Georgia Power

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241 Ralph McGill Boulevard NE
Atlanta, GA 30308-3374

PUBLIC DISCLOSURE

January 31, 2018

Mr. Reece McAlister
Executive Secretary
Georgia Public Service Commission
244 Washington Street, S. W.
Atlanta, Georgia 30334

RE: Georgia Power Company's Report on Achievable Energy Efficiency Potentials Assessment; Docket No. 41253

Dear Mr. McAlister:

Enclosed for filing is Georgia Power Company's Report on Achievable Energy Efficiency Potentials Assessment (the "Report").

The Report contains certain information that is subject to the trade secret rules of the Georgia Public Service Commission (the "Commission"). Therefore, in addition to the trade secret document and per agreement with Commission Staff, an original and five (5) copies of a redacted version of the Report, as well as an electronic redacted version of the Report, are enclosed for public disclosure.

If you have any questions, please contact Mr. Marc Vinson at 404-506-2687.

Sincerely,

Kyle C. Leach
Vice President, Regulatory Affairs
kcleach@southernco.com

Enclosure

33858370

GEORGIA POWER COMPANY'S REPORT ON ACHIEVABLE ENERGY EFFICIENCY POTENTIAL ASSESSMENT

Docket No. 41253

January 31, 2018

GEORGIA POWER COMPANY'S

REPORT ON ACHIEVABLE ENERGY EFFICIENCY POTENTIAL ASSESSMENT

Docket No. 41253

Georgia Power Company
241 Ralph McGill Blvd NE
Atlanta, Georgia 30308

Authorized person to receive notices or communications with respect to this report:

Marc Vinson, Sr. Regulatory Affairs Representative
Regulatory Affairs, BIN 10230
Georgia Power Company
241 Ralph McGill Blvd NE
Atlanta, Georgia 30308
Voice: 404-506-2687
Fax: 404-506-7253

BASIS FOR THE ASSERTION THAT THE

INFORMATION SUBMITTED IS A TRADE SECRET

As part of the 2017 Demand Side Management Working Group process under Docket No. 41253, Georgia Power Company ("Georgia Power" or the "Company") submits to the Georgia Public Service Commission its Report on Achievable Energy Efficiency Potential Assessment, which contains specific market information (the "Information") of the Company. The Information is a trade secret of Georgia Power, the Southern Company and their affiliates.

The Information derives economic value from not being generally known to, and not being readily ascertainable by proper means by other persons who can obtain economic value from its disclosure or use. Additionally, the Information is subject to extensive efforts to maintain its confidentiality.

Specifically, the Information includes detailed information regarding the Company's energy and demand forecast. Revealing the redacted information regarding the energy and demand forecast would give competitors of Georgia Power a competitive advantage in the marketplace by revealing the Company's prospective growth and load shapes. The information provided constitutes detailed energy usage information regarding specific classes of customers. If revealed to the public, a competitor could use the information to tailor proposals with the intention of targeting certain groups of customers, thereby undermining the Company's market position. Such information would assist competitors in undercutting Georgia Power's bids to win both wholesale and retail customers. In addition, such information would reveal the Company's needs in the short-term, thereby potentially harming the Company's ability to make cost-effective sales or purchases of energy on behalf of its customers.

The Information is subject to substantial procedures to maintain its secrecy. Only select Georgia Power and Southern Company personnel and their legal counsel are granted access to the Information. Those personnel receive access only on a "need to know" basis. If a party outside of Georgia Power and Southern Company affiliates and their legal counsel are granted access to the trade secret portions of the Information, the party is required to sign a confidentiality agreement with respect to the trade secret portions of the Information.

Larry Legg, first being duly sworn, deposes and states that he has reviewed the Report on Achievable Energy Efficiency Potential Assessment and that to the best of his knowledge the information included in such report is accurate and that the specific information designated as trade secret constitute trade secrets pursuant to Article 27, Chapter 1, Title 10 of the Official Code of Georgia.

Larry Legg

Larry Legg
Manager, Market Planning
Georgia Power Company

Subscribed and sworn to before me this 30th day of January 2018.

Mary B. Harris

Notary Public

My Commission expires: 09-21-2018

My Commission Expires 09/21/2018

NOTARY PUBLIC

GEORGIA POWER COMPANY'S REPORT ON

ACHIEVABLE ENERGY EFFICIENCY POTENTIAL ASSESSMENT

Docket No. 41253

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APPENDICES

1. Background

Georgia Power submits this report to the Georgia Public Service Commission (the "Commission") in accordance with the Commission's Final Order for Docket No. 40161, Georgia Power Company's Application for Approval of its 2016 Integrated Resource Plan and Docket No. 40162, Georgia Power Company's Application for the Certification, Decertification, and Amended Demand Side Management ("DSM") Plan. The Final Order specifies the use of the DSM Program Planning Approach for the 2019 IRP which outlines the requirement for the Company to prepare an energy efficiency potential study:

> *"Georgia Power will utilize a technical and economic potential study for Georgia Power's service territory to assist in targeting DSM programs in the areas where the highest market potential exists. For the 2019 IRP, Georgia Power will file a new energy efficiency potential study one year in advance of the 2019 IRP filing."*

The DSM Program Planning Approach includes nine specific steps that address the preparation of the DSM plan for the 2019 IRP. Specifically, steps one through three discuss the process of preparing this report, including the hiring of a third-party consultant, preparing an energy-efficiency "Technical Reference Manual," and using the results of this energy-efficiency potential study to "assist in targeting DSM programs in the areas where the highest market potential exists." The Company collaborated with the Demand Side Management Working Group ("DSMWG") throughout the process of preparing this report. This collaboration began with the DSMWG helping the Company identify energy-efficiency measures to include in the Technical Reference Manual, reviewing and commenting on the potential study's analytical methodologies, and continued with the Company sharing specific technical information on certain energy-efficiency measures through the Technical Reference Manual as detailed in step three of the DSM Program Planning Approach.

The Company hired Nexant, Inc. ("Nexant") to provide services in support of these requirements, including preparation of the Technical Reference Manual and energy-efficiency potential study, using a similar methodology and approach as that employed in 2015 for the Company's most recent potential study. These studies estimate efficiency potential within the context of current laws and regulations. Nexant is a nationally-recognized consulting firm and has recently conducted energy-efficiency potential studies of similar scope in other states.

This report provides an updated energy-efficiency study similar to the Company's previous energy-efficiency potential studies ("Georgia Power Company's Report on Achievable Energy Efficiency Potentials Assessment"), filed with the Commission in 2007, 2012, and 2015 under Dockets 22449-U, 34414, and 38401 respectively. These energy-efficiency potential studies are comprehensive analytical undertakings, requiring a substantial commitment of Company and consultant time and expense to prepare.

2. Results of the Study

The study estimates the technical, economic, and achievable potential for energy-efficiency technologies for the Company's residential, commercial, and industrial customers for the study period of 2019 - 2030. The technical potential includes all energy-efficiency measures suitable for the Company's customers, climate, building stock, and production facilities, and assumes there are no economic or other market barriers preventing customers from installing these measures. The economic potential is defined as taking all the technically-feasible measures and installing all that are economic, as defined by the Total Resource Cost ("TRC") Test. The TRC Test is described fully in the attached report, however in general terms, the test is a measure of net societal value that compares the benefits of avoided utility supply costs (including electricity, natural gas, and water) with the costs to achieve those savings (incremental measure costs). Other cost tests measure economic attractiveness from the participant's perspective (the Participant Cost Test), the non-participant's perspective (the Ratepayer Impact Measure Test), and the utility's perspective (the Program Administrator Cost Test).

The achievable potential included in this report consists of four planning scenarios based on different levels of incentives provided by the Company to customers to encourage the purchase and installation of energy-efficiency measures. Since this study estimates the technical, economic, and achievable potential, it is also referred to as the "TEAPOT" study. This TEAPOT study was conducted using industry-standard methodologies. Please see the report for detailed descriptions of the methodologies used to estimate energy-efficiency potential.

The TEAPOT study estimates that approximately one-quarter of the Company's energy forecast for the year 2030 could be avoided with technically feasible energy-efficiency measures. If all economically feasible measures were installed, a smaller amount (about one-sixth) of the energy forecast for 2030 could be avoided (Table 5 in the attached report).

While the technical and economic potential estimates are useful in providing a context of the total available market, these estimates are strictly hypothetical calculations that bear little-to-no relation to a reasonable estimate of what could be achieved in the market. When considering real-world barriers, estimates of what can be achieved in the market are significantly lower than the economic potential. For example, many measures require a significant upfront payment to install, requiring homeowners or business owners to make a trade-off between the somewhat uncertain future return on investment from energy-efficient technologies with other competing uses for homeowners' cash, savings, and investment funds or for business owners' capital and maintenance budgets. Other structural issues, such as a tenant/landlord relationship (where the equipment purchaser is not the energy bill payer), can inhibit the purchase and implementation of energy-efficiency measures.

Even with these barriers, significant economic stimuli exist today without utility incentives to justify higher levels of adoption for many energy-efficiency measures if customers acted solely on the basis of economic returns. Since some customers don't always act in a rational economic manner, four different levels of incentives were used to overcome customer and institutional barriers to determine the achievable potential. The results show hypothetical achievable energy savings, ranging from about 4.6% to about 9.3% of forecasted 2030 energy sales, depending on the level of incentives paid to customers (Table 1 in the attached report).

The study further shows that the achievable energy-efficiency potential provides significant TRC net benefits, however they come at a significant rate impact to Georgia Power customers, particularly those customers who do not participate in the programs. Theoretically, TRC net benefits of between $2.0 and $4.0 billion can be achieved, at a RIM net cost of between $2.4 and $6.3 billion to electricity customers (Table 2 in the attached report). These impacts occur over the life of the installed measures due to program administration costs, customer incentive costs, and the re-allocation of fixed costs embedded in Georgia Power's current rate design.

3. Utility Planning and Policy Implications

The detailed analysis and results of this comprehensive study are useful in guiding energy-efficiency program design. Utility planners use the results to provide direction in designing future energy-efficiency programs, as well as monitoring the relative economics of energy-efficiency programs compared to supply-side options. Policymakers can use the results to understand the benefits and costs of encouraging energy-efficiency investments through the use of utility programs, incentives, and educational initiatives.

Utility Planning

Energy-efficiency program planners will leverage the detailed analysis in the study to gain insight into the current saturation and potential customer acceptance of energy-efficiency technologies for a wide variety of customer segments, buildings and facility types. The study results also provide useful insight into the relative attractiveness of various energy-efficiency measures, allowing program planners, customers, and trade allies to consider focusing their efforts on the most cost-effective technologies. For example, the commercial market offers the largest opportunity for energy-efficiency improvements, representing 58% of the total energy savings potential identified for all three customer classes - residential, commercial, and industrial (Figure 4 in the attached report). These energy savings represent a reduction of about 13% of the commercial class energy forecast for 2030 for the 100% incentive scenario (Table 18 in the attached report).

Resource planners will find the study results useful in understanding the economics of serving customers' needs through increased energy efficiency relative to supply-side options. The large rate impacts resulting from the four theoretically achievable incentive scenarios ($2.4 - $6.3 billion) demonstrate that the current supply-side plan for serving future customer needs puts significantly less upward pressure on rates. Resource planners also need to balance the fact that the availability of physical generation assets is much more certain than the expected reductions from energy-efficiency programs. Energy-efficiency reductions depend on customers' behavior and may differ significantly from the expectations included in this study. Reliability can be jeopardized if too much reliance is placed on uncertain savings from energy-efficiency programs.

In addition to making assumptions on future customer behavior, this TEAPOT study is also based on a multitude of other assumptions subject to uncertainty. These uncertain factors include the future prices of energy (electricity and natural gas), the cost and performance of energy-efficiency technologies, and future building codes and appliance standards. These and other important assumptions may alter the relative economics of demand- and supply-side options.

Policy Implications

Policymakers can gain important insights into the benefits and costs of the alternative scenarios presented in this report. First, many energy-efficiency technologies offer attractive economic returns to customers without additional incentives. While ratepayer-funded programs with financial incentives offered to customers are effective at increasing the awareness and adoption of energy-efficiency technologies, these increases come at a cost to all customers through higher utility rates. Policymakers should continue to consider the balance of raising utility rates to pay for the incentive programs received by program participants with the economic benefits the programs offer.

Second, significant structural market barriers inhibit customers from participating in utility-sponsored programs, regardless of the size of the financial incentives offered. For example, customers who rent their residences or businesses often cannot make improvements to their buildings and yet they typically pay the energy bills. Likewise, landlords are often responsible for providing the energy systems in their buildings, but typically do not pay the energy bills, so they do not directly receive bill savings from energy-efficiency improvements. Codes and standards are a more effective strategy for overcoming this type of structural barrier than ratepayer-funded incentive programs.

Third, many industrial customers have long resisted required participation in ratepayer-funded programs because of their associated rate impacts. While industrial customers remain committed to improving the efficiency of their operations in order to remain globally competitive, they oppose programs that result in cross-subsidies within the industrial class which would result in the subsidizing of some investments by other industrial customers, possibly even a direct competitor.

Finally, the Company employs industry standard methods that comply with the Commission rules regarding DSM evaluations. The Commission rules state that for new demand-side resources, the Company will screen demand-side measures using the Ratepayer Impact Measure Test, the Participant's Cost Test, the Total Resource Cost Test and the Societal Cost Test (See Commission Rule 515-3-4-.04(4)). The Company supports the Commission rules that address these issues.

4. Conclusions and Recommendations

The results presented in this report estimate the potential for energy-efficiency technologies to reduce energy consumption by the Company's residential, commercial, and industrial customers across varying levels of incentives and market adoption. The achievable scenario estimates show potentially large reductions in customers' energy and peak demand needs in the future. At the same time, obtaining these reductions with ratepayer-funded incentive programs comes at a significant cost in the form of higher rates. Additionally, reliability could be impacted at the levels of energy and demand reduction described in some scenarios in this report.

The Company supports the Commission's policy that the Company's DSM plan should minimize upward pressure on rates and maximize economic efficiency. This policy requires the careful balancing of the benefits available to the participants of the programs with the costs borne by all customers through higher rates.

TRADE SECRET

APPENDIX

Achievable Energy Efficiency Potential Assessment

Submitted to Georgia Power Company

Submitted by Nexant

January 31, 2018

PUBLIC DISCLOSURE

APPENDIX

Achievable Energy Efficiency Potential Assessment

Submitted to Georgia Power Company

Submitted by Nexant

January 31, 2018

REPORT

Reimagine tomorrow.

Achievable Energy Efficiency Potential Assessment

PUBLIC DISCLOSURE

Submitted to Georgia Power Company
January 31, 2018

Reimagine tomorrow.

Every day our employees partner with our customers to reimagine the world we live in and how we can drive a more productive and sustainable energy future. Nexant provides utilities, energy enterprises, and chemical companies with comprehensive industry software, expertise, consulting, and energy solutions, so they can deliver on their promise, better serve their customers, and deliver a better future.

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1 Executive Summary

As part of the 2019 Integrated Resource Plan ("IRP") process, Georgia Power Company ("Georgia Power") must complete an updated energy efficiency technical, economic, and achievable potentials study, as described in the 2016 IRP Final Order (Dockets 40161 and 40162), per the Georgia Public Service Commission. This report details the results of the study.

Georgia Power retained Nexant, Inc. ("Nexant") to conduct an assessment of energy efficiency potentials in the Georgia Power service area, building on results from the energy efficiency measure screening and technical analyses, which Nexant had supported over the preceding months. Southern Company Services provided additional support with the study's modeling analyses.

1.1 Assessment Approach

The achievable energy efficiency potentials assessment used the following three sequential steps:

- Organize input data: Nexant compiled final energy efficiency measure screening results, effective useful life, incremental cost, and collected service area sales forecast data. Inputs included confidential data, such as forecasts of customer counts and floor space, end-use saturations, end-use unit energy consumption, and energy intensity.
- Estimate energy efficiency potentials impacts at the end-use level: Southern Company Services modeled individual energy efficiency measures in EnerSim[1] to create load shapes, calculate electricity revenues, and evaluate any other utility impacts. The Profitability Reliability Incremental Cost Evaluation Model ("PRICEM") used the EnerSim load shapes to calculate the electric economics of energy efficiency measures. Using energy savings and associated economic impacts (electric, gas, and water) for each of the 427 discrete measures, Nexant analyzed groups of measures by facility type and end use.
- Estimate theoretically achievable impacts: Following a review of energy efficiency market potentials studies, reported Energy Information Administration ("EIA") data, and observed program results across North America, Nexant applied plausible market penetration curves to each end use, estimating technically feasible, economically feasible, and potentially achievable energy efficiency impacts.

[1] EnerSim—a building energy simulation model, used to predict hourly energy consumption in buildings based on construction characteristics, insulation, occupancy, orientation, local weather, and other attributes—was used to generate all energy usage profiles for weather-sensitive end uses examined for both residential and nonresidential measures. The U.S. Department of Energy, having certified and approved EnerSim, lists the model as a "Qualified Software" on its website.

1.2 Definitions of Energy Efficiency Potential

Figure 1 shows types of potentials available in a utility's territory, defined as follows:

- Technical potential: The quantification of savings that can be realized if energy efficiency measures passing the qualitative screening are applied in all feasible instances, regardless of cost.
- Economic potential: A subset of technical potential, where measures are cost-effective from the Total Resource Cost ("TRC") perspective, without regard to cross-subsidies.
- Achievable potential: A subset of economic potential, energy savings that can feasibly be achieved through program and policy interventions. This study estimated theoretically achievable potential for four policy 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 1. Illustration of Energy Efficiency Potentials

Note: Figure 1 is from the Environmental Protection Agency National Action Plan for Energy Efficiency ("EPA-NAPEE") Guide for Conducting Energy Efficiency Potential Studies; for illustrative purpose only.

Each scenario included significant expenditures on incentives subsidizing energy efficiency measure purchases. Note that this study has been based on a number of estimates, including penetration rate projections that attempt to describe human behaviors associated with program structures. One cannot know with certainty whether results can be obtained under the scenarios studied.

1.3 Summary Results

This section provides high-level results of achievable potential; the following section provides detailed results. The assessment period covers 2019-2030, with cumulative results shown below. Achievable potential ranged from 4.61% to 9.31% of 2030 electricity sales and 4.42% to 8.92% of 2030 peak demand[2], depending on incentive scenarios. Table 1 presents the 2030 potential and percent of load for the four incentive scenarios.

Table 1. Theoretically Achievable Potential Savings (Cumulative through 2030)

Achievable Scenario	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Reduction in Electricity Sales (MWh)	REDACTED	4.61%	REDACTED	6.66%	REDACTED	8.12%	REDACTED	9.31%
Reduction in Peak Demand (MW)	REDACTED	4.42%	REDACTED	6.37%	REDACTED	7.78%	REDACTED	8.92%

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

Figure 2 and Figure 3 provide forecasts (electricity sales and peak demand, respectively) relative to Georgia Power's baseline forecast[3], based on the achievable potential scenarios over the study horizon.

Figure 2. Energy Forecasts for Theoretically Achievable Potential (Electricity Sales)

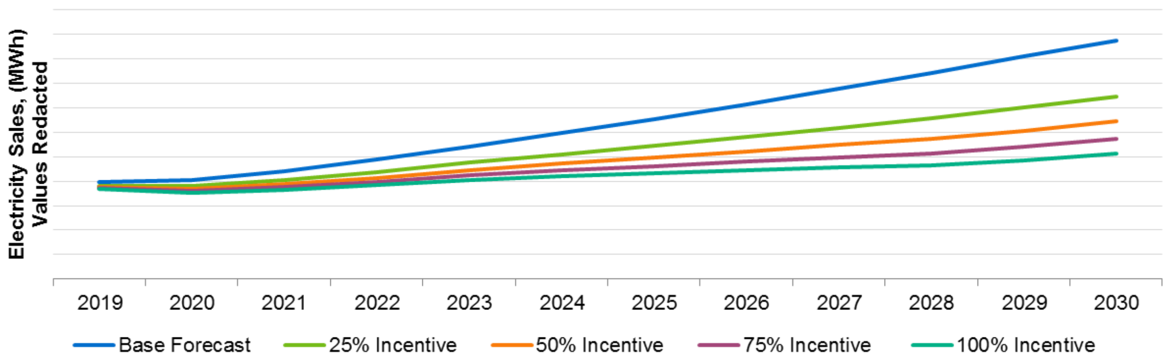
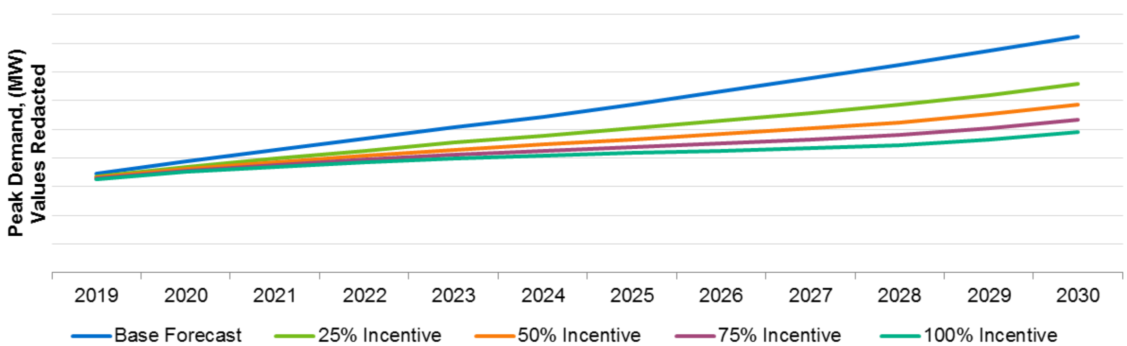


Figure 3. Demand Forecasts for Theoretically Achievable Potential (Peak Demand)



3 Baseline forecast is based on Georgia Power's total retail forecast for Budget 2017.

1.4 Achievable Potentials by Sector

Figure 4 and Figure 5 provide the relative contributions by each sector to the theoretically achievable energy and peak demand potential for 2030.

Figure 4. 2030 Theoretically Achievable Potential by Sector (Electricity Sales)[4]

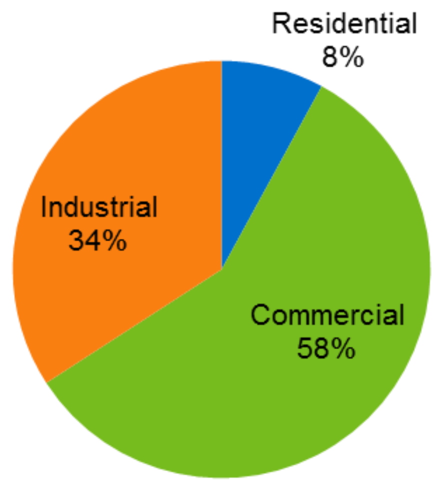
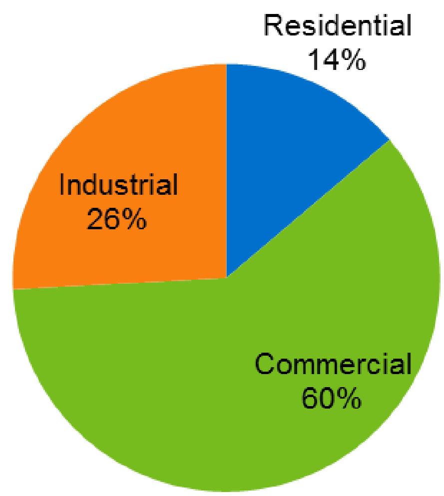


Figure 5. 2030 Theoretically Achievable Potential by Sector (Peak Demand)[4]

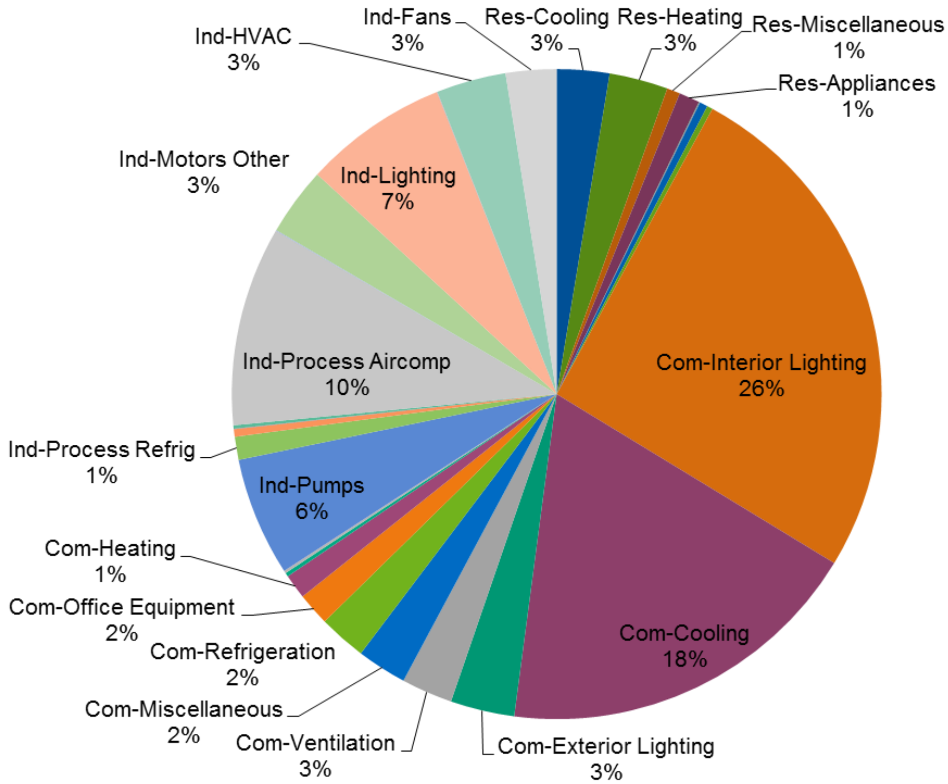


[4] Sector-level data presented is based on 100% incentive scenario but relative contributions by sector are approximately the same for all achievable potential scenarios.

1.5 Achievable Potentials by End Use

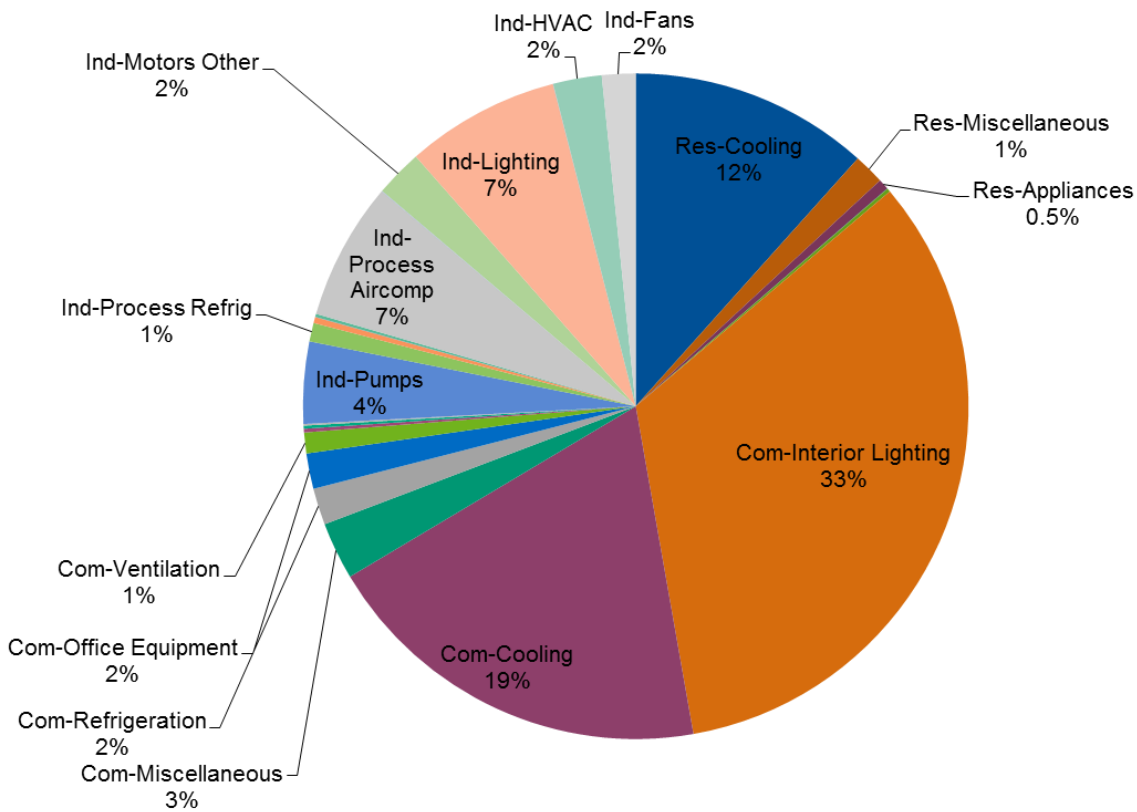
Figure 6 and Figure 7 provide energy and peak demand potential for 2030 by end use (all sectors).

Figure 6. 2030 Theoretically Achievable Potential by End Use (Electricity Sales)[5]



[5] Labels omitted for end uses representing less than 0.5% of theoretically achievable potential. The following are removed: residential electronics; lighting; and water heating; commercial food preparation and water heating; industrial process cooling, process heating, process other, indirect boiler, and other. End use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

Figure 7. 2030 Theoretically Achievable Potential by End Use (Peak Demand)[6]



6 Labels omitted for end uses representing less than 0.5% of achievable peak demand savings. These include the following: residential electronics, lighting, and water heating; commercial water heating, food preparation; industrial process cooling, process heating, process other, indirect boiler, and other. End use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

1.6 Achievable Potential Cost-Effectiveness

The following tables present cost-effectiveness indicators from Total Resource Cost ("TRC"), Ratepayer Impact Measure ("RIM"), Participant Cost Test ("PCT") and Program Administrator Cost Test ("PAC") perspectives, respectively, for achievable energy efficiency impacts from 2019 through 2030. The tables present economic indicators for each scenario of theoretically achievable potential. Refer to Appendix B for a detailed description of the methods used for calculating TRC, RIM, PCT, and PAC. Theoretically, TRC net benefits of between $2.0 and $4.0 billion can be achieved, at a RIM net cost between $2.4 and $6.3 billion to electricity 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[7]. Theoretically, PCT net benefits of between $4.4 and $10.3 billion are available to participants. PAC net benefits are between $2.2 and $2.9 billion.

Table 2. Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2030)

	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	$1,977	2.76	($2,378)	0.52	$4,355	5.34	$2,206	6.93
50% Incentive	$2,856	2.76	($3,798)	0.50	$6,654	5.60	$2,827	4.15
75% Incentive	$3,485	2.76	($5,075)	0.47	$8,559	5.85	$3,007	2.96
100% Incentive	$3,996	2.76	($6,325)	0.45	$10,321	6.10	$2,942	2.30

[7] This study does not estimate RIM benefits and costs from a gas and water utility perspective, when applicable. To the extent gas or water utility lost revenues exceed avoided gas or water supply costs, as would normally be expected, gas or water rates would be adversely affected, and would rise above otherwise anticipated increases. This assessment provides estimated net present value data for 2019 through 2030.

Figure 8, Figure 9, Figure 10, and Figure 11 illustrate the cost breakdowns for TRC, RIM, PCT, and PAC perspectives for each of the four scenarios.

Figure 8. TRC Benefits and Costs by Scenario (Cumulative through 2030)

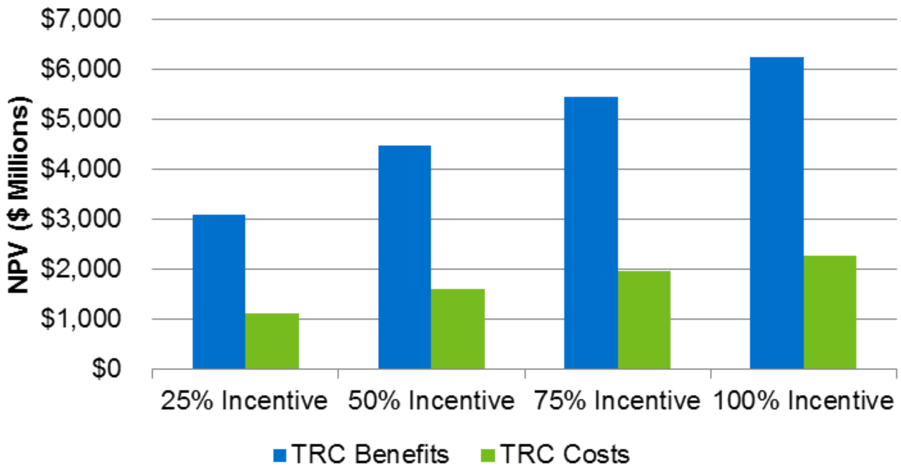


Figure 9. RIM Benefits and Costs by Scenario (Cumulative through 2030)

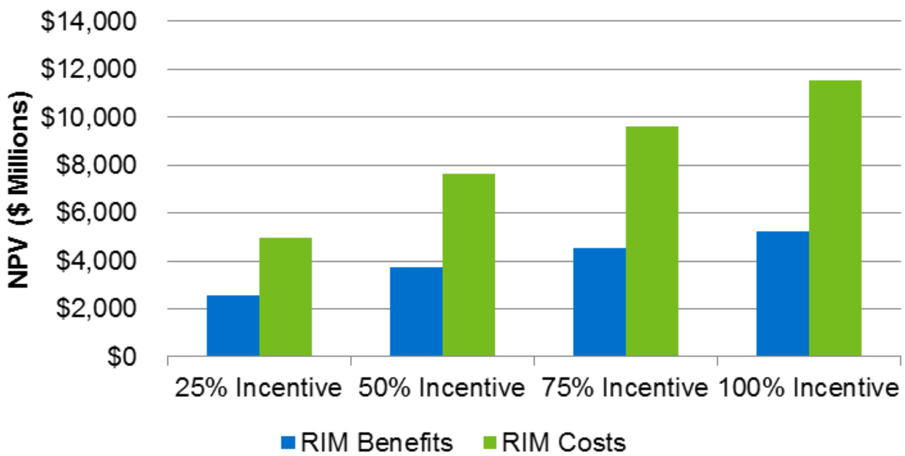


Figure 10. PCT Benefits and Costs by Scenario (Cumulative through 2030)

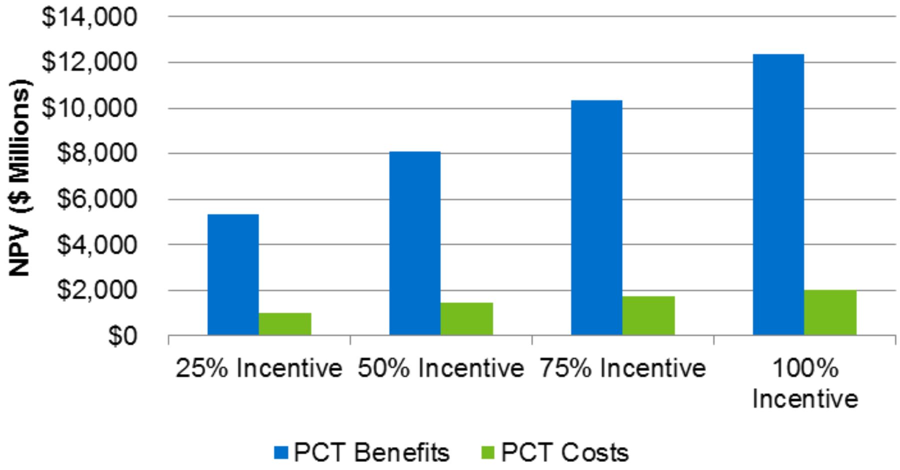


Figure 11. PAC Benefits and Costs by Scenario (Cumulative through 2030)

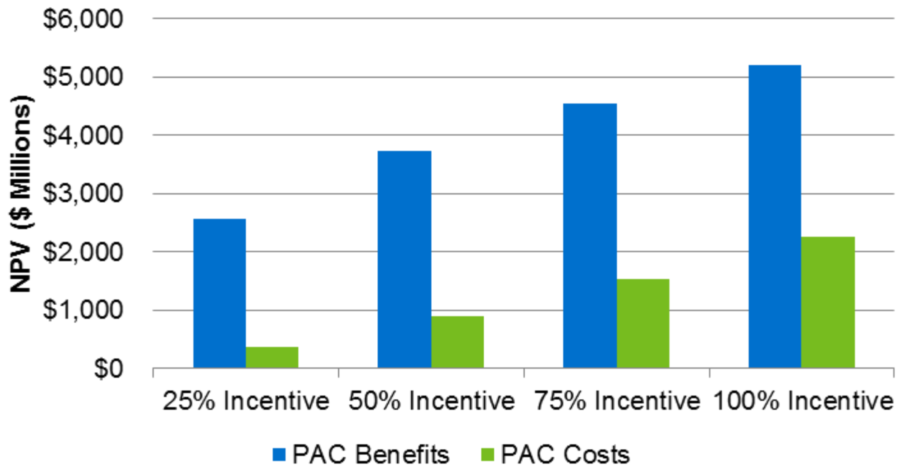


Table 3 illustrates program incentive and administrative costs for the four scenarios.

Table 3. Energy Efficiency Program Expenditures (Cumulative NPV through 2030)

Achievable Scenario	Incentives ($MM)	Administrative Costs ($MM)	Total Costs ($MM)
25% Incentive	$251	$171	$422
50% Incentive	$723	$319	$1,042
75% Incentive	$1,324	$476	$1,800
100% Incentive	$2,024	$647	$2,671

1.7 Conclusions

This assessment identifies the potential for future energy efficiency investments by Georgia Power customers above the levels that would naturally occur but 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 a similar 2015 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 4.61% of year 2030 forecast sales under a 25% Incentive Scenario to 9.31% under a 100% Incentive Scenario.
- TRC benefits from energy efficiency improvements could range as high as $2.0 billion to $4.0 billion.
- Cumulative program incentives for energy efficiency ranging from $251 million to $2.0 billion by 2030.
- Not including incentives, net participant benefits range from $4.1 billion to $8.3 billion.

However, these benefits come at substantial costs to customers:

- Net costs to electric utility customers could range from $2.4 billion to $6.3 billion, over and above those associated with supply-side costs.
- Program costs alone could increase electric ratepayer burden by a total of $422 million to $2.7 billion.

1.8 Caveats

Readers should consider the following, important caveats when considering these results.

1.8.1 Uncertainties

Market acceptance rates serve as a key determinant of the potential for achievable energy efficiency savings. However, market acceptance depends on behavioral factors that are hard to predict and involve a high level of uncertainty. The estimated impacts of efficient technologies on energy consumption provide another key determinant of savings potential, yet these inputs also present uncertainty. While efficient technology options can be reasonably well-defined in the near term, customer behaviors and electricity usage patterns vary widely and can differ significantly from assumptions made to model “typical” usage profiles. Future years may experience greater uncertainties due to insufficient information about future technology choices and future codes and standards improvement. Consequently, the availability and magnitude of future impacts must be considered inherently speculative.

1.8.2 Potential Reliability Impacts

The above-noted uncertainties could result in a deterioration of system reliability if estimates of achievable energy savings are used to justify cancellation or deferral of Power Purchase Agreements (“PPAs”) and generation capacity construction programs. If expected energy and capacity savings do not materialize or sustain, planned PPAs and generation resource options—many of which require long lead times—might be insufficient to maintain system reliability until additional resource options can be secured.

1.8.3 Rate Impacts

Energy Efficiency programs could cause electricity rates to rise faster than they would ordinarily. The noted uncertainties could result in lower energy savings, without corresponding reductions in fixed program costs and, hence, adversely impact rates. Market acceptance rates failing to materialize, for example, reduce incentives and rebate processing costs, but do not reduce marketing or other fixed program management and reporting costs. Moreover, if realized technology impacts prove less than estimated, impacts of all estimated costs for rebates, processing, marketing, and administration would remain, but with diminished supply cost savings. Thus, rate impacts could be more severe than those estimated in this study.

2 Study Approach

This report presents findings from the electric energy efficiency technical, economic, and achievable potentials study, supporting Georgia Power's 2019 IRP filing. The study's horizon covers 2019-2030, encompassing the residential, commercial, and industrial sectors.

2.1 Background

As part of the 2019 IRP process, Georgia Power must complete an updated energy efficiency technical, economic, and achievable potentials study, as described in the 2016 IRP Final Order (Dockets 40161 and 40162), per the Georgia Public Service Commission. This report details the results of the potentials study.

Georgia Power retained Nexant to conduct an assessment of energy efficiency potentials in the Georgia Power service area, building on results from the energy efficiency measure screening and technical analyses, which Nexant had supported over the preceding months. Southern Company Services provided additional support with the study's modeling analyses.

2.2 Objectives

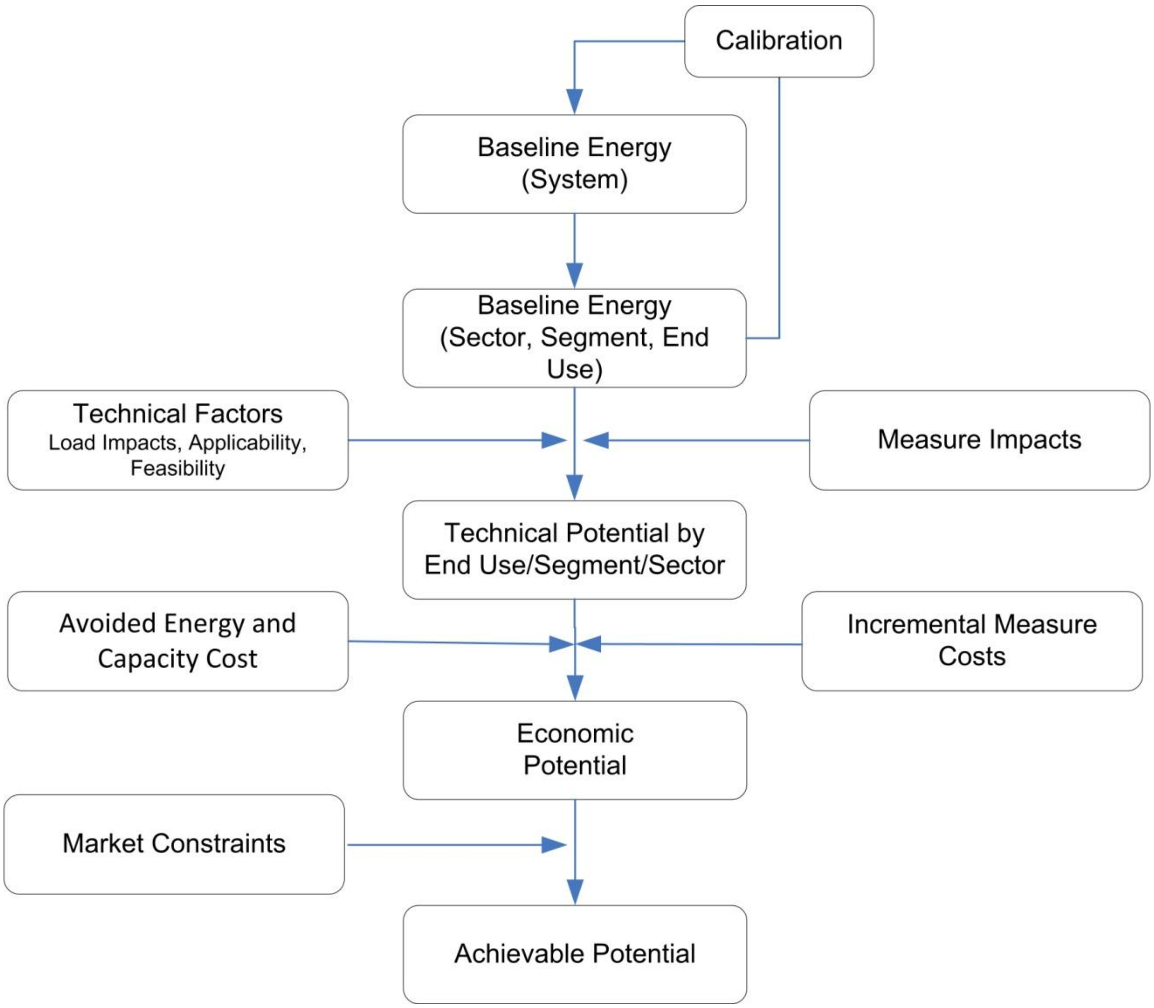
This study includes the following key objectives:

- Expanding the scope of energy efficiency measure screening and economic analyses to quantify theoretical technical and economic energy efficiency potentials.
- Assessing theoretically achievable energy efficiency potential through scenario analyses, corresponding to potential policy settings, in which customers would be offered incentives to offset a percentage of the incremental measure cost.

2.3 Approach

The general methodology used can best be described as a hybrid "top-down/bottom-up" approach. As illustrated in Figure 12, it began by examining the current energy forecast, and then disaggregating this into its constituent customer-class and end-use components. Effects for a range of energy efficiency approaches and practices for each end use could then be examined, while accounting for fuel shares, current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce resource potentials estimates at the end-use, customer-class, and system levels.

Figure 12. Potentials Assessment Methodology



The following, detailed methodology for estimating energy efficiency potentials remained consistent for all three sectors:

- Develop a baseline forecast: The study created a baseline electric energy forecast, based on end-use consumption estimates, and calibrated to Georgia Power's official electric energy forecast. This provided accurate consumption estimates by sector, customer segment, end use, and year.
- Compile measure lists: All measures applicable to Georgia Power's climate and customers were analyzed to best depict energy efficiency potentials over a 12-year planning horizon (2019-2030). A qualitative screen was applied to the measure list using the following criteria for removal:
  - Difficult to quantify savings
  - Current practice
  - Better measure available

  - Immature or unproven technology
  - Limited applicability
  - Poor customer acceptance
  - Health and environmental concerns
  - End-use service degradation
- Collect cost and impact data for measures: For all measures passing the qualitative screening, market research and models were used to estimate costs, energy, and demand savings.
  - Nexant conducted market research to estimate measure costs and effective useful life. The cost data differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
  - Georgia Power and Southern Company Services conducted the economic analysis for energy efficiency measures. All residential and commercial measures were analyzed using the EnerSim model, which simulated energy usage in homes and buildings using weather data specific to Georgia Power's service area. Home and building prototypes were modeled for existing and new dwellings and facilities. The resulting EnerSim data included load shapes, calculation of electricity impacts (revenues, energy, and demand), and gas and water impacts. Load shapes and electricity revenue impacts provided inputs for PRICEM in calculating total electric utility avoided costs and electric utility revenue impacts.

Nexant determined industrial energy efficiency measure savings using the Industrial Assessment Centers ("IAC") Database and other sources Nexant had available. Georgia Power used BillGen[8] for calculating electricity revenue impacts of industrial measures with load shapes either created using EnerSim or selected from an end-use database. As with residential and commercial, the load shapes and electricity revenue impacts were then input into PRICEM for calculating total electric utility avoided costs and electric utility revenue impacts.

- Estimate Potentials:
  - Naturally occurring conservation refers to energy efficiency gains occurring due to normal market forces, such as technological changes, energy prices, market transformation efforts, and improved energy codes and standards. This analysis accounted for market effect components resulting from naturally occurring

[8] BillGen® is a data analysis and billing application system used to calculate utility bills and perform rate comparisons for residential, commercial, and industrial customers. BillGen® is a registered trademark of Hansen Technologies.

conservation by explicitly incorporating changes to codes and standards and marginal efficiency shares in developing base-case forecasts.

- Technical potential assumes all resource opportunities may be captured, regardless of their costs or market barriers. For energy efficiency, technical potential is divided into two classes: equipment and non-equipment technologies.
- Economic potential can be defined as the portion of technical potential proving cost-effective, using the TRC test as the basis for an economic screen. Measures with a TRC benefit-cost ratio equal to or greater than one are included in the economic potential.
- Achievable potential can be defined as the portion of economic potential that might be assumed achievable in the course of the planning horizon, given market barriers may impede customer participation in energy efficiency programs; these achievable potential levels serve principally as planning guidelines. Ultimately, actual achievable opportunity levels depend on customers' willingness and ability to participate in energy efficiency programs, administrative constraints, and availability of an effective delivery infrastructure. Customers' willingness to participate in energy efficiency programs also depends on the size of an incentive offered. As such, the study analyzed four incentive scenarios relative to their incremental cost: a 25% incentive scenario, a 50% incentive scenario, a 75% incentive scenario, and a 100% incentive scenario.

The study classified measures used to assess potentials into the following four categories:

- Existing non-equipment represents retrofit opportunities in existing construction. An example is shell improvements (e.g., insulation, weather-stripping). This potential can be considered a "retrofit" as it would occur in existing building stock and, theoretically, would be available any time during the study.
- Existing equipment replacement refers to efficiency upgrades conducted during normal replacements of equipment in existing buildings. These include efficient end-use equipment, such as central air conditioners and ENERGY STAR® appliances. Equipment burnout rates drive the availability of these resources. If an opportunity to upgrade is missed, it does not become available until the new equipment burns out (hence, a lost opportunity).
- New construction improvements represent the potential specific to retrofit measures in new construction. For some retrofit measures, costs and savings differ from existing construction due to an array of baseline conditions (building codes vs. existing conditions). Georgia's new construction forecast drives this potential's availability, and missed efficiency upgrades typically must wait until installed technologies are replaced (hence, a lost opportunity).
- New construction equipment efficiency refers to efficiency equipment upgrades in new construction. These include efficient end-use equipment above existing efficiency standards for new construction. Similar to new construction retrofit opportunities, the new construction forecast drives this potential, and efficient equipment must be installed

as part of the construction process. Missed efficiency upgrades must be considered lost opportunities.

The methodology used for estimating energy efficiency potentials was based on standard industry practices. Appendix A provides a detailed discussion of this methodology.

3 Estimates of Energy Efficiency Potentials

This assessment primarily sought to develop estimates of available energy efficiency potentials to assist in targeting energy efficiency programs in sectors with end-uses where the highest market potentials exist. To support these efforts, Nexant performed an in-depth assessment of technical, economic, and achievable potentials on energy efficiency measures in the residential, commercial, and industrial sectors.

Data on measure costs, savings, and market size were collected at the most granular level possible. Within each sector, the study distinguished between customer segments or facility types, and their respective applicable end uses. Six residential segments (existing and new construction for single-family, multifamily, and manufactured homes), 26 commercial segments (13 building types within existing and new construction vintages), and 13 industrial segments were analyzed.

The 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 a previous assessment, as well as new measures made commercially available since the last study. As shown in Table 4, the analysis began by assessing technical potential for 427 unique energy efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end uses, and construction types, customized data had to be compiled and analyzed for 6,940 measure permutations.

Table 4. Energy Efficiency Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	124	1,336
Commercial	170	4,234
Industrial	133	1,370

3.1 Summary of Energy Efficiency Potentials

This section presents detailed results of technical, economic, and achievable potential by sector. Table 5 and Table 6 provide the three potentials, by sector, for energy and demand savings, respectively, in 2030 (the study's final year). Potentials are provided in absolute terms and as a percent of forecasted load. The achievable potential described in the summary represents the 100% incentive scenario.

Table 5. Summary of Energy Potentials (Cumulative through 2030) by Sector

Sector	Technical Potential		Economic Potential		Achievable Potential	
	MWh	% of 2030 Load	MWh	% of 2030 Load	MWh	% of 2030 Load
Residential	REDACTED	16.41%	REDACTED	6.03%	REDACTED	2.37%
Commercial	REDACTED	34.29%	REDACTED	22.60%	REDACTED	13.14%
Industrial	REDACTED	17.01%	REDACTED	16.78%	REDACTED	11.46%
TOTAL	REDACTED	23.91%	REDACTED	15.81%	REDACTED	9.31%

Table 6. Summary of Peak Demand Potentials (Cumulative through 2030) by Sector

Sector	Technical Potential		Economic Potential		Achievable Potential	
	MW	% of 2030 Load	MW	% of 2030 Load	MW	% of 2030 Load
Residential	REDACTED	19.43%	REDACTED	6.61%	REDACTED	3.14%
Commercial	REDACTED	37.48%	REDACTED	19.74%	REDACTED	13.10%
Industrial	REDACTED	16.24%	REDACTED	16.24%	REDACTED	11.75%
TOTAL	REDACTED	26.22%	REDACTED	13.89%	REDACTED	8.92%

3.2 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-savings 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 potentials.

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 13 and Figure 14 illustrate that the commercial sector has the largest, technically feasible energy savings potential, followed by the residential sector, then the industrial sector. The majority of technically feasible potential in the non-residential sector also proves economically feasible. A lower share of technically feasible energy savings is economically feasible for the residential sector.

Figure 13. Technically and Economically Feasible Potential by Sector (2030 Electricity Sales)

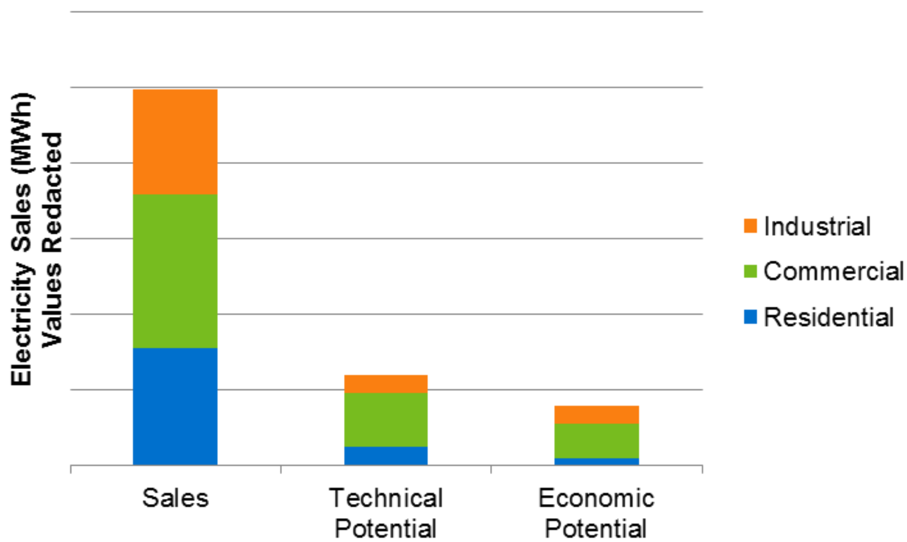
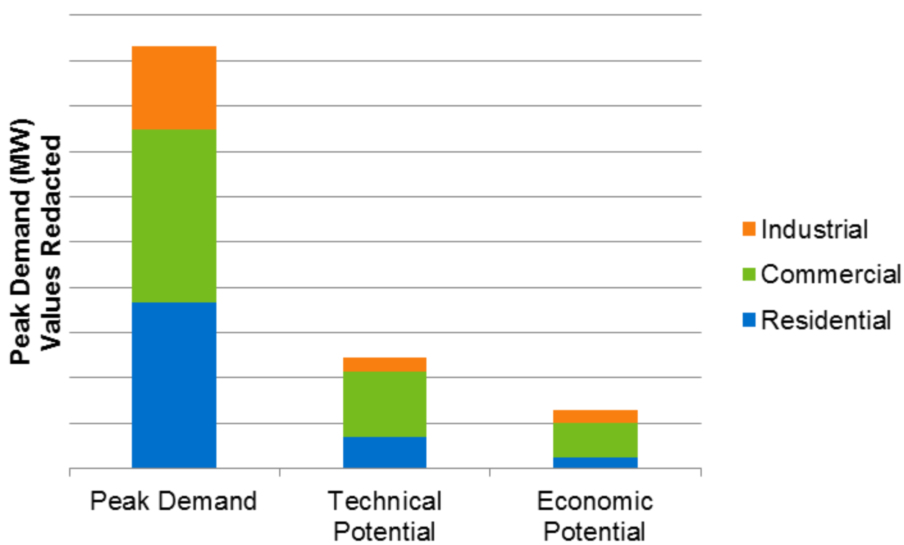


Figure 14. Technically and Economically Feasible Potential by Sector (2030 Peak Demand)



3.3 Theoretically Achievable Potentials

Table 7 provides the achievable potential in 2030 by incentive scenario.

Table 7. Theoretically Achievable Potential Savings (Cumulative through 2030)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Reduction in Electricity Sales (MWh)	REDACTED	4.61%	REDACTED	6.66%	REDACTED	8.12%	REDACTED	9.31%
Reduction in Peak Demand (MW)	REDACTED	4.42%	REDACTED	6.37%	REDACTED	7.78%	REDACTED	8.92%

Figure 15 and Figure 16 present energy and peak demand forecasts by scenario over the planning horizon assuming all theoretically achievable potential was realized. These forecasts are produced by Nexant using the methodology described in Appendix A.

Figure 15. Energy Forecasts for Theoretically Achievable Potential (Electricity Sales)

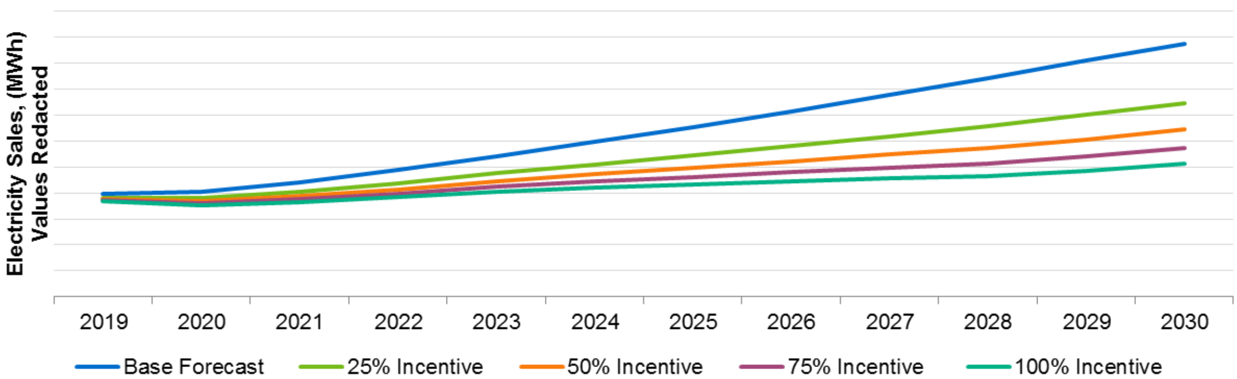
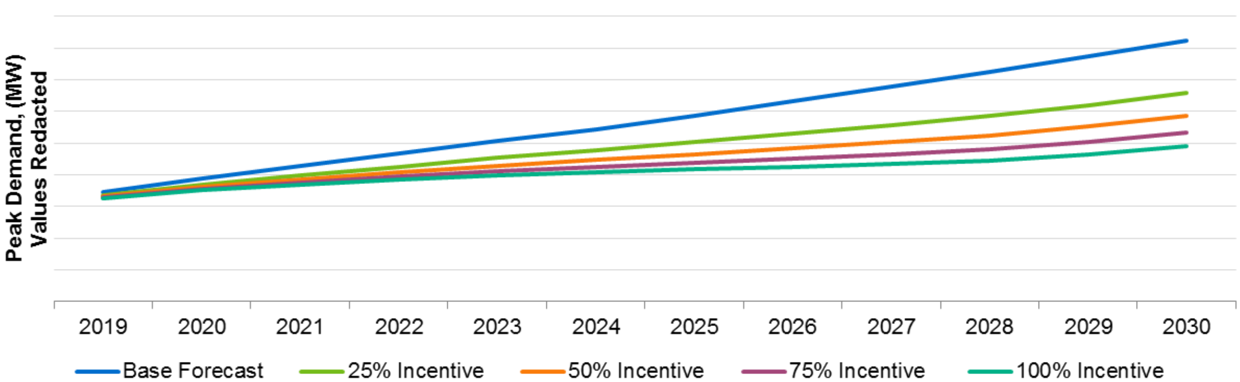


Figure 16. Demand Forecasts for Theoretically Achievable Potential (Peak Demand)



3.4 Sector Achievable Potential

Figure 17 and Figure 18 show theoretically achievable energy and peak demand savings potential by sector. The commercial sector accounts for more than half of the energy and demand savings potential. The industrial sector accounts for the majority of the remaining potential for electricity sales and peak demand reduction.

Figure 17. 2030 Theoretically Achievable Potential by Sector (Electricity Sales)[9]

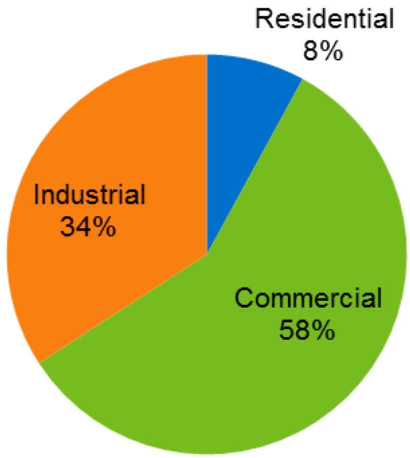
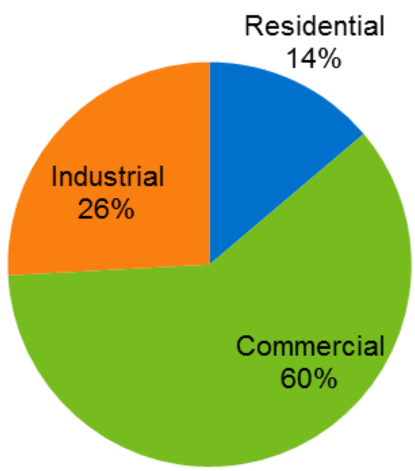


Figure 18. 2030 Theoretically Achievable Potential by Sector (Peak Demand)[9]

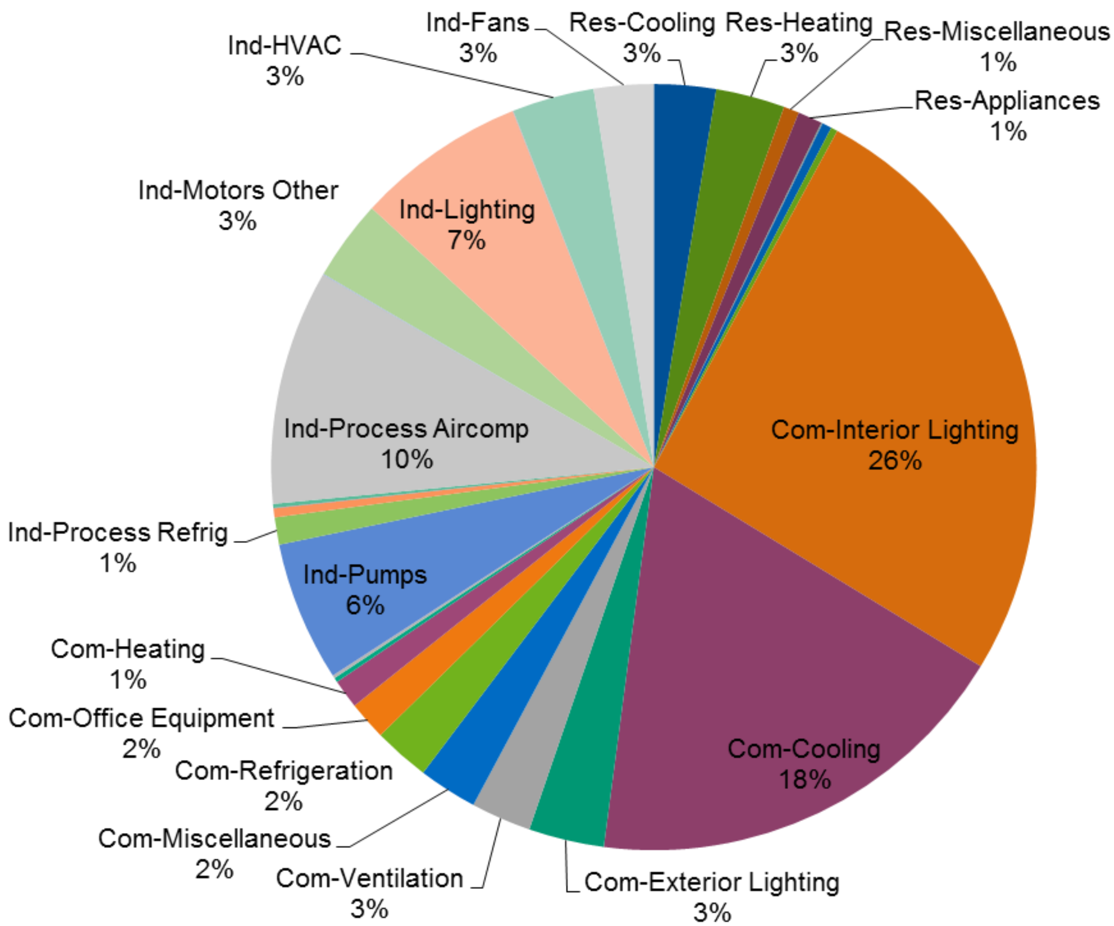


[9] Sector-level data presented is based on 100% incentive scenario but relative contributions by sector are approximately the same for all achievable potential scenarios.

3.5 End Use Achievable Potential

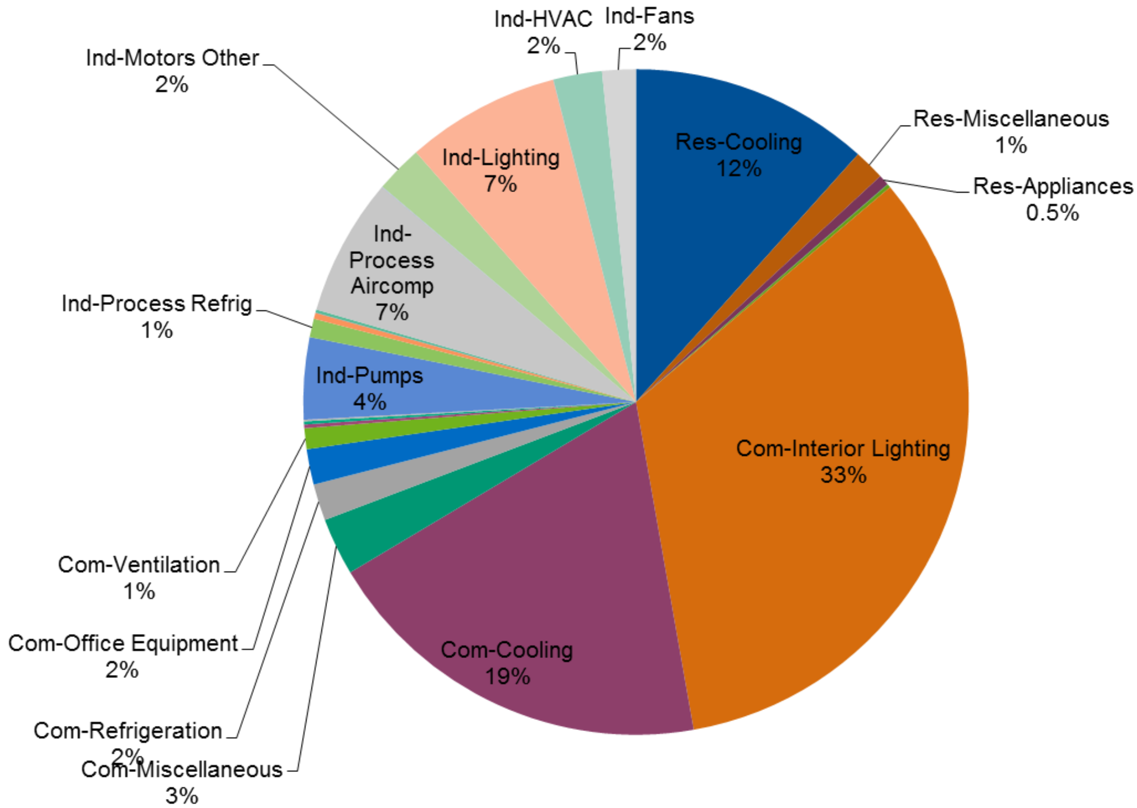
A further understanding of theoretically achievable potential is aided by consideration of contributing end uses. Figure 19 and Figure 20 illustrate—in terms of potential energy and peak demand savings—that commercial interior lighting (26% of potential energy savings) and commercial cooling (18% of potential energy savings) are the end uses with the most significant contribution to the theoretically achievable potential.

Figure 19. 2030 Theoretically Achievable Potential by End Use (Electricity Sales)[10]



[10] Labels omitted for end uses representing less than 0.5% of theoretically achievable potential. The following are removed: residential electronics; lighting; and water heating; commercial food preparation and water heating; industrial process cooling, process heating, process other, indirect boiler, and other. End use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

Figure 20. 2030 Theoretically Achievable Potential by End Use (Peak Demand)[11]



11 Labels omitted for end uses representing less than 0.5% of achievable peak demand savings. These include the following: residential electronics, lighting, and water heating; commercial water heating, food preparation; industrial process cooling, process heating, process other, indirect boiler, and other. End use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

3.6 Cost-Effectiveness

Theoretically achievable estimated 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 significant costs for all ratepayers.

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 administration costs: Administrative, marketing, promotional, and other costs associated with managing programs designed to achieve energy efficiency savings.

Table 8 lists estimated participant and program costs associated with the theoretically achievable scenarios.

Table 8. Participant and Program Costs by Achievable Potential Scenario (NPV Millions, Cumulative through 2030)

Achievable Scenario	Net Participant Costs	Program Incentives	Program Administration[12]
25% Incentive	$752	$251	$171
50% Incentive	$723	$723	$319
75% Incentive	$441	$1,324	$476
100% Incentive	$0	$2,024	$647

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 2019 through 2030, could range as high as $2.0 billion to $4.0 billion from a TRC perspective. Associated costs to electricity customers could range from $2.4 billion to $6.3 billion from the RIM perspective. The RIM net cost indicates the amount electricity rates would have to increase due to energy efficiency, over

[12] The study did not attempt to develop specific program offerings, which can have a range of administrative costs depending on the program goals and delivery structure. For the purposes of this study, average program administration costs were developed at the sector level based on Georgia Power's 2014-2016 program costs and impacts.

and above rate increases ordinarily expected.[13] Figure 21 through 24 show benefits and costs from TRC, RIM, PCT, and PAC perspectives, respectively, for the theoretically achievable scenarios.

Figure 21. TRC Benefits and Costs by Scenario (Cumulative through 2030)

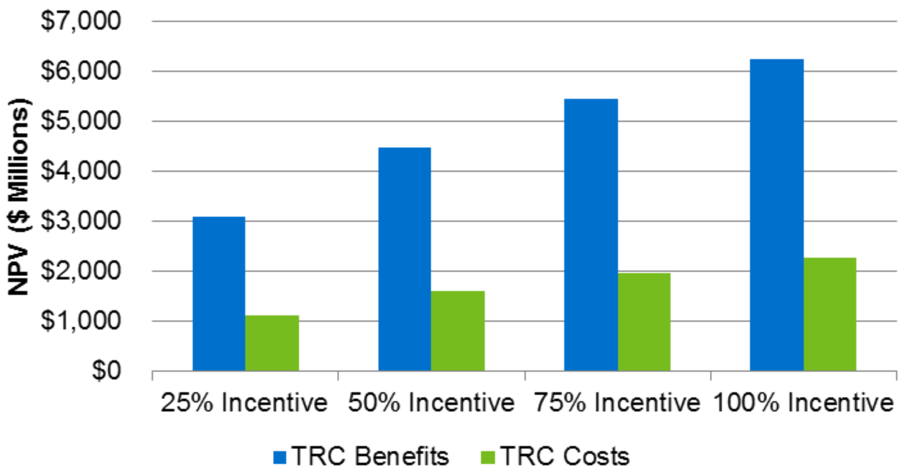
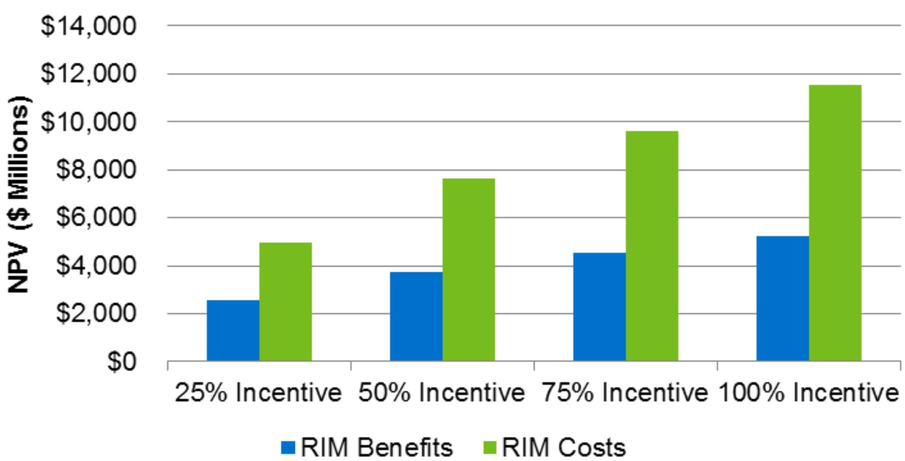


Figure 22. RIM Benefits and Costs by Scenario (Cumulative through 2030)



13 This study does not estimate RIM benefits and costs from a gas and water utility perspective, when applicable. To the extent gas or water utility lost revenues exceed avoided gas or water supply costs, as would normally be expected, gas or water rates would be adversely affected, and would rise above otherwise anticipated increases. This assessment provides estimated net present value data for 2019 through 2030.

Figure 23. PCT Benefits and Costs by Scenario (Cumulative through 2030)

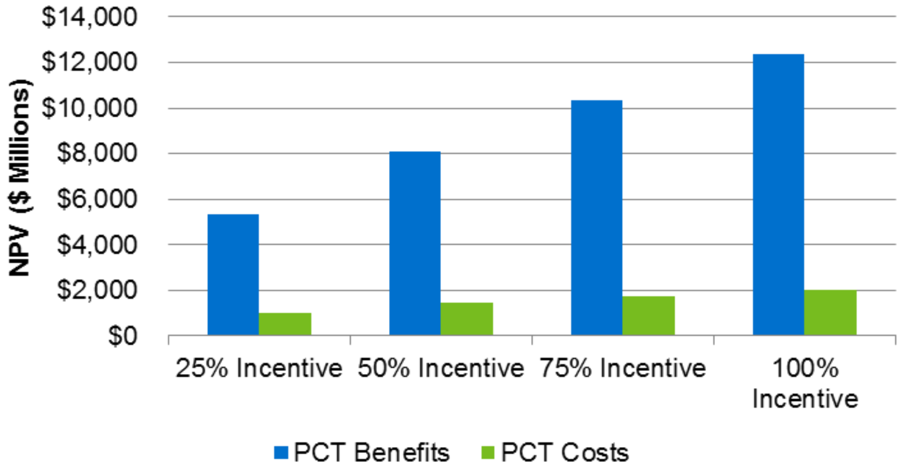


Figure 24. PAC Benefits and Costs by Scenario (Cumulative through 2030)

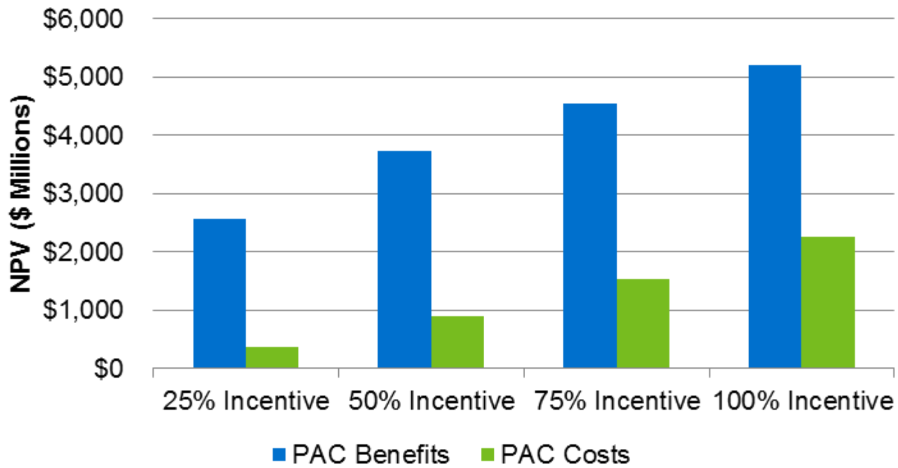


Table 9 provides net benefits and benefit-to-cost ratios for each achievable potential scenario.

Table 9. Net Benefits and Benefit-to-Cost Ratio from TRC, RIM, PCT, and PAC Perspectives (Cumulative NPV through 2030)

	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	$1,977	2.76	($2,378)	0.52	$4,355	5.34	$2,206	6.93
50% Incentive	$2,856	2.76	($3,798)	0.50	$6,654	5.60	$2,827	4.15
75% Incentive	$3,485	2.76	($5,075)	0.47	$8,559	5.85	$3,007	2.96
100% Incentive	$3,996	2.76	($6,325)	0.45	$10,321	6.10	$2,942	2.30

Table 10 through Table 17 list similar economic indicators by sector and end use for each scenario. The PCT is given both with and without incentives.

Table 10. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (25% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC		RIM	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$12	2.2	($47)	0.3
Res-Cooling	$247	2.6	($123)	0.5
Res-Electronics	($0)	1.0	($1)	0.3
Res-Exterior Lighting	$0	1.3	($1)	0.3
Res-Heating	$7	1.1	($86)	0.4
Res-Interior Lighting	$5	2.0	($19)	0.4
Res-Miscellaneous	($4)	0.8	($25)	0.3
Res-Water Heating	($1)	0.8	($11)	0.3
Com-Cooling	$456	2.9	($268)	0.7
Com-Exterior Lighting	$47	3.4	($51)	0.6
Com-Food Preparation	$2	1.9	($5)	0.5
Com-Heating	$13	1.9	($17)	0.6
Com-Interior Lighting	$419	3.0	($856)	0.5
Com-Miscellaneous	$144	3.8	($94)	0.4
Com-Office Equipment	$15	2.4	($34)	0.4
Com-Refrigeration	$49	3.7	($41)	0.6
Com-Ventilation	$53	2.3	($22)	0.8
Com-Water Heating	$3	3.0	($3)	0.5
Ind-Fans	$40	5.3	($46)	0.5
Ind-HVAC	$56	3.4	($76)	0.5
Ind-Indirect Boiler	$0	2.8	($1)	0.5
Ind-Lighting	$179	5.8	($103)	0.7
Ind-Motors Other	$46	2.7	($71)	0.5
Ind-Other	$0	2.1	($1)	0.5
Ind-Process Aircomp	$116	2.4	($211)	0.5
Ind-Process Cool	$3	2.4	($5)	0.5
Ind-Process Heat	$0	2.9	($0)	0.5
Ind-Process Other	$5	2.6	($7)	0.5
Ind-Process Refrig	$3	1.1	($29)	0.5
Ind-Pumps	$60	1.9	($125)	0.5

Table 11. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (50% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$17	2.2	($69)	0.3
Res-Cooling	$356	2.6	($227)	0.4
Res-Electronics	($0)	1.0	($1)	0.3
Res-Exterior Lighting	$0	1.3	($2)	0.3
Res-Heating	$10	1.1	($138)	0.4
Res-Interior Lighting	$7	2.0	($29)	0.4
Res-Miscellaneous	($5)	0.8	($39)	0.3
Res-Water Heating	($1)	0.8	($18)	0.3
Com-Cooling	$657	2.9	($469)	0.6
Com-Exterior Lighting	$68	3.4	($80)	0.5
Com-Food Preparation	$3	1.9	($8)	0.3
Com-Heating	$19	1.9	($29)	0.5
Com-Interior Lighting	$603	3.0	($1,298)	0.4
Com-Miscellaneous	$208	3.8	($153)	0.4
Com-Office Equipment	$21	2.4	($53)	0.4
Com-Refrigeration	$70	3.7	($65)	0.6
Com-Ventilation	$76	2.3	($45)	0.6
Com-Water Heating	$5	3.0	($5)	0.3
Ind-Fans	$67	5.3	($80)	0.5
Ind-HVAC	$80	3.4	($116)	0.5
Ind-Indirect Boiler	$1	2.8	($1)	0.5
Ind-Lighting	$258	5.8	($159)	0.7
Ind-Motors Other	$66	2.7	($111)	0.5
Ind-Other	$1	2.1	($1)	0.5
Ind-Process Aircomp	$167	2.4	($330)	0.5
Ind-Process Cool	$4	2.4	($7)	0.5
Ind-Process Heat	$0	2.9	($1)	0.4
Ind-Process Other	$7	2.6	($11)	0.5
Ind-Process Refrig	$4	1.1	($49)	0.4
Ind-Pumps	$87	1.9	($202)	0.5

Table 12. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (75% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$21	2.2	($86)	0.3
Res-Cooling	$434	2.6	($339)	0.4
Res-Electronics	($0)	1.0	($1)	0.3
Res-Exterior Lighting	$0	1.3	($2)	0.3
Res-Heating	$12	1.1	($185)	0.4
Res-Interior Lighting	$9	2.0	($36)	0.4
Res-Miscellaneous	($6)	0.8	($51)	0.3
Res-Water Heating	($2)	0.8	($24)	0.3
Com-Cooling	$801	2.9	($675)	0.6
Com-Exterior Lighting	$83	3.4	($105)	0.5
Com-Food Preparation	$4	1.9	($11)	0.4
Com-Heating	$23	1.9	($42)	0.5
Com-Interior Lighting	$736	3.0	($1,665)	0.4
Com-Miscellaneous	$253	3.8	($208)	0.3
Com-Office Equipment	$26	2.4	($69)	0.4
Com-Refrigeration	$86	3.7	($86)	0.6
Com-Ventilation	$92	2.3	($72)	0.6
Com-Water Heating	$6	3.0	($6)	0.4
Ind-Fans	$82	5.3	($102)	0.5
Ind-HVAC	$98	3.4	($151)	0.5
Ind-Indirect Boiler	$1	2.8	($1)	0.4
Ind-Lighting	$315	5.8	($208)	0.6
Ind-Motors Other	$80	2.7	($146)	0.5
Ind-Other	$1	2.1	($2)	0.4
Ind-Process Aircomp	$204	2.4	($434)	0.4
Ind-Process Cool	$5	2.4	($10)	0.5
Ind-Process Heat	$0	2.9	($1)	0.4
Ind-Process Other	$8	2.6	($15)	0.5
Ind-Process Refrig	$5	1.1	($68)	0.4
Ind-Pumps	$106	1.9	($272)	0.4

Table 13. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC Net Benefits (Millions)	TRC Benefit/Cost	RIM Net Benefits (Millions)	RIM Benefit/Cost
Res-Appliances	$24	2.2	($101)	0.3
Res-Cooling	$498	2.6	($459)	0.3
Res-Electronics	($0)	1.0	($1)	0.3
Res-Exterior Lighting	$0	1.3	($3)	0.3
Res-Heating	$14	1.1	($232)	0.3
Res-Interior Lighting	$10	2.0	($44)	0.4
Res-Miscellaneous	($7)	0.8	($63)	0.3
Res-Water Heating	($2)	0.8	($30)	0.3
Com-Cooling	$919	2.9	($890)	0.5
Com-Exterior Lighting	$96	3.4	($129)	0.5
Com-Food Preparation	$5	1.9	($14)	0.4
Com-Heating	$27	1.9	($55)	0.5
Com-Interior Lighting	$844	3.0	($2,001)	0.4
Com-Miscellaneous	$291	3.8	($263)	0.3
Com-Office Equipment	$30	2.4	($84)	0.4
Com-Refrigeration	$99	3.7	($107)	0.6
Com-Ventilation	$106	2.3	($101)	0.6
Com-Water Heating	$7	3.0	($8)	0.4
Ind-Fans	$94	5.3	($121)	0.5
Ind-HVAC	$112	3.4	($184)	0.5
Ind-Indirect Boiler	$1	2.8	($2)	0.4
Ind-Lighting	$361	5.8	($254)	0.6
Ind-Motors Other	$92	2.7	($179)	0.4
Ind-Other	$1	2.1	($2)	0.4
Ind-Process Aircomp	$234	2.4	($535)	0.4
Ind-Process Cool	$6	2.4	($12)	0.4
Ind-Process Heat	$1	2.9	($1)	0.4
Ind-Process Other	$9	2.6	($19)	0.5
Ind-Process Refrig	$6	1.1	($88)	0.4
Ind-Pumps	$121	1.9	($343)	0.4

Table 14. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (25% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$59	16.8	$53	6.4
Res-Cooling	$370	3.6	$357	3.3
Res-Electronics	$1	10.5	$1	4.8
Res-Exterior Lighting	$1	7.0	$1	3.8
Res-Heating	$93	3.4	$79	2.5
Res-Interior Lighting	$24	8.4	$23	5.6
Res-Miscellaneous	$21	3.7	$12	1.7
Res-Water Heating	$10	3.0	$9	2.4
Com-Cooling	$724	4.1	$666	3.9
Com-Exterior Lighting	$99	6.7	$94	6.4
Com-Food Preparation	$7	3.9	$7	3.6
Com-Heating	$30	3.1	$27	2.9
Com-Interior Lighting	$1,275	7.9	$1,229	7.7
Com-Miscellaneous	$238	5.9	$226	5.6
Com-Office Equipment	$49	6.2	$47	5.9
Com-Refrigeration	$90	6.4	$86	6.1
Com-Ventilation	$75	3.0	$65	2.7
Com-Water Heating	$6	4.8	$6	4.5
Ind-Fans	$86	12.8	$84	12.5
Ind-HVAC	$131	7.3	$126	7.1
Ind-Indirect Boiler	$1	6.6	$1	6.4
Ind-Lighting	$282	10.2	$275	9.9
Ind-Motors Other	$117	6.1	$111	5.8
Ind-Other	$1	4.6	$1	4.3
Ind-Process Aircomp	$327	5.5	$308	5.2
Ind-Process Cool	$8	5.5	$7	5.2
Ind-Process Heat	$1	6.9	$1	6.7
Ind-Process Other	$12	5.6	$11	5.4
Ind-Process Refrig	$32	2.6	$27	2.4
Ind-Pumps	$185	4.1	$170	3.8

Table 15. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (50% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives) Net Benefits (Millions)	PCT (with incentives) Benefit/Cost	PCT (without incentives) Net Benefits (Millions)	PCT (without incentives) Benefit/Cost
Res-Appliances	$87	17.0	$78	6.5
Res-Cooling	$583	3.9	$565	3.6
Res-Electronics	$1	10.8	$1	4.9
Res-Exterior Lighting	$2	7.3	$2	4.0
Res-Heating	$148	3.6	$128	2.7
Res-Interior Lighting	$36	8.6	$34	5.8
Res-Miscellaneous	$34	3.9	$21	1.8
Res-Water Heating	$17	3.3	$15	2.6
Com-Cooling	$1,126	4.4	$959	3.9
Com-Exterior Lighting	$148	6.9	$136	6.4
Com-Food Preparation	$11	4.1	$9	3.6
Com-Heating	$48	3.4	$38	2.9
Com-Interior Lighting	$1,902	8.2	$1,769	7.7
Com-Miscellaneous	$361	6.1	$325	5.6
Com-Office Equipment	$74	6.4	$67	5.9
Com-Refrigeration	$135	6.6	$123	6.1
Com-Ventilation	$121	3.2	$94	2.7
Com-Water Heating	$9	5.0	$8	4.5
Ind-Fans	$147	12.7	$141	12.2
Ind-HVAC	$197	7.6	$182	7.1
Ind-Indirect Boiler	$2	6.9	$1	6.4
Ind-Lighting	$417	10.4	$395	9.9
Ind-Motors Other	$177	6.3	$160	5.8
Ind-Other	$2	4.8	$2	4.3
Ind-Process Aircomp	$497	5.7	$444	5.2
Ind-Process Cool	$11	5.7	$10	5.2
Ind-Process Heat	$1	7.2	$1	6.7
Ind-Process Other	$18	5.9	$16	5.4
Ind-Process Refrig	$53	2.9	$39	2.4
Ind-Pumps	$288	4.3	$245	3.8

Table 16. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$108	17.3	$97	6.6
Res-Cooling	$773	4.1	$751	3.8
Res-Electronics	$1	11.0	$1	5.0
Res-Exterior Lighting	$3	7.5	$2	4.1
Res-Heating	$197	3.9	$174	2.9
Res-Interior Lighting	$45	8.9	$42	5.9
Res-Miscellaneous	$45	4.2	$29	2.0
Res-Water Heating	$22	3.5	$20	2.8
Com-Cooling	$1,476	4.6	$1,170	3.9
Com-Exterior Lighting	$189	7.2	$166	6.4
Com-Food Preparation	$15	4.4	$11	3.6
Com-Heating	$65	3.6	$47	2.9
Com-Interior Lighting	$2,401	8.4	$2,159	7.7
Com-Miscellaneous	$462	6.4	$397	5.6
Com-Office Equipment	$95	6.7	$82	5.9
Com-Refrigeration	$172	6.9	$150	6.1
Com-Ventilation	$164	3.5	$115	2.7
Com-Water Heating	$12	5.3	$10	4.5
Ind-Fans	$184	13.0	$172	12.2
Ind-HVAC	$249	7.8	$222	7.1
Ind-Indirect Boiler	$2	7.1	$2	6.4
Ind-Lighting	$523	10.7	$482	9.9
Ind-Motors Other	$226	6.6	$195	5.8
Ind-Other	$3	5.1	$2	4.3
Ind-Process Aircomp	$638	6.0	$542	5.2
Ind-Process Cool	$15	6.0	$12	5.2
Ind-Process Heat	$1	7.4	$1	6.7
Ind-Process Other	$23	6.1	$20	5.4
Ind-Process Refrig	$73	3.1	$48	2.4
Ind-Pumps	$378	4.6	$299	3.8

Table 17. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for All Sectors (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Res-Appliances	$125	17.5	$113	6.6
Res-Cooling	$957	4.4	$931	4.0
Res-Electronics	$1	11.3	$1	5.1
Res-Exterior Lighting	$3	7.8	$3	4.3
Res-Heating	$246	4.1	$219	3.1
Res-Interior Lighting	$54	9.1	$50	6.1
Res-Miscellaneous	$55	4.4	$37	2.1
Res-Water Heating	$28	3.8	$26	3.0
Com-Cooling	$1,809	4.9	$1,342	3.9
Com-Exterior Lighting	$225	7.4	$190	6.4
Com-Food Preparation	$18	4.6	$13	3.6
Com-Heating	$82	3.9	$54	2.9
Com-Interior Lighting	$2,845	8.7	$2,475	7.7
Com-Miscellaneous	$554	6.6	$455	5.6
Com-Office Equipment	$113	6.9	$94	5.9
Com-Refrigeration	$206	7.1	$172	6.1
Com-Ventilation	$207	3.7	$131	2.7
Com-Water Heating	$15	5.5	$11	4.5
Ind-Fans	$215	13.2	$197	12.2
Ind-HVAC	$296	8.1	$254	7.1
Ind-Indirect Boiler	$2	7.4	$2	6.4
Ind-Lighting	$615	10.9	$553	9.9
Ind-Motors Other	$271	6.8	$224	5.8
Ind-Other	$3	5.3	$2	4.3
Ind-Process Aircomp	$769	6.2	$621	5.2
Ind-Process Cool	$18	6.2	$14	5.2
Ind-Process Heat	$2	7.7	$1	6.7
Ind-Process Other	$28	6.4	$23	5.4
Ind-Process Refrig	$94	3.4	$55	2.4
Ind-Pumps	$464	4.8	$343	3.8

3.7 Detailed Analysis

Congruent with Georgia Power's 2007, 2012, and 2015 studies[14] scope and detail, this section presents analytical results of estimated savings associated with each theoretically achievable scenario, by sector. Table 18 lists theoretically achievable potential, in absolute terms and as a share of 2030 load, by sector.

Table 18. Theoretically Achievable Potential Savings by Sector (Cumulative through 2030)

Load Type	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Residential								
Reduction in Electricity Sales (MWh)	REDACTED	1.18%	REDACTED	1.70%	REDACTED	2.07%	REDACTED	2.37%
Reduction in Peak Demand (MW)	REDACTED	1.56%	REDACTED	2.24%	REDACTED	2.74%	REDACTED	3.14%
Commercial								
Reduction in Electricity Sales (MWh)	REDACTED	6.52%	REDACTED	9.39%	REDACTED	11.46%	REDACTED	13.14%
Reduction in Peak Demand (MW)	REDACTED	6.50%	REDACTED	9.36%	REDACTED	11.42%	REDACTED	13.10%
Industrial								
Reduction in Electricity Sales (MWh)	REDACTED	5.63%	REDACTED	8.19%	REDACTED	10.00%	REDACTED	11.46%
Reduction in Peak Demand (MW)	REDACTED	5.79%	REDACTED	8.40%	REDACTED	10.24%	REDACTED	11.75%
Total								
Reduction in Electricity Sales (MWh)	REDACTED	4.61%	REDACTED	6.66%	REDACTED	8.12%	REDACTED	9.31%
Reduction in Peak Demand (MW)	REDACTED	4.42%	REDACTED	6.37%	REDACTED	7.78%	REDACTED	8.92%

[14] This is also consistent with the 2005 Georgia Environmental Facilities Authority study, *Assessment of Energy Efficiency Potential in Georgia*, prepared for Georgia Environmental Facilities Authority, by ICF Consulting, 2005.

3.8 Residential Sector

Table 19 presents the residential sector's achievable potential for the four incentive scenarios.

Table 19. Theoretically Achievable Potential Savings for Residential Sector (Cumulative through 2030)

Load Type	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2026 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Reduction in Electricity Sales (MWh)	REDACTED	1.18%	REDACTED	1.70%	REDACTED	2.07%	REDACTED	2.37%
Reduction in Peak Demand (MW)	REDACTED	1.56%	REDACTED	2.24%	REDACTED	2.74%	REDACTED	3.14%

Figure 25 and Figure 26 show the residential baseline forecast and forecasts by achievable potential scenario, for energy sales and peak demand, respectively.

Figure 25. Energy Forecasts for Theoretically Achievable Potential in Residential Sector (Electricity Sales)

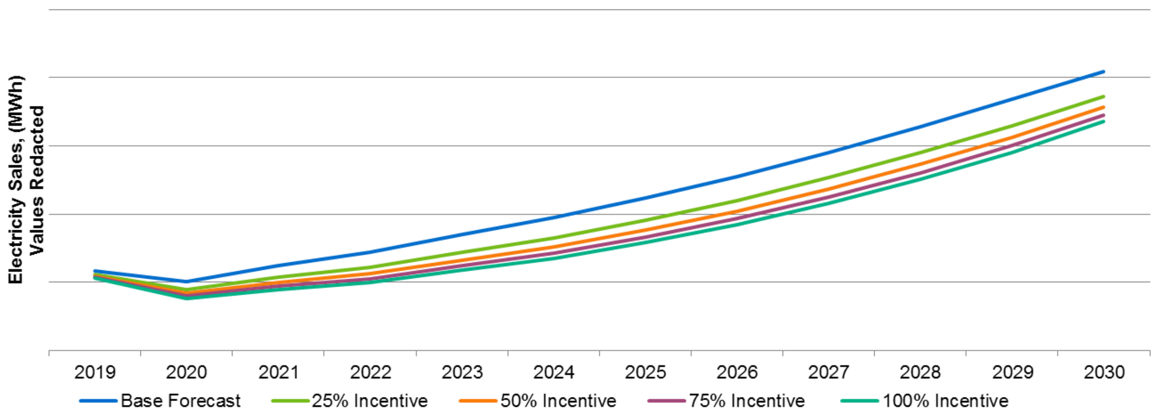


Figure 26. Demand Forecasts for Theoretically Achievable Potential in Residential Sector (Peak Demand)

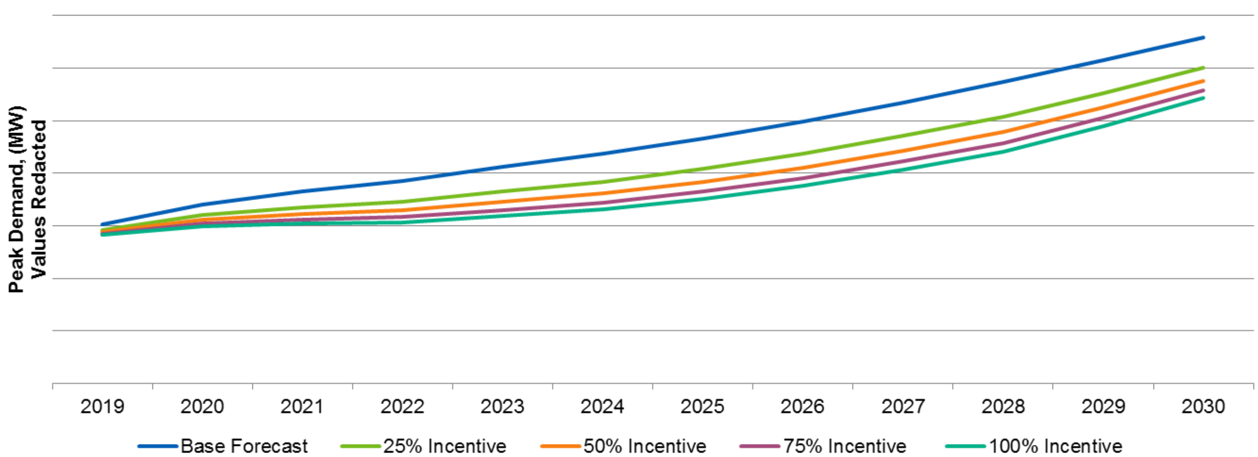


Figure 27 and Figure 28 illustrate theoretically achievable residential savings by end use for energy and peak demand, respectively. The potential electric energy savings concentrate in four end-use categories: heating (37% of potential); cooling (33%); appliances (13%) and miscellaneous (8%).

Figure 27. Residential - 2030 Theoretically Achievable Potential by End Use (Electricity Sales)[15]

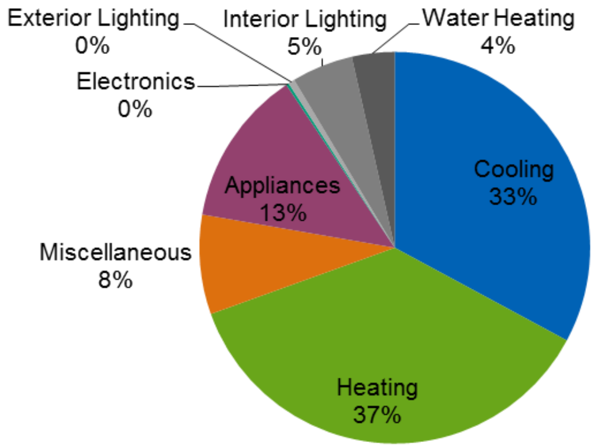
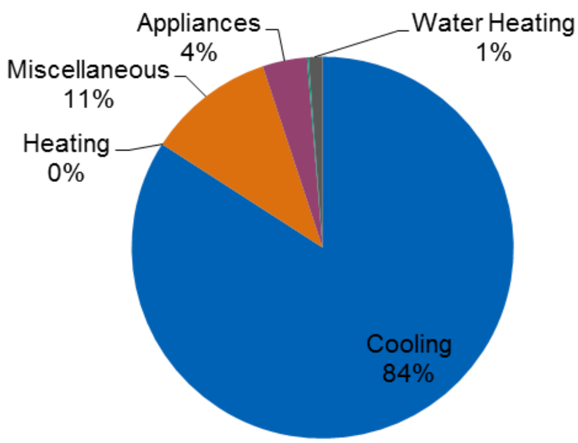


Figure 28. Residential - 2030 Theoretically Achievable Potential by End Use (Peak Demand)[16]



The relative increase in the share for HVAC shell measures under the peak demand potential reflects the cooling savings from these measures.

[15] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

[16] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

Figure 29 shows achievable potential residential savings by construction vintage. “Existing” constitutes homes constructed before 2019. Homes constructed in 2019 and beyond are considered “New.” Figure 30 shows achievable potential residential peak demand savings by construction vintage.

Figure 29. Residential - 2030 Theoretically Achievable Potential by Construction Vintage (Electricity Sales)[17]

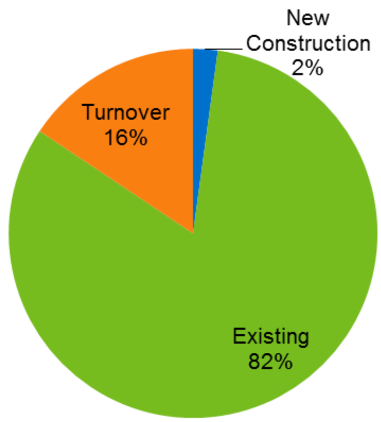
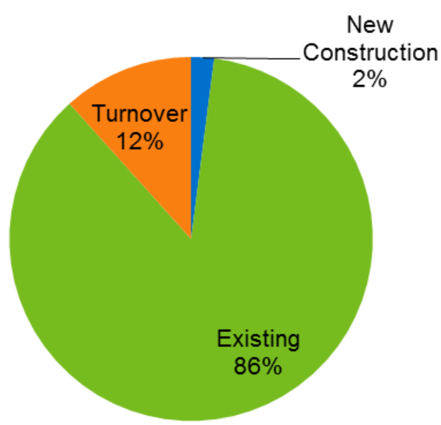


Figure 30: Residential – 2030 Theoretically Achievable Potential by Construction Vintage (Peak Demand)[18]



[17] Vintage data presented is based on 100% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

[18] Vintage data presented is based on 100% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

Figure 31 and Figure 32 show the achievable potential by residential customer segment, for energy savings and peak demand savings, respectively.

Figure 31. Residential – 2030 Theoretically Achievable Potential by Customer Segment (Electricity Sales)[19]

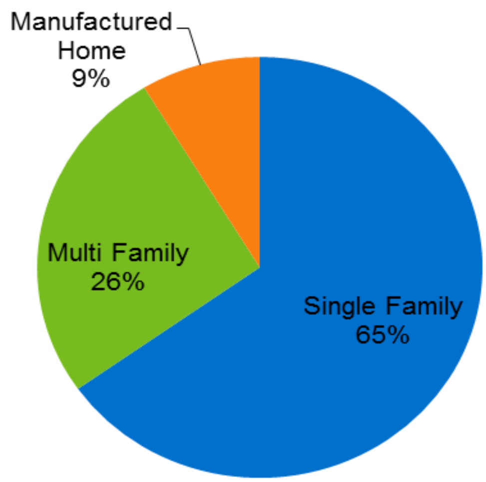
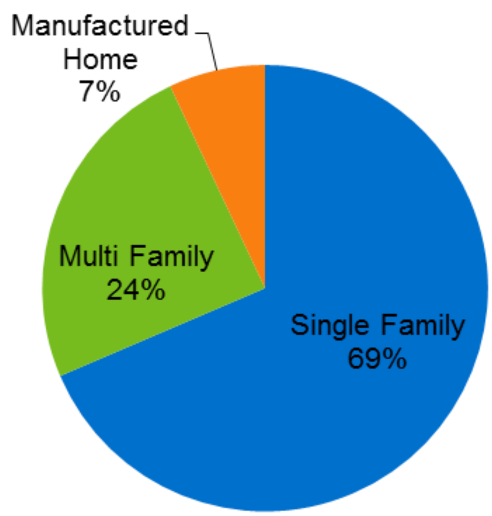


Figure 32. Residential – 2030 Theoretically Achievable Potential by Customer Segment (Peak Demand)[20]



[19] Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

[20] Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 20 lists the net present value of participant and program costs associated with theoretically achievable potential scenarios.

Table 20. Participant and Program Costs by Achievable Potential Scenario for Residential Sector (NPV Thousands, Cumulative through 2030)

Achievable Scenario	Net Participant Costs	Program Incentives	Program Administration
25% Incentive	$149,926	$49,975	$94,706
50% Incentive	$143,929	$143,929	$208,341
75% Incentive	$87,796	$263,389	$341,972
100% Incentive	$0	$402,693	$492,801

Table 21 lists benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable residential sector benefits, from programmatic efforts from 2019 through 2030, could range from $0.3 billion to $0.5 billion from a TRC perspective. Associated costs to customers could range from $0.3 billion to $0.9 billion from the RIM perspective.

Table 21. Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives for Residential Sector (Cumulative NPV through 2030)

	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	$267	2.1	($313)	0.4	$580	3.9	$137	2.4
50% Incentive	$384	2.1	($523)	0.4	$907	4.2	$126	1.6
75% Incentive	$468	2.1	($726)	0.4	$1,194	4.4	$66	1.2
100% Incentive	$537	2.1	($933)	0.3	$1,470	4.7	($25)	0.9

Table 22 through Table 25 list benefits and costs from TRC and RIM perspectives, by end use, for the four scenarios.

Table 22. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (25% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$12	2.2	($47)	0.3
Cooling	$247	2.6	($123)	0.5
Electronics	($0)	1.0	($1)	0.3
Exterior Lighting	$0	1.3	($1)	0.3
Heating	$7	1.1	($86)	0.4
Interior Lighting	$5	2.0	($19)	0.4
Miscellaneous	($4)	0.8	($25)	0.3
Water Heating	($1)	0.8	($11)	0.3

Table 23. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (50% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$17	2.2	($69)	0.3
Cooling	$356	2.6	($227)	0.4
Electronics	($0)	1.0	($1)	0.3
Exterior Lighting	$0	1.3	($2)	0.3
Heating	$10	1.1	($138)	0.4
Interior Lighting	$7	2.0	($29)	0.4
Miscellaneous	($5)	0.8	($39)	0.3
Water Heating	($1)	0.8	($18)	0.3

Table 24. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC Net Benefits (Millions)	TRC Benefit/Cost	RIM Net Benefits (Millions)	RIM Benefit/Cost
Appliances	$21	2.2	($86)	0.3
Cooling	$434	2.6	($339)	0.4
Electronics	($0)	1.0	($1)	0.3
Exterior Lighting	$0	1.3	($2)	0.3
Heating	$12	1.1	($185)	0.4
Interior Lighting	$9	2.0	($36)	0.4
Miscellaneous	($6)	0.8	($51)	0.3
Water Heating	($2)	0.8	($24)	0.3

Table 25. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC Net Benefits (Millions)	TRC Benefit/Cost	RIM Net Benefits (Millions)	RIM Benefit/Cost
Appliances	$24	2.2	($101)	0.3
Cooling	$498	2.6	($459)	0.3
Electronics	($0)	1.0	($1)	0.3
Exterior Lighting	$0	1.3	($3)	0.3
Heating	$14	1.1	($232)	0.3
Interior Lighting	$10	2.0	($44)	0.4
Miscellaneous	($7)	0.8	($63)	0.3
Water Heating	($2)	0.8	($30)	0.3

Table 26 through Table 29 list benefits and costs from the PCT perspective for the four scenarios by end use, with and without incentives, illustrating energy efficiency measures' economic attractiveness, even without utility incentives to subsidize initial measure costs.

Table 26. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (25% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$59	16.8	$53	6.4
Cooling	$370	3.6	$357	3.3
Electronics	$1	10.5	$1	4.8
Exterior Lighting	$1	7.0	$1	3.8
Heating	$93	3.4	$79	2.5
Interior Lighting	$24	8.4	$23	5.6
Miscellaneous	$21	3.7	$12	1.7
Water Heating	$10	3.0	$9	2.4

Table 27. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (50% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$87	17.0	$78	6.5
Cooling	$583	3.9	$565	3.6
Electronics	$1	10.8	$1	4.9
Exterior Lighting	$2	7.3	$2	4.0
Heating	$148	3.6	$128	2.7
Interior Lighting	$36	8.6	$34	5.8
Miscellaneous	$34	3.9	$21	1.8
Water Heating	$17	3.3	$15	2.6

Table 28. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$108	17.3	$97	6.6
Cooling	$773	4.1	$751	3.8
Electronics	$1	11.0	$1	5.0
Exterior Lighting	$3	7.5	$2	4.1
Heating	$197	3.9	$174	2.9
Interior Lighting	$45	8.9	$42	5.9
Miscellaneous	$45	4.2	$29	2.0
Water Heating	$22	3.5	$20	2.8

Table 29. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Residential Sector (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Appliances	$125	17.5	$113	6.6
Cooling	$957	4.4	$931	4.0
Electronics	$1	11.3	$1	5.1
Exterior Lighting	$3	7.8	$3	4.3
Heating	$246	4.1	$219	3.1
Interior Lighting	$54	9.1	$50	6.1
Miscellaneous	$55	4.4	$37	2.1
Water Heating	$28	3.8	$26	3.0

3.9 Commercial Sector

Table 30 presents commercial sector achievable potential for the four incentive scenarios.

Table 30. Theoretically Achievable Potential Savings for Commercial Sector (Cumulative through 2030)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Reduction in Electricity Sales (MWh)	REDACTED	6.52%	REDACTED	9.39%	REDACTED	11.46%	REDACTED	13.14%
Reduction in Peak Demand (MW)	REDACTED	6.50%	REDACTED	9.36%	REDACTED	11.42%	REDACTED	13.10%

Figure 33 and Figure 34 show the commercial baseline forecast and forecasts by achievable potential scenario, for energy sales and peak demand respectively.

Figure 33. Energy Forecasts for Theoretically Achievable Potential in Commercial Sector (Electricity Sales)

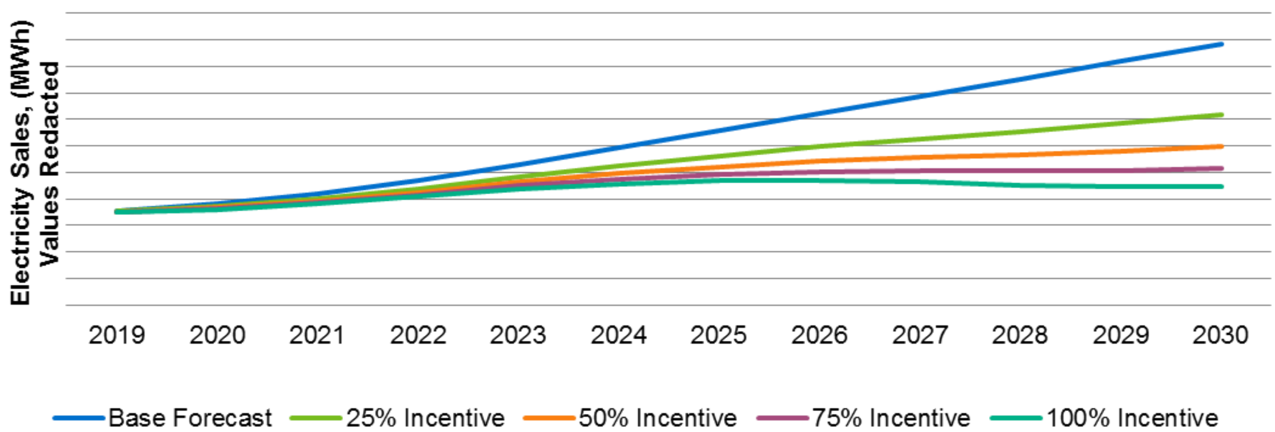


Figure 34. Demand Forecasts for Theoretically Achievable Potential in Commercial Sector (Peak Demand)

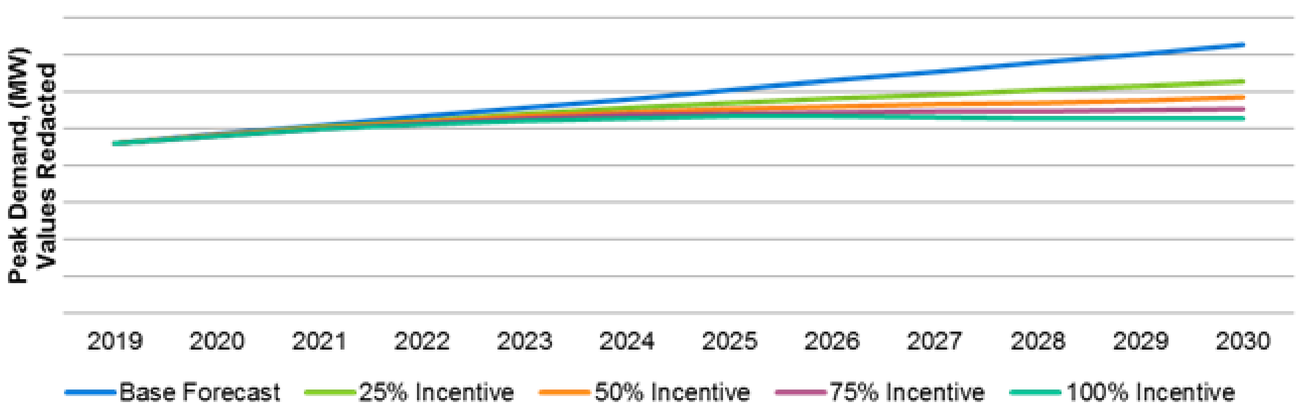
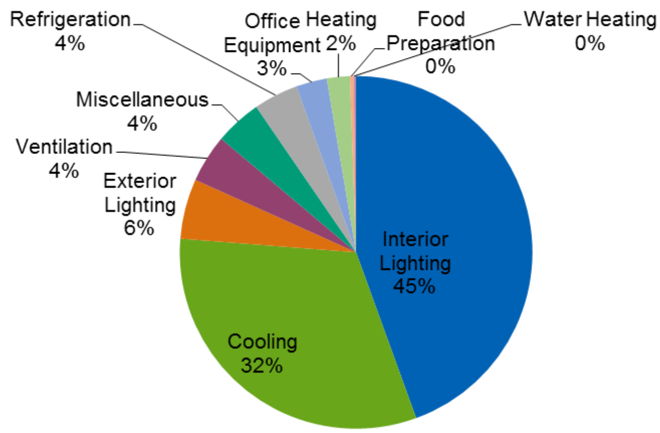


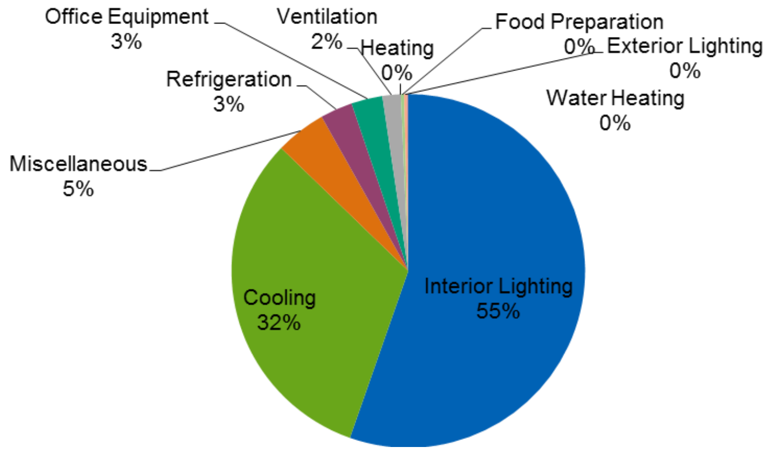
Figure 35 and Figure 36 illustrates theoretically achievable commercial savings by end use. Potential savings of electric energy concentrate in three end-use categories: interior lighting (45% of potential); cooling (32%) and exterior lighting (6%).

Figure 35. Commercial - 2030 Theoretically Achievable Potential by End Use (Electricity Sales)[21]



The potential peak demand savings have a different distribution than energy savings, with a concentration in interior lighting (55% of potential), cooling (32%) and miscellaneous commercial (5%).

Figure 36. Commercial - 2030 Theoretically Achievable Potential by End Use (Peak Demand)[22]



[21] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

[22] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

Figure 37 shows the relative contribution of achievable energy efficiency potential by construction vintage. Figure 38 shows theoretically achievable peak demand savings by construction vintage.

Figure 37. Commercial - 2030 Theoretically Achievable Potential by Construction Vintage (Electricity Sales)[23]

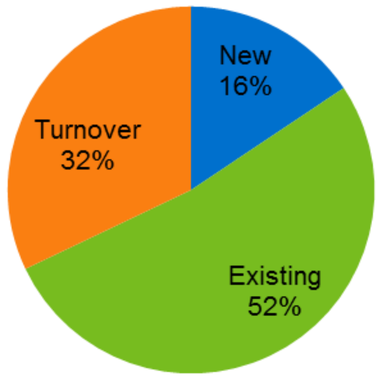
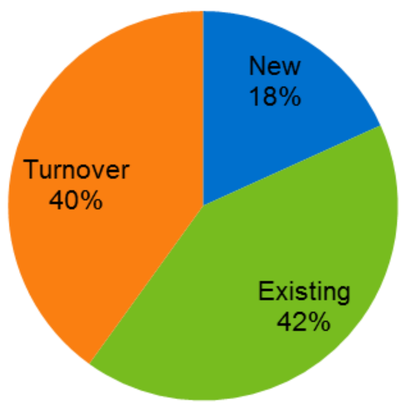


Figure 38. Commercial – 2030 Theoretically Achievable Potential by Construction Vintage (Peak Demand)[24]



[23] Vintage data presented is based on 100% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

[24] Vintage data presented is based on 100% incentive scenario but relative contributions by vintage are approximately the same for all achievable potential scenarios.

Figure 39 and Figure 40 show the relative contribution of achievable energy efficiency potential by commercial building segment, for energy savings and peak demand savings, respectively.

Figure 39. Commercial – 2030 Theoretically Achievable Potential by Commercial Building Segment (Electricity Sales)[25]

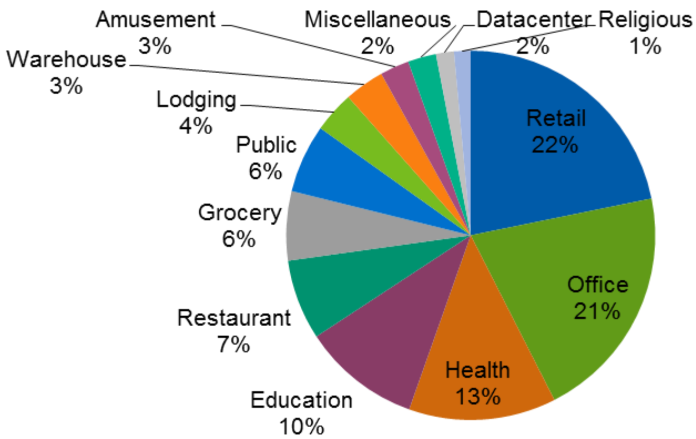


Figure 40. Commercial – 2030 Theoretically Achievable Potential by Commercial Building Segment (Peak Demand)[26]

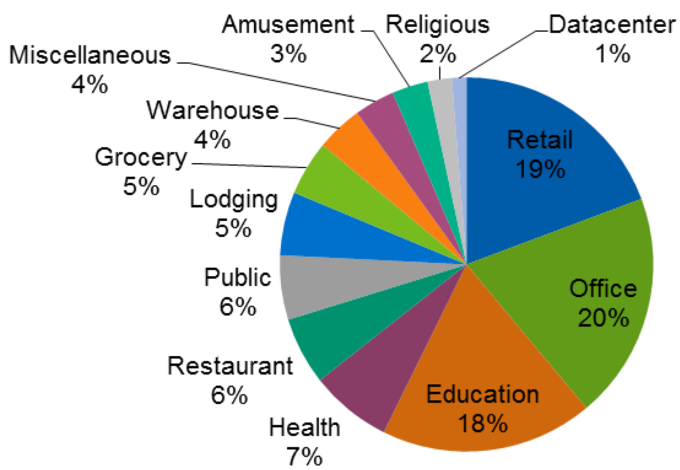


Table 31 lists the net present value of participant and program costs associated with theoretically achievable potential scenarios.

25 Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

26 Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 31. Participant and Program Costs by Achievable Potential Scenario for Commercial Sector (NPV Thousands, Cumulative through 2030)

Achievable Scenario	Net Participant Costs	Program Incentives	Program Administration
25% Incentive	$422,659	$140,886	$44,570
50% Incentive	$405,753	$405,753	$64,181
75% Incentive	$247,509	$742,527	$78,301
100% Incentive	$0	$1,135,242	$89,785

Table 32 lists the benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable benefits in the commercial sector from programmatic efforts from 2019 through 2030 could range from $1.2 billion to $2.4 billion from a TRC perspective. Associated costs to ratepayers could range from $1.4 billion to $3.7 billion from the RIM perspective.

Table 32. Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives for Commercial Sector (Cumulative NPV through 2030)

	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	$1,202	3.0	($1,391)	0.5	$2,593	5.6	$1,381	8.4
50% Incentive	$1,731	3.0	($2,205)	0.5	$3,936	5.9	$1,786	4.8
75% Incentive	$2,112	3.0	($2,938)	0.5	$5,050	6.1	$1,931	3.4
100% Incentive	$2,421	3.0	($3,653)	0.5	$6,074	6.4	$1,931	2.6

Table 33 through Table 36 list benefits and costs from TRC and RIM perspectives, by end use, for the four scenarios.

Table 33. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (25% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$456	2.9	($268)	0.7
Exterior Lighting	$47	3.4	($51)	0.6
Food Preparation	$2	1.9	($5)	0.5
Heating	$13	1.9	($17)	0.6
Interior Lighting	$419	3.0	($856)	0.5
Miscellaneous	$144	3.8	($94)	0.4
Office Equipment	$15	2.4	($34)	0.4
Refrigeration	$49	3.7	($41)	0.6
Ventilation	$53	2.3	($22)	0.8
Water Heating	$3	3.0	($3)	0.5

Table 34. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (50% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$657	2.9	($469)	0.6
Exterior Lighting	$68	3.4	($80)	0.5
Food Preparation	$3	1.9	($8)	0.5
Heating	$19	1.9	($29)	0.6
Interior Lighting	$603	3.0	($1,298)	0.4
Miscellaneous	$208	3.8	($153)	0.4
Office Equipment	$21	2.4	($53)	0.4
Refrigeration	$70	3.7	($65)	0.6
Ventilation	$76	2.3	($45)	0.7
Water Heating	$5	3.0	($5)	0.4

Table 35. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC		RIM	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$801	2.9	($675)	0.6
Exterior Lighting	$83	3.4	($105)	0.5
Food Preparation	$4	1.9	($11)	0.4
Heating	$23	1.9	($42)	0.5
Interior Lighting	$736	3.0	($1,665)	0.4
Miscellaneous	$253	3.8	($208)	0.3
Office Equipment	$26	2.4	($69)	0.4
Refrigeration	$86	3.7	($86)	0.6
Ventilation	$92	2.3	($72)	0.6
Water Heating	$6	3.0	($6)	0.4

Table 36. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC		RIM	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$919	2.9	($890)	0.5
Exterior Lighting	$96	3.4	($129)	0.5
Food Preparation	$5	1.9	($14)	0.4
Heating	$27	1.9	($55)	0.5
Interior Lighting	$844	3.0	($2,001)	0.4
Miscellaneous	$291	3.8	($263)	0.3
Office Equipment	$30	2.4	($84)	0.4
Refrigeration	$99	3.7	($107)	0.6
Ventilation	$106	2.3	($101)	0.6
Water Heating	$7	3.0	($8)	0.4

Table 37 through Table 40 list benefits and costs from the PCT perspective for the four scenarios by end use, with and without incentives, illustrating energy efficiency measures' economic attractiveness, even without utility incentives to subsidize initial measure costs.

Table 37. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (25% Incentive Scenario, Cumulative NPV through 2030)

	PCT (with incentives)		PCT (without incentives)	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$724	4.1	$666	3.9
Exterior Lighting	$99	6.7	$94	6.4
Food Preparation	$7	3.9	$7	3.6
Heating	$30	3.1	$27	2.9
Interior Lighting	$1,275	7.9	$1,229	7.7
Miscellaneous	$238	5.9	$226	5.6
Office Equipment	$49	6.2	$47	5.9
Refrigeration	$90	6.4	$86	6.1
Ventilation	$75	3.0	$65	2.7
Water Heating	$6	4.8	$6	4.5

Table 38. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (50% Incentive Scenario, Cumulative NPV through 2030)

	PCT (with incentives)		PCT (without incentives)	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$1,126	4.4	$959	3.9
Exterior Lighting	$148	6.9	$136	6.4
Food Preparation	$11	4.1	$9	3.6
Heating	$48	3.4	$38	2.9
Interior Lighting	$1,902	8.2	$1,769	7.7
Miscellaneous	$361	6.1	$325	5.6
Office Equipment	$74	6.4	$67	5.9
Refrigeration	$135	6.6	$123	6.1
Ventilation	$121	3.2	$94	2.7
Water Heating	$9	5.0	$8	4.5

Table 39. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$1,476	4.6	$1,170	3.9
Exterior Lighting	$189	7.2	$166	6.4
Food Preparation	$15	4.4	$11	3.6
Heating	$65	3.6	$47	2.9
Interior Lighting	$2,401	8.4	$2,159	7.7
Miscellaneous	$462	6.4	$397	5.6
Office Equipment	$95	6.7	$82	5.9
Refrigeration	$172	6.9	$150	6.1
Ventilation	$164	3.5	$115	2.7
Water Heating	$12	5.3	$10	4.5

Table 40. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Commercial Sector (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Cooling	$1,809	4.9	$1,342	3.9
Exterior Lighting	$225	7.4	$190	6.4
Food Preparation	$18	4.6	$13	3.6
Heating	$82	3.9	$54	2.9
Interior Lighting	$2,845	8.7	$2,475	7.7
Miscellaneous	$554	6.6	$455	5.6
Office Equipment	$113	6.9	$94	5.9
Refrigeration	$206	7.1	$172	6.1
Ventilation	$207	3.7	$131	2.7
Water Heating	$15	5.5	$11	4.5

3.10 Industrial Sector

Table 41 presents the industrial sector's achievable potential for the four incentive scenarios.

Table 41. Theoretically Achievable Potential Savings for Industrial Sector (Cumulative through 2030)

	25% Incentive		50% Incentive		75% Incentive		100% Incentive	
	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load	Total Potential	% of 2030 Load
Reduction in Electricity Sales (MWh)	REDACTED	5.63%	REDACTED	8.19%	REDACTED	10.00%	REDACTED	11.46%
Reduction in Peak Demand (MW)	REDACTED	5.79%	REDACTED	8.40%	REDACTED	10.24%	REDACTED	11.75%

Figure 41 and Figure 42 show the industrial baseline forecast and forecasts by achievable potential scenario, for energy sales and peak demand, respectively.

Figure 41. Energy Forecasts for Theoretically Achievable Potential in Industrial Sector (Electricity Sales)

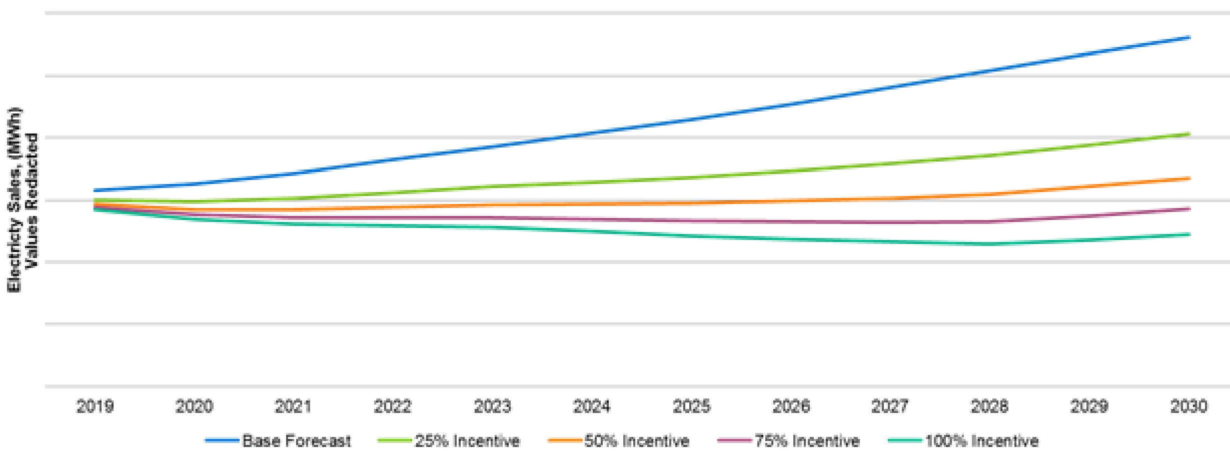


Figure 42. Demand Forecasts for Theoretically Achievable Potential in Industrial Sector (Peak Demand)

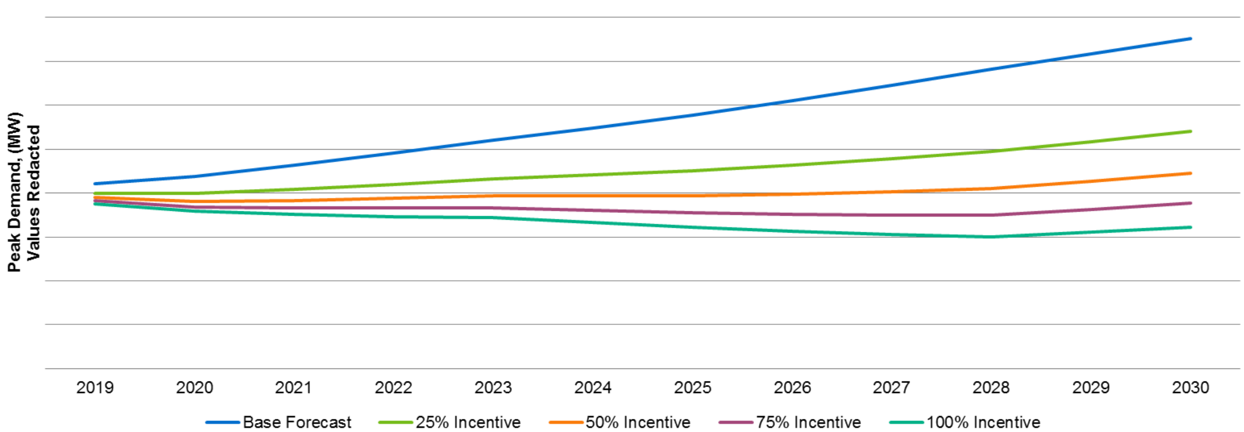


Figure 43 illustrates theoretically achievable industrial energy savings by end use. Potential electric energy savings concentrate in three end-use categories: process air compressors (29% of potential), lighting (21%), and pumps (17%).

Figure 43. Industrial - 2030 Theoretically Achievable Potential by End Use (Electricity Savings)[27]

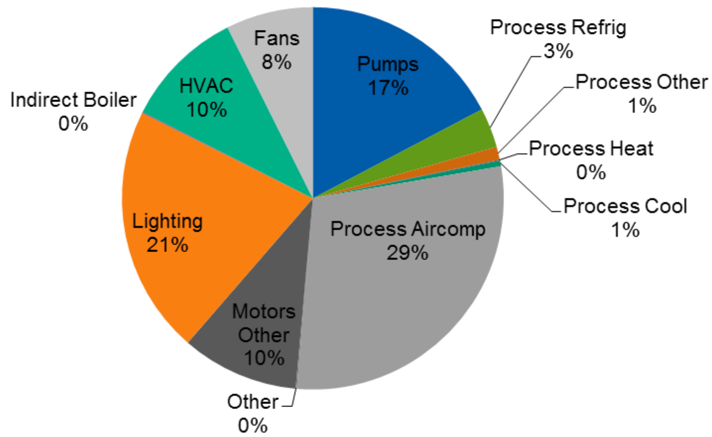
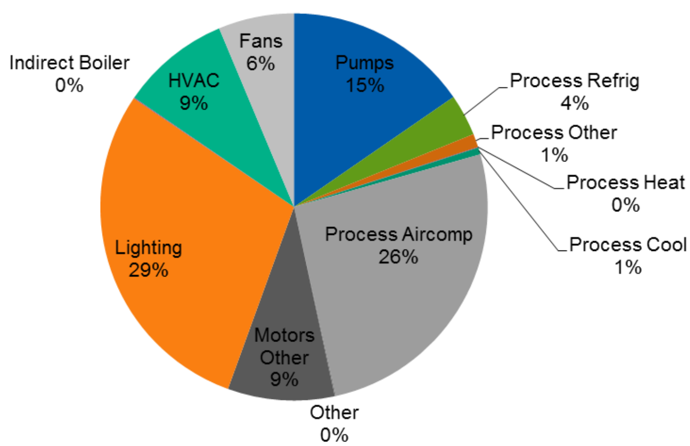


Figure 44 illustrates theoretically achievable industrial peak demand savings by end use. The potential peak demand savings concentrate much more in the process air compressors (26% of potential) and lighting (29%) end-use categories, with lesser amounts in other end uses.

Figure 44. Industrial - 2030 Theoretically Achievable Potential by End Use (Peak Demand)[28]



[27] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

[28] End-use data presented is based on 100% incentive scenario but relative contributions by end-use are approximately the same for all achievable potential scenarios.

Figure 45 and Figure 46 illustrate theoretically achievable potential by industrial segment, for energy savings and peak demand savings, respectively.

Figure 45. Industrial – 2030 Theoretically Achievable Potential by Industrial Segment (Electricity Sales)[29]

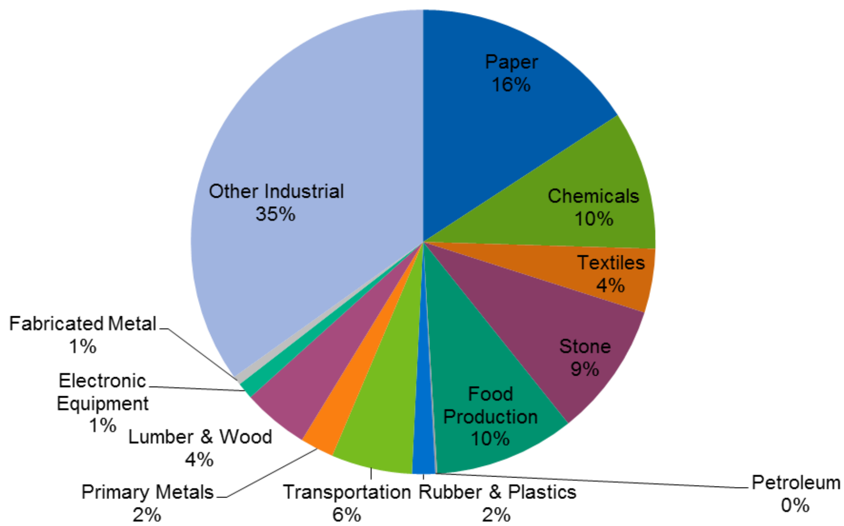
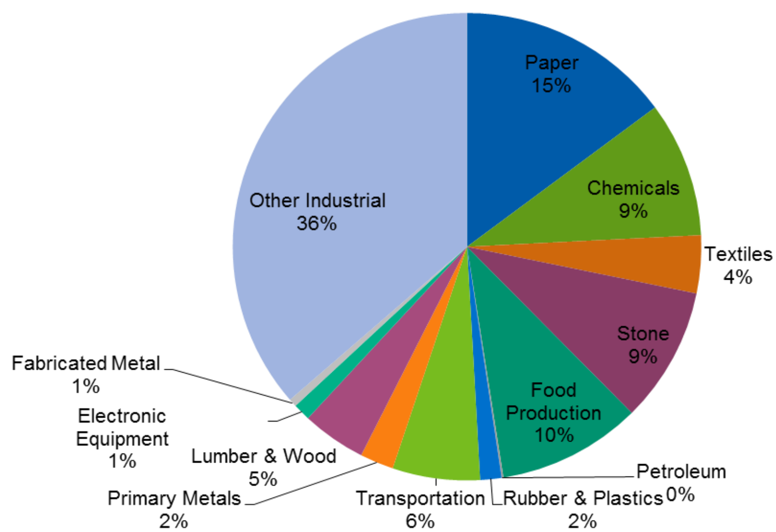


Figure 46. Industrial – 2030 Theoretically Achievable Potential by Industrial Segment (Peak Demand)[30]



[29] Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

[30] Segment data presented is based on 100% incentive scenario but relative contributions by segment are approximately the same for all achievable potential scenarios.

Table 42 lists the net present value of participant and program costs associated with theoretically achievable potential scenarios.

Table 42. Participant and Program Costs by Achievable Potential Scenario for Industrial Sector (NPV thousands, Cumulative through 2030)

Achievable Scenario	Net Participant Costs	Program Incentives	Program Administration
25% Incentive	$179,856	$59,952	$31,662
50% Incentive	$173,722	$173,722	$45,999
75% Incentive	$105,971	$317,912	$56,118
100% Incentive	$0	$486,052	$64,349

Table 43 lists benefits and costs from TRC, RIM, PCT, and PAC perspectives of theoretically achievable scenarios. Potentially achievable industrial sector benefits, from programmatic efforts from 2019 through 2030, could range from $0.5 billion to $1 billion from a TRC perspective. Associated costs to customers could range from $0.7 billion to $1.7 billion from a RIM perspective.

Table 43. Net Benefits and Benefit-to-Cost Ratio for TRC, RIM, PCT, and PAC Perspectives for Industrial Sector (Cumulative NPV through 2030)

	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	$508	2.9	($674)	0.5	$1,183	5.9	$688	8.5
50% Incentive	$741	2.9	($1,069)	0.5	$1,811	6.2	$915	5.2
75% Incentive	$905	2.9	($1,411)	0.5	$2,315	6.5	$1,011	3.7
100% Incentive	$1,037	2.9	($1,739)	0.5	$2,776	6.7	$1,037	2.9

Table 44 through Table 47 list benefits and costs from TRC and RIM perspectives, by end use, for the four scenarios.

Table 44. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (25% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC		RIM	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$40	5.3	($46)	0.5
HVAC	$56	3.4	($76)	0.5
Indirect Boiler	$0	2.8	($1)	0.5
Lighting	$179	5.8	($103)	0.7
Motors Other	$46	2.7	($71)	0.5
Other	$0	2.1	($1)	0.5
Process Aircomp	$116	2.4	($211)	0.5
Process Cool	$3	2.4	($5)	0.5
Process Heat	$0	2.9	($0)	0.5
Process Other	$5	2.6	($7)	0.5
Process Refrig	$3	1.1	($29)	0.5
Pumps	$60	1.9	($125)	0.5

Table 45. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (50% Incentive Scenario, Cumulative NPV through 2030)

End Use	TRC		RIM	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$67	5.3	($80)	0.5
HVAC	$80	3.4	($116)	0.5
Indirect Boiler	$1	2.8	($1)	0.5
Lighting	$258	5.8	($159)	0.7
Motors Other	$66	2.7	($111)	0.5
Other	$1	2.1	($1)	0.5
Process Aircomp	$167	2.4	($330)	0.5
Process Cool	$4	2.4	($7)	0.5
Process Heat	$0	2.9	($1)	0.4
Process Other	$7	2.6	($11)	0.5
Process Refrig	$4	1.1	($49)	0.4
Pumps	$87	1.9	($202)	0.5

Table 46. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (75% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$82	5.3	($102)	0.5
HVAC	$98	3.4	($151)	0.5
Indirect Boiler	$1	2.8	($1)	0.4
Lighting	$315	5.8	($208)	0.6
Motors Other	$80	2.7	($146)	0.5
Other	$1	2.1	($2)	0.4
Process Aircomp	$204	2.4	($434)	0.4
Process Cool	$5	2.4	($10)	0.5
Process Heat	$0	2.9	($1)	0.4
Process Other	$8	2.6	($15)	0.5
Process Refrig	$5	1.1	($68)	0.4
Pumps	$106	1.9	($272)	0.4

Table 47. TRC and RIM Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (100% Incentive Scenario, Cumulative NPV through 2030)

	TRC		RIM	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$94	5.3	($121)	0.5
HVAC	$112	3.4	($184)	0.5
Indirect Boiler	$1	2.8	($2)	0.4
Lighting	$361	5.8	($254)	0.6
Motors Other	$92	2.7	($179)	0.4
Other	$1	2.1	($2)	0.4
Process Aircomp	$234	2.4	($535)	0.4
Process Cool	$6	2.4	($12)	0.4
Process Heat	$1	2.9	($1)	0.4
Process Other	$9	2.6	($19)	0.5
Process Refrig	$6	1.1	($88)	0.4
Pumps	$121	1.9	($343)	0.4

Table 48 through Table 51 list benefits and costs from the PCT perspective for the four scenarios by end use, with and without incentives, illustrating energy efficiency measures' economic attractiveness, without utility incentives to subsidize initial measure costs.

Table 48. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (25% Incentive Scenario, Cumulative NPV through 2030)

	PCT (with incentives)		PCT (without incentives)	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$86	12.8	$84	12.5
HVAC	$131	7.3	$126	7.1
Indirect Boiler	$1	6.6	$1	6.4
Lighting	$282	10.2	$275	9.9
Motors Other	$117	6.1	$111	5.8
Other	$1	4.6	$1	4.3
Process Aircomp	$327	5.5	$308	5.2
Process Cool	$8	5.5	$7	5.2
Process Heat	$1	6.9	$1	6.7
Process Other	$12	5.6	$11	5.4
Process Refrig	$32	2.6	$27	2.4
Pumps	$185	4.1	$170	3.8

Table 49. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (50% Incentive Scenario, Cumulative NPV through 2030)

	PCT (with incentives)		PCT (without incentives)	
End Use	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$147	12.7	$141	12.2
HVAC	$197	7.6	$182	7.1
Indirect Boiler	$2	6.9	$1	6.4
Lighting	$417	10.4	$395	9.9
Motors Other	$177	6.3	$160	5.8
Other	$2	4.8	$2	4.3
Process Aircomp	$497	5.7	$444	5.2
Process Cool	$11	5.7	$10	5.2
Process Heat	$1	7.2	$1	6.7
Process Other	$18	5.9	$16	5.4
Process Refrig	$53	2.9	$39	2.4
Pumps	$288	4.3	$245	3.8

Table 50. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (75% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$184	13.0	$172	12.2
HVAC	$249	7.8	$222	7.1
Indirect Boiler	$2	7.1	$2	6.4
Lighting	$523	10.7	$482	9.9
Motors Other	$226	6.6	$195	5.8
Other	$3	5.1	$2	4.3
Process Aircomp	$638	6.0	$542	5.2
Process Cool	$15	6.0	$12	5.2
Process Heat	$1	7.4	$1	6.7
Process Other	$23	6.1	$20	5.4
Process Refrig	$73	3.1	$48	2.4
Pumps	$378	4.6	$299	3.8

Table 51. PCT Net Benefits and Benefit-to-Cost Ratio by End Use for Industrial Sector (100% Incentive Scenario, Cumulative NPV through 2030)

End Use	PCT (with incentives)		PCT (without incentives)	
	Net Benefits (Millions)	Benefit/Cost	Net Benefits (Millions)	Benefit/Cost
Fans	$215	13.2	$197	12.2
HVAC	$296	8.1	$254	7.1
Indirect Boiler	$2	7.4	$2	6.4
Lighting	$615	10.9	$553	9.9
Motors Other	$271	6.8	$224	5.8
Other	$3	5.3	$2	4.3
Process Aircomp	$769	6.2	$621	5.2
Process Cool	$18	6.2	$14	5.2
Process Heat	$2	7.7	$1	6.7
Process Other	$28	6.4	$23	5.4
Process Refrig	$94	3.4	$55	2.4
Pumps	$464	4.8	$343	3.8

4 Conclusions

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

Customers can reduce their energy consumption and peak power requirements by implementing energy efficiency measures or actions, allowing them to receive 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, and in effect, subsidize costs of incentives and other program costs, to the benefit of program participants.

As in a similar 2015 assessment, this study examines scenarios of theoretically achievable energy efficiency potential associated with incentives of 25%, 50%, 75%, and 100%. Each scenario in the study involves substantial expenditures on incentives, ranging from $251 million to nearly $2.0 billion (Cumulative NPV through 2030).

Economic benefits from energy efficiency improvements made by customers in Georgia Power's service territory as calculated by the TRC Test, could range as high as $2.0 billion to $4.0 billion. If implemented through electric utility programs, potential electric energy savings would range from 4.61% of year 2030 forecast sales under a 25% incentive scenario to 9.31% under a 100% incentive scenario. However, these savings result in substantial costs to customers. Net costs to electric utility customers could range from $2.4 billion to $6.3 billion, over and above those costs associated with meeting energy and demand needs using supply-side options. Program costs alone could increase rates from $422 million to nearly $2.7 billion. This study does not estimate costs to gas and water utility customers, who may also experience adverse rate impacts.

The study also demonstrates that customers can realize substantial benefits from increased energy efficiency, even without financial subsidies. Not including incentives, net participant benefits range from $4.1 billion to $8.3 billion. However, for a variety of financial and structural reasons, customers may not make these energy efficiency investments on their own.

Appendix A Detailed Methodology

Energy Efficiency potentials can be determined through a sequential analysis of various energy efficiency measures in terms of technical feasibility (technical potential) and economic viability, based on standard cost-effectiveness criteria (economic potential) and market adoption criteria (achievable potential). This assessment follows two main steps:

> Baseline forecasts determine future energy consumption by segment and end use and are calibrated to the utility's energy sales forecasts. Baseline forecasts reflect efficiency characteristics of current and pending codes and standards.
>
> Estimation of forecasts based on technical, economic, and theoretically achievable potentials reflect technical impacts of specific energy efficiency measures, measures' cost-effectiveness, and market constraints, respectively. The difference in energy consumption between the baseline and individual, alternative forecasts represents the energy efficiency potential.

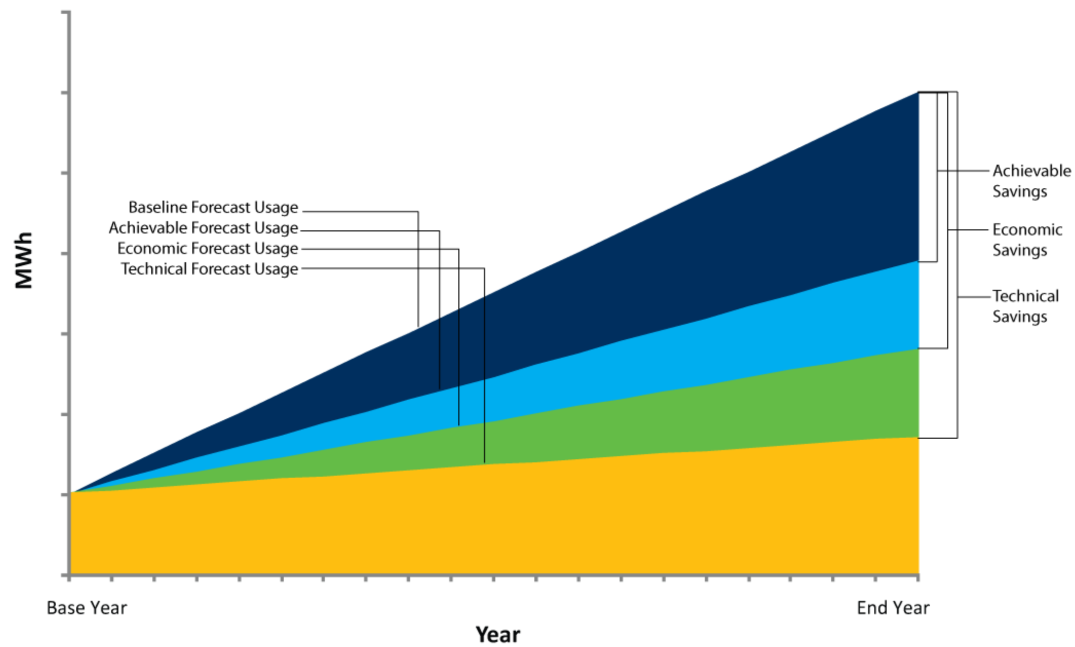
Figure A-1 illustrates these steps conceptually, showing a hypothetical baseline forecast, along with alternative forecasts associated with technical, economic, and achievable potential.[31] These alternative forecasts represent consumption under different sets of assumptions, and the difference between 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.

This approach offers two advantages. First, it drives savings estimates by a baseline that is calibrated to each utility's energy sales forecasts and is thus consistent with filings. The energy sales forecast serves as a "reality check," helping control for possible errors. Other approaches may simply generate the total potential by summing estimated impacts of individual measures; this may result in total savings estimates representing unrealistically high percentages of baseline sales.

Second, the approach maintains consistency among all assumptions underlying the baseline and theoretical forecasts. In the theoretical forecasts, relevant end-use level inputs change to reflect energy efficiency measures' impacts. As estimated savings represent the difference between the baseline and alternative forecasts, they can be directly attributed to specific changes made to analysis inputs.

[31] 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



A.1 Developing a Baseline Forecast

Nexant created the baseline forecast by combining all baseline data to obtain average consumption estimates by fuel type, customer segment, construction vintage, and end use; this breakdown is summed up to the sector level. This method was then calibrated to Georgia Power's Budget 2017 end-use forecast.

This approach offered several key advantages:

- Savings estimates were driven by a baseline and calibrated to official energy sales forecasts. This calibration required a great deal of scrutiny to ensure underlying inputs and assumptions remained consistent with known customer population characteristics. Other study approaches could generate the total potentials by summing individual measures' estimated impacts, resulting in total savings estimates representing unrealistically high baseline sales percentages.
- 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 from inflating potentials 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.

A.2 Data Sources

Creating a baseline forecast accurately reflecting Georgia Power's customers' consumption characteristics required many data inputs (Table A-1), including:

- Energy sales and customer forecasts;
- Customer counts by major customer segments (e.g., building type or industry);
- End-use and equipment saturations, including fuel shares;
- Efficiency shares (the percent of equipment below, at, and above code); and
- Annual end-use consumption estimates, by efficiency level.

Table A-1. Key Data Sources

Data Source	Key Variables
Georgia Power B17 end-use consumption forecast	Total electric sales by customer segment and end use, excluding energy efficiency program activity.
Georgia Power B17 customer forecast	Number of customers by rate class, commercial square footage estimate.
Georgia Power B17 saturations	Residential and commercial equipment saturations.
Residential and commercial saturation surveys	Supplemental saturations and fuel share information.
Manufacturing Energy Consumption Survey	End-use breakout for industrial facilities.
EnerSim building simulations	End-use equipment energy consumption estimate.

A.3 Compiling Energy Efficiency Technology Data

Nexant, along with input from members of the Demand Side Management Working Group ("DSMWG"), created a comprehensive catalog of energy efficiency measures applicable to Georgia Power's service territory, containing more than 427 unique measures. Expanding the measures to account for all appropriate combinations of segments, end uses, and construction types resulted in 6940 measure permutations, as shown in Table A-2.

Table A-2. Energy Efficiency Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	124	1,336
Commercial	170	4,234
Industrial	133	1,370

These measures required a number of inputs to accurately assess their potential and cost-effectiveness, primarily using secondary local, regional, and national data, where appropriate. For example, the 2013 Georgia Power Residential Saturation Survey ("RSS") provided inputs for the residential sector, and EIA's Commercial Building Energy Consumption Survey ("CBECS") provided inputs for the commercial sector. The industrial sector relied on EIA's Manufacturing Energy Consumption Survey ("MECS"). Relevant inputs for each type of measure included the following:

- End-use savings: Energy savings associated with a measure as a percentage of total end-use consumption, based primarily on EnerSim building simulation models for the residential and commercial sectors and the IAC database for the industrial sector. In order to manage the number of building simulations required to estimate energy savings for each measure, energy savings for some building types were calculated by scaling simulated energy savings from a similar, proxy building type (e.g., manufactured home energy savings derived from a single-family home simulation).
- Measure costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: RS Means, merchant websites, and other secondary sources. As with energy savings, scaling costs from similar, proxy building types allowed measure costs to be calculated for some building types.
- Measure life: A measure's expected useful lifetime. Sources included the Database for Energy Efficient Resources ("DEER"), the American Society of Heating, Refrigerating and Air Conditioning Engineers ("ASHRAE") Handbook, and other regional and national measure databases and energy efficiency program evaluations.
- Measure applicability: A general term encompassing an array of factors, including: fuel saturation, end-use saturation, technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used primarily derived from data in current regional and national databases, as well as Georgia Power's program tracking data. These factors are described in Table A-3.

Table A-3. Measure Applicability Factors

Measure Impact	Explanation	Sources
End-Use Saturation	The percentage of customers with the specific end use. (If not all commercial customers had a chiller unit, for example, end-use saturation would be less than 100%).	RSS; CBECS; MECS; various secondary sources.
Fuel Saturation	Of customers with a given end use, the percentage using electricity to fuel a specific end use (e.g., water heat, space heat).	RSS; CBECS; MECS; various secondary sources.
Measure Share	Used to distribute the percentage of market shares for competing measures (e.g., Cool Roofs and Green Roofs each have their own shares of the market), and to account for measure replacement at burnout or early replacement.	Various secondary sources and engineering experience.
Technical Feasibility	Accounts for the percentage of buildings that can have the measure physically installed. Various factors may affect this percentage, including whether the building already has the baseline measure (e.g., dishwasher), and limitations on installation (e.g., size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	Represents the percentage of buildings without the specific measure currently installed.	RSS; CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Interaction	Adjustment to measure savings due to interactions with other end uses. For example, increased lighting efficiency could increase space heating requirements.	EnerSim modeling.

A.4 Estimating Technical Potential

Once the measure database had been fully populated, Nexant used measure-level inputs to estimate technical potential over the planning horizon. This required creating an alternate forecast, reducing consumption by installation of all technically feasible measures, and then subtracting this forecast from the baseline forecast to estimate technical potential by customer segment, vintage, end use, year, and measure.

As noted, this approach ensured consistency with Georgia Power's forecast, and ensured the technical potential accurately reflected Georgia Power's customer characteristics, and represented a reasonable amount of projected sales. Further, the 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: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.
- 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 EnerSim 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.

A.5 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 objective 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 *ije*, taking into account 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 TRC ratio determined the stacking order for measures within each end use.

A.6 Estimating Economic Potential

Once the technical potential had been established, the economic (cost-effective) potential had to be determined.

This study determined measure cost-effectiveness according to the TRC test, treating a measure's benefits as the net present value of avoided utility costs and costs as incurred by the customer for installing the measure. If a measure had non-negative, net benefits, it could be considered cost-effective. Expressed as an equation:

$$\frac{\text{TRCBenefits}}{\text{TRCCosts}} \geq 1$$

Where:

$$\text{TRC Benefits} = NPV\left(\sum_{year=1}^{measurelife}\left(\sum_{i}^{i=8760}\int (impact_i \times avoided\cos t_i)\right)\right)$$

And:

TRC Costs = Customer Cost (excluding utility incentives)

TRC was calculated using estimated utility savings benefits (electric, gas, and water) and incremental costs collected by Nexant. 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.

A.7 Benefit Components

Benefits used in the TRC calculation included the value of time-differentiated and seasonally-differentiated electric avoided energy and capacity costs.

A.8 Measure Cost Components

The cost-benefit analysis' cost component 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 total measure benefits were calculated by discounting at the designated rate.

Upon screening all measures, impacts of measures deemed cost-effective to baseline consumption estimates could be applied, creating a separate forecast. Subtracting this new forecast from the baseline forecast provided the economic potential.

A.9 Caveats

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

- As the analysis has been based on a societal perspective, assumptions have not been made regarding how measure costs split between utilities and participants in energy efficiency programs. Achievable potential included that analysis level. This pure economic screen at the measure level did not assume program administration costs.
- Screening procedure outcomes, described above, depended on assumptions that will likely change over time. Measure costs, for example, will likely decline over time, as demand for energy-efficient technologies increases. At the same time, costs of reaching each successive participant can often increase. Forecasted avoided costs will also likely change over time, and, as they change, so will the value of savings resulting from installation of energy-efficient technologies (i.e., a measure failing the economic screen in earlier planning period years may become cost-effective in later years, if decrement values increase over the course of the planning horizon).
- 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.

Despite 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 at the time of the study. 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.

A.10 Estimating Achievable Potential

In estimating long-run achievable potential, this study incorporated realistic assumptions about economic constraints and market demand for energy efficiency at a range of incentive levels, adopting a two-step approach:

- Determining the rate at which the market adopts energy efficiency technologies based on similar offerings by other utilities throughout North America.
- Applying secondary data describing the elasticity between incentive levels and savings from analysis of EIA Form 861 data. These data included historical information on expenditures and savings from energy efficiency programs by utilities around the country.

To estimate the adoption rate of energy efficiency for the achievable potential, Nexant incorporated Georgia Power program data as well as secondary data from other utility sponsored DSM initiatives across North America. Nexant included secondary data on program performance because the period of program performance data available from Georgia Power was not long enough to make statistical projections of future participation rates and not all measures considered for the study are included in Georgia Power's current portfolio. This situation is not unique to Georgia Power; most jurisdictions have relatively short DSM program histories. Nexant developed an approach to overcome this issue by combining program performance data of many utilities and conducting a meta-analysis of program performance that broadly describes customers' program adoption rates over time. As described below, Nexant estimates a calibrated program participation model by combining meta-analysis adoption parameters with historic Georgia Power program performance data.

Nexant used historic Georgia Power participation data to derive estimates of baseline penetration (or participation) rates based on technology, typical program offering, or end-use. Participation in Georgia Power's most recent program year prior to the market potential study (MPS) was taken as the baseline cumulative penetration rate. Nexant developed estimates of future adoption using secondary research and standard economic theories on product diffusion. Forecasting future market penetration beyond the most recent participation rate requires assumptions about the ultimate market penetration for a given technology or set of measures, and information on the expected rate of market diffusion or uptake.

Nexant considered a number of secondary data sources to develop market adoption parameters. These sources include EPA ENERGY STAR data on qualified product shipments, empirically-derived market penetration curves from other utility-sponsored programs, and primary research conducted in other markets. The use of secondary data for estimating market penetration is based on aligning energy efficiency measures with typical program concepts designed to address specific market segments and the varieties of DSM measures widely available in and suitable for the Georgia market.

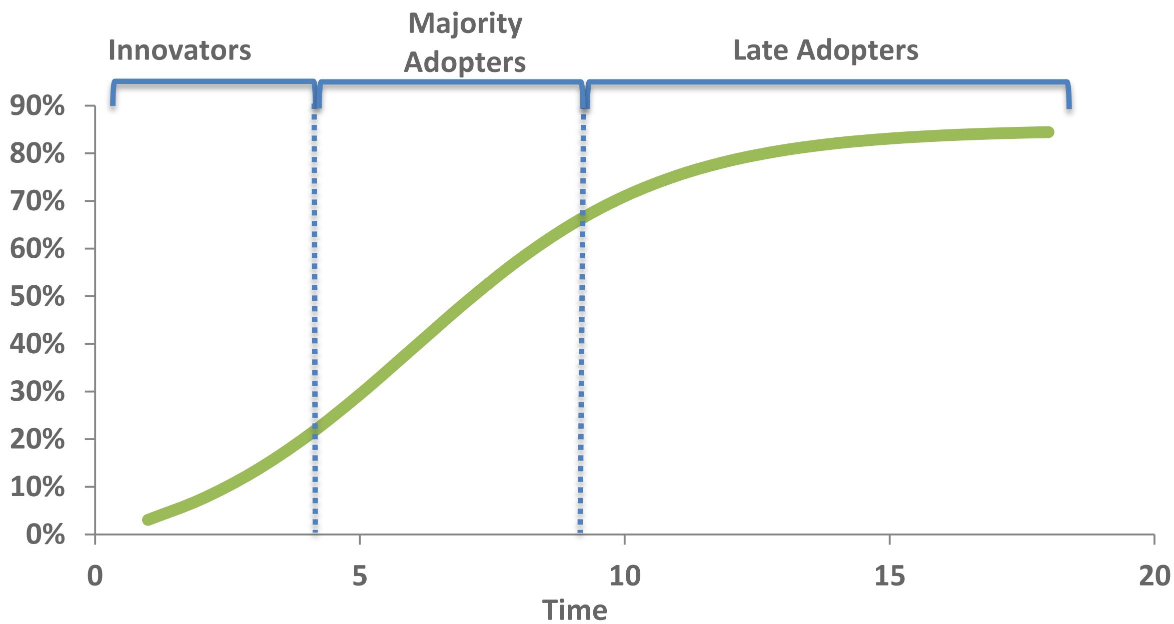
As previously described, the technical and economic potential included in this study are theoretical constructs that assume 100% adoption of energy efficiency technologies over an extended period of time, including the assumption that there will be an in-kind replacement measure to replace the transformed current measure. However, the achievable potential incorporates Nexant's market penetration estimates, which follow accepted theories of product diffusion. This theoretical model of market adoption, referred to as the Bass Diffusion Model, is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969 and, in 2004, was voted one of the top 10 most influential papers published in the 50-year history of the peer-reviewed publication *Management Science*[32]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[33]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in Georgia Power's service territory.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure A-2.

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

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

Figure A-2: Bass Model Market Penetration with Respect to Time



The Bass Diffusion model is a mathematical description of how the rate of new product diffusion in a market changes over time. Figure A-2 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

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

Where:

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

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

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

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

Next, to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, which was also used to estimate elasticity in the 2015 study, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. The market adoption rates described above were applied to the 25% incentive scenario and the EIA-based elasticity rate was then used to estimate increases in market adoption for the other incentive scenarios (50%, 75%, and 100%). Annual utility and customer economic impacts were then estimated by applying the appropriate ramp rates for each measure, coupled with specific escalation rates on costs and discount rates. A single escalation rate was used to preserve the relative cost-effectiveness for both options, commonly done when conducting assessments of achievable potential.

Appendix B Benefit Cost Analysis

When analyzing energy efficiency measures, cost-effectiveness 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 a societal perspective, which considers costs of an energy efficiency measure or program relative to the benefits of avoided utility supply costs. 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); the calculations remain consistent with the California Standard Practice Manual[1].

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	Increase in electric bill Increase in gas bill Increase in water bill Customer incremental costs (less any tax incentives)

[1] 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	Increase in electric utility supply costs Increase in gas utility supply costs Increase in water utility supply costs Customer incremental costs (less any tax incentives) Program costs (excluding incentives)

Table B-4. Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in electric revenues Decrease in electric utility supply costs
Cost	Decrease in electric revenues Increase in electric utility supply costs Program costs (including incentives)

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

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incentives Program costs (excluding incentives)

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