AEG

Idaho Power Company Energy Efficiency Potential Study

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EXECUTIVE SUMMARY

In 2024, Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to provide an Energy Efficiency Potential Study (Potential Study) to support its 2025 Integrated Resource Plan (IRP) process. This study provides reliable estimates of the magnitude, timing, and costs of DSM resources that are likely available to IPC over a 20-year planning horizon. The study focuses on resources assumed achievable during the planning horizon, recognizing that known market dynamics may hinder resource acquisition. Study results will be incorporated into IPC's 2025 IRP and subsequent DSM planning and program development efforts. This study serves as an update to similar studies completed previously for IPC.

AEG used the analysis framework and data developed for the 2022 Potential Study as a starting point, implementing targeted updates to address IPC's evolving energy efficiency program requirements and stakeholder feedback. The key updates relative to the 2022 study include:

- Measure characterization based on changes in measure assumptions used in the Northwest Power and Conservation Council's 2021 Power Plan.
- Recent IPC energy efficiency program experience.
- Base-year (2023) customer usage.
- Expected impacts of future known codes and standards throughout the forecast period.
- Current technology saturations and assumptions about future adoption of energy-efficient options from the Energy Information Administration's 2023 Annual Energy Outlook (AEO).

The study uses the updated data to:

- Provide credible and transparent estimation of the technical, economic, and achievable energy efficiency potential annually over the next 20 years within IPC's service area,
- Develop a final report including summary data tables and graphs reporting annual incremental and cumulative potential from 2025 through 2044, and
- Provide inputs into IPC's 2025 IRP to test the need for, and value of, energy efficiency potential.

The results presented in this report are estimates based on the best available information available at the time of the analysis. Variation in outcomes is expected in the real world, giving energy-efficiency administrators the opportunity to use the results as guidance (instead of gospel) as they design programs and develop annual program targets. In addition, we recommend that IPC strive to incorporate any additional territory-specific information about baselines, saturations, and demand for program offerings that may become available in the future.

Summary of Potential Savings

Potential estimates presented in this report represent gross savings for three types of potential: technical, economic, and achievable. Table ES-1 summarizes the cumulative energy efficiency savings in terms of annual energy use for all measures for these levels of potential relative to the baseline projection. All savings in this report are provided at the customer meter level.

- Technical potential reflects the adoption of all energy-efficiency measures regardless of cost-effectiveness or customer willingness to adopt. First-year savings in 2025 are 394 GWh or 2.4% of the baseline projection. Cumulative technical savings in 2044 are 4,215 GWh, or 22.6% of the baseline.

- Economic potential reflects the savings for measures deemed cost-effective using the Utility Cost Test. The first-year savings in 2025 are 172 GWh, or 1.1% of the baseline projection. By 2044, cumulative economic savings reach 1,775 GWh, or 9.5% of the baseline projection.
- Achievable potential represents a subset of economic potential accounting for likely customer measure adoption. The achievable potential is 112 GWh savings in the 2025, or 0.7% of the baseline projection, and reaches 1,512 GWh cumulative achievable savings by 2044, or 8.1% of the baseline projection. This equates to an average annual savings of 0.4% of the baseline projection each year. Achievable potential represents 85% of economic potential by the end of the forecast horizon .

Table ES-1 Summary of Energy Efficiency Potential (Cumulative and Incremental Energy Savings, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	16,137	16,616	17,289	17,945	18,654
Cumulative Savings (GWh)					
Achievable Potential	112	515	908	1,247	1,512
Economic Potential	172	773	1,243	1,597	1,775
Technical Potential	394	1,777	2,976	3,757	4,215
Cumulative Savings as a % of Baseline					
Achievable Potential	0.7%	3.1%	5.3%	6.9%	8.1%
Economic Potential	1.1%	4.7%	7.2%	8.9%	9.5%
Technical Potential	2.4%	10.7%	17.2%	20.9%	22.6%
Incremental Savings (GWh)					
Achievable Potential	112	100	86	69	54
Economic Potential	172	139	107	62	39
Technical Potential	394	348	254	144	98

Table ES-2 summarizes the summer peak demand savings from all energy efficiency measures for the three levels of potential relative to the baseline projection.

- Technical potential for summer peak demand savings is 97 MW in 2025 or 2.8% of the baseline projection. This increases to 1,327 MW by 2044, or 32.6% of the summer peak demand baseline projection.
- Economic potential is estimated at 27 MW in 2025, or 0.8% of the baseline projection. In 2044, savings are 339 MW, or 8.3% of the summer peak baseline projection.
- Achievable potential is 17 MW in 2025 or 0.5% of the baseline projection. By 2044, cumulative savings reach 275 MW, or 6.8% of the baseline projection.

Table ES-2 Summary of Energy Efficiency Potential (Summer Peak, MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	3,487	3,611	3,783	3,947	4,069
Cumulative Savings (MW)					
Achievable Potential	17	79	154	222	275
Economic Potential	27	125	219	300	339
Technical Potential	97	469	843	1,138	1,327
Cumulative Savings as a % of Baseline					
Achievable Potential	0.5%	2.2%	4.1%	5.6%	6.8%
Economic Potential	0.8%	3.5%	5.8%	7.6%	8.3%
Technical Potential	2.8%	13.0%	22.3%	28.8%	32.6%

Summary of Energy Efficiency Potential by Sector

Residential Sector

Table ES-3 shows the cumulative energy efficiency potential for the residential sector. Achievable potential in the first year, 2025, is 27 GWh, or 0.4% of the baseline projection. By 2044, cumulative achievable savings are 386 GWh, or 5.6% of the baseline projection.

Table ES-3 Residential Energy Efficiency Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	6,079	6,181	6,471	6,706	6,874
Cumulative Savings (GWh)					
Achievable Potential	27	91	186	294	386
Economic Potential	54	227	376	494	492
Technical Potential	176	847	1,513	1,934	2,140
Cumulative Savings as a % of Baseline					
Achievable Potential	0.4%	1.5%	2.9%	4.4%	5.6%
Economic Potential	0.9%	3.7%	5.8%	7.4%	7.2%
Technical Potential	2.9%	13.7%	23.4%	28.8%	31.1%

The top measures contributing to cumulative energy savings over the next 20 years are high-efficiency water heaters (less than 55 gallons), connected thermostats, home energy reports, air purifiers, and TVs. Together these measures account for over 65% of total cumulative savings. Efficiency lighting, which has played a big role in the past accounts for minimal savings in the future due to successful programs and the EISA standards.

Commercial Sector

Table ES-4 shows the cumulative energy efficiency potential for the commercial sector. In 2025, the achievable potential is 35 GWh, or 0.9% of the baseline projection. By 2044, savings are 628 GWh, or 15.5% of the baseline projection. The top two measures in the commercial sector are interior LED replacements for High-Bay and Linear Lighting, contributing 60% of the cumulative energy savings by 2044 and 56.3% of the savings during the summer peak.

Table ES-4 Commercial Energy Efficiency Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	3,694	3,695	3,789	3,915	4,066
Cumulative Savings (GWh)					
Achievable Potential	35	197	355	505	628
Economic Potential	56	277	436	580	707
Technical Potential	117	533	842	1,062	1,211
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	5.3%	9.4%	12.9%	15.5%
Economic Potential	1.5%	7.5%	11.5%	14.8%	17.4%
Technical Potential	3.2%	14.4%	22.2%	27.1%	29.8%

Industrial Sector

Table ES-5 presents cumulative energy efficiency potential for the Industrial sector. Achievable savings in the first year, 2025, are 40 GWh, or 0.9% of the baseline projection. In 2044, savings reach 361 GWh, or 6.6% of the baseline projection. Long-term potential is lower than in the previous study, due to the maturation of IPC's industrial programs when compared to similar utilities. The top measures from the perspective of cumulative energy savings over the next 20 years are Linear and High Bay Lighting, followed by Refrigeration System Optimization and Upgrade, Compressed Air Optimization, and Fan System Controls. Together, these measures account for over 60% of the savings potential.

Table ES-5 Industrial Energy Efficiency Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	4,462	4,773	4,976	5,179	5,468
Cumulative Savings (GWh)					
Achievable Potential	40	170	266	322	361
Economic Potential	49	203	312	375	417
Technical Potential	88	329	501	611	701
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	3.6%	5.3%	6.2%	6.6%
Economic Potential	1.1%	4.3%	6.3%	7.2%	7.6%
Technical Potential	2.0%	6.9%	10.1%	11.8%	12.8%

Irrigation Sector Potential Savings

Table ES-6 shows the cumulative energy efficiency potential for the Irrigation sector. Achievable savings in the first year, 2025, are 11 GWh, or 0.6% of the baseline projection. In 2044, savings reach 136 GWh, or 6.1% of the baseline projection. Incorporating updated Regional Technical Forum (RTF) methodologies and draft updates to the Irrigation measures from The Council's 2021 Power Plan reduces savings and potentially cost-effective potential compared to the previous study. Key findings include:

- The top measure is Variable Frequency Drives for motors, which accounts for 37% of cumulative savings by 2044.
- The next highest measures in ranking are Pump Upgrades and Lower Energy Spray Application Center Pivot Systems, contributing 47% of the cumulative energy savings by 2044.

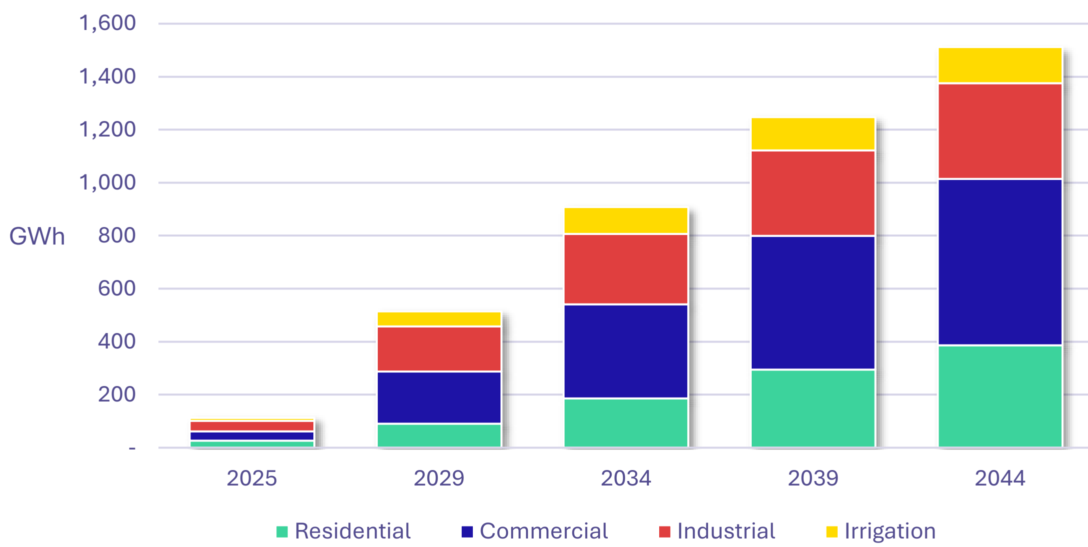
Table ES-6 Irrigation Energy Efficiency Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	1,902	1,967	2,052	2,145	2,244
Cumulative Savings (GWh)					
Achievable Potential	11	57	101	126	136
Economic Potential	13	67	119	148	160
Technical Potential	13	68	121	150	163
Cumulative Savings as a % of Baseline					
Achievable Potential	0.6%	2.9%	4.9%	5.9%	6.1%
Economic Potential	0.7%	3.4%	5.8%	6.9%	7.1%
Technical Potential	0.7%	3.5%	5.9%	7.0%	7.3%

Summary of Achievable Potential by Sector

Figure ES-1 summarizes cumulative achievable potential by sector. The commercial sector contributes the highest savings throughout the forecast horizon, followed by the industrial and residential sectors. Although not illustrated here, the sector contributions to summer peak demand savings follow the same pattern.

Figure ES-1 Achievable Cumulative EE Potential by Sector (Energy, GWh)



Summary of Technical Achievable Potential

While the potential assessment focuses primary on technical, economic, and achievable potential, AEG also estimated potential for a fourth type of potential, referred to as technical achievable potential. Technical achievable applies adoption rates to technical potential as if every measure were cost effective. While this level of potential is not reflective of what IPC may be able to achieve cost-effectively at this time, it does provide useful information for integrated resource planning and comparison to results of the Northwest Power and Conservation Council's 2021 Power Plan. It also provides useful information for measure bundling for program design.

A high-level summary of the technical achievable potential results is presented in Table ES-7. Detail is provided in Appendix A | of this report.

Table ES-7 Summary of Technical and Technical Achievable Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	16,413	21,432	22,720	23,376	24,084
Cumulative Savings (GWh)					
Technical Achievable Potential	302	1,391	2,264	2,863	3,293
Technical Potential	434	1,992	3,191	3,972	4,430
Cumulative Savings as a % of Baseline					
Technical Achievable Potential	1.9%	8.4%	13.1%	16.0%	17.7%
Technical Potential	2.7%	12.0%	18.5%	22.1%	23.8%

Comparison with the Previous Study

Table ES-8 summarizes cumulative achievable potential savings by sector for the current and previous studies. Key findings from this comparison include:

- Residential potential is higher in the first year due to higher savings from building shell measures, but the current study is lower than the previous in the forecast years. The biggest reduction comes from Central ACs, which are no longer cost-effective throughout the forecast.
- Commercial sector continues to contribute the most savings, but they are about 33% lower than the previous study. Lighting potential is lower than the previous study and makes up most of the difference in potential from the previous study. Updates to the measure assumptions reflects increased market adoption of these efficient measures.
- Industrial sector potential is lower than the previous study, due to the continuing maturity and success of IPC's industrial programs. Similar to commercial, lighting potential has decreased to market adoption of efficient linear and high-bay lighting. However, process refrigeration and motor control measures continue to be strong measures for IPC so we anticipate additional potential savings from these measures.
- Irrigation sector potential is higher than the previous study, showing increased potential in variable frequency drives for motors.

Table ES-8 Comparison of Achievable Potential Savings by Sector (Energy, Cumulative GWh)

	Current Study (2024)			Previous Study (2022)		
	2025	2034	2044	2023	2032	2042
Residential	27	186	386	20	202	445
Commercial	35	355	628	39	516	946
Industrial	40	266	361	38	351	543
Irrigation	11	101	136	9	79	109
Total	**112**	**908**	**1,512**	**106**	**1,148**	**2,043**

Report Organization

The details on how the potential estimates were developed and the results by sector are included in more detail through the rest of this report. The body of the report is organized as follows:

1. Introduction
2. Analysis Approach and Data Development
3. Market Characterization and Market Profiles
4. Baseline Projection

5. Energy Efficiency Potential

Table of Contents

List of Tables

List of Figures

1 | Introduction

In 2024, Idaho Power Company (IPC) contracted with Applied Energy Group (AEG) to provide an Energy Efficiency Potential Assessment to support its 2025 Integrated Resource Plan (IRP) process. This study provides reliable estimates of the magnitude, timing, and costs of DSM resources that are likely available to IPC over a 20-year planning horizon. The study focuses on resources assumed achievable during the planning horizon, recognizing that known market dynamics may hinder resource acquisition. Study results will be incorporated into IPC's 2025 IRP and subsequent DSM planning and program development efforts. This study serves as an update to similar studies completed previously for IPC.

AEG used the analysis framework and data developed for the 2022 Potential Assessment as a starting point, implementing targeted data updates and the measures analyzed to address IPC's evolving energy efficiency program requirements and stakeholder feedback. This study incorporates several key updates relative to the 2022 study that include:

- Measure characterization based on changes in measure assumptions used in the Northwest Power and Conservation Council's 2021 Power Plan.
- Recent IPC energy efficiency program experience.
- Results of IPC's 2022 Residential End-Use Survey, a residential saturation survey.
- Expected impacts of future known codes and standards throughout the forecast period.
- Current technology saturations and assumptions about future adoption of energy-efficient options from the Energy Information Administration's 2023 Annual Energy Outlook (AEO).

The study uses the updated data to:

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Abbreviations and Acronyms

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

Table 1-1 Explanation of Abbreviations and Acronyms

Acronym	Explanation
ACS	American Community Survey
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
CAC	Central Air Conditioning
CFL	Compact fluorescent lamp
CHP	Combined heat and power
C&I	Commercial and Industrial
DSM	Demand Side Management
EE	Energy Efficiency
EIA	Energy Information Administration
EUL	Estimated Useful Life
EUI	Energy Usage Intensity
RTF	Regional Technical Forum
HH	Household
HVAC	Heating Ventilation and Air Conditioning
IRP	Integrated Resource Plan
kWh	Kilowatt hour
LED	Light emitting diode lamp
LoadMAP	AEG's Load Management Analysis and Planning™ tool
MW	Megawatt
O&M	Operations and Maintenance
RTF	Regional Technical Forum
RTU	Roof top unit
TRC	Total Resource Cost test
UCT	Utility Cost Test
UEC	Unit Energy Consumption
WH	Water heater

2 | ANALYSIS APPROACH AND DATA DEVELOPMENT

This section describes the analysis approach taken for the study and the data sources used to develop the potential estimates.

Overview of Analysis Approach

To perform the potential analysis, AEG used a bottom-up approach following steps listed below. These analysis steps are defined in more detail throughout the remainder of this chapter.

1. Perform a market characterization to describe sector-level electricity use for the residential, commercial, industrial, and irrigation sectors for the base year, 2023. This included using IPC data and other secondary data sources such as the Energy Information Administration (EIA).
2. Develop a baseline projection of energy consumption and peak demand by sector, segment, and end use for 2023 through 2044.
3. Define and characterize several hundred EE measures to be applied to all sectors, segments, and end uses.
4. Estimate technical, economic, and achievable potential at the measure level in terms of energy and peak demand impacts from EE measures for 2025 through 2044.
5. Develop measure bundles for dynamic optimization within Idaho Power's IRP utilizing technical achievable potential, estimated at the measure level in terms of energy and peak demand impacts from EE measures for 2025 through 2044.

LoadMAP Model

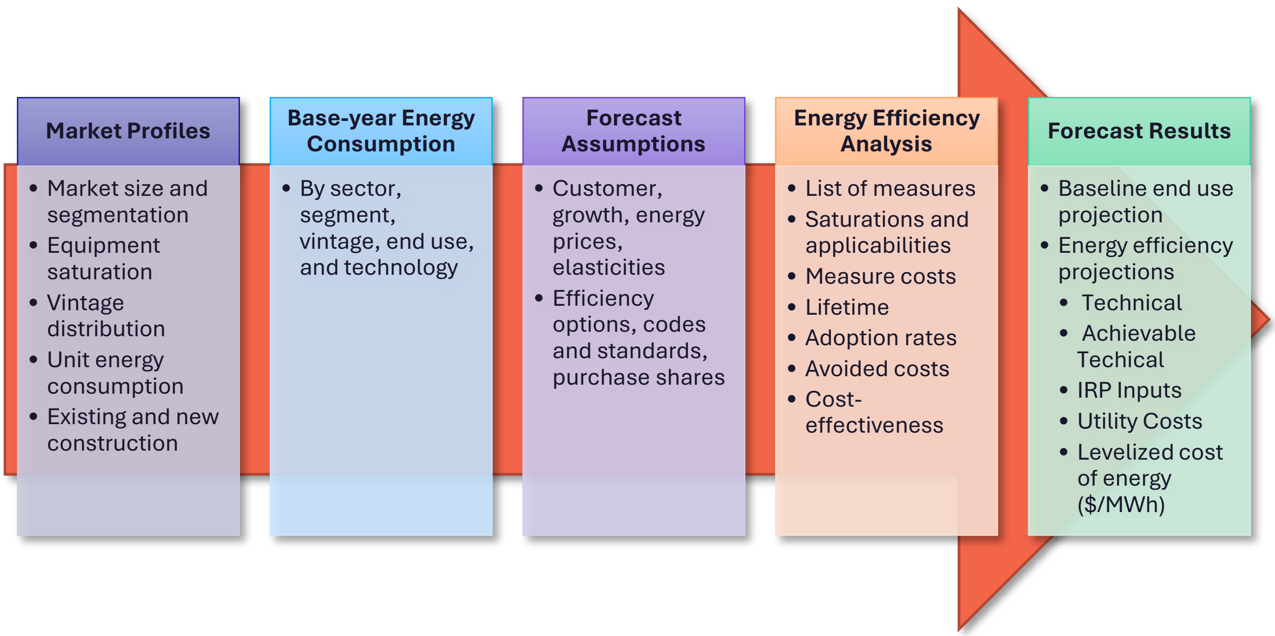
AEG used its Load Management Analysis and Planning tool (LoadMAP™) version 5.0 to develop both the baseline projection and the estimates of potential. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for the Electric Power Research Institute (EPRI) National Potential Study and numerous utility-specific forecasting and potential studies since that time. 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 simplified and more 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.
- 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, rather than complex decision choice algorithms or diffusion assumptions which tend to be difficult to estimate or observe and sometimes produce anomalous results that require calibration or manual adjustment. 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.

- Includes appliance and equipment models customized by end use. For example, the logic for lighting is distinct from refrigerators and freezers.
- Accommodates 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).
- Can incorporate conservation measures, demand-response options, combined heat and power, distributed generation options, and fuel switching.

Consistent with the segmentation scheme and the market profiles described below, the LoadMAP model provides forecasts 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 levels of potential.

Figure 2-1 LoadMAP Analysis Framework



Market Characterization

The first step in the analysis approach is market characterization. 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 being used. This characterization begins with a segmentation of Idaho Power's electricity footprint to quantify energy use by sector, segment, vintage, end-use application, and the current set of technologies used. For this we rely primarily on information provided by Idaho Power and input from secondary sources, as necessary.

Segmentation for Modeling Purposes

The market assessment first defined the market segments (building types, end uses, and other dimensions) that are relevant in the Idaho Power service area. The segmentation scheme for this project is presented in Table 2-1.

Table 2-1 Overview of Idaho Power Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, Commercial, Industrial, Irrigation
2	Segment	**Residential:** single family, multi-family, manufactured home **Commercial:** small office, large office, restaurant, retail, grocery, college, school, hospital, lodging, warehouse, and miscellaneous **Industrial:** Food manufacturing, agriculture, general manufacturing, water and wastewater, electronics, and other industrial **Irrigation:** as a whole
3	Vintage	Existing and new construction
4	End uses	Cooling, heating, lighting, water heating, motors, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp type, air conditioning equipment, motors, etc.
6	Equipment efficiency levels for new purchases	Baseline and higher-efficiency options as appropriate for each technology

With the segmentation scheme defined, a high-level market characterization of electricity sales in the base year is performed to allocate sales to each customer segment. Idaho Power data and secondary sources were used to allocate energy use and customers to the various sectors and segments such that the total customer count, energy consumption, and peak demand matched the Idaho Power system totals from 2023 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, it is number of households. In the commercial sector, it is floor space measured in square feet. For the industrial sector, it is number of employees, and for the irrigation sector, it is number of service points.
- **Saturations** define the fraction of the market size that is served by a particular end-use technology (e.g., homes with electric space heating).
- **UEC (unit energy consumption) or EUI (energy-use index)** describes the amount of energy consumed in 2023 by a specific technology in buildings that have the technology. The UECs are expressed in kWh/household for the residential sector, and EUIs are expressed in kWh/square foot, kWh/employee, or kWh/service point for the commercial, industrial and irrigation sectors, respectively.
- **Annual Energy Intensity** for the residential sector represents the average energy use for the technology across all homes in 2023. It is computed as the product of the saturation and the UEC and is defined as kWh/household for electricity. For the commercial, industrial, and irrigation sectors, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology across all floor space, all employees, or all service points in 2023.
- **Annual Usage** is the annual energy use by an end-use technology in the segment. It is the product of the market size and intensity and is quantified in GWh.

- **Peak Demand** for each technology, summer peak and winter peak are calculated using peak fractions of annual energy use from AEG's load shape library and Idaho Power system peak data. For this study, May through September are considered summer months, while October through April are considered Winter months.

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

Baseline Projection

The next step in the analysis is to develop the baseline projection of annual electricity use and summer peak demand for 2023 through 2044 by customer segment and end use in the absence of new utility programs. The end-use projection includes the relatively certain impacts of codes and standards that will unfold over the study timeframe. All such mandates that were defined as of January 2024 are included in the baseline. The baseline projection is the foundation for the analysis of savings from future EE efforts as well as the metric against which potential savings are measured.

Inputs to the baseline projection include:

- Current economic growth forecasts (i.e., customer growth, income growth)
- Electricity price forecasts
- Trends in fuel shares and equipment saturations
- Existing and approved changes to building codes and equipment standards.
- Idaho Power's internally developed sector-level projections for electricity sales

A baseline projection was developed for summer and winter peak by applying the peak fractions from the energy market profiles to the annual energy forecast in each year.

The baseline projection results are presented for the system as a whole and for each sector in Chapter 4 | .

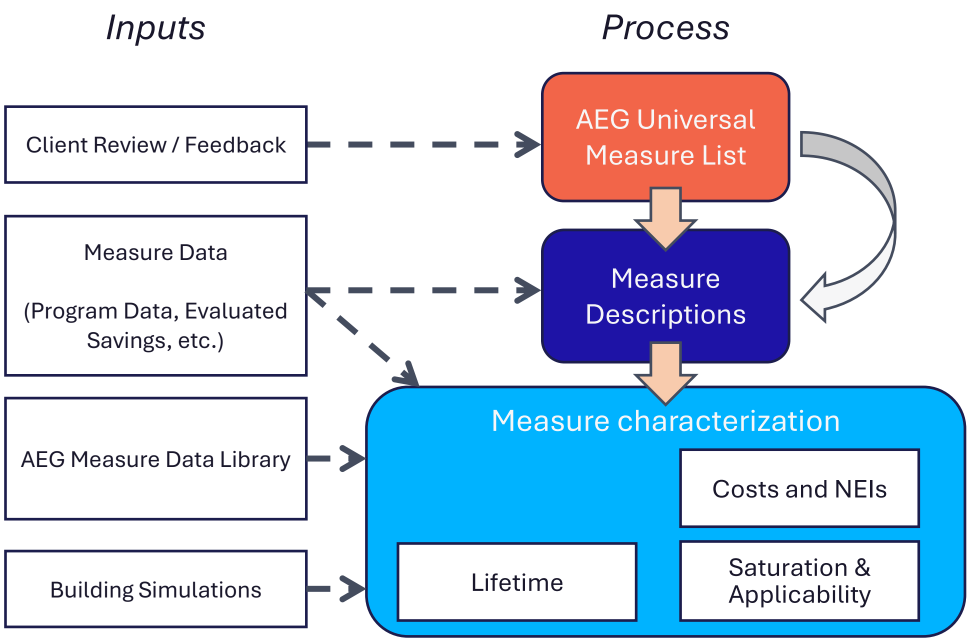
Energy Efficiency Measure Analysis

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. For all measures, AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. This information, along with Idaho Power's avoided costs data, were used in the economic screen to determine economically feasible measures.

Figure 2-2 outlines the framework for energy efficiency measure analysis. The framework for assessing savings, costs, and other attributes of energy efficiency measures involves identifying the list of energy efficiency measures to include in the analysis, determining their applicability to each market sector and segment, fully characterizing each measure, and performing cost-effectiveness screening. Potential measures include the replacement of a unit that has failed or is at the end of its useful life with an efficient unit, retrofit or early replacement of equipment, improvements to the building envelope, the application of controls to optimize energy use, and other actions resulting in improved energy efficiency.

A robust list of energy efficiency measures was compiled for each customer sector, drawing upon Idaho Power's measure database, and the Regional Technical Forum's (RTF) deemed measures databases, as well as a variety of secondary sources, compiled from AEG's work across the country. This universal list of energy efficiency measures covers all major types of end-use equipment, as well as devices and actions to reduce energy consumption. If considered today, some of these measures would not pass the economic screens initially but may pass in future years as a result of lower projected equipment costs or higher avoided costs.

Figure 2-2 Approach for Energy Efficiency Measure Characterization and Assessment



The selected measures are categorized into two types according to the LoadMAP 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. An example is an ENERGY STAR refrigerator that replaces a standard efficiency refrigerator. For equipment measures, many efficiency levels may be available for a given technology, ranging from the baseline unit (often determined by code or standard) up to the most efficient product commercially available. For instance, in the case of central air conditioners, this list begins with the current federal standard SEER 14 unit and spans a broad spectrum up to a maximum efficiency of a SEER 24 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). An example would be a programmable thermostat that is pre-set to run heating and cooling systems only when people are home. Non-equipment measures can apply to more than one end use. For instance, addition of wall insulation will affect the energy use of both space heating and cooling. Non-equipment measures typically fall into one of the following categories:
  - Building shell (windows, insulation, roofing material)
  - Equipment controls (thermostat, energy management system)
  - Equipment maintenance (cleaning filters, changing set points)
  - Whole-building design (building orientation, passive solar lighting)
  - Lighting retrofits (included as a non-equipment measure because retrofits are performed prior to the equipment's normal end of life)

- Displacement measures (ceiling fan to reduce use of central air conditioners)
- Commissioning and retro commissioning (initial or ongoing monitoring of building energy systems to optimize energy use)
- Behavioral Programs (home energy reports)

AEG developed a preliminary list of EE measures, which was distributed to the Idaho Power project team for review. The list was finalized after incorporating comments.

Once the list of EE measures was assembled, the project team assessed their energy-saving characteristics. For each measure, AEG also characterized incremental cost, service life, and other performance factors, drawing upon data from the Idaho Power measure database, the RTF deemed measure workbooks, and simulation modeling. Following the measure characterization, AEG performed an economic screening of each measure, which serves as the basis for developing the economic and achievable potential.

Screening Energy Efficiency Measures for Cost-Effectiveness

Only measures that are cost-effective are included in economic and achievable potential. Therefore, for each individual measure, LoadMAP performs an economic screen. This study uses the utility cost test (UCT) that compares the lifetime energy and peak demand benefits of each applicable measure with its cost from the utility perspective. The lifetime benefits are calculated by multiplying the annual energy and demand savings for each measure by all appropriate avoided costs for each year and discounting the dollar savings to the present value equivalent. Lifetime costs represent annual Operation and Maintenance (O&M) costs and program administrator costs. 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 projection.

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.
- The economic screening was conducted only for measures that are applicable to each building type and vintage; thus, if a measure is deemed to be irrelevant to a particular building type and vintage, it is excluded from the respective economic screen.
- If multiple equipment measures have Benefit/Cost (B/C) ratios greater than or equal to 1.0, the most efficient technology is selected by the economic screen.

Table 2-2 Measures Evaluated for Each Segment Within Each Sector

Sector	Total Measures	Measure Permutations w/ 2 Vintages	Measure Permutations w/ Segments
Residential	105	210	630
Commercial	131	262	2,882
Industrial	97	194	2,910
Irrigation	38	76	76
Total Measures Evaluated	**371**	**742**	**6,498**

Calculating Energy Efficiency Potential

This study developed into four types of potential: technical potential, economic potential, and achievable potential. Technical achievable potential was also estimated to develop measure bundles for IPC's IRP modeling.

- **Technical Potential** – The calculation of technical potential is a straightforward algorithm, aggregating the full, energy-saving effects of all the individual DSM measures included in the study at their maximum theoretical deployment levels, adjusting only for technical applicability.
  While all discretionary resources could theoretically be acquired in the study's first year, this would skew the potential for equipment measures and provide an inaccurate picture of measure-level potential. Therefore, the study assumes the realization of these opportunities over the 20-year planning horizon according to the shape of corresponding ramp rates adapted from the Northwest Power and Conservation Council's 2021 Power Plan, applied to 100% of applicable market units. By applying this assumption, natural equipment turnover rates, and other adjustments described above, the annual incremental and cumulative potential was estimated by sector, segment, construction vintage, end use, and measure. This allows the technical potential to be more closely compared with the technical achievable potential as defined below since a similar "phased-in" approach is used for both.
- **Economic Potential** – Economic potential constrains technical potential to EE measures that are cost-effective based upon the UCT. The LoadMAP model calculates the tests for each year in the forecast horizon. Thus, the model allows for a measure that does not pass in the early years of the forecast but passes in later years to be included in the analysis. LoadMAP applies measures one-by-one, stacking their effects successively and interactively in descending order of their B/C ratios, thereby avoiding double counting of savings.
- **Achievable Potential** – To develop estimates for achievable potential, we constrain the economic potential by applying market adoption rates for each measure that estimate the percentage of customers who would be likely to select each measure, given consumer preferences (partially a function of incentive levels), retail energy rates, imperfect information, and real market barriers and conditions. These barriers tend to vary, depending on the customer sector, local energy market conditions, and other, hard-to-quantify factors. In addition to utility-sponsored programs, alternative acquisition methods, such as improved codes and standards and market transformation, can be used to capture portions of these resources, and are included within the achievable potential, per The Council's 2021 Power Plan methodology. This proves particularly relevant in the context of long-term DSM resource acquisition plans, where incentives might be necessary in earlier years to motivate acceptance and installations. As acceptance increases, so would demand for energy efficient products and services, likely leading to lower costs, and thereby obviating the need for incentives and (ultimately) preparing for transitions to codes and standards.
- **Technical Achievable Potential** –Technical Achievable Potential represents the potential savings if every measure were cost effective. This is useful in developing measure bundles for IPC's IRP modeling. It is calculated by applying market adoption rates to technical potential estimates.

Market adoption rates are based on ramp rates from The Council's Seventh Power Plan. As discussed below, two types of ramp rates (lost opportunity and retrofit) have been incorporated for all measures and market regions.

Measure Ramp Rates

The study applied measure ramp rates to determine the annual availability of the identified potential for lost opportunity and discretionary resources, interpreting and applying these rates differently for each class (as described below). Measure ramp rates generally matched those used in The Council's Seventh Power Plan, although the study incorporated additional considerations for DSM measure acquisition:

Lost Opportunity Resources

Lost opportunity energy efficiency measures correspond to equipment measures, which follow a natural equipment turnover cycle, as well as non-equipment measures in new construction instances that are fundamentally different and typically easier to implement during the construction process as opposed to after construction has been completed. For general measures, annual turnover is modeled as equipment stock divided by a measure's effective useful life (EUL). When information on existing equipment vintage was available, particularly due to IPC's 2022 End-Use survey, turnover is instead customized to the actual vintage distribution and varies by study year as units reach their EUL. In the Council's Seventh Power Plan, lighting fixture control measures are also modeled as lost opportunity measures, assumed that these advanced controls must be installed alongside new linear LED panels.

In addition to natural timing constraints imposed by equipment turnover and new construction rates, the AEG team applied measure ramp rates to reflect other resource acquisition limitations over the study horizon, such as market availability. These measure ramp rates had a maximum value of 85%, reflecting The Council's assumption that, on average, up to 85% of technical potential could be achieved by the end of a 20-year planning horizon. Measures on The Council's Seventh Power Plan's emerging technology ramp rate are constrained to 65% of economic potential.

To calculate the annual achievable potential for each lost-opportunity measure, the study multiplied the number of units turning over or available in any given year by the adoption factor provided by the ramp rate, consistent with The Council's methodology. Because of the interactions between equipment turnover and new construction, the lost opportunities of measure availability until the next life cycle, and the time frame limits at 20 years, The Council methodology for these measures produces potential less than 85% of economic potential.

Retrofit (Discretionary) Resources

Retrofit resources differ from lost opportunity resources due to their acquisition availability at any point within the study horizon. From a theoretical perspective, all achievable potential for discretionary resources could be acquired in the study's first year, but from a practical perspective, this outcome is realistically impossible to achieve due to infrastructure and cost constraints as well as customer preferences and considerations.

As a result, the study addresses the achievable potential for retrofit opportunities by spacing the acquisition according to the ramp rates specified for a given measure, thus creating annual, incremental values. To assess achievable potential, we then apply the 85% market achievability limit defined by The Council. Consistent with lost opportunity, discretionary measures on The Council's Seventh Power Plan's emerging technology ramp rate are constrained to 65% of economic potential. Since the opportunity is not limited by equipment turnover, achievable potential for these measures reaches 85% of the economic potential by the end of the 20-year period.

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:

- Idaho Power data
- Energy efficiency measure data
- AEG's databases and analysis tools
- Other secondary data and reports

Idaho Power Data

The highest priority data sources for this study were those that were specific to Idaho Power.

- Idaho Power customer data: Idaho Power provided billing data for development of customer counts and energy use for each sector. AEG used the results of the Idaho Power 2022 Residential End-Use Survey, a residential saturation survey. The lighting results from the 2019 survey were also supplemented with 2022 Residential End-Use Survey results.
- Load forecasts: Idaho Power provided an economic growth forecast by sector; electric load forecast; peak-demand forecasts at the sector level; and retail electricity price history and forecasts.
- Economic information: Idaho Power provided avoided cost forecasts, a discount rate, and line loss factor.
- Idaho Power program data: Idaho Power provided the C&I Technical Reference Manual and information about past and current programs, including program descriptions, goals, and achievements to date.

Northwest Region Data

Several sources of data were used to characterize the conservation measures. We used the following regional data sources and supplemented them with AEG's data sources to fill in any gaps.

- Regional Technical Forum (RTF) Unit Energy Savings Measure Workbooks: The RTF maintains workbooks that characterize selected measures and provide data on unit energy savings (UES), measure cost, measure life, and non-energy benefits. These workbooks provide Pacific Northwest-specific measure assumptions, drawing upon primary research, energy modeling (using the RTF's Simple Energy Enthalpy Model (SEEM), regional third-party research, and well-vetted national data. Workbooks are available at https://rtf.nwcouncil.org/measures
- RTF Standard Protocols: The RTF also maintains standard workbooks containing useful information for characterizing more complex measures for which UES values have not been developed, such as commercial sector lighting. https://rtf.nwcouncil.org/standard-protocols
- Northwest Power and Conservation Council's 2021 Power Plan Conservation Supply Curve Workbooks, 2020. To develop its Power Plan, The Council created workbooks with detailed information about measures, available at https://www.nwcouncil.org/2021-power-plan-technical-information-and-data
- Northwest Energy Efficiency Alliance Data. The NEEA conducts research for the Northwest region. The following studies were particularly useful:

- RBSA II, Single-Family Homes Report 2016-2017.
- RBSA II, Manufactured Homes Report 2016-2017.
- RBSA II, Multifamily Buildings Report 2016-2017.
- 2019 Commercial Building Stock Assessment (CBSA), May 21, 2020.
- 2014 Industrial Facilities Site Assessment (IFSA), December 29, 2014.

AEG Data

AEG maintains several databases and modeling tools that are used 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 EnergyShape™:** This database of load shapes includes the following:
  - Residential – electric load shapes for ten regions, three housing types, 13 end uses
  - Commercial – electric load shapes for nine regions, 54 building types, ten end uses
  - Industrial – electric load shapes, whole facility only, 19 2-digit SIC codes, as well as various 3-digit and 4-digit SIC codes
- **AEG's Database of Energy Efficiency Measures (DEEM):** AEG maintains an extensive database of measure data for our studies. The 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 energy efficiency potential in the last five years. We checked our input assumptions and analysis results against the results from these other studies, which include but are not limited to Tacoma Power, Idaho Power, Avista Energy, and PacifiCorp.

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, data from the 2021 AEO was used.
- **Local Weather Data:** Weather from NOAA's National Climatic Data Center for Boise, Idaho was used as the basis for building simulations.
- **EPRI End-Use Models (REEPS and COMMEND).** These models provide the elasticities applied to electricity prices, household income, home size and heating and cooling.
- **Database for Energy Efficient Resources (DEER).** The California Energy Commission and California Public Utilities Commission (CPUC) sponsor this database, which is designed to provide well-documented estimates of energy and peak demand savings values, measure

costs, and effective useful life (EUL) for the state of California. AEG used the DEER database to cross check the measure savings developed using BEST and DEEM.

- **Other relevant regional sources:** These include reports from the Consortium for Energy Efficiency, the Environmental Protection Agency (EPA), and the American Council for an Energy Efficient Economy.

Application of Data to the Analysis

This section describes how each of the data sources described above were used for each step of the study.

Data Application for Market Characterization

To construct the high-level market characterization of electricity, use and households/floor space/service point for the residential, commercial, industrial, and irrigation sectors, AEG used Idaho Power billing data and customer surveys to estimate energy use.

- For the residential sector, Idaho Power estimated the numbers of customers and the average energy use per customer for each of the three segments, based on its 2022 Home Energy Survey, matched to billing data for surveyed customers. Growth in technology saturations since 2022 is based on the growth from EIA's Annual Energy Outlook (AEO). AEG compared the resulting segmentation with data from the American Community Survey (ACS) regarding housing types and income and found that the Idaho Power segmentation corresponded well with the ACS data; See Chapter 3 | for additional details.
- To segment the commercial and industrial segments, AEG relied upon the allocation from the previous energy efficiency potential study. For the previous study, customers and sales were allocated to building type based on Standard Industrial Classification (SIC) codes, with some adjustments between the commercial and industrial sectors to better group energy use by facility type and predominate end uses. For this study, the SIC codes were mapped differently, in order to line up customers with the same segmentation used for the Idaho Power load forecasting department; see Chapter 3 | for additional details.
- For the irrigation sector, AEG treated the market as a single segment.

Data Application for Market Profiles

The specific data elements for the market profiles, together with key data sources, are shown in Table 2-3. To develop the market profiles for each segment, AEG used the following approach:

1. Developed control totals for each segment. These include market size, segment-level annual electricity use, and annual intensity.
2. Used the Idaho Power 2022 Residential End-Use Survey, Idaho Power 2019 Lighting Study, NEEA's RBSA, NEEA's CBSA, and AEG's Energy Market Profiles database to develop existing appliance saturations, appliance, and equipment characteristics, and building characteristics.
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 Idaho Power staff to vet the data against their knowledge and experience.

Table 2-3 Data Applied for the Market Profiles

Model Inputs	Description	Key Sources
Market size	Base-year residential dwellings and commercial floor space, industrial employment	Idaho Power Billing Data Idaho Power 2022 Home Energy Survey NEEA RBSA and CBSA AEO 2023
Annual intensity	Residential: Annual use per household Commercial: Annual use per square foot Industrial: Annual use per employee Irrigation: Annual use per service point	Idaho Power billing data AEG's Energy Market Profiles NEEA RBSA and CBSA AEO 2023 Other Recent Studies
Appliance/equipment saturations	Fraction of dwellings with an appliance/technology Percentage of commercial floor space/employment with technology	Idaho Power 2022 Home Energy Survey Idaho Power Lighting Study NEEA RBSA and CBSA AEG's Energy Market Profiles Idaho Power Load Forecasting
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	NWPCC 2021 Plan and RTF data HVAC uses: BEST simulations using prototypes developed for Idaho Engineering Analysis AEG's DEEM Recent AEG studies AEO 2023
Appliance/equipment age distribution	Age distribution for each technology	NWPCC 2021 Plan and RTF Data NEEA RBSA and CBSA Idaho Power 2022 Home Energy Survey AEG's DEEM Recent AEG Studies
Efficiency options for each technology	List of available efficiency options and annual energy use for each technology	AEG's DEEM AEO 2023 DEER NWPCC Workbooks, RTF Recent AEG Studies
Peak factors	Share of technology energy use that occurs during the system peak hour	RTF's Generalized Load Shape (GLS) Database AEG's EnergyShape Database Idaho Power historical load data

Data Application for Baseline Projection

Table 2-4 summarizes the LoadMAP model inputs required for the baseline projection. These inputs are required for each segment within each sector, as well as for new construction and existing dwellings/buildings.

Table 2-4 Data Needs for the Baseline Projection and Potentials Estimation in LoadMAP

Model Inputs	Description	Key Sources
Customer growth forecasts	Forecasts of new construction in residential, commercial and industrial sectors	Idaho Power Load Forecast AEO 2021 Economic Growth Forecast
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 AEO 2023 Regional Forecast Assumptions Appliance/Efficiency Standards Analysis Idaho Power Program Results and Evaluation Reports
Electricity prices	Forecast of average energy and capacity avoided costs and retail prices	Idaho Power Forecast
Utilization model parameters	Price elasticities, elasticities for other variables (income, weather)	EPRI's REEPS and COMMEND Models AEO 2023

In addition, AEG implemented assumptions for known future equipment standards as of January 2024, as shown in Table 2-5, and Table 2-6.

Table 2-5 Residential Electric Equipment Standards

End Use	Technology	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Cooling	Central AC	SEER 13.0	SEER 14.0								
	Room AC	CEER 10.9				CEER 16.0					
Cool/Heating	Heat Pumps	SEER 14.0 / HSPF 7.7	SEER 15.0 / HSPF 8.8 | SEER2 14.3 / HSPF2 7.5								
Water Heating	Water Heater ≤55Gal	UEF 0.92								CCE 2.0 (NEEA Tier 1)	
	Water Heater >55Gal	CCE 2.0 (NEEA Tier 1)									
Lighting	General Service	EISA Tier 1 (18.6 lm/W)		EISA Tier 2 (45.0 lm/W)							
	Linear Fluorescent	T8-F32 (80.0 lm/W system)									
Appliances	Refrigerator/Freezer	2014 Standard								2029 Standard	
	Clothes Washer	IMEF 1.71 / IWF 5.6									
	Clothes Dryer	UCEF 2.29									
	Microwave	2016 Standard				2026 Standard					
	Stove/Oven	Typical							2028 Standard		
	Air Purifier	1.5 CADR/W		1.9 CADR/W		2.4 CADR/W					
	Dehumidifier	2016 Standard									
Miscellaneous	Furnace Fans	ECM									

Table 2-6 Commercial and Industrial Electric Equipment Standards

End Use	Technology	2022	2023	2024	2025	2026	2027
Cooling	Air-Cooled Chiller	COP 4.10 (IPLV 14.0)					
	Water-Cooled Chiller	COP 7.03 (0.5 kW/ton)					
	RTUs	IEER 12.9	IEER 14.8				
	PTAC	EER 10.4					
Cool/Heating	Heat Pump	IEER 12.8 / COP 3.3	IEER 14.1 / COP 3.4				
	PTHP	EER 10.4/COP 3.1					
Ventilation	All	Constant Air Volume/Variable Air Volume					
Lighting	General Service	EISA Compliant (19.8 lm/W)		EISA Compliant (45.0 lm/W)			
	Linear Lighting	T8 - F32 (82.5 lm/W system)					
	High Bay	High-Intensity Discharge (56.0 lm/W)					
Refrigeration	Walk-In	2020 Standard					
	Reach-In / Glass Door/ Open Display	2017 Standard					
	Vending Machine	2019 Standard					
Food Service	Pre-Rinse Spray Valve	1.0 GPM					
Motors	All	NEMA Premium					

Energy Efficiency Measure Data Application

Table 2-7 details the energy efficiency data inputs to the LoadMAP model. It describes each input and identifies the key sources used in the Idaho Power analysis.

Table 2-7 Data Needs for the Measure Characteristics in LoadMAP

Model Input	Description	Key Source
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.	Idaho Power Measure Data BEST AEG's DEEM AEO 2023 DEER NWPCC Workbooks, RTF 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.	Idaho Power Measure Data NWPCC Seventh Plan Conservation Workbooks BEST AEG's DEEM AEG EnergyShape
Costs	Equipment Measures: Includes the full cost of purchasing and installing the equipment on a per-unit basis. 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.	Idaho Power Measure Data NWPCC 2021 Plan Conservation Workbooks RTF Deemed Measure Database AEG's DEEM AEO 2023 RS Means Other Secondary Sources
Measure Lifetimes	Estimates derived from the technical data and secondary data sources that support the measure demand and energy savings analysis.	Idaho Power Measure Data NWPCC 2021 Plan Conservation Workbooks RTF Deemed Measure Database AEG's DEEM DEER AEO 2021 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.	Idaho Power Measure Data NWPCC 2021 Plan Conservation Workbooks RTF Deemed Measure Database AEG's DEEM DEER Other Secondary Sources
On / Off Market Availability	Identifies when the equipment technology is available or no longer available in the market.	AEG Appliance Standards and Building Codes Analysis

3 | MARKET CHARACTERIZATION AND MARKET PROFILES

This section describes how customers use electricity in the Idaho Power service area in the base year of the study, 2023. It begins with a high-level summary of energy use across all sectors and then delves into each sector in more detail.

Energy Use Summary

Total electricity use for the residential, commercial, industrial and irrigation sectors for Idaho Power in 2023 was 15,745 GWh.

As shown in Figure 3-1 and Table 3-1, the residential sector accounts for more than one-third (38%) of annual energy use, followed by industrial with 27%, commercial with 23%, and irrigation with 12%. In terms of summer peak demand, the total system peak in 2023 was 3,467 MW. The residential sector contributes the most to peak with 46%. This is due to the saturation of air conditioning equipment. The winter peak in 2023 was 2,248 MW, with the residential sector contributing half of the impact (50%) at peak.

Figure 3-1 Sector-Level Electricity Use, 2023

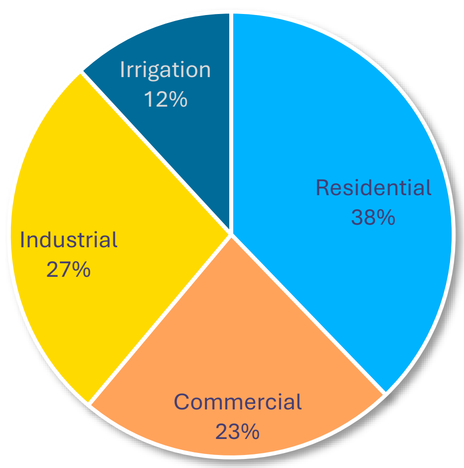


Table 3-1 Idaho Power Sector Control Totals, 2023

Sector	Annual Electricity Use (GWh)	% of Annual Use	Summer Peak Demand (MW)	% of Summer Peak	Winter Peak Demand (MW)	% of Winter Peak
Residential	5,948	43%	1,583	46%	1,113	50%
Commercial	3,674	26%	699	20%	666	30%
Industrial	4,255	31%	551	16%	464	21%
Irrigation	1,868	13%	634	18%	5	0.2%
Total	**13,878**	**100%**	**3,467**	**100%**	**2,248**	**100%**

Residential Sector

The total number of households and electricity sales for the service area were obtained from Idaho Power's customer database. In 2023, there were 525,110 households in the Idaho Power service area that used a total of 5,948 GWh with summer peak demand of 1,583 MW. Average use per customer (or household) at 11,328 kWh is about average compared to other regions of the country. AEG allocated these totals into three residential segments and the values are shown in Table 3-2. This table shows that Mobile homes have the highest use per customer at 14,566 kWh/year, which reflects a higher saturation of electric space heating and less efficient building shell.

Table 3-2 Residential Sector Control Totals, 2023

Segment	Number of Customers	Electricity Use (GWh)	% of Annual Use	Annual Use/Customer (kWh/HH)	Summer Peak (MW)	Winter Peak (MW)
Single Family	408,905	4,770	80%	11,665	1,374	881
Multifamily	80,309	656	11%	8,164	118	123
Manufactured Home	35,896	523	9%	14,566	91	109
Total	**525,110**	**5,948**	**100%**	**11,328**	**1,583**	**1,113**

Residential Sector Energy Market Profile

As described 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 3-3. Segment-specific market profiles are presented in Appendix B | .

Table 3-3 Average Market Profile for the Residential Sector, 2023

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)	Summer Peak (MW)
Cooling	Central AC	68.3%	2,052	1,402	736	824
	Room AC	9.5%	474	45	24	2
	Air-Source Heat Pump	6.7%	1,955	131	69	77
	Geothermal Heat Pump	0.2%	1,984	5	2	3
	Ductless Mini Split Heat Pump	2.1%	500	10	5	6
	Evaporative Cooler	0.8%	562	4	2	3
Space Heating	Electric Room Heat	9.1%	1,836	168	88	-
	Electric Furnace	14.3%	11,534	1,653	868	-
	Air-Source Heat Pump	6.7%	8,225	550	289	-
	Geothermal Heat Pump	0.2%	8,772	20	11	-
	Ductless Mini Split Heat Pump	2.1%	1,450	30	16	-
	Secondary Heating	19.5%	407	79	42	-
Water Heating	Water Heater (<= 55 Gal)	40.0%	2,601	1,041	547	88
	Water Heater (> 55 Gal)	4.4%	2,417	107	56	9
Interior Lighting	General Service Lighting	100.0%	937	937	492	37
	Linear Lighting	100.0%	65	65	34	3
	Exempted Lighting	100.0%	6	6	3	0

End Use	Technology	Saturation	UEC (kWh)	Intensity (kWh/HH)	Usage (GWh)	Summer Peak (MW)
Exterior Lighting	General Service Lighting	100.0%	260	260	137	10
Appliances	Clothes Washer	96.4%	45	44	23	3
	Clothes Dryer	97.9%	752	735	386	34
	Dishwasher	92.3%	81	75	39	4
	Refrigerator	100.0%	525	525	276	21
	Freezer	56.2%	465	261	137	15
	Second Refrigerator	35.5%	699	249	131	327
	Stove/Oven	75.2%	160	120	63	8
	Microwave	103.1%	112	115	60	8
	Air Purifier	11.4%	349	40	21	2
Electronics	Personal Computers	72.2%	119	86	45	3
	Monitor	178.6%	54	96	51	4
	Laptops	141.3%	30	43	22	2
	TVs	224.4%	76	170	89	6
	Printer/Fax/Copier	72.2%	38	28	15	1
	Set-top Boxes/DVRs	226.9%	87	197	104	7
	Devices and Gadgets	100.0%	400	400	210	15
Miscellaneous	Electric Vehicle Supply Equipment	2.8%	2,538	72	38	3
	Pool Pump	2.0%	3,508	70	37	3
	Pool Heater	0.5%	3,517	18	9	1
	Furnace Fan	75.3%	328	247	130	9
	Well pump	9.0%	557	50	26	2
	Miscellaneous	100.0%	1,173	1,173	616	44
Total	**Total**			**11,328**	**5,948**	**1,583**

Figure 3-2 shows the distribution of annual electricity use by end use for all customers. Two main electricity end uses —appliances and space heating— account for 41% of total electricity use. Appliances include refrigerators, freezers, stoves, clothes washers, clothes dryers, dishwashers, and microwaves. The remainder of the energy falls into the water heating, lighting, cooling, 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 3-3 such as hair dryers, power tools, coffee makers, etc.).

Figure 3-2 also shows estimates of summer peak demand by end use. As expected, cooling is the largest contributor to summer peak demand, followed by appliances. Lighting has low coincidence and makes a small contribution at the time of the system peak.

Figure 3-3 presents the electricity intensities by end use and housing type.

Figure 3-2 Residential Electricity Use and Summer Peak Demand by End Use, 2023

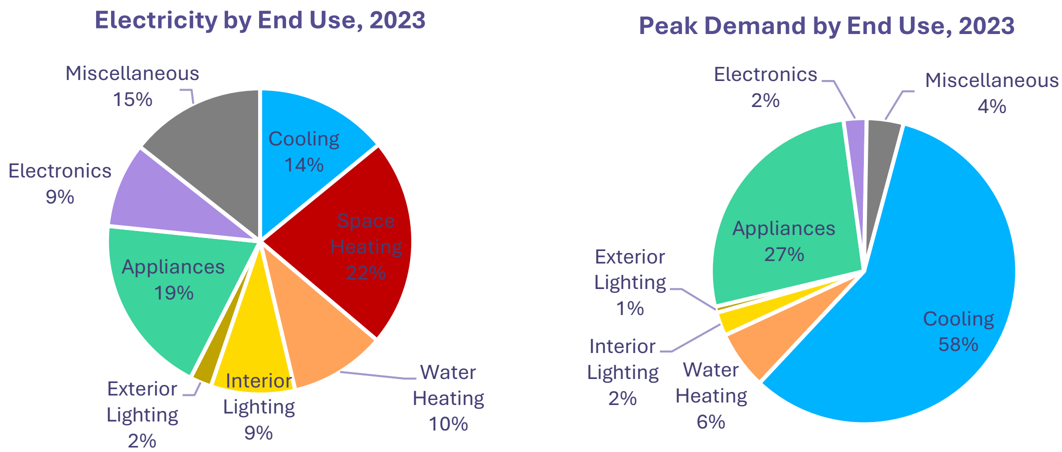
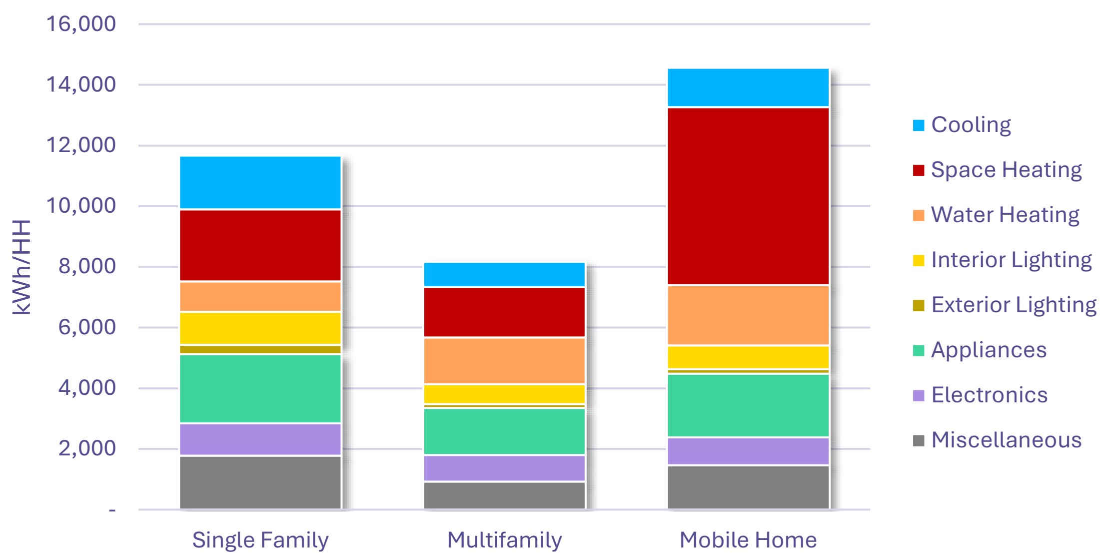


Figure 3-3 Residential Intensity by End Use and Segment (kWh/HH), 2023



Commercial Sector

The total electric energy consumed by commercial customers in Idaho Power's service area in 2023 was 3,674 GWh. As described in Chapter 2 | , Idaho Power billing data, CBSA and secondary data were used to allocate this energy usage to building type segments and to develop estimates of energy intensity (annual kWh/square foot). Using the electricity use and intensity estimates, floor space is inferred which is the unit of analysis in LoadMAP for the commercial sector. In addition, each segment's contribution to the summer and winter peak demand is estimated so that the weighted average aligns with the commercial sector contribution to the system peaks. The values are shown in Table 3-4.

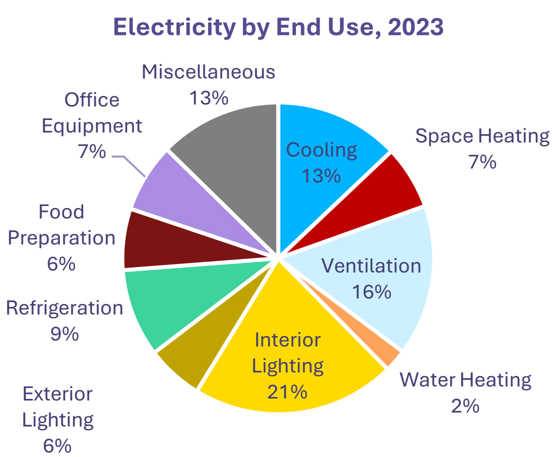
Table 3-4 Commercial Sector Control Totals, 2023

Segment	Electricity Sales (GWh)	% of Total Usage	Intensity (Annual kWh/SqFt)	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Small Office	609	16.6%	12.3	123	134
Large Office	232	6.3%	14.7	29	40
Restaurant	265	7.2%	43.0	49	33
Retail	434	11.8%	12.9	94	53
Grocery	237	6.5%	40.1	23	45
College	139	3.8%	12.8	21	23
School	264	7.2%	9.2	92	78
Hospital	321	8.7%	24.2	35	64
Lodging	178	4.9%	14.1	18	54
Warehouse	377	10.3%	3.8	74	56
Miscellaneous	618	16.8%	9.5	140	87
Total	**3,674**	**100.0%**	**10.8**	**699**	**666**

Commercial Sector Energy Market Profile

Figure 3-4 shows the distribution of annual electricity consumption and summer peak demand by end use across all commercial buildings. Electric usage is dominated by lighting, cooling and ventilation, which comprise 56% of annual electricity usage. Summer peak demand is dominated by cooling.

Figure 3-4 Commercial Sector Electricity Consumption and Summer Peak Demand by End Use, 2023



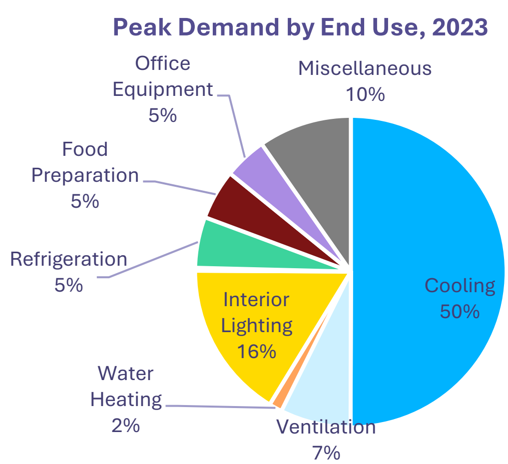


Figure 3-5 presents the electricity usage in annual GWh per square foot by end use and segment. Small offices, retail, and miscellaneous buildings use the most electricity in the service area whereas grocery and restaurants use the most electricity on a square footage basis. As far as end uses, cooling and lighting are the major end uses across all segments.

Figure 3-5 Commercial Electricity Intensity by End Use and Segment (kWh/sq.ft.), 2023

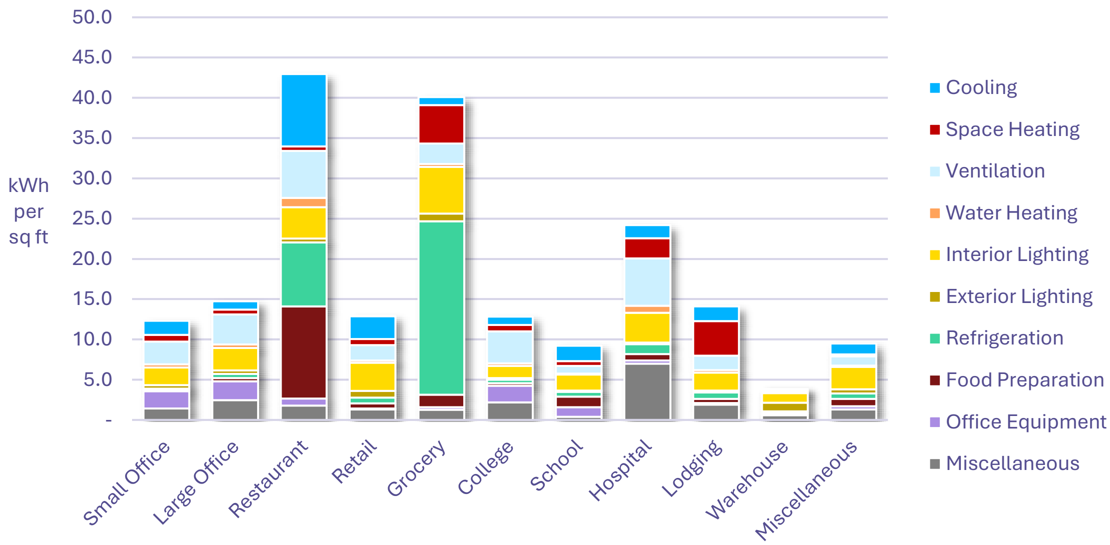


Table 3-5 shows the average market profile for electricity for the commercial sector, across all building types. Market profiles for each segment are presented in Appendix B | .

Table 3-5 Average Electric Market Profile for the Commercial Sector, 2023

End Use	Technology	Saturation	UEC (kWh/ SqFt)	Intensity (kWh/ SqFt)	Usage (GWh)	Summer Peak Demand (MW)
Cooling	Air-Cooled Chiller	5.6%	3.19	0.18	60	60
	Water-Cooled Chiller	4.1%	1.67	0.07	23	9
	RTU	38.9%	2.08	0.81	276	197
	Packaged Terminal AC	3.6%	2.04	0.07	25	16
	Packaged Terminal HP	2.5%	1.65	0.04	14	12
	Air-Source Heat Pump	8.2%	2.12	0.17	59	44
	Geothermal Heat Pump	3.5%	1.49	0.05	18	12
Space Heating	Electric Furnace	2.4%	6.53	0.16	53	0
	Electric Room Heat	10.5%	2.70	0.28	96	0
	Packaged Terminal HP	2.5%	1.81	0.05	16	-
	Air-Source Heat Pump	8.2%	1.65	0.14	46	0
	Geothermal Heat Pump	3.5%	2.67	0.09	32	0
Ventilation	Ventilation	100.0%	1.70	1.70	577	51
Water Heating	Water Heater	29.6%	0.86	0.26	87	10
Interior Lighting	General Service Lighting	100.0%	0.34	0.34	116	16
	Exempted Lighting	100.0%	0.10	0.10	35	5
	High-Bay Lighting	100.0%	0.29	0.29	99	15
	Linear Lighting	100.0%	1.55	1.55	527	79
Exterior Lighting	General Service Lighting	100.0%	0.26	0.26	88	1
	Area Lighting	100.0%	0.04	0.04	12	0

End Use	Technology	Saturation	UEC (kWh/ SqFt)	Intensity (kWh/ SqFt)	Usage (GWh)	Summer Peak Demand (MW)
	Linear Lighting	100.0%	0.34	0.34	117	1
Refrigeration	Walk-in Refrig/Freezer	12.8%	0.49	0.06	21	2
	Reach-in Refrig/Freezer	14.6%	0.65	0.10	32	4
	Glass Door Display	28.8%	0.56	0.16	55	6
	Open Display Case	28.8%	1.23	0.35	120	13
	Icemaker	30.7%	0.73	0.23	77	8
	Vending Machine	30.7%	0.30	0.09	31	3
Food Preparation	Oven	19.4%	0.67	0.13	44	7
	Fryer	22.1%	1.30	0.29	98	14
	Dishwasher	9.8%	0.99	0.10	33	5
	Hot Food Container	11.6%	0.37	0.04	14	2
	Steamer	9.4%	1.40	0.13	45	8
Office Equipment	Desktop Computer	100.0%	0.30	0.30	102	12
	Laptop	99.4%	0.09	0.09	32	4
	Server	87.6%	0.31	0.27	92	11
	Monitor	100.0%	0.05	0.05	18	2
	Imaging Equipment	100.0%	0.03	0.03	11	1
	POS Terminal	59.0%	0.04	0.02	8	1
Miscellaneous	Non-HVAC Motors	51.0%	0.67	0.34	116	18
	Pool Pump	7.0%	0.26	0.02	6	1
	Pool Heater	2.4%	0.31	0.01	3	0
	Clothes Washer	10.3%	0.10	0.01	4	1
	Clothes Dryer	6.8%	0.32	0.02	7	1
	Miscellaneous	100.0%	0.97	0.97	330	47
Total				**10.82**	**3,674**	**699**

Industrial Sector

The total electricity used in 2023 by Idaho Power's industrial customers was 4,255 GWh, while summer peak demand was 551 MW and winter peak demand was 464 MW. As described in Chapter 2 | , Idaho Power billing data, load forecast and secondary sources were used to allocate usage to industrial segments and to develop estimates of energy intensity (annual kWh/employee). Using the electricity use and intensity estimates, the number of employees is inferred, which is the unit of analysis in LoadMAP for the industrial sector. These are shown in Table 3-6.

Table 3-6 Industrial Sector Control Totals, 2023

Segment	Electricity Sales (GWh)	% of Total Usage	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Base Manufacturing	243	5.7%	41	25
Construction	243	5.7%	20	26
Dairy	562	13.2%	67	63
Electronics	777	18.3%	131	81
Food Base	630	14.8%	73	71
Food Packaging	513	12.1%	56	57
Gas pipeline	23	0.5%	2	3
Mining	9	0.2%	1	1
Snow Maker	15	0.4%	1	2
Sugar Base	141	3.3%	14	16
Water Treatment	113	2.7%	12	13
Other Agriculture	301	7.1%	35	33
Other Food Manufacturing	108	2.5%	13	12
Other Industrial	412	9.7%	70	42
Other Wastewater	162	3.8%	14	19
Total	**4,255**	**100.0%**	**551**	**464**

Industrial Sector Energy Market Profile

Figure 3-6 shows the distribution of annual electricity consumption and summer peak demand by end use for all industrial customers, not including the special contracts. Motors are the largest overall end use for the industrial sector, accounting for 37% of annual energy use. Note that this end use includes a wide range of industrial equipment, such as air compressors and refrigeration compressors, pumps, conveyor motors, and fans. The process end use accounts for 34% of annual energy use, which includes heating, cooling, refrigeration, and electro-chemical processes. Lighting is the next highest, followed by space heating, miscellaneous, cooling and ventilation.

Figure 3-6 Industrial Sector Electricity Consumption by End Use (2023), All Industries

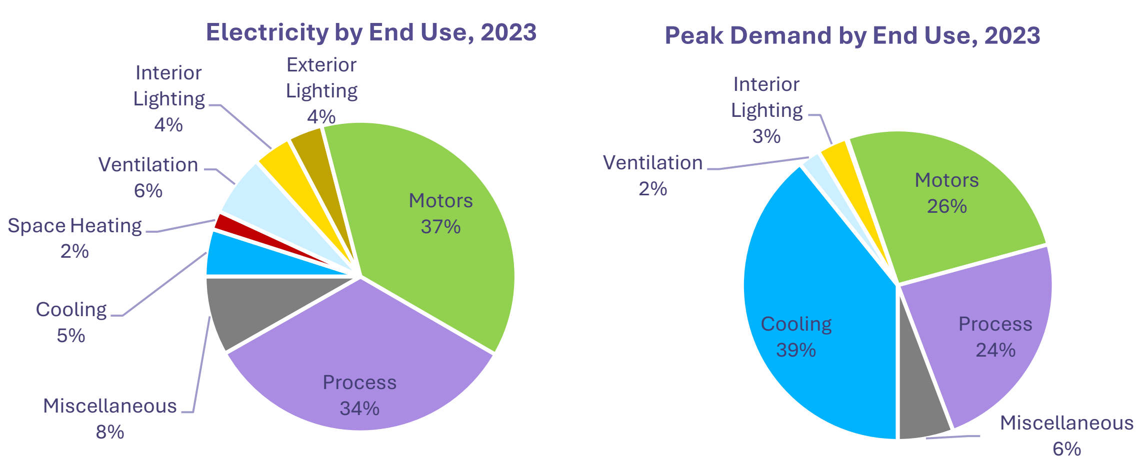


Table 3-7 shows the composite market profile for the industrial sector. The individual segment market profiles are shown in the Appendix B | .

Table 3-7 Average Electric Market Profile for the Industrial Sector, 2023

End Use	Technology	Saturation	UEC(kWh/ employee)	Intensity (kWh/ employee)	Usage (GWh)	Summer Peak Demand (MW)
Cooling	Air-Cooled Chiller	1.8%	8,284	151	14	15
	Water-Cooled Chiller	1.8%	5,481	100	9	10
	RTU	11.0%	6,010	664	63	64
	Air-Source Heat Pump	4.5%	6,703	300	28	29
	Geothermal Heat Pump	0.0%	-	-	-	-
Space Heating	Electric Furnace	1.0%	4,765	49	5	-
	Electric Room Heat	5.6%	4,538	253	24	-
	Air-Source Heat Pump	4.5%	4,111	184	17	-
	Geothermal Heat Pump	0.0%	-	-	-	-
Ventilation	Ventilation	96.8%	1,659	1,606	152	7
Interior Lighting	General Service Lighting	99.9%	119	119	11	1
	High-Bay Lighting	99.9%	511	510	48	5
	Linear Lighting	99.9%	581	580	55	6
Exterior Lighting	General Service Lighting	99.9%	352	351	33	0
	Area Lighting	99.9%	10	10	1	0
	Linear Lighting	99.9%	746	745	71	0
Motors	Pumps	92.8%	3,189	2,960	281	26
	Fans & Blowers	90.6%	1,379	1,249	118	11
	Compressed Air	89.8%	2,617	2,349	223	20
	Material Handling	94.7%	6,598	6,248	593	52
	Other Motors	47.3%	1,470	695	66	6
Process	Process Heating	91.6%	1,909	1,748	166	14
	Process Cooling	72.9%	6,624	4,829	458	42
	Process Refrigeration	86.4%	3,752	3,240	307	28
	Process Electrochemical	59.7%	296	177	17	2
	Process Other	59.7%	619	369	35	3
Miscellaneous	Miscellaneous	100.0%	2,367	2,367	225	20
	Total			**31,855**	**3,022**	**361**

Irrigation Sector

The total electricity used in 2023 by Idaho Power's irrigation customers was 1,868 GWh, while summer peak demand was 634 MW and winter peak demand was 5 MW. Idaho Power billing data were used to develop estimates of energy intensity (annual kWh/service point). For the irrigation sector, all the energy use is for the motors end use. Table 3-8 shows the composite market profile for the irrigation sector.

Table 3-8 Average Electric Market Profile for the Irrigation Sector, 2023

Motor Size	Service Points	UEC (kWh/Service Point)	Intensity (kWh/Service Point)	Electric Use (MWh)	Summer Peak Demand (MW)
5 HP	2,212	6,027	628	13	5
10 HP	3,237	12,054	1,838	39	13
15 HP	1,681	18,081	1,432	30	10
20 HP	1,658	23,958	1,872	40	13
25 HP	1,586	33,976	2,539	54	18
30 HP	1,378	41,016	2,663	57	19
40 HP	1,770	54,030	4,505	96	32
50 HP	1,386	66,939	4,371	93	31
60 HP	853	74,211	2,982	63	21
75 HP	1,012	92,630	4,417	94	32
100 HP	997	123,159	5,787	123	42
125 HP	628	136,787	4,049	86	29
150 HP	565	163,725	4,358	92	31
200 HP	696	218,296	7,163	152	52
250 HP	362	341,881	5,832	124	42
300 HP	332	406,516	6,367	135	46
350 HP	227	472,683	5,045	107	36
400 HP	203	539,909	5,159	110	37
450 HP	117	605,346	3,329	71	24
500 HP	114	673,126	3,608	77	26
600 HP	93	741,001	3,247	69	23
600+ HP	118	1,227,144	6,807	144	49
Total	**21,225**		**87,997**	**1,868**	**634**

4 | BASELINE PROJECTION

Prior to developing estimates of energy efficiency potential, a baseline end-use projection is developed to quantify what the consumption would likely be in the future in absence of any efficiency programs. The savings from past programs are embedded in the forecast, but the baseline projection assumes that programs cease to exist in the future. Possible savings from future programs are captured by the potential estimates.

The baseline projection incorporates assumptions about:

- Customer population and economic growth
- Appliance/equipment standards and building codes already mandated
- Forecasts of future electricity prices and other drivers of consumption
- Trends in fuel shares and appliance saturations and assumptions about miscellaneous electricity growth

Although it aligns closely, the baseline projection is not IPC's official load forecast. Rather, it was developed to serve as the metric against which EE potential estimates are measured. This chapter presents the baseline projections developed for this study. Below, the baseline projections for each sector are presented, which include projections of annual use in GWh and summer peak demand in MW. A summary across all sectors is also presented.

Summary of Baseline Projections Across Sectors

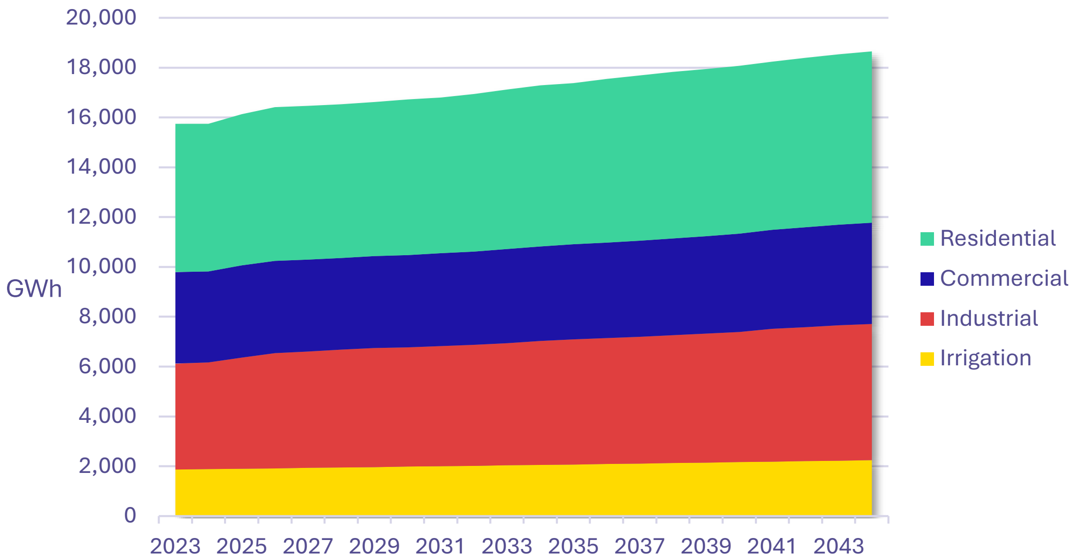
Annual Use

Table 4-1 and Figure 4-1 provide a summary of the baseline projection of annual use by sector for the entire Idaho Power service area, excluding special contracts. Overall, the projection shows strong growth in electricity use, driven by customer growth forecasts.

Table 4-1 Baseline Projection Summary (GWh)

Sector	2025	2029	2034	2039	2044	% Change ('25-'44)
Residential	6,079	6,181	6,471	6,706	6,874	15.6%
Commercial	3,694	3,695	3,789	3,915	4,066	10.7%
Industrial	4,462	4,773	4,976	5,179	5,468	28.5%
Irrigation	1,902	1,967	2,052	2,145	2,244	20.2%
Total	**16,137**	**16,616**	**17,289**	**17,945**	**18,654**	**18.5%**

Figure 4-1 Baseline Projection Summary (GWh)



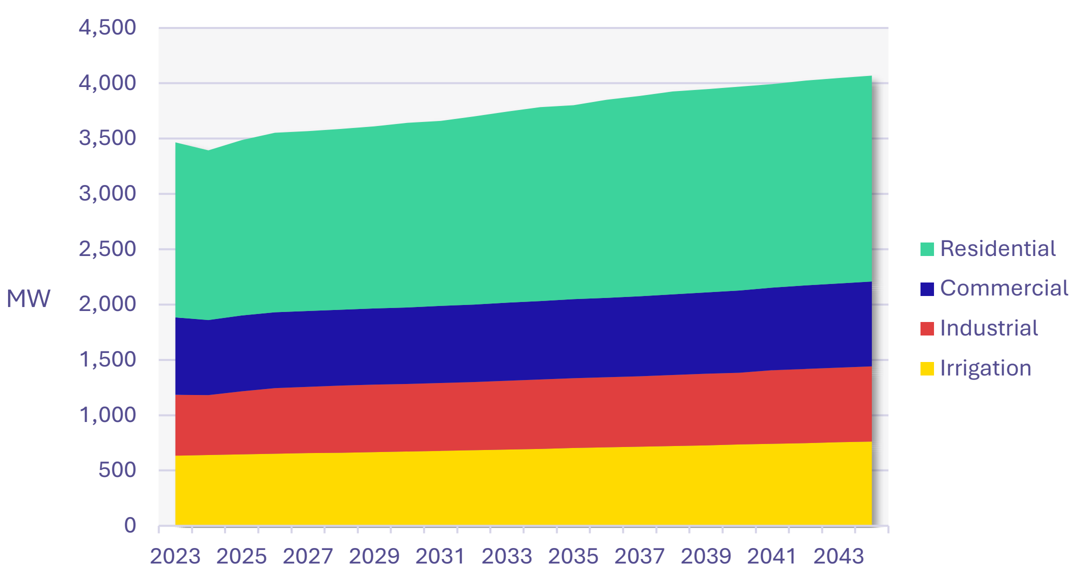
Summer Peak Demand Projection

Table 4-2 and Figure 4-2 provide a summary of the baseline projection for summer peak demand. Overall, the projection shows steady growth, again driven by the growth in customers.

Table 4-2 Summer Peak Baseline Projection Summary (MW)

Sector	2025	2029	2034	2039	2044	% Change ('25-'44)
Residential	1,586	1,645	1,750	1,838	1,860	17.5%
Commercial	686	689	709	735	768	9.8%
Industrial	569	610	628	646	679	23.4%
Irrigation	645	667	696	728	761	20.2%
Total	**3,487**	**3,611**	**3,783**	**3,947**	**4,069**	**17.4%**

Figure 4-2 Summer Peak Baseline Projection Summary (MW)



Residential Sector Baseline Projection

Table 4-3 and Figure 4-3 present the baseline projection for electricity at the end-use level for the residential sector as a whole. Overall, residential use increases from 6,079 GWh in 2025 to 6,874 GWh in 2044, an increase of 15.6%. This reflects a modest customer growth forecast. Figure 4-4 presents the baseline projection of annual electricity use per household. Most noticeable is that lighting use decreases throughout the time period with the continued adoption of more efficient lighting options.

This projection is in general alignment with Idaho Power's residential load forecast. Specific observations include:

1. Lighting use declines as a result of the market transformation, which is expected to lead to the development of more efficient LED lamps becoming available in 2024. The more efficient lamp types are expected based on the assumptions from the Department of Energy's Forecast of Solid-State Lighting.
2. Growth in the water heating end use is lower than average, reflecting the efficiency standards and impacts of RTF's market baseline on the projection.
3. Growth in electronics and appliances is substantial and reflects the trend toward higher-powered computers and smart appliances. Growth in other miscellaneous use is also substantial. This category includes electric vehicles and many other small uses that are expected to grow in the forecast period. This end use has grown consistently in the past and future growth assumptions are incorporated that are consistent with the EIA's Annual Energy Outlook.

Table 4-3 Residential Baseline Projection by End Use (GWh)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	829	880	970	1,045	1,059	28%
Heating	1,352	1,340	1,359	1,359	1,371	1%
Water Heating	622	629	611	586	563	-9%
Interior Lighting	497	391	323	292	278	-44%
Exterior Lighting	130	106	86	71	62	-52%
Appliances	1,188	1,256	1,333	1,381	1,418	19%
Electronics	560	593	650	692	726	30%
Miscellaneous	902	985	1,139	1,280	1,397	55%
Total	**6,079**	**6,181**	**6,471**	**6,706**	**6,874**	**13%**

Figure 4-3 Residential Baseline Projection by End Use (GWh)

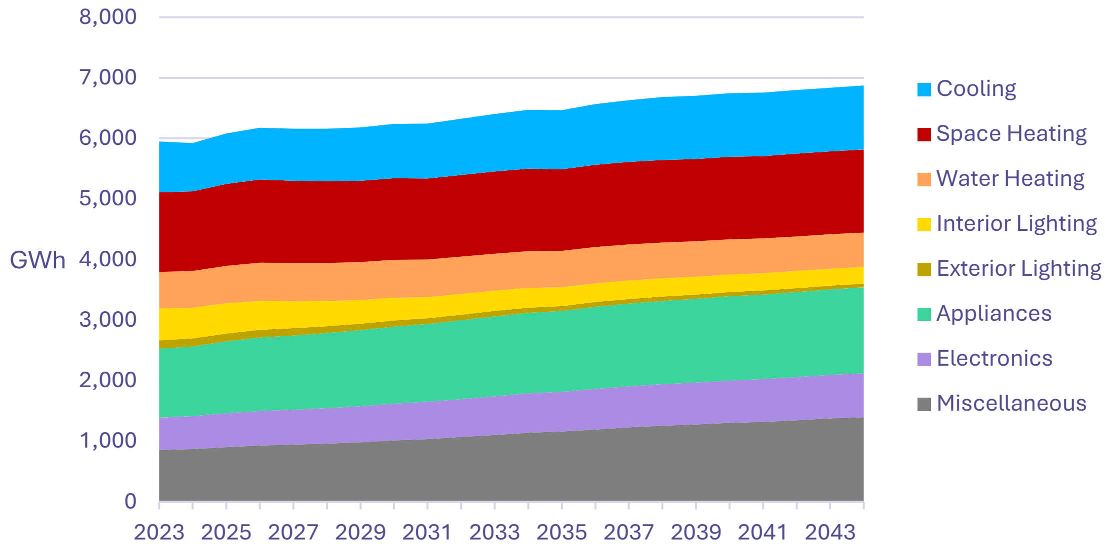
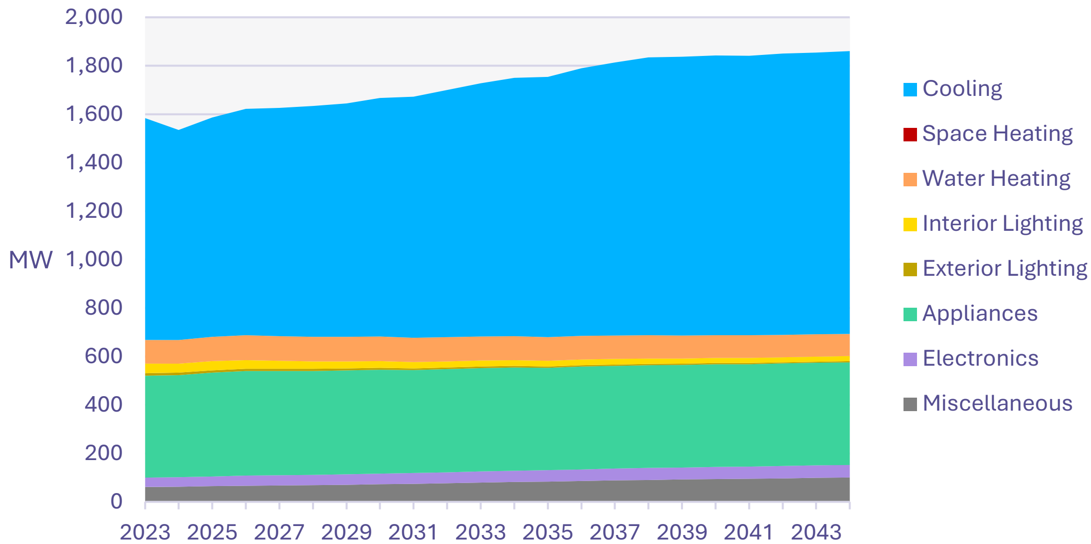


Table 4-4 and Figure 4-4 present the residential baseline projection for summer peak demand at the end-use level. Overall, residential summer peak increases from 1,586 MW in 2025 to 1,860 MW in 2044, an increase of 17%. All end uses except lighting show increases in the baseline peak projections. Electronics, appliances, and miscellaneous uses increases substantially, in correspondence with growth in annual energy use.

Table 4-4 Residential Summer Peak Baseline Projection by End Use (MW)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	905	963	1,067	1,151	1,168	29%
Water Heating	101	102	99	95	91	-9%
Interior Lighting	37	29	24	22	21	-44%
Exterior Lighting	10	8	6	5	5	-52%
Appliances	428	429	426	423	424	-1%
Electronics	40	43	47	50	52	30%
Miscellaneous	65	71	82	92	100	55%
Total	**1,586**	**1,645**	**1,750**	**1,838**	**1,860**	**17%**

Figure 4-4 Residential Summer Peak Baseline Projection by End Use (MW)



Commercial Sector Baseline Projection

Annual electricity use in the commercial sector grows during the overall forecast horizon, starting at 3,694 GWh in 2025 and increasing by 10.7% to 4,066 GWh in 2044.

Table 4-5 and Figure 4-5 present the baseline projection at the end-use level for the commercial sector. Two main electricity end uses — Cooling and Lighting — account for 39% of the total annual electricity use.

Table 4-5 Commercial Baseline Projection by End Use (GWh)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	450	453	469	489	515	14%
Heating	252	261	280	299	317	26%
Ventilation	578	566	564	569	584	1%
Water Heating	91	97	107	115	121	34%
Interior Lighting	788	771	766	773	782	-1%
Exterior Lighting	213	198	193	193	195	-8%
Refrigeration	348	368	400	431	459	32%
Food Preparation	234	232	238	246	255	9%
Office Equipment	258	238	216	199	193	-25%
Miscellaneous	482	510	556	601	644	34%
Total	**3,694**	**3,695**	**3,789**	**3,915**	**4,066**	**10%**

Figure 4-5 Commercial Baseline Projection by End Use (GWh)

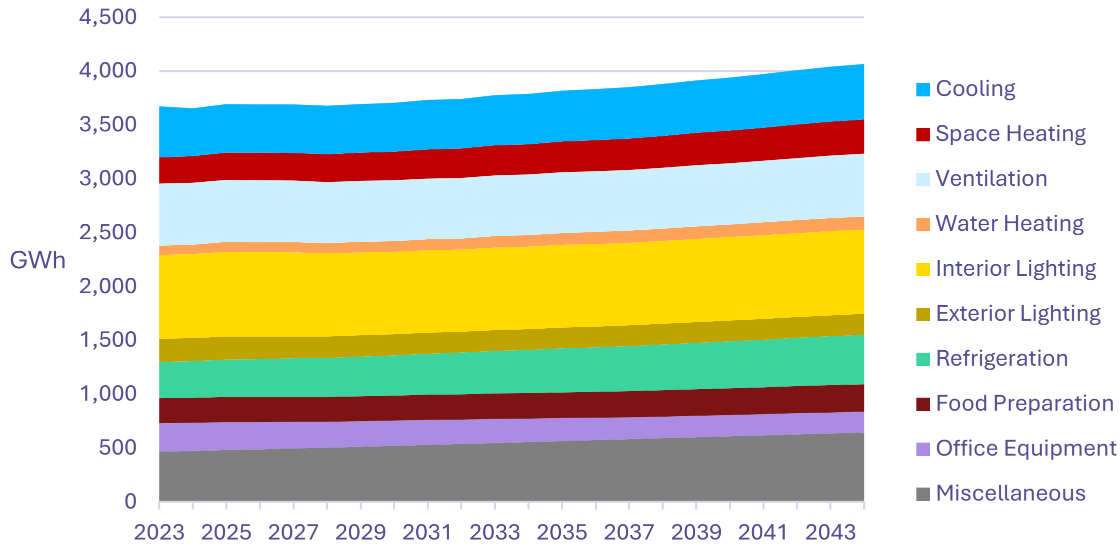
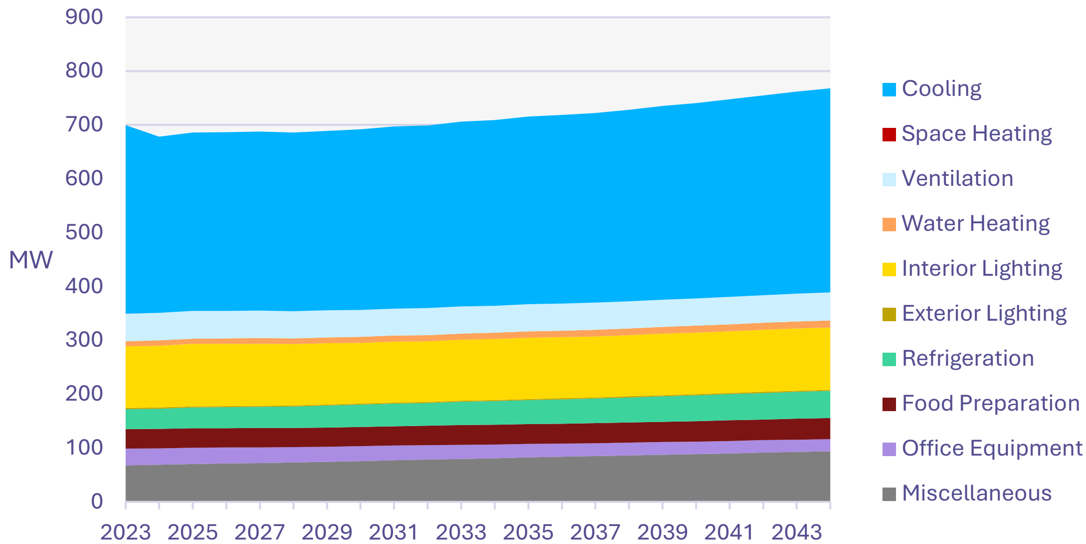


Table 4-6 and Figure 4-6 present the summer peak baseline projection at the end-use level for the commercial sector. Summer peak demand increases during the overall forecast horizon, starting at 699 MW in 2025 and increasing by 12% to 768 in 2044.

Table 4-6 Commercial Summer Peak Baseline Projection by End Use (MW)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	331	333	345	360	379	14%
Ventilation	51	50	50	51	52	1%
Water Heating	10	11	12	13	13	34%
Interior Lighting	116	114	113	114	116	0%
Exterior Lighting	2	2	2	2	2	-8%
Refrigeration	38	40	44	47	50	32%
Food Preparation	36	36	37	38	39	8%
Office Equipment	30	28	25	23	23	-25%
Miscellaneous	70	74	81	88	94	34%
Total	**686**	**689**	**709**	**735**	**768**	**12%**

Figure 4-6 Commercial Summer Peak Baseline Projection by End Use (MW)



Industrial Sector Baseline Projection

Table 4-7 and Figure 4-7 present the projection of electricity use in the industrial sector at the end-use level. Overall, industrial annual electricity use increases from 4,462 GWh in 2025 to 5,468 GWh in 2044. This comprises an overall increase of 23% over the 20-year period. Two main electricity end uses —Motors and Process — account for 71% of the total annual electricity use.

Table 4-7 Industrial Baseline Projection by End Use (GWh)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	210	224	224	224	233	11%
Heating	90	100	104	108	115	27%
Ventilation	288	298	285	276	279	-3%
Interior Lighting	176	184	181	178	180	2%
Exterior Lighting	148	141	139	143	149	0%
Motors	1,668	1,799	1,908	2,012	2,145	29%
Process	1,505	1,609	1,696	1,780	1,875	25%
Miscellaneous	376	418	440	460	492	31%
Total	**4,462**	**4,773**	**4,976**	**5,179**	**5,468**	**23%**

Figure 4-7 Industrial Baseline Projection by End Use (GWh)

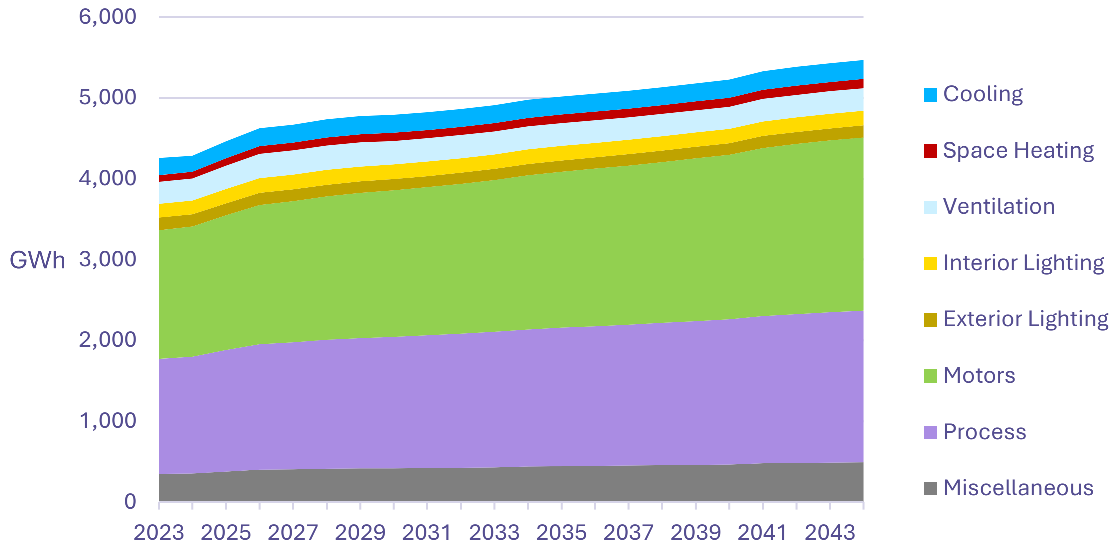
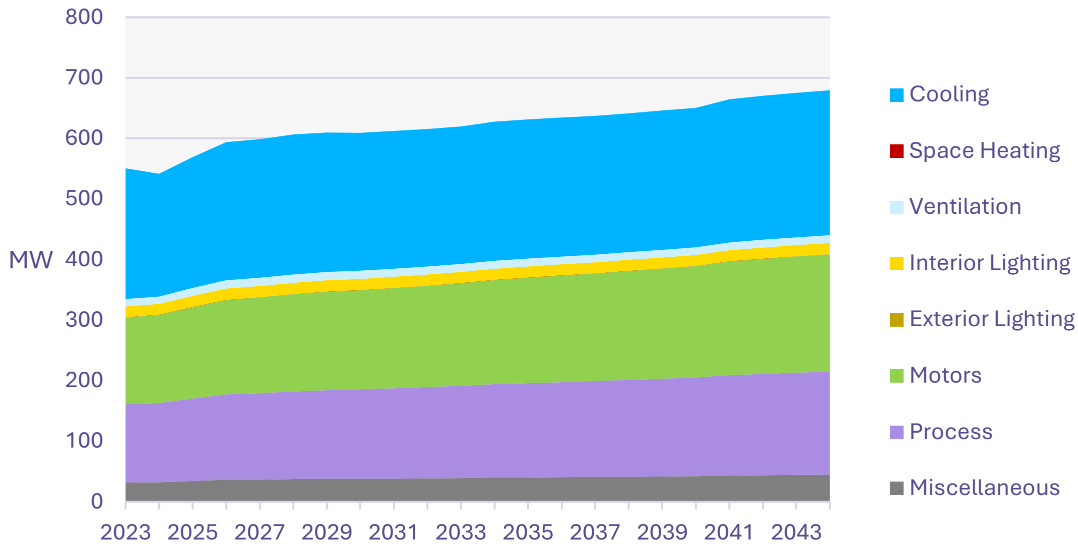


Table 4-8 and Figure 4-8 present the projection of summer peak demand for the industrial sector. Summer peak usage is 569 MW in the 2025, increasing by 19% to 679 MW in 2044.

Table 4-8 Industrial Summer Peak Baseline Projection by End Use (MW)

End Use	2025	2029	2034	2039	2044	% Change ('25-'44)
Cooling	216	231	230	230	239	11%
Ventilation	13	14	13	13	13	-3%
Interior Lighting	18	19	18	18	18	2%
Exterior Lighting	1	1	1	1	1	0%
Motors	150	162	172	181	193	29%
Process	137	146	154	162	170	25%
Miscellaneous	34	38	40	42	45	31%
Total	**569**	**610**	**628**	**646**	**679**	**19%**

Figure 4-8 Industrial Summer Peak Baseline Projection by End Use (MW)



Irrigation Sector Baseline Projection

Annual irrigation uses increases throughout the forecast horizon by approximately 18%. However, use per service point decreases by 3% by 2044. The summer peak demand forecast is very similar because the irrigation sector has a high load factor. Table 4-9 presents the projections. It is not broken out by end use since all usage is due to motors.

Table 4-9 Irrigation Baseline Projection

	2025	2029	2034	2039	2044	% Change ('25-'44)
Annual Energy Use:						
Total Energy Use (GWh)	1,902	1,967	2,052	2,145	2,244	18%
Use per service point (kWh/service point)	87,447	86,395	85,389	84,794	84,453	-3%
Summer Peak Demand (MW):						
Total Summer Peak Demand (MW)	645	667	696	728	761	18%
Use per service point (kW/service point)	30	30	29	29	29	-3%

5 | ENERGY EFFICIENCY POTENTIAL

This chapter presents the measure-level energy efficiency potential for Idaho Power. The cumulative energy savings in GWh and the summer peak demand savings are presented in MW for selected years of the study. Year-by-year savings for energy and peak demand (summer and winter) are available in the LoadMAP model, which was provided to Idaho Power at the conclusion of the study.

A summary of energy and summer peak demand savings across all four sectors is provided first, followed by sector level results. Please note that all savings are provided at the customer meter.

Overall Summary of Energy Efficiency Potential

Table 5-1 and Figure 5-1 summarize the EE savings in terms of cumulative energy use for all measures for three levels of potential relative to the baseline projection. Figure 5-2 displays the EE projections as well as the baseline projection.

- Technical potential reflects the adoption of all EE measures regardless of cost-effectiveness. First-year savings are 394 GWh, or 2.4% of the baseline projection. Cumulative technical savings in 2044 are 4,215 GWh, or 22.6% of the baseline.
- Economic potential reflects the savings when the most efficient cost-effective measures, using the utility cost test, are taken by all customers. The first-year savings in 2025 are 172 GWh, or 1.1% of the baseline projection. By 2044, cumulative economic savings reach 1,775 GWh, or 9.5% of the baseline projection.
- Achievable potential represents savings that are possible when considering the availability, knowledge, and acceptance of the measure. Achievable potential is 112 GWh savings in the first year, or 0.7% of the baseline, and reaches 1,512 GWh cumulative achievable savings by 2044, or 8.1% of the baseline projection. This results in average annual savings of 0.4% of the baseline each year. Achievable potential reflects 85% of economic potential by the end of the forecast horizon. By 2044, cumulative achievable savings offset more than half the growth in the baseline projection.

Table 5-1 Summary of EE Potential (Cumulative Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Forecast (GWh)	16,137	16,616	17,289	17,945	18,654
Cumulative Savings (GWh)					
Achievable Potential	112	515	908	1,247	1,512
Economic Potential	172	773	1,243	1,597	1,775
Technical Potential	394	1,777	2,976	3,757	4,215
Savings (as % of Baseline)					
Achievable Potential	0.7%	3.1%	5.3%	6.9%	8.1%
Economic Potential	1.1%	4.7%	7.2%	8.9%	9.5%
Technical Potential	2.4%	10.7%	17.2%	20.9%	22.6%
Incremental Savings (GWh)					
Achievable Potential	112	100	86	69	54
Economic Potential	172	139	107	62	39
Technical Potential	394	348	254	144	98

Figure 5-1 *Summary of EE Potential as % of Baseline Projection (Cumulative Energy)*

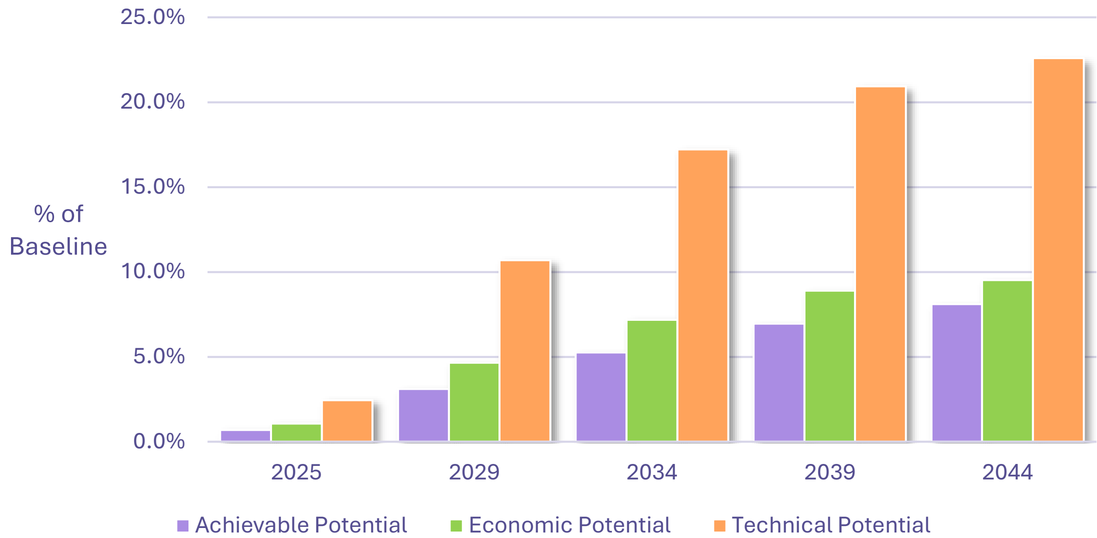


Figure 5-2 *Baseline Projection and EE Forecast Summary (Energy, GWh)*

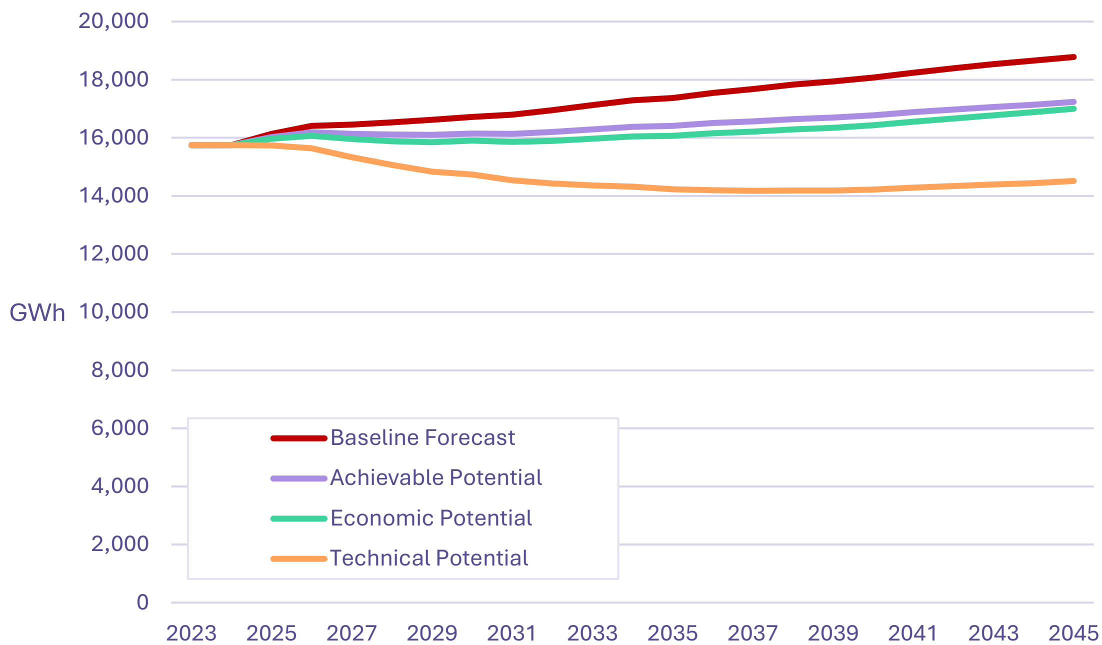


Table 5-2 and Figure 5-3 summarize the summer peak demand savings from all EE measures for three levels of potential relative to the baseline projection. Figure 5-4 displays the EE forecasts of summer peak demand.

- Technical potential for summer peak demand savings is 97 MW in 2025, or 2.8% of the baseline projection. This increases to 1,327 MW by 2044 or 32.6% of the summer peak demand baseline.
- Economic potential is estimated at 27 MW in 2025, or 0.8% of the baseline projection. In 2044, savings are 339 MW, or 8.3% of the baseline projection.

- Achievable potential is 17 MW in 2025, or 0.5% of the baseline projection. By 2044, cumulative savings reach 275 MW, or 6.8% of the baseline projection.

Table 5-2 Summary of EE Potential (Summer Peak, MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	3,487	3,611	3,783	3,947	4,069
Cumulative Savings (MW)					
Achievable Potential	17	79	154	222	275
Economic Potential	27	125	219	300	339
Technical Potential	97	469	843	1,138	1,327
Cumulative Savings as a % of Baseline					
Achievable Potential	0.5%	2.2%	4.1%	5.6%	6.8%
Economic Potential	0.8%	3.5%	5.8%	7.6%	8.3%
Technical Potential	2.8%	13.0%	22.3%	28.8%	32.6%

Figure 5-3 Summary of EE Potential as % of Summer Peak Baseline Projection

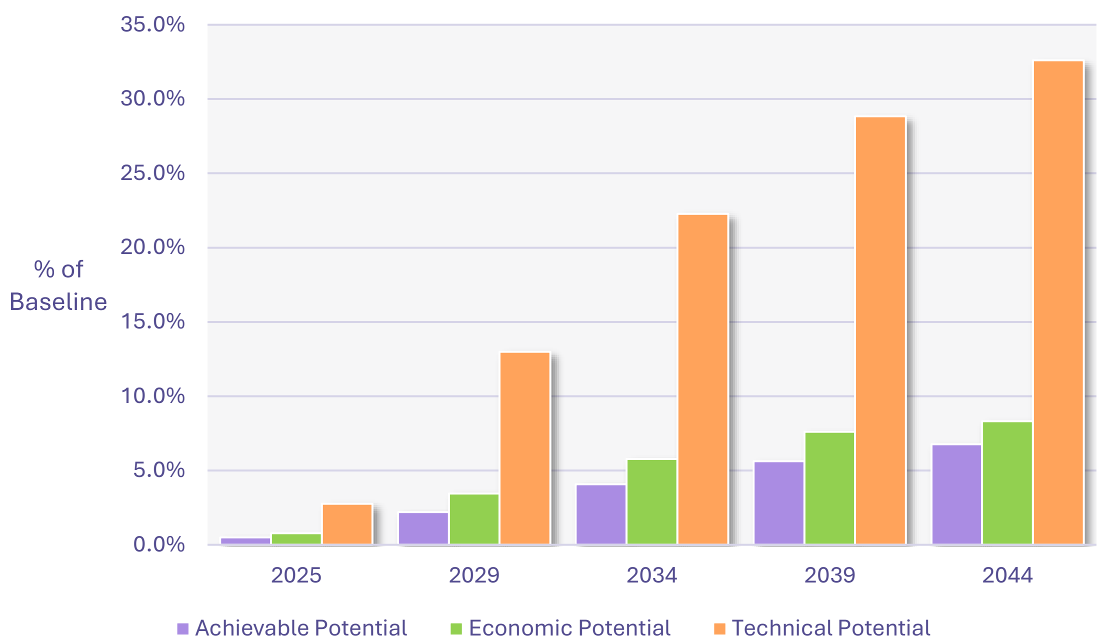
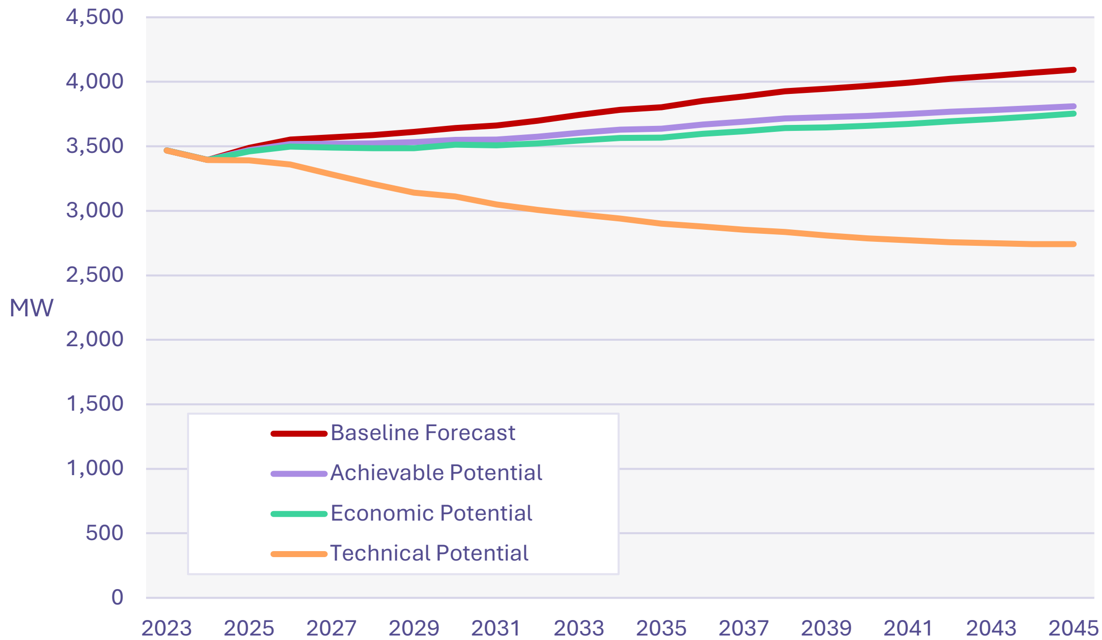


Figure 5-4 Summary Peak Baseline Projection and EE Forecast Summary (MW)



Energy Efficiency by Sector

Table 5-3, Figure 5-5, and Figure 5-6 summarize the range of potential cumulative energy and summer peak savings by sector. The commercial sector contributes the most savings throughout the forecast, followed by the residential sector.

Table 5-3 Achievable EE Potential by Sector (Energy and Summer Peak Demand)

	2025	2029	2034	2039	2044
Cumulative Energy Savings (GWh)					
Residential	27	91	186	294	386
Commercial	35	197	355	505	628
Industrial	40	170	266	322	361
Irrigation	11	57	101	126	136
Total	**112**	**515**	**908**	**1,247**	**1,512**
Cumulative Summer Peak Demand Savings (MW)					
Residential	6	20	48	80	109
Commercial	5	28	51	71	87
Industrial	3	12	21	28	33
Irrigation	4	19	34	43	46
Total	**17**	**79**	**154**	**222**	**275**

Figure 5-5 Achievable Cumulative EE Potential by Sector (Energy, GWh)

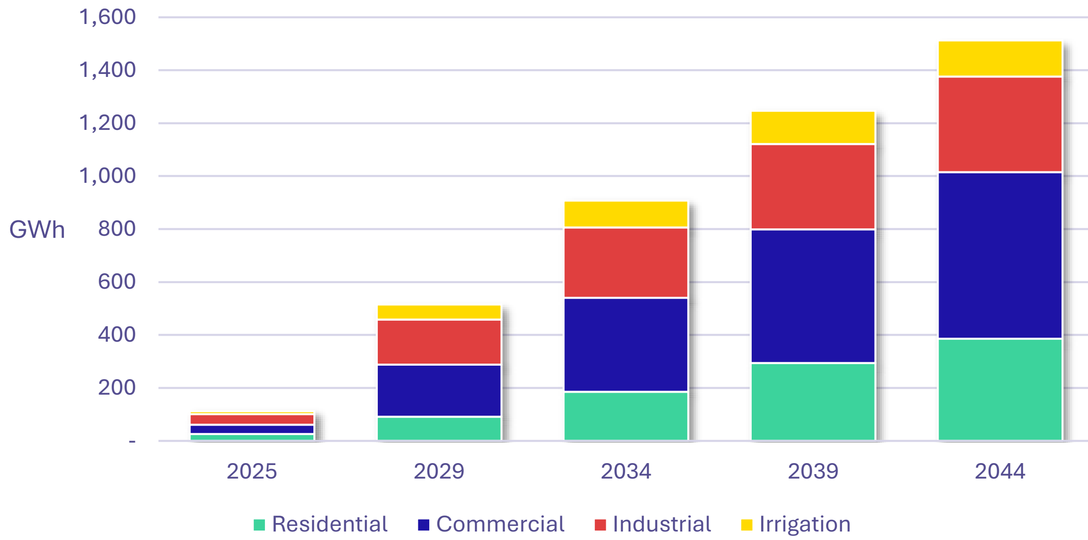
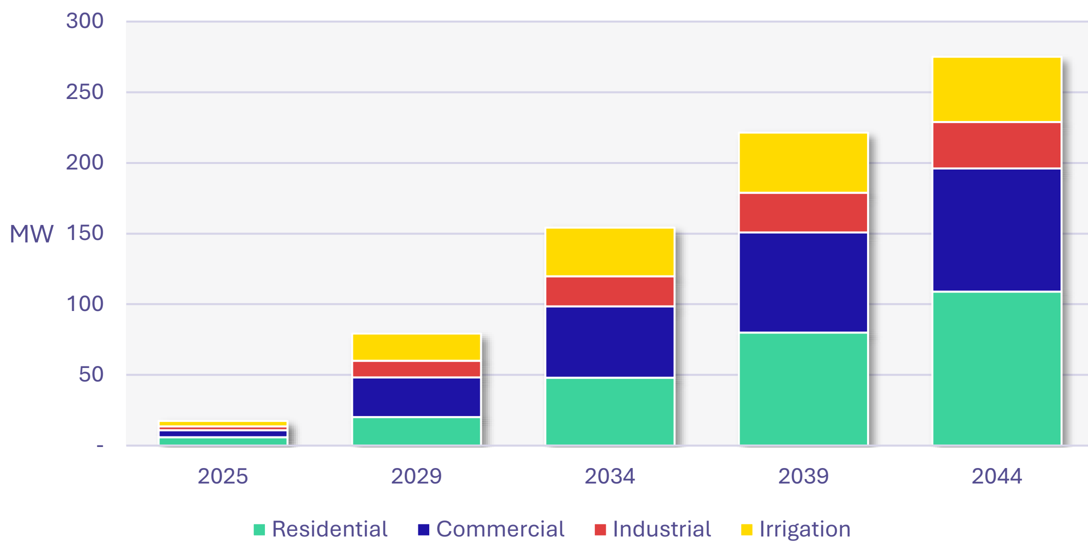


Figure 5-6 Achievable Cumulative EE Potential by Sector (Summer Peak Demand, MW)



Residential EE Potential

Table 5-4 and Figure 5-7 present estimates for measure-level EE potential for the residential sector in terms of cumulative energy savings. Achievable potential in the first year, 2025 is 27 GWh, or 0.4% of the baseline projection. By 2044, cumulative achievable savings are 386 GWh, or 5.6% of the baseline projection. At this level, it represents just 78% of economic potential.

Table 5-4 Residential EE Energy Potential (GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	6,079	6,181	6,471	6,706	6,874
Cumulative Savings (GWh)					
Achievable Potential	27	91	186	294	386
Economic Potential	54	227	376	494	492
Technical Potential	176	847	1,513	1,934	2,140
Cumulative Savings as a % of Baseline					
Achievable Potential	0.4%	1.5%	2.9%	4.4%	5.6%
Economic Potential	0.9%	3.7%	5.8%	7.4%	7.2%
Technical Potential	2.9%	13.7%	23.4%	28.8%	31.1%

Figure 5-7 Residential Cumulative EE Savings as a % of the Energy Baseline Projection

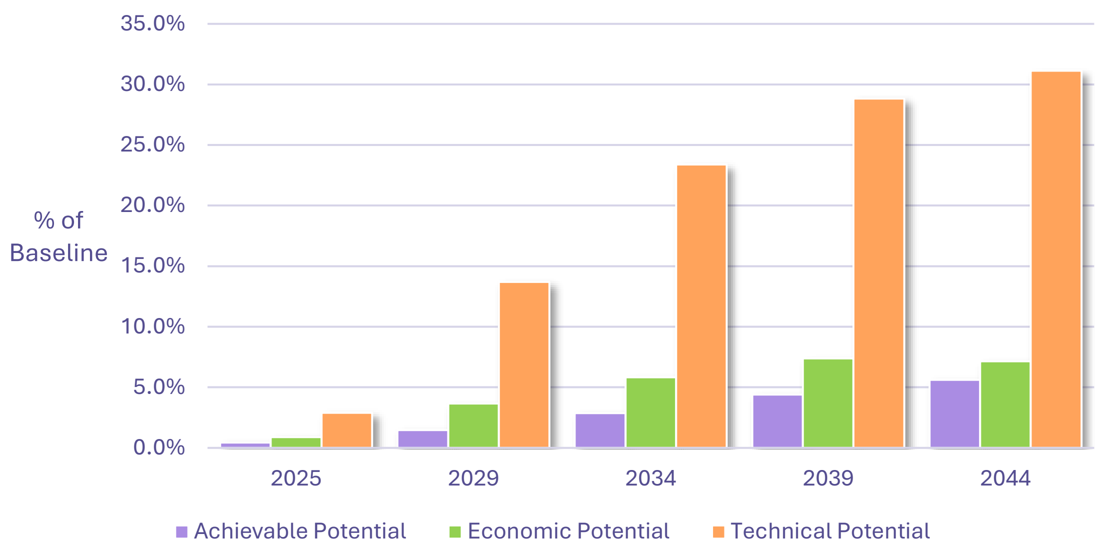
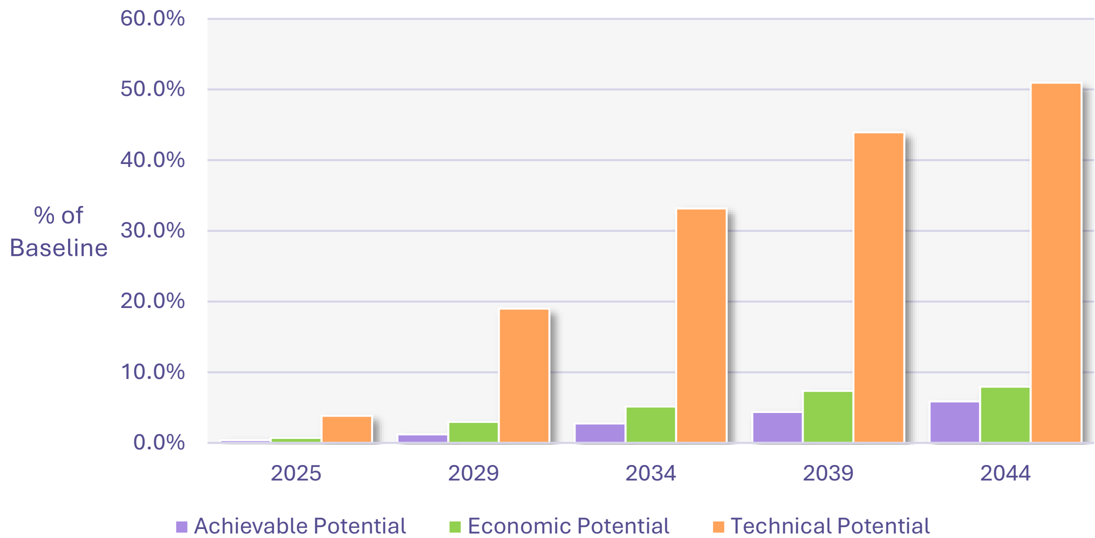


Table 5-5 and Figure 5-8 show residential EE potential in terms of summer peak savings. In the first year, 2025, achievable summer peak savings are 6 MW of the baseline summer peak projection. By 2044, cumulative achievable savings are 109 MW of the baseline summer peak projection.

Table 5-5 Residential EE Summer Peak Demand Potential (MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	1,586	1,645	1,750	1,838	1,860
Cumulative Savings (MW)					
Achievable Potential	6	20	48	80	109
Economic Potential	11	49	90	135	148
Technical Potential	61	312	581	808	948
Cumulative Savings as a % of Baseline					
Achievable Potential	0.4%	1.2%	2.7%	4.4%	5.9%
Economic Potential	0.7%	3.0%	5.2%	7.4%	7.9%
Technical Potential	3.8%	19.0%	33.2%	43.9%	51.0%

Figure 5-8 Residential EE Savings as a % of the Summer Peak Demand Baseline Projection



Residential Top Measures

Below, the top residential measures from the perspective of energy use and summer peak demand are presented. Table 5-6 identifies the top 20 residential measures from the perspective of cumulative energy savings in 2034 and 2044, ranked by the cumulative savings in 2044. The top measures are Water Heaters, Connected Thermostats, Home Energy Reports, TVs and Air Purifiers.

Table 5-6 Residential Top Measures in 2034 and 2044 (Energy, MWh)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Water Heater (<= 55 Gal)	18,241	125,201	32.4%
2	Connected Thermostat - ENERGY STAR (1.0)	37,933	60,321	15.6%
3	Home Energy Reports	34,669	31,481	8.1%
4	TVs	9,610	19,835	5.1%
5	Air Purifier	2,046	17,780	4.6%
6	Linear Lighting	7,036	16,314	4.2%
7	Refrigerator	1,756	15,305	4.0%
8	Water Heater - Low-Flow Showerheads	8,618	12,612	3.3%
9	Connected Thermostat - Line-Voltage	5,263	8,522	2.2%
10	Engine Block Heater Controls	2,673	8,225	2.1%
11	Ducting - Repair and Sealing	7,464	7,857	2.0%
12	Insulation - Ceiling Installation	6,721	6,991	1.8%
13	Second Refrigerator	713	6,438	1.7%
14	Water Heater - Faucet Aerators	4,728	6,130	1.6%
15	Laptops	5,497	5,386	1.4%
16	Water Heater (> 55 Gal)	558	4,758	1.2%
17	Well pump	588	4,677	1.2%
18	Insulation - Ducting	4,465	4,673	1.2%
19	Ductless Mini Split Heat Pump	561	3,028	0.8%
20	Water Heater - Thermostatic Shower Restriction Valve	1,682	2,965	0.8%
	Total of Top 20 Measures	**160,822**	**368,499**	**95.4%**

Figure 5-9 presents forecasts of energy savings by end use in cumulative savings and as a percent of total savings per year. Lighting savings account for a substantial portion of the savings throughout the forecast horizon, but the share declines over time as the market is transformed. The same is true for exterior lighting. Behavioral Program savings contribute a large portion of the savings to all end uses in the early years of the forecast but taper off later in the study due to degrading savings from sunsetting of the program. Water heater savings contribute a large portion, as a result of heat pump water heaters being cost effective from the start of the forecast. Savings from cooling measures and appliances are steadily increasing throughout the forecast horizon.

Figure 5-9 Residential Achievable EE Savings Forecast by End Use (Cumulative Energy)

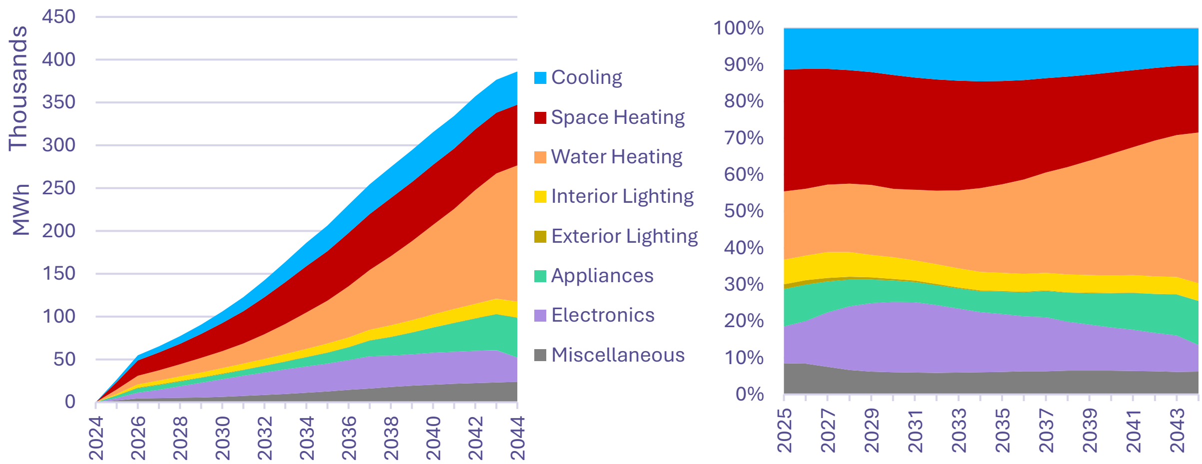
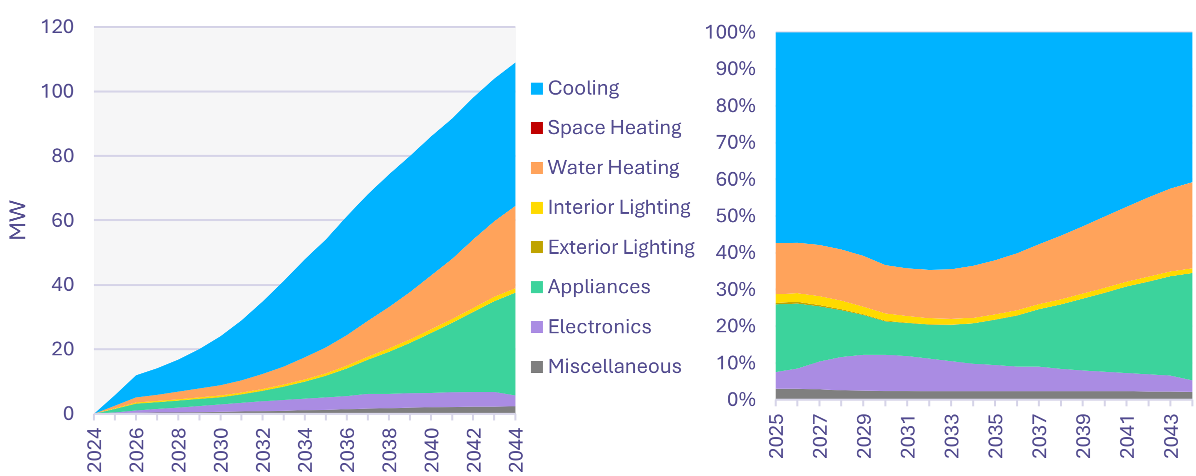


Table 5-7 identifies the top 20 residential measures from the perspective of summer peak savings in 2034 and 2044. The top measure is Connected Thermostats, accounting for 26.7% of cumulative peak achievable savings. Water Heaters account for approximately 18.5% of the achievable savings. Figure 5-10 presents forecasts of summer peak savings by end use as cumulative savings and as a percent of total savings per year. Savings from appliances, cooling, and water heating-related measures are expected to increase throughout the forecast horizon as lighting usage decreases with more efficient lightbulbs.

Table 5-7 Residential Top Measures in 2034 and 2044 (Summer Peak Demand, MW)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Connected Thermostat - ENERGY STAR (1.0)	17.8	29.1	26.7%
2	Second Refrigerator	2.9	26.7	24.5%
3	Water Heater (<= 55 Gal)	2.9	20.2	18.5%
4	Home Energy Reports	7.6	6.7	6.1%
5	Ductless Mini Split Heat Pump	0.5	2.6	2.4%
6	TVs	1.2	2.4	2.2%
7	Insulation - Ceiling Installation	2.0	2.2	2.0%
8	Room AC - Recycling	2.0	2.0	1.8%
9	Water Heater - Low-Flow Showerheads	1.3	2.0	1.8%
10	Refrigerator	0.2	1.9	1.8%
11	Connected Thermostat - Line-Voltage	1.3	1.8	1.7%
12	Insulation - Ducting	1.6	1.8	1.6%
13	Air Purifier	0.2	1.4	1.3%
14	Ducting - Repair and Sealing	1.3	1.4	1.3%
15	Linear Lighting	0.5	1.2	1.1%
16	Water Heater - Faucet Aerators	0.7	1.0	0.9%
17	Water Heater (> 55 Gal)	0.1	0.8	0.7%
18	Laptops	0.7	0.7	0.6%
19	Engine Block Heater Controls	0.2	0.7	0.6%
20	Well pump	0.1	0.5	0.5%
	Total of Top 20 Measures	**45.2**	**106.9**	**98.1%**

Figure 5-10 Residential Achievable Savings Forecast (Summer Peak, MW)



Commercial EE Potential

Table 5-8 and Figure 5-11 present estimates for the three levels of EE potential for the commercial sector from the perspective of cumulative energy savings. In 2025, achievable potential is 35 GWh, or 0.9% of the baseline projection. By 2044, savings are 628 GWh, or 15.5% of the baseline projection. By the end of the forecast horizon, achievable potential represents about 85% of economic potential.

Table 5-8 Commercial EE Energy Potential (GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	3,694	3,695	3,789	3,915	4,066
Cumulative Savings (GWh)					
Achievable Potential	35	197	355	505	628
Economic Potential	56	277	436	580	707
Technical Potential	117	533	842	1,062	1,211
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	5.3%	9.4%	12.9%	15.5%
Economic Potential	1.5%	7.5%	11.5%	14.8%	17.4%
Technical Potential	3.2%	14.4%	22.2%	27.1%	29.8%

Figure 5-11 Commercial Cumulative EE Savings as a % of the Energy Baseline Projection

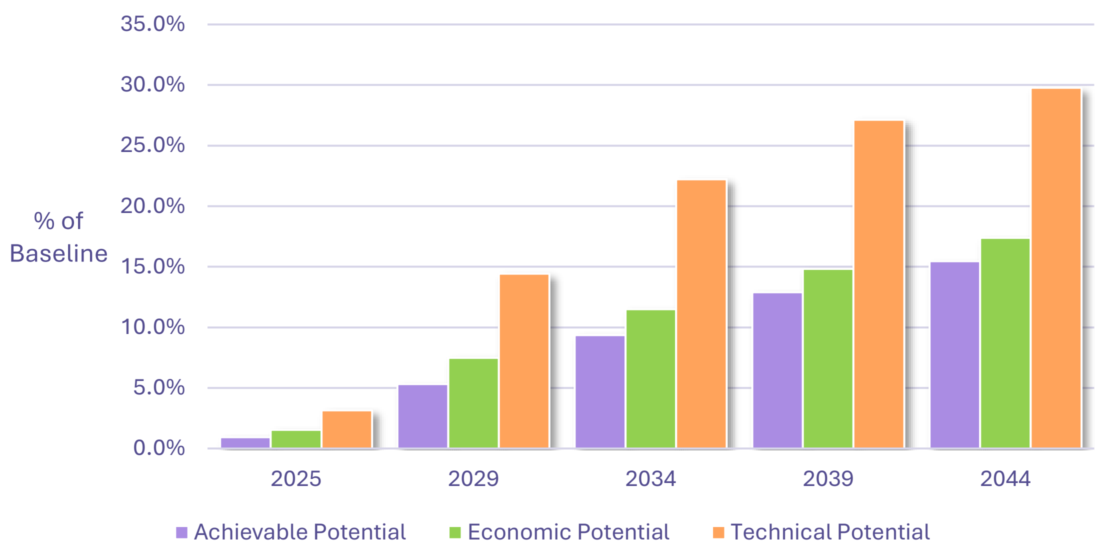
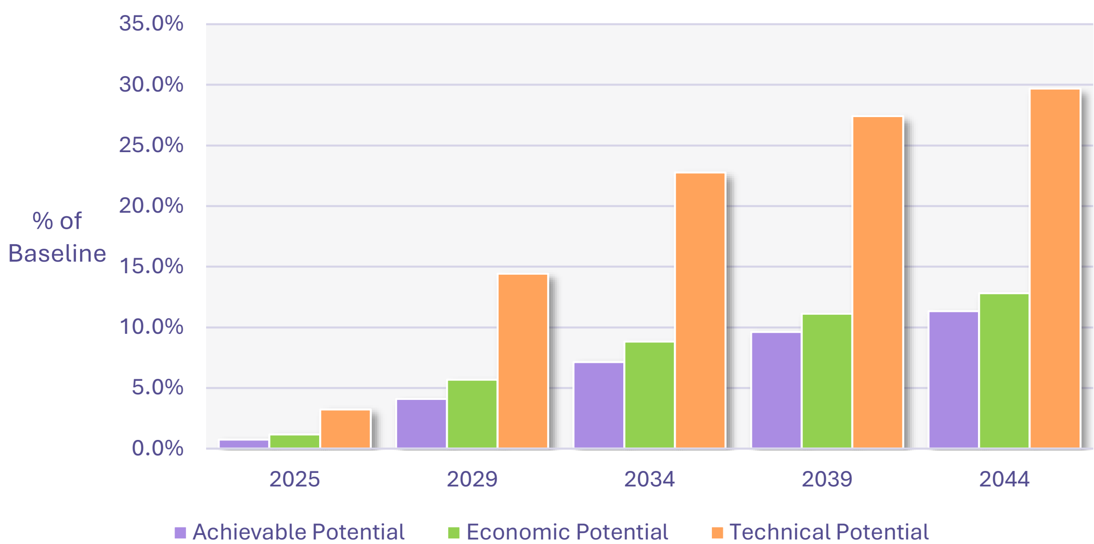


Table 5-9 and Figure 5-12 present savings estimates from the perspective of summer peak demand. In 2025, achievable potential is 5 MW of the baseline summer peak projection or 0.7% of the baseline projection. By 2044, savings are 87 MW or 11.3% of the baseline projection.

Table 5-9 Commercial EE Summer Peak Demand Potential (MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	686	689	709	735	768
Cumulative Savings (MW)					
Achievable Potential	5	28	51	71	87
Economic Potential	8	39	63	82	98
Technical Potential	22	99	161	202	228
Cumulative Savings as a % of Baseline					
Achievable Potential	0.7%	4.1%	7.1%	9.6%	11.3%
Economic Potential	1.2%	5.7%	8.8%	11.1%	12.8%
Technical Potential	3.2%	14.4%	22.8%	27.4%	29.7%

Figure 5-12 Commercial EE Savings as a % of the Summer Peak Baseline Projection



Commercial Sector Top Measures

Table 5-10 identifies the top 20 commercial-sector measures from the perspective of energy savings in 2034 and 2044. The top two measures are interior LED replacements for Linear-Fluorescent and High-Bay-style lighting applications, making up nearly 60% of the total cumulative Achievable Potential by 2044. This is followed by Variable Speed Control for Ventilation, Economizer Additions for commercial refrigeration, and Connected Thermostats.

Table 5-10 Commercial Top Measures in 2034 and 2044 (Energy, MWh)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Linear Lighting	130,307	312,185	49.7%
2	High-Bay Lighting	33,302	62,822	10.0%
3	Ventilation - Variable Speed Control	13,687	38,052	6.1%
4	Refrigeration - Economizer Addition	17,163	19,600	3.1%
5	Steamer	7,145	15,111	2.4%
6	Connected Thermostat - ENERGY STAR (1.0)	12,153	13,458	2.1%
7	HVAC - Dedicated Outdoor Air System (DOAS)	9,064	9,862	1.6%
8	RTU	2,696	9,347	1.5%
9	Strategic Energy Management	8,825	9,191	1.5%
10	General Service Lighting	7,162	9,056	1.4%
11	Kitchen Ventilation - Advanced Controls	8,935	8,653	1.4%
12	Exempted Lighting	7,911	8,357	1.3%
13	Ventilation - Demand Controlled	7,867	8,317	1.3%
14	Oven	3,217	8,218	1.3%
15	Area Lighting	4,327	8,146	1.3%
16	Retrocommissioning	7,447	7,678	1.2%
17	Refrigeration - Floating Head Pressure	5,881	6,753	1.1%
18	Refrigeration - High Efficiency Compressor	5,445	6,306	1.0%
19	Laptop	5,953	6,186	1.0%
20	Grocery - Display Case - LED Lighting	4,926	5,698	0.9%
	Total of Top 20 Measures	**303,412**	**572,997**	**91.2%**

Figure 5-13 presents forecasts of energy savings by end use as cumulative savings and a percent of total savings per year. Lighting savings from interior and exterior applications account for a substantial portion of the savings throughout the forecast horizon.

Figure 5-13 Commercial Achievable EE Savings Forecast by End Use (Energy, MWh)

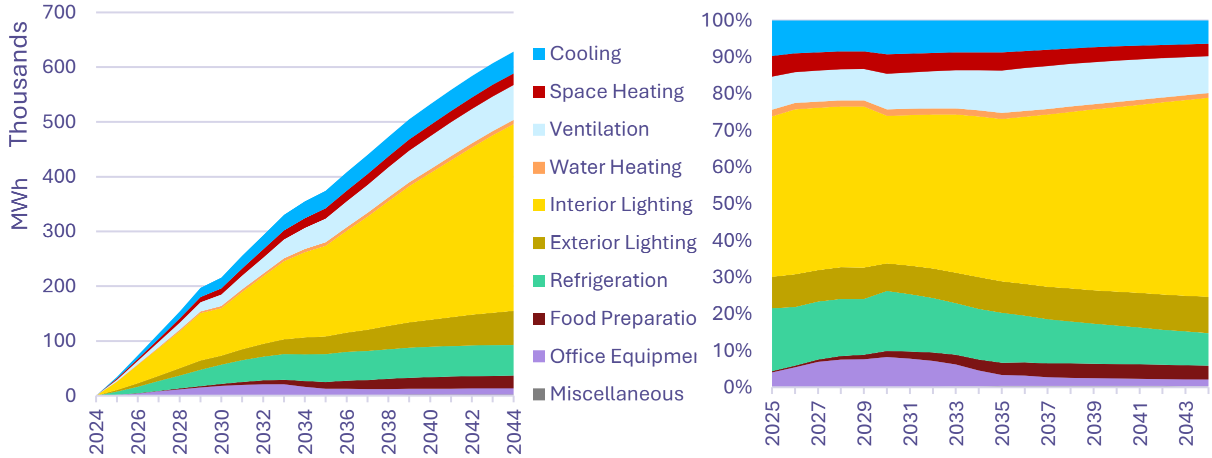


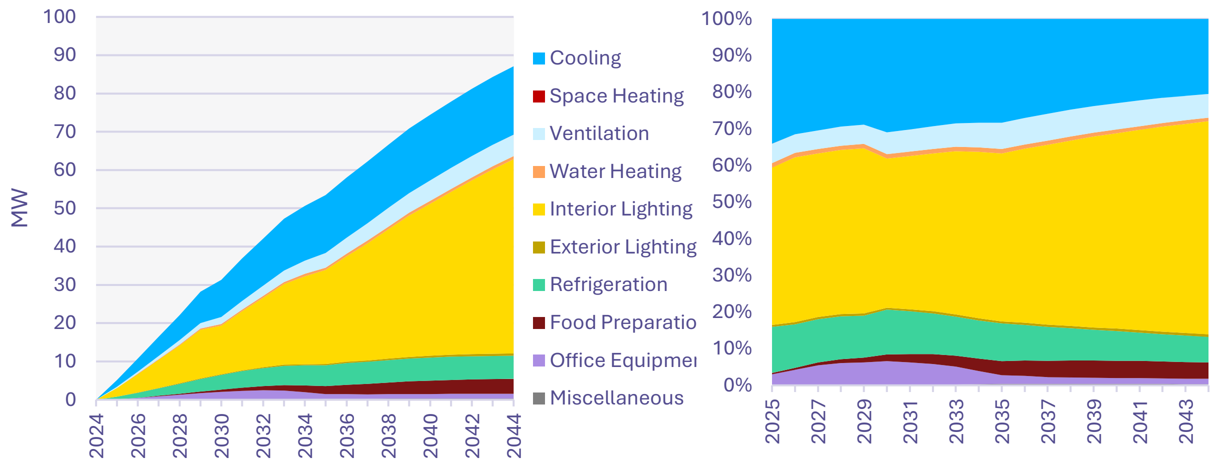
Table 5-11 identifies the top 20 commercial-sector measures from the perspective of summer peak savings in 2034 and 2044. The top two measures are Linear Lighting and High-Bay Lighting, with over half of the cumulative peak savings 2044. This is because commercial lighting use is coincident with the system peak hour. The top 20 measures account for nearly all of total summer peak savings in 2044.

Table 5-11 Commercial Top Measures in 2034 and 2044 (Summer Peak Demand, MW)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Linear Lighting	16.3	39.7	45.5%
2	High-Bay Lighting	5.0	9.4	10.8%
3	Ventilation - Demand Controlled	3.6	3.7	4.3%
4	Ventilation - Variable Speed Control	1.2	3.4	3.9%
5	Ventilation - Nighttime Air Purge	3.0	3.3	3.8%
6	RTU	0.9	3.1	3.5%
7	Steamer	1.2	2.6	3.0%
8	Chiller - Chilled Water Reset	2.1	2.2	2.5%
9	Refrigeration - Economizer Addition	1.9	2.1	2.4%
10	Strategic Energy Management	1.7	1.8	2.1%
11	HVAC - Dedicated Outdoor Air System (DOAS)	1.4	1.5	1.7%
12	Oven	0.5	1.3	1.4%
13	Exempted Lighting	1.1	1.2	1.4%
14	Chiller - Variable Flow Chilled Water Pump	1.1	1.1	1.3%
15	Retrocommissioning	1.1	1.1	1.2%
16	Laptop	0.7	0.7	0.8%
17	Refrigeration - Floating Head Pressure	0.6	0.7	0.8%
18	General Service Lighting	0.5	0.7	0.8%
19	Kitchen Ventilation - Advanced Controls	0.7	0.7	0.8%
20	Windows - Secondary Glazing Systems	0.7	0.7	0.8%
	Total of Top 20 Measures	**45.3**	**81.0**	**93.0%**

Figure 5-14 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Savings from cooling and lighting-related measures dominate throughout the forecast horizon.

Figure 5-14 Commercial Achievable EE Savings Forecast by End Use (Summer Peak Demand)



Industrial EE Potential

Table 5-12 and Figure 5-15 present potential estimates at the measure level for the Industrial sector, from the perspective of cumulative energy savings. Achievable savings in the first year, 2025, are 40 GWh, or 0.9% of the baseline projection. In 2044, savings reach 361 GWh, or 6.6% of the baseline projection.

Table 5-12 Industrial EE Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	4,462	4,773	4,976	5,179	5,468
Cumulative Savings (GWh)					
Achievable Potential	40	170	266	322	361
Economic Potential	49	203	312	375	417
Technical Potential	88	329	501	611	701
Cumulative Savings as a % of Baseline					
Achievable Potential	0.9%	3.6%	5.3%	6.2%	6.6%
Economic Potential	1.1%	4.3%	6.3%	7.2%	7.6%
Technical Potential	2.0%	6.9%	10.1%	11.8%	12.8%

Figure 5-15 Industrial Cumulative EE Savings as a % of the Energy Baseline Projection)

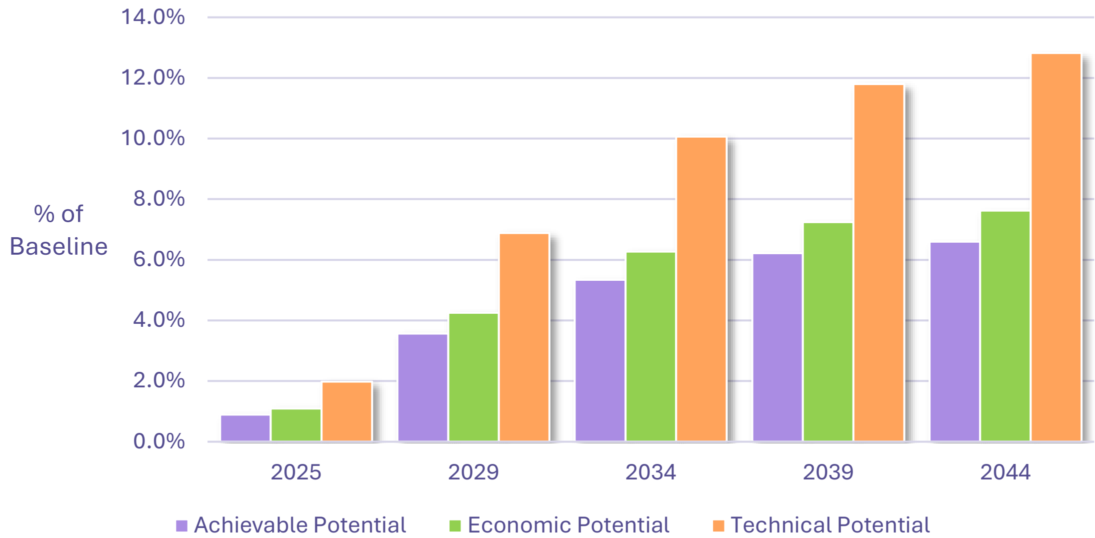
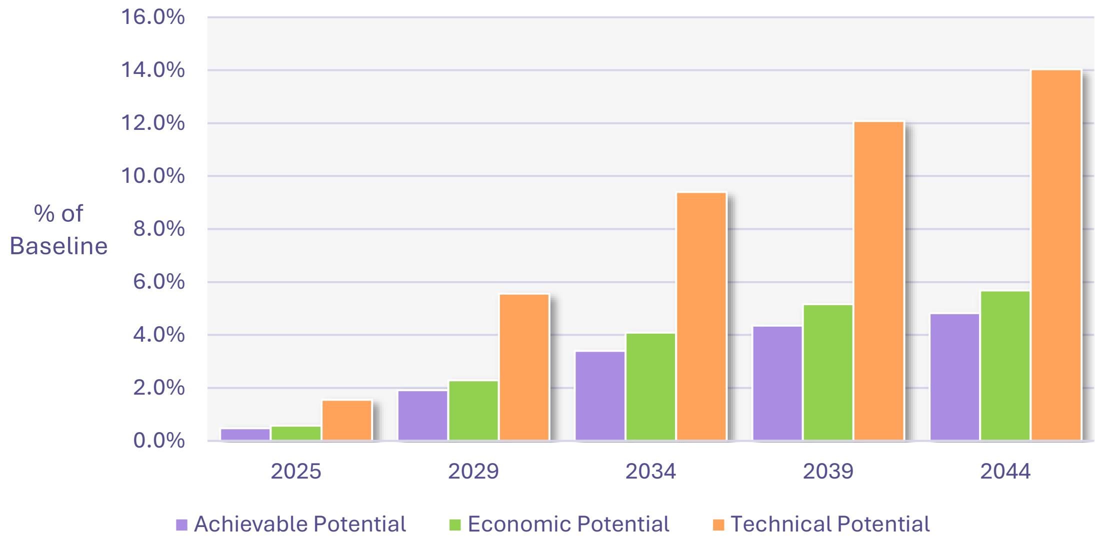


Table 5-13 and Figure 5-16 present potential estimates from the perspective of summer peak savings. In 2025, the first year of the potential forecast, achievable savings are 3 MW of the baseline projection or 0.5% of the baseline projection. By 2044, savings have increased to 33 MW of the baseline summer peak projection or 4.8% of the baseline projection.

Table 5-13 Industrial EE Potential (Summer Peak Demand, MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	569	610	628	646	679
Cumulative Savings (MW)					
Achievable Potential	3	12	21	28	33
Economic Potential	3	14	26	33	39
Technical Potential	9	34	59	78	95
Cumulative Savings as a % of Baseline					
Achievable Potential	0.5%	1.9%	3.4%	4.4%	4.8%
Economic Potential	0.6%	2.3%	4.1%	5.2%	5.7%
Technical Potential	1.6%	5.6%	9.4%	12.1%	14.0%

Figure 5-16 Industrial EE Savings as a % of the Summer Peak Demand Baseline Projection



Industrial Sector Top Measures

Table 5-14 identifies the top 20 industrial measures from the perspective of energy savings in 2034 and 2044. The top measures are Linear and High Bay Lighting, followed by Refrigeration System Optimization and Upgrades, Compressed Air System Optimization, and Fan System Controls.

Table 5-14 Industrial Top Measures in 2034 and 2044 (Energy, MWh)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Linear Lighting	52,200	82,422	22.8%
2	High-Bay Lighting	22,592	42,682	11.8%
3	Refrigeration - System Optimization	31,531	39,055	10.8%
4	Refrigeration - System Upgrade	20,489	25,079	6.9%
5	Compressed Air - End Use Optimization	18,887	19,467	5.4%
6	Fan System - Controls	16,567	19,447	5.4%
7	Advanced Industrial Motors	13,446	15,906	4.4%
8	Fan System - Equipment Upgrade	12,925	15,440	4.3%
9	Municipal Sewage Treatment - Optimization	7,186	15,255	4.2%
10	Pumping System - System Optimization	11,367	13,411	3.7%
11	Refrigeration - System Maintenance	10,176	12,498	3.5%
12	Compressed Air - Zero-Loss Condensate Drain	9,035	9,289	2.6%
13	RTU	1,948	8,424	2.3%
14	Fan System - Flow Optimization	5,492	6,409	1.8%
15	Municipal Water Supply Treatment - Optimization	5,683	5,732	1.6%
16	Connected Thermostat - ENERGY STAR (1.0)	4,262	4,509	1.2%
17	General Service Lighting	3,105	4,200	1.2%
18	Pumping System - Equipment Upgrade	3,129	3,888	1.1%
19	Motors - Green Rewind (<100 HP)	2,306	2,674	0.7%
20	Compressed Air - Dryer Optimization and Replacement	2,396	2,468	0.7%
	Total of Top 20 Measures	**254,721**	**348,258**	**96.4%**

Figure 5-17 presents forecasts of energy savings by end use as a percent of total savings per year and cumulative savings. Motor-related measures account for a substantial portion of the savings throughout the forecast horizon. The share of savings for interior lighting and process end use increases over the study period, while the share of exterior lighting and motors by end use declines as the market potential for those measures become saturated.

Figure 5-17 Industrial Achievable EE Savings Forecast by End Use (Cumulative Energy, MWh)

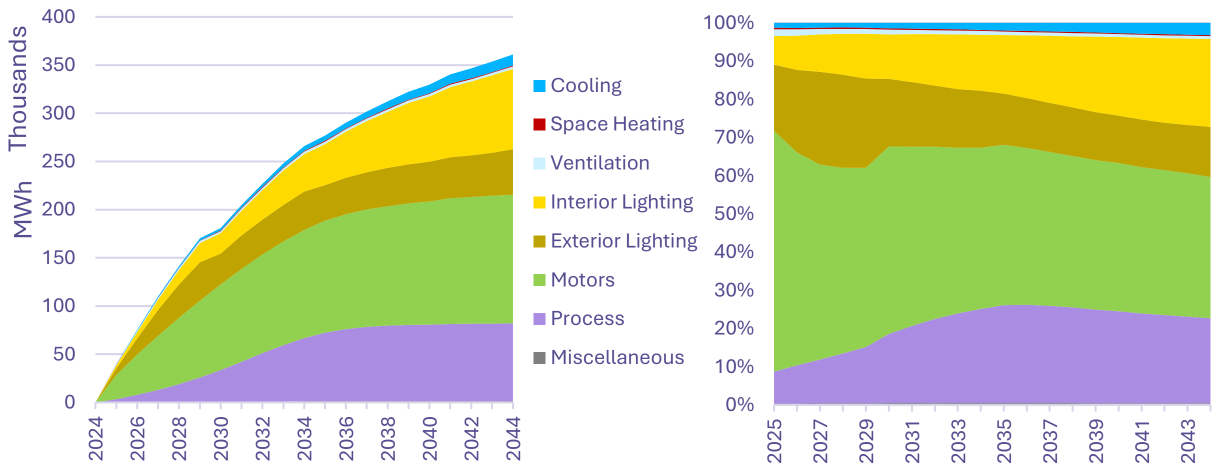


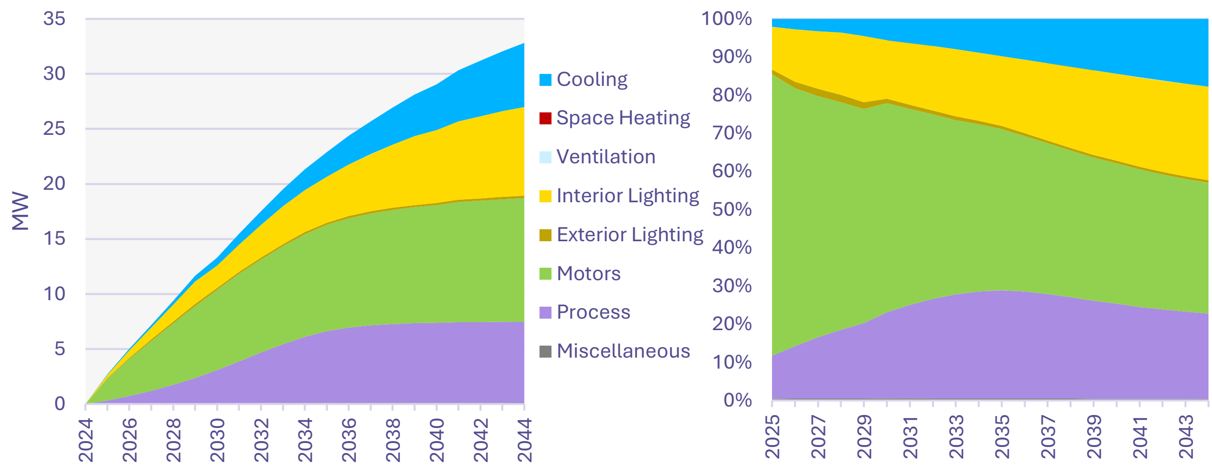
Table 5-15 identifies the top 20 Industrial measures from the perspective of summer peak savings in 2034 and 2044. The top measure, Roof Top AC units, accounts for 15.1% of the cumulative peak savings in 2044. Linear and High-Bay Lighting, and Refrigeration control measures also provide significant summer peak savings.

Table 5-15 Industrial Top Measure in 2034 and 2044 (Summer Peak Demand, MW)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	RTU	1.1	5.0	15.1%
2	High-Bay Lighting	2.3	4.4	13.5%
3	Linear Lighting	1.6	3.7	11.4%
4	Refrigeration - System Optimization	2.9	3.6	10.9%
5	Refrigeration - System Upgrade	1.9	2.3	7.0%
6	Fan System - Controls	1.5	1.8	5.4%
7	Compressed Air - End Use Optimization	1.7	1.7	5.2%
8	Fan System - Equipment Upgrade	1.2	1.4	4.3%
9	Municipal Sewage Treatment - Optimization	0.7	1.4	4.2%
10	Advanced Industrial Motors	1.2	1.4	4.2%
11	Refrigeration - System Maintenance	0.9	1.1	3.5%
12	Pumping System - System Optimization	0.8	1.0	3.0%
13	Compressed Air - Zero-Loss Condensate Drain	0.8	0.8	2.5%
14	Ventilation - Demand Controlled	0.7	0.7	2.3%
15	Fan System - Flow Optimization	0.5	0.6	1.8%
16	Pumping System - Equipment Upgrade	0.2	0.3	0.9%
17	Motors - Green Rewind (<100 HP)	0.2	0.2	0.7%
18	Compressed Air - Dryer Optimization and Replacement	0.2	0.2	0.7%
19	Electronics - Exhaust Injection	0.2	0.2	0.6%
20	Compressed Air - System Controls	0.2	0.2	0.6%
	Total of Top 20 Measures	**20.7**	**32.0**	**97.7%**

Figure 5-18 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Lighting, motors, and process all contribute to the savings throughout the forecast horizon.

Figure 5-18 Industrial Achievable EE Savings Forecast by End Use (Summer Peak Demand, MW)



Irrigation EE Potential

Table 5-16 and Figure 5-19 present potential estimates at the measure level for the Irrigation sector, from the perspective of cumulative energy savings. Achievable savings in the first year, 2025, are 11 GWh, or 0.6% of the baseline projection. In 2044, savings reach 136 GWh, or 6.1% of the baseline projection.

Table 5-16 Irrigation EE Energy Potential (GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	1,902	1,967	2,052	2,145	2,244
Cumulative Savings (GWh)					
Achievable Potential	11	57	101	126	136
Economic Potential	13	67	119	148	160
Technical Potential	13	68	121	150	163
Cumulative Savings as a % of Baseline					
Achievable Potential	0.6%	2.9%	4.9%	5.9%	6.1%
Economic Potential	0.7%	3.4%	5.8%	6.9%	7.1%
Technical Potential	0.7%	3.5%	5.9%	7.0%	7.3%

Figure 5-19 Irrigation Cumulative EE Savings as a % of the Energy Baseline Projection

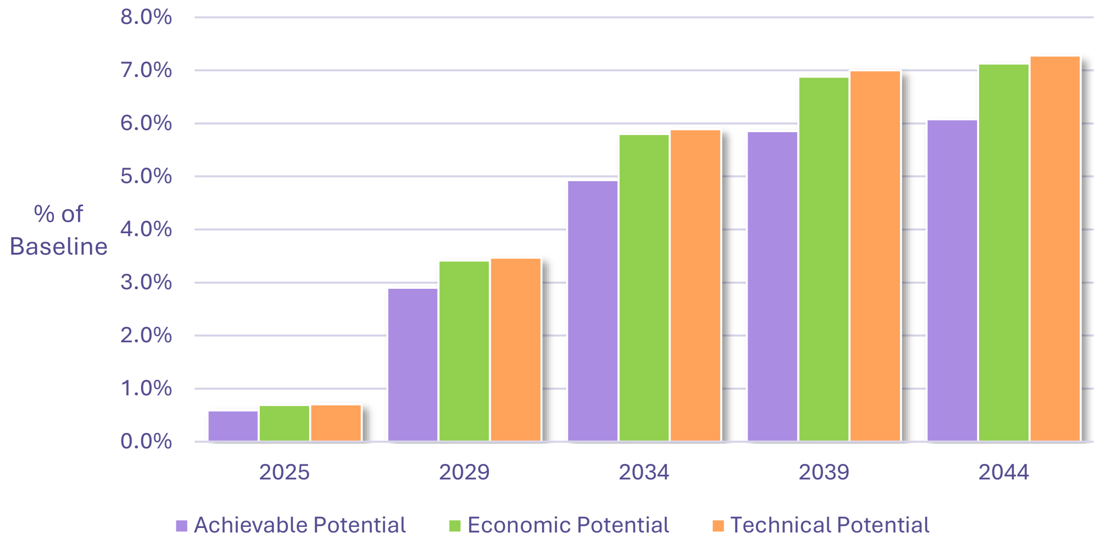
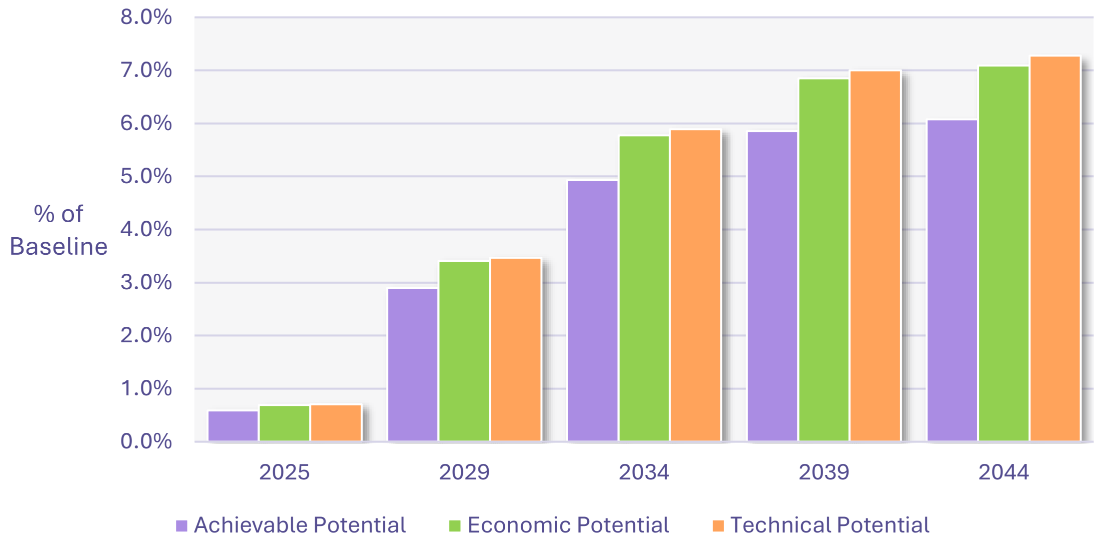


Table 5-17 and Figure 5-20 present potential estimates from the perspective of summer peak savings. In 2025, the first year of the potential forecast, achievable savings are 4 MW or 0.6% of the baseline projection. By 2044, cumulative peak savings have increased to 46 MW or 6.1% of the baseline summer peak projection.

Table 5-17 Irrigation EE Potential (Summer Peak Demand, MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	645	667	696	728	761
Cumulative Savings (MW)					
Achievable Potential	4	19	34	43	46
Economic Potential	4	23	40	50	54
Technical Potential	5	23	41	51	55
Cumulative Savings as a % of Baseline					
Achievable Potential	0.6%	2.9%	4.9%	5.9%	6.1%
Economic Potential	0.7%	3.4%	5.8%	6.8%	7.1%
Technical Potential	0.7%	3.5%	5.9%	7.0%	7.3%

Figure 5-20 Irrigation EE Savings as a % of the Summer Peak Demand Baseline Projection



Irrigation Sector Top Measures

Table 5-18 identifies the top Irrigation measures from the perspective of energy savings in 2034 and 2044. The top measure is Variable Frequency Drives for motors, which accounts for 37% cumulative savings in 2044. The next two measures in ranking are a pump replacements and Center pivot/Linear sprinkler replacements.

Table 5-18 Irrigation Top Measures in 2034 and 2044 (Energy, MWh)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Motors - Variable Frequency Drive	45,173	51,036	37.4%
2	Pump Equipment Upgrade (<100 HP)	20,263	22,892	16.8%
3	Center Pivot/Linear - MESA	8,628	15,795	11.6%
4	Center Pivot/Linear - LESA/LEPA/MDI	5,649	10,376	7.6%
5	Center Pivot/Linear - MESA to LESA/LEPA/MDI	2,770	8,315	6.1%
6	Center Pivot/Linear - High Pressure to LESA/LEPA/MDI	4,055	7,095	5.2%
7	Pump Equipment Upgrade (100 HP+)	5,033	5,688	4.2%
8	Center Pivot/Linear - High Pressure to MESA	3,427	4,027	3.0%
9	Wheel/Hand - Nozzle Replacement	1,970	3,661	2.7%
10	Center Pivot/Linear - High Pressure	1,726	3,173	2.3%
	Total of Top 10 Measures	**96,967**	**128,884**	**94.5%**

Table 5-19 identifies the top Irrigation measures from the perspective of summer peak savings in 2034 and 2044. The list of top measures is very similar to the top measures for energy savings. Over half the peak savings come from a Variable Frequency Drives and Pump Replacements.

Table 5-19 Irrigation Top Measure in 2034 and 2044 (Summer Peak Demand, MW)

Rank	Measure	Cumulative Achievable Potential in 2034	Cumulative Achievable Potential in 2044	% of Total in 2044
1	Motors - Variable Frequency Drive	15.3	17.3	37.4%
2	Pump Equipment Upgrade (<100 HP)	6.9	7.8	16.8%
3	Center Pivot/Linear - MESA	2.9	5.4	11.6%
4	Center Pivot/Linear - LESA/LEPA/MDI	1.9	3.5	7.6%
5	Center Pivot/Linear - MESA to LESA/LEPA/MDI	0.9	2.8	6.1%
6	Center Pivot/Linear - High Pressure to LESA/LEPA/MDI	1.4	2.4	5.2%
7	Pump Equipment Upgrade (100 HP+)	1.7	1.9	4.2%
8	Center Pivot/Linear - High Pressure to MESA	1.2	1.4	3.0%
9	Wheel/Hand - Nozzle Replacement	0.7	1.2	2.7%
10	Center Pivot/Linear - High Pressure	0.6	1.1	2.3%
	Total of Top 10 Measures	**33.5**	**44.8**	**96.9%**

A | Technical Achievable Potential

This Appendix presents the Technical and Technical Achievable energy efficiency potential for Idaho Power. This includes every possible measure that is considered in the measure list, regardless of program implementation concerns or cost-effectiveness. The energy savings in GWh and the summer peak demand savings are presented in MW from energy efficiency measures. Year-by-year savings for energy and peak demand (summer and winter) are available in the LoadMAP model, which was provided to Idaho Power at the conclusion of the study.

A summary of cumulative energy and summer peak demand savings across all four sectors is provided, then details for each sector are shown. Please note that all savings are provided at the customer meter.

Technical Achievable Potential

To develop estimates for technical achievable potential, we constrain the technical potential by applying market adoption rates for each measure that estimate the percentage of customers who would be likely to select each measure, given consumer preferences (partially a function of incentive levels), retail energy rates, imperfect information, and real market barriers and conditions. These barriers tend to vary, depending on the customer sector, local energy market conditions, and other, hard-to-quantify factors. In addition to utility-sponsored programs, alternative acquisition methods, such as improved codes and standards and market transformation, can be used to capture portions of these resources, and are included within the technical achievable potential, per The Council's Seventh Power Plan methodology. This proves particularly relevant in the context of long-term DSM resource acquisition plans, where incentives might be necessary in earlier years to motivate acceptance and installations. As acceptance increases, so would demand for energy efficient products and services, likely leading to lower costs, and thereby obviating the need for incentives and (ultimately) preparing for transitions to codes and standards.

These market adoption rates are based on ramp rates from The Council's Seventh Power Plan. As discussed below, two types of ramp rates (lost opportunity and retrofit) have been incorporated for all measures and market regions.

Estimated technical achievable potential principally serves as a planning guideline since the measures have not yet been screened for cost-effectiveness, which is assessed within IPC's IRP modeling.

Levelized Cost of Measures

Although Technical Achievable Potential was not screened for cost-effectiveness, a levelized cost of energy ($/MWh) was calculated for each measure following the supply curve development process for The Council's Seventh Power Plan. This metric serves as an indicator for cost-effectiveness where all costs and non-energy impacts for a measure have been levelized over its lifetime. This calculation is guided by principles of the Utility Cost Test (UCT) and is intended to pass the inputs necessary to conduct cost-effectiveness testing within the IRP. Since the benefits of energy conservation are not monetized as part of this process, the denominator in this case is the first-year MWh saved.

Summary of Technical Achievable EE Potential

Table A-1 summarizes the EE savings in terms of cumulative energy use for all measures for two levels of potential relative to the baseline projection.

- Technical potential reflects the adoption of all EE measures regardless of cost-effectiveness. First-year savings are 394 GWh, or 2.4% of the baseline projection. Cumulative technical savings in 2044 are 4,215 GWh, or 22.6% of the baseline.
- Technical achievable potential represents savings that are possible when considering the availability, knowledge, and acceptance of the measure regardless of cost. The first-year savings in 2025 are 262 GWh, or 1.6% of the baseline projection. By 2044, cumulative technical achievable savings reach 3,078 GWh, or 16.5% of the baseline projection.

Table A-1 Summary of Technical Achievable Potential (Energy, GWh)

	2025	2029	2034	2039	2044
Baseline Projection (GWh)	16,137	16,616	17,289	17,945	18,654
Cumulative Savings (GWh)					
Technical Achievable Potential	262	1,176	2,049	2,648	3,078
Technical Potential	394	1,777	2,976	3,757	4,215
Cumulative Savings as a % of Baseline					
Technical Achievable Potential	1.6%	7.1%	11.9%	14.8%	16.5%
Technical Potential	2.4%	10.7%	17.2%	20.9%	22.6%

Table A-2 summarize the summer peak demand savings from all EE measures for three levels of potential relative to the baseline projection.

- Technical potential for summer peak demand savings is 97 MW in 2025 of the baseline projection. This increases to 1,327 MW by 2044 of the summer peak demand baseline projection.
- Technical achievable potential is estimated at 59 MW in the 2025 summer peak demand baseline projection. In 2044, savings are 880 MW of the summer peak baseline projection.

Table A-2 Summary of EE Potential (Summer Peak, MW)

	2025	2029	2034	2039	2044
Baseline Projection (MW)	3,487	3,611	3,783	3,947	4,069
Cumulative Savings (MW)					
Technical Achievable Potential	59	283	532	723	880
Technical Potential	97	469	843	1,138	1,327
Cumulative Savings as a % of Baseline					
Technical Achievable Potential	1.7%	7.8%	14.1%	18.3%	21.6%
Technical Potential	2.8%	13.0%	22.3%	28.8%	32.6%

Technical Achievable Potential by Sector

Table A-3, Figure A-1 and Figure A-2 summarize the range of electric achievable potential summer peak savings by sector. The commercial sector contributes the most savings throughout the forecast, followed by the residential sector.

Table A-3 Technical Achievable Potential by Sector (Annual Energy and Summer Peak Demand)

	2025	2029	2034	2039	2044
Cumulative Energy Savings (GWh)					
Residential	105	484	901	1,184	1,388
Commercial	74	360	622	816	952
Industrial	72	274	422	519	598
Irrigation	11	58	103	128	140
Total	**262**	**1,176**	**2,049**	**2,648**	**3,078**
Cumulative Summer Peak Demand Savings (MW)					
Residential	34	169	333	467	586
Commercial	15	69	119	152	173
Industrial	7	26	45	60	73
Irrigation	4	20	35	44	47
Total	**59**	**283**	**532**	**723**	**880**

Figure A-1 Technical Achievable Cumulative EE Potential by Sector (Energy, GWh)

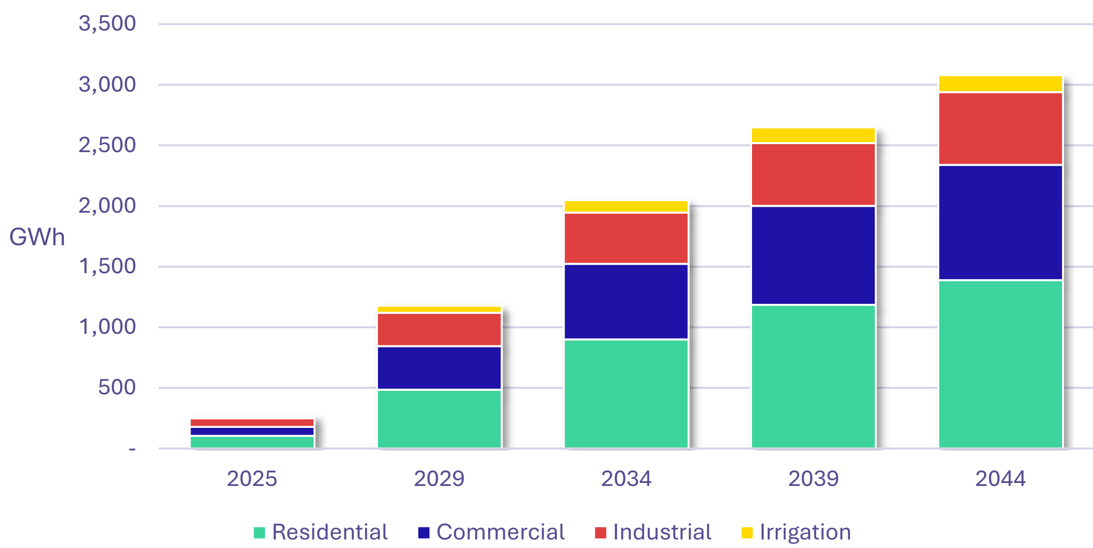
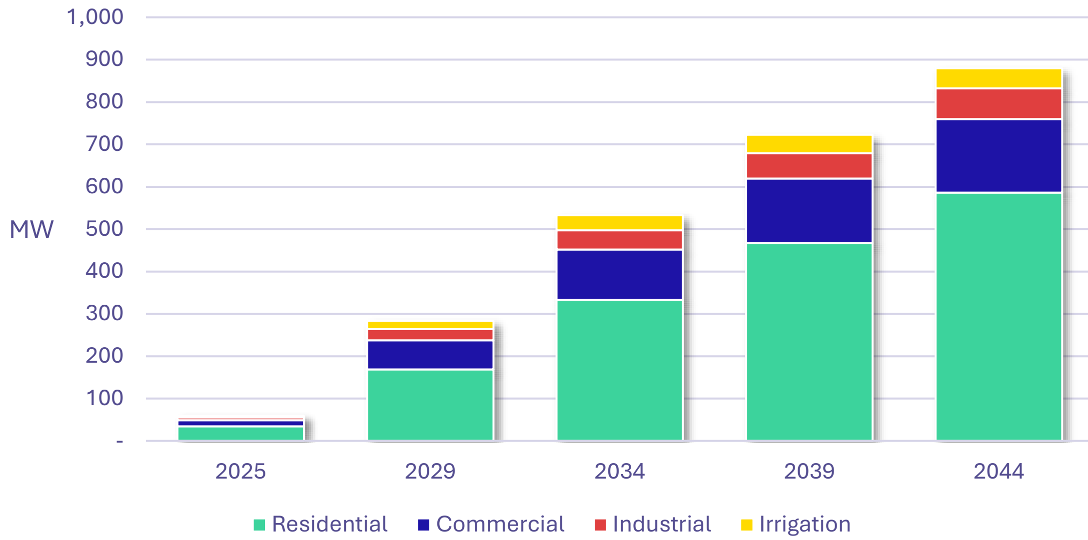


Figure A-2 Technical Achievable EE Potential by Sector (Summer Peak Demand, MW)



Residential Technical Achievable Potential by End Use

Figure A-3 presents forecasts of technical achievable energy savings by end use as a percent of total savings per year and cumulative savings. Lighting savings account for a substantial portion of the savings throughout the forecast horizon, but the share declines over time as the market is transformed. The same is true for exterior lighting. Water heater savings contribute a large portion of savings as a result of increased adoption throughout the forecast horizon. Savings from cooling measures and appliances are steadily increasing throughout the forecast horizon.

Figure A-3 Residential Technical Achievable Savings Forecast (Energy, GWh)

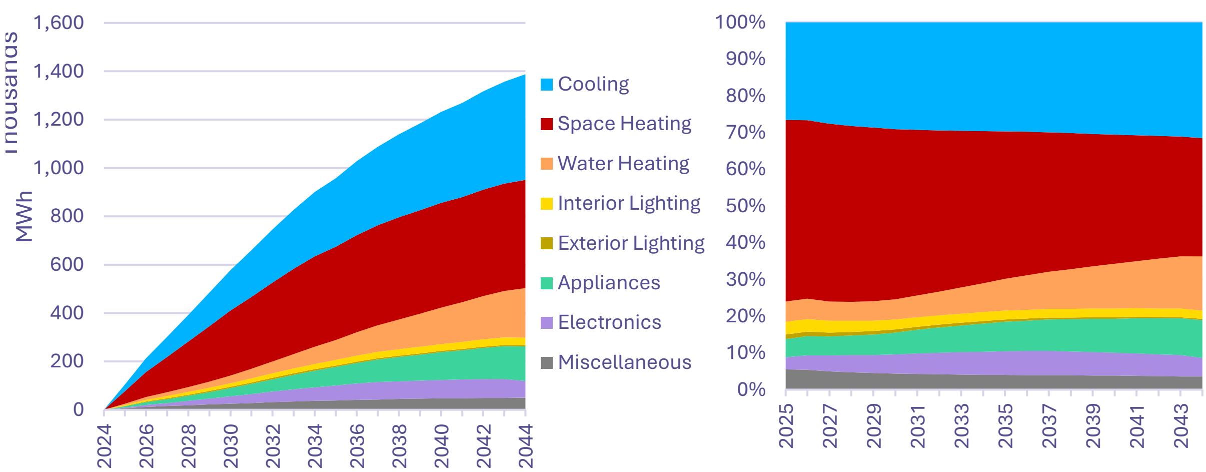
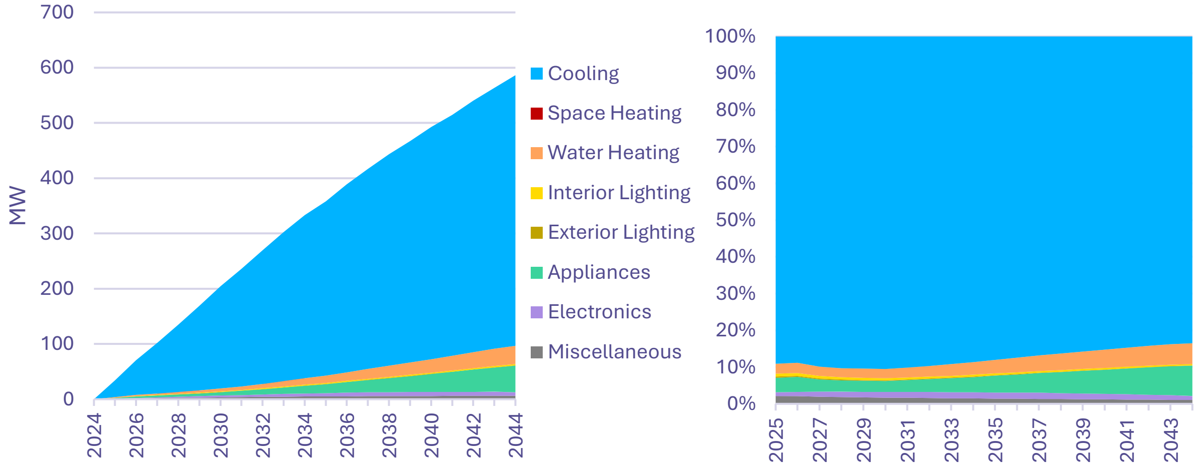


Figure A-4 presents technical achievable savings for summer peak demand by end use. Savings are dominated by cooling, as expected.

Figure A-4 Residential Technical Achievable Savings Forecast (Summer Peak, MW)



Commercial Technical Achievable Potential by End Use

Figure A-5 presents forecasts of energy savings by end use as a percent of total savings per year and cumulative savings. Lighting savings from interior and exterior applications account for a substantial portion of the savings throughout the forecast horizon.

Figure A-5 Commercial Technical Achievable Savings Forecast (Energy, GWh)

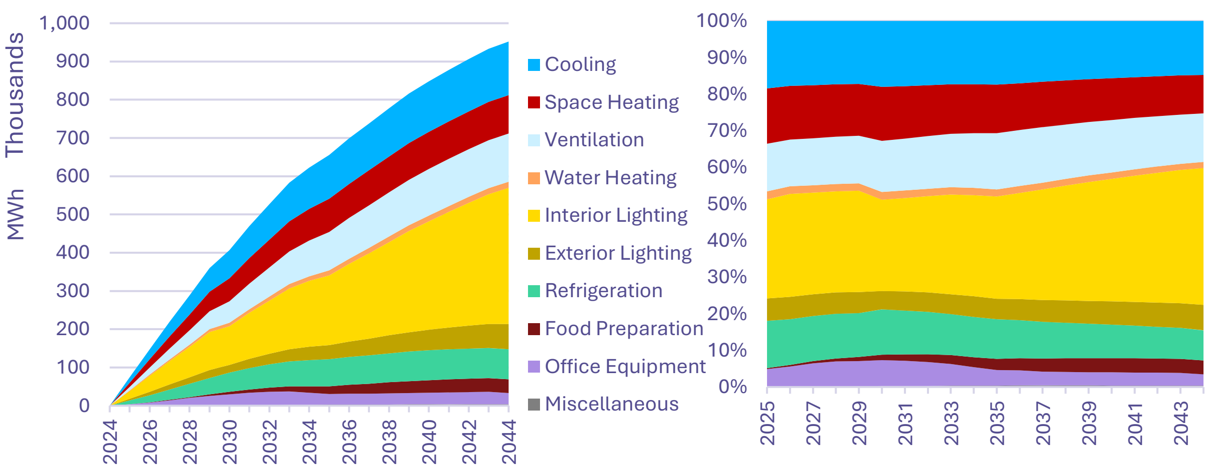
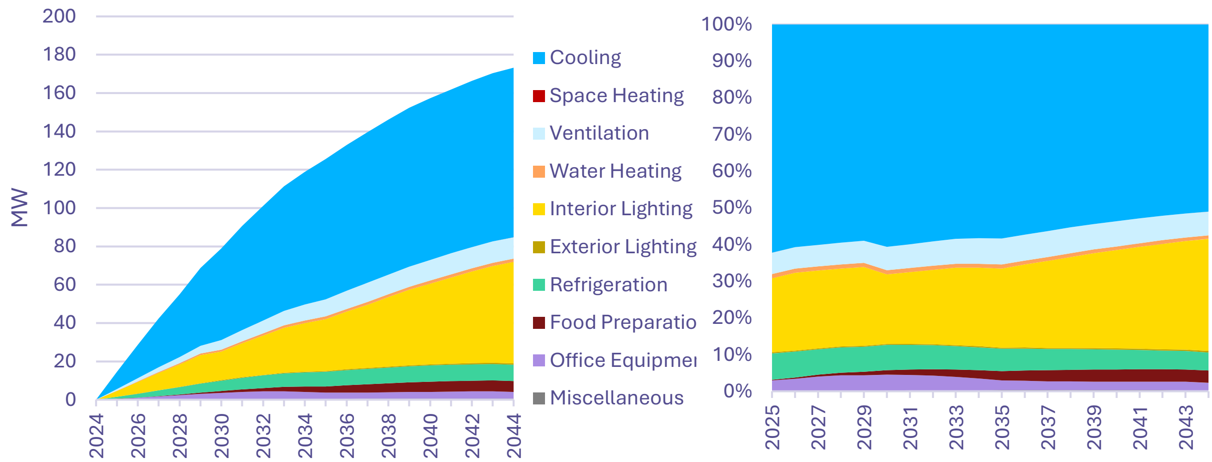


Figure A-6 presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Savings from cooling and lighting-related measures dominate throughout the forecast horizon.

Figure A-6 Commercial Technical Achievable Savings Forecast (Summer Peak, MW)



Industrial Technical Achievable Potential by End Use

Figure A-7 presents forecasts of energy savings by end use as a percent of total savings per year and cumulative savings. Motor-related measures account for a substantial portion of the savings throughout the forecast horizon. The share of savings by end use remains fairly similar throughout the forecast period.

Figure A-7 Industrial Technical Achievable Savings Forecast (Energy, GWh)

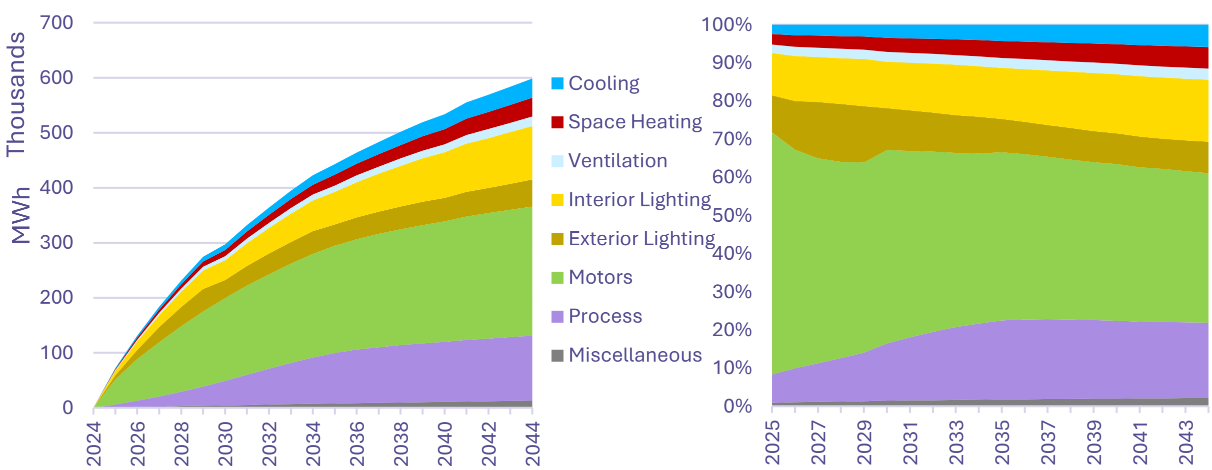
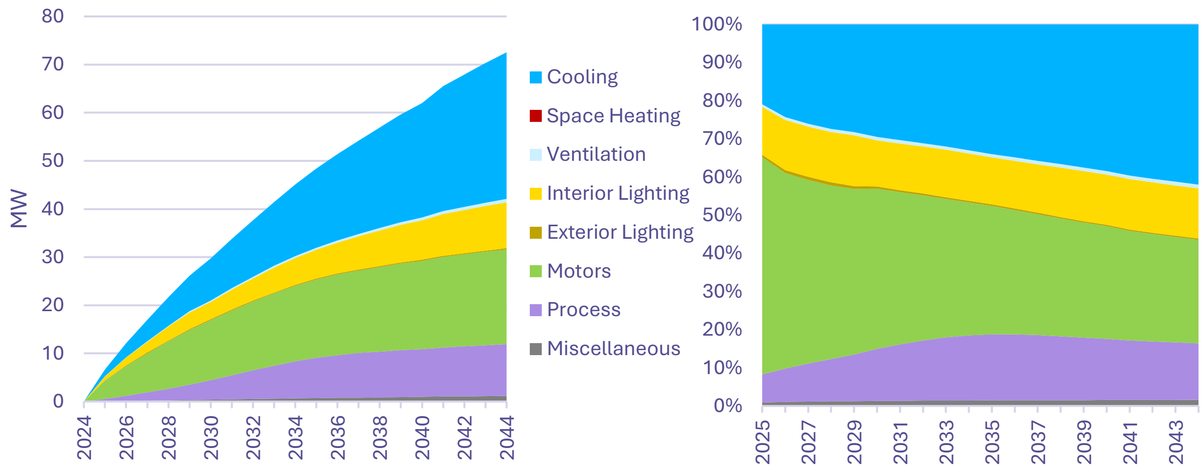


Figure A-8 Industrial Technical Achievable Savings Forecast (Summer Peak, MW) presents forecasts of summer peak savings by end use as a percent of total summer peak savings and cumulative savings. Cooling, lighting, motors, and process all contribute to the savings throughout the forecast horizon.

Figure A-8 Industrial Technical Achievable Savings Forecast (Summer Peak, MW)



B | Market Profiles

The market profiles can be found in the file called *"Appendix B – Idaho Power Market Profiles.xlsx."*

Appendix B - Idaho
Power Market Profil

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