implement point of sale rebates. Duke Energy is also work with major retailer to educate customers and create awareness, including the use of co-branding strategies with manufacturers and national retailers.

Multifamily Energy Efficiency

This program offers lighting and water measures to reduce consumption at multifamily properties. LED lighting measures include typical A-lines, as well as other specialty bulb types. The measure are professionally installed by a contractor and quality assurance is performed on 20% of properties each month. In 2019 the Duke Energy year-end program summary indicates the program completed installation at 45,422 multifamily units. Duke Energy is implementing technology solutions to support participation tracking and data accuracy. The third-party implementation contractor is responsible for marketing and outreach to property managers. This is done with outbound calling, and recruiting at industry trade events, and on-site visits.

E.2 Commercial

Small Business Energy Saver

The Small Business Energy Saver (SBES) program offers a performance-based incentive of up to 80% of total project caught, including materials and installation. The main focus of program measures is lighting, HVAC, and refrigeration equipment. The program is implemented by a third party that conducts marketing outreach, provides technical expertise, and performance incentives to reduce equipment and installation costs.

Nexant reviewed the 2018 EM&V report for the program, which recommends clear communication about the quality and depth of retrofit. The most common feedback from participants described post-installation equipment issue and a perceived lack of coordination between the parties involved in delivering the program. Some customers also appeared to be confused about what measures could be provided under the program, versus those desired by participants. The current eligibility criterion of 180 kW demand, may lead to larger projects being included in the SBES program when those projects might be better accommodated by other programs.

The EM&V also recommends tracking burnout lamps at customer locations during the initial audit, as burnouts may be ignored by customers and reduce the savings achievable for retrofits. The EM&V also notes the implementation contract might benefit from having more up-to-date and accurate customer billing data.

Duke Energy's 2019 year-end summary for the SBES program indicates customers receive a free audit and recommendations for energy efficiency upgrades. The program is administered as a pay-for-performance program where the implementation contractor is compensated on the basis of customer savings. In 2019 the program began offering a tiered incentive structure for deeper retrofits, which is designed to encourage the adoption of more non-lighting measures. This approach successfully reduce the share of lighting measure in the program from 80% to 53%.

The program is also contemplating changes that would lead to using energy savings to pay off the project cost and thereby reduce the financial impact on customers. The program is marketed directly through the implementer, direct mail, website, social media, email, and Business Energy Advisors, and community events.

Non-residential Smart $aver Prescriptive

The Duke Energy Smart $aver Prescriptive program provides incentives for electric commercial and industrial customer to purchase and install a variety of high-efficiency equipment, including lighting, HVAC, pumps and drives, qualifying process, food service, and information technology equipment. Incentives are paid for new construction, retrofits, and replacements. Incentives are limited to 75% or less of the customer cost. The program is primarily application-based and driven by trade allies. The program has two delivery channels: the Business Savings Story on Duke Energy's website ("Store"). The program also includes a midstream channel that lets distributors give instant discounts on eligible lighting equipment.

Nexant review the 2018 EM&V report for this program, and primary recommendations include promoting lesser-known program components. For example, business energy advisors have an opportunity to promote the online store. Likewise, trade allies had a relatively low level of knowledge about, and attendance at trade ally training events. The EM&V also suggests introducing a mandatory, introductory training seminar to educate trade allies on program processes and requirements. Additional feedback included improvements to program tracking around trade ally performance, and adding customer identifiers for tracking participation. Data entry and data quality in the program tracking database could be improved, and well as ensuring complete program application data is entered into the participation database.

The 2019 year-end program summary prepared by Duke Energy indicates the midstream delivery channel garnered the most participants, followed by the online store; both of these deliver channels offer instant rebates and avoid the application process. The program also offers a pre-qualification procedure that allows customers to ensure their selected equipment qualifies for a rebate prior to purchase. Duke Energy's trade ally management strategy for the program includes a search tool allowing customers to find participating trade allies, QC inspections, co-marketing, online application portal, year-end awards for trade allies, a quarterly newsletter, training, discussion groups, and an online collateral toolkit.

Duke Energy plans to look for ways to bolster non-lighting measures and projects. This involves continual reassessment to look for additional measures that can be added to the program. Duke Energy is also looking for ways to reach out to customer segments with lower participations rates. The program is marketed through direct marketing such as mail and email, online marketing, print marketing, and supporting partnerships. The program is also marketed by Large Business Account Managers and Business Energy Advisors at Duke Energy.

Non-residential Smart Saver Custom

The Non-residential Smart $aver Customer program looks for ways to incentivize energy efficiency projects that do not qualify for Smart $aver Prescriptive. Typically these projects are more complex and would not be completed without technical or financial assistance from Duke Energy. Nexant reviewed the 2018 program EM&V findings, which suggest using T8 lighting as a baseline for linear fluorescent lamp types. Other recommendations include continuing to focus on trade allies and contractors as the main conduit for bringing customers into the program. Similarly, tools and calculators made available to contractors should remain up-to-date with program baselines and non-lighting measures. EM&V also recommends looking for ways to reduce application preapprovals to a period of less than six weeks.

Duke Energy's 2019 year-end program summary describes the pre-approval process, which uses the Classic Custom and Smart $aver Tools. These processes have slightly different documentation requirements, depending on the expect size of project savings. The program uses a flat incentive rate for energy and demand savings. There is also a fast-track option where customers can pay a fee to speed up the application process. In 2019 Duke Energy launched the Smart $aver tools, which allows customers to submit a single application to cover lighting measures incentivized by the Prescriptive and Customer programs. Following recommendations from EM&V, Duke Energy has reduced application processing time to an average of 19 days.

The program is marketed through a variety of channels to create customer awareness of the program. In some cases this involves targeted marketing such as to trade allies, to ensure they are aware of the program incentive offers. Larger accounts are targeted primarily through business account managers. Unassigned medium and small accounts are targeted through Business Energy Advisors. In 2017 Duke Energy began a new marketing channel focused on energy efficiency design assistance.

Non-residential Smart $aver Customer Assessment

This program is a recruitment channel for Smart $aver Custom. It offers incentives to fund a detailed energy assessment and retro-commissioning design that can take advantage of Smart $aver Customer incentives. In 2019 this program was enhanced with a virtual auditing tool that can use data collected remotely to shorten the audit period to 2-3 weeks. Typical recruitment channels include Business Account Managers, electronic postcards, emails, and information obtained through the Duke Energy website and direct customer inquiries. Anticipated future marketing may tie more directly to the virtual audit tool as it becomes more applicable.

Non-residential Smart $aver Performance Incentive

This program provides incentive payments to offset a portion of the higher cost of energy efficiency installations that are not eligible for Smart $aver Customer or Prescriptive. Typically these types of measures include projects with some combination of unknown building conditions or system constraints or uncertainty operating, occupancy, or production schedules. The performance incentive program pays incentives on the basis of observed performance, not modeled, expected, or pre-approved savings determined via the Customer or Prescriptive programs. M&V may include individual equipment sub-metering or billing analysis. This program is also marketed in a wide array of channels.

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