AEG

Achievable Energy Efficiency Potential Assessment



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Date: January 30, 2024
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EXECUTIVE SUMMARY

As part of the 2025 Integrated Resource Plan ("IRP") process and in accordance with the Commission-approved DSM Program Planning Approach, Georgia Power Company (Georgia Power) must complete an updated energy efficiency technical, economic, and achievable potentials study (TEAPot study); this report details the results of the current study.

Georgia Power retained Applied Energy Group (AEG) to assess the energy efficiency potentials in the Georgia Power service area, building on results from the energy efficiency measure screening and technical analyses, which AEG had supported over the preceding months. Southern Company Services provided additional support with the study's modeling analyses.

Definitions of Potential

In this study, AEG developed the savings estimates for three types of potential: technical, economic, and achievable. These estimates are developed at the measure level, and results are provided as annual savings impacts over the 12-year projection horizon presented in this report. The various levels of potential are described below and shown visually in Figure ES-1.

- **Technical Potential** is the theoretical upper limit of efficiency potential, if customers adopt all feasible measures regardless of their cost, customer preference, or other market barriers. At the time of existing equipment failure, customers replace their equipment with the most efficient option available. In new construction, customers and developers also choose the most efficient equipment option.

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

- **Economic Potential** represents the adoption of all cost-effective energy efficiency measures. In this study, measure cost-effectiveness is measured by the Total Resource Cost (TRC) test, which compares lifetime benefits to the incremental cost of the measure. If the benefits equal or outweigh the costs (that is, if the TRC benefit-cost ratio is 1.0 or greater), a given measure is included in the economic potential. Customers are then assumed to purchase the cost-effective option at any decision juncture.

- **Achievable Potential** refines economic potential by applying customer participation rates that account for market barriers, customer awareness and attitudes, program maturity, and recent Georgia Power program history. It represents energy savings that could be achieved through program and policy interventions. This study estimated achievable potential for four intervention scenarios corresponding to varying incentive levels provided to end use consumers:

  - **25% Incentive**. Monetary incentives to customers, equaling 25% of incremental costs of energy efficiency improvements.
  - **50% Incentive.** Monetary incentives to customers, equaling 50% of incremental costs of energy efficiency improvements.
  - **75% Incentive**. Monetary incentives to customers, equaling 75% of incremental costs of energy efficiency improvements.

- **100% Incentive**. Monetary incentives to customers, equaling 100% of incremental costs of energy efficiency improvements.

Figure ES-1 Illustration of Energy Efficiency Potentials



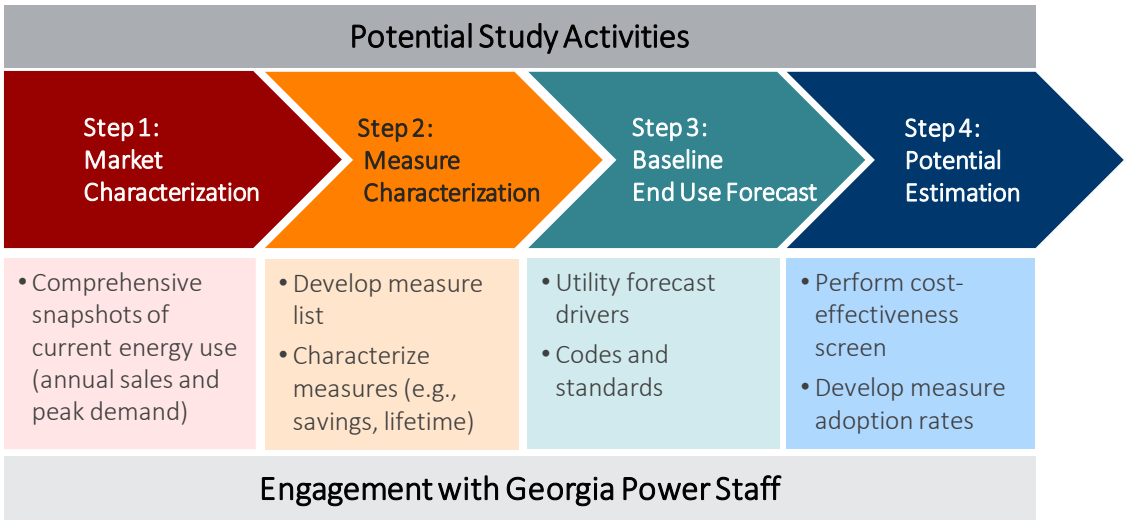
Source: Environmental Protection Agency National Action Plan for Energy Efficiency ("EPA-NAPEE") Guide for Conducting Energy Efficiency Potential Studies; for illustrative purpose only.

Study Approach

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below and illustrated in Figure ES-2. Section 2 of this report describes the analysis steps in additional detail.

1. Performed a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors.
2. Defined and characterized energy efficiency measures to be applied to all sectors, segments, and end uses.
3. Developed baseline end use projections of energy consumption by sector, segment, end use, and technology, calibrated to Georgia Power's forecasted sales.
4. Estimated technical, economic, and achievable potential at the measure level for 2024 through 2035.

Figure ES-2 Analysis Approach



Summary Results

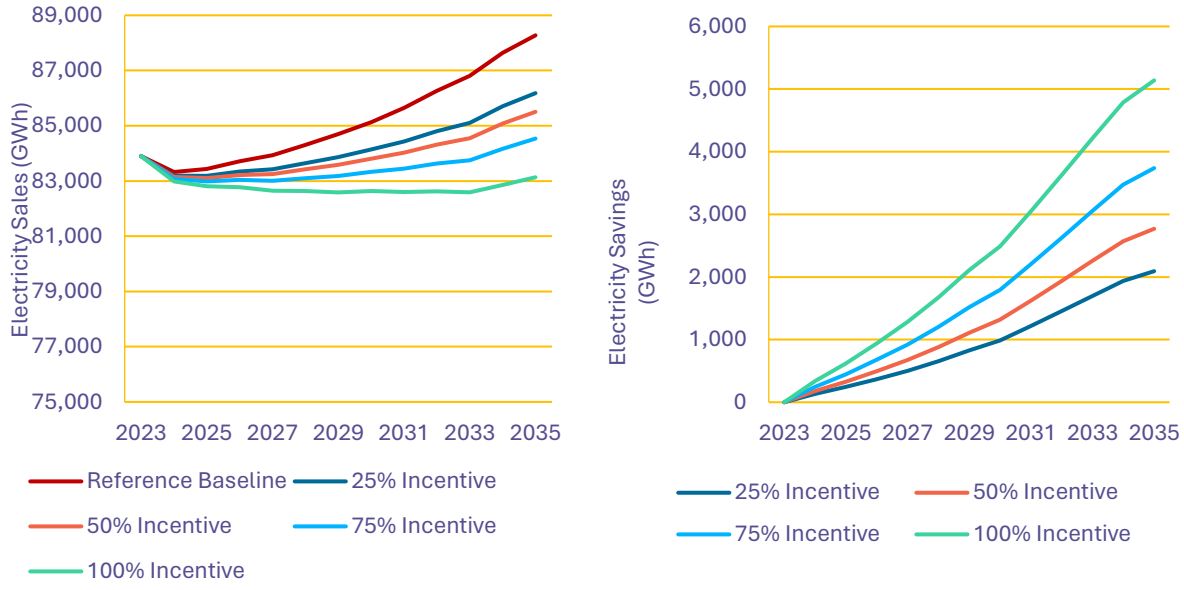
This section provides high-level results of achievable potential; the following section presents detailed results. The assessment period covers 2024-2035, with cumulative results shown below. Across incentive scenarios, achievable potential ranged from 2.4% to 5.8% of 2035 electricity sales and 2.3% to 5.4% of 2035 peak demand.[1] Table ES-1 presents the cumulative achievable potential in 2035 for each incentive scenario in absolute terms and as a percent of Georgia Power's forecasted baseline sales and peak demand.

Table ES-1 Achievable Potential Savings (Cumulative through 2035)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Reduction in Electricity Sales (GWh)	2,093	2.4%	2,770	3.1%	3,738	4.2%	5,138	5.8%
Reduction in Peak Demand (MW)	367	2.3%	476	3.0%	630	4.0%	852	5.4%

Figure ES-3 and Figure ES-4 provide forecasts for electricity and peak demand relative to Georgia Power's baseline forecast[2] based on the achievable potential scenarios over the study horizon.

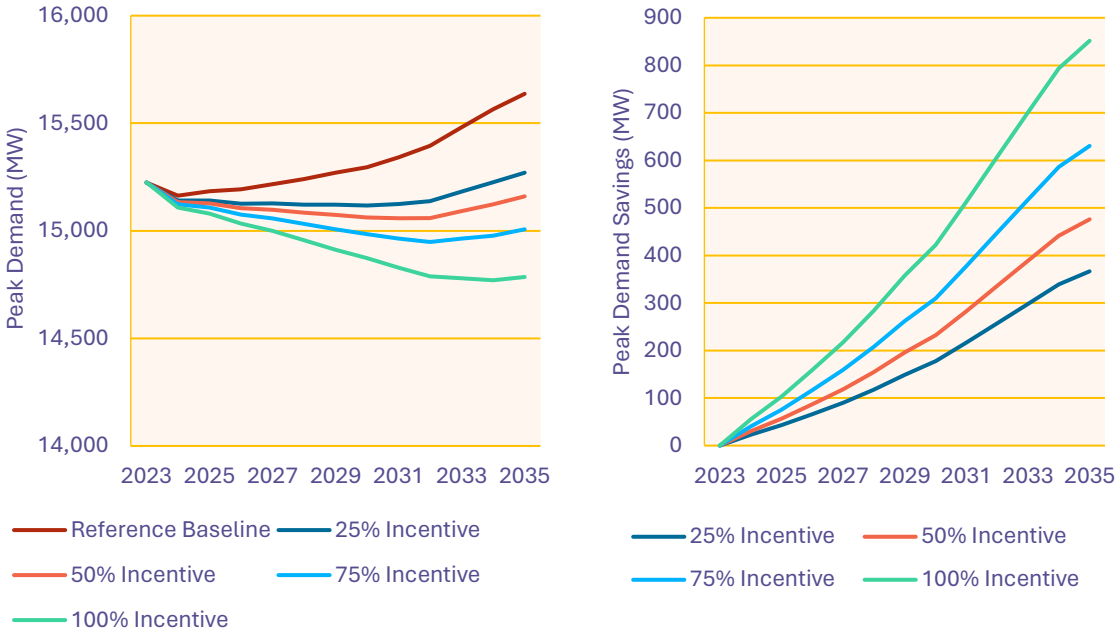
Figure ES-3 Electricity Forecasts for Achievable Potential (Electricity Sales and Electricity Savings)



[1] Electricity sales are defined as electric energy at the customer's meter. Peak Demand is defined as coincident peak at the customer's meter.

[2] Baseline forecast is based on Georgia Power's total retail forecast for Budget 2023.

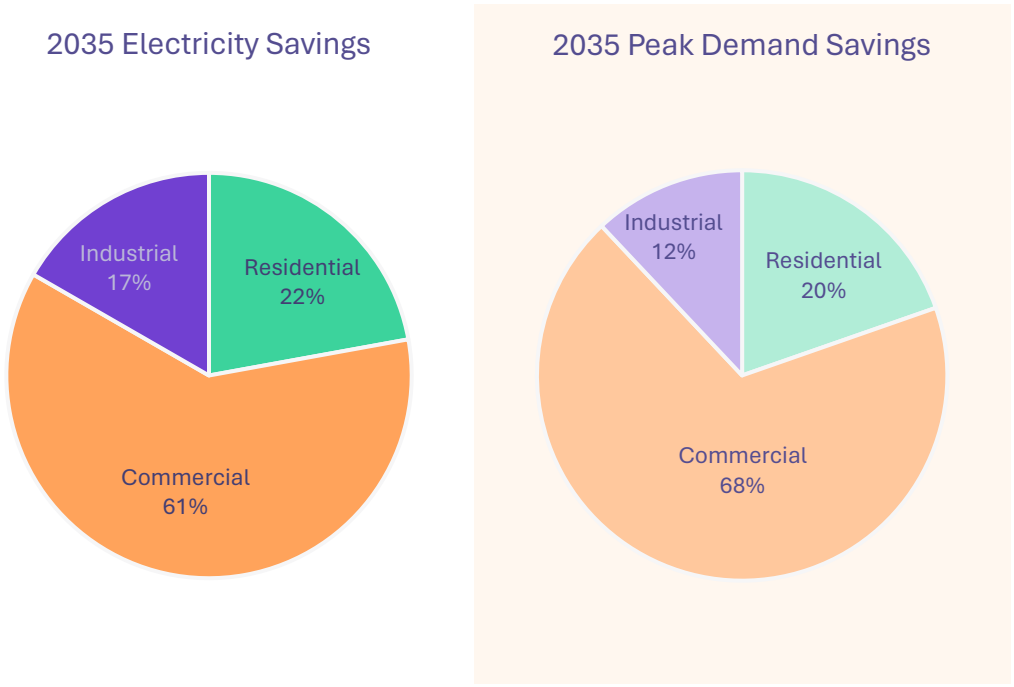
Figure ES-4 Peak Demand Forecasts for Achievable Potential (Peak Demand and Peak Demand Savings)



Achievable Potentials by Sector

Figure ES-5 provides the relative contributions of each sector to the theoretically achievable electricity and peak demand potential in 2035. The commercial sector accounts for the largest share of cumulative electricity savings (61%) and peak demand savings 68%). The residential and industrial sectors account for roughly equal shares of the potential.

Figure ES-5 Cumulative Achievable Potential by Sector (Electricity and Peak Demand[1] Savings)



Achievable Potentials by End Use

Figure ES-6 provides achievable electricity and peak demand potential in 2035 by residential end use, while Figure ES-7 and Figure ES-8 provide the commercial and industrial end use results, respectively.

Figure ES-6 Cumulative Achievable Potential by Residential End Use (Electricity and Peak Demand)[1]

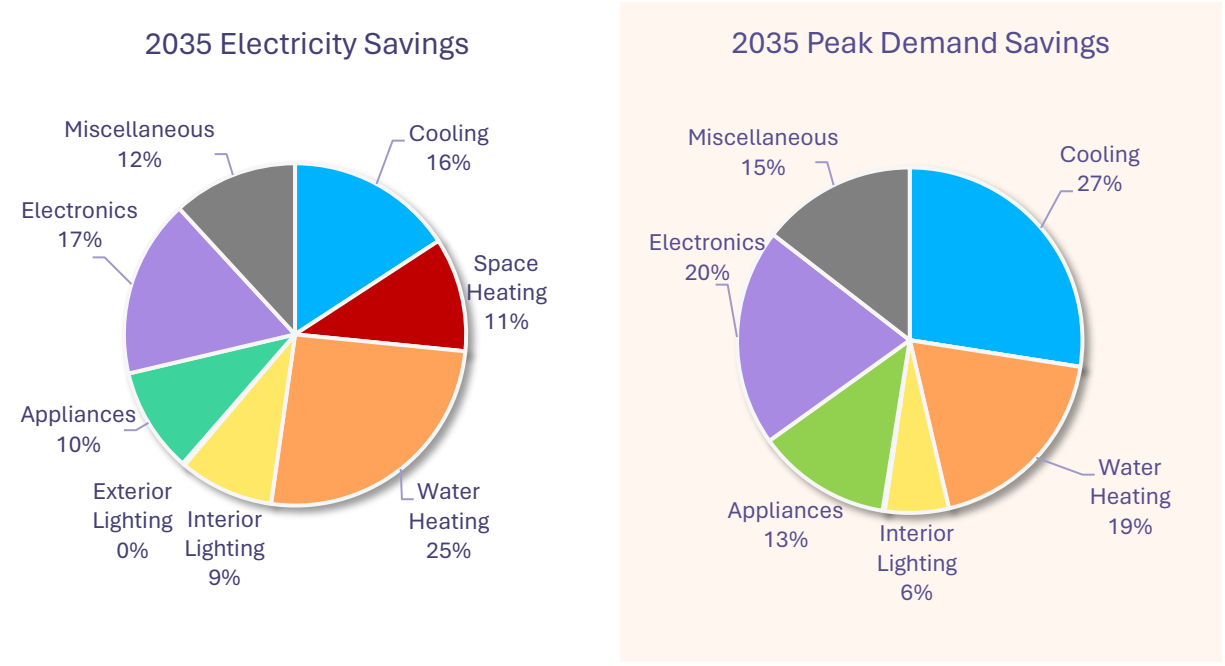


Figure ES-7 Cumulative Achievable Potential by Commercial End Use (Electricity and Peak Demand)

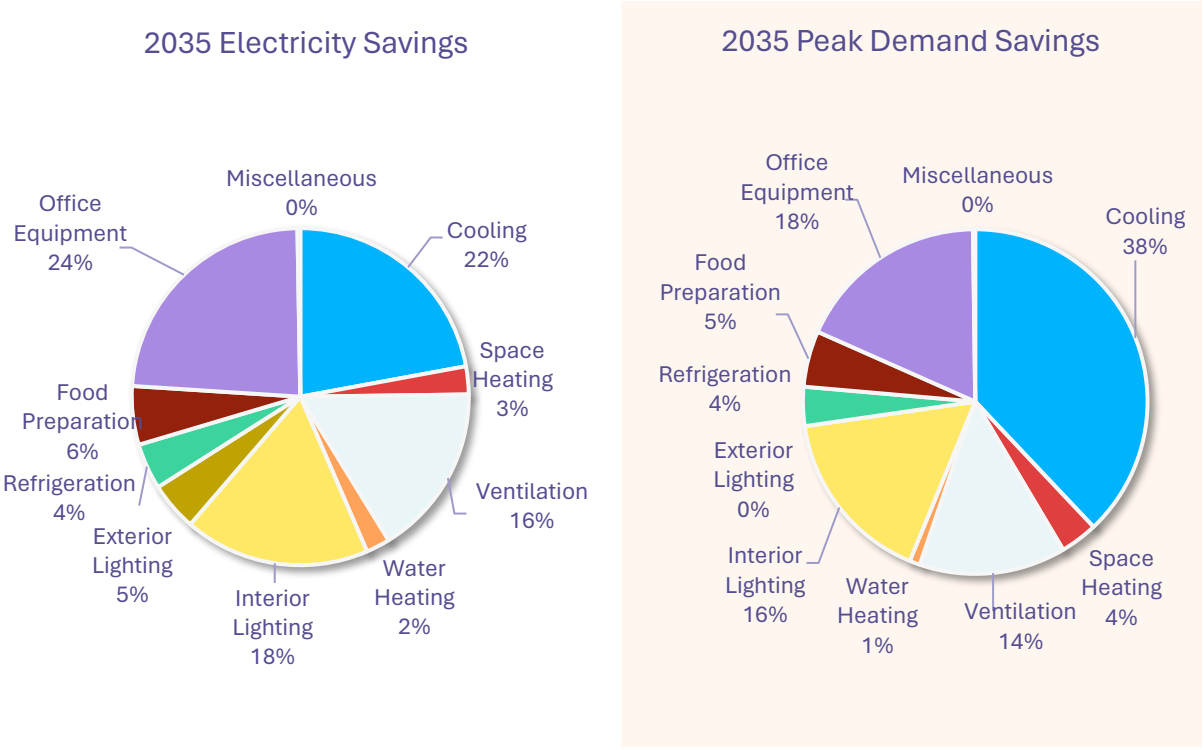
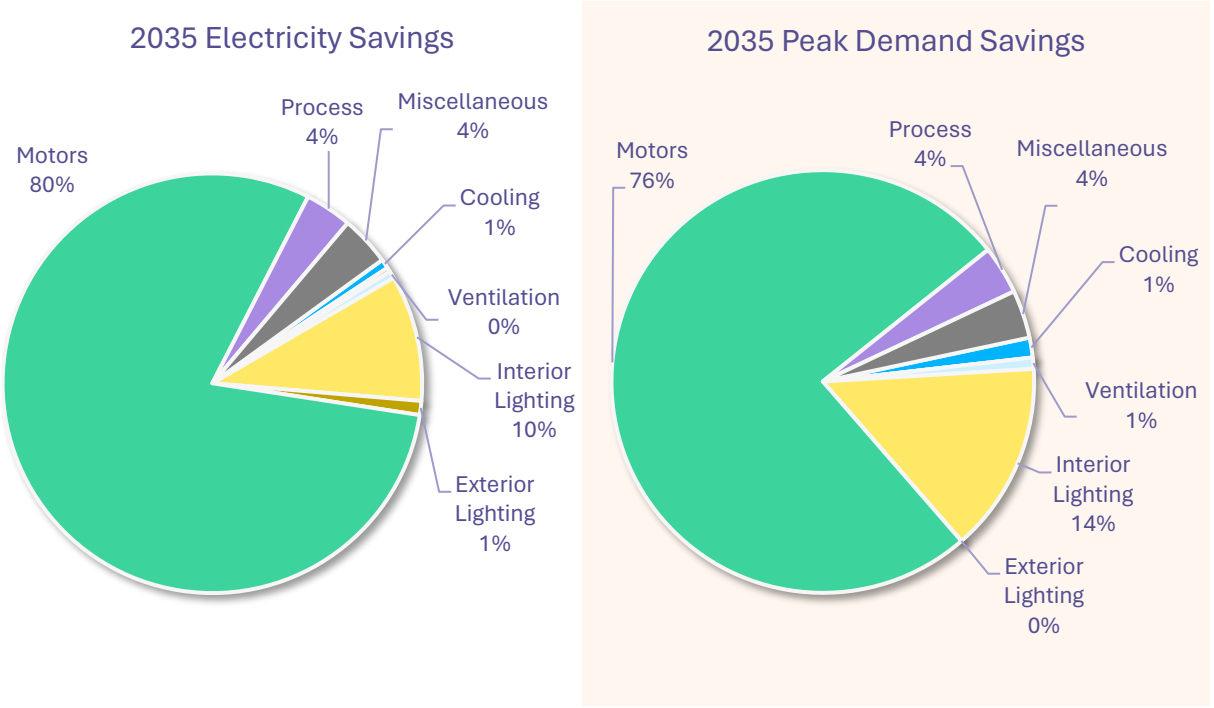


Figure ES-8 Cumulative Achievable Potential by Industrial End Use (Electricity and Peak Demand)



Achievable Potential Cost-Effectiveness

The following tables present estimated cost-effectiveness indicators from TRC, Ratepayer Impact Measure (RIM), Participant Cost Test (PCT) and Program Administrator Cost Test (PAC) perspectives, respectively, for each scenario of achievable energy efficiency impacts from 2024 through 2035. Refer to Appendix B for a detailed description of the methods used for calculating TRC, RIM, PCT, and PAC benefits and costs. As shown, the analysis estimates that TRC net benefits of between $752 million and $2.0 billion can be achieved, at a RIM net cost between $4.7 and $11.0 billion to electric customers. The RIM net cost indicates the amount electricity rates would have to increase due to energy efficiency—over and above rate increases ordinarily expected. PCT net benefits of between $5.5 and $13.0 billion are available to participants and PAC net benefits are between $732 and $952 million.

Table ES-2 Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2035)

	TRC		RIM		PCT		PAC	
Achievable Scenario	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost
25% Incentive	$752	2.05	($4,715)	0.19	$5,467	12.29	$732	3.06
50% Incentive	$1,019	2.08	($6,114)	0.19	$7,133	12.31	$821	2.30
75% Incentive	$1,409	2.10	($8,093)	0.20	$9,502	12.25	$904	1.85
100% Incentive	$1,986	2.11	($10,971)	0.20	$12,957	12.15	$952	1.53

Table ES-3 illustrates estimated program incentive and administrative costs for the four scenarios.

Table ES-3 Energy Efficiency Program Expenditures (Cumulative NPV through 2035)

Achievable Scenario	Net Participant Costs (Millions)	Program Incentives (Millions)	Program Administration[3] (Millions)
25% Incentive	$363	$121	$234
50% Incentive	$315	$315	$315
75% Incentive	$211	$634	$436
100% Incentive	$0	$1,162	$621

Conclusions

This assessment identifies the potential for future energy efficiency investments by Georgia Power customers above the levels that would naturally occur. These results could be useful in targeting energy efficiency program planning efforts to sectors and end uses with the highest market potential.

Participating customers can reduce their energy consumption and peak power requirements by implementing energy efficiency measures or actions, receiving economic benefits directly through reductions in their energy bills. Customers who participate could also benefit from financial incentives offered by programs intended to accelerate markets for the purchase and installation of high-efficiency measures. At the same time, rates will rise for all customers. Non-participating customers will pay higher bills, in effect, subsidizing the costs of incentives and other program costs to the benefit of program participants.

As in the previous assessment, this study examines scenarios of theoretically achievable energy efficiency potential associated with utility interventions at 25%, 50%, 75% and 100% of incremental measure costs.

Economic benefits include:

- Potential electric energy savings ranging from 2.4% of year 2035 forecast sales under a 25% Incentive Scenario to 5.8% under a 100% incentive scenario from all three customer classes.
- TRC benefits from energy efficiency improvements could range from $752 million to $2.0 billion.
- Cumulative program incentives for energy efficiency ranging from $121 million to $1.2 billion by 2035.
- Net participant benefits range from $5.5 billion to $13.0 billion.

However, these benefits come at substantial costs to customers where net costs to those customers range from $4.7 billion to $11.0 billion, over and above those associated with supply-side costs.

In addition, this study provides valuable guidance for program design. While the study provides estimates of annual savings for hundreds of individual measures, the results should be taken with a measure of discretion. This is because the results come from a model and AEG expects variation in actual real-world outcomes. In order to address the potential for such variation, Georgia Power has the opportunity to make appropriate adjustments from the specific annual values developed in the TEAPot study as it designs programs and identifies annual program targets.

[3] The study did not attempt to develop specific program offerings, which can have a range of non-incentive costs depending on the program goals and delivery structure. For the purposes of this study, non-incentive program cost assumptions were developed at the sector level based on AEG research.

As a result of this study, Georgia Power is able to revisit current customer electricity use patterns and existing programs with an eye toward developing the program portfolio for the 2025 IRP filing. This provides Georgia Power with the opportunity to refine existing programs and develop new programs using a solid analytical and data-driven foundation.

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1 | STUDY APPROACH

This report presents findings from the electric energy efficiency technical, economic, and achievable potentials study, supporting Georgia Power's 2025 IRP filing. The report covers 2024-2035, encompassing the residential, commercial, and industrial sectors.

Background

As part of the 2025 IRP process and in accordance with the Commission-approved DSM Program Planning Approach, Georgia Power must complete an updated energy efficiency technical, economic, and achievable potentials study.

In 2023, Georgia Power Company (Georgia Power) contracted with Applied Energy Group (AEG) to perform a comprehensive demand-side management (DSM) market potential study (MPS). This study is an integral part of Georgia Power's program planning process.

Objectives

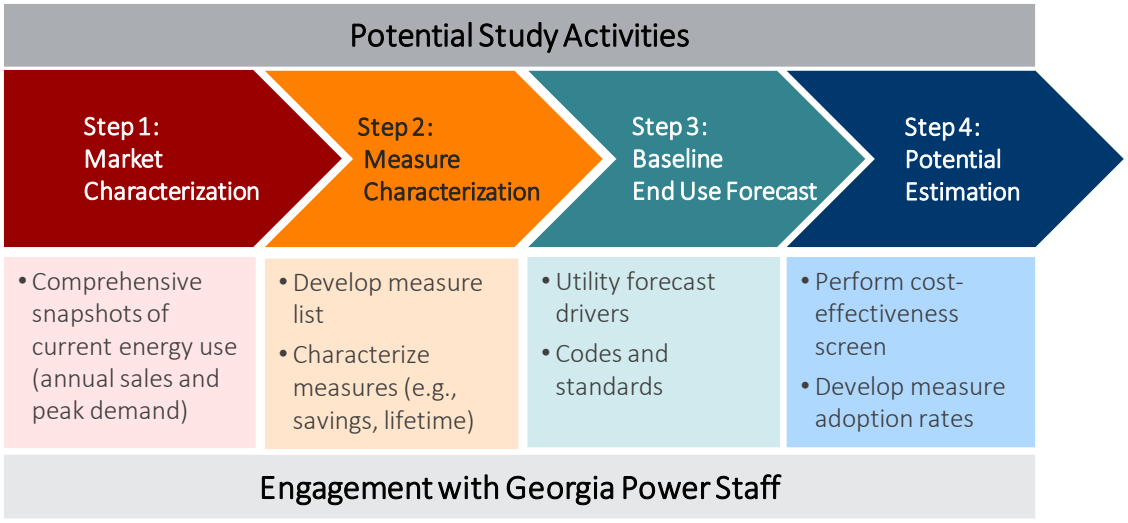
The primary objectives of this study are to provide projections of the estimated technical, economic, and achievable potential for various incentive levels based on defined criteria (e.g., incentive level as a percent of incremental cost) for the residential, commercial, and industrial sectors.

Overview of Analysis Steps

To perform the potential analysis, AEG used a bottom-up approach following the major steps listed below and illustrated in Figure 1-1. These analysis steps are described in more detail in the remainder of this section.

1. Performed a market characterization to describe sector-level electricity use for the residential, commercial, and industrial sectors.
2. Defined and characterized energy efficiency measures to be applied to all sectors, segments, and end uses.
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Figure 1-1 Analysis Approach



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Figure 1-2 Illustration of Energy Efficiency Potentials



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LoadMAP Model

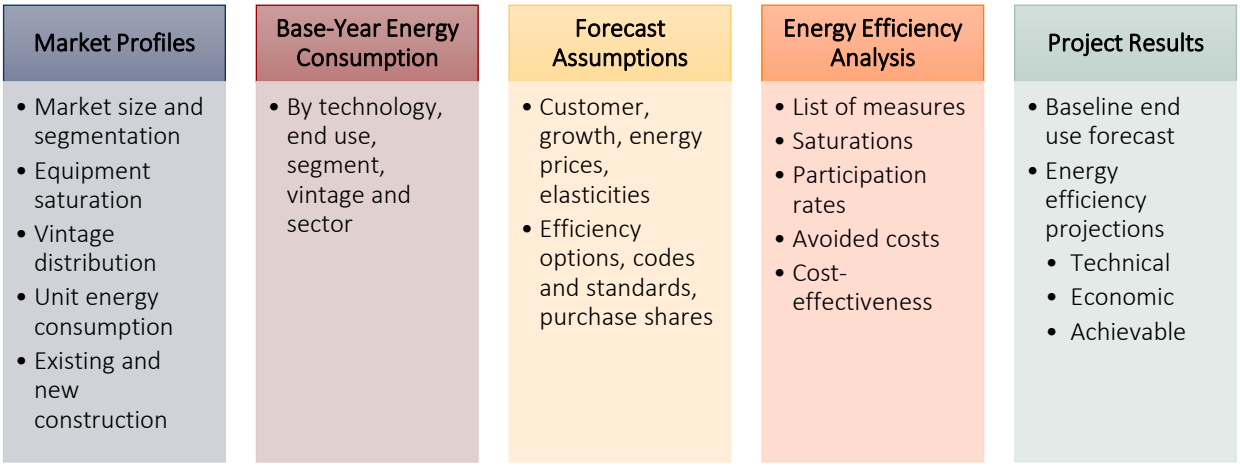
To develop the baseline end use forecast and to perform the energy efficiency potential analysis, AEG utilized its Load Management Analysis and Planning (LoadMAP) tool. AEG developed LoadMAP in 2007 and has enhanced it over time, using it for more than 80 utility-specific forecasting and potential studies. Built in Microsoft Excel, the LoadMAP framework 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.
- 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.

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 1-3 LoadMAP Analysis Framework



Southern Company and Georgia Power have been using LoadMAP since 2014 to prepare long-term end use forecasts. AEG used the end use forecast from Budget 2023 as the starting point for this study.

Market Characterization

The first step in the analysis approach is market characterization. In order to estimate the savings potential from energy-efficient measures, it is necessary to understand the equipment that was being used in a recent base year and its associated energy consumption. AEG began with the LoadMAP models for Georgia Power from Budget 2023 and then performed the steps described below.

Segmentation for Modeling Purposes

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

Table 1-1 Overview of Analysis Segmentation Scheme

Dimension	Segmentation Variable	Description
1	Sector	Residential, commercial, industrial
2	Customer Category	Residential: single family, multifamily, and manufactured home in low, low-moderate, and market rate income categories Commercial: by building type Industrial: by industry type
3	Vintage	Existing and new construction
4	End uses	Cooling, space heating, lighting, water heating, motors, etc. (as appropriate by sector)
5	Appliances/end uses and technologies	Technologies such as lamp and fixture type, air conditioning equipment type, motors by application, etc.
6	Equipment efficiency for new purchases	Baseline and higher-efficiency options as appropriate for each technology

Residential.Income_Based.Segmentation

In previous TEAPot studies, residential customers were segmented solely based on building type (single family, multifamily, and manufactured homes) and construction vintage (new and existing). As an enhancement for this study, AEG added income as an additional segmentation variable to capture differences in energy consumption and energy efficiency opportunities by annual household income range.

To perform this analysis, AEG worked with Georgia Power staff to identify appropriate definitions of low, low-moderate, and market rate incomes based on current program qualifications and other factors. Income groups were defined as follows; corresponding annual household income thresholds by household size are shown in Table 1-2.

- **"Low Income"** is defined as households at or below 200% of the 2023 Federal Poverty Level
- **"Low-Moderate Income"** is defined at households above 200% of the federal poverty level, but below the living wage for Georgia, as defined by the Massachusetts Institute of Technology (MIT)[4]
- **"Market Rate"** is defined as households with annual income above the Georgia living wage

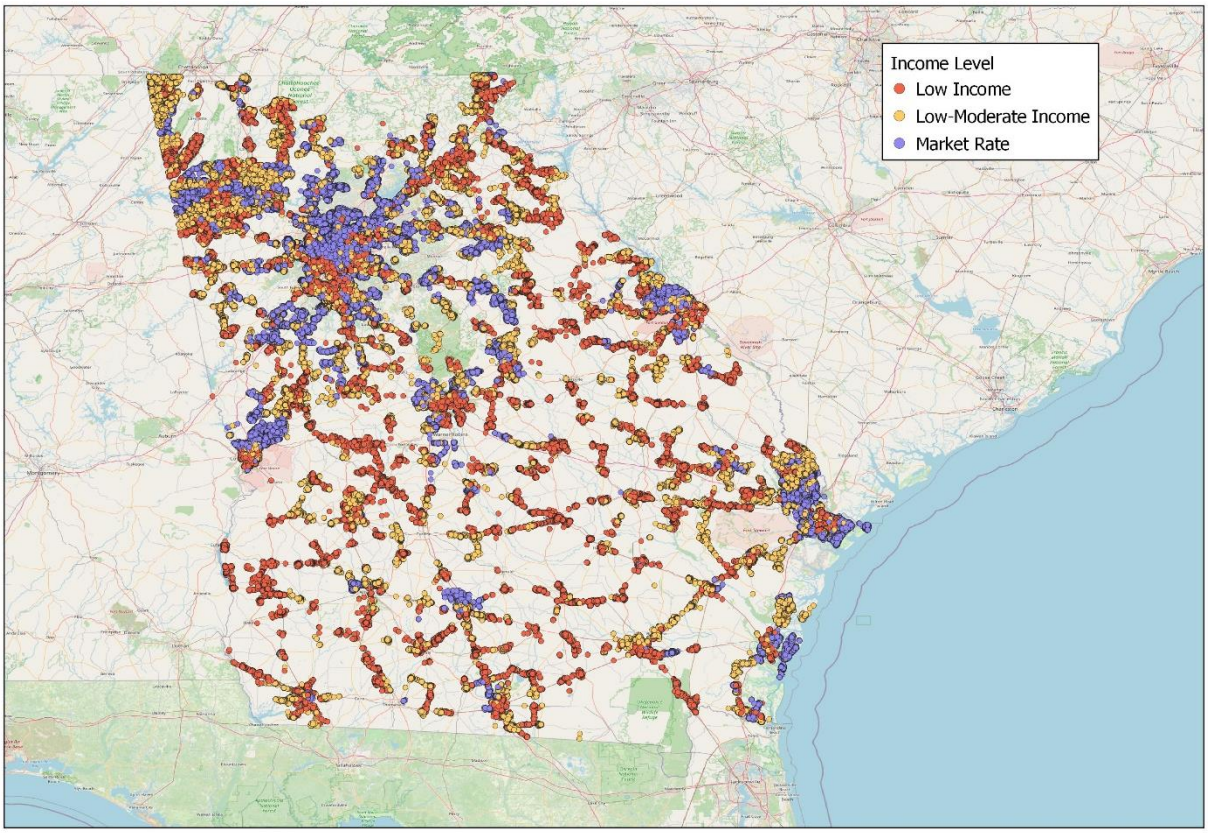
Table 1-2 Residential Income Segmentation Definitions

	Annual Household Income	
Household Size (persons)	Low Income (up to)	Low-Moderate Income (up to)
1	$29,160	$50,000
2	$39,440	$60,000
3	$49,720	$70,000
4	$60,000	$80,000
5	$70,280	$90,000

[4] MIT's living wage calculator for Georgia is available at the following URL: Living Wage Calculator - Living Wage Calculation for Georgia (mit.edu)

After defining the income ranges, AEG used the US Census Bureau's American Community Survey to classify each block group within Georgia Power's service territory based on median household size and annual income. This information was then applied to Georgia Power's residential customer database to identify the likelihood that a customer fell into each income range based on their location. The result of this analysis is shown in Figure 1-4, where each dot on the map represents a Georgia Power residential customer. Note, areas of the map with no dots are areas where Georgia Power either does not provide electricity service or does not serve any residential customers.

Figure 1-4 Residential Customer Income Distribution Across Georgia Power's Service Territory



Market Profiles

The next step was to develop and/or refine base-year 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 the number of households. In the commercial sector, it is the floor space, measured in square feet. For the industrial sector, it is the number of employees.
- **Saturations** define the fraction of the market where various technologies are installed (e.g., percent of homes with electric space heating). In the case of end uses such as appliances and electronics, saturations of greater than 100% indicate that more than one of a given technology is present in an average home.
- **UEC (unit energy consumption) or EUI (energy utilization index)** describes the average energy consumed by a specific technology within buildings that have the technology.

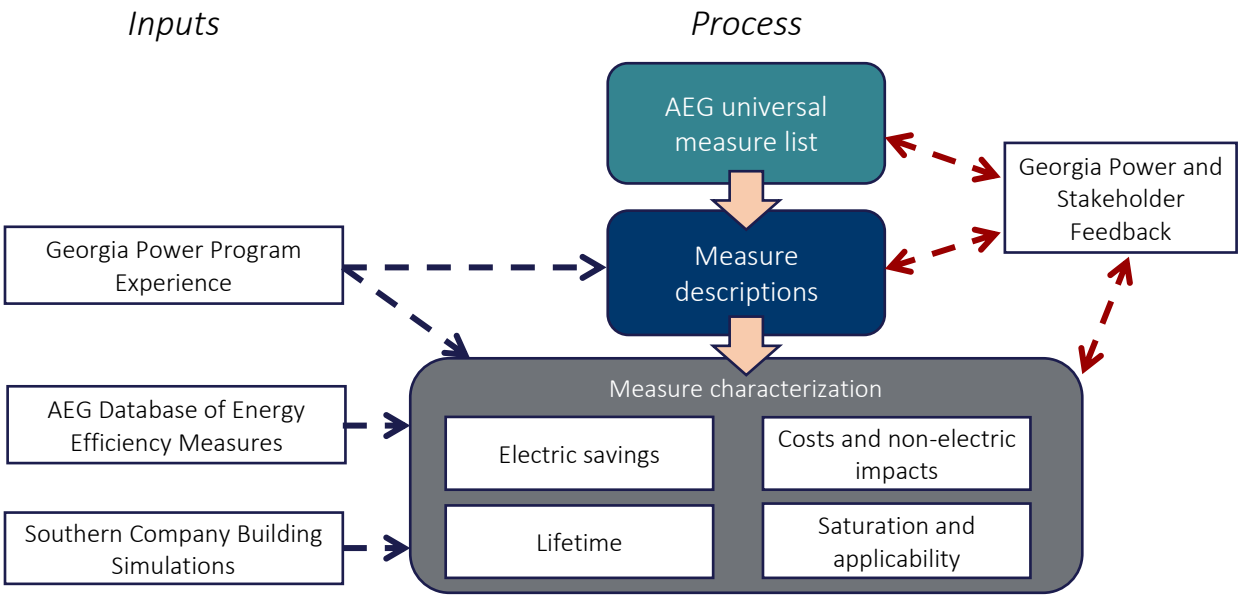
UECs are expressed in kWh/household for the residential sector, and EUIs are expressed in kWh/square foot or kWh/employee for the commercial and industrial sectors, respectively.

- **Intensity** for the residential sector represents the average energy use for the technology across all homes and is computed as the product of the saturation and the UEC. For the commercial and industrial sectors, intensity, computed as the product of the saturation and the EUI, represents the average use for the technology per square foot or per employee. The sum of all energy intensities in a specific market segment yields the total consumption per market unit (e.g., total kWh per household).
- **Usage** is the total annual energy use by an end use technology within a given segment. It is the product of the market size and intensity and is quantified in gigawatt-hours (GWh). As mentioned above, this usage is calibrated to actual sales in the base year.
- **Peak factor** is the fraction of annual energy that is consumed during the coincident summer peak.

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 determining measure-level savings and levelized costs as well as the subsequent build up to sector and state-level savings and levelized costs. For all measures, AEG assembled information to reflect equipment performance, incremental costs, and equipment lifetimes. Figure 1-5 outlines the framework for measure analysis.

Figure 1-5 Approach for Energy Efficiency Measure Assessment



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 preparing for integration with the greater potential modeling process.

AEG compiled a robust list of energy efficiency measures for each customer sector, drawing upon Georgia Power's previous Technical Reference Manual (TRM), Georgia Power's recent program experience, AEG's own measure databases, other secondary sources, and a comprehensive

screen of emerging technologies within the region and country. This universal list of energy efficiency measures covers all major types of end use equipment, as well as devices and actions which reduce energy consumption when installed or implemented.

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. These measures are applied on a stock-turnover basis and are often referred to as "lost opportunity" measures because once a purchasing decision is made, there will not be another opportunity to improve the efficiency of that equipment item until the lifetime expires again. New construction measures, such as ENERGY STAR home design and Advanced New Construction building design, are modeled as lost opportunity as well since the structure must be built with these designs in mind.
- **Non-equipment measures** save energy by reducing the need for delivered energy, but do not involve replacement or purchase of major end use equipment on a stock-turnover schedule (such as a refrigerator or air conditioner). For this reason, these measures are generally termed "discretionary" or "retrofit" measures. An example is a connected thermostat, which can be configured to run space heating and/or cooling systems only when people are home, and which can be installed at any time (e.g., installation does not need to occur at the time of heating or cooling equipment replacement). Non-equipment measures can apply to more than one end use. For instance, adding wall insulation will reduce the energy use of both space heating and cooling systems. Non-equipment measures typically fall into one of the following categories:
    - Building shell (windows, insulation, roofing material)
    - Equipment controls (thermostats, integrated lighting fixture controls)
    - Equipment maintenance (heat pump commissioning, setpoint adjustments)
    - Displacement measures (destratification fan to reduce use of HVAC systems)
    - Commissioning and retro-commissioning
    - Behavioral (home energy reports)

AEG developed a preliminary list of energy efficiency measures, which was provided to the Georgia Power project team for review and then to stakeholders as part of the DMSWG process. AEG started with all measures analyzed in the previous study, introduced new emerging technologies, and updated or excluded obsolete measures. A qualitative screen was applied to the measure list using the following criteria; measures that met one or more of these criteria were excluded from further consideration.

- Difficult to quantify savings; measure may not produce verifiable or persistent savings
- Current practice (either through code requirements or natural market adoption)
- Better measure or technology available

- Immature or unproven technology, or not commercially available in Georgia Power's service territory
- Limited applicability in Georgia Power's service territory
- Poor customer acceptance
- Health or environmental concerns
- End use service degradation
- Consolidation to avoid overlap

The final measure list for this study included a comprehensive set of energy efficiency measures, applicable to climate and customer characteristics in Georgia Power's service territory and drawn from measures used in the previous assessment, as well as new measures made commercially available since the last study. As shown in Table 1-3, analysis began with 304 unique energy efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end uses, and construction types, customized data were compiled and analyzed for 6,624 measure permutations.

Table 1-3 Energy Efficiency Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	100	1,800
Commercial	124	3,234
Industrial	80	1,600
Total	**304**	**6,624**

Measure development included identifying descriptive information, such as baseline and efficiency case characteristics, energy and demand impacts, incremental cost, and measure life. Energy and demand impacts were developed for each measure using one of two methods:

- Energy simulation modeling was employed for many of the weather-sensitive measures using prototypical building energy simulations in EnergyPlus™. EnergyPlus is an energy simulation engine run with an OpenStudio front-end. The simulation modeling included development of an appropriate base case (standard or existing efficiency) and change case (including the energy-efficient measure) model runs for each measure to isolate the impacts of the improvement. The modeling resulted in hourly load shapes for both the base and change case, and the difference in the two shapes resulted in annual energy savings and peak demand savings estimates.
- Prescriptive energy savings algorithms and/or deemed measure savings were selected or developed for all other measures. Algorithms apply engineering-based calculations and specific input assumptions on measure and operating characteristics to estimate annual energy impacts. Algorithm development included referencing publicly available sources such as Department of Energy Technical Support Documents, ENERGY STAR equipment specifications, other statewide and utility technical reference manuals, other regional and national sources, and secondary data collection. Input assumptions were developed based on current codes and standards, estimated efficiency levels (tied to existing criteria such as ENERGY STAR standards, where applicable), and typical weather and customer characteristics appropriate for Georgia Power's service territory.

Detailed documentation of measure analysis is provided in the Technical Reference Manual (TRM) that accompanies this study.

Baseline End-Use Projection

The next step was to develop a baseline end use projection of annual electricity use by sector, customer segment, end use and technology to quantify the projected consumption in the future in absence of any energy efficiency programs. The end use forecast includes the relatively certain impacts of codes and standards that will unfold over the study timeframe; all such mandates that were defined as of June 2023 are included. The baseline forecast also includes projected naturally occurring energy efficiency during the potential forecast period. The baseline projection is the foundation for the analysis of savings from future efficiency cases and scenarios as well as the metric against which potential savings are measured.

Inputs to the baseline projection include:

- Historic energy sales for 2016-2022
- Current economic growth forecasts (i.e., customer growth, income growth) provided by Georgia Power
- Electricity price forecasts provided by Georgia Power
- Existing and approved changes to building codes and equipment standards
- Naturally occurring efficiency improvements, which include purchases of high-efficiency equipment options outside of energy efficiency programs

2 | ESTIMATES OF ENERGY EFFICIENCY POTENTIAL

This section details the study results and potential estimates for Georgia Power's service territory as a whole and for each customer sector. It begins with a summary of results and then presents sector-specific results. Unless otherwise indicated in the figure or table, the achievable potential described in this section represents the 50% incentive scenario.

Summary of Energy Efficiency Potentials

This section presents detailed results of technical, economic, and achievable potential by sector. Table 2-1 and Table 2-2 provide the three levels of potential, by sector, for cumulative energy and peak demand savings, respectively, in 2035. Potentials are provided in absolute terms and as a percent of forecasted load.

Table 2-1 Summary of Electricity Savings Potentials (Cumulative through 2035) by Sector

Sector	Technical Potential		Economic Potential		Achievable Potential	
	GWh	% of 2035 Load	GWh	% of 2035 Load	GWh	% of 2035 Load
Residential	8,309	31%	2,755	10.3%	618	2.3%
Commercial	7,646	22%	3,868	11.1%	1,686	4.9%
Industrial	2,162	7%	1,065	3.7%	466	1.6%
Total	**18,117**	**21%**	**7,678**	**8.5%**	**2,770**	**3.1%**

Table 2-2 Summary of Peak Demand Potentials (Cumulative through 2035) by Sector

Sector	Technical Potential		Economic Potential		Achievable Potential	
	MW	% of 2035 Load	MW	% of 2035 Load	MW	% of 2035 Load
Residential	1,583	27.4%	413	7.2%	94	1.6%
Commercial	1,368	21.2%	704	10.9%	324	5.0%
Industrial	310	9.8%	132	4.2%	57	1.8%
Total	**3,260**	**21.2%**	**1,250**	**8.1%**	**476**	**3.1%**

Technical and Economic Potentials

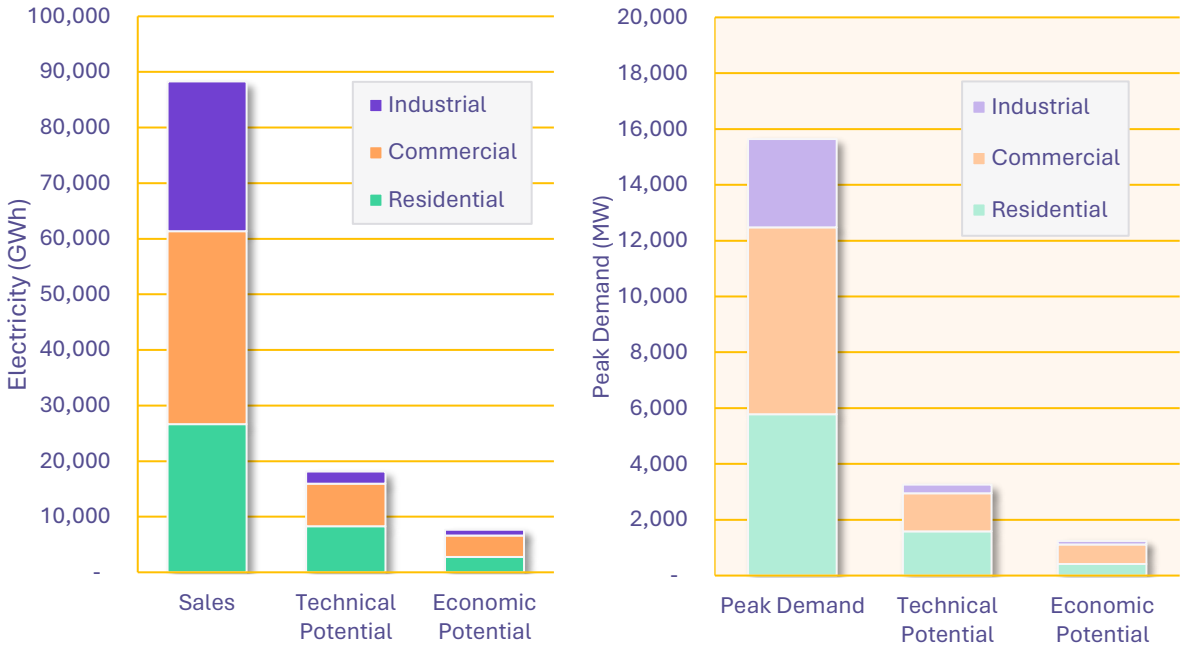
The technical and economic potential concepts, used by energy efficiency practitioners since the late 1980s, have often identified sectors and end uses associated with the largest amounts of energy-saving potential. The concepts have not been used to represent how much potential could be achieved, but rather to focus research efforts on the sectors and end uses with higher savings opportunities.

To derive technical and economic potential estimates, technically and economically feasible measures are applied to all sectors and end uses. Economically feasible measures have a TRC benefit-to-cost ratio greater than or equal to 1.0. Appendix A provides further details on the methodology.

Figure 2-1 illustrates that the residential sector has the largest technically feasible energy savings potential, followed by the commercial sector, then the industrial sector. However, the commercial

sector has the largest, cost-effective energy savings potential, followed by the residential and industrial sectors, respectively.

Figure 2-1 2035 Technically and Economically Feasible Potential by Sector



Achievable Potentials

Table 2-3 provides the cumulative achievable potential in 2035 by incentive scenario.

Table 2-3 Achievable Potential Savings (Cumulative through 2035)

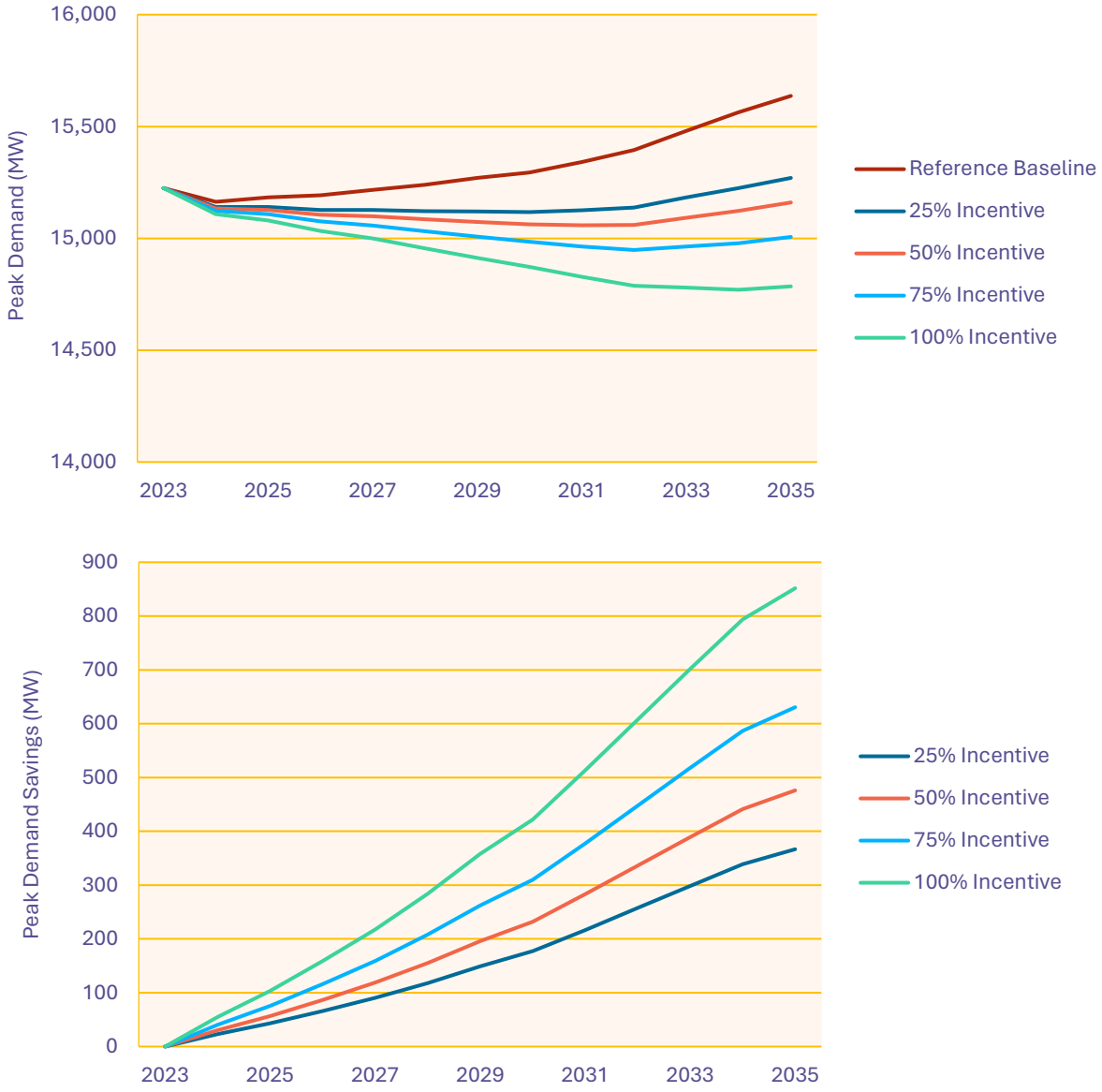
	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Reduction in Electricity Sales (GWh)	2,093	2.4%	2,770	3.1%	3,738	4.2%	5,138	5.8%
Reduction in Peak Demand (MW)	367	2.3%	476	3.0%	630	4.0%	852	5.4%

Figure 2-2 and Figure 2-3 present electricity and peak demand forecasts by scenario over the planning horizon assuming all theoretically achievable potential was realized.

Figure 2-2 Electricity Forecasts for Achievable Potential (Electricity Sales, top and Electricity Savings, bottom)



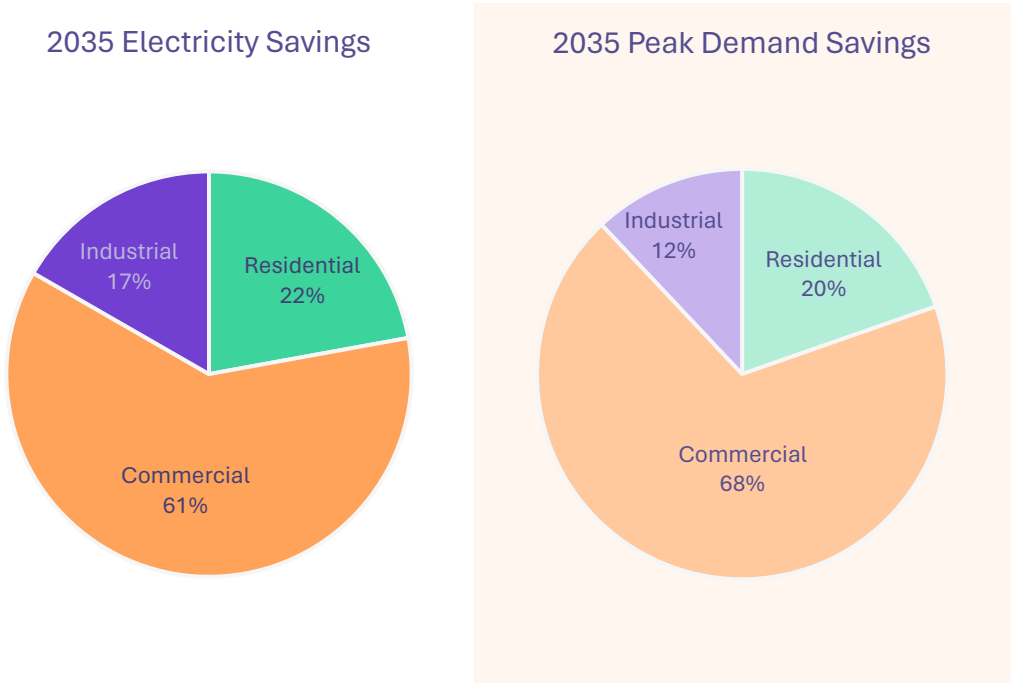
Figure 2-3 Demand Forecasts for Achievable Potential (Peak Demand, top and Peak Demand Savings, bottom)



Sector Achievable Potential

Figure 2-4 shows theoretically achievable electricity and peak demand savings potential by sector. The commercial sector accounts for over 60% of both the electricity savings potential (61%) and the peak demand savings potential (68%). The residential and industrial sectors account similar shares of the remaining potential for electricity savings, with the residential sector representing a larger share of the peak demand savings.

Figure 2-4 Cumulative Achievable Potential by Sector (Energy and Peak Demand)[1]



End Use Achievable Potential

A further understanding of theoretically achievable potential is aided by consideration of contributing end uses. Potential electricity and peak demand savings for each sector (residential, commercial, industrial) are presented below. Figure 2-5 illustrates that water heating (25% of potential electricity savings) and cooling (27% of potential peak demand savings) are the end uses with the most significant contribution to the theoretically achievable potential in the residential sector. For more information on the measures within these end uses, see the Residential Top Measures in Table 2-8 later in this chapter.

Figure 2-5 Cumulative Achievable Potential by Residential End Use (Electricity and Peak Demand)

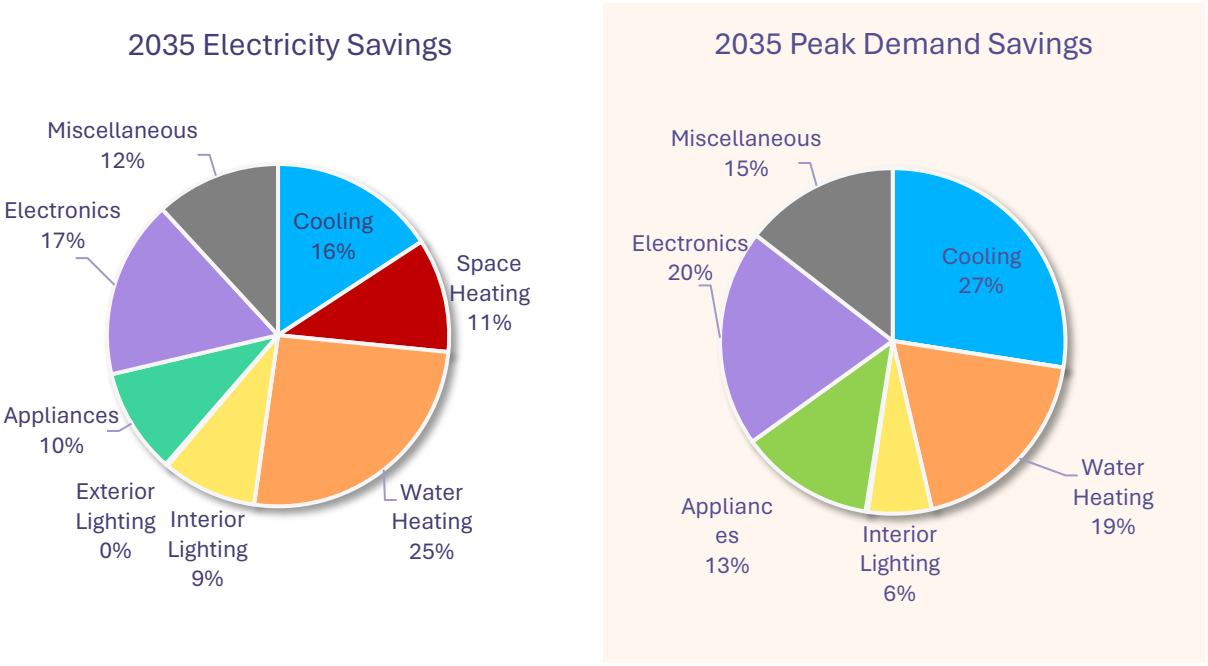


Figure 2-6 shows the potential electricity and peak demand savings for the commercial sector. Office equipment (24% of potential electricity savings) and cooling (38% of potential peak demand savings) are the end uses with the most significant contribution to the theoretically achievable potential. Other commercial end uses with large savings impacts include ventilation and interior lighting. For more information on the measures within these end uses, see the Commercial Top Measures in Table 2-12 later in this chapter.

Figure 2-6 Cumulative Achievable Potential by Commercial End Use (Electricity and Peak Demand)

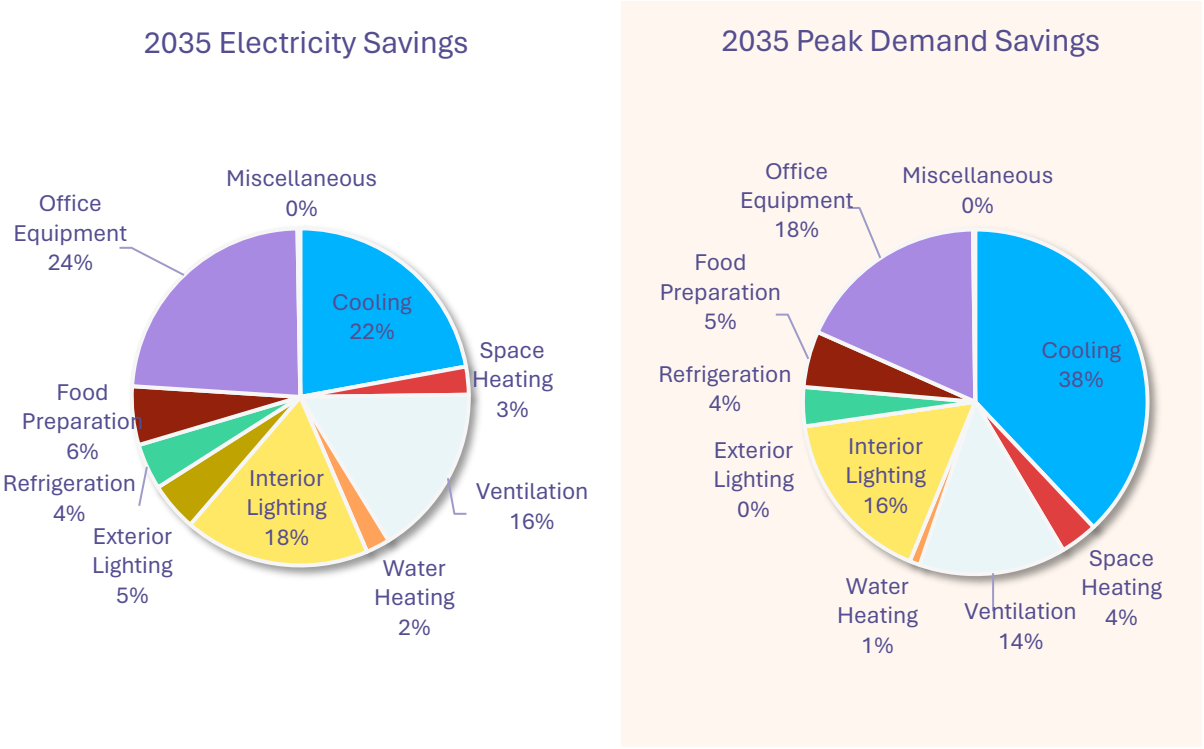
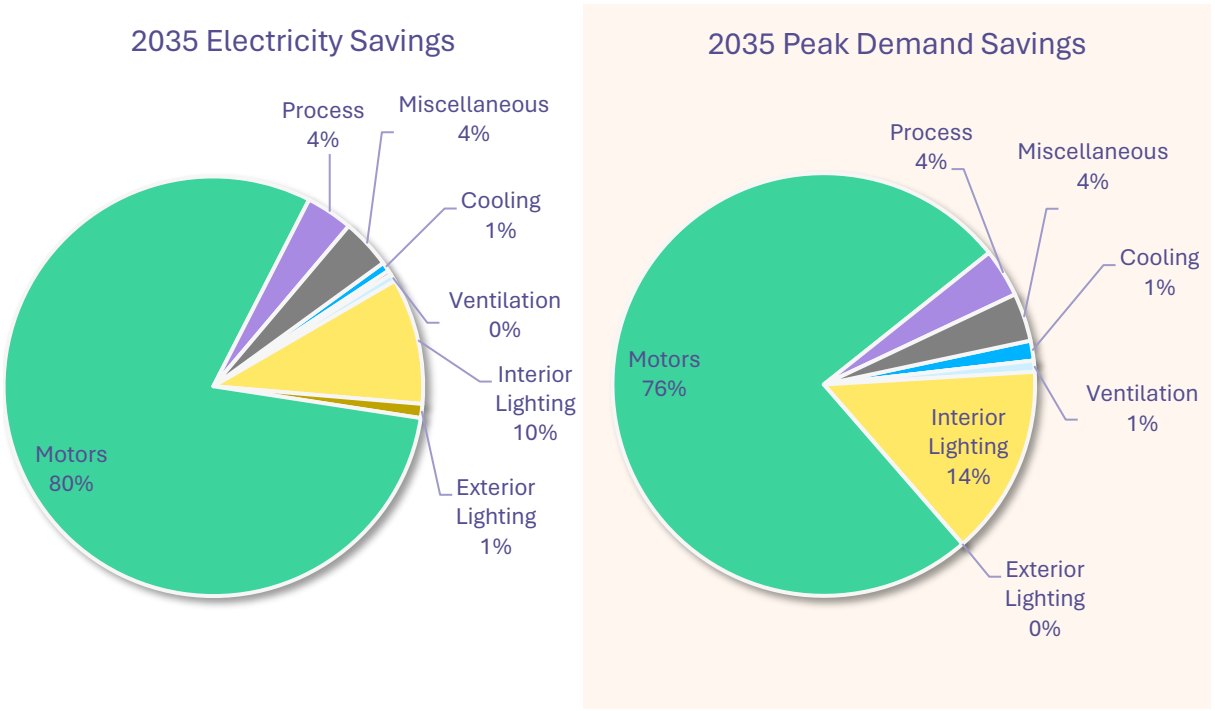


Figure 2-7 shows the potential electricity and peak demand savings for the industrial sector. Motors account for over three-quarters of the potential electricity savings (80%) and peak demand savings (76%) in the industrial sector. For more information on the measures within these end uses, see the Industrial Top Measures in Table 2-16 later in this chapter.

Figure 2-7 Cumulative Achievable Potential by Industrial End Use (Electricity and Peak Demand)



Cost-Effectiveness

Theoretically achievable energy savings potential has significant economic benefits to the general economy and many customers served by Georgia Power. These economic benefits, however, require significant investment, which would add sizeable costs for all customers.

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

- **Net participant costs:** Incremental costs to purchase, install, and maintain energy efficiency measures less any incentive received.
- **Program incentives:** Financial incentives paid by energy efficiency programs to subsidize purchases of energy efficiency measures.
- **Program non-incentive costs:** Administrative, marketing, promotional, and other costs associated with managing programs designed to achieve energy efficiency savings.

Table 2-4 lists estimated participant and program costs associated with the theoretically achievable scenarios.

Table 2-4 Participant and Program Costs by Achievable Potential Scenario (Cumulative NPV through 2035)

Achievable Scenario	Net Participant Costs (Millions)	Program Incentives (Millions)	Program Administration[5] (Millions)
25% Incentive	$363	$121	$234
50% Incentive	$315	$315	$315
75% Incentive	$211	$634	$436
100% Incentive	$0	$1,162	$621

Benefits and costs can be expressed from four unique perspectives: TRC, RIM, PCT, and PAC. Further details on these perspectives can be found in Appendix B.

Potentially achievable benefits, from programmatic efforts from 2024 through 2035, could range from $752 million to $2 billion from a TRC perspective. Associated costs to electricity customers could range from $4.7 and $11 billion from the RIM perspective. The RIM net cost indicates the amount electricity rates would have to increase due to energy efficiency, over and above rate increases ordinarily expected.

Table 2-5 provides estimated net benefits and benefit-to-cost ratios for each achievable potential scenario.

Table 2-5 Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2035)

	TRC		RIM		PCT		PAC	
Achievable Scenario	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost
25% Incentive	$752	2.05	($4,715)	0.19	$5,467	12.29	$732	3.06
50% Incentive	$1,019	2.08	($6,114)	0.19	$7,133	12.31	$821	2.30
75% Incentive	$1,409	2.10	($8,093)	0.20	$9,502	12.25	$904	1.85
100% Incentive	$1,986	2.11	($10,971)	0.20	$12,957	12.15	$952	1.53

[5] The study did not attempt to develop specific program offerings, which can have a range of non-incentive costs depending on the program goals and delivery structure. For the purposes of this study, non-incentive program cost assumptions were developed at the sector level based on AEG research.

Detailed Analysis

Consistent with previous studies' scope and detail, this section presents analytical results of estimated savings associated with each theoretically achievable scenario, by sector. Table 2-6 lists theoretically achievable potential, in absolute terms and as a share of 2035 load, by sector.

Table 2-6 Achievable Potential Savings by Sector (Cumulative through 2035)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Residential								
Reduction in Electricity Sales (GWh)	402	1.5%	618	2.3%	962	3.6%	1,512	5.7%
Reduction in Peak Demand (MW)	61	1.0%	94	1.6%	148	2.6%	233	4.0%
Commercial								
Reduction in Electricity Sales (GWh)	1,360	3.9%	1,686	4.9%	2,118	6.1%	2,696	7.8%
Reduction in Peak Demand (MW)	265	4.0%	324	4.8%	402	6.0%	504	7.5%
Industrial								
Reduction in Electricity Sales (GWh)	331	1.2%	466	1.7%	658	2.4%	931	3.5%
Reduction in Peak Demand (MW)	41	1.3%	57	1.8%	81	2.6%	115	3.6%
Total								
Reduction in Electricity Sales (GWh)	2,093	2.4%	2,770	3.1%	3,738	4.2%	5,138	5.8%
Reduction in Peak Demand (MW)	367	2.3%	476	3.0%	630	4.0%	852	5.4%

Residential Sector

Table 2-7 presents the residential sector's achievable potential for the four incentive scenarios. Figure 2-8 and Figure 2-9 show the residential baseline forecast and savings forecasts by achievable potential scenario, for energy sales and peak demand, respectively.

Table 2-7 Residential Achievable Potential Savings (Cumulative through 2035)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Reduction in Electricity Sales (GWh)	402	1.5%	618	2.3%	962	3.6%	1,512	5.7%
Reduction in Peak Demand (MW)	61	1.0%	94	1.6%	148	2.6%	233	4.0%

Figure 2-8 Residential Electricity Sales Forecasts for Achievable Potential (Electricity Sales, top and Electricity Savings, bottom)

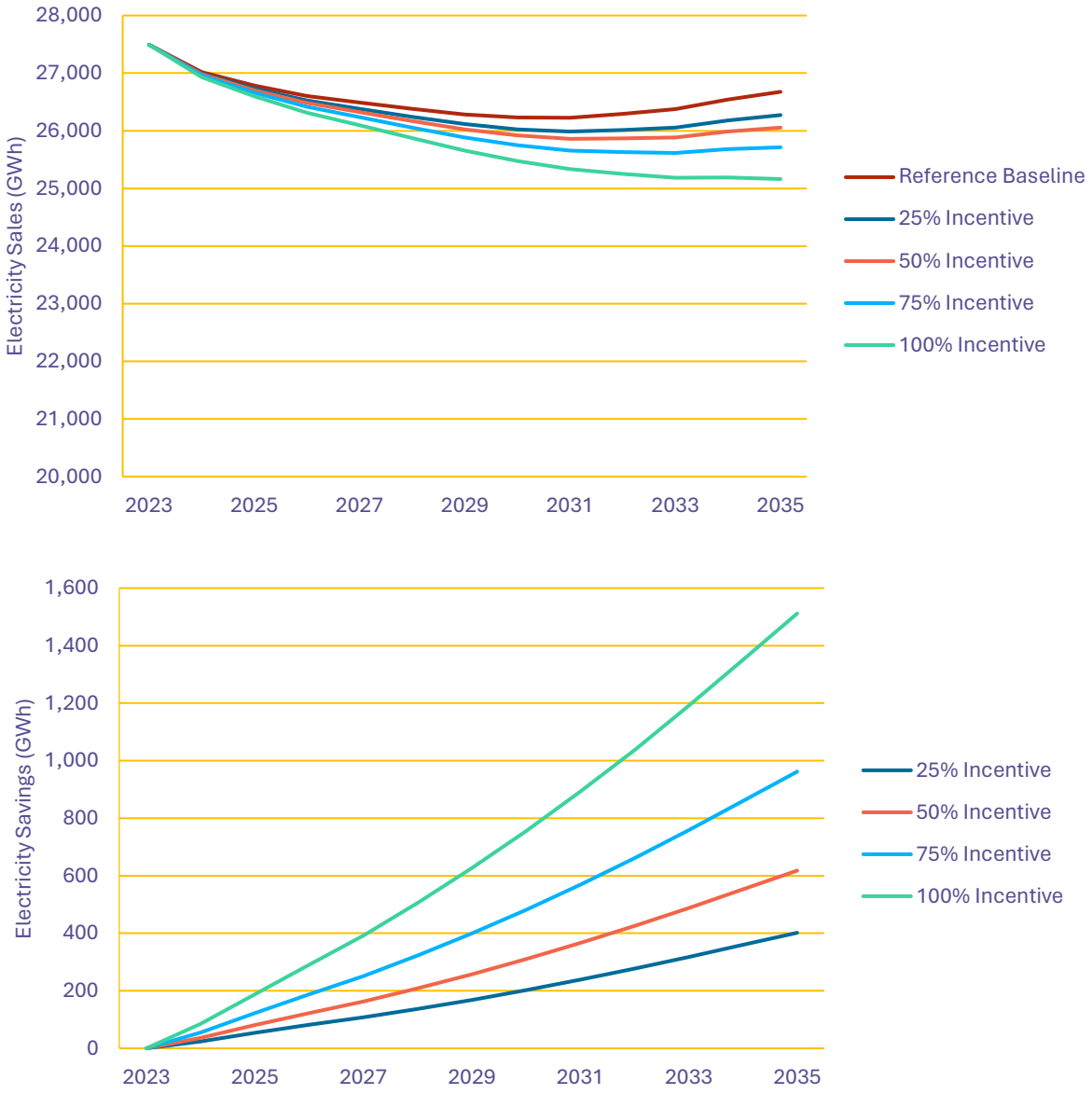


Figure 2-9 Residential Peak Demand Forecasts for Achievable Potential (Peak Demand, top and Peak Demand Savings, bottom)

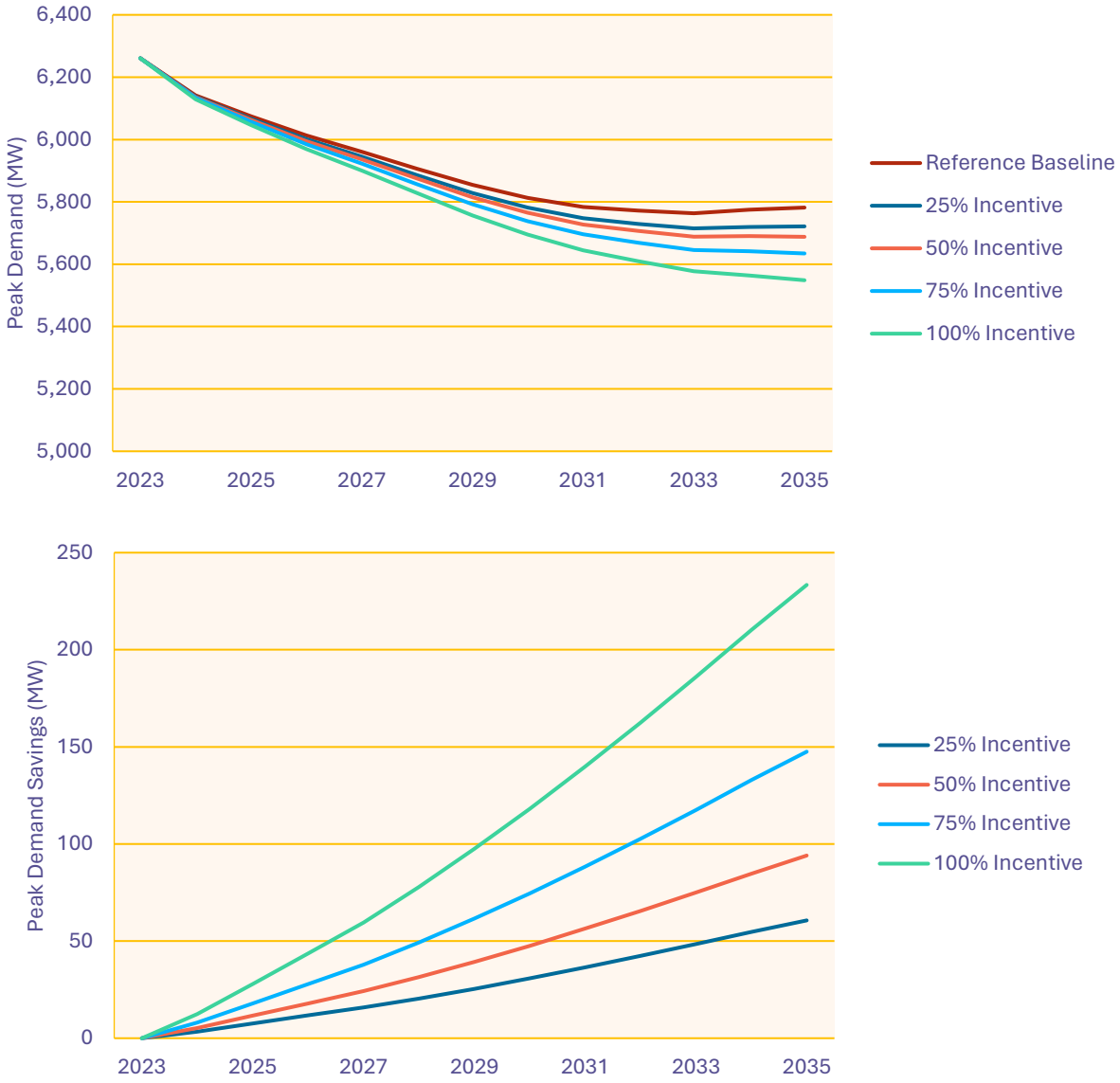


Table 2-8 presents the top 20 residential measures from the perspective of achievable potential savings in 2024. The table also shows the cumulative savings from these measures by 2035. Key findings include:

- In the first year of the study, 2024, connected thermostats, LED Lamps and high efficiency clothes washers represent over three-quarters of the total potential.
- By 2035, connected thermostats are still the top measure, but heat pump water heaters have grown to represent the second largest opportunity.

Table 2-8 Residential Top 20 Measures in 2024 – Achievable Potential Savings (Cumulative)

Rank	Measure / Technology	2024 (MWh)	% of 2024 Total	2035 (MWh)
1	Connected Thermostat - ENERGY STAR (1.0)	18,655	51.8%	170,890
2	Exempted Lighting - LED 2020 (95 lm/W)	6,139	17.0%	16,229
3	General Service Lighting - LED 2020 (105 lm/W)	3,652	10.1%	14,241
4	Clothes Washer - CEE Tier 2	3,408	9.5%	41,102
5	Thermostat - Programmable	616	1.7%	5,058
6	Dehumidifier Recycling	466	1.3%	11,294
7	Advanced Power Strips - Load or Occupancy	380	1.1%	30,221
8	Water Heater - Low-Flow Showerheads	322	0.9%	21,969
9	Behavioral	297	0.8%	1,293
10	Dishwasher - ENERGY STAR (7.0)	297	0.8%	3,618
11	Water Heater (<= 55 Gal) - Heat Pump (UEF 3.3) - ENERGY STAR 4.0	258	0.7%	103,362
12	Desktop Computer - ENERGY STAR (8.0)	252	0.7%	30,081
13	Room AC - Recycling	219	0.6%	1,079
14	Insulation - Ceiling Installation	169	0.5%	3,641
15	Microwave - 2026 Efficient (Level 4)	125	0.3%	17,483
16	TVs - ENERGY STAR (9.0)	99	0.3%	18,507
17	Air Purifier - High-Efficiency Air Purifier (5.4 CADR/W)	98	0.3%	33,533
18	Water Heater - Faucet Aerators	94	0.3%	6,161
19	Laptop - ENERGY STAR (8.0)	92	0.3%	10,045
20	Water Heater - Shower Timer	76	0.2%	4,297
	Total of Top 20 Measures	**35,715**	**99.08%**	**544,104**
	Total Cumulative Savings	**36,045**	**100.00%**	**617,925**

Figure 2-10 depicts the top 10 residential measures from the perspective of achievable potential savings in 2024. It also shows the cumulative savings from these measures by 2035.

Figure 2-10 Residential Top 10 Measures in 2024- Achievable Potential -- Electricity Sales

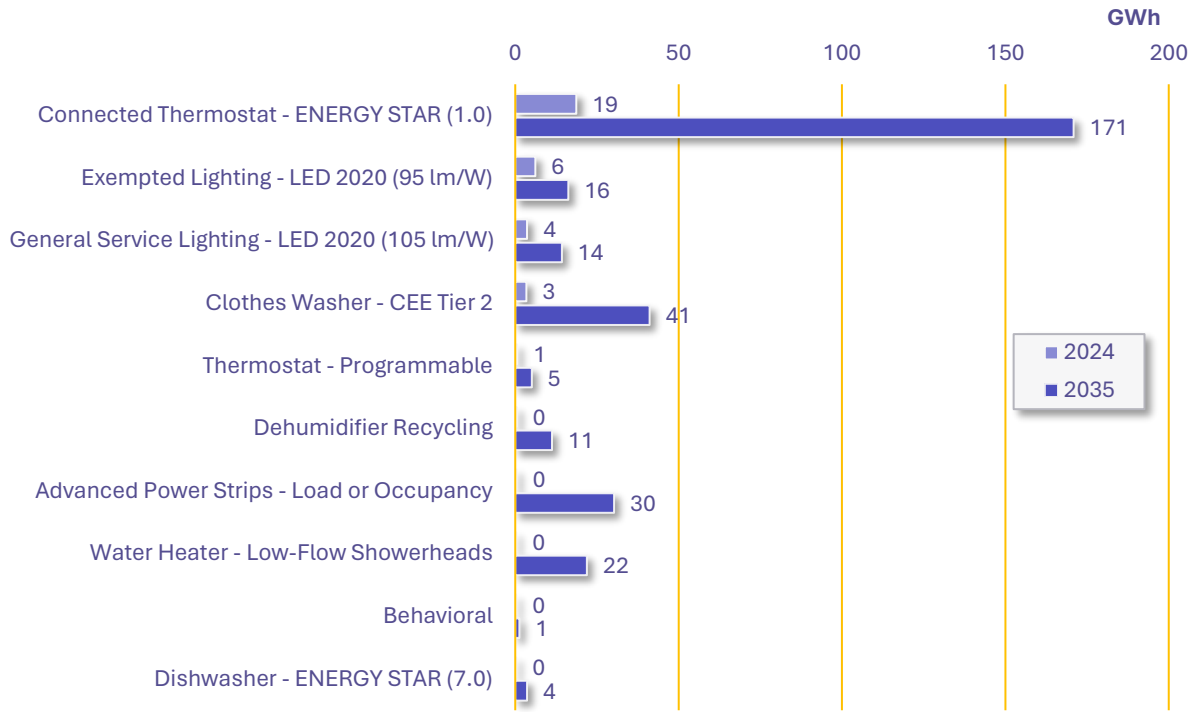


Figure 2-11 and Figure 2-12 illustrate theoretically achievable residential savings forecasts by end use for energy and peak demand, respectively, for 2024-2035. The potential electric energy savings is found largely in water heating, cooling, and electronics. The potential peak demand savings has a similar distribution as for energy, but with an increase in cooling and no demand impacts for heating, given the timing of Georgia Power's peak.

Figure 2-11 Residential Cumulative Achievable Potential by End Use - Electricity Savings[6]

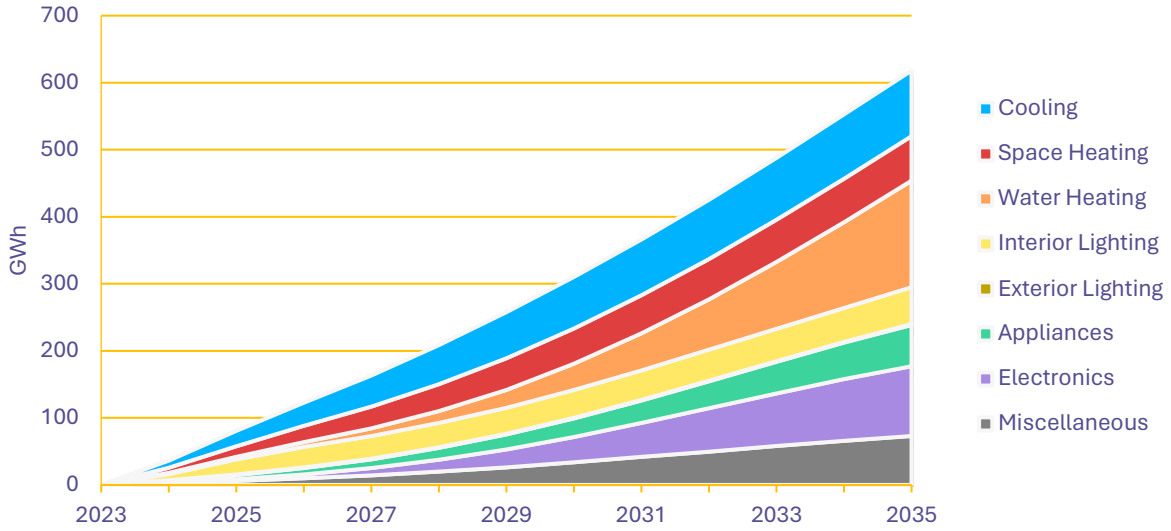


Figure 2-12 Residential Cumulative Achievable Potential by End Use - Peak Demand Savings[7]

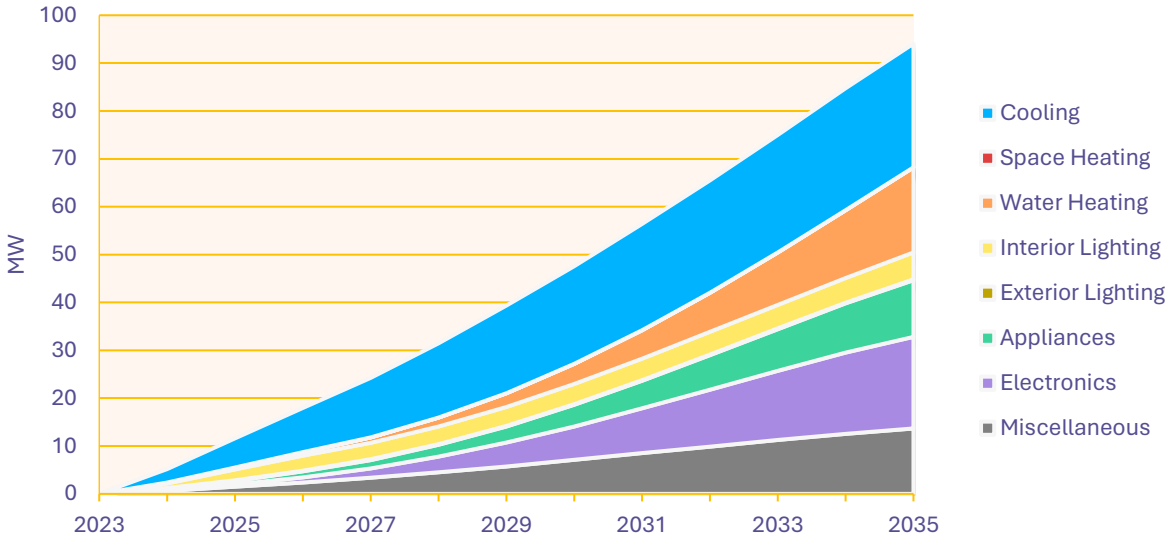


Figure 2-13 shows achievable potential residential savings by construction vintage. "Existing" constitutes homes constructed before 2024. Homes constructed in 2024 and beyond are considered "New." Existing homes account for the largest share of electricity and peak demand savings. Figure 2-14 shows the achievable potential by housing type and income level. Single family market rate homes account for the largest share of electricity and peak demand savings and single family homes represent the largest share of potential for all income levels.

[6] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios.

[7] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios. Please note that the miscellaneous potential includes pool pump savings.

Figure 2-13 Residential Cumulative Achievable Potential by Construction Vintage - Electricity and Peak Demand Savings[8]

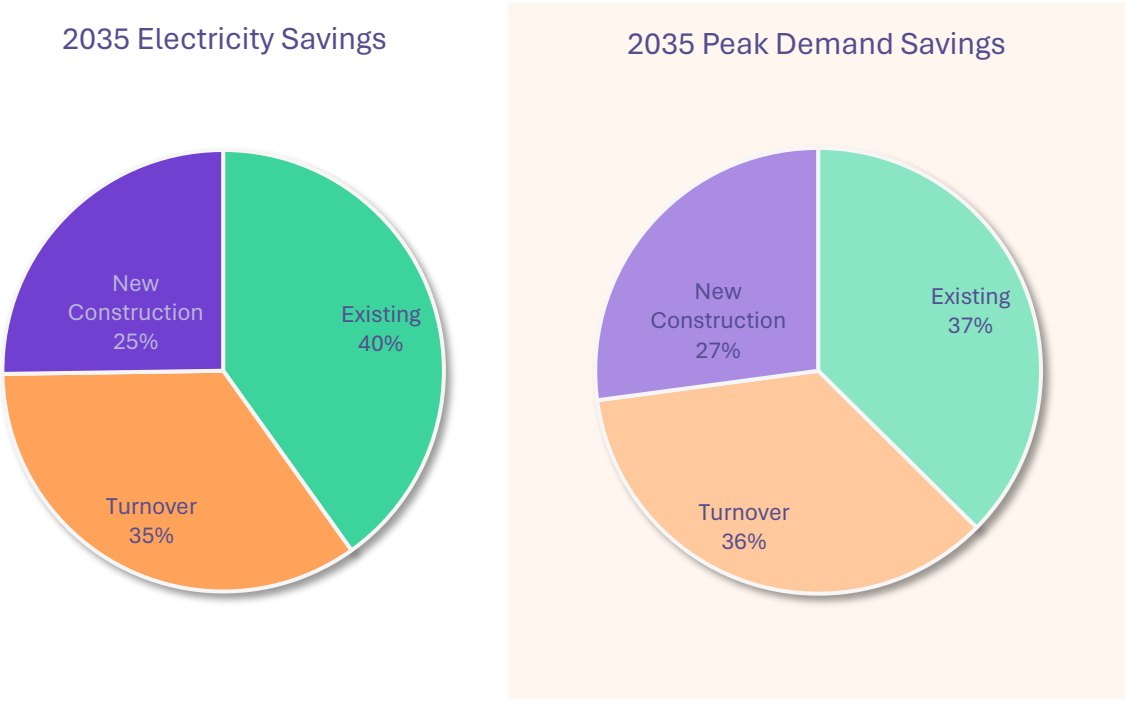
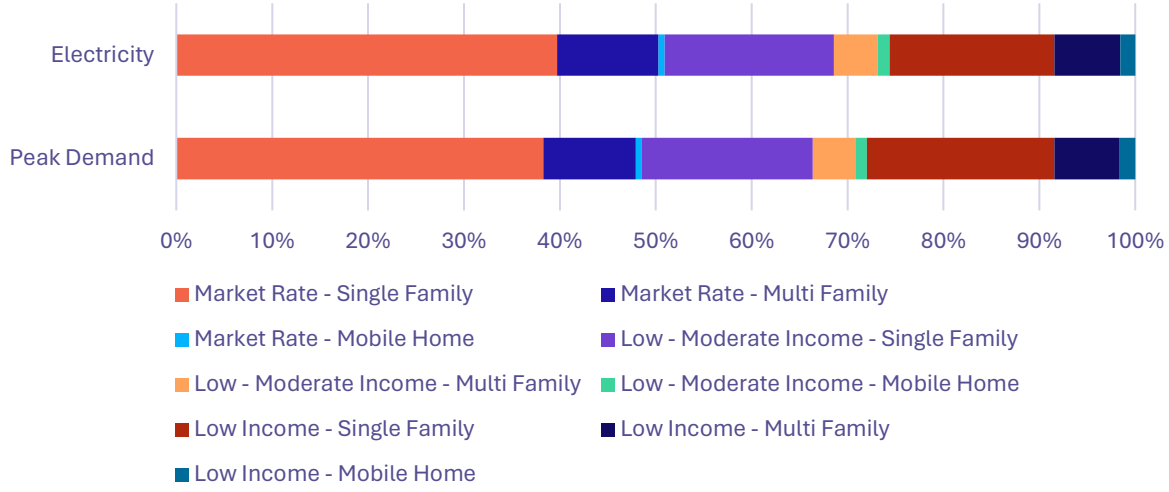


Figure 2-14 Residential Cumulative Achievable Potential by Housing Type and income Level - Electricity and Peak Demand Savings[9]



[8] Vintage data presented is based on 50% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

[9] Segment data presented is based on 50% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 2-9 lists the net present value of estimated participant and program costs associated with theoretically achievable potential scenarios.

Table 2-9 Residential Participant and Program Costs by Achievable Potential Scenario (Cumulative NPV through 2035)

Achievable Scenario	Net Participant Costs ($Millions)	Program Incentives ($Millions)	Program Administration ($Millions)
25% Incentive	$98	$33	$92
50% Incentive	$101	$101	$143
75% Incentive	$79	$237	$225
100% Incentive	$0	$503	$357

Table 2-10 lists estimated benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable residential sector net benefits, from programmatic efforts from 2024 through 2035, could range from $264 million to $906 million from a TRC perspective. Associated costs to customers could range from $535 million to $2.7 billion from a RIM perspective.

Table 2-10 Residential – Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2035)

	TRC		RIM		PCT		PAC	
Achievable Scenario	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost
25% Incentive	$264	2.19	($535)	0.30	$799	7.15	$105	1.84
50% Incentive	$392	2.14	($912)	0.28	$1,304	7.47	$112	1.46
75% Incentive	$592	2.09	($1,552)	0.26	$2,143	7.77	$95	1.20
100% Incentive	$906	2.05	($2,652)	0.25	$3,558	8.08	$18	1.02

Commercial Sector

Table 2-11 presents the commercial sector achievable potential for the four incentive scenarios.

Table 2-11 Commercial Achievable Potential Savings (Cumulative through 2035)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Reduction in Electricity Sales (GWh)	1,360	3.9%	1,686	4.9%	2,118	6.1%	2,696	7.8%
Reduction in Peak Demand (MW)	265	4.0%	324	4.8%	402	6.0%	504	7.5%

Figure 2-15 and Figure 2-16 show the commercial baseline forecast and forecasts by achievable potential scenario, for energy sales and peak demand, respectively.

Figure 2-15 Commercial Electricity Forecasts for Achievable Potential (Electricity Sales, top and Electricity Savings, bottom)

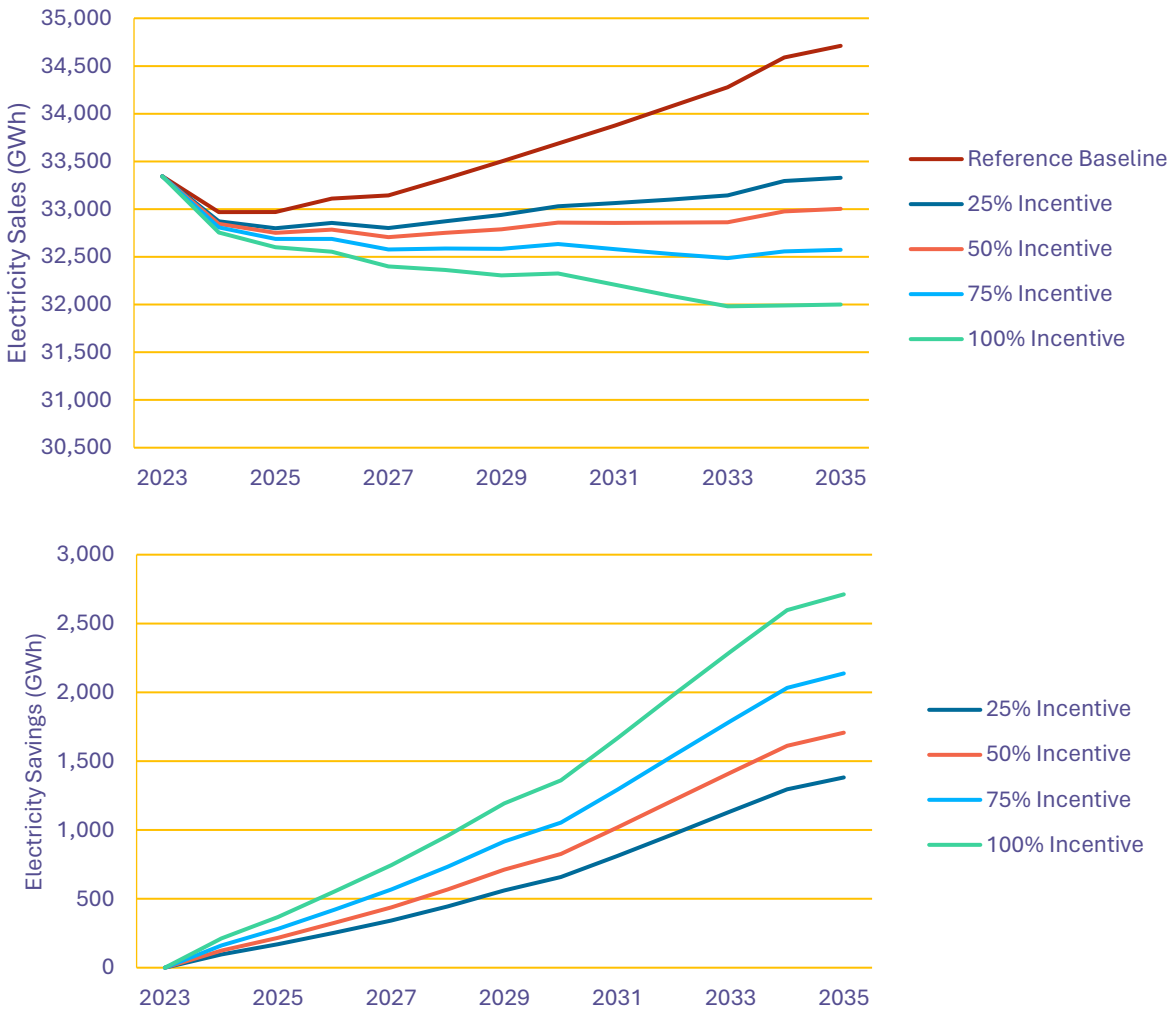


Figure 2-16 Commercial Peak Demand Forecasts for Achievable Potential (Peak Demand, top and Peak Demand Savings, bottom)



Table 2-12 presents the top 20 commercial measures from the perspective of cumulative achievable potential savings in 2024. The table also shows the cumulative savings from these measures by 2035. Key findings include:

- In the first year of the study, 2024, three of the top four measures are LED lighting and associated controls. Together these measures account for 50% of total potential.
- By 2035, ENERGY STAR servers are the top measure, accounting for 15% of total cumulative savings. Linear LED lighting, connected thermostats and air source heat pumps also contribute significantly to cumulative savings.
- The large amount of savings potential coming from ENERGY STAR server upgrades by 2035 reflects the impact of new ENERGY STAR standards and widespread use of server equipment in the commercial sector. However, due to historically low participation of this equipment class in programs, AEG has not assumed all units are available for upgrade, particularly in the energy-intense Data Center segment.

Table 2-12 Commercial Top 20 Measures in 2024 - Achievable Potential Savings (Cumulative)

Rank	Measure / Technology	2024 (MWh)	% of 2024 Total	2035 (MWh)
1	Linear Lighting - LED 2020 (109 lm/W system) w/ Controls	44,142	36.3%	243,368
2	High-Bay Lighting - LED 2020 (132 lm/W) w/ Controls	9,308	7.6%	65,593
3	Air-Source Heat Pump - IEER 20.3 / COP 3.7 - EIA High Efficiency	9,294	7.6%	143,411
4	Area Lighting - LED 2020 (120 lm/W) w/ Controls	8,447	6.9%	49,988
5	Refrigeration - High Efficiency Evaporator Fan Motors	7,164	5.9%	30,527
6	Grocery - Display Case - LED Lighting	6,449	5.3%	9,631
7	Connected Thermostat - ENERGY STAR (1.0)	5,814	4.8%	167,085
8	RTU - IEER 12.9 - Federal Standard 2018	4,830	4.0%	81,269
9	Exterior Lighting - Photovoltaic Installation	3,160	2.6%	4,322
10	Ventilation - Variable Speed Control	3,131	2.6%	108,668
11	Kitchen Ventilation - Advanced Controls	2,069	1.7%	21,926
12	Advanced New Construction Designs	1,791	1.5%	13,221
13	Refrigeration - High Efficiency Compressor	1,741	1.4%	7,462
14	Insulation - Ducting	1,326	1.1%	46,681
15	Refrigeration - Efficient Compressor Head Fan Motor	1,209	1.0%	5,133
16	Server - ENERGY STAR (3.0)	1,122	0.9%	255,384
17	Ventilation - High Efficiency Motors	1,071	0.9%	29,094
18	Exempted Lighting - LED 2020 (95 lm/W)	1,043	0.9%	2,979
19	Refrigeration - Automatic High Speed Doors	712	0.6%	2,742
20	Ducting - Repair and Sealing	704	0.6%	20,261
	Total of Top 20 Measures	**114,527**	**94.06%**	**1,308,743**
	Total Cumulative Savings	**121,760**	**100.00%**	**1,686,082**

Figure 2-17 depicts the top 10 commercial measures from the perspective of achievable potential savings in 2024. It also shows the cumulative savings from these measures by 2035.

Figure 2-17 Commercial Top 10 Measures in 2024- Achievable Potential - Electricity Sales

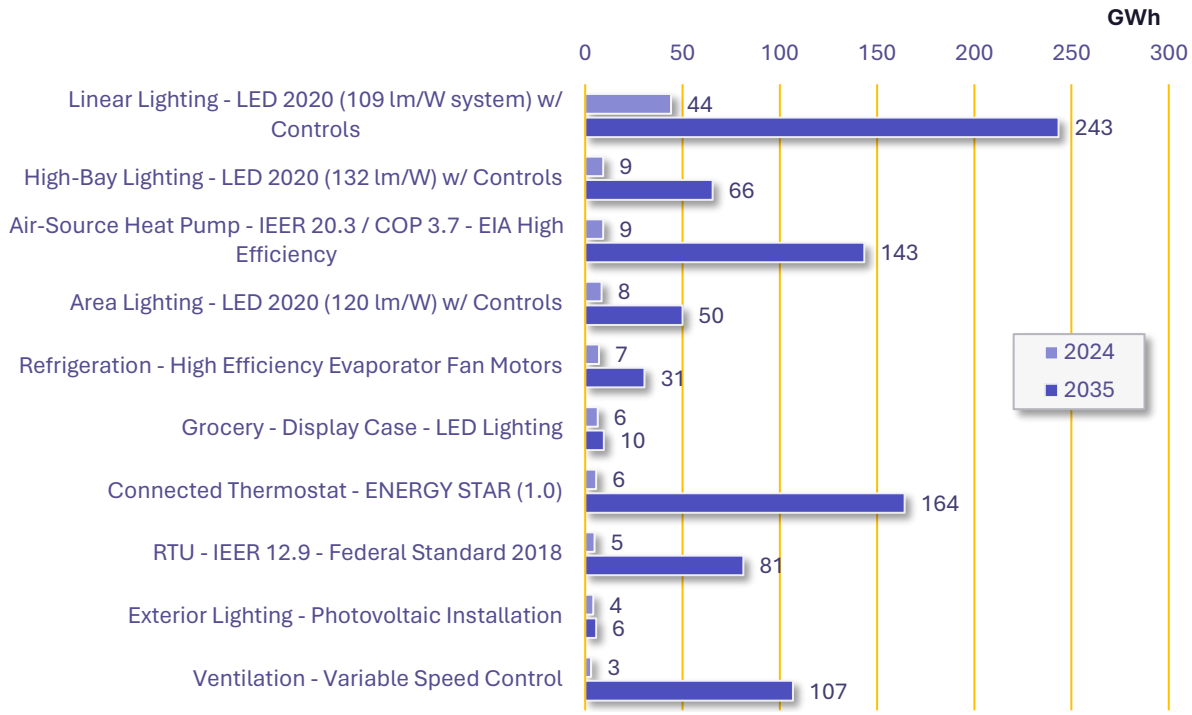


Figure 2-18 and Figure 2-19 illustrate achievable commercial savings by end use. Energy savings potential is concentrated in four end use categories: office equipment, cooling, interior lighting, and ventilation. Cooling represents the largest share of demand savings, given the coincidence of this end use with Georgia Power's system peak.

Figure 2-18 Commercial Cumulative Achievable Potential by End Use - Electricity Savings[10]

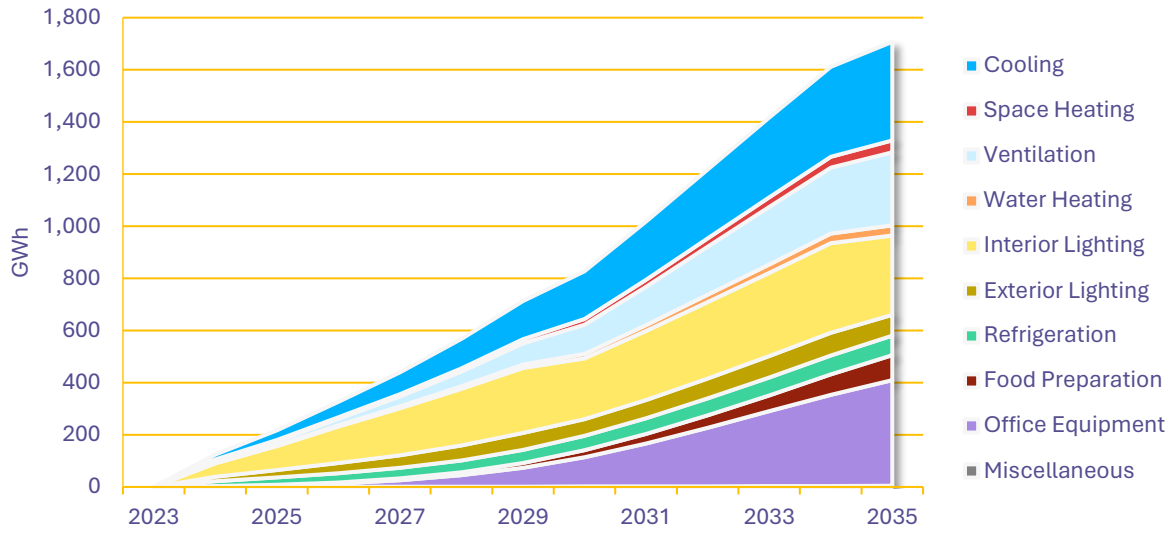


Figure 2-19 Commercial Cumulative Achievable Potential by End Use - Peak Demand Savings[11]

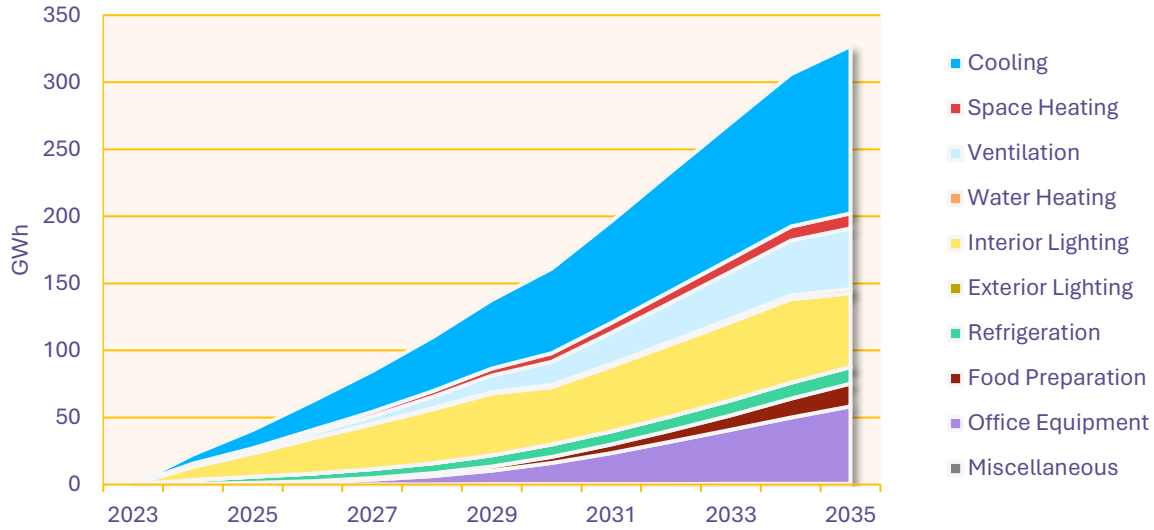


Figure 2-20 shows the relative contribution of achievable energy efficiency potential by construction vintage. New construction accounts for the largest share of electricity savings (40%), while equipment turnover provide the most peak demand saving (41%).

[10] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios.

[11] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios.

Figure 2-20 Commercial Cumulative Achievable Potential by Construction Vintage (Electricity Sales and Peak Demand)[12]

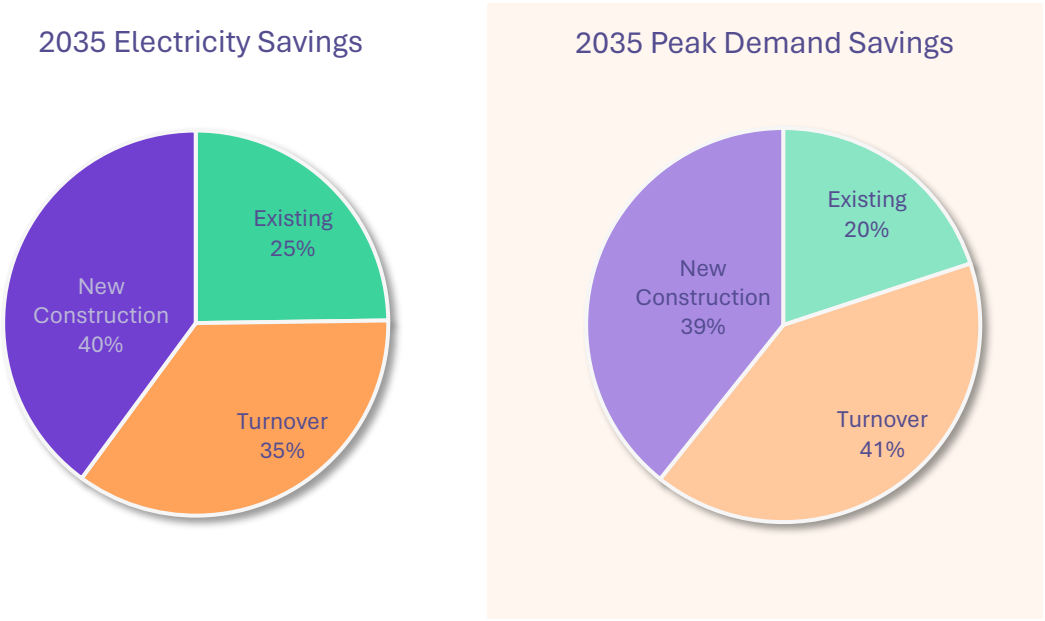
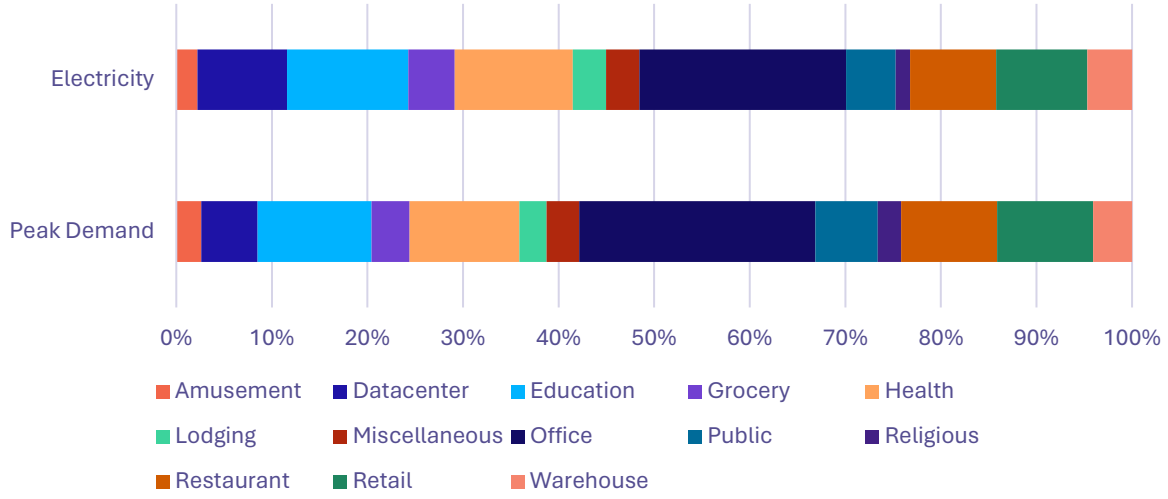


Figure 2-21 shows the relative contribution to the achievable potential for electricity and peak demand savings by the commercial building segment. The office (21%), education (13%), and health (12%) segments combined account for nearly 50% of the electricity savings. The distribution of peak demand savings by building segment is similar to energy.

Figure 2-21 Commercial – Cumulative Achievable Potential by Building Segment (Electricity and Peak Demand)[13]



[12] Vintage data presented is based on 50% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

[13] Segment data presented is based on 50% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 2-13 lists the net present value of estimated participant and program costs associated with theoretically achievable potential scenarios.

Table 2-13 Commercial Participant and Program Costs by Achievable Potential Scenario (Cumulative NPV through 2035)

Achievable Scenario	Net Participant Costs (Millions)	Program Incentives (Millions)	Program Administration (Millions)
25% Incentive	$249	$83	$133
50% Incentive	$199	$199	$159
75% Incentive	$120	$361	$193
100% Incentive	$0	$593	$237

Table 2-14 lists the estimated benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable net benefits in the commercial sector from programmatic efforts from 2024 through 2035 could range from $397 million to $822 million from a TRC perspective. Associated costs to customers could range from $3.6 billion to $6.7 billion from a RIM perspective.

Table 2-14 Commercial Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2035)

	TRC		RIM		PCT		PAC	
Achievable Scenario	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost
25% Incentive	$397	1.85	($3,645)	0.17	$4,042	13.19	$514	3.38
50% Incentive	$498	1.90	($4,430)	0.17	$4,928	13.41	$556	2.55
75% Incentive	$635	1.94	($5,423)	0.18	$6,059	13.58	$604	2.09
100% Incentive	$822	1.99	($6,697)	0.18	$7,519	13.68	$660	1.80

Industrial Sector

Table 2-15 presents the industrial sector's achievable potential for the four incentive scenarios.

Table 2-15 Industrial Achievable Potential Savings (Cumulative through 2035)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load	Total Potential	% of 2035 Load
Reduction in Electricity Sales (GWh)	331	1.2%	466	1.7%	658	2.4%	931	3.5%
Reduction in Peak Demand (MW)	41	1.3%	57	1.8%	81	2.6%	115	3.6%

Figure 2-22 and Figure 2-23 show the industrial baseline forecast and forecasts by achievable potential scenario for electricity sales and peak demand, respectively.

Figure 2-22 Industrial Electricity Forecasts for Achievable Potential (Electricity Sales, top and Electricity Savings, bottom)

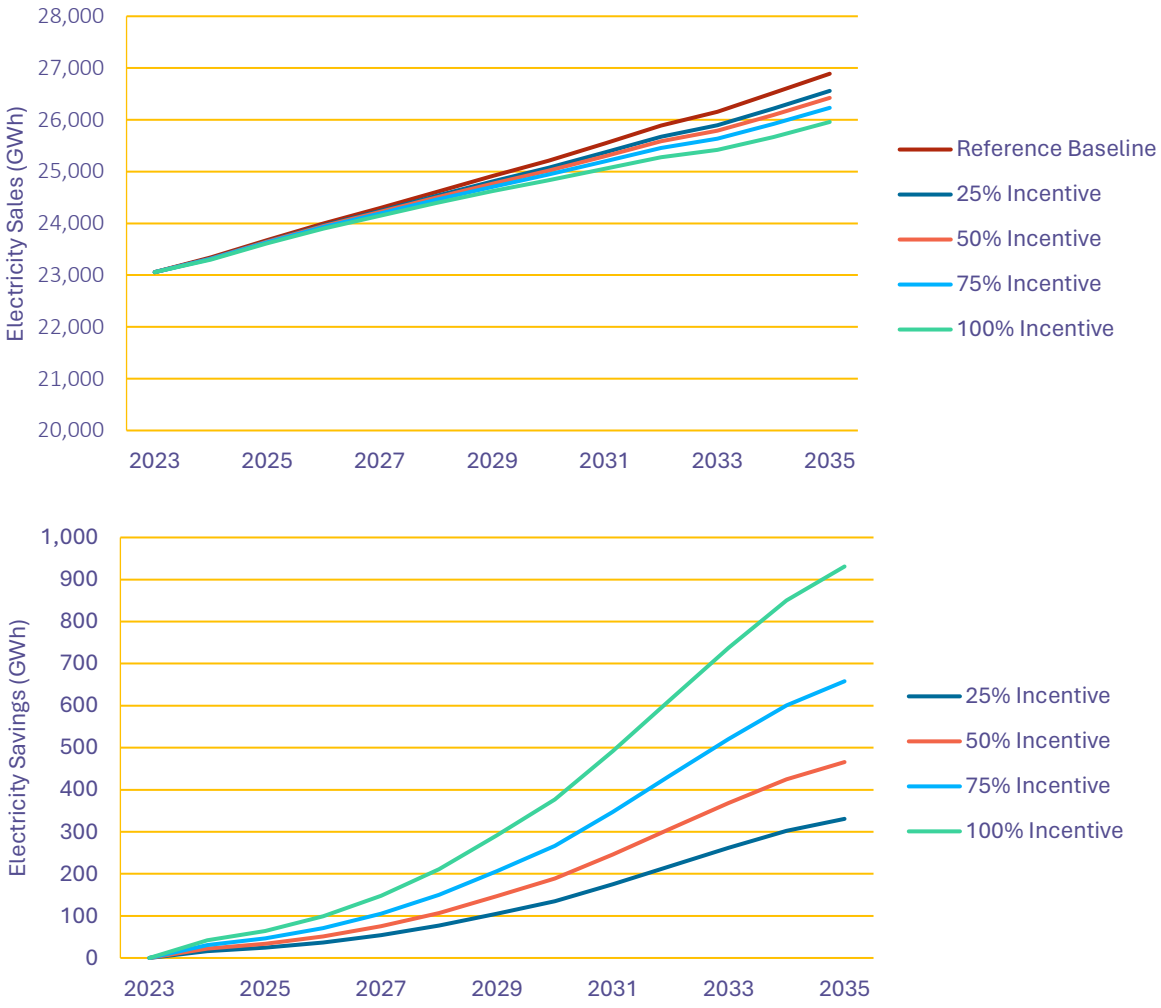


Figure 2-23 Industrial Peak Demand Forecasts for Achievable Potential (Peak Demand, top and Peak Demand Savings, bottom)



Table 2-16 presents the top 20 industrial measures from the perspective of achievable potential savings in 2024. The table also shows the cumulative savings from these measures by 2035. Key findings include:

- In the first year of the study, 2024, three of the top four measures are associated with interior lighting, with additional large savings opportunities from pump and fan systems. Combined, the top six measures account for nearly 80% of first-year electricity savings potential.
- By 2035, pump and fan system upgrades and controls are the measures with the largest potential. This shift reflects increased adoption of LED technologies assumed in the reference forecast; because these improvements are captured in the reference forecast, they are excluded from the energy efficiency potential.

Figure 2-24 depicts the top 10 industrial measures from the perspective of achievable potential savings in 2024. It also shows the cumulative savings from these measures by 2035.

Table 2-16 Industrial Top 20 Measures in 2024 - Achievable Potential Savings (Cumulative)

Rank	Measure / Technology	2024 (MWh)	% of 2024 Total	2035 (MWh)
1	High-Bay Lighting - LED 2020 (132 lm/W) w/ Controls	5,686	25.6%	34,472
2	Pumping System - Controls	3,193	14.4%	114,956
3	Indoor Agriculture - LED Lighting	2,576	11.6%	4,141
4	Linear Lighting - LED 2020 (109 lm/W system) w/ Controls	2,555	11.5%	12,108
5	Fan System - Controls	1,919	8.7%	68,164
6	Pumping System - System Optimization	1,540	6.9%	54,354
7	Material Handling - Variable Speed Drive	1,017	4.6%	35,358
8	Fan System - Equipment Upgrade	704	3.2%	24,287
9	Area Lighting - LED 2020 (120 lm/W) w/ Controls	646	2.9%	2,988
10	Compressed Air - End Use Optimization	518	2.3%	37,156
11	High Frequency Battery Chargers	446	2.0%	17,320
12	Motors - Green Rewind (<100 HP)	182	0.8%	5,911
13	Transformer - High Efficiency	176	0.8%	5,730
14	Connected Thermostat - ENERGY STAR (1.0)	141	0.6%	4,357
15	Refrigeration - System Optimization	126	0.6%	4,691
16	Compressed Air - Dryer Optimization and Replacement	108	0.5%	7,703
17	Pumping System - Equipment Upgrade	106	0.5%	8,573
18	Compressed Air - System Controls	86	0.4%	5,903
19	Thermostat - Programmable	82	0.4%	2,474
20	Refrigeration - System Maintenance	66	0.2%	2,155
	Total of Top 20 Measures	**21,872**	**98.56%**	**452,800**
	Total Cumulative Savings	**22,172**	**100.00%**	**465,869**

Figure 2-24 Industrial Top 10 Measures in 2024 - Achievable Potential - Electricity Savings

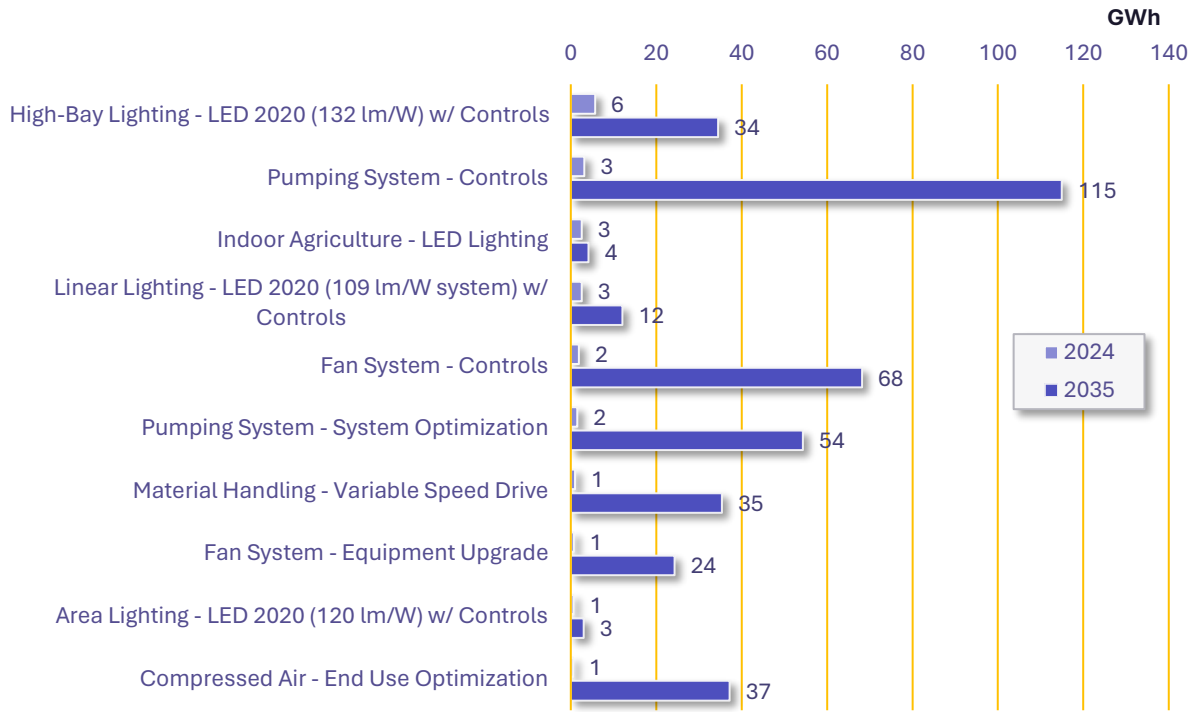


Figure 2-25 illustrates theoretically achievable industrial electricity savings by end use. The motors end use represents the majority of the energy savings potential, followed by interior lighting. The distribution of peak demand potential by end use is similar to that of energy.

Figure 2-25 Industrial Cumulative Achievable Potential by End Use – Electricity Savings[14]

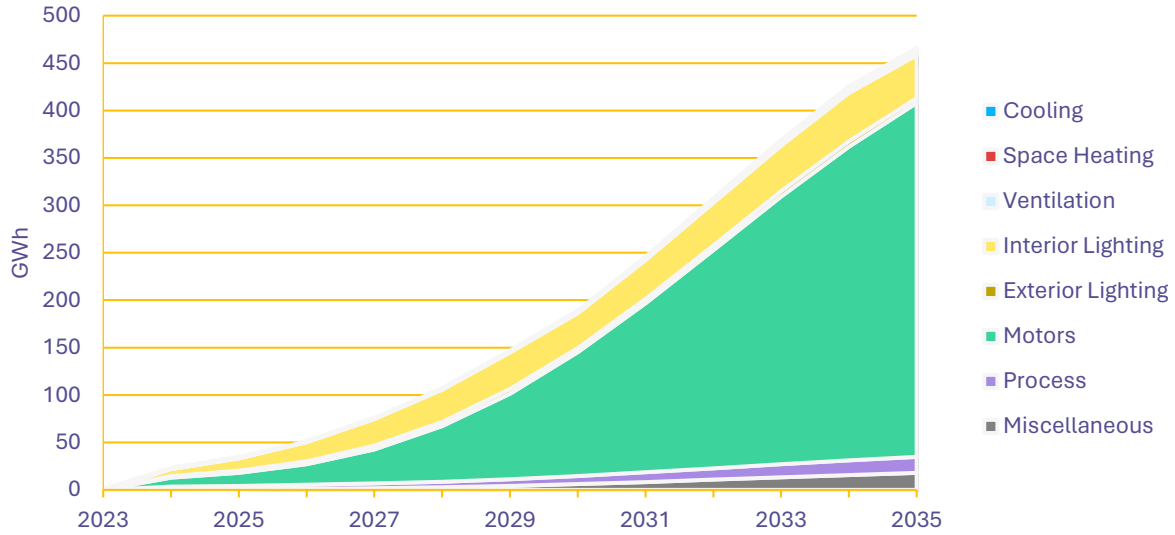


Figure 2-26 Industrial - Cumulative Achievable Potential by End Use - Peak Demand Savings[15]

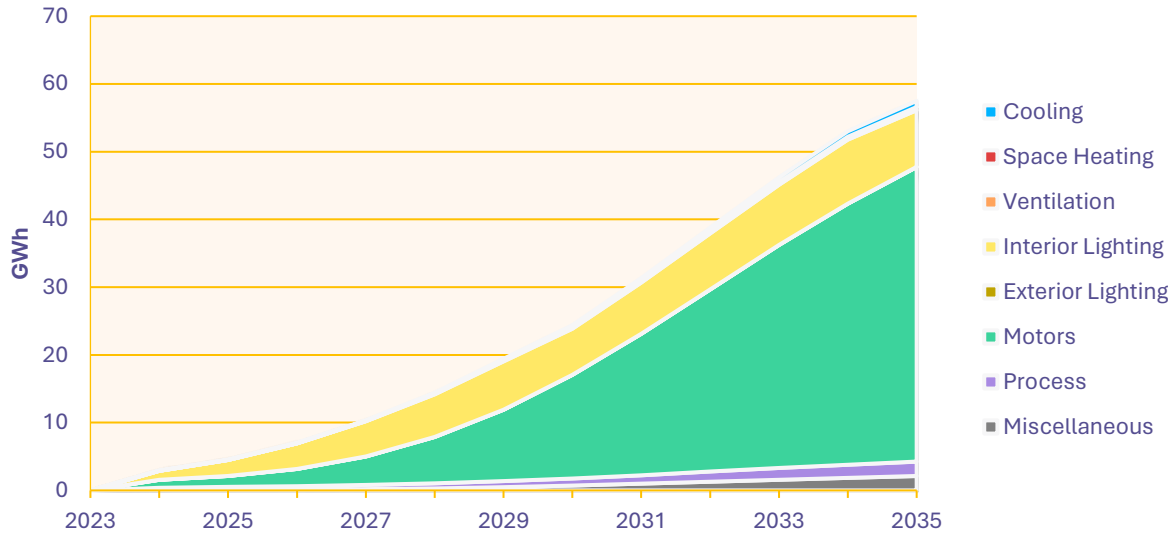


Figure 2-27 illustrates theoretically achievable potential by industrial segment for electricity and peak demand savings. Forestry (22%), chemicals (18%), and food production (14%) provide the most electricity savings. These three industrial segments also provide the largest shares of peak demand savings.

[14] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios.

[15] End use data presented is based on 50% incentive scenario but relative contributions by end use are approximately the same for all achievable potential scenarios.

Figure 2-27 Industrial Cumulative Achievable Potential by Industrial Segment (Electricity and Peak Demand Savings)[16]

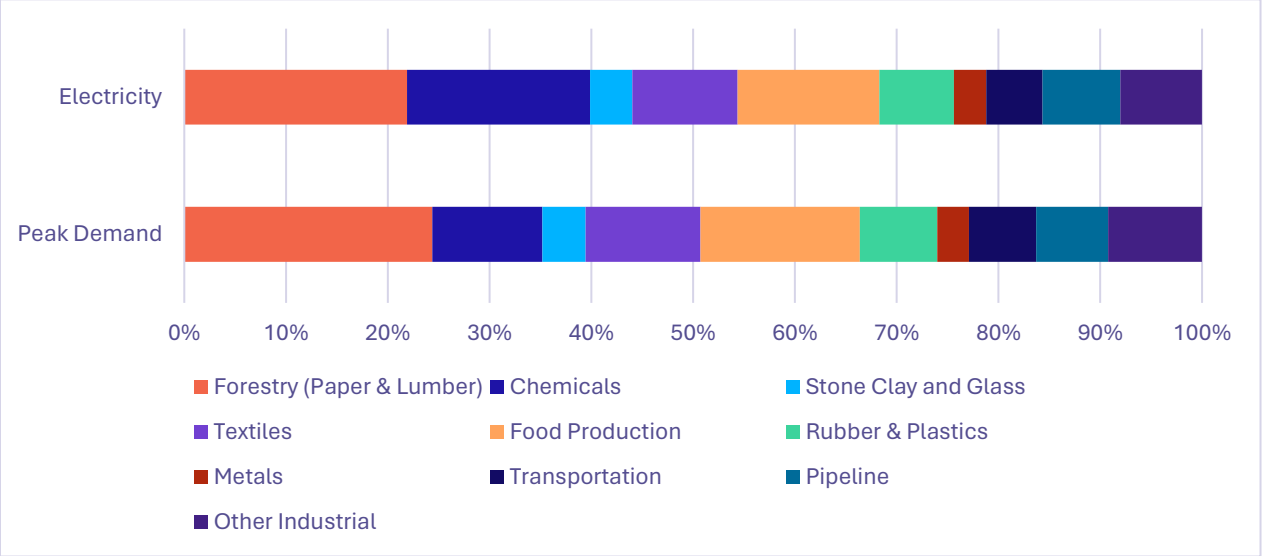


Table 2-17 lists the net present value of estimated participant and program costs associated with theoretically achievable potential scenarios.

Table 2-17 Industrial – Participant and Program Costs by Achievable Potential Scenario (Cumulative NPV through 2035)

Achievable Scenario	Net Participant Costs ($Millions)	Program Incentives ($Millions)	Program Administration ($Millions)
25% Incentive	$17	$6	$9
50% Incentive	$16	$16	$13
75% Incentive	$12	$35	$19
100% Incentive	$0	$67	$27

Table 2-18 lists estimated benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable industrial sector net benefits, from programmatic efforts from 2024 through 2035, could range from $91 million to $258 million from a TRC perspective. Associated costs to customers could range from $534 million to $1.6 billion from a RIM perspective.

[16] Segment data presented is based on 50% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 2-18 Industrial – Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2035)

	TRC		RIM		PCT		PAC	
Achievable Scenario	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost	Net Benefits (Millions)	Benefit/ Cost
25% Incentive	$91	3.90	($534)	0.19	$626	28.79	$114	8.78
50% Incentive	$129	3.86	($772)	0.19	$901	28.95	$153	6.27
75% Incentive	$182	3.81	($1,118)	0.19	$1,300	29.06	$205	4.85
100% Incentive	$258	3.76	($1,622)	0.18	$1,880	29.14	$274	3.93

3 | CONCLUSION

This assessment identifies the potential for future energy efficiency investments by Georgia Power customers above the levels that would naturally occur and would require the incentives assumed in this analysis. These results could be useful in targeting energy efficiency program planning efforts to sectors and end uses with the highest market potential.

Participating customers can reduce their energy consumption and peak power requirements by implementing energy efficiency measures or actions, receiving economic benefits directly through reductions in their energy bills. Customers who participate could also benefit from financial incentives offered by programs intended to accelerate markets for the purchase and installation of high-efficiency measures. At the same time, rates will rise for all customers. Non-participating customers will pay higher bills, in effect, subsidizing the costs of incentives and other program costs to the benefit of program participants.

As in the previous assessment, this study examines scenarios of theoretically achievable energy efficiency potential associated with utility interventions at 25%, 50%, 75% and 100% of incremental measure costs.

Economic benefits include:

- Achievable electric energy savings ranging from 2.4% of year 2035 forecast sales under a 25% incentive scenario to 5.8% under a 100% incentive scenario from all three customer classes.
- TRC benefits from energy efficiency improvements could range from $752 million to $2.0 billion.
- Cumulative program incentives for energy efficiency ranging from $121 million to $1.2 billion by 2032.
- Net participant benefits range from $5.5 billion to $13.0 billion.

However, these benefits come at substantial costs to customers where:

- Net costs to electric utility customers range from $4.7 billion to $11.0 billion, over and above those associated with supply-side costs.

In addition, this study provides valuable guidance for program design. While the study provides estimates of annual savings for hundreds of individual measures, the results should be taken with a measure of discretion. This is because the results come from a model and AEG expects variation in the actual outcomes in the real world. In order to address the potential for such variation, Georgia Power has the opportunity to make appropriate adjustments from the specific annual values developed in the study as it designs programs and develops annual program targets.

This study allows Georgia Power to revisit current customer electricity use patterns and existing programs with an eye toward developing the program portfolio for the 2025 IRP filing. This provides Georgia Power with the opportunity to refine existing programs and develop new programs using a solid analytical and data-driven foundation.

A | DETAILED METHODOLOGY

Potential energy efficiency savings are estimated using a sequential analysis of energy efficiency measures in terms of technical feasibility (technical potential), cost effectiveness (economic potential) and customer acceptance criteria (achievable potential). AEG followed two main steps to perform this assessment:

- Developed long-run, baseline end use forecasts, calibrated to Georgia Power's sales forecasts, to estimate future energy consumption by segment and end use. The baseline forecasts reflect natural turnover of appliances and equipment, efficiency characteristics of current and pending codes and standards, and naturally occurring conservation. AEG developed the forecast in collaboration with the Southern Company Forecasting Group.
- Developed forecasts for technical, economic, and achievable potential that reflect technical impacts of specific energy efficiency measures, measures' cost-effectiveness from a TRC perspective, and customer behavior, respectively. The difference in energy consumption and peak demand between the baseline and individual, alternative forecasts results in forecasts of energy efficiency savings.

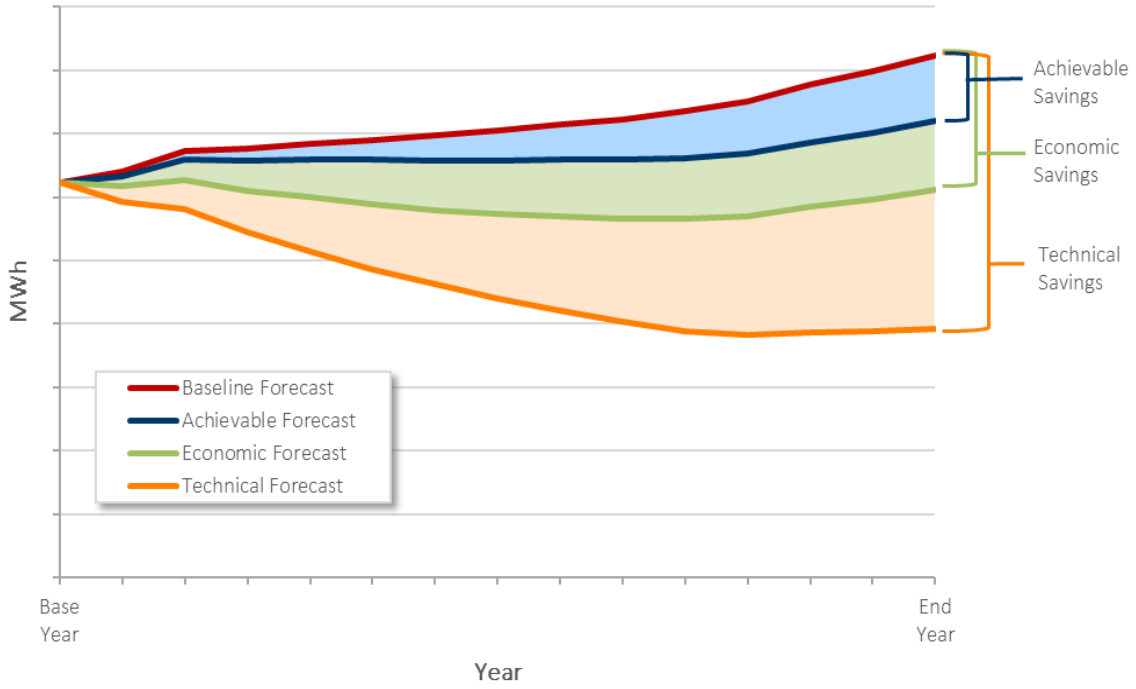
This approach offered several key advantages over alternate approaches:

- Savings estimates were driven by a baseline that aligns with official energy sales and peak demand forecasts. This ensures underlying inputs and assumptions remained consistent with known customer population characteristics. Other study approaches may generate the total potentials by summing individual measures' estimated impacts, resulting in total savings estimates representing unrealistically high percentages of baseline sales and peak demand.
- The forecast incorporates the effects of known changes to equipment standards and naturally occurring efficiency improvements. Equipment standard changes and naturally occurring savings reduce energy use as customers retire lower-efficiency units and install higher-efficiency systems. Including these effects in the baseline forecast prevents inflating potential estimates.
- The same assumptions underlying baseline forecasts were used to develop energy efficiency measure inputs, along with technical, economic, and achievable potential estimates, ensuring consistency across the study.

Figure A-1 illustrates these steps conceptually, showing a hypothetical baseline forecast, along with alternative forecasts associated with technical, economic, and achievable potential.[17] These alternative forecasts represent consumption under different sets of assumptions, and the difference between the baseline and each alternative forecast represents respective potential savings. For example, the technical potential forecast represents total consumption following incorporation of all measures, with total consumption for the technical potential forecast much lower than the baseline (which also indicates the greatest amount of potential). As respective benefit-cost and market acceptance constraints are added, forecasts for economic and achievable scenarios approach the baseline, and the resulting potential savings decrease.

[17] Figure A-1's baseline and alternative forecasts serve purely as examples, and do not represent actual data underlying this assessment.

Figure A-1 Representation of an Alternative Forecast Approach for Estimating Energy Efficiency Potentials



Section 2 describes several steps in this process, including market characterization, baseline forecast development and energy efficiency analysis. In the remainder of this appendix, the focus is on the estimation of technical, economic, and achievable potential.

Estimating Technical Potential

AEG developed the technical potential forecast by assuming that customers install the most efficient, technically feasible measure at time of replacement for end use equipment or over an assumed period for retrofit measures. The resulting forecast of energy consumption was subtracted from the baseline forecast to estimate the technical savings opportunity by customer segment, vintage, end use, year, and measure. This approach accounted for the following three interactive effects:

- Equipment and non-equipment measures: Installing high-efficiency equipment, such as heat pumps, could reduce energy savings in absolute terms (kWh) associated with non-equipment measures, such as wall insulation. For example, installing a high-efficiency heat pump reducing heating and cooling consumption by 20% would reduce the baseline against which insulation would be applied, thus reducing savings associated with installing insulation.
- Non-equipment measure interactions: Due to the interactive effects of installing multiple measures affecting the same end use, standalone savings values cannot simply be added together to calculate total potential. For example, if insulation is installed in a home, this reduces the savings that will be realized from installing new windows. This study accounted for these interactive effects by "stacking" measure installations as described below.
- Inter-end use interactions: Some measures could indirectly affect an end use. For example, installing more efficient lighting could increase heating loads. Where appropriate, the building simulation analysis captured these impacts.

Technical potential for equipment and non-equipment measures required different estimating techniques. For equipment measures, the study assumed consumers would install the most efficient unit available upon equipment burnout, generating savings over standard equipment.

Non-Equipment Measures

Estimating the potential for non-equipment measures required assessing the collective impacts of many measures with interactive effects. For each segment and end use combination, the analysis sought to estimate cumulative effects of the group of eligible measures, incorporating those impacts into the end use model as a percentage adjustment to baseline end use consumption. In other words, the approach estimated the percentage reduction in end use consumption that could be saved in a "typical" structure (e.g., office buildings, retail building) by installing all available measures. This approach began by characterizing individual measure savings in terms of their percentage of end use consumption, rather than their absolute energy savings. The following basic relationship estimated savings for each individual, non-equipment measure:

$$SAVE_{ijm} = EUI_{ije} * PCTSAV_{ijem} * APP_{ijem}$$

where:

- $SAVE_{ijm}$ = annual energy savings for measure m for end use j in customer segment i.
- EUI_{ije} = calibrated annual end use energy consumption for the equipment e for end use j and customer segment i.
- $PCTSAV_{ijem}$ = the percentage savings of measure m relative to base usage for the equipment configuration i.e., considering interactions among measures.
- APP_{ijem} = measure applicability, a fraction representing a combination of technical feasibility, existing measure saturation, end use interaction, and adjustments to account for competing measures.

A measure's savings can be appropriately viewed in terms of its savings as a percentage of baseline end use consumption, given its overall applicability. For example, if wall insulation had overall applicability of only 50%, 10% savings in space heating consumption would yield a final 5% savings for this end use. This value would represent the percentage of baseline consumption the measure would save in an average commercial building.

However, capturing all applicable measures required examining many instances where multiple measures affected a single end use. To avoid overestimating total savings, assessment of cumulative impacts accounted for interaction among various measures, a treatment known as "measure stacking." Stacking effects can be accounted for primarily by establishing a rolling, reduced baseline, applied sequentially to measures in the stack, as shown in the equations below, which apply measures 1, 2, and 3 to the same end use:

$$SAVE_{ij1} = EUI_{ije} * PCTSAV_{ije1} * APP_{ije1}$$

$$SAVE_{ij2} = (EUI_{ije} - SAVE_{ij1}) * PCTSAV_{ije2} * APP_{ije2}$$

$$SAVE_{ij3} = (EUI_{ije} - SAVE_{ij1} - SAVE_{ij2}) * PCTSAV_{ije3} * APP_{ije3}$$

Measures can be stacked using different criteria, such as total savings or cost-effectiveness. For this study, the levelized cost of energy savings determined the stacking order for measures within each end use.

Estimating Economic Potential

Once the technical potential was calculated, the economic (cost-effective) potential was estimated. The first step in this process is to calculate measure cost-effectiveness using the total resource cost (TRC) test, which compares a measure's benefits to the costs that the utility and customers pay to acquire it.[18] If a measure has non-negative, net benefits (i.e., its benefits equal or exceed its costs), it is considered cost-effective. TRC was calculated using estimated utility savings benefits (electric, gas, and water) and incremental costs. Hourly (electric) and monthly (gas and water) end use load shapes account for seasonal differences and system peak coincidence of different end uses. That is, a cooling measure using a greater amount of electric energy during peak periods would be more cost-effective than a lighting measure with the same amount of savings but lower peak coincidence.

Benefit components used in the TRC calculation included the value of time-differentiated and seasonally differentiated avoided electric energy and capacity costs. For measures capable of also saving natural gas and/or water (e.g., high efficiency clothes washers), those avoided cost benefits were also included. Measure cost components consisted of total installed measure costs and applicable operation and maintenance costs (or savings) associated with ensuring the measure is properly functioning over its expected life. The present values of measure costs and benefits were calculated by discounting at the designated rate.

Upon screening all measures, impacts of measures deemed cost-effective relative to baseline consumption estimates could be applied, creating a separate forecast. Where more than one option for a specific application was cost-effective, the most efficient cost-effective option was used. Subtracting this new forecast from the baseline forecast provided the economic potential.

Caveats

The following important considerations should be noted in interpreting economic screening results, as they relate to the assessment of energy efficiency potentials:

- Screening procedure outcomes, described above, depended on assumptions that will likely change over time.
    - Measure costs, for example, will change over time, as demand for energy-efficient technologies increases.
    - Forecasted avoided costs will also likely change over time, and, as they change, so will the value of savings that results from installation of energy-efficient technologies.
    - At the same time, costs of reaching each successive participant can often increase.
- The measure-level analysis includes forecasts of measure costs, forecasts of avoided costs, and annual cost-effectiveness screening. Program costs are not incorporated into the analysis at this stage.
- The economic analysis relied on assumptions intended to reflect an "average" or "typical" customer. Thus, while a measure may have passed the economic screen within the study's context, the measure could fail the cost-effectiveness test in other instances. For example, a premium central air conditioner may be cost-effective in an average, single-family home, but, in a smaller home with fewer occupants, it could fail the economic screen due to decreased savings. Similarly, a measure failing the economic screen on average may be effective in certain niche applications.

[18] The benefits and costs considered in the TRC test are included in Appendix B.

With these caveats, the study's underlying inputs, having been thoroughly reviewed, represent the best information available about specific conditions (regarding technical measure details and customer attributes) in Georgia Power's service territory at the time of the analysis. As with any study of this nature, as new information becomes available, it can be used to update key drivers, but the current study results sufficiently inform the resource planning, program planning, and implementation processes.

Estimating Achievable Potential

Achievable potential represents what customers are likely to do in the face of existing barriers and real-world conditions. It refines economic potential by applying market penetration curves that account for market barriers, customer awareness and attitudes, program maturity, incentive budget levels and other factors that affect market penetration of energy efficiency measures. This study estimated four levels of achievable potential, corresponding to different levels of incentives (25%, 50%, 75% and 100%) relative to the incremental measure cost.

The amount of energy efficiency deemed achievable under each of the four scenarios is a function of three primary factors, the first of which is described above, with the remaining two described below:

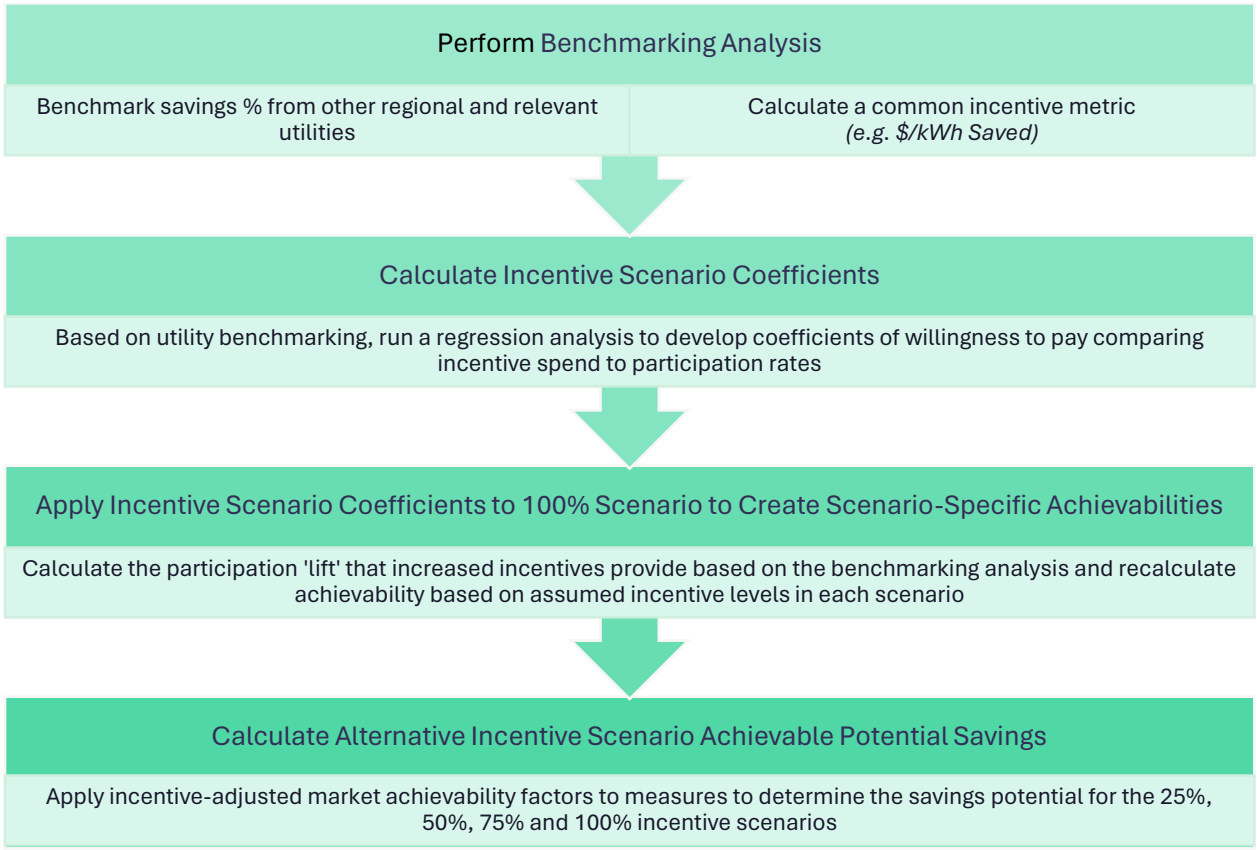
1. The available economic potential,
2. The amount of potential assumed to be achievable over the long-term, and
3. The assumed rate of acquisition, or market adoption curves

Long-Term Achievability

AEG's analysis began with an assumption that over a 20-year period, 85% of the economic potential could be acquired if a utility was willing to pay the full incremental measure cost (the 100% incentive scenario).[19] With this assumption as an anchor point, AEG developed achievability assumptions for other incentive scenarios by benchmarking other utilities' program savings and incentive levels to investigate the relationship between incentives and program savings. Table A-1 below provides a high-level flow chart of the methodology for developing long-term achievability assumptions for each incentive scenario.

[19] This level of achievability is consistent with the assumption in the Northwest Power and Conservation Council's 2021 Power Plan.

Table A-1 Incentive Scenario Achievability Approach



Market Adoption Curves

Market adoption curves are defined by a starting point (represented as a percent of the economic potential) and a rate at which they ramp up to 100% of the identified long-term achievable potential. These curves tend to follow S-shaped patterns, representing the shape of technology diffusion in markets.

In the 2020 TEAPot cycle, AEG conducted a participation analysis which compared Georgia Power's 2018 and 2019 program savings to the first-year economic potential results from this study at the measure category-level within each sector.[20] The results of this analysis were used to set the starting penetration of the market adoption curves for each measure category. In addition, by anchoring the analysis on recent program achievements, the analysis ensures that the near-term achievable potential is realistic at similar incentive levels.

Once the starting point of the market adoption curve was determined, each measure category was matched to the closest ramp rate from the Northwest Power and Conservation Council's 2021 Power Plan, which represents a well-vetted source for reasonable technology diffusion curves. For each measure, the same market adoption curve was used in each incentive scenario, with the varying level of achievability dictating how the resulting achievable potential may vary as the incentives as a percent of incremental measure cost are increased or decreased.

[20] For the purpose of this analysis, commercial and industrial sectors were grouped together to align with Georgia Power's program delivery.

B | BENEFIT-COST ANALYSIS

When analyzing the cost effectiveness of energy efficiency, the following indicators are considered to account for perspectives of different stakeholders:

- The Participant Cost Test (PCT) addresses a participant perspective, which considers net benefits to those participating in an energy efficiency program.
- The Total Resource Cost (TRC) addresses the combined perspective of the utility and its customers, which considers costs of an energy efficiency measure or program relative to the benefits of avoided utility supply costs (including energy and water).
- The Ratepayer Impact Measure (RIM) addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or energy efficiency program.
- The Program Administrator Cost Test (PAC) considers the cost of energy efficiency measure incentives and program administration relative to the benefits of avoided utility supply costs.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (PCT, TRC, RIM, and PAC); consistent with the California Standard Practice Manual.[21]

Table B-1 Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, and maintain an energy efficiency measure
Program Costs	Administrative and marketing costs required to implement energy efficiency programs
Incentives	Costs from the utility to the participant to encourage the purchase, installation, and maintenance of energy efficiency measures

Table B-2 Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Decrease in gas bill Decrease in water bill Customer incentives
Cost	Customer incremental costs

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

Table B-3 *Total Resource Cost (TRC)*

Component	Definition
Benefit	Decrease in electric utility supply costs Decrease in gas utility supply costs Decrease in water utility supply costs
Cost	Measure incremental costs Non-incentive program costs[22]

Table B-4 *Ratepayer Impact Measure (RIM)*

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Decrease in electric revenues Non-incentive program costs[23]

Table B-5 *Program Administrator Cost Test (PAC)*

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Customer incentives Non-incentive program costs[24]

[22] These costs are not included in measure-level cost-effectiveness screening, but are included in sector- and portfolio-level cost-effectiveness analysis presented in this report

[23] These costs are not included in measure-level cost-effectiveness screening, but are included in sector- and portfolio-level cost-effectiveness analysis presented in this report

[24] These costs are not included in measure-level cost-effectiveness screening, but are included in sector- and portfolio-level cost-effectiveness analysis presented in this report



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