

AEG Applied Energy Group

DEMAND SIDE MANAGEMENT POTENTIAL STUDY

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Report prepared for:
PUBLIC SERVICE OF NEW MEXICO

Energy Solutions. Delivered.

This work was performed by

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EXECUTIVE SUMMARY

In mid-2019, Public Service of New Mexico (PNM) contracted with Applied Energy Group (AEG) to conduct this Energy Efficiency (EE) Potential Study in support of their energy efficiency and planning activities. This report documents this effort and provides estimates of the potential reductions in annual energy usage for electricity customers in the PNM service territory from energy efficiency efforts in the time period of 2018 to 2040.

To produce a reliable and transparent estimate of future energy-efficiency potential, the AEG team performed the following tasks to meet PNM's key objectives:

- Used information and data from PNM, as well as secondary data sources to describe how customers currently use energy by sector, segment, end use and technology. Section 3 presents an updated characterization of PNM customer electricity use.
- Developed a baseline forecast of how customers are likely to use electricity in absence of future energy-efficiency programs. This forecast provides the metric against which future program savings are measured. This forecast reflects up-to-date technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact energy-efficiency potential. Section 4 presents the details of the baseline forecast.
- Identified and characterized a robust set of energy-efficiency measures to include in the analysis.
- Estimated the technical, economic, and achievable potential at the measure level for energy efficiency within the PNM service territory over the 2021 to 2040 planning horizon.
    - While technical and economic potential are theoretical constructs, as discussed in the report, achievable potential represents a best estimate of what is likely to happen in the future. First-year savings in 2021 are consistent with what is expected to be achieved in 2020. Beyond 2021, the estimates of achievable potential reflect the expected impact of the EISA standard and ongoing naturally occurring energy efficiency.

Summary of Findings

AEG analyzed potential for the residential and commercial and industrial (C&I) market sectors. Table ES-1 summarizes the results of this study at a high level. The total cumulative potential across all sectors in 2023 is 190 GWh, with the C&I sector making up about 40% of the savings.

Table ES-1 Cumulative, Three-Year Achievable Potential in 2025 by Sector

Sector	Achievable Savings Potential (GWh)	% of Baseline Projection
Residential	103	3.0%
Commercial and Industrial	131	2.6%
Total	235	2.8%

For 2021 through 2023, savings from the top five measures are shown in Table ES-2.

- In the residential sector, the top five measures account for 91% of cumulative savings over 2021-2023. Three of the top five measures are associated with lighting. In the C&I sectors, the top five measures account for 59% of three-year savings. Four of the top five measures are lighting measures
- However, beginning in 2023, the continued adoption of LEDs will shift the savings from programs to the baseline load forecast. Other measures, especially those with longer lifetimes, will contribute to savings.

Additional information about measures that contribute to sector-level savings are presented in Section 4.

Table ES-2 Cumulative, Three-Year Achievable Potential in 2024 – Top Measures by Sector

Rank	Measure / Technology	2024 Achievable Cumulative Savings (MWh)	% of Total Sector Savings
Residential Sector			
1	Interior Lighting - General Service Lighting	22,813	31.1%
2	Refrigerator - Remove Second Unit	18,348	25.0%
3	Central AC	10,797	14.7%
4	Exempted Lighting	8,423	11.5%
5	Exterior Lighting - Screw-in	6,408	8.8%
Residential subtotal, top 5 measures		***66,790***	***91.2%***
Commercial and Industrial Sectors			
1	Interior Lighting - Screw-in	22,875	24.7%
2	Interior Lighting - High-Bay Fixtures	10,361	11.2%
3	Interior Lighting - Linear Lighting	10,080	10.9%
4	Ventilation	5,903	6.4%
5	Exterior Lighting - Screw-in	5,556	6.0%
C&I subtotal, top 5 measures		***54,774***	***59.1%***

Estimating Program Potential to Reach Savings Goals

House Bill (HB) 291, which the Legislature passed in 2019 and the governor signed into law on April 3, 2019, requires the state of New Mexico's three public utilities to achieve savings equal to 5% of 2020 retail sales by 2025. This initial target will be followed by incrementally higher savings targets through 2030 that have yet to be set by the state Public Regulation Commission. HB 291 also authorizes up to a 66 percent increase in utility spending on energy-efficiency programs.

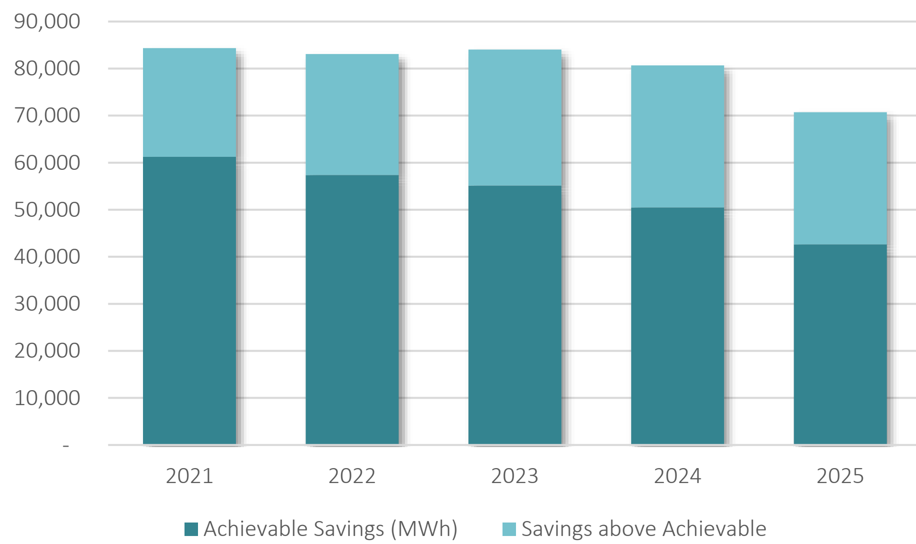
The new mandates modify the state's Efficient Use of Energy Act, enacted in 2005. Under that legislation, Public Service Company of New Mexico, El Paso Electric Co. and Southwestern Public Service were required to achieve 5 percent savings off 2005 retail sales by 2014, and 8 percent by 2020.

To assist in the planning of achieving these savings goals, AEG estimated the savings required to meet the new mandate by increasing participation in EE during the 2021-2025 timeframe. We also estimated the resulting potential through the end of the study timeframe.

Achieving the Mandated Goal

The first step in the process was to estimate the level of participation required to meet the mandated goal of 5% savings by 2025. We did this by ramping up participation in the Achievable Potential for EE from the LoadMAP modeling. In Figure 6-1 below, the light teal portion of the bars represent the incremental economic EE savings above the current forecast of achievable savings that would need to be captured by programs to achieve the EUEA Savings goal. The most likely way to capture additional technical savings through increased participation is through additional spending on incentives, education, and marketing.

Figure ES-1 Incremental EE Savings to Achieve Updated EUEA Savings Goal



Forecasting Potential after 2025

In addition to estimating the incremental potential associated with achieving the EUEA goal, AEG also estimated three scenarios for the level of potential after 2025 which account for the increased participation that was required to achieve the savings goal in the following ways:

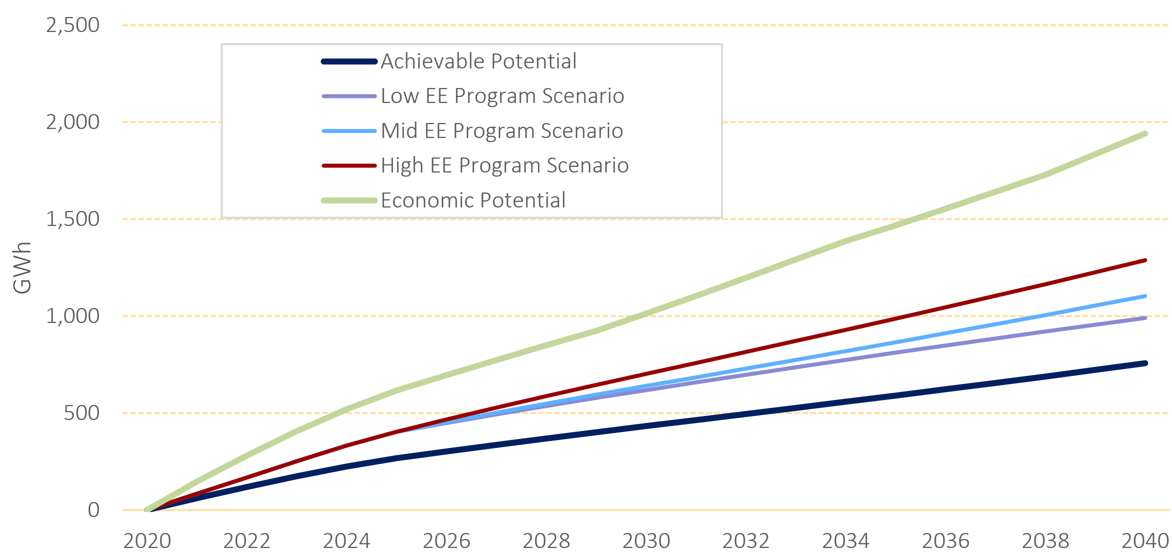
- In the Low scenario, we estimated post 2025 savings based on a continued spending threshold of 3% of revenue for the 2026-2040 time period. By 2040, the cumulative first-year savings reach 990 GWh, which is 10.4% of the baseline projection.
- In the Mid scenario, we assumed that the potential post 2025 would ramp up at the same rate as the Achievable Potential from LoadMAP. This assumes that program outreach would need to increase in order to capture more of the Economic Potential. By 2040, the cumulative first-year savings are 1,103 GWh, which is 11.6% of the baseline projection.
- In the High scenario, we assumed that a new savings mandate would be set, and that program participation would increase to meet this new goal. The cumulative first-year savings by 2040 is 1,288, 13.5% of the baseline projection.

Table ES - 3 and Figure 6-2 illustrate each of the three scenarios bracketed by achievable potential on the bottom and economic potential on the top.

Table ES-3 Summary of Estimated Program Potential (GWh)

	2020	2021	2025	2030	2035	2040
Baseline Forecast (GWh)	**7,985**	**8,073**	**8,441**	**8,799**	**9,147**	**9,534**
Cumulative First-Year Savings (GWh)						
Achievable Potential		61	267	433	590	757
Low EE Program Scenario		84	403	618	812	990
Mid EE Program Scenario		84	403	640	865	1,103
High EE Program Scenario		84	403	702	987	1,288
Economic Potential		147	616	1,013	1,467	1,942
Savings (% of Baseline)						
Achievable Potential		0.8%	3.2%	4.9%	6.5%	7.9%
Low EE Program Scenario		1.0%	4.8%	7.0%	8.9%	10.4%
Mid EE Program Scenario		1.0%	4.8%	7.3%	9.5%	11.6%
High EE Program Scenario		1.0%	4.8%	8.0%	10.8%	13.5%
Economic Potential		1.8%	7.3%	11.5%	16.0%	20.4%

Figure ES-2 Cumulative First-Year Potential Program Savings



CONTENTS

LIST OF FIGURES

LIST OF TABLES

1

INTRODUCTION

In mid-2019, Public Service of New Mexico (PNM) contracted with Applied Energy Group (AEG) to conduct this Demand Side Management (DSM) Potential Study in support of their energy efficiency and demand response and planning activities. This report documents this effort and provides estimates of the potential reductions in annual energy and demand for electricity customers in the PNM service territory from DSM efforts in the time period of 2018 to 2040.

To produce a reliable and transparent estimate of potential, the AEG team performed the following tasks to meet PNM's key objectives:

- Used information and data from PNM, as well as secondary data sources to describe how customers currently use energy by sector, segment, end use and technology.
- Developed a baseline projection of how customers are likely to use electricity in absence of future conservation programs. This defines the metric against which future program savings are measured. This projection used up-to-date technology data, modeling assumptions, and energy baselines that reflect both current and anticipated federal, state, and local energy efficiency legislation that will impact energy conservation potential.
- Estimated the technical, economic, and achievable potential at the measure level for energy efficiency within the PNM service territory over the 2021 to 2040 planning horizon.
- Estimated the level of savings needed to achieve EUEA's statutory and spending goals by 2025.
- Estimated the achievable potential at the program level for demand response programs within the PNM service territory over the 2021 to 2040 planning horizon.

It should be noted that AEG relied heavily on the 2017 Energy Efficiency Potential Study in the development of these updated potential scenarios specifically in the use of the 2017 market profiles and customer adoption rates for EE potential. The DR assessment also leverages the 2017 market profiles however as a new aspect of the study, customer adoption rates were developed in real time.

Report Contents

This report documents the results of the study as well as the steps followed in its completion. Throughout this study, AEG worked with PNM to understand the baseline characteristics of their service territory, including a detailed understanding of energy consumption in the territory, the assumptions and methodologies used in PNM's official load forecast, and recent programmatic accomplishments. AEG then developed an independent estimate of achievable, economic, and technical potential within PNM's service territory between 2021 and 2040.

This report is divided into eight chapters as described below:

- Energy Efficiency Analysis Approach and Data Development. Detailed description of AEG's approach to conducting PNM's 2018-2038 Potential Study and documentation of primary and secondary sources used.
- Market Characterization and Market Profiles. Characterization of PNM's service territory in the base year of the study, 2018, including total consumption, number of customers and market units, and

energy intensity. This also includes a breakdown of the energy consumption for the residential and commercial sectors by end use and technology.

- Baseline Projection. Projection of baseline energy consumption under a frozen-efficiency case, described at the end-use level. The LoadMAP models were first aligned with PNM's official load forecast and then varied to include the impacts of future federal standards. AEG estimated baseline consumption for the residential and commercial and industrial market sectors.
- Energy Efficiency Potential. Summary of energy efficiency potential for PNM's entire service territory for selected years between 2021 and 2040. Includes potential estimates for each sector. Summary of energy efficiency potential for each market sector within PNM's service territory, including detailed residential and commercial and industrial potential. For the residential, commercial and industrial sectors, this section includes a more detailed breakdown of potential by measure type, vintage, market segment, and end use.
- Energy Efficiency Potential in the Context of Savings Goals. Includes an estimation of the EE program savings needed to meet the EUEA mandate of 5% savings off of 2020 retail sales by 2025. Also presents three scenarios of program potential for 2026 and beyond, based on the accelerated adoption of EE measures to meet the 2025 goal, and assumptions of likely new statutory goals in the future.
- Demand Response Analysis Approach. Detailed description of AEG's approach to conducting PNM's 2018-2038 Demand Response assessment.
- Demand Response Potential. Provides estimates of the magnitude, timing, and costs of DR resources likely available to PNM over the 20-year planning horizon of 2021-2040. Identifies relevant DR programs and assumptions of key program parameters for potential and cost analysis in the residential, and commercial and industrial sectors.

Abbreviations and Acronyms

Throughout the report we use several abbreviations and acronyms. Table 1-1 shows the abbreviation or acronym, along with an explanation.

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
AEO	Annual Energy Outlook forecast developed by EIA
B/C Ratio	Benefit to Cost Ratio
BEST	AEG's Building Energy Simulation Tool
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
DHW	Domestic Hot Water
DSM	Demand Side Management
DR	Demand Response
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Utilization Index
HVAC	Heating Ventilation and Air Conditioning
LED	Light Emitting Diode lamp
LoadMAP	AEG's Load Management Analysis and Planning™ tool
MW	Megawatt
O&M	Operations and Maintenance
UEC	Unit Energy Consumption

2

ENERGY EFFICIENCY ANALYSIS APPROACH AND DATA DEVELOPMENT

This section describes the analysis approach and data sources used to develop the energy efficiency potential estimates.

Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. We describe these analysis steps in more detail throughout the remainder of this chapter.

1. Characterized the market to describe sector-level electricity use for the residential and commercial sectors for the base year, 2018. This included using PNM data and other secondary data sources such as the Energy Information Administration (EIA).
2. Developed a baseline end-use forecast of energy consumption by sector, segment, end use, and technology for 2019 through 2040.
3. Defined and characterized several hundred energy efficiency measures to be applied to all sectors, segments, and end uses.
4. Estimated technical, economic, and achievable potential energy savings at the measure level for 2021-2040.

LoadMAP Model

For this analysis, AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 5.0 to develop both the baseline end-use forecast and the estimates of potential. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for the EPRI National Potential Study and numerous utility-specific forecasting and potential studies since. Built in Excel, the LoadMAP framework (see Figure 2-1) is both accessible and transparent and has the following key features.

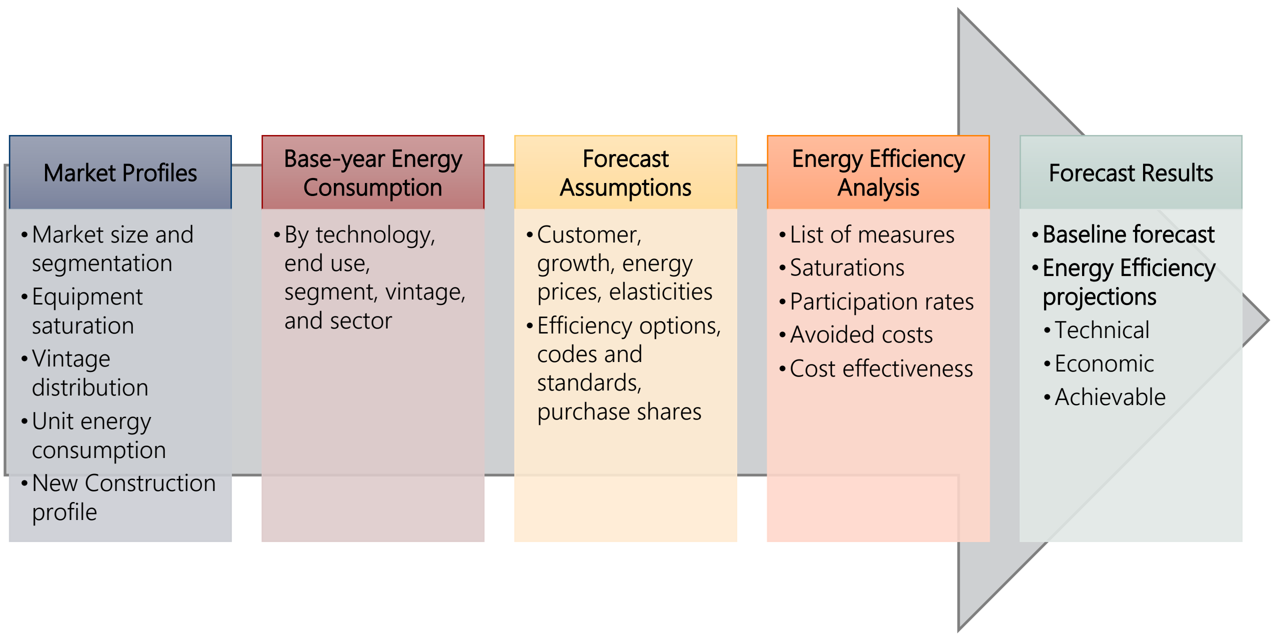
- Embodies the basic principles of rigorous end-use models (such as EPRI's REEPS and COMMEND) but in a more simplified, accessible form.
- Includes stock-accounting algorithms that treat older, less efficient appliance/equipment stock separately from newer, more efficient equipment. Equipment is replaced according to the measure life and appliance vintage distributions defined by the user.
- Balances the competing needs of simplicity and robustness by incorporating important modeling details related to equipment saturations, efficiencies, vintage, and the like, where market data are available, and treats end uses separately to account for varying importance and availability of data resources.
- Isolates new construction from existing equipment and buildings and treats purchase decisions for new construction and existing buildings separately.
- Uses a simple logic for appliance and equipment decisions. Other models available for this purpose embody complex decision choice algorithms or diffusion assumptions, and the model parameters tend to be difficult to estimate or observe and sometimes produce anomalous results that require calibration or even overriding. The LoadMAP approach allows the user to drive the appliance

and equipment choices year by year directly in the model. This flexible approach allows users to import the results from diffusion models or to input individual assumptions. The framework also facilitates sensitivity analysis.

- Can accommodate various levels of segmentation. Analysis can be performed at the sector level (e.g., total residential) or for customized segments within sectors (e.g., housing type or income level).
- Natively outputs model results in a detailed line-by-line summary file, allowing for review of input assumptions, cost-effectiveness results, and potential estimates at a granular level.

Consistent with the segmentation scheme and the market profiles we describe below, the LoadMAP model provides projections of baseline energy use by sector, segment, end use, and technology for existing and new buildings. It also provides forecasts of total energy use and energy-efficiency savings associated with the various types of potential. [1]

Figure 2-1 LoadMAP Analysis Framework



[1] The model computes energy and peak-demand forecasts for each type of potential for each end use as an intermediate calculation. Annual-energy and peak-demand savings are calculated as the difference between the value in the baseline forecast and the value in the potential forecast (e.g., the technical potential forecast).

Definitions of Potential

Before we delve into the details of the analysis approach, it is important to define what we mean when discussing energy efficiency potential. In this study, the savings estimates are developed for three types of potential: technical potential, economic potential, and achievable potential. These are developed at the measure level, and results are provided as annual savings impacts over the 20-year forecasting horizon. The various levels are described below.

- Technical Potential is defined as the theoretical upper limit of efficiency potential. It assumes that customers adopt all feasible measures regardless of their cost. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

  Technical potential also assumes the adoption of every other available measure, where applicable. For example, it includes installation of high-efficiency windows in all new construction opportunities and air conditioner maintenance in all existing buildings with central and room air conditioning. These retrofit measures are phased in over a number of years to align with the stock turnover of related equipment units, rather than modeled as immediately available all at once.

- Economic Potential applies a cost-effectiveness screen. In this analysis, the cost-effectiveness is calculated using the utility cost test (UCT), which compares lifetime energy and capacity benefits to the costs of delivering the measure through a utility program. These costs are the incremental cost of the measure relative to the relevant baseline condition, plus any utility costs that are incurred by the program to deliver and implement the measure. If the benefits outweigh the costs (that is, if the UCT ratio is greater than 1.0), the measure is included in the economic potential.
- Achievable Potential refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of efficiency measures.

Market Characterization

In order to estimate the savings potential from energy-efficient measures, it is necessary to understand how much energy is used today and what equipment is currently in service. This characterization begins with a segmentation of PNM's electricity footprint to quantify energy use by sector, segment, end-use application, and the current set of technologies used. In this study we relied heavily on the market characterization developed for the 2017 Energy Efficiency Potential Assessment (2017 Study) calibrated to reflect usage in the new base year, 2018.

Segmentation for Modeling Purposes

This assessment first defined the market segments (building types, end uses, and other dimensions) that are relevant in the PNM service territory within the residential, commercial and industrial sectors. The segmentation scheme for this project is presented in Table 2-1 below and aligns with the segmentation developed for the 2017 Study.

Table 2-1 Overview of PNM Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, commercial and industrial
2	Segment	Residential: single family, single family low income, multifamily, multifamily and manufactured home low income Commercial and industrial: small office, large office, restaurant, retail, grocery, college, school, health, lodging, warehouse, miscellaneous, and industrial
3	Vintage	Existing and new construction
4	End uses	Cooling, lighting, water heating, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, we then performed a high-level market characterization of electricity sales in the base year, 2018. We used the detailed PNM customer data collected for the 2017 Study with minimal augmentation from secondary sources to allocate energy use and customers to the various sectors and segments such that the total customer count and energy consumption matched the PNM system totals from 2018 billing data. This information provided control totals at a sector level for calibrating the LoadMAP model to known data for the base-year.

Market Profiles

The next step was to develop market profiles for each sector, customer segment, end use, and technology. A market profile includes the following elements:

- Market size is a representation of the number of customers in the segment. For the residential sector, the unit is number of households. In the commercial and industrial sector, it is floor space measured in square feet.
- Saturations define the fraction of homes and square feet with the various technologies. (e.g., percent of homes with electric space heating).
- UEC (unit energy consumption) or EUI (energy-utilization index) describes the amount of energy consumed in the base year by a specific technology in homes or buildings that have the technology. UECs are expressed in kWh/household for the residential sector, and EUIs are expressed in kWh/square foot for the commercial and industrial sector.
- Annual energy intensity for the residential sector represents the average energy use for the technology across all homes in 2018. It is computed as the product of the saturation and the UEC and is defined as kWh/household for electricity. For the commercial and industrial sector, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology across all floor space in the base year.
- Annual usage is the annual energy used by each end-use technology in the segment. It is the product of the market size and intensity and is quantified in GWh.

The market characterization results, and the market profiles are presented in Chapter 3.

Baseline End-use Forecast

The next step was to develop a baseline forecast of annual electricity use for 2019 through 2040 by customer segment and end use without the continuation of PNM energy efficiency programs.

The baseline end-use forecast includes the relatively certain impacts of codes and standards that will unfold over the study timeframe. All such mandates that were defined as of September 2019 are included in the baseline. The baseline forecast also includes naturally occurring efficiency that might take place in the future (2019 and beyond). As such, the baseline forecast is the foundation for the analysis of savings from future efficiency cases and scenarios, as well as the metric against which potential savings are measured. Since naturally occurring efficiency is present in the baseline forecast, all potential estimates are described as "net" savings.

Inputs to the baseline forecast include:

- Customer growth forecast provided by PNM
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards

We present the baseline forecast for each sector in Chapter 4.

Energy Efficiency Measure Development

This section describes the framework used to assess the savings, costs, and other attributes of energy efficiency measures. These characteristics form the basis for measure-level cost-effectiveness analyses as well as for determining measure-level savings. AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. We used this information along with PNM's avoided cost data in the economic screen to determine economically feasible measures.

For all measures, AEG again relied on the information collected as part of the 2017 Study with minimal modifications to the measures and their underlying assumptions.[2] The 2017 Study included a robust list of measures for each customer sector which drew upon PNM's program experience, AEG's own measure databases and building simulation models, and secondary sources. This universal list of measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption.

The selected measures are categorized into two types according to the LoadMAP modeling taxonomy: equipment measures and non-equipment measures.

- Equipment measures are efficient energy consuming pieces of equipment that save energy by providing the same service with a lower energy requirement than a standard unit.
- Non-equipment measures save energy by reducing the need for delivered energy, but do not involve replacement or purchase of major end-use equipment (such as a refrigerator or air conditioner). Non-equipment measures typically fall into one of the following categories:
  - Building shell (windows, insulation, roofing material)
  - Equipment controls (thermostat, integrated lighting fixture controls)
  - Whole-building design (building orientation, passive solar lighting)
  - Displacement measures (ceiling fan to reduce use of central air conditioners)

[2] For a detailed description of the measure development process see AEG's 2017 Energy Efficiency Potential Study

- Retro-commissioning
- Residential behavioral programs
- Energy Management programs

Once we assembled the list of measures, the project team assessed their energy-saving characteristics. For each measure, we also characterized incremental cost, service life, and other performance factors. Following the measure characterization, we performed an economic screening of each measure, which serves as the basis for developing the economic and achievable potential.

Representative Measure Data Inputs

To provide an example of the energy-efficiency measure data, Table 2-2 and Table 2-3 present examples of the detailed data inputs behind both equipment and non-equipment measures, respectively, for the case of residential Central Air Conditioning (CAC) in single-family homes. Table 2-2 displays the various efficiency levels available as equipment measures, as well as the corresponding useful life, energy usage, and cost estimates. The columns labeled On Market and Off Market reflect equipment availability due to codes and standards or the entry of new products to the market.

Table 2-2 Example Equipment Measures for Central AC – Single-Family Home

Efficiency Level	Useful Life	Equipment Cost	Energy Usage (kWh/yr)	On Market	Off Market
SEER 13	15	$2,065	953	2019	n/a
SEER 14 (Energy Star)	15	$2,466	874	2019	n/a
SEER 15 (CEE Tier 2)	15	$2,868	834	2019	n/a
SEER 16 (CEE Tier 3)	15	$3,270	802	2019	n/a
SEER 18	15	$4,076	750	2019	n/a
SEER 21	15	$4,761	695	2019	n/a

Table 2-3 lists some of the non-equipment measures applicable to zonal electric resistance heating in an existing single-family home. All measures are evaluated for cost-effectiveness based on the lifetime benefits relative to the cost of the measure. The total savings, costs, and monetized non-energy benefits are calculated for each year of the study and depend on the base year saturation of the measure, the applicability[3] of the measure, and the savings as a percentage of the relevant energy end uses.

[3] The applicability factors take into account whether the measure is applicable to a particular building type and whether it is feasible to install the measure. For instance, attic fans are not applicable to homes where there is insufficient space in the attic or there is no attic at all.

Table 2-3 Example Non-Equipment Measures – Single Family Home, Existing

End Use	Measure	Saturation in 2012[4]	Applicability	Lifetime (yrs)	Measure Installed Cost	Energy Savings (%)
Heating	Insulation - Ceiling Installation	6.1%	11.1%	45	$1,255	21%
Heating	Ductless Mini Split Heat Pump (Zonal)	0.0%	56.7%	15	$3,439	18%
Heating	Windows - High Efficiency (SP to CI30)	6.8%	14.8%	45	$2,531	23%
Heating	Windows - High Efficiency (SP to CI22)	6.8%	14.8%	45	$2,998	25%

Calculation of Energy Efficiency Potential

The approach we used for this study to calculate the energy efficiency potential adheres to the approaches and conventions outlined in the National Action Plan for Energy-Efficiency (NAPEE) Guide for Conducting Potential Studies.[5] This document represents credible and comprehensive industry best practices for specifying energy efficiency potential. Three types of potential were developed as part of this effort: technical potential, economic potential, and achievable potential. The calculation of technical potential is a straightforward algorithm which, as described above, assumes that customers adopt all feasible measures regardless of their cost.

Screening Measures for Cost-Effectiveness

With technical potential established, the final step is to apply an economic screen and arrive at the subset of measures that are cost-effective and ultimately included in achievable potential.

LoadMAP performs an economic screen for each individual measure in each year of the planning horizon. This study uses the UCT test as the cost-effectiveness metric, which compares the lifetime energy benefits and monetized non-energy benefits of each applicable measure with its cost. The lifetime benefits are calculated by multiplying the annual energy savings for each measure by PNM's avoided cost, and discounting the dollar savings to the present value equivalent. Lifetime costs represent incremental measure cost and annual O&M costs, also discounted to present value. The analysis uses each measure's values for savings, costs, and lifetimes that were developed as part of the measure characterization process described above.

The LoadMAP model performs this screening dynamically, taking into account changing savings and cost data over time. Thus, some measures pass the economic screen for some — but not all — of the years in the forecast.

It is important to note the following about the economic screen:

- The economic evaluation of every measure in the screen is conducted relative to a baseline condition. For instance, in order to determine the kilowatt-hour (kWh) savings potential of a measure, kWh consumption with the measure applied must be compared to the kWh consumption of a baseline condition.

[4] Note that saturation levels reflected for the base year change over time as more measures are adopted.
[5] National Action Plan for Energy Efficiency (2007). *National Action Plan for Energy Efficiency Vision for 2025: Developing a Framework for Change*. www.epa.gov/eeactionplan.

- The economic screening is conducted only for measures that are applicable to each building type and vintage; thus, if a measure is deemed to be irrelevant to a building type and vintage, it is excluded from the respective economic screen.

This constitutes the economic potential and includes every program-ready opportunity for energy efficiency savings. Potential results are presented in Chapters 5 and 6.

Estimating Customer Adoption

Once the economic potential is established, estimates for the market adoption rates for each measure are applied that specify the percentage of customers that will select the highest–efficiency cost-effective option. This phases potential in over a more realistic time frame that considers barriers such as imperfect information, supplier constraints, technology availability, and individual customer preferences.

The market adoption rates, or take rates, used in the analysis were based on the adoption rates that were developed for the 2017 Study which leveraged market research program interest results.[6] The intent of market adoption rates is to establish a path to full market maturity for each measure or technology group.

Data Development

This section details the data sources used in this study, followed by a discussion of how these sources were applied. In general, data were adapted to local conditions, for example, by using local sources for measure data and local weather for building simulations.

Data Sources

The data sources are organized into the following categories:

- PNM data
- AEG's databases and analysis tools
- Other secondary data and reports

PNM Data

Our highest priority data sources for this study were those that were specific to PNM.

- PNM customer account database. Data on customer counts and consumption for each residential, commercial and industrial market segment analyzed. The top 50 industrial customers were added to the commercial sector model in the industrial segment.
- Load forecast data. PNM provided the following forecast data: customer growth forecast, electricity price forecasts
- Economic information. PNM provided a discount rate as well as avoided cost forecasts and line loss factors on an annual basis.
- 2017 PNM Residential Appliance Saturation Survey (RASS). AEG utilized PNM's 2017 RASS to develop saturations of most equipment types in residential homes.
- Solar PV installation data. PNM provided its database of distributed solar photovoltaic installations through November 2017. PNM also provided an energy forecast for solar PV generation through 2031.

[6] For a detailed description of the market research, see AEG's 2017 Energy Efficiency Potential Study

AEG Data

AEG maintains several databases and modeling tools that we use for forecasting and potential studies. Relevant data from these tools has been incorporated into the analysis and deliverables for this study.

- AEG Energy Market Profiles. For more than 10 years, AEG staff has maintained profiles of end-use consumption for the residential, commercial, and industrial sectors. These profiles include market size, fuel shares, unit consumption estimates, and annual energy use by fuel (electricity and natural gas), customer segment and end use for 10 regions in the U.S. The Energy Information Administration surveys (RECS, CBECS and MECS) as well as state-level statistics and local customer research provide the foundation for these regional profiles.
- Building Energy Simulation Tool (BEST). AEG's BEST is a derivative of the DOE 2.2 building simulation model, used to estimate base-year UECs and EUIs, as well as measure savings for the HVAC-related measures.
- AEG's Database of Energy Efficiency Measures (DEEM). AEG maintains an extensive database of measure data for our studies. Our database draws upon reliable sources including the California Database for Energy Efficient Resources (DEER), the EIA Technology Forecast Updates – Residential and Commercial Building Technologies – Reference Case, RS Means cost data, and Grainger Catalog Cost data.
- Recent studies. AEG has conducted numerous studies of EE potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, which include Black Hills Colorado Electric, Tacoma Power, PacifiCorp, the State of New Mexico, and numerous studies from across the U.S. In addition, we used the information about impacts of building codes and appliance standards from recent reports for the Edison Electric Institute[7].

Other Secondary Data and Reports

Finally, a variety of secondary data sources and reports were used for this study. The main sources are identified below.

- Annual Energy Outlook. The Annual Energy Outlook (AEO), conducted each year by the U.S. Energy Information Administration (EIA), presents yearly projections and analysis of energy topics. For this study, we used data for the Mountain region from the 2017 and 2018 AEO.
- American Community Survey. The US Census American Community Survey is an ongoing survey that provides data every year on household characteristics. Data for the State of Washington available for this study.
- Other relevant resources: These include reports from the Consortium for Energy Efficiency, the EPA, and the American Council for an Energy-Efficient Economy.

Application of Data to the Analysis

We now discuss how the data sources described above were used for each step of the study.

[7]AEG staff has prepared three white papers on the topic of factors that affect U.S. electricity consumption, including appliance standards and building codes. Links to all three white papers are provided:
http://www.edisonfoundation.net/IEE/Documents/IEE_RohmundApplianceStandardsEfficiencyCodes1209.pdf
http://www.edisonfoundation.net/iee/Documents/IEE_CodesandStandardsAssessment_2010-2025_UPDATE.pdf.
http://www.edisonfoundation.net/iee/Documents/IEE_FactorsAffectingUSElecConsumption_Final.pdf

Data Application for Market Characterization

To construct the high-level market characterization of electricity consumption and market size units (households for residential and floor space for commercial), we used PNM-provided data, the 2017 PNM RASS, the State of New Mexico study and secondary data from AEG's Energy Market Profiles.

Data Application for Market Profiles

The specific data elements for the market profiles, together with the key data sources, are shown in Table 2-4. To develop the market profiles for each segment, we used the following approach:

1. Developed control totals for each segment. These include market size, segment-level annual electricity use, and annual intensity. PNM's estimates on residential households and the State of New Mexico estimates on consumption per floor area were used. These calculations were then compared with other regional sources and prior AEG studies in the region for reasonableness. Adjustments to intensity were then made as necessary.
2. Used the 2017 PNM RASS and the State of New Mexico study to develop existing appliance saturations, appliance and equipment characteristics, and building characteristics. We compared the results with surveys from other jurisdictions, the American Housing Survey, and AEG's Energy Market Profiles database
3. Ensured calibration to control totals for annual electricity sales in each sector and segment.
4. Compared and cross-checked with other recent AEG studies.
5. Worked with PNM staff to vet the data against their knowledge and experience.

Data Application for Baseline Forecast

Table 2-5 summarizes the LoadMAP model inputs required for the baseline forecast. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-4 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Annual energy consumption	Base-year energy consumption by sector as well as detailed market segment	PNM Historical Sales PNM Nonresidential Account Database
Market size	Base-year residential dwellings, commercial floor space, and industrial employment	PNM Customer Forecasts for residential customers Calculated value for nonresidential customers
Annual intensity	Residential: Annual use per household Commercial and Industrial: Annual use per square foot	PNM's 2017 Residential Appliance Saturation Survey (RASS) AEG's Energy Market Profiles AEO 2018 – Mountain Region Other recent studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of C&I floor space/employment with equipment/technology	PNM's 2017 RASS AEO 2016 through 2018, 2009 RECS American Community Survey (ACS) AEG's Energy Market Profiles
UEC/EUI for each end-use technology	UEC: Annual electricity use in homes and buildings that have the technology EUI: Annual electricity use per square foot/employee for a technology in floor space that has the technology	HVAC uses: BEST simulations using prototypes developed for PNM AEG's Database of Energy Efficiency Measures (DEEM) Recent AEG studies
Appliance/equipment age distribution	Age distribution for each technology	PNM's 2017 RASS Recent AEG Studies

Table 2-5 Data Applied for the Baseline Forecast in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential and C&I sectors	PNM customer forecasts
Equipment purchase shares for baseline projection	For each equipment/technology, purchase shares for each efficiency level; specified separately for existing equipment replacement and new construction	Shipments data from AEO and ENERGY STAR AEO 2018 regional forecast assumptions[8] Appliance/efficiency standards analysis
Electricity prices	Forecast of electricity prices	PNM forecasts

In addition, assumptions were incorporated for known future equipment standards as of September 2019, as shown in Table 2-6, Table 2-7 and Table 2-8. The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

[8] We developed baseline purchase decisions using the Energy Information Agency's *Annual Energy Outlook* report (2016), which utilizes the National Energy Modeling System (NEMS) to produce a self-consistent supply and demand economic model. We calibrated equipment purchase options to match distributions/allocations of efficiency levels to manufacturer shipment data for recent years and then held values constant for the study period.

Table 2-6 Residential Electric Equipment Standards [9]

<table>
<tr><th>End Use</th><th>Technology</th><th>2015</th><th>2016</th><th>2017</th><th>2018</th><th>2019</th><th>2020</th><th>2021</th><th>2022</th><th>2023</th><th>2024</th><th>2025</th></tr>
<tr><td rowspan="2">Cooling</td><td>Central AC</td><td colspan="11">SEER 14</td></tr>
<tr><td>Room AC</td><td colspan="11">EER 10.8</td></tr>
<tr><td>Cooling/Heating</td><td>Heat Pump</td><td colspan="11">SEER 14.0/HSPF 8.0</td></tr>
<tr><td rowspan="2">Water Heating</td><td>Water Heater (<=55 gallons)</td><td colspan="11">EF 0.95</td></tr>
<tr><td>Water Heater (>55 gallons)</td><td colspan="11">Heat Pump Water Heater</td></tr>
<tr><td rowspan="2">Lighting</td><td>Screw-in/Pin Lamps</td><td colspan="5">Advanced Incandescent (~20 lumens/watt)</td><td colspan="6">Advanced Incandescent (45 lumens/watt)</td></tr>
<tr><td>Linear Fluorescent</td><td colspan="3">T8 (89 lumens/watt)</td><td colspan="8">T8 (92.5 lumens/watt)</td></tr>
<tr><td rowspan="4">Appliances</td><td>Refrigerator</td><td colspan="11">25% more efficient</td></tr>
<tr><td>Freezer</td><td colspan="11">25% more efficient</td></tr>
<tr><td>Clothes Washer</td><td colspan="3">1.29 IMEF top loader</td><td colspan="8">1.57 IMEF top loader</td></tr>
<tr><td>Clothes Dryer</td><td colspan="11">3.73 Combined EF</td></tr>
<tr><td>Miscellaneous</td><td>Furnace Fans</td><td colspan="4">Conventional</td><td colspan="7">40% more efficient</td></tr>
</table>

[9] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-7 Commercial and Industrial Electric Equipment Standards [10]

End Use	Technology	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1										
	Roof Top Units	EER 11.0/11.2										
	PTAC	EER 11.7		EER 11.9								
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3										
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume										
Lighting	Screw-in/Pin Lamps	Advanced Incandescent (~20 lumens/watt)					Advanced Incandescent (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)			T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005		Metal Halide Ballast Improvement								
Water Heating	Water Heater	EF 0.97										
Refrigeration	Walk-in Refrigerator/Freezer	EISA 2007		10-38% more efficient								
	Reach-in Refrigerator/Freezer	EPACT 2005		40% more efficient								
	Glass Door Display	EPACT 2005		12-28% more efficient								
	Open Display Case	EPACT 2005		10-20% more efficient								
	Ice maker	EPACT 2005			15% more efficient							
Food Service	Pre-rinse Spray Valve	1.6 GPM				1.0 GPM						
Miscellaneous	Motors	EISA '07	Expanded EISA 2007									

[10] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Table 2-8 Industrial Electric Equipment Standards [11]

End Use	Technology	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Cooling	Chillers	2007 ASHRAE 90.1										
	Roof Top Units	EER 11.0/11.2										
	PTAC	EER 11.7		EER 11.9								
Cooling/Heating	Heat Pump	EER 11.0/COP 3.3										
	PTHP	EER 11.9/COP 3.3										
Ventilation	Ventilation	Constant Air Volume/Variable Air Volume										
Lighting	Screw-in/Pin Lamps	Advanced Incandescent (~20 lumens/watt)					Advanced Incandescent - tier 2 (45 lumens/watt)					
	Linear Fluorescent	T8 (89 lumens/watt)			T8 (92.5 lumens/watt)							
	High Intensity Discharge	EPACT 2005 (Mercury Vapor Fixture Phase-out)		Metal Halide Ballast Improvement								
Motors	Pumps, Fans & Blowers, Compressors	EISA '07	Expanded EISA 2007									

[11] The assumptions tables here extend through 2025, after which all standards are assumed to hold steady.

Efficiency Measure Data Application

Table 2-9 details the energy-efficiency data inputs to the LoadMAP model. It describes each input and identifies the key sources used in the PNM analysis.

Table 2-9 Data Needs for the Measure Characteristics in LoadMAP

Model Inputs	Description	Key Sources
Energy Impacts	The annual reduction in consumption attributable to each specific measure. Savings were developed as a percentage of the energy end use that the measure affects.	AEG DEEM BEST AEO 2017 and AEO 2018 New Mexico TRM Other secondary sources
Peak Demand Impacts	Savings during the peak demand periods are specified for each electric measure. These impacts relate to the energy savings and depend on the extent to which each measure is coincident with the system peak.	AEG's Energy Shape database AEG DEEM
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-household, per-square-foot, or per employee basis for the residential, commercial, and industrial sectors, respectively. Non-Equipment Measures: Existing buildings – full installed cost. New Construction - the costs may be either the full cost of the measure, or as appropriate, it may be the incremental cost of upgrading from a standard level to a higher efficiency level.	AEG DEEM AEO 2017 and AEO 2018 RS Means New Mexico TRM Other secondary sources
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	AEG DEEM AEO 2018 Other secondary sources
Applicability	Estimate of the percentage of dwellings in the residential sector, square feet in the commercial sector, or employees in the industrial sector where the measure is applicable and where it is technically feasible to implement.	AEG DEEM New Mexico TRM Other secondary sources
On Market and Off Market Availability	Expressed as years for equipment measures to reflect when the equipment technology is available or no longer available in the market.	AEG appliance standards and building codes analysis

Data Application for Cost-effectiveness Screening

To perform the cost-effectiveness screening, a number of economic assumptions were needed. All cost and benefit values were analyzed as real 2018 dollars. We applied a discount rate of 7% in real dollars. All impacts in this report are presented at the customer meter, but electric energy delivery losses were provided by PNM to estimate impacts at the generator for economic analysis.

Estimates of Customer Adoption

To estimate the timing and rate of customer adoption in the potential forecasts, two sets of parameters are needed:

- Technical diffusion curves for non-equipment measures. Equipment measures are installed when existing units fail. Non-equipment measures do not have this natural periodicity, so rather than installing all available non-equipment measures in the first year of the projection (instantaneous potential), they are phased in according to adoption schedules that generally align with the diffusion of similar equipment measures.

- Customer adoption rates, also referred to as take rates or ramp rates, are applied to measures on a year by year basis. These rates represent customer adoption of measures when delivered through a best-practice portfolio of well-operated efficiency programs under a reasonable policy or regulatory framework. Information channels are assumed to be established and efficient for marketing, educating consumers, and coordinating with trade allies and delivery partners. The primary barrier to adoption reflected in this case is customer preferences. The rates used for PNM are based on those developed for the 2017 Study.

3

MARKET CHARACTERIZATION AND MARKET PROFILES

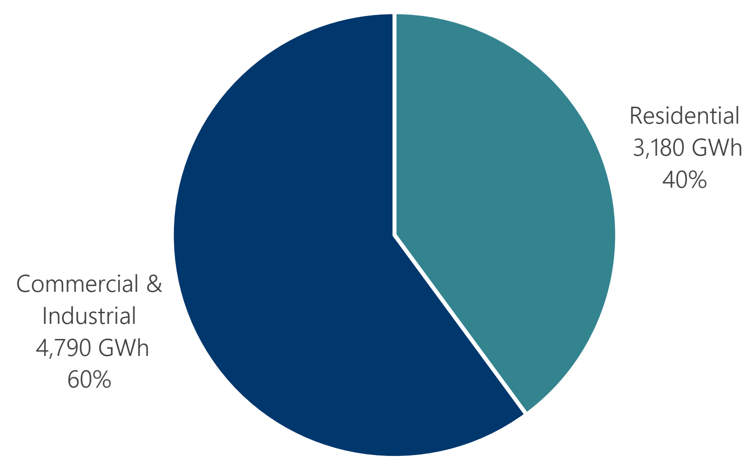
In this section, we describe how customers in the PNM service territory use electricity[12] in the base year of the study, 2018. Keep in mind that the characterization and profiles were based largely on the results of the 2017 Study calibrated to reflect actual usage in 2018.

It begins with a high-level summary of energy use across all sectors and then delves into each sector in more detail.

Overall Energy Use Summary

Total electricity use for the residential, commercial, and industrial sectors for PNM in 2018 was 7,927 GWh. The base year consumption is shown in Figure 3-1. The residential sector accounted for 3,180 GWh or 40% of annual energy use. The commercial and industrial sector consumed 4,790 GWh, or 60%.

Figure 3-1 Sector-Level Electricity Use in Base Year 2018 (Annual GWh, Percent)



In the remainder of this section, we describe energy use by end use (energy market profiles) for the residential, commercial, and industrial sectors.

Residential Sector

The total number of households and electricity sales for the service territory were provided by PNM. In 2018, there were over 467 thousand households in the PNM territory that used a total of 3,180 GWh. Average use per customer (or household) at 6,808 kWh. Individual household consumption may vary

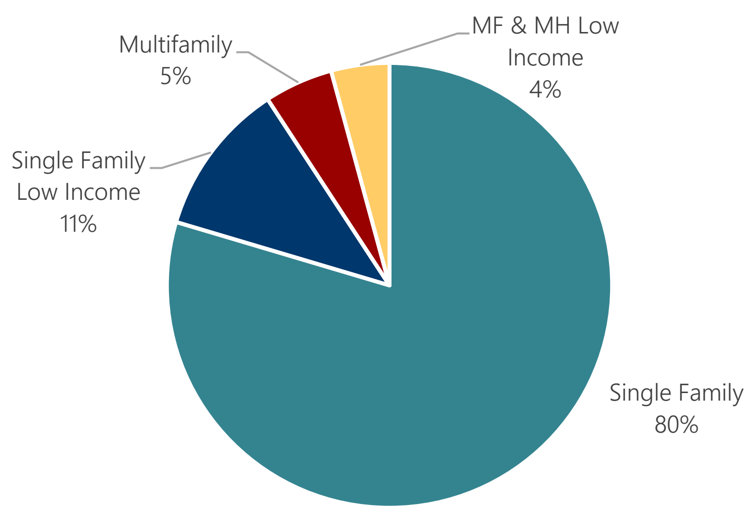
[12] Please note that the analysis in this study does not include existing or future sales impacts from solar photovoltaics (PV) or electric vehicles. These are being addressed separately by PNM's Load Forecasting Group. The figures presented in this report represent end-use consumption or usage.

based on house size, or age. We allocated these totals into four residential segments and the values are shown in Table 3-1.

Table 3-1 Residential Sector Control Totals (2018)

Segment	Number of Customers (HH)	Electricity Use (GWh)	Annual Use/Customer (kWh/HH)
Single Family (SF)	348,526	2,531	7,263
Single Family Low Income (SF-LI)	60,892	356	5,839
Multifamily (MF)	31,247	159	5,082
Multifamily & Manufactured Home Low Income (MF/MH-LI)	26,440	134	5,082
Total	**467,105**	**3,180**	**6,808**

Figure 3-2 Residential Electricity Use by Segment 2018



As we describe in the previous chapter, the market profiles provide the foundation for development of the baseline projection and the potential estimates. The average market profile for the residential sector is presented in Table 3-2. Segment-specific market profiles can be found in the 2017 Study.

Figure 3-3 shows the average distribution of annual electricity use by end use for all customers. Appliances alone accounts for nearly a third (33%) of total usage, which includes refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. Heating and cooling account for slightly less consumption at 27% overall. The remainder of the energy falls into the lighting, water heating, electronics and the miscellaneous category – which is comprised of furnace fans, pool pumps, and other "plug" loads (all other usage not covered by those listed in Table 3-2 such as hair dryers, power tools, coffee makers, etc.). This reflects average consumption and is used to describe consumption residential consumption for the entire service territory.

Figure 3-4 presents the electricity intensities by end use and housing type. Single family homes have the highest use per customer at 7,263 kWh/year, reflecting the larger floor area than other home types.

Figure 3-3 Residential Electricity Use by End Use (2018)

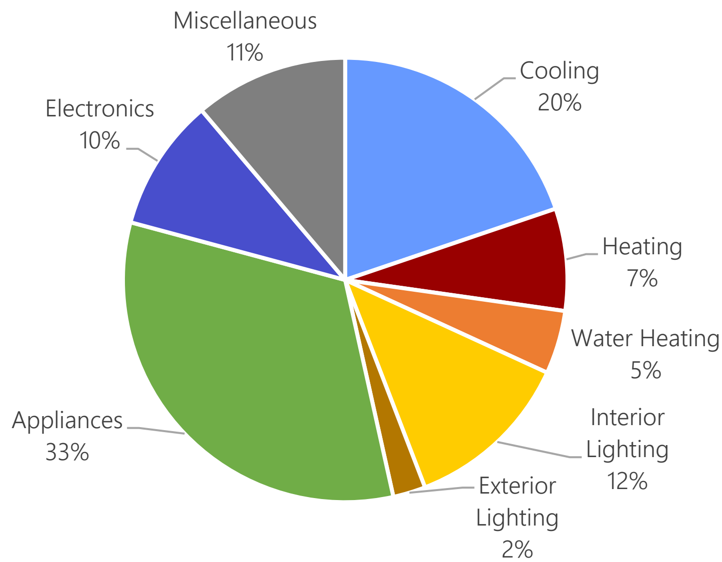


Figure 3-4 Residential Energy Intensity by End Use and Segment (Annual kWh/HH, 2018)

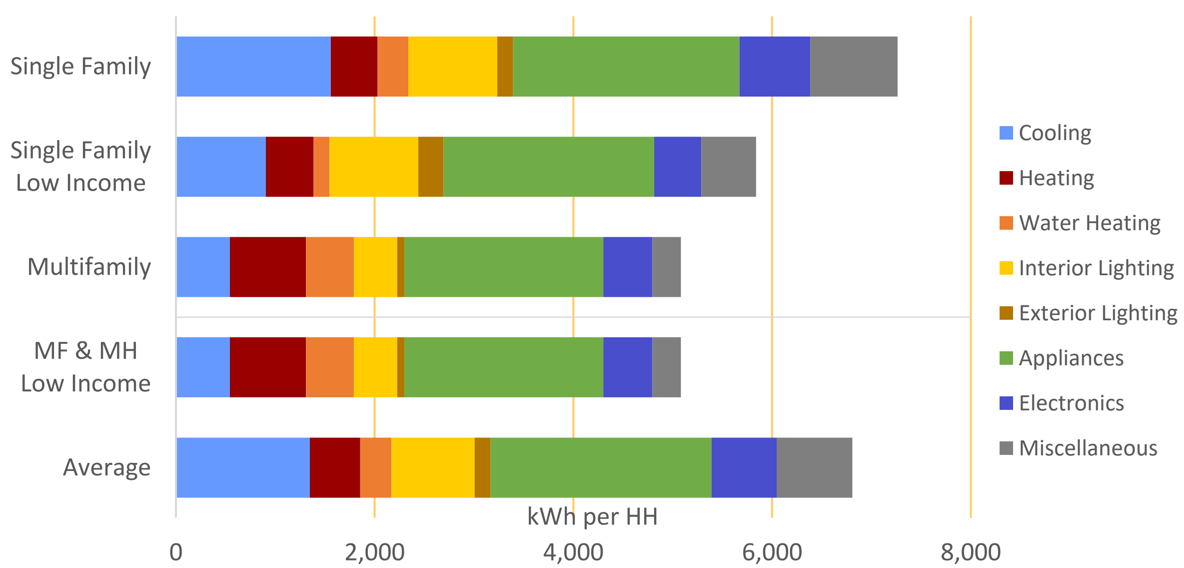


Table 3-2 Average Market Profile for the Residential Sector, 2018

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)
Cooling	Central AC	43.6%	2,306	1,006	470
Cooling	Room AC	2.7%	441	12	6
Cooling	Air-Source Heat Pump	0.3%	2,246	6	3
Cooling	Geothermal Heat Pump	0.8%	2,322	18	9
Cooling	Evaporative AC	46.1%	662	305	143
Heating	Electric Zonal Room Heat	10.6%	3,432	364	170
Heating	Electric Furnace	3.7%	3,378	124	58
Heating	Air-Source Heat Pump	0.3%	2,096	6	3
Heating	Geothermal Heat Pump	0.8%	1,580	13	6
Water Heating	Water Heater (<= 55 Gal)	3.1%	2,701	84	39
Water Heating	Water Heater (> 55 Gal)	9.4%	2,451	231	108
Interior Lighting	General Service Lighting	100.0%	599	599	280
Interior Lighting	Linear Lighting	100.0%	78	78	37
Interior Lighting	Exempted Lighting	100.0%	160	160	75
Exterior Lighting	Screw-in	100.0%	161	161	75
Appliances	Clothes Washer	93.7%	79	74	35
Appliances	Clothes Dryer	67.3%	728	490	229
Appliances	Dishwasher	83.8%	369	309	144
Appliances	Refrigerator	100.0%	674	674	315
Appliances	Freezer	40.6%	532	216	101
Appliances	Second Refrigerator	24.4%	800	195	91
Appliances	Stove/Oven	36.4%	394	143	67
Appliances	Microwave	99.2%	122	122	57
Electronics	Personal Computers	55.3%	157	87	41
Electronics	Monitor	54.0%	61	33	15
Electronics	Laptops	123.2%	42	52	24
Electronics	TVs	208.6%	115	240	112
Electronics	Printer/Fax/Copier	78.8%	57	45	21
Electronics	Set-top Boxes/DVR	148.5%	86	127	59
Electronics	Devices and Gadgets	100.0%	73	73	34
Miscellaneous	Pool Pump	3.2%	2,125	67	31
Miscellaneous	Pool Heater	0.5%	3,355	16	7
Miscellaneous	Hot Tub/Spa	4.1%	2,006	83	39
Miscellaneous	Furnace Fan	67.6%	487	329	154
Miscellaneous	Well pump	11.9%	544	65	30
Miscellaneous	Dehumidifiers	2.1%	428	9	4
Miscellaneous	Miscellaneous	100.0%	192	192	90
Total				**6,808**	**3,180**

Commercial and Industrial Sector

The total electric energy consumed by commercial and industrial (C&I) customers in PNM's service area in 2018 was 4,790 GWh. PNM billing data were used to classify each account into a market segment and to allocate energy usage among twelve commercial and industrial segments. Secondary data were used to develop estimates of energy intensity (annual kWh/square foot). The values are shown in Table 3-3.

Table 3-3 Commercial and Industrial Sector Control Totals (2018)

Segment	Electricity Use (GWh)	Intensity (kWh/Sq.Ft.)	Floor space (Million Sq.Ft.)
Small Office	400	14.0	28.6
Large Office	733	17.4	42.2
Retail	687	13.5	51.0
Restaurant	329	40.9	8.0
Grocery	219	44.9	4.9
College	175	12.0	14.6
School	218	7.6	28.9
Health	175	22.2	7.9
Lodging	194	16.2	12.0
Warehouse	153	6.6	23.1
Miscellaneous	618	11.5	53.8
Industrial	888	45.8	19.4
Total	4,790	16.3	294.3

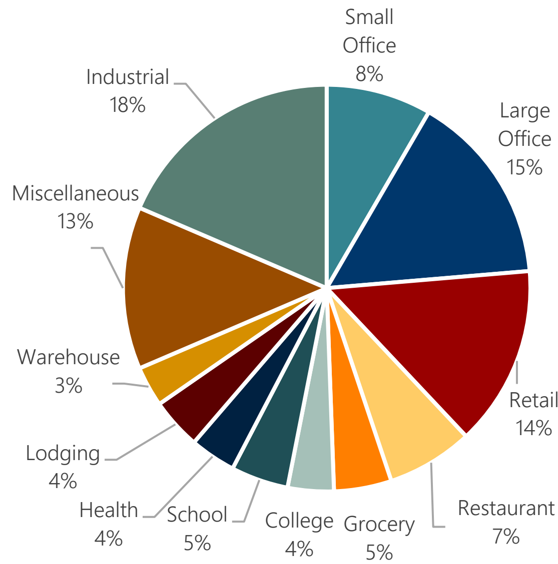


Figure 3-5 shows the distribution of annual electricity consumption by end use across all commercial and industrial buildings. HVAC end uses account for about a quarter of C&I electricity consumption (26%). Miscellaneous electricity consumption represents 27% of overall usage due to the industrial segment, which has a large amount of motors and other miscellaneous processes unique to that segment.

Figure 3-5 Commercial and industrial Sector Electricity Consumption by End Use (2018)

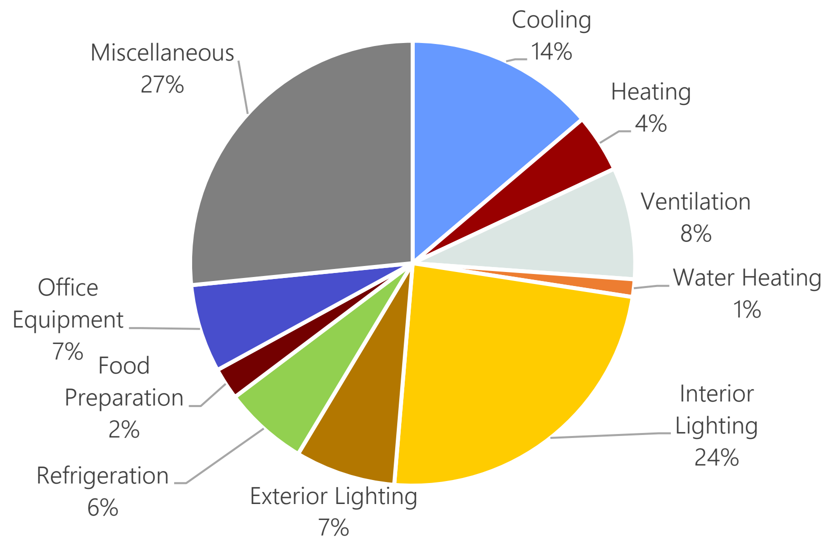


Figure 3-6 presents the electricity intensities by end use and segment. As expected, intensities are highest among restaurant, grocery, health, and industrial segments mainly due to end uses specific to their facilities' energy usage. For example, restaurants have high saturation of food preparation, while grocery stores require significant refrigeration. The health segment intensity is mainly driven by HVAC, due to high cooling requirement, and miscellaneous medical devices. The industrial segment has the highest miscellaneous intensity due to high concentration of non-HVAC motors and other energy intensive industrial processes associated with that segment.

Figure 3-6 Commercial and Industrial Intensity by End Use and Segment (Annual kWh/SqFt, 2018)

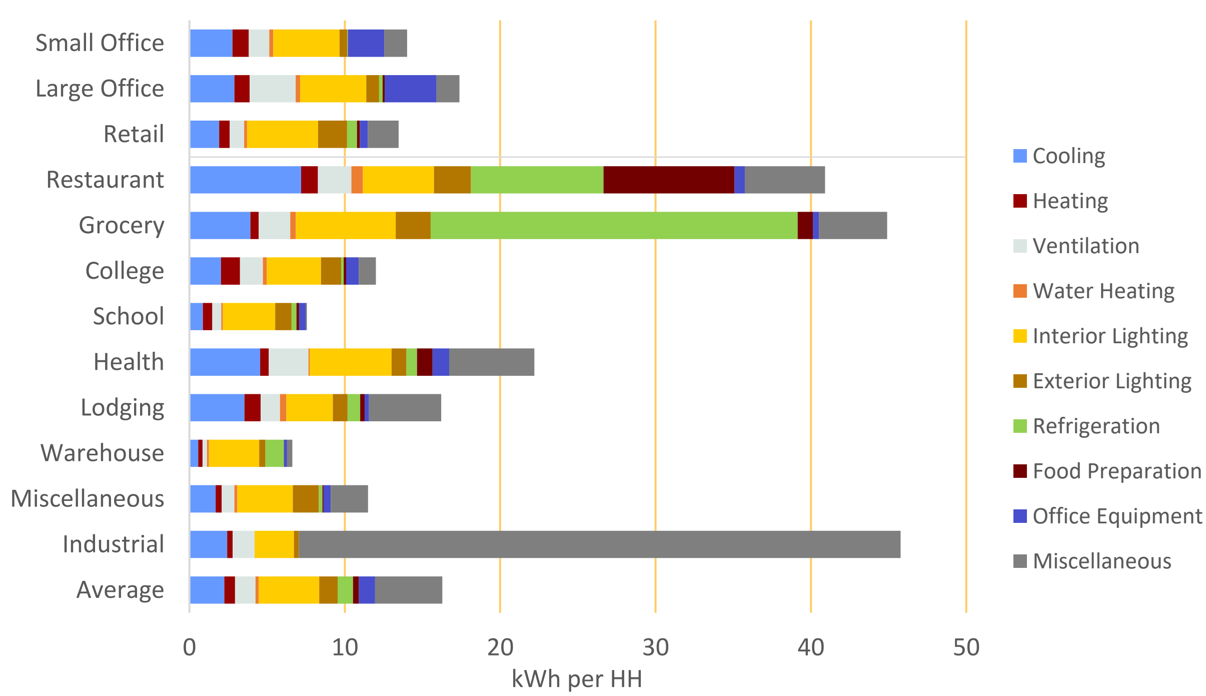


Table 3-4 Average Electric Market Profile for the Commercial and Industrial Sector, 2018

End Use	Technology	Saturation	EUI (kWh/SqFt)	Intensity (kWh/SqFt)	Usage (GWh)
Cooling	Air-Cooled Chiller	12.0%	2.83	0.34	100
Cooling	Water-Cooled Chiller	14.1%	2.93	0.41	122
Cooling	Evaporative AC	9.6%	1.21	0.12	34
Cooling	RTU	28.8%	3.24	0.93	275
Cooling	PTAC	2.1%	3.84	0.08	23
Cooling	Air-Source Heat Pump	8.8%	3.26	0.29	84
Cooling	Geothermal Heat Pump	0.8%	2.41	0.02	5
Cooling	PTHP	1.4%	3.91	0.05	16
Heating	Electric Furnace	1.3%	3.46	0.04	13
Heating	Electric Zonal Heating	15.7%	2.40	0.38	111
Heating	Air-Source Heat Pump	8.8%	2.30	0.20	59
Heating	Geothermal Heat Pump	0.8%	1.97	0.02	4
Heating	PTHP	1.4%	3.61	0.05	15
Ventilation	Ventilation	100.0%	1.32	1.32	389
Water Heating	Water Heater	35.8%	0.58	0.21	61
Interior Lighting	Screw-in	100.0%	0.79	0.79	231
Interior Lighting	Linear Fluorescent	100.0%	1.86	1.86	547
Interior Lighting	High-Bay Fixtures	100.0%	1.24	1.24	366
Exterior Lighting	Screw-in	100.0%	0.21	0.21	60
Exterior Lighting	Linear Fluorescent	100.0%	0.34	0.34	99
Exterior Lighting	HID	100.0%	0.64	0.64	189
Refrigeration	Walk-in Refrigerator	20.2%	0.92	0.19	55
Refrigeration	Reach-in Refrigerator	27.2%	0.22	0.06	17
Refrigeration	Glass Door Display	39.5%	0.21	0.08	25
Refrigeration	Open Display Case	26.3%	1.70	0.45	132
Refrigeration	Icemaker	45.3%	0.31	0.14	41
Refrigeration	Vending Machine	46.1%	0.17	0.08	24
Food Preparation	Oven	20.3%	0.35	0.07	21
Food Preparation	Fryer	2.8%	1.75	0.05	15
Food Preparation	Steamer	2.9%	1.76	0.05	15
Food Preparation	Dishwasher	18.4%	0.92	0.17	50
Food Preparation	Hot Food Container	9.2%	0.37	0.03	10
Office Equipment	Desktop Computer	94.3%	0.64	0.61	178
Office Equipment	Laptop	93.7%	0.06	0.05	15
Office Equipment	Monitor	94.3%	0.11	0.11	31
Office Equipment	Server	86.7%	0.19	0.16	47
Office Equipment	Printer/Copier/Fax	97.1%	0.09	0.09	25
Office Equipment	POS Terminal	53.0%	0.05	0.03	8
Miscellaneous	Non-HVAC Motors	31.0%	5.65	1.76	517
Miscellaneous	Pool Pump	4.9%	0.12	0.01	2
Miscellaneous	Pool Heater	1.2%	0.15	0.00	1
Miscellaneous	Other Miscellaneous	100.0%	2.56	2.56	754
Total				**16.27**	**4,790**

4

BASELINE END-USE FORECAST

Prior to developing estimates of energy efficiency potential for the residential, commercial, and industrial sectors, we developed a baseline end-use forecast to quantify what the consumption is likely to be in the future in absence of any efficiency programs. The savings from past programs are embedded in the base-year market profiles and the baseline end-use forecast assumes that those past programs cease to exist in the future. Thus, the potential analysis captures all possible savings from future programs.

The baseline forecast incorporates assumptions about:

- Energy market profiles for new homes, which reflects differences in appliance and equipment efficiency (higher in new homes and buildings), size of new homes, different appliance saturations. The profiles are available for review in LoadMAP.
- Customer growth. These were developed by AEG as part of the load forecast project.
- Trends in appliance saturations. We incorporated trends in cooling and electronics.
- Expected impact of appliance standards on the books. These standards affect many end-uses, especially lighting.
- Naturally-occurring energy efficiency. The effects of early-adopter decisions and market transformation are reflected in the appliance purchase shares.
- Forecasts of customer growth
- Appliance/equipment standards and building codes already mandated (see Chapter 2)
- Appliance/equipment purchase decisions frozen at contemporary levels throughout (except where superseded by a code or standard)
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous electricity growth

Below, we present the baseline projections for each sector, which include projections of annual use in GWh. We also present a summary across all sectors.

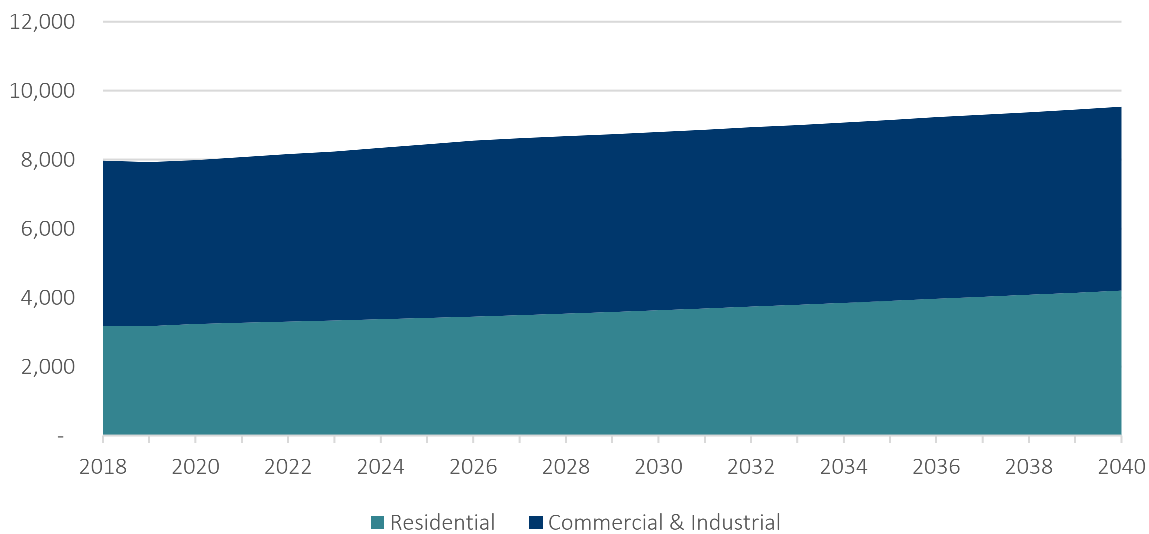
Summary of Baseline Forecast Across All Sectors

Table 4-1 and Figure 4-1 provide a summary of the baseline projection for the entire PNM service territory. Electric vehicle consumption and solar photovoltaic generation are not included in the baseline projection. Overall, the forecast shows flat growth in electricity use.

Table 4-1 Baseline Projection Summary (GWh)

Sector	2018	2020	2025	2030	2035	2040	% Change ('18-'40)	Avg. Growth Rate
Residential	3,180	3,235	3,407	3,632	3,905	4,202	32%	1.3%
Commercial and Industrial	4,790	4,751	5,033	5,167	5,243	5,331	11%	0.5%
Total	**7,970**	**7,985**	**8,441**	**8,799**	**9,147**	**9,534**	**20%**	**0.8%**

Figure 4-1 Baseline Projection Summary (GWh)



Residential Sector Baseline Projection

Table 4-2 and Figure 4-2 present AEG's independent baseline projection for electricity at the end-use level for the residential sector as a whole. Overall, residential use increases from 3,180 GWh in 2018 to 4,202 GWh in 2040, an increase of 32%. Figure 4-3 presents the baseline projection of annual electricity use per household. Specific observations include:

1. Lighting use declines as a result of phase two of the EISA lighting standards coming online in 2020.
2. Appliance energy use experiences significant efficiency gains from new standards, but this is offset by customer growth.
3. Growth in electronics is substantial and reflects an increase in the saturation of electronics and the trend toward higher-powered computers.

Table 4-2 Residential Baseline Projection by End Use (GWh)

End Use	2018	2020	2025	2030	2035	2040	% Change ('18-'40)
Cooling	630	659	757	858	966	1,083	72%
Heating	236	243	267	286	302	316	34%
Water Heating	147	150	164	175	186	196	33%
Interior Lighting	391	365	254	196	184	185	-53%
Exterior Lighting	75	68	47	35	33	31	-58%
Appliances	1,039	1,069	1,176	1,276	1,369	1,461	41%
Electronics	307	315	353	394	438	485	58%
Miscellaneous	355	365	391	412	427	444	25%
Total	**3,180**	**3,235**	**3,407**	**3,632**	**3,905**	**4,202**	**32%**

Figure 4-2 Residential Baseline Forecast by End Use (GWh)

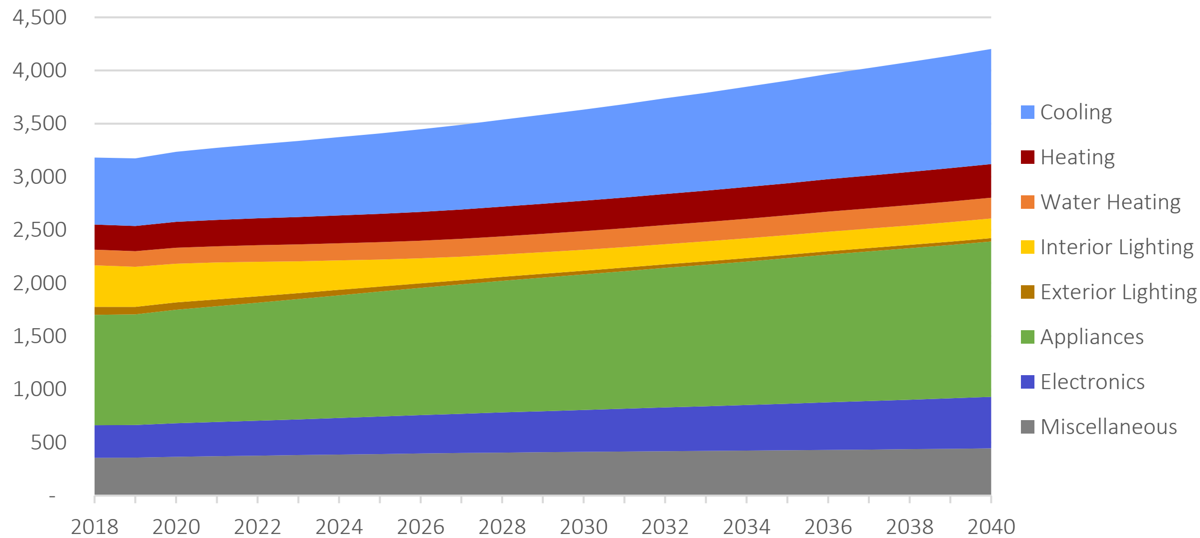
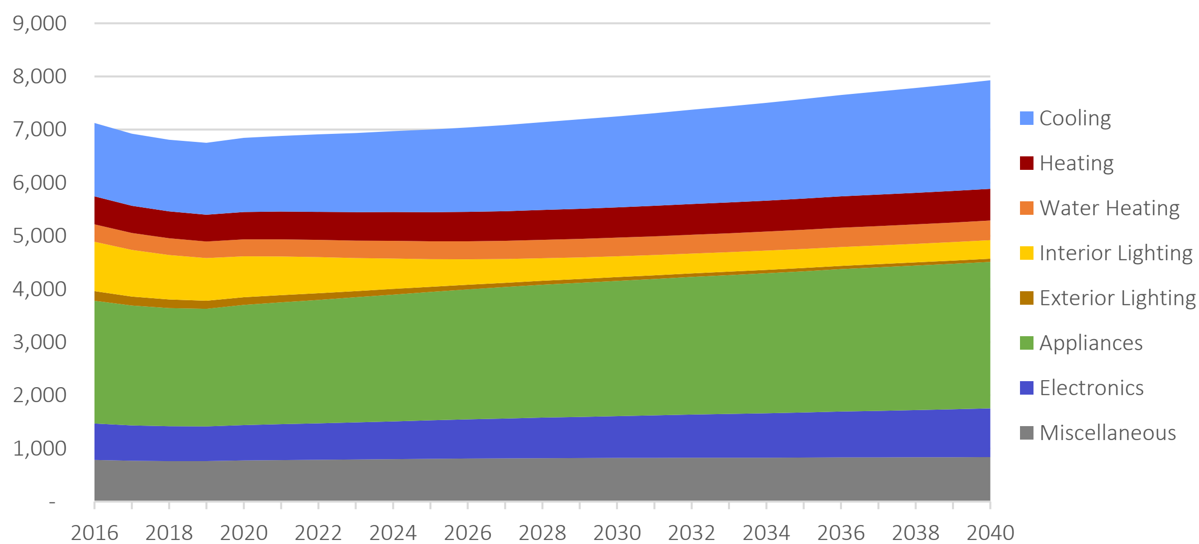


Figure 4-3 Residential Baseline Forecast of Annual Use per Customer



Commercial and Industrial Baseline End-use Forecast

Annual electricity use in the commercial and industrial sector grows 11% during the overall forecast horizon, starting at 4,790 GWh in 2018, and increasing to 5,331 in 2040. Table 4-3 and Figure 4-4 present the baseline projection at the end-use level for the commercial and industrial sector as a whole.

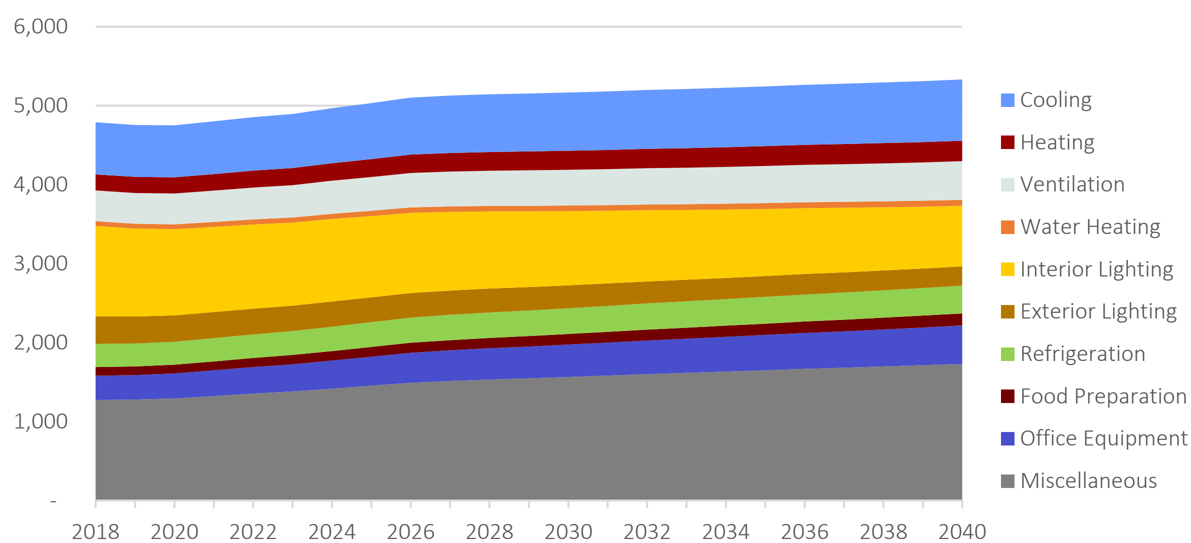
- Usage in lighting is declining throughout the forecast, due largely to the phasing in of codes and standards such as the EISA 2007 lighting standards, as well as embedded market practices of stocking and purchasing high efficiency lamps.

- Usage in commercial and industrial ventilation increases at a slower rate than cooling and heating due to market trends in fan efficiency and controls.
- The phasing in of recent refrigeration standards results in a decrease in consumption for this end use.
- Growth in miscellaneous use is substantial. This end use has grown consistently in the past and we incorporate future growth assumptions that are consistent with the Annual Energy Outlook.

Table 4-3 Commercial and industrial Baseline Projection by End Use (GWh)

End Use	2018	2020	2025	2030	2035	2040	% Change ('18-'40)
Cooling	661	658	710	737	756	776	17%
Heating	203	205	227	241	251	259	28%
Ventilation	389	391	428	452	470	488	25%
Water Heating	61	61	67	71	74	76	24%
Interior Lighting	1,144	1,091	1,027	939	849	767	-33%
Exterior Lighting	349	333	316	291	264	243	-30%
Refrigeration	293	291	312	326	339	353	20%
Food Preparation	110	111	124	134	143	153	38%
Office Equipment	306	316	368	410	447	485	58%
Miscellaneous	1,273	1,293	1,454	1,565	1,650	1,731	36%
Total	**4,790**	**4,751**	**5,033**	**5,167**	**5,243**	**5,331**	**11%**

Figure 4-4 Commercial and Industrial Baseline End-use Forecast (GWh)



5

ENERGY EFFICIENCY POTENTIAL

This chapter presents the measure-level energy conservation potential across all sectors. Year-by-year savings for annual energy usage are available in the LoadMAP model, which was provided to PNM at the conclusion of the study.

Summary of Overall Efficiency Potential

Table 5-1 and Figure 5-1 summarize the efficiency savings in terms of annual energy use for all measures for three levels of potential relative to the baseline projection. Savings are represented in cumulative terms, which reflect the effects of persistent savings in prior years in addition to new savings. This allows for the reporting of annual savings impacts as they impact each year of the forecast.

- Technical Potential reflects the adoption of all efficiency measures regardless of cost-effectiveness. In 2021 first-year net savings are 182 GWh, or 2.3% of the baseline projection. Cumulative savings in 2030 are 1,117 GWh, or 12.7% of the baseline. By 2040, cumulative savings reach 1,888 GWh, or 19.8% of the baseline.
- Economic Potential reflects the adoption of all cost-effective energy efficiency measures with a UTC greater than 1.0. In 2021first-year net savings are 137GWh, or 1.7% of the baseline projection. Cumulative net savings in 2030 are 700 GWh, or 8.0% of the baseline. By 2040, cumulative economic savings potential reaches 1,060 GWh, or 11.1% of the baseline.
- Achievable Potential refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and other factors that affect market penetration of energy efficiency measures. In 2021, first-year net savings are 61 GWh, or 0.8% of the baseline projection. Cumulative net savings in 2030 are 2025 GWh, or 2.8% of the baseline. By 2040 cumulative savings reach 536 GWh, or 5.6% of the baseline.

Table 5-1 Summary of Efficiency Potential (Annual Energy, GWh)

	2021	2025	2030	2035	2040
Baseline Forecast (GWh)	8,073	8,441	8,799	9,147	9,534
Cumulative Savings (GWh)					
Achievable Potential	61	235	333	442	536
Economic Potential	137	494	700	909	1,060
Technical Potential	182	706	1,117	1,532	1,888
Cumulative Savings as a % of Baseline					
Achievable Potential	0.8%	2.8%	3.8%	4.8%	5.6%
Economic Potential	1.7%	5.8%	8.0%	9.9%	11.1%
Technical Potential	2.3%	8.4%	12.7%	16.8%	19.8%

Figure 5-1 Summary of Efficiency Potential as % of Baseline Projection (Annual Energy)

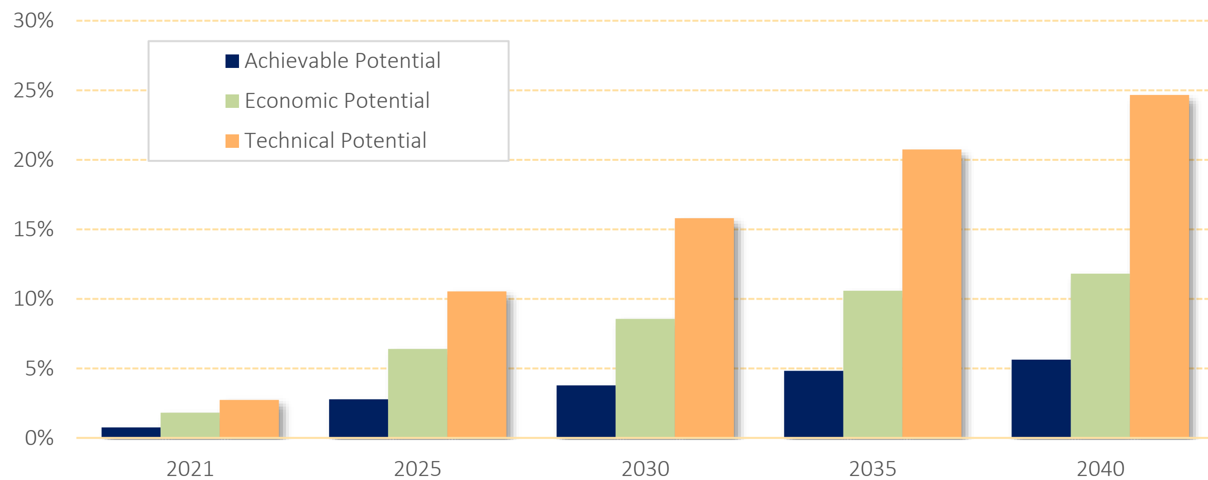


Figure 5-2 Baseline Projection and Potential Forecasts (GWh), All Sectors

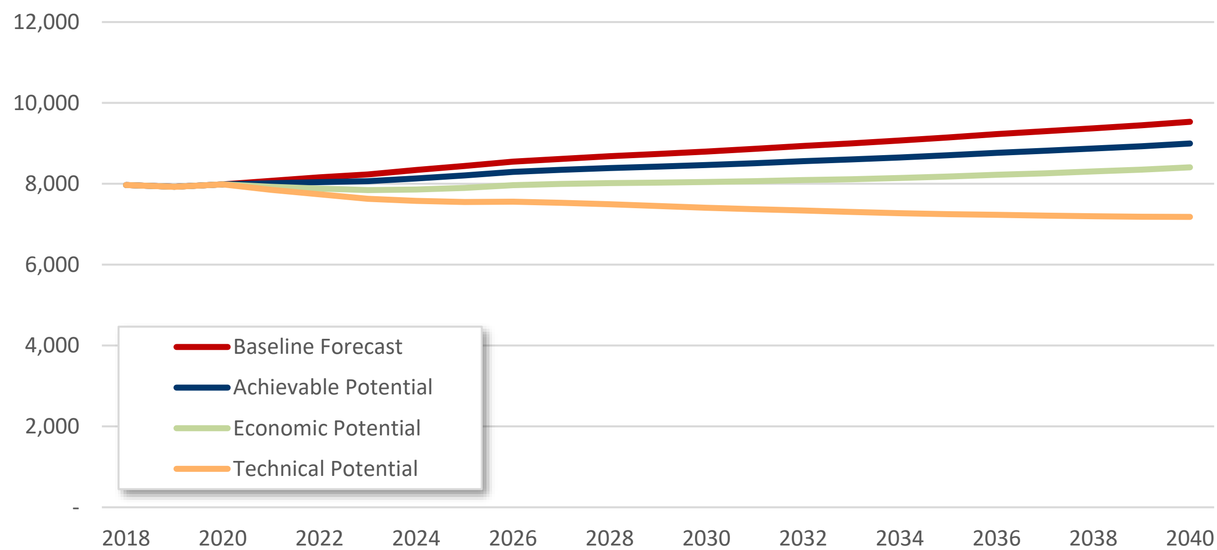


Table 5-2 summarizes achievable economic potential by market sector for selected years. In 2030, the commercial and industrial segments make up a majority of the potential.

Table 5-2 Achievable Potential by Sector, Selected Years (GWh)

	2021	2025	2030	2035	2040
Total Achievable Potential	**61**	**235**	**333**	**442**	**536**
Residential	26	103	124	166	215
Commercial and Industrial	36	131	208	276	321

Residential Potential

Table 5-3 and Figure 5-3 present estimates for measure-level efficiency potential for the residential sector. In 2021, achievable potential is 26 GWh, or 1.3% of the baseline projection. By 2025, cumulative savings are 103 GWh, or 3.0% of the baseline projection.

Table 5-3 Residential Efficiency Potential (Annual Energy, GWh)

	2021	2025	2030	2035	2040
Baseline Forecast (GWh)	3,272	3,407	3,632	3,905	4,202
Cumulative Savings (GWh)					
Achievable Potential	26	103	124	166	215
Economic Potential	59	231	275	363	454
Technical Potential	105	452	671	940	1,203
Cumulative Savings as a % of Baseline					
Achievable Potential	0.8%	3.0%	3.4%	4.3%	5.1%
Economic Potential	1.8%	6.8%	7.6%	9.3%	10.8%
Technical Potential	3.2%	13.3%	18.5%	24.1%	28.6%

Figure 5-3 Residential Savings as a % of the Baseline Projection (Annual Energy)

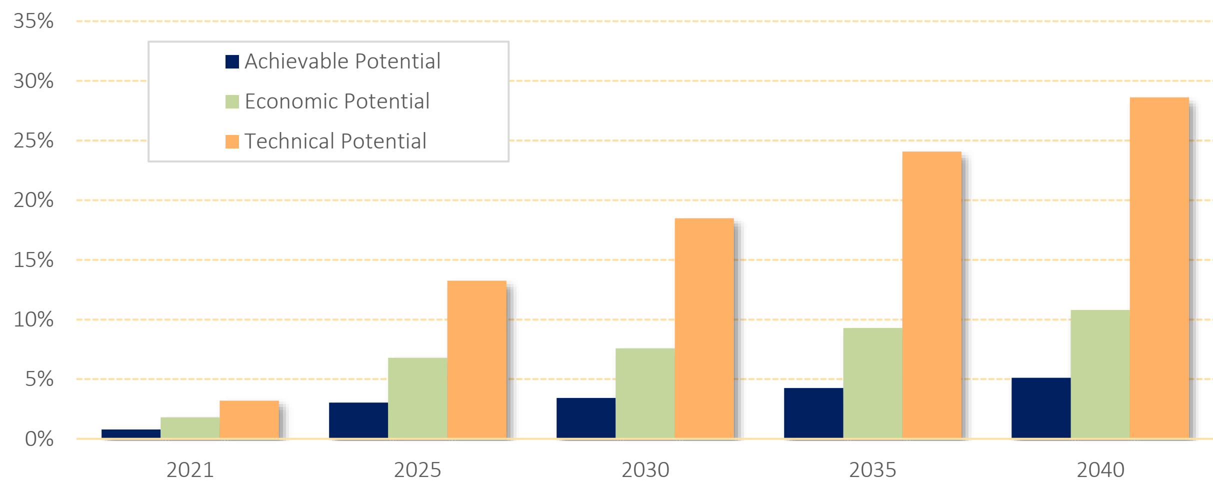


Figure 5-4 Residential Baseline Projection and Potential Forecasts (GWh)

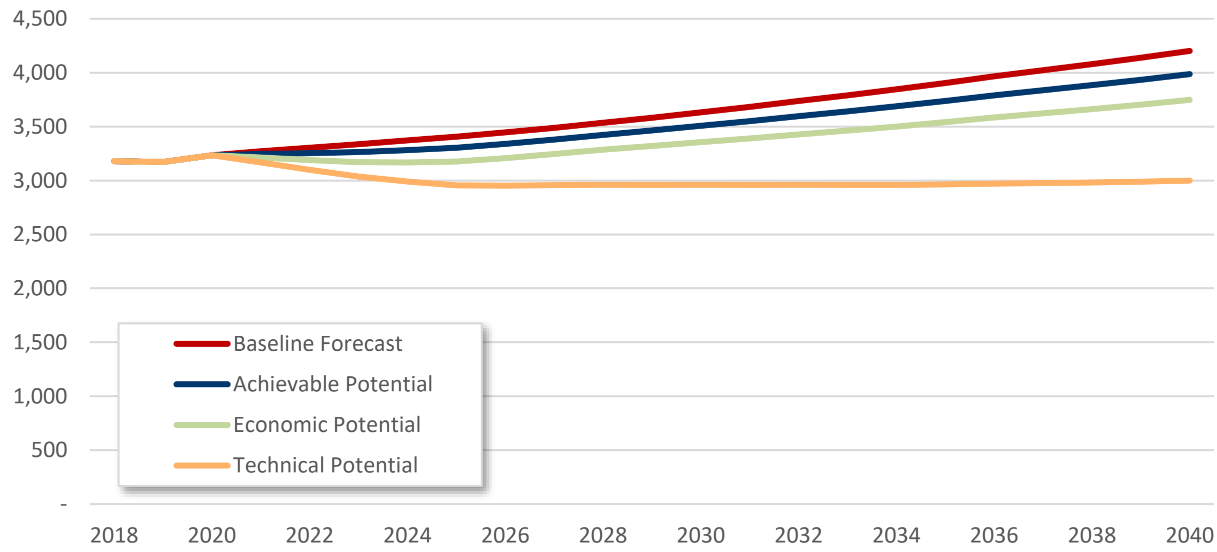


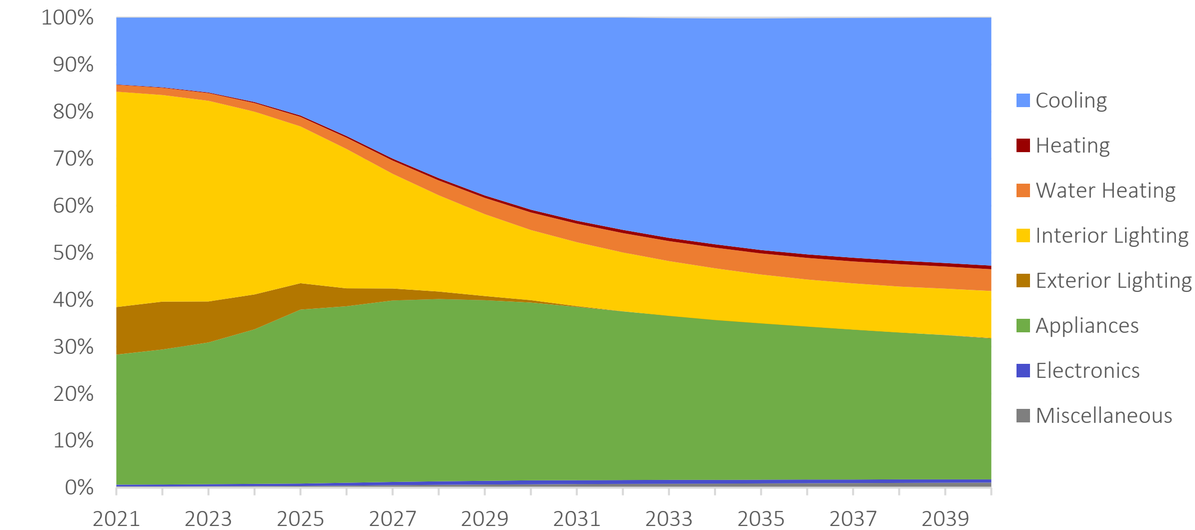
Table 5-4 identifies the top 20 residential measures by cumulative 2021 savings.

Table 5-4 Residential Top Measures in 2021 (Annual Energy, MWh)

Rank	Measure / Technology	2021 Achievable Cumulative Savings (MWh)	% of Total
1	Interior Lighting - General Service Lighting	8,910	34.7%
2	Refrigerator - Remove Second Unit	5,842	22.7%
3	Central AC	3,442	13.4%
4	Exempted Lighting	2,862	11.1%
5	Exterior Lighting - Screw-in	2,599	10.1%
6	Refrigerator	605	2.4%
7	Freezer	516	2.0%
8	Ducting - Repair and Sealing	162	0.6%
9	Water Heater (> 55 Gal)	153	0.6%
10	Water Heater - Low-Flow Showerheads	141	0.5%
11	Second Refrigerator	129	0.5%
12	Pool Pump - Timer	67	0.3%
13	Printer/Fax/Copier	67	0.3%
14	Water Heater - Faucet Aerators	48	0.2%
15	Room AC	33	0.1%
16	TVs	33	0.1%
17	Water Heater - Pipe Insulation	28	0.1%
18	Insulation - Ducting	24	0.1%
19	Dishwasher	12	<0.1%
20	Air-Source Heat Pump	5	<0.1%
	Total Top 20	**25,680**	100.0%
	Total Cumulative Savings in 2021	**25,684**	**100.0%**

Figure 5-5 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings. Table 5-5 summarizes residential sector savings by end use.

Figure 5-5 Residential Achievable Potential – Cumulative Savings by End Use (% of Total and Annual MWh)



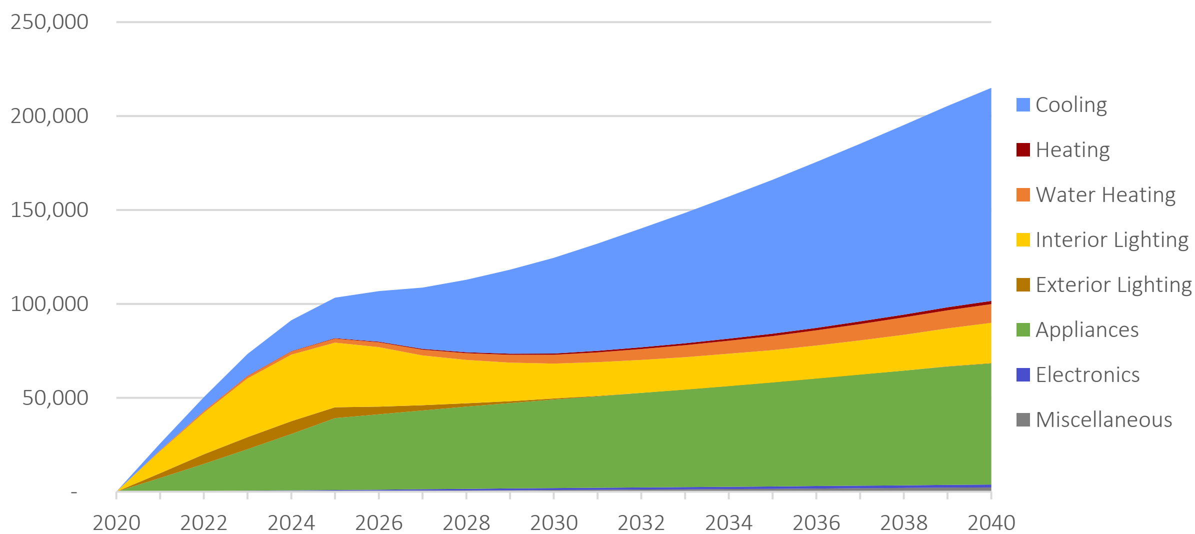


Table 5-5 Residential Achievable Potential by End Use (MWh), 2021

End Use	Single Family	Single Family Low Income	Multifamily	MF & MH Low Income	Total Residential
Cooling	3,209	288	82	69	3,649
Heating	14	5	2	1	23
Water Heating	286	27	30	27	370
Interior Lighting	9,300	1,673	425	374	11,772
Exterior Lighting	1,897	513	94	94	2,599
Appliances	6,056	788	141	119	7,104
Electronics	86	4	5	4	100
Miscellaneous	58	9	-	-	67
Total	**20,908**	**3,308**	**779**	**690**	**25,684**

Commercial and Industrial Potential

Table 5-6 and Figure 5-6 present the annual energy savings estimates for the three levels of efficiency potential for the commercial and industrial sector. In 2021, the first year of the projection, the achievable potential is 36 GWh, or 0.7% of the baseline projection. By 2025, achievable potential savings are 154 GWh, or 3.1% of the baseline projection.

Table 5-6 Commercial and Industrial Efficiency Potential (Annual Energy, GWh)

	2021	2025	2030	2035	2040
Baseline Forecast (GWh)	4,801	5,033	5,167	5,243	5,331
Cumulative Savings (GWh)					
Achievable Potential	36	131	208	276	321
Economic Potential	87	309	478	605	673
Technical Potential	116	438	719	958	1,149
Cumulative Savings as a % of Baseline					
Achievable Potential	0.7%	2.6%	4.0%	5.3%	6.0%
Economic Potential	1.8%	6.1%	9.3%	11.5%	12.6%
Technical Potential	2.4%	8.7%	13.9%	18.3%	21.6%

Figure 5-6 Commercial and industrial Savings as a % of the Baseline Projection (Annual Energy)

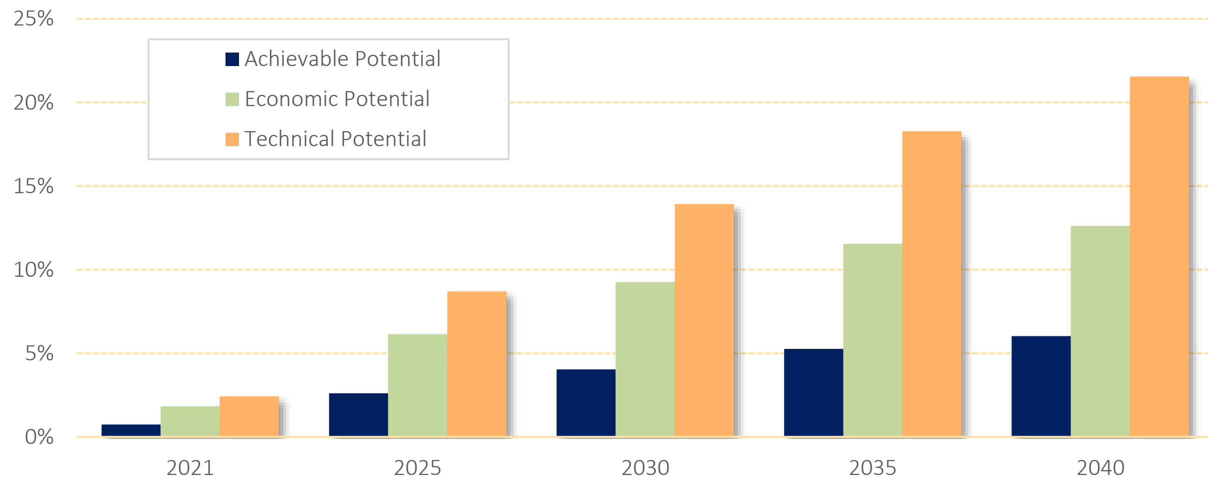


Figure 5-7 C&I Baseline Projection and Potential Forecasts (GWh)

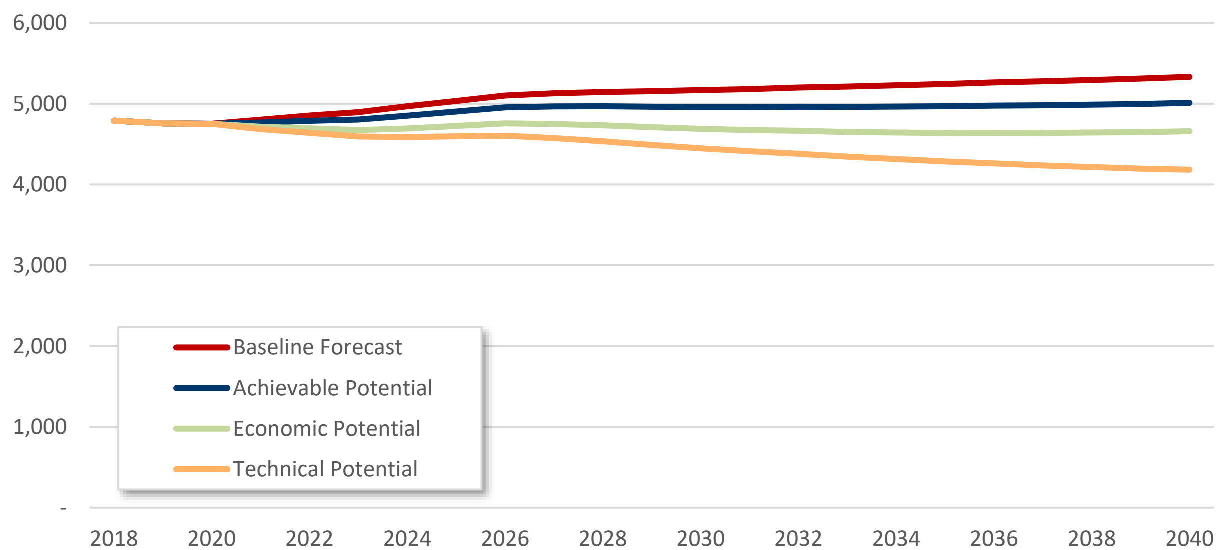


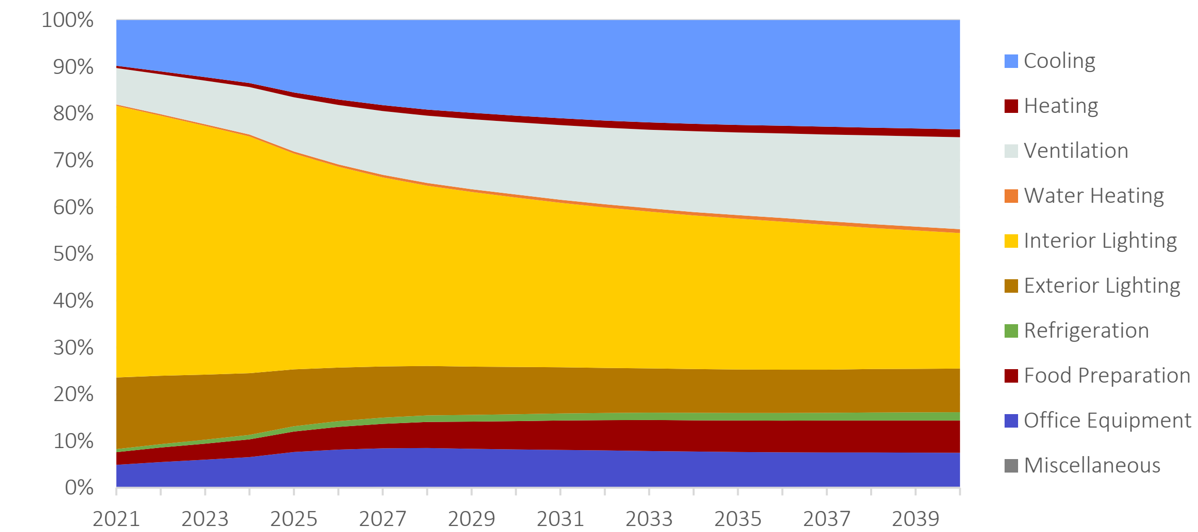
Table 5-7 identifies the top 20 commercial and industrial sector measures in 2021.

Table 5-7 Commercial and Industrial Sector Top Measures in 2021 (Annual Energy, MWh)

Rank	Measure / Technology	2021 Achievable Cumulative Savings (MWh)	% of Total
1	Interior Lighting - Screw-in	11,451	32.2%
2	Interior Lighting - Linear Lighting	3,701	10.4%
3	Interior Lighting - High-Bay Fixtures	3,551	10.0%
4	Exterior Lighting - Screw-in	2,885	8.1%
5	Ventilation	1,961	5.5%
6	Exterior Lighting - Area Lighting	1,551	4.4%
7	Exterior Lighting - Linear Lighting	989	2.8%
8	Interior Lighting - Networked Fixture Controls	879	2.5%
9	HVAC - Economizer	822	2.3%
10	Desktop Computer	685	1.9%
11	Water-Cooled Chiller	656	1.8%
12	Ventilation - Variable Speed Control	648	1.8%
13	Interior Lighting - Embedded Fixture Controls	635	1.8%
14	Air-Cooled Chiller	603	1.7%
15	Steamer	485	1.4%
16	RTU	380	1.1%
17	Retrocommissioning	319	0.9%
18	PTAC	294	0.8%
19	HVAC - Duct Repair and Sealing	286	0.8%
20	Interior Fluorescent - Delamp and Install Reflectors	227	0.6%
	Total Top 20	**33,008**	**92.8%**
	Total Cumulative Savings in 2021	**35,577**	**100.0%**

Figure 5-8 presents forecasts of energy savings by end use as a percent of total annual savings and cumulative savings.

Figure 5-8 Commercial and Industrial Achievable Potential – Cumulative Savings by End Use (% of Total and Annual MWh)



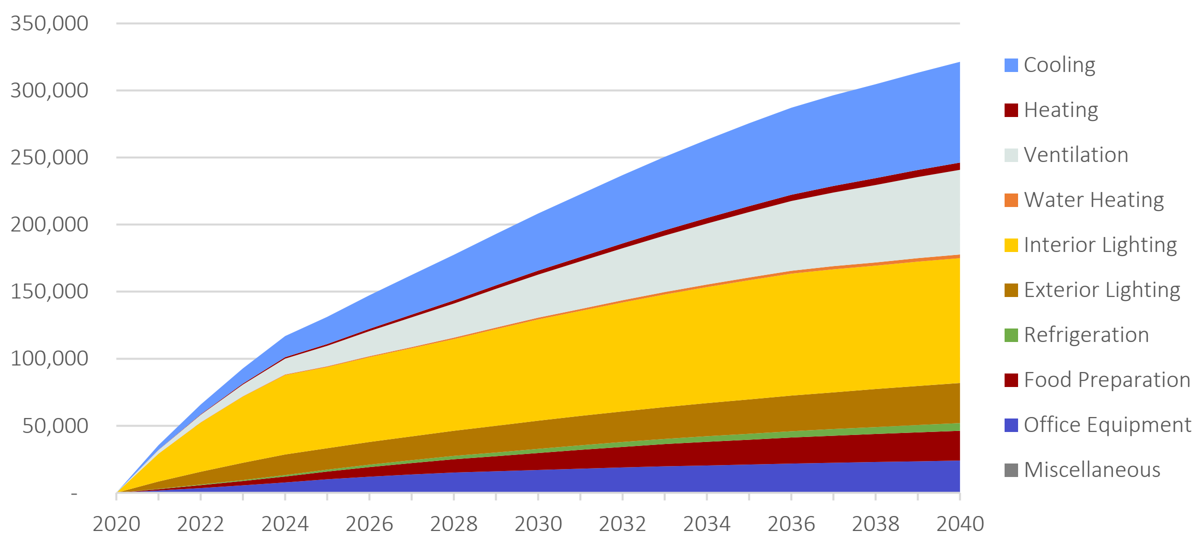


Table 5-8 summarizes commercial and industrial sector savings by end use.

Table 5-8 Commercial and Industrial Achievable Potential by End Use (MWh), 2021

Segment	Cooling	Heating	Ventilation	Water Heating	Interior Lighting	Exterior Lighting	Refrigeration	Food Preparation	Office Equipment	Miscellaneous	Total
Small Office	658	12	471	6	2,026	182	0	2	255	647	4,261
Large Office	189	21	959	22	3,382	501	4	28	535	661	6,301
Retail	156	6	92	17	2,986	1,311	50	47	143	572	5,381
Restaurant	205	14	36	11	800	204	-	657	31	202	2,160
Grocery	131	1	68	3	454	95	61	59	12	202	1,086
College	177	8	47	7	1,025	194	2	18	45	262	1,784
School	122	18	15	6	2,080	329	8	32	47	164	2,820
Health	269	4	232	1	739	72	3	72	40	284	1,716
Lodging	218	42	29	9	1,297	143	26	22	21	94	1,903
Warehouse	96	14	22	5	1,019	227	52	0	22	262	1,719
Miscellaneous	839	35	493	18	4,223	2,046	30	22	99	886	8,689
Industrial	415	2	303	-	630	148	-	-	462	709	2,668
Total	**3,475**	**177**	**2,767**	**103**	**20,662**	**5,452**	**235**	**960**	**1,713**	**4,944**	**40,487**

6

ESTIMATING PROGRAM POTENTIAL TO REACH SAVINGS GOALS

House Bill (HB) 291, which the Legislature passed in 2019 and the governor signed into law on April 3, 2019, requires the state of New Mexico's three public utilities to achieve savings equal to 5% of 2020 retail sales by 2025. This initial target will be followed by incrementally higher savings targets through 2030 that have yet to be set by the state Public Regulation Commission. HB 291 also authorizes up to a 66 percent increase in utility spending on energy-efficiency programs.

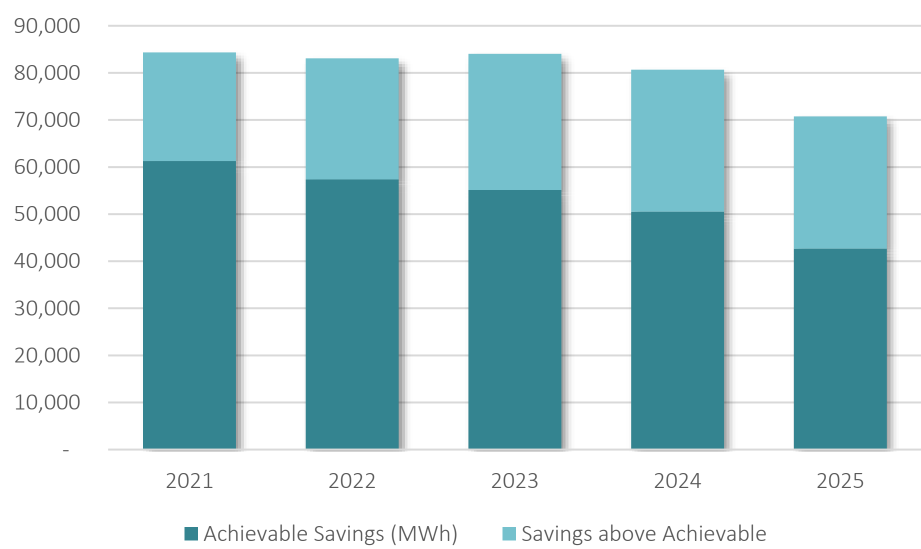
The new mandates modify the state's Efficient Use of Energy Act, enacted in 2005. Under that legislation, Public Service Company of New Mexico, El Paso Electric Co. and Southwestern Public Service were required to achieve 5 percent savings off 2005 retail sales by 2014, and 8 percent by 2020.

To assist in the planning of achieving these savings goals, AEG estimated the savings required to meet the new mandate by increasing participation in EE during the 2021-2025 timeframe. We also estimated the resulting potential through the end of the study timeframe.

Achieving the Mandated Goal

The first step in the process was to estimate the level of participation required to meet the mandated goal of 5% savings by 2025. We did this by ramping up participation in the Achievable Potential for EE from the LoadMAP modeling. In Figure 6-1 below, the light teal portion of the bars represent the incremental economic EE savings above the current forecast of achievable savings that would need to be captured by programs to achieve the EUEA Savings goal. The most likely way to capture additional technical savings through increased participation is through additional spending on incentives, education, and marketing.

Figure 6-1 Incremental EE Savings to Achieve Updated EUEA Savings Goal



Forecasting Potential after 2025

In addition to estimating the incremental potential associated with achieving the EUEA goal, AEG also estimated three scenarios for the level of potential after 2025 which account for the increased participation that was required to achieve the savings goal in the following ways:

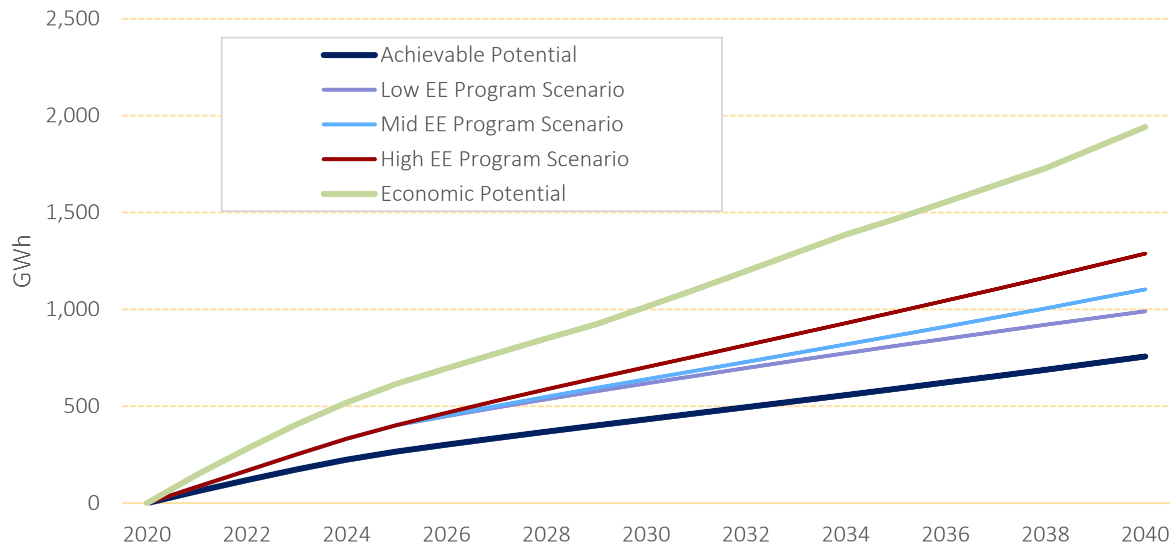
- In the Low scenario, we estimated post 2025 savings based on a continued spending threshold of 3% of revenue for the 2026-2040 time period. By 2040, the cumulative first-year savings reach 990 GWh, which is 10.4% of the baseline projection.
- In the Mid scenario, we assumed that the potential post 2025 would ramp up at the same rate as the Achievable Potential from LoadMAP. This assumes that program outreach would need to increase in order to capture more of the Economic Potential. By 2040, the cumulative first-year savings are 1,103 GWh, which is 11.6% of the baseline projection.
- In the High scenario, we assumed that a new savings mandate would be set, and that program participation would increase to meet this new goal. The cumulative first-year savings by 2040 is 1,288, 13.5% of the baseline projection.

Table 6-1 and Figure 6-2 illustrate each of the three scenarios bracketed by achievable potential on the bottom and economic potential on the top.

Table 6-1 Summary of Estimated Program Potential (GWh)

	2020	2021	2025	2030	2035	2040
Baseline Forecast (GWh)	**7,985**	**8,073**	**8,441**	**8,799**	**9,147**	**9,534**
Cumulative First-Year Savings (GWh)						
Achievable Potential		61	267	433	590	757
Low EE Program Scenario		84	403	618	812	990
Mid EE Program Scenario		84	403	640	865	1,103
High EE Program Scenario		84	403	702	987	1,288
Economic Potential		147	616	1,013	1,467	1,942
Savings (% of Baseline)						
Achievable Potential		0.8%	3.2%	4.9%	6.5%	7.9%
Low EE Program Scenario		1.0%	4.8%	7.0%	8.9%	10.4%
Mid EE Program Scenario		1.0%	4.8%	7.3%	9.5%	11.6%
High EE Program Scenario		1.0%	4.8%	8.0%	10.8%	13.5%
Economic Potential		1.8%	7.3%	11.5%	16.0%	20.4%

Figure 6-2 Cumulative First-Year Potential Program Savings



7

DEMAND RESPONSE ANALYSIS APPROACH

This section describes the analysis approach and data sources used to develop the demand response potential estimates including the market and program characterization.

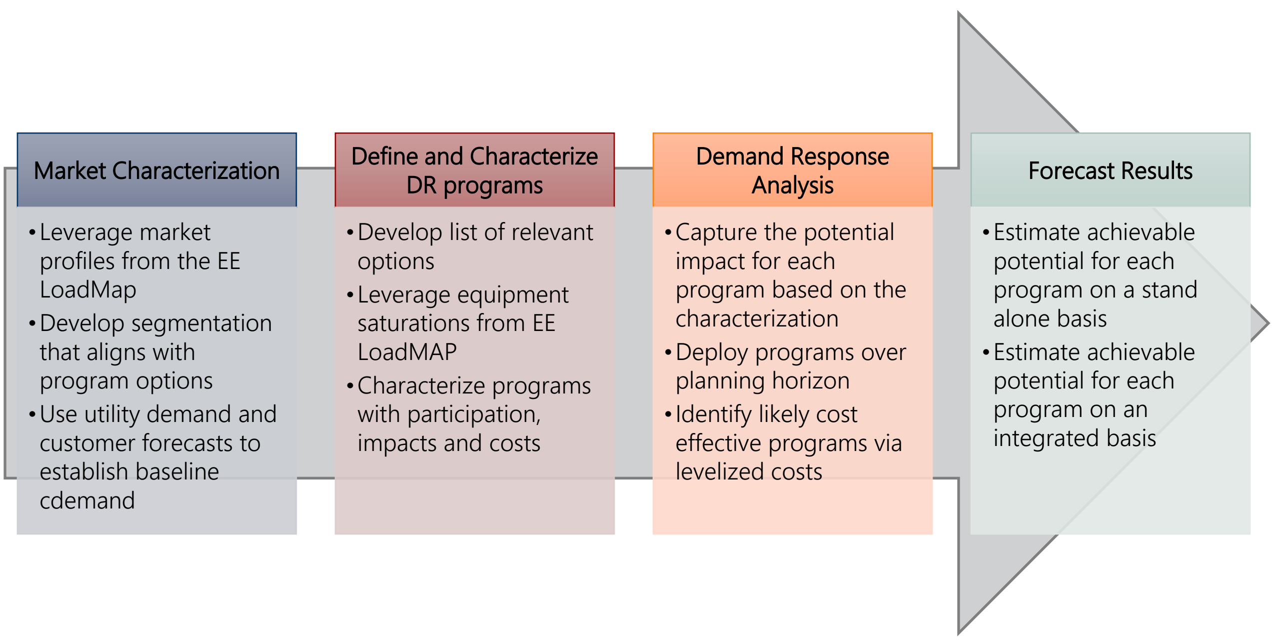
Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below. We describe these analysis steps in more detail throughout the remainder of this chapter.

1. Market characterization. In this step we segment the market into customer classes and establish baseline peak demand and customer forecasts.
2. Define DR options. Next, we develop a list of relevant DR program options by customer class. Then we characterize each program option in terms of participation or acceptance rates, peak demand impacts, and program costs.
3. Estimation of potential. We use LoadMAP's DR module to estimate potential.
4. Calculation of levelized costs. Finally, we calculate levelized costs for each program option by customer class.

Figure 7-1 below illustrates the demand response analysis approach within the LoadMAP framework.

Figure 7-1 Demand Response LoadMAP Analysis Framework



Definitions of Potential

For this study, we defined two types of potential which we believe lead to meaningful conclusions and recommendations regarding future DR:

- Technical Achievable Potential – Stand-Alone Case. Technical achievable potential represents an upper, realistic bound for potential DR attributable to each individual program without consideration of whether the program is cost effective or not. These individual potential estimates cannot be added together since the case also does not account for participation in multiple programs.
- Realistic Achievable Potential. The integrated case accounts for participation in multiple programs and eliminates double counting.

IMPACTS ARE INCREMENATL:

It is very important to note that all estimates of DR potential presented in this study are incremental to the existing and forecasted DR from programs that are currently being implemented in by PNM.

Market Characterization

The first step in the DR study was to create a market characterization. The market characterization creates a snapshot in time for each of the segments and records how many customers there are, what their peak demand was in the base year, and what programs customers are involved in. The process began by gathering data from PNM, leveraging the data already compiled in EE LoadMAP, and relying on secondary sources to create a complete picture. Once all the data is gathered, the market profile is created which establishes the high level, base year values for the model. Finally, once the base year values are assembled, a baseline forecast is created that extends to the end of study period. The baseline forecast is critical to study as it is the key determinant for customer growth, measuring potential peak reductions, and the economic feasibility of programs based off avoided cost projections.

Customer Segmentation

Due to the varied nature of the programs being offered in the model, each of the sectors were broken down and grouped into various segments based on their load profile. For this study, we segmented PNM's customers as follows:

- By sector: residential, commercial and industrial (C&I),
- By customer class: C&I customers are further segmented into customer classes of Small C&I and Medium and Large C&I, based on utility rate schedules. Extremely large customers, who are served through special contracts, are outside the scope of this analysis as they are currently providing load reduction through specialized agreements and are already accounted for in PNM's existing resource base.

Table 7-1 summarizes the overall market segmentation approach for the study.

Table 7-1 Analysis Segmentation

Rate Class	Customer Class
Sch. 1A: Residential	Residential
Sch. 1B: Residential - TOU	Residential
Sch. 2A: Small Power	Small C&I
Sch. 2B: Small Power - TOU	Small C&I
Sch. 3B: General Power	Medium / Large C&I
Sch. 3C: General Power (low load factor)	Medium / Large C&I
Sch. 3D: General Power Govt	Medium / Large C&I
Sch. 3E: General Power Govt LLF	Medium / Large C&I
Sch. 4B: Large Power (PNM-owned transformer)	Medium / Large C&I
Sch. 4B: Large Power (customer-owned transformer)	Medium / Large C&I
Sch. 5B: Industrial Power Service - Mining	Medium / Large C&I
Sch. 14: Large Service - Mining	Medium / Large C&I
Sch. 15: Large Service - Universities	Medium / Large C&I
Sch. 17: Large Service Manufacturing (10 MW Min)	Medium / Large C&I
Sch. 30B: Large Service Manufacturing (30 MW Min)	Medium / Large C&I
Sch. 35B: Large Power (> 3MW)	Medium / Large C&I

System and Coincident Peak Forecasts

The next step in market characterization is to define the estimated peak load forecast for the study timeframe. This is done at the PNM system level.

Figure 7-2 shows the estimated system coincident summer peak, developed based on load forecast data provided by PNM. In the base year of analysis, 2018, system peak load for the summer (a typical August weekday at 4:00 pm) is 1,717 MW. Over the study period, summer coincident peak load is expected to grow by an average of 0.7% annually.

Figure 7-2 Contribution to Estimated System Coincident Peak Forecast (Summer)

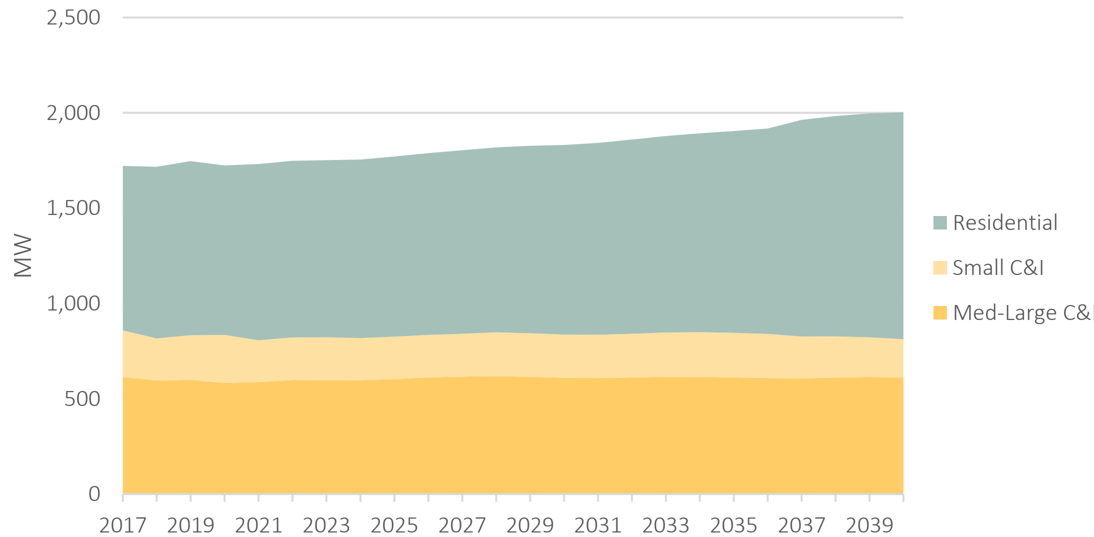
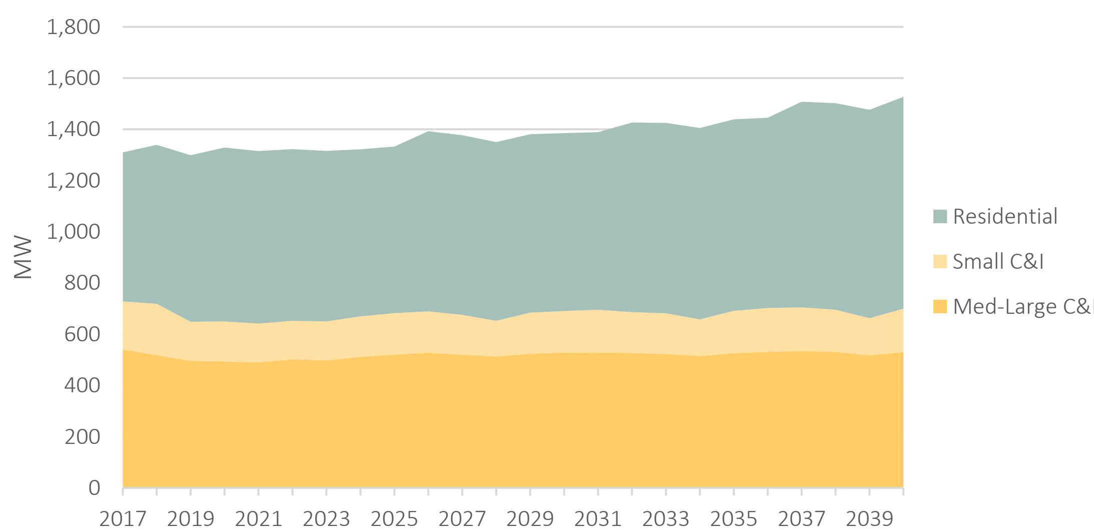


Figure 7-3 shows the estimated system coincident winter peak forecast, developed based on load forecast data provided by PNM. In the base year of analysis, 2018, system peak load for the winter (a typical December weekday at 6:00 pm) is 1,339 MW. The winter system peak is about 22% lower than the summer peak. Over the study period, winter coincident peak load is expected to grow by an average of 0.59% annually.

Figure 7-3 Contribution to Estimated System Coincident Peak Forecast (Winter)



Definition of Program Options

The next step in the analysis is to characterize the products for the analysis. We considered the characteristics and applicability of a comprehensive list of options available in the marketplace today as well as those projected into the 20-year study time horizon. We included for quantitative analysis those options which have been deployed at scale such that reliable estimates exist for cost, lifetime, and performance. Each selected product is described briefly below, as well as a description and rationale for any product that was considered but ultimately screened out because of insufficient data applicability. We grouped the DR program options into two groups, controllable options and rate based options.

- Resources from controllable resources or scheduled firm capacity product offerings/programs – Programs for which capacity savings occur as a result of active control or advanced scheduling. Once customers agree to participate in the program, the timing and persistence of load reduction is involuntary on their part, within agreed upon limits and parameters of the program. In most cases, loads are shifted rather than avoided. The most common type of controllable program is a residential direct load control (DLC).
- Resources from rate based resources and capacity product offerings/programs – These programs seek to achieve short-duration energy and capacity savings from actions taken by customers voluntarily, based on a financial incentive or signal. Savings typically only endure for the duration of the incentive offering. Program examples include time-of-use pricing plans, critical peak pricing plans, and behavioral demand response.

Controllable Demand Response Resources

Table 7-2 lists the controllable DR options considered in the study, followed by a brief discussion of the options selected.

Table 7-2 Controllable DR Options

Program Option	Eligible Customer Segments	Mechanism	Current PNM Offering?
Direct Load Control (DLC) of air conditioners (A/C) and domestic hot water (DHW)	Residential, Small C&I	DLC switch installed on customer's equipment	Yes
	Medium C&I	DLC switch installed on customer's equipment	Yes
DLC of space heating	All segments	DLC switch installed on customer's equipment	
Two-way communicating or Smart T-stats	Residential, Small C&I	Internet enabled control of thermostat set points, can be coupled with any dynamic pricing rate	Yes
Curtailment Agreements	Large C&I,	Customers enact their customized, mandatory curtailment plan. May use stand-by generation. Penalties apply for non-performance.	
Electric Vehicle DLC Smart Chargers	Residential	Smart, connected EV chargers that would automate vehicle charging such that it occurred preferentially during overnight, off-peak hours.	
Battery Energy Storage	All segments	Peak shifting of loads using stored electrochemical energy	
DR Providing Ancillary Services (Fast DR)	All segments	Automated, fast-responding curtailment strategies with advanced telemetry capabilities suitable for load balancing, frequency regulation, etc.	

The description of options below includes a summary of the basic features of each program type and the key assumptions used for potential and levelized cost calculations. The development of these assumptions is based on findings from research and review of available information on the topic, including national program survey databases, evaluation studies, program reports, and regulatory filings.

Direct Load Control (DLC)

For residential customers, we consider DLC for space cooling, space heating, water heating, smart thermostats, smart appliances, and smart electric vehicle chargers. For small and medium C&I customers, we consider DLC for space cooling, space heating, and water heating. Table 7-3 presents DLC offering basics.

Table 7-3 Residential and C&I DLC Program Basics

Controlled end uses	Eligible Customer Classes	Applicable Hours
Cooling equipment, including Central Air Conditioners and Heat Pumps	Residential, Small C&I, Medium and Large C&I	Top 50 summer system hours
Electric Water Heating	Residential, Small C&I, Medium and Large C&I	Top 50 summer system hours, and top 50 winter system hours
Space Heating	Residential, Small C&I, Medium and Large C&I	Top 50 winter system hours
Smart Thermostats	Residential, Small C&I	Top 36 summer system hours, and top 36 winter system hours
Electric Vehicle Charging	Residential	6 hours at peak every summer weekday (528 total) and every winter weekday (also 528 total)

Battery Energy Storage

Battery Storage works when electrical energy is stored during times when production (especially from intermittent sources such as renewable electricity sources such as wind power or, solar power) exceeds consumption, and is returned to the grid when production falls below consumption. Behind-the-meter or customer sited battery storage functions in a similar fashion on a smaller scale. Utilities would call a peak event and customers would activate the energy stored on the battery. For this analysis, utilities would pay for the cost of the battery in exchange for the ability to call on the battery during peak events.

Battery Storage is an emerging technology with low penetration and high costs, although based on our research, costs are expected to come down and penetration is expected to increase over time. Estimations of how long this will take are varied, therefore for this analysis the participation was kept conservative and a longer program participation ramp up period was applied.

Ancillary Services

Ancillary Services refer to functions that help grid operators maintain a reliable electricity system. Ancillary services maintain the proper flow and direction of electricity, address imbalances between supply and demand, and help the system recover after a power system event. In systems with significant variable renewable energy penetration, additional ancillary services may be required to manage increased variability and uncertainty.

Curtailable Agreements

Under this program option, it is assumed that participating customers will agree to reduce demand by a specific amount or curtail their consumption to a predefined level at the time of an event. In return, they receive a fixed incentive payment in the form of capacity credits or reservation payments (typically expressed as $/kW-month or $/kW-year), they may also receive payment for energy reduction. The amount of the capacity payment typically varies with the load commitment level. Because it is a firm, contractual arrangement for a specific level of load reduction, enrolled loads represent a firm resource and can be counted toward installed capacity requirements. Customers are paid to be on call even though actual load curtailments may not occur and penalties are assessed for under-performance or non-performance. Events may be called on a day-of or day-ahead basis as conditions warrant for emergency capacity reasons. Emergency events are called in response to an emergency at the wholesale level.

Rate-Based Demand Response Resources

Price Responsive resources considered in our analysis include the following rate-based options: Time-of-Day (TOD) Rates, TOD Rates specifically for electric vehicle owners, Demand Bidding, and Behavioral Demand Response (BDR). Further, the analysis in this study focuses on a case where voluntary, “opt-in” rate-based options are offered to customers.

We assume that rate-based options require an Advanced Metering Infrastructure (AMI) to enable two-way communication between the customer and utility for notification and billing purposes, except in cases where existing rates and infrastructure have already been established. PNM does not currently have comprehensive AMI in its service territory, so in order to assess the potential for rate-based options, this study assumes that a third party may be leveraged to collect data to verify savings.

The pricing program options that are included in the study are briefly described below, first for residential customers and then for non-residential customers. We also present participation, impact, and cost assumptions used for potential and levelized cost calculations.

Rate-Based Options for Residential Customers

In Table 7-4 below we present the dynamic pricing and behavioral program options that we considered in this study. The table also includes a brief description of the approach and identifies whether PNM currently offers the program, and if it was part of the previous study.

Table 7-4 Rate-Based for Residential Customers

Pricing DSM Option	Description	Current PNM Offering?
Time-Of-Day Rate	Increased cost of electricity during peak summer weekdays.	Yes, optional
TOD Rate for Electric Vehicle Owners	This rate has the same structure as the TOD Rate listed above but reflects the group of customers who would participate while owning and charging an electric vehicle. These participants would in effect have an “enabling technology” in the form of their EV that would enable them to shift usage and demand off-peak.	
Behavioral Demand Response	Voluntary demand reductions in response to behavioral messaging.	

Time of Day (TOD) is an electric rate that varies based on the time of day to reflect the varying cost to utility of supply. Typically, electricity cost of supply is higher during peak hours and they are lower during non-peak hours.

Table 7-5 below presents the key characteristics of the residential TOD rates. A more detailed description of the BDR program follows.

Table 7-5 Residential TOD Program Basics

Program Element	Assumption
Eligible Customer Classes	All residential customers are eligible for TOD rates. TOD with EVs is only applicable for households with an electric vehicle
Controlled end uses	Any end use, although some are more likely than others to be affected. For example, customers may modulate their use of air conditioners, dishwashers, or clothes wasters, but are not likely to unplug their refrigerators.
Applicable Hours	TOD Rates: 6 hours at peak every summer weekday (528 total) and every winter weekday (also 528 total)
Rate structure	TOD: 2:1 on-peak/off-peak price ratio

BDR is structured like traditional demand response interventions, but it does not rely on enabling technologies nor does it offer financial incentives to participants. Participants are notified of an event and simply asked to reduce their consumption during the event window. Generally, notification occurs the day prior to the event and are deployed utilizing a phone call, email, or text message. The next day, customers may receive post-event feedback that includes personalized results and encouragement. For this analysis, we assumed the BDR program would be offered as part of a Home Energy Reports program in a typical opt-out scenario.

Rate-Based Program Options for Non-Residential Customers

Table 7-6 lists the relevant rate-based options considered in the study for non-residential customers. For potential estimation purposes over the 2021-2040 timeframe, only TOD, and Demand Bidding are considered for commercial and industrial customers.

Table 7-6 Rate-Based Program Options for Non-Residential Customers

Pricing Program Option	Eligible Customer Classes	Analysis Approach	Current PNM offering?
Time-Of-Day (TOD) Rate	All C&I	For customer classes without existing TOD rates, study analyzes impacts associated with new TOD rates.	Yes, Optional
Demand Bidding (3rd party)	Medium & Large C&I	Customers volunteer a specified amount of capacity during a predefined “economic event” called by the utility in return for a financial incentive.	

The TOD rate for C&I customers is structured in the same manner as the residential TOD rate described above.

Demand Bidding is a voluntary program usually administered by a 3rd parting that provides customers with energy and/or capacity payments based on their performance during events. Customers can receive a capacity payment for a pre-specified amount of load reduction in response to an economic event as defined by the utility. Economic events are typically called when the wholesale price of electricity is higher than the cost paid out to the demand response customers. Customers also generally receive an energy payment based on the amount of load reduced during an event. However, customers usually do not enter into a contractual agreement directly with the utility therefore penalties are generally not assessed for non-performance.

Key Assumptions by Program

In this section we present the key assumptions developed from various sources to characterize each program option. We group the assumptions into three categories:

- Equipment saturations, which apply only to controllable DR options
- Participation rates or acceptance rates
- Per participant impacts

Additional assumptions around program costs, and more detailed descriptions of the assumptions for each program can be found in Appendix B.

Equipment Saturations

For controllable DR options that directly control a specific end-use or piece of equipment, information on equipment saturations must be taken into account as part of participation to ensure that only customers with a specific type of equipment are eligible for the program. The table below lists the equipment saturations assumed for each program and the source.

Table 7-7 Equipment Saturations by DR Program

Equipment Type	Residential	Small C&I	Med-Large C&I	Sources
Central AC	44%	76%	73%	Res: 2017 PNM RASS C&I: Previous PNM EE Potential Study
Smart Thermostats	25%	30%	29%	Res: 2017 PNM RASS
Elec Space Heat	14%	8%	23%	Res: 2017 PNM RASS C&I: Previous PNM EE Potential Study
Elec Water Heat	12%	33%	38%	Res: 2017 PNM RASS C&I: Previous PNM EE Potential Study
Room AC	3%			Res: 2017 PNM RASS C&I: Previous PNM EE Potential Study
Electric Vehicles	0.4%			Res: 2017 PNM RASS C&I: Previous PNM EE Potential Study
Battery Storage	2.0%	2.3%	2.3%	EIA Solar PV Data

Participation Rates

presents key participation assumptions by customer class used to develop potential and levelized cost estimates. Due to longstanding market involvement and experience, DLC assumptions for PNM have been calibrated to existing program information. For all other programs, DLC participation is assumed to ramp up following an "S-shaped" diffusion curve over a five-year timeframe. The rate of participation growth accelerates over the first half of the five-year period and then slows over the second half. For all programs, other than the existing residential Power Saver program, we assume program ramp-up and participant recruitment would begin in 2025. This is to account for the necessary time to secure regulatory approvals, engage a vendor, and launch the offerings (if selected by the IRP).

Participation assumptions for rate-based options are based on an extensive review of enrollment in full-scale, time-varying rates being offered in the United States and internationally, as well as findings of recent market research studies. With respect to full-scale deployments, the review focused specifically on rate offerings that have been heavily marketed to customers and have achieved significant levels of enrollment. Enrollment estimates are based on data reported to FERC by utilities and competitive retail suppliers and other entities. To provide additional insight, the analysis included survey-based market research studies from other comparable utilities and transferrable jurisdictions designed to gauge customer interest in time-varying rates. The surveys are from a statistically valid sample of respondents who are representative of all considered customers. Adjustments are made to account for the natural tendency of respondents to overstate their interest.

Table 7-8 Participation Rates by DR Program

Program Option	Residential	Small C&I	Med-Large C&I	Sources
DLC Central AC	18%	16%	0%	Based on current PNM programs
DLC Water Heating	20%	3%	4%	Best estimate based on industry experience and past electric programs
DLC Space Heating	20%	3%	3%	
DLC Smart Thermostats	12%	14%		
DLC Elec Vehicle Charging	25%			
Battery Energy Storage	3%	3%	3%	
Ancillary Services	15%	8%	8%	
Curtail Agreements			8%	Based on current PNM programs
Time-Of-Day	28%	13%	13%	Best estimate based on industry experience and past electric programs
Time-Of-Day w EV	28%			
Demand Bidding (3rd Party)			12%	
Behavioral	20%			

Per Customer Impacts

Per customer impacts are determined either through secondary research or based on evaluated results from existing PNM programs. Table 7-9 presents the per customer impacts by DR program.

Table 7-9 Per Customer Impacts by DR Program

Program Option	Residential	Small C&I	Med-Large C&I	Sources
DLC Central AC	0.57	0.80	1.76	Based on PNM evaluated results
DLC Water Heating	0.35	0.49	0.69	Average of impacts using older and newer higher efficiency water heater equipment
DLC Space Heating	1.38	1.94	1.94	*Winter Peak impacts Based on PSE 2010 DLC Pilot (WA)
DLC Smart Thermostats	0.57	0.80		Impacts are based on DLC Cooling/Heating programs
DLC Elec Vehicle Charging	0.28			Xcel Energy "Electric Vehicle Charging Station. Pilot Evaluation Report" May 2015
Battery Energy Storage	2.00	2.00	15.00	Typical battery size for segment
Ancillary Services	0.11	0.24	2.36	
Curtail Agreements			21%	Based on PNM evaluated results
Time-Of-Day	6%	0.2%	3%	Estimate based on industry experience and past programs
Time-Of-Day w EV	0.59			Estimate based on industry experience and past programs
Demand Bidding (3rd Party)			25%	Based on PNM evaluated results
Behavioral	0.04			OPower

Estimation of Potential

Once the market characterization is complete and the program assumptions are developed, the actual estimation of potential is performed, first for technical achievable potential, or the stand-alone case, and then for the realistic potential or integrated case.

Estimation of Technical Achievable Potential

Technical achievable potential represents an upper, realistic bound for potential DR attributable to each individual program without consideration of whether the program is cost effective or not. These individual potential estimates cannot be added together since the case also does not account for participation in multiple programs.

Estimation of Market Potential

The integrated case accounts for participation in multiple programs and eliminates double counting. It is often the case that different types of DR programs rely on similar customer classes and end-use loads to realize impacts during peak periods. For example, residential customers enrolled in an air-conditioner DLC program are unlikely to have sufficient load available to further reduce loads through a Time of Day program, given the likelihood of both programs targeting the same peak load hours and end uses. In order to determine how programs interact, we develop a loading order, or hierarchy, to determine which program take precedence over others and eliminate double counting. The hierarchy is presented below in Table 7-10. Programs are loaded in order beginning at the top of the table.

Table 7-10 Program Hierarchy

Customer Class	Residential	Small C&I	Medium C&I
DLC Smart Thermostats	X	X	
DLC Central AC	X	X	X
DLC Space Heating	X	X	X
DLC Water Heating	X	X	X
DLC Elec Vehicle Charging	X		
Battery Energy Storage	X	X	X
Ancillary Services	X	X	X
Curtail Agreements			X
Time-Of-Day	X	X	X
Time-Of-Day w EV	X		
Demand Bidding (3rd Party)			X
Behavioral	X		

Calculation of Levelized Cost

The annualized costs divided by the annualized demand reductions provides the levelized cost per kilowatt for each resource, for direct comparison with supply-side alternatives in PNM's IRP. The levelized cost ($/kW-year) calculations include costs for items such as program development and administration, customer marketing and recruitment, incentive payments, enabling technology, and O&M costs. An assessment of the levelized cost per summer peak kW is conducted independently of an assessment of the cost per winter peak kW. In other words, there is no allocation of costs between seasons and each figure in this report represents the full program cost applied to the seasonal peak impact.

In developing estimates of levelized costs, program costs were allocated annually over the expected program life cycle and then discounted using PNM's weighted average cost of capital (WACC) of 6.57% to calculate net present value (NPV) costs. An inflation rate of 2.30% was applied only to administrative program costs. Other costs, such as equipment and installation costs, were assumed to experience technology improvements or economies of scale to offset the effects of inflation.

Unless otherwise specified, all energy impacts in this report are presented at the generator or system level, rather than at the customer meter. Therefore, electric delivery losses, as provided by PNM is 12.73% for all sectors.

Table 7-11 shows the program lifecycle assumptions for all resources that are used for annualizing or levelizing the numbers in the calculations. DLC options have a lifetime assumption of 10 years, which is associated with the lifespan of switching equipment and is a standard industry assumption. For Curtailable Agreements and Demand Bidding, program lifetime assumptions are 3 years. For pricing programs, industry experience suggests a useful life of 10 years. For the Battery Energy Storage program, a lifetime of 15 years is assumed to align with the lifetime of the associated HVAC equipment. The above lifetime assumptions are used to appropriately capture all costs that would occur over PNM's 20-year IRP planning horizon, including equipment replacement and periodic implementation costs.

Table 7-11 Program Life Assumptions

Program Option	Lifetime (Years)
Direct Load Control of all considered end-uses	10
Battery Energy Storage	15
Ancillary Services	10
Curtailment Agreements	3
TOD Options	10
Demand Bidding	3
Behavioral	1

8

DEMAND RESPONSE POTENTIAL RESULTS

This section presents potential analysis results for Demand Response (DR) options based on the assumptions and methodologies outlined in this report. The results are provided first for the technical achievable, or standalone, case which means that that no interactions are considered between the DR options. Then the realistic achievable results, or the integrated results, are presented.

We present potential results both at an aggregate level, and disaggregated by DR option, and customer class. The discussion of results in this report centers on potential impacts in 2040. Potential is presented in terms of both the total estimated impact and the incremental impact beyond participation in PNM's current offerings.

This chapter also presents levelized costs by resource option. The results presented in the main body of the report are not additive between the two resource classes.

Technical Achievable Results

Technical achievable potential represents an upper, realistic bound for potential DR attributable to each individual program without consideration of whether the program is cost effective or not. These individual potential estimates cannot be added together since the case also does not account for participation in multiple programs. potential estimates are incremental to programs already implemented by PNM.

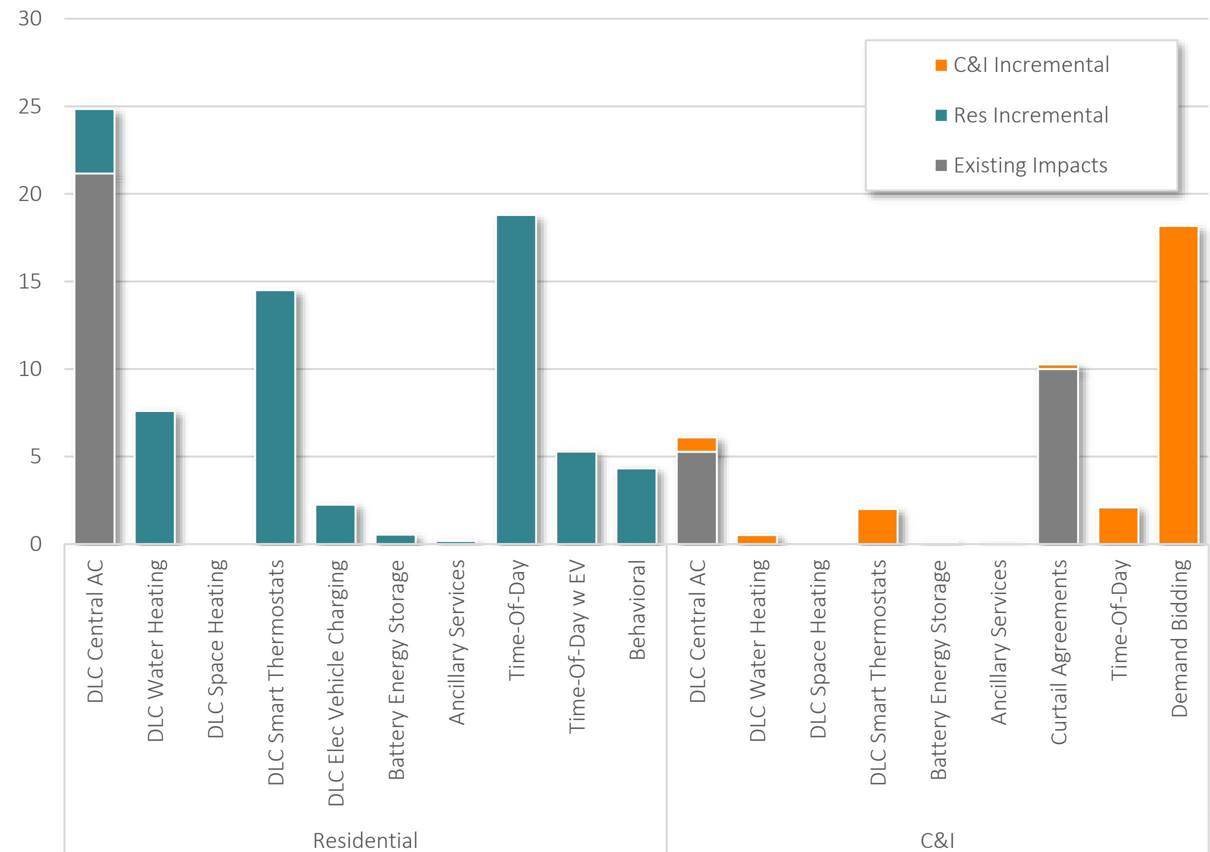
Key observations from our analysis results are:

- Technical Achievable potential increases by more than 2.5 times in 20 years from 2021-2040. Savings potential from DR resources are estimated to grow from 48.7 MW in 2021 to 124 MW in 2040, translating into 6.2% of projected system peak demand in 2040.
- In 2021, incremental technical achievable potential is derived from PNM's existing programs as well as new program starting in 2021. Existing programs include a residential and small C&I air conditioning load control program and medium and large C&I curtailment agreements; while new programs starting in 2021 include a residential and small C&I smart thermostat load control program, a small C&I water heater load control program and a small C&I battery storage program.
- Direct load control of residential and small C&I cooling end uses provides the highest total potential of DR products. There is a total of 35.6 MW of reduction from air conditioning DLC in 2040.
- Time of Day rates, Demand Bidding and Curtailment Agreements all make significant contributions to the market potential, achieving 20.9 MW, 18.2 MW and 17.4 MW of reduction respectively in 2040.

Figure 8-1 presents the technical achievable potential by program and class in 2040. Existing impacts are highlighted in the grey portion of each bar when appropriate and incremental potential is shown in teal or orange for the residential and C&I classes, respectively. Note that we intentionally do not add the program level potential together since these estimates represent the stand alone case.

In the subsections that follow we present additional detail on the residential and C&I results.

Figure 8-1 DR Technical Achievable Potential in 2040 (Summer)



Residential Results

In Table 8-1 below, we present the results for the residential class only, by program in selected years. Some key observations on the residential results include:

- The existing Power Saver program accounts for 27 MW in 2018, but the potential increases modestly throughout the forecast, as the DLC Smart Thermostat program absorbs new participants.
- In 2025, the DLC Smart Thermostat program contributes the most to the incremental potential at 5.5 MW. This is followed by the Time-of-Day program, which contributes 4.5 MW.
- By 2040, incremental potential for the Time-of-Day program increases to 18.8 MW, due to the higher number of eligible participants from the customer population.
- Incremental potential for DLC Smart Thermostats increases to 8.1 MW by 2040.

Table 8-1 Residential Technical Achievable Results – Summer MW unless otherwise noted

Residential Program	2018*	2021	2022	2025	2030	2040
Baseline Projection (MW)	**900**	**925**	**926**	**945**	**995**	**1,190**
DLC Central AC	27.1	0.6	0.9	1.5	2.6	4.7
(Power Saver)	*3.0%*	*0.1%*	*0.1%*	*0.2%*	*0.3%*	*0.4%*
DLC Water Heating		0.0	0.0	3.5	7.2	7.6
		0.0%	*0.0%*	*0.4%*	*0.7%*	*0.6%*
DLC Space Heating		0.0	0.0	5.7	19.3	19.9
**Winter Peak Impacts*		*0.0%*	*0.0%*	*0.6%*	*1.9%*	*1.7%*
DLC Smart Thermostats		0.5	1.5	5.5	6.3	8.1
		0.1%	*0.2%*	*0.6%*	*0.6%*	*0.7%*
DLC Elec Vehicle Charging		0.0	0.0	0.2	1.1	2.2
		0.0%	*0.0%*	*0.0%*	*0.1%*	*0.2%*
Battery Energy Storage		0.00	0.00	0.03	0.17	0.54
		0.0%	*0.0%*	*0.00%*	*0.02%*	*0.05%*
Ancillary Services		0.0	0.0	0.05	0.16	0.18
		0.0%	*0.0%*	*0.01%*	*0.02%*	*0.01%*
Time-Of-Day		0.0	0.0	4.5	15.7	18.8
		0.0%	*0.0%*	*0.5%*	*1.6%*	*1.6%*
Time-Of-Day w EV		0.0	0.0	0.4	2.6	5.3
		0.0%	*0.0%*	*0.0%*	*0.3%*	*0.4%*
Behavioral		0.0	0.0	1.9	4.0	4.3
		0.0%	*0.0%*	*0.2%*	*0.4%*	*0.4%*

Commercial Results

In Table 8-2 below, we present the results for the C&I class only, by program in selected years. Some key observations on the C&I results include:

- The existing Power Saver program accounts for 3.2 MW in 2018 and increases modestly throughout the forecast.
- In 2025, the Demand Bidding program contributes the most to the incremental potential at 5.4 MW. This is followed by the DLC Smart Thermostat program, which contributes 2.7 MW.
- By 2040, incremental potential for the Demand Bidding program increases to 18.2 MW. DLC Smart Thermostats provide the next highest potential, reaching 2.9 MW by the end of the study forecast period. This is followed by the Time-of-Day program, at 2.1 MW.

Table 8-2 Commercial Technical Achievable Results – Summer MW unless otherwise noted

Commercial Program	2018*	2021	2022	2025	2030	2040
Baseline Projection (MW)	**817**	**807**	**822**	**826**	**837**	**813**
DLC Central AC	3.2	0.1	0.1	0.2	0.3	0.5
(Power Saver)	*0.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.1%*
DLC Water Heating		0.1	0.2	0.5	0.5	0.5
		0.0%	*0.0%*	*0.1%*	*0.1%*	*0.1%*
DLC Space Heating		0.0	0.1	0.3	0.3	0.4
**Winter Peak Impacts*		*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
DLC Smart Thermostats		0.3	0.8	2.7	2.8	2.9
		0.0%	*0.1%*	*0.3%*	*0.3%*	*0.4%*
Battery Energy Storage		0.0	0.00	0.02	0.05	0.11
		0.0%	*0.0%*	*0.00%*	*0.01%*	*0.01%*
Ancillary Services		0.0	0.00	0.02	0.04	0.04
		0.0%	*0.0%*	*0.00%*	*0.00%*	*0.01%*
Curtail Agreements	17.0	0.0	0.1	0.2	0.4	0.4
(Peak Saver)	*2.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.1%*
Time-Of-Day		0.0	0.0	0.0	2.1	2.1
		0.0%	*0.0%*	*0.0%*	*0.3%*	*0.3%*
Demand Bidding		0.0	0.0	5.4	18.1	18.2
		0.0%	*0.0%*	*0.7%*	*2.2%*	*2.2%*

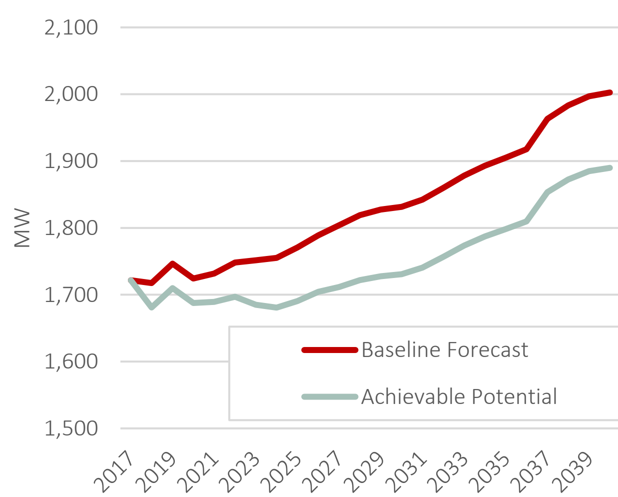
Realistic Achievable Results

The realistic achievable case accounts for participation in multiple programs and presents the achievable potential from the integrated set of DR options considered in this study. If PNM offers more than one program, then the potential for double counting exists. To address this possibility, we created a participation hierarchy to define the order in which the programs are taken by customers. The details are presented above in Chapter 7.

Then we computed the savings and costs under this scenario. Also, as in the Technical Achievable case, potential estimates are incremental to programs already implemented by PNM.

Key observations from our analysis results are:

Figure 8-2 Achievable Potential Over Time



- Realistic Achievable potential increases from DR resources are estimated to grow from 48.6 MW in 2021 to 119 MW in 2040, translating into 6% of projected system peak demand in 2040.
- In 2021, incremental potential is derived from PNM's existing programs as well as new programs starting in 2021. Existing programs include a residential and small C&I air conditioning load control program and medium and large C&I curtailment agreements; while new programs starting in 2021 include a residential and small C&I smart thermostat load control program, a small C&I water heater load control program and a small C&I battery storage program.
- Direct load control of residential and small C&I cooling end uses provides the highest total potential of DR products. There is a total of 34.5 MW of reduction from air conditioning DLC in 2040.
- Time of Day rates, Demand Bidding and Curtailment Agreements all make significant contributions to the realistic potential, achieving 18.6 MW, 18.2 MW and 17.4 MW of reduction respectively in 2040.

Figure 8-3 and associated Table 8-3 below, present the total realistic achievable potential by program for selected years.

Figure 8-3 DR Savings Potential in 2040 (Summer)

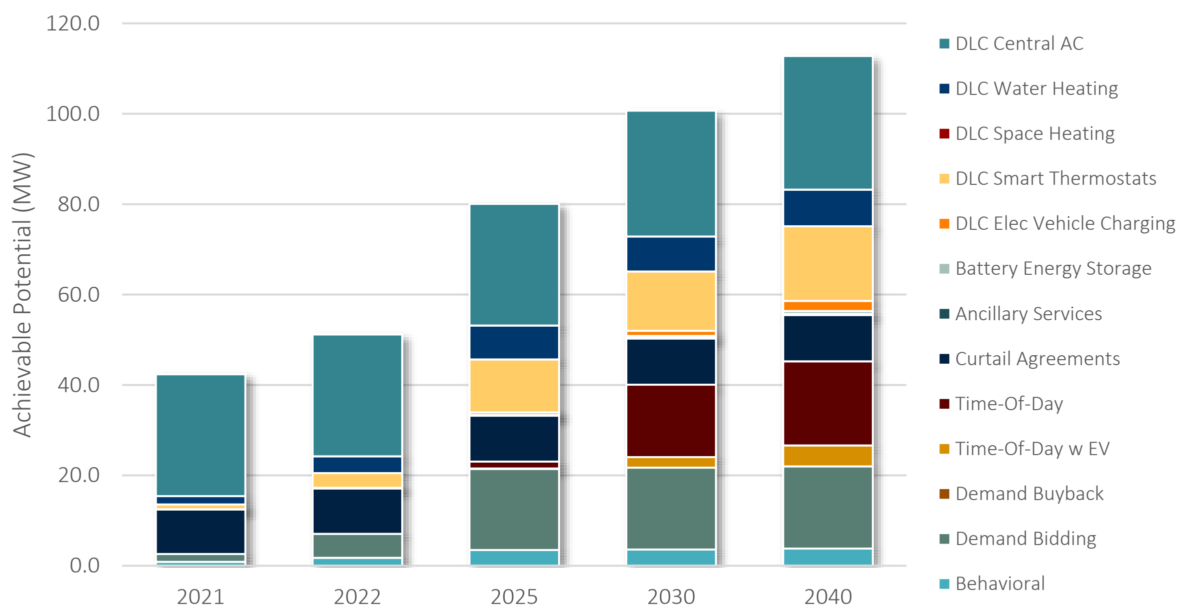


Table 8-3 Realistic Achievable DR Savings Potential in 2040 (Summer)

Summer Peak Potential	2021	2022	2025	2030	2040
Baseline Forecast (MW)	1,731.6	1,748.1	1,770.7	1,831.4	2,002.6
Achievable Potential (MW)	**48.6**	**50.7**	**72.4**	**108.1**	**119.4**
Achievable Potential (% of Baseline)	**2.8%**	**2.9%**	**4.1%**	**5.9%**	**6.0%**
DLC Central AC	31.0	31.1	31.3	32.4	34.5
DLC Water Heating	0.1	0.2	4.0	7.7	8.1
DLC Space Heating	0.0	0.0	0.0	0.0	0.0
DLC Smart Thermostats	0.8	2.3	8.2	9.1	11.1
DLC Elec Vehicle Charging	0.0	0.0	0.2	1.1	2.2
Battery Energy Storage	0.0	0.0	0.0	0.2	0.6
Ancillary Services	0.0	0.0	0.1	0.2	0.2
Curtail Agreements	16.7	17.1	17.2	17.4	17.4
Time-Of-Day	0.0	0.0	4.0	15.9	18.6
Time-Of-Day w EV	0.0	0.0	0.4	2.3	4.6
Demand Buyback	0.0	0.0	0.0	0.0	0.0
Demand Bidding	0.0	0.0	5.4	18.1	18.2
Behavioral	0.0	0.0	1.7	3.6	3.8

In Error! Not a valid bookmark self-reference. below, we also present the total realistic achievable results by sector. Residential participants have the highest contribution to overall potential at 62% in 2040. Small C&I has a relatively low contribution to overall potential, which is common throughout the industry, while medium and large C&I make up the bulk of the remainder with a total contribution of 31%.

Table 8-4 Total Realistic Achievable Potential by Sector

	2021	2022	2025	2030	2040
Achievable Potential (Summer MW)					
Residential	28.2	29.4	43.4	63.8	74.6
Small C&I	3.6	4.3	6.3	6.6	7.1
Med-Large C&I	16.7	17.1	22.6	37.6	37.8
Total	**48.6**	**50.7**	**72.4**	**108.1**	**119.4**

In the subsections that follow, we present the results for the residential and C&I classes, respectively.

Residential Results

In Table 8-5 below, we present the results for the residential class only, by program in selected years. Some key observations on the residential results include:

- In 2025, the DLC Smart Thermostat program contributes the most to the incremental potential at 5.5 MW. This is followed by the Time-of-Day program, which contributes 3.9 MW.
- By 2040, incremental potential for the Time-of-Day program increases to 16.5 MW, due to the higher number of eligible participants from the customer population.
- Incremental potential for DLC Smart Thermostats increases to 8.1 MW by 2040.

Table 8-5 Residential Realistic Achievable Results – Summer MW unless otherwise noted

Residential Program	2018*	2021	2022	2025	2030	2040
Baseline Projection (MW)	**900**	**925**	**926**	**945**	**995**	**1,190**
DLC Central AC	27.1	0.6	0.7	1.0	2.0	3.9
(Power Saver)	*3.0%*	*0.1%*	*0.1%*	*0.1%*	*0.2%*	*0.3%*
DLC Water Heating		0.0	0.0	3.5	7.2	7.6
		0.0%	*0.0%*	*0.4%*	*0.7%*	*0.6%*
DLC Space Heating		0.0	0.0	5.0	17.0	17.4
**Winter Peak Impacts*		*0.0%*	*0.0%*	*0.5%*	*1.7%*	*1.5%*
DLC Smart Thermostats		0.5	1.5	5.5	6.3	8.1
		0.1%	*0.2%*	*0.6%*	*0.6%*	*0.7%*
DLC Elec Vehicle Charging		0.0	0.0	0.2	1.1	2.2
		0.0%	*0.0%*	*0.0%*	*0.1%*	*0.2%*
Battery Energy Storage		0.0	0.0	0.0	0.2	0.5
		0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Ancillary Services		0.0	0.0	0.0	0.2	0.2
		0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Time-Of-Day		0.0	0.0	3.9	13.8	16.5
		0.0%	*0.0%*	*0.4%*	*1.4%*	*1.4%*
Time-Of-Day w EV		0.0	0.0	0.4	2.3	4.6
		0.0%	*0.0%*	*0.0%*	*0.2%*	*0.4%*
Behavioral		0.0	0.0	1.7	3.6	3.8
		0.0%	*0.0%*	*0.2%*	*0.4%*	*0.3%*
Total Residential	**27.1**	**1.1**	**2.2**	**16.3**	**36.7**	**47.5**
		0.1%	***0.2%***	***1.7%***	***3.7%***	***4.0%***

Commercial Results

In Table 8-6 below, we present the results for the C&I class only, by program in selected years. Some key observations on the C&I results include:

- In 2025, the Demand Bidding program contributes the most to the incremental potential at 5.4 MW. This is followed by the DLC Smart Thermostat program, which contributes 2.7 MW.
- By 2040, incremental potential for the Demand Bidding program increases to 18.2 MW. DLC Smart Thermostats provide the next highest potential, reaching 2.9 MW by the end of the study forecast period. This is followed by the Time-of-Day program, at 2.1 MW.

Table 8-6 Commercial Realistic Achievable Results – Summer MW unless otherwise noted

Commercial Program	2018*	2021	2022	2025	2030	2040
Baseline Projection (MW)	**817**	**807**	**822**	**826**	**837**	**813**
DLC Central AC	3.2	0.0	0.0	0.0	0.1	0.3
(Power Saver)	*0.4%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
DLC Water Heating		0.1	0.2	0.5	0.5	0.5
		0.0%	*0.0%*	*0.1%*	*0.1%*	*0.1%*
DLC Space Heating		0.0	0.1	0.3	0.3	0.3
**Winter Peak Impacts*		*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
DLC Smart Thermostats		0.3	0.8	2.7	2.8	2.9
		0.0%	*0.1%*	*0.3%*	*0.3%*	*0.4%*
Battery Energy Storage		0.00	0.00	0.02	0.05	0.11
		0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Ancillary Services		0.00	0.00	0.02	0.04	0.04
		0.0%	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Curtail Agreements	17.0	0.0	0.1	0.2	0.4	0.4
(Peak Saver)	*2.1%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.1%*
Time-Of-Day		0.0	0.0	0.0	2.1	2.1
		0.0%	*0.0%*	*0.0%*	*0.3%*	*0.3%*
Demand Bidding		0.0	0.0	5.4	18.1	18.2
		0.0%	*0.0%*	*0.7%*	*2.2%*	*2.2%*
Total Commercial	**20.2**	**0.4**	**1.1**	**8.8**	**24.1**	**24.6**
		0.1%	***0.1%***	***1.1%***	***2.9%***	***3.0%***

Levelized Costs

For each option, we estimated levelized costs over the entire study period of 2021–2040. Table 8-7 shows levelized costs, program costs and potential by option. We focus our discussion of findings on levelized cost per summer peak kW since this is PNM's primary system peak season and controlling system constraint.

- Residential Time of Day which has the second highest savings potential in the Residential sector, has the lowest levelized cost.
- Across all sectors, Battery Energy Storage has the highest levelized costs. In the Residential sector Ancillary Services also have very high levelized cost.
- In the Medium and Large C&I sector the programs with the highest savings potential, Curtailment Agreements and Demand Bidding, are among the programs with the highest costs.

Table 8-7 Levelized Costs and Incremental Potential @ Generator (Summer Peak)

Customer Class	Program	Levelized $/Summer kW-year @gen	NPV Program Costs	NPV Summer kW @gen
Residential	DLC Central AC	$ 98	$ 33,171	338.30
	DLC Water Heating	$ 116	$ 7,403	64.05
	DLC Space Heating	n/a	$ -	-
	DLC Smart Thermostats	$ 67	$ 3,897	57.89
	DLC Elec Vehicle Charging	$ 815	$ 9,154	11.23
	Battery Energy Storage	$ 1,272	$ 2,815	2.21
	Ancillary Services	$ 1,882	$ 2,584	1.37
	Time-Of-Day	$ 11	$ 1,516	134.65
	Time-Of-Day w EV	$ 33	$ 879	26.41
	Behavioral	$ 81	$ 2,917	35.90
Small C&I	DLC Central AC	$ 122	$ 4,877	40.04
	DLC Water Heating	$ 84	$ 359	4.27
	DLC Space Heating	n/a	$ -	-
	DLC Smart Thermostats	$ 40	$ 1,022	25.40
	Battery Energy Storage	$ 1,109	$ 380	0.34
	Ancillary Services	$ 124	$ 28	0.22
	Time-Of-Day	$ 175	$ 81	0.46
Med-Large C&I	DLC Central AC	n/a	$ -	-
	DLC Water Heating	$ 99	$ 40	0.41
	DLC Space Heating	n/a	$ -	-
	Battery Energy Storage	$ 1,544	$ 255	0.16
	Ancillary Services	$ 13	$ 2	0.17
	Time-Of-Day	$ 35	$ 539	15.53
	Curtail Agreements	$ 100	$ 20,151	201.41
	Demand Bidding	$ 111	$ 16,765	150.52

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DETAILED DR POTENTIAL ASSUMPTIONS BY PROGRAM

This appendix includes the assumptions for each program in two subsections, first for the direct load control programs, and second for rate based programs.

Assumptions for Direct Load Control Programs

In the tables that follow we present the assumptions for the residential and commercial direct load control programs. Tables summarize customer participation rates, program ramp up periods, per customer impacts, and program costs.

Table A-1 Residential DLC Program: Planning Assumptions

Data Item	Unit	Value
		Participation Assumptions
Residential customer participation	Steady-state Participation (as % of eligible customers)	*Cooling:* 23% *Water Heating:* 17% *Space Heating*: 20% *Smart Thermostats*: 7% *EV Charging: 25%*
Program ramp up period	Years	Five, Three years for Water heating
		Impact Assumptions
Residential customer per participant impact - Summer Peak	Average kW reduction per participant @ meter	*Cooling & Smart Thermostats:* 0.57 *Water Heating:* 0.35 *EV Charging:* 0.28
Residential customer per participant impact – Winter Peak	Average kW reduction per participant @ meter	*Smart Thermostats:* 0.21 *Water Heating:* 0.35 *Space Heating:* 1.38 *EV Charging:* 0.28
		Cost Assumptions
Annual Program Administration Cost	$/year	*Central Cooling: $80,552* *Space Heating:* $88,402 *Water Heating: $84,271* *Smart thermostats: $79,070* *EV Charging:* $90,000 each
Annual Marketing and Recruitment Costs	$/new participant	$50 per each residential program
Equipment capital and installation cost	$/technology	*CAC and Space Heating:* $215 each *Water Heating:* $315 *Smart thermostat:* Bring-your-own[13] *EV Charging:* $1,200
Annual O&M cost	$/participant/year	$11, except for Smart Thermostat, $44
Per participant annual incentive	$/participant/year	*CAC:* $21 each *Water Heating and EV Charging:* $24 Space Heating and *Smart thermostat:* $20

[13] Assumes that participating customers already own a compatible thermostat. A program design that pays for all or a portion of thermostat cost would have additional costs.

Table A-2 C&I DLC Program: Planning Assumptions

Data Item	Unit	Value
Participation Assumptions		
C&I customer participation	Steady-state Participation (as % of eligible customers)	*CAC:* Small C&I: 9%, Medium and Large C&I: 92% *Water Heating:* Small C&I: 3%, Medium and Large C&I: 4% *Space Heating*: 3% for All C&I
Program ramp up period	Years	n/a
Impact Assumptions		
C&I customer per participant impact for cooling	Average kW reduction per participant @ meter	Small C&I: 0.8 Medium and Large C&I: 1.76
C&I customer per participant impact for water heating		Small C&I: 0.49 Medium and Large C&I: 0.69
C&I customer per participant impact for space heating		1.94, same for each class
Cost Assumptions		
Annual Program Administration Cost	$/year	*CAC: $9,447* *Space Heating:* $1327 for Small C&I, $270 for Med/Large C&I *Water Heating:* $5,207 for Small C&I, $520 for Med/Large C&I *Smart Thermostats: $10,929* *EV Charging:* $75,000
Annual Marketing and Recruitment Costs	$/new participant	$63 for Small C&I, $75 for Med/Large C&I
Equipment capital and installation cost	$/technology	*CAC & Space Heating:* $387 each for Small C&I, $1,104 each for Med/Large C&I *Water Heating:* $315
Annual O&M cost	$/participant/year	$19 for Small C&I, $60 for Med/Large C&I
Per participant annual incentive	$/participant/year	*CAC & Space Heating:* each $38 for Small C&I, $128 for Med/Large C&I *Water Heating:* $24 *Smart Thermostats:* $20

Table A-3 Battery Energy Storage Program: Planning Assumptions

Data Item	Unit	Value
Participation Assumptions		
Residential customer participation **C&I customer participation**	Steady-state Participation (as % of eligible customers)	All customers – 3%
Program ramp up period	Years	15
Impact Assumptions		
Residential customer per participant impact **C&I customer per participant impact for cooling**	Average kW reduction per participant @ meter	All customers - 2.00
Cost Assumptions		
Annual Program Administration Cost	$/year	$120,878 for residential $16,653 for Small C&I $12,468 for Med/Large C&I
Annual Marketing and Recruitment Costs	$/new participant	Included in program administration costs
Equipment capital and installation cost	$/technology	$6,912 for residential $6,542 for Small C&I $49,068 for Med/Large C&I
Annual O&M cost	$/participant/year	No O&M
Per participant annual incentive	$/participant/year	No annual incentive. As an initial incentive, the program purchases & installs unit.

Table A-4 Ancillary Services: Planning Assumptions

Data Item	Unit	Value
Participation Assumptions		
Residential customer participation **C&I customer participation**	Steady-state Participation (as % of eligible load)	Residential: 15% Small C&I: 8% Medium and Large C&I: 8%
Program ramp up period	Years	5
Impact Assumptions		
Per participant load reduction	Average kW reduction per participant @ meter	Residential: 0.11 Small C&I: 0.24 Medium and Large C&I: 2.36
Cost Assumptions		
Program Development Cost	$/program	$75,000
Annual Program Administration Cost	$/year	$150,000

Table A-5 Curtailable Agreements: Planning Assumptions

Data Item	Unit	Value
Participation Assumptions		
Medium and Large **C&I customer participation**	Steady-state Participation (as % of eligible load)	Medium and Large C&I: 8%
Program ramp up period	Years	5
Impact Assumptions		
Per participant load reduction	Average kW reduction per participant @ meter	Medium and Large C&I: 21%
Cost Assumptions		
Program Development Cost	$/kW-year	$300,000
Annual Program Administration Cost	$/year	$257,250 ($150,000 for full time employee (FTE))

Rate-Based Program Assumptions

In the sections that follow we present the assumptions for the residential and commercial rate-based programs.

Residential Rate-Based Programs Customer Participation Assumptions

Table A-6 presents participation assumptions for residential customers in rate-based with a voluntary, opt-in offering. In 2019-2020, we assume impacts are realized only from existing TOU rates (i.e. no incremental potential), whereas new rates are offered beginning in 2021 to allow time for rate design and regulatory approvals. The assumed program start date varies by state based on AMI deployment assumptions mentioned above.

Participation levels to reach a steady state over a 5-year timeframe once the new rates are offered. As described earlier, ramp up to steady-state participation follows an "S-shaped" diffusion curve. Participation rates are specified in terms of a percentage of the eligible customer base.

Table A-6 Participation Assumptions for Residential Customers (with Opt-in Offer)

	Steady State Participation Rate	Program Start Date
Time of Day	28%	2025
Time of Day w/ EV	28%	2025
Behavioral DR	20%	2021

Residential Rate-Based Programs Customer Impact Assumptions

Residential impact assumptions for rate-based options are based on AEG's comprehensive database of time-varying pricing pilots that have been conducted across the U.S. and internationally over the past decade. These pilots have tested over 200 different time-varying rate offerings for residential customers.

Table A-7 presents impact assumptions for residential customers in time varying rates. The peak-to-off-peak price ratio is the key driver of demand response among participants in time-varying rates. A higher cost during peak means a stronger price signal and greater bill savings and demand reduction opportunities for participants. We surveyed the range of price ratios that have been offered in new time-varying rates over the past decade to establish reasonable assumptions for PNM. Within the range of values, we chose a moderate 2:1 TOD price ratio to be representative of similar rates that are delivered in regions like PNM's where energy prices are lower than the national average and time-varying rates are relatively uncommon.

Note also that the impacts during summer months tend to be larger than during winter months. The primary driver of this difference is that, in our experience, customers tend to be less sensitive to heat, than they are to the cold. That is to say, that they are more willing to be warmer than usual for a few hours, than they are to be colder than usual therefor resulting in a higher summer response and lower winter response.

Impact assumptions are presented in A-7 and are based on these ratios and rate designs.

Table A-7 Rate-Based Program Impact Assumptions for Residential Customers

Customer Class	Option	Per Customer Summer Peak Demand Reduction (%)
Residential	Time-Of-Day	6%
Residential	Time-Of-Day with EVs	0.59
Residential	Behavioral DR	0.04

Non-Residential Rate-Based Program Customer Participation Assumptions

Table A-8 presents participation assumptions for non-residential customers in rate-based options with a voluntary, opt-in offering. Participation assumptions are based on a portfolio of rate offerings which include TOD and Demand Bidding. New rates are assumed available the year that AMI is assumed to be fully deployed in a given territory as mentioned above.

Participation levels are assumed to reach a steady-state five years after the introduction of a new product. As described earlier in this study, ramp up to steady-state participation follows an "S-shaped" diffusion curve. Participation rates are specified in terms of a percentage of the eligible customer base.

Table A-8 Rate-Based Program Participation Assumptions for Non-Residential Customers (with Opt-in Offer)

		Steady State Participation Rate	Program Start Date
Time of Day	Small	13%	2025
	Medium and Large	13%	2026
Demand Bidding	Medium and Large	12%	2025

Non-Residential Price Responsive Program Customer Impact Assumptions

Table A-9 shows the load impact assumptions (represented as "% of peak load reduction") for rate-based options offered to non-residential customers. The industry, in general, has conducted fewer price elasticity studies for small and medium C&I customers than residential customers; for these segments, we relied on price elasticity estimates from a dynamic pricing pilot in California[14]. Due to the lack of national data, impacts for larger customers are derived from experience with full-scale deployments in the northeastern U.S. In all cases, we account for a non-linear relationship between the price ratio in the time-varying rate and the customer's load reduction.

The price ratios for developing impact assumptions for non-residential customers are the same as those used for residential customers. Impact assumptions in Table are based on a 2:1 TOD on-to-off peak price ratio. However, unlike those for residential customers, impact assumptions for non-residential customers do not differ under opt-in and opt-out cases. Business customers are assumed to be driven more by their

[14] "Impact Evaluation of the California Statewide Pricing Pilot" Final Report, prepared by Charles River Associates, March 2005

operational needs, with more sophisticated energy management capabilities, therefore their response would not be driven by behaviors as a residential customer.

Table A-9 Rate-Based Program Load Impact Assumptions for Non-Residential Customers

Customer Class	Option	Per Customer Summer Peak Demand Reduction (%)
Small C&I	Time-Of-Day	0.2%
Medium -Large C&I	Time-Of-Day	2.6%
	Demand Bidding	25%

Rate-Based Programs Customer Cost Assumptions

Table A-10 presents cost assumptions for rate-based options. Itemized cost assumptions include fixed and variable cost elements such as program development costs, annual administration costs, marketing and recruitment costs, and enabling technology costs. Costs for rate-based options do not include any incremental AMI or metering costs that may be required.

Table A-10 Rate-Based Program Cost Assumptions

Cost Item	Unit	Value
Development Cost	$/program	$150,000 (1 full-time employee equivalent, or FTE) for Res and all C&I TOD + $75,000 for Med/Large C&I $67,468 for TOD w EV
Annual Program Administration Cost	$/year	$75,000 (0.5 FTE) for each pricing program + $30,000 for Med/Large C&I $26,987 for TOD w EV
Annual Marketing and Recruitment Costs	$/new participant	All sectors: $10 for TOD $50 TOD w EV
Enabling technology costs	$/participant or $/kW	Assumed zero costs to program