

2020 Bill Impacts

Summary

National Grid has performed analyses of the electric and gas bill impacts resulting from the proposed 2020 Energy Efficiency Program Plan. Bill impacts are distinct from rate impacts because they model the effects of efficiency programs on annual customer bills by aggregating rate and consumption changes. In the electric bill impact analysis, rate impacts are modeled by mapping EE programs to rate classes and estimating changes in both delivery service rates and supply costs due to the energy efficiency (EE) program charge proposed in the Plan. Consumption impacts are predicted from proposed participation and energy efficiency savings. In the electric model, other effects of energy efficiency beyond direct energy savings such as price suppression and avoided infrastructure investments are also included. The gas bill impact analysis uses a simpler model that models the impacts to rates based on the EE charge proposed in 2020 and the associated first year consumption impacts modeled based on predicted participation and energy savings by sector in the 2020 plan in order to characterize the bill impacts to average customers and average participants in comparison to non-participants.

Key Findings

In the 2020 analysis, National Grid used the same methods for the electric bill impacts as in previous years. In the natural gas analysis, a simplified analysis was used for the 2020 plan. The electric findings did not change dramatically from the 2019 Annual Plan analysis to the present 2020 Annual Plan analysis. Because of the change in methods for the natural gas analysis, the results are not directly comparable to prior years' analyses. Changes to the natural gas analysis are discussed in more detail in the gas bill impacts methodology of this attachment. The key findings of the bill impact analyses are:

- Most customers are participating in EE programs.
- In the electric portfolio, high participation means that over the lifetimes of the programs proposed for 2020, the average Rhode Island customer's (participants and non-participants combined) bill will be less than if there were no programs. Overall, rates may increase, but energy savings from participation in electric EE programs results in bill savings that offset the costs of the EE program charge and revenue recovery.

- In the gas portfolio, participants see modest annual bill savings in 2020 in comparison to energy efficiency non-participants. As detailed later in this attachment, the natural gas model uses a simplified modeling approach as compared to the approach used in the electric sector this year, or in the gas analysis in prior years. This year's gas analysis does not take into account impacts on future rates and does not compare against a counterfactual without an energy efficiency surcharge.

Electric Bill Impacts

Methodology

The electric bill impact models used to generate the electric results were adapted from models originally built by Synapse Energy Economics on behalf of the Division of Public Utilities and Carriers in 2013. These models are distinct from the traditional electric bill impacts models the Company presents in Rates proceedings before the PUC. The new models analyze two cases: the fulfillment of the 2020 Plan and the absence of an efficiency plan in 2020. This comparison isolates the effects of the proposed 2020 EE program charge and Fully Reconciling Funding Mechanism. It assumes energy efficiency plans have been implemented before 2020 but will not be offered starting in 2020. The analysis also incorporates how system-wide reduction in energy consumption affects the different elements of rates such as transmission, distribution, and commodity charges.

As in the analysis in the 2019 Plan, five separate electric models were developed, one for each of the main customer segments: Residential, Income Eligible, Small Commercial, Medium Commercial, and Large Commercial and Industrial. For all of the electric models, the key inputs are the net planned participation and savings numbers from Table E-7 in Attachment 5.^{1 2} The models combine these data with rate class information to determine the benefits to customer bills from program participation. Table 1 below shows the mapping of efficiency programs to rate

¹ The 2020 Annual Plan analysis maintains the approach of modeling five rate class groupings as used in the last year's annual plan to allow for a more realistic depiction of bill impacts because there is a wide array of usage among commercial customers and having more groupings helps illustrate typical impacts.⁹

² For the Residential and Income-Eligible analyses, the total participant count was set to the total 2020 customer population for each respective group. In the past the source for the total participant count was a Company analysis of participation counts that generated a count of participants that removed overlap between programs to generate a unique count of participants across all programs in a segment. That analysis has not been updated since 2013 and given the increase in customer participation since then, the 2013 assumptions are no longer relevant to program delivery today. Therefore, the total annual net participant counts for each of the Residential and Income-Eligible models is set to the respective populations. This is a conservative approach in that it uses the largest possible pool of participants over which to calculate bill impacts, moderating the per-participant impacts. It also accounts for the fact that the Home Energy Reports and residential lighting programs reach a significant portion of the residential and income eligible customer base.

classes for the five models.³ The diversity of the commercial customer profile means that customers from multiple rate classes can participate in any commercial program. Assumptions for these rate classes were made based on historical program participation data.⁴

Table 1. Electric Rate and Program Mapping

Electric Bill Impact Model	Rate Class(es)	Efficiency Programs
Residential Electric	A-16	Home Energy Reports
		EnergyStar HVAC
		EnergyWise Multifamily
		EnergyStar Lighting
		Residential Consumer Products
Income Eligible Electric	A-60	Income Eligible Single Family
		Income Eligible Multifamily
		Home Energy Reports
		EnergyStar Lighting
Small Commercial	C-06	Small Business Direct Install
		Large Commercial New Construction
		Large Commercial Retrofit
Medium Commercial	G-02	Small Business Direct Install
		Large Commercial New Construction
		Large Commercial Retrofit
Large Commercial	G-32, G-62	Small Business Direct Install
		Large Commercial New Construction
		Large Commercial Retrofit

Explanation of Electric Bill Impact Results

The results of the models are shown in Tables 2 through 6, and some highlights of the results are presented after the Tables. The columns in the Tables are as follows:

- Long-term rate impacts are defined as the average rate increase percentage from 2020 to 2039 (positive numbers indicate rate increase).
- Typical energy savings refer to the average percentage of energy savings to total annual consumption from 2020 to 2039 (positive numbers indicate electricity consumption reduction).

³ Delivery service rate tariffs is R.I.P.U.C. Tariff No. 2095 for rates A-16 (basic residential rate), A-60 (low-income residential rate), C-06 (small C&I rate), G-02 (medium C&I rate), G-32 (large C&I rate). Standard Offer Service rates used in the analysis are R.I.P.U.C. No. 2096 and R.I.P.U.C. No. 4809 A-16 & A-60 total commodity charge for standard and low income residential rate group, C-06 total commodity charge for small C&I rate group, G-02 total commodity charge for medium C&I rate group and G-32 total commodity charge for large C&I rate group.

⁴ Savings and participation modeled by C&I rate classes is partitioned and estimated based on historical data.

- Typical bill savings are defined as average percentage of bill decrease to total customer bill from 2020 to 2039 (positive numbers indicate electricity bill reduction).

The long-term rate impacts, typical energy savings, and typical bill savings are shown for average participants in energy efficiency programs, non-participants, and average customers within each of the five main customer segments. Average customers combine the bill impacts of EE participants and non EE participants to show the impacts of all customers combined. For the 2020 Bill Impact analysis the key finding is that over the lifetimes of the programs proposed for 2020 the average Rhode Island customer’s (participants and non-participants combined) bill will be less than if there were no programs.

Table 2. Residential Bill Impact Analysis – A-16 (2020 EE Plan vs. No EE)

Residential	Long-Term Rate Impacts	Typical Energy Savings	Typical Bill Savings
	(% of Total Rate)	(% per Participant)	(% of Total Bill)
Average Participant	0.16%	1.48%	1.00%
Non-Participant	0.16%	0.00%	-0.16%
Average Customer	0.16%	1.47%	0.99%

Table 3. Income-Eligible Bill Impact Analysis – A-60 (2020 EE Plan vs. No EE)⁵

Income-Eligible	Long-Term Rate Impacts	Typical Energy Savings	Typical Bill Savings
	(% of Total Rate)	(% per Participant)	(% of Total Bill)
Average Participant	1.10%	4.55%	3.50%
Non-Participant	1.10%	0.00%	-1.10%
Average Customer	1.10%	4.47%	3.41%

Table 4. Small Commercial Bill Impact Analysis – C-06 (2020 EE Plan vs. No EE)⁶

Small Business	Long-Term Rate Impacts	Typical Energy Savings	Typical Bill Savings
	(% of Total Rate)	(% per Participant)	(% of Total Bill)
Average Participant	0.24%	23.8%	21.7%
Non-Participant	0.24%	0.00%	-0.24%
Average Customer	0.24%	2.37%	2.16%

⁵ Home Energy Reports and Energy Star Lighting participation and savings are split between standard residential and income-eligible customers, since these measures reach all residential customers. For analysis purposes, the participation and savings in these two programs are allocated based on the percent of residential customers in standard income and income-eligible rates. Income-eligible customers account for 7.7% of participation and 7.7% of savings in the two programs.

⁶ For 2020, as in the 2019 Plan analysis, the small business (C-06 rate) customer count has been refined to better estimate customers. The number of accounts on the C-06 rate is greater than the number of customers, for example there are many accounts for cell towers, pumps, etc. that belong to one customer. This is an estimate based on the best data currently available to the Company.

Table 5. Medium Commercial Bill Impact Analysis – G-02 (2020 EE Plan vs. No EE)

Medium C&I	Long-Term Rate Impacts	Typical Energy Savings	Typical Bill Savings
	(% of Total Rate)	(% per Participant)	(% of Total Bill)
Average Participant	-0.43%	10.5%	10.0%
Non-Participant	-0.43%	0.00%	0.43%
Average Customer	-0.43%	1.84%	2.26%

Table 6. Large C&I Bill Impact Analysis – G-32, G-62 (2020 EE Plan vs. No EE)

Commercial & Industrial	Long-Term Rate Impacts	Typical Energy Savings	Typical Bill Savings
	(% of Total Rate)	(% per Participant)	(% of Total Bill)
Average Participant	-0.72%	4.66%	5.35%
Non-Participant	-0.72%	0.00%	0.72%
Average Customer	-0.72%	2.50%	3.21%

On the residential side, rates increase for both the residential and income-eligible rate classes. For all rate classes non-participant bills increase slightly, while participant and average customer bills decrease. The reduction in average customer bills demonstrates that the scale of the energy savings due to program participation outweighs the incremental costs to implement the program.

On the commercial side, long-term rates increase slightly for small C&I customers, and decrease for medium, and large C&I customers. Overall, long term rate impacts are similar in terms of magnitude and direction across all rate classes from 2019 to 2020. For Small, Medium, and Large Commercial customers, bill savings are positive for all customers (participants and non-participants), with the exception of slightly negative bill savings (-0.24%) for non-participant small business customers.

- *Residential long-term rate impact:* EE programs bring system benefits in terms of avoided infrastructure investment in generation, transmission, and distribution in the long-run. These avoided investments will ultimately flow through rates and offset the short-term contribution of the EE program charge to 2020 rate and bring the long-term rate increase down to 0.16% for standard residential customers and 1.10% for income-eligible residential customers.
- *Small, Medium, and Large C&I long-term rate impact:* Avoided infrastructure costs flow through rates and offset the EE program charge for 2020 and beyond, leading to a 0.24% increase in rates for small C&I customers, a 0.43% rate decrease for medium C&I customers, and a 0.72% rate decrease for large C&I customers through 2039.

- *Average participant bill savings:* the proposed EE programs will bring bill savings to participants in all rate groups. Specifically, typical bill savings are 1.00% for standard residential participants, 3.50% for income-eligible residential participants, 21.7% for small C&I participants, 10.0% for medium C&I participants, and 5.35% for large C&I participants.
- For the 2020 Bill Impact Analysis, Commercial participation by rate class is assumed to be similar to historical participation from calendar year 2018.
- *Average customer typical bill savings:* among all participants and non-participants, typical bill savings are 0.99% for standard residential customers, 3.41% for income-eligible residential customers, 2.16% for small C&I customers, 2.26% for medium C&I customers, and 3.21% for large C&I customers, indicating that the proposed EE programs will bring net benefits to all types of electric customers in Rhode Island (Tables 2-6).

Figure 1 through Figure 5 show examples of electric bill reduction for average residential, income-eligible, small C&I, medium C&I and large C&I customers and participants. Bills are calculated based on average annual consumption of a typical customer in Rhode Island in each class, using the values in Table 7.

Table 7. Average Annual Consumption per Customer in Modeled Customer Classes⁷

Modeled Customer Class	Average Annual Per-Customer Consumption (kWh/year)
Residential (A-16)	6,764
Income-Eligible (A-60)	6,134
Small C&I (C-06)	33,885
Medium C&I (G-02)	151,049
Large C&I (G-32 and G-62)	2,143,795

In the figures below, the rates are the same as rates used in the bill impact analysis above. This illustration is different from traditional incremental bill impacts because it shows the long-term bill impact of the proposed EE programs and accounts for the measure life of the energy efficiency measures.

⁷ Average per-customer annual consumption is calculated based on the forecast electric consumption for each rate class for 2020 and the latest customer counts, for all classes except small business C-06. The small business (C-06 rate) average customer consumption has been refined to better estimate customers based on best data currently available to the Company for both count of customers and their annual consumption. The number of accounts on the C-06 rate is greater than the number of customers, for example there are many accounts for cell towers, pumps, etc. that belong to one customer.

Figure 1. Example of Typical Residential (A-16) Participant and Customer Annual Electric Bill Impact (2020 EE Plan vs. No EE)

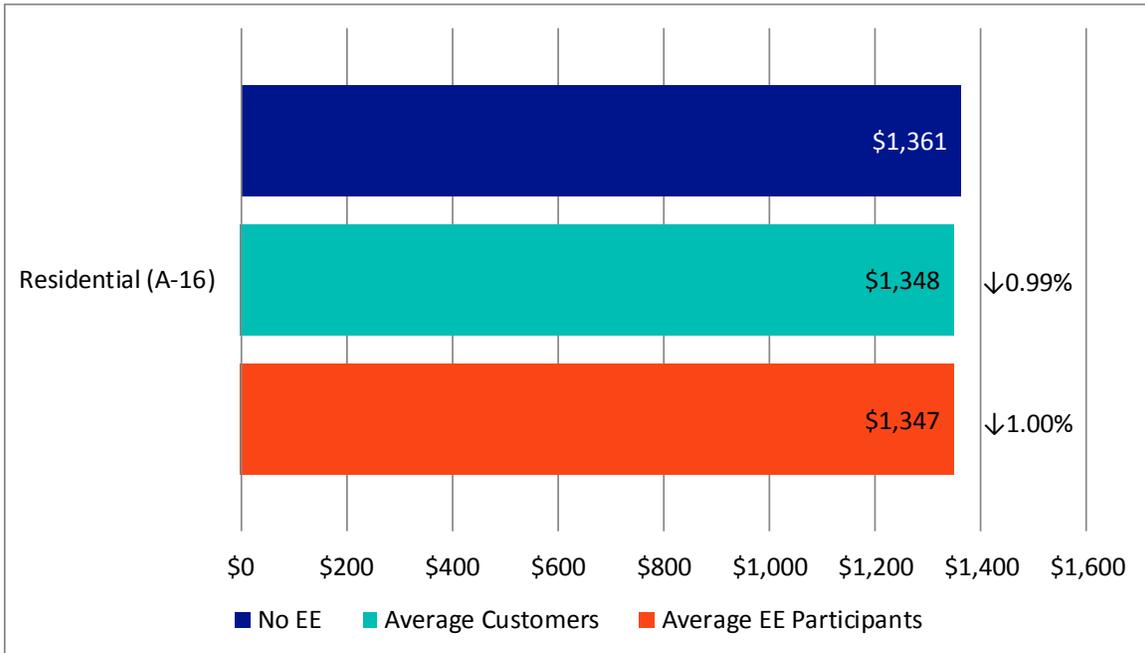


Figure 2. Example of Typical Income Eligible (A-60) Participant and Customer Annual Electric Bill Impact (2020 EE Plan vs. No EE)

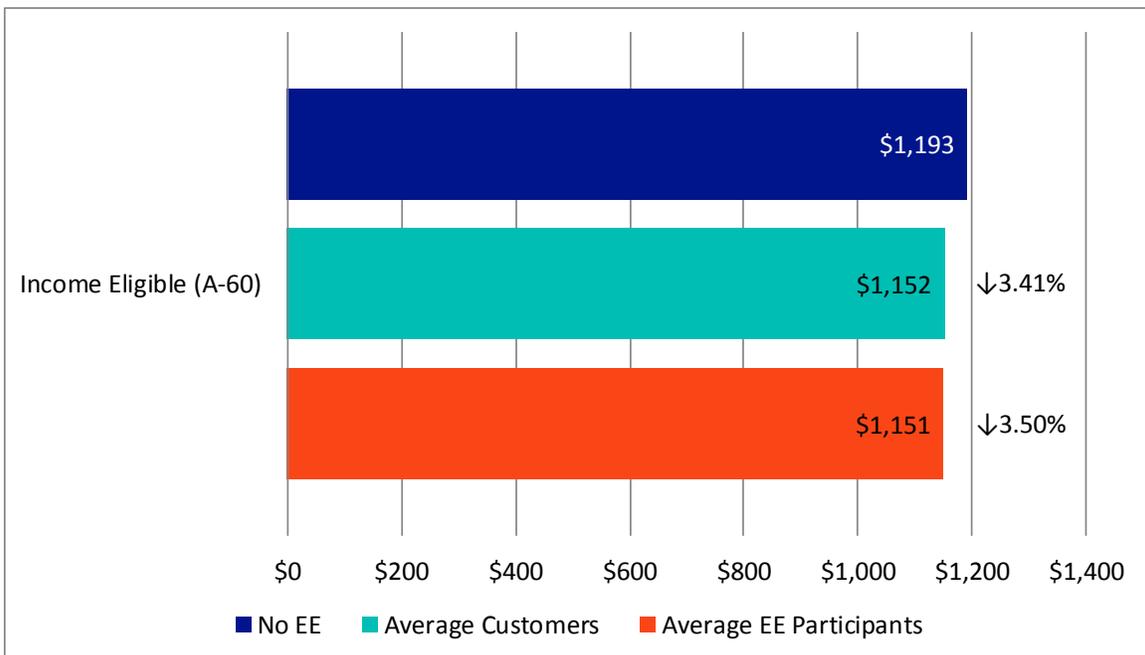


Figure 3. Example of Typical Small C&I (C-06) Participant and Customer Annual Electric Bill Impact (2020 EE Plan vs. No EE)

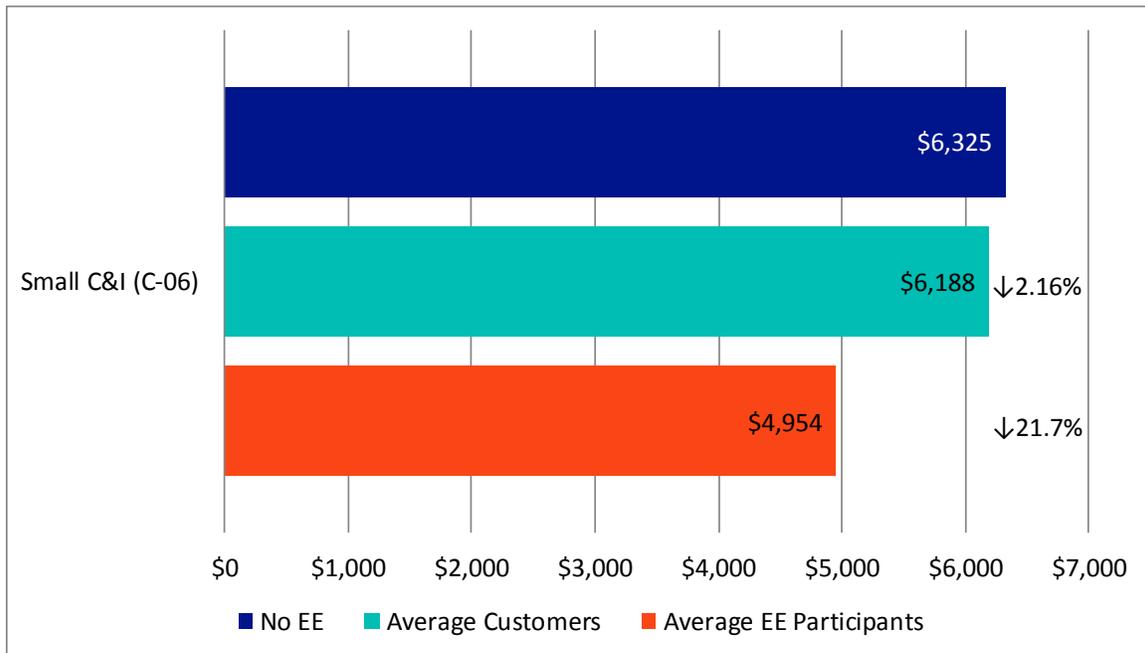


Figure 4. Example of Typical Medium C&I (G-02) Participant and Customer Annual Electric Bill Impact (2020 EE Plan vs. No EE)

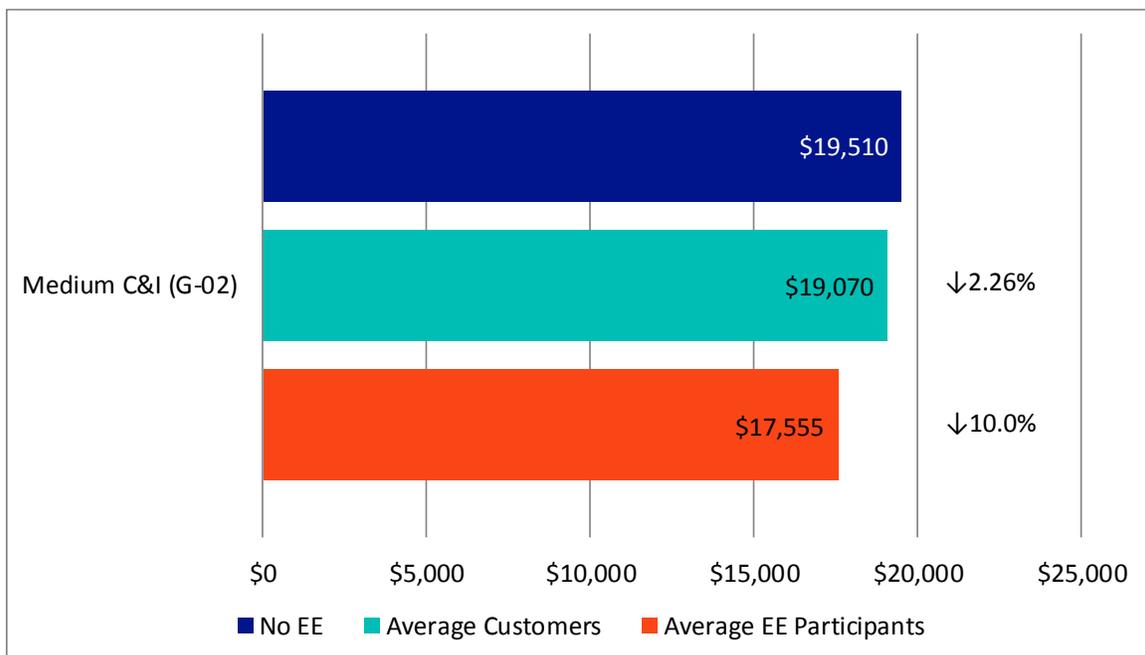
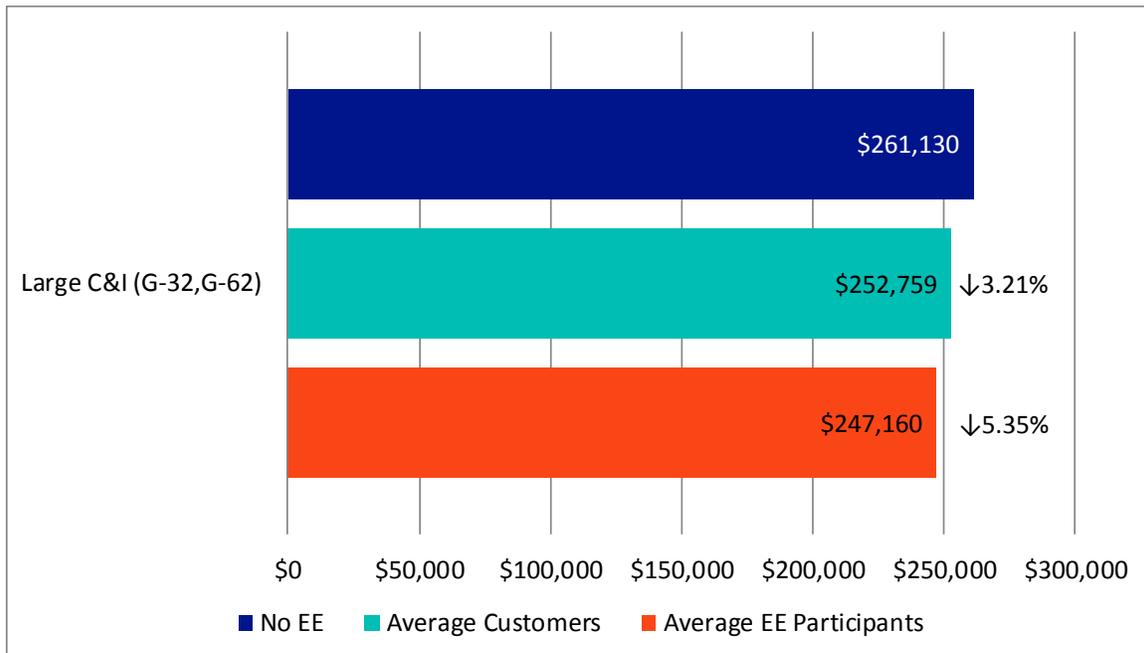


Figure 5. Example of Typical Large C&I (G-32, G-62) Participant and Customer Annual Electric Bill Impact (2020 EE Plan vs. No EE)



Gas Bill Impacts

Methodology

The natural gas bill impacts were analyzed by adapting an existing gas bill impact model used by the Company in Dockets 4955 and 4963.⁸ The gas bill impacts model differs from the electric bill impacts model in the following ways:

- The adapted gas model analyzes the effects of the 2020 Plan by looking at a change in average first year consumption due to energy efficiency.
- The adapted gas model does not account for energy efficiency's effects on future gas rates.
- The adapted gas model does not compare to a counterfactual scenario where there are no energy efficiency charges. The model only compares expected natural gas expenditures between participants and non-participants, and average customers and non-participants in the presence of an energy efficiency charge and taking into consideration energy efficiency consumption savings from participants.

⁸ Proposed DAC rates are in Docket 4955 and proposed GCR rate are in Docket 4963.

It should be noted that the bill impacts output of the gas model must be interpreted differently than the impacts from the electric model because of these fundamental differences in analytic approach.

Changes from 2019 Analysis

As noted above, the gas bill impacts model used in 2020 differs from the model used in 2019. The 2019 model incorporated lifetime impacts of energy efficiency savings and compared to an estimated proxy for a counterfactual scenario with no energy efficiency charge. In 2020 National Grid conducted an initial analysis using the same approach as used in 2019. Given changed inputs reflecting the 2020 plan, the 2019 model produced highly unrealistic results, and therefore has not been included in this attachment. Upon discussion of this issue with stakeholders, the Company determined that in lieu of this approach, a simplified approach would be taken in 2020. Further discussion of the potential for additional refinement of the gas bill impacts analysis is included in the final subsection of this attachment.

In the simplified 2020 analysis, the bill impacts are calculated as follows:

- Average Participant first year bill savings compared to non-participants: $(\text{Average participant's first year bill with EE charge} - \text{average non-participant's first year bill with EE charge}) / \text{average non-participant's first year bill with EE charge}$
- Average Customer first year bill savings compared to non-participants: $(\text{Average customer's first year bill with EE charge} - \text{average non-participant's first year bill with EE charge}) / \text{average non-participant's first year bill with EE charge}$

In comparison, in the 2019 analysis, the bill impacts were calculated as follows:

- Average Participant Bill Savings: $(\text{Present value of average EE participant lifetime savings} + \text{First year EE bill surcharge}) / \text{average non-participant's first year bill with EE charge}$
 - First Year EE bill surcharge in the preceding is calculated as: $\text{average participant's first year bill with EE charge} - \text{average non-participant's first year bill without EE charge}$
- Average Customer Bill Savings: $(\text{average customer's annual bill with EE charge} - \text{average non-participant's annual bill with EE charge}) / \text{average non-participant's annual bill with EE charge}$
 - Average customer's annual bill with EE charge in the preceding is calculated as: $((\text{average non-participant's annual bill with EE charge} + (\text{Present value of average participant lifetime savings} + \text{First year EE bill surcharge})) * \% \text{ of customers that})$

are participants) + (average non-participant’s annual bill with EE charge * % of customers that are non-participants)

Customer Rate Mapping to Models

The model maps customers to four models that account for their rate classes. These four customer segments are: Residential, Income Eligible, Small Business, and Large Commercial and Industrial. Table 8 shows the mapping of rates to customer segments.⁹

Table 8. Natural Gas Rate Mapping

Gas Bill Impact Model	Rate Classes
Residential Gas	Residential Heating
Income Eligible Gas	Residential Heating – Low Income
Small Commercial Gas	C&I Small
Large Commercial Gas	C&I Medium
	Large Low Load
	Large High Load
	Extra Large Low Load
	Extra Large High Load

Model Outputs

The gas bill impacts model calculates first year rate impacts and first year bill impacts in the presence of energy efficiency. The output of the gas bill impact model is an estimate of the percent change in rates by each customer segment, as well as the percentage bill change for participants and the average customer compared to a non-participant in the presence of energy efficiency.

Explanation of Gas Bill Impact Results

The proposed EE programs lead to reduction in first year bills for average participants and average customers (inclusive of both participants and non-participants) in all rate groups in comparison to a non-participant in energy efficiency programs, though in the presence of an energy efficiency surcharge. The detailed bill impact changes by rate group are shown in Table 9. The columns in the Tables are as follows:

- The rate impact is calculated as percent increase in rates due to EE (positive numbers indicate rate increase).

⁹ The analysis uses residential and income eligible heating to represent the two groups. As of August 2019, residential heating represents 92.6% of standard residential customers and income eligible heating represents 97.8% of income eligible customers.

- The participant bill savings is defined as percent change in average participant annual bill in 2020 compared to an average non-participant, in the presence of the EE charge (positive numbers indicate participant bill decrease).
- The average customer bill savings is expressed as the percent change in average annual bill in 2020 for average customers compared to an average non-participant, in the presence of the EE charge (positive numbers indicate average customer bill decrease).

Table 9. Rhode Island Gas Bill Impact Analysis

Rate Group	Rate Impact (% of 2020 Total Rate)	Bill Savings (as a % Change in 2020 Bills Compared to a Non-Participant in the Presence of EE Charge)	
		Average Participant	Average Customer
Residential Heating	7.11%	0.81%	0.63%
Low Income Heating	7.18%	1.71%	0.35%
Small Commercial	5.53%	0.711%	0.004%
Large Commercial	5.59%	1.019%	0.03%

- The total EE contribution to the 2020 gas rate is 7.11% for residential heating, 7.18% for low income heating, 5.53% for small commercial, and 5.59% for large commercial rates.
- For average participants, bill savings compared to a non-participant range from 0.81% to 1.71%.
- For average customers, bill savings compared to a non-participant range from 0.004% to 0.63%. In the case of residential heating, where most customers are also participants through the Home Energy Reports program, the rate impact is similar for average participants and average customers. In contrast, the small commercial group, for example, are a smaller participant pool relative to the population so the impact on average customers is minimal.¹⁰

Figure 6 through Figure 9 show examples of gas bill changes for average residential heating, income-eligible heating, small commercial, and large commercial customers and participants for typical annual gas bills. Bills are calculated based on average annual consumption of a typical customer in Rhode Island for each group at the following levels of annual consumption:

¹⁰ This analysis treats all Home Energy Reports as if they were sent to standard residential customers, including those actually sent to low income heating customers. We recognize that this is a simplification, and plan to revisit this as part of the gas rate and bill impact analysis discussion the Company will initiate with other stakeholders in anticipation of the upcoming three-year planning process. Additionally, in 2019 participants in the C&I Multifamily program began to be counted on the account level for the Bill Impacts Analysis instead of individual level. This means that master-metered multifamily facilities are now treated as a single account, where in past individual residents had been treated separately. This change was implemented in order to more accurately represent the number of large commercial customers participating in the program.

- residential heating: 845 therms,
- low-income residential heating: 845 therms,
- small commercial: 1,277 therms,
- large commercial: 327,997 therms.

Figure 6. Example of Annual Gas Bill Impact on Average Customers and Participants in the Residential Heating Group, compared to Non-Participants

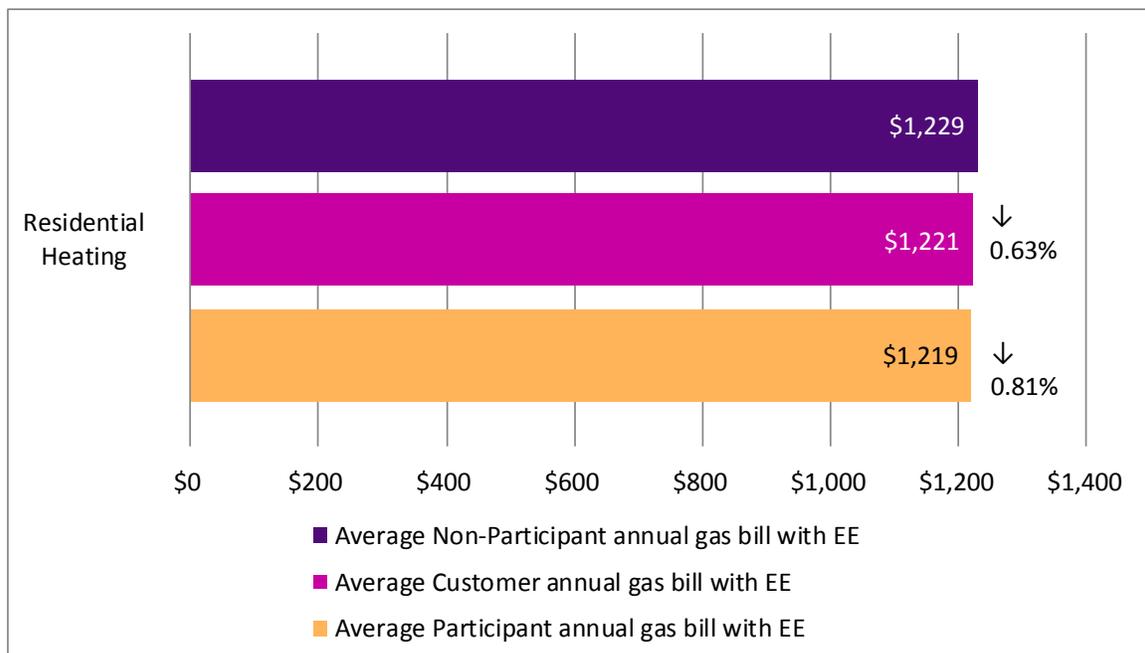


Figure 7. Example of Annual Gas Bill Impact on Average Customers and Participants in the Income Eligible Heating Group, compared to Non-Participants

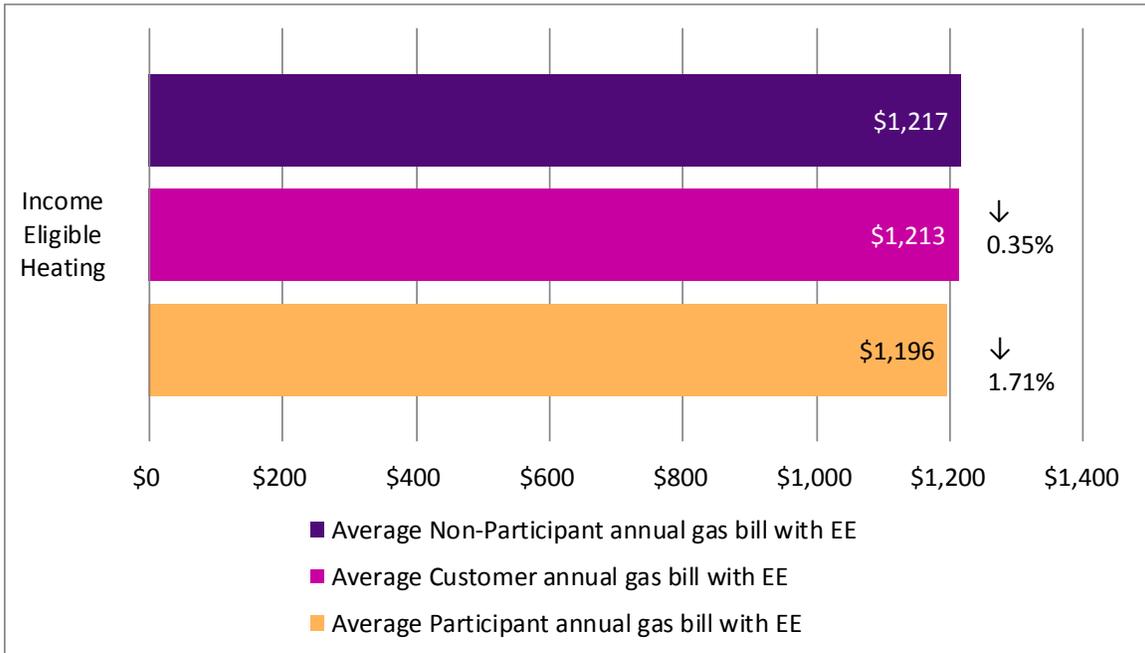


Figure 8. Example of Annual Gas Bill Impact on Average Customers and Participants in the Small Commercial Group, compared to Non-Participants

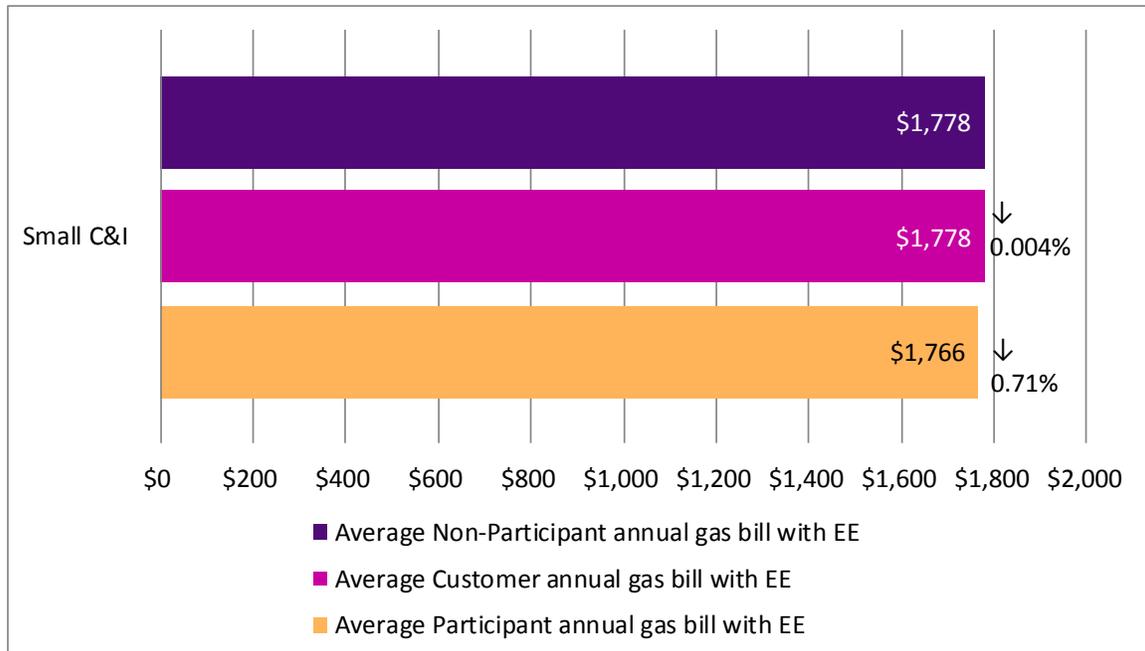
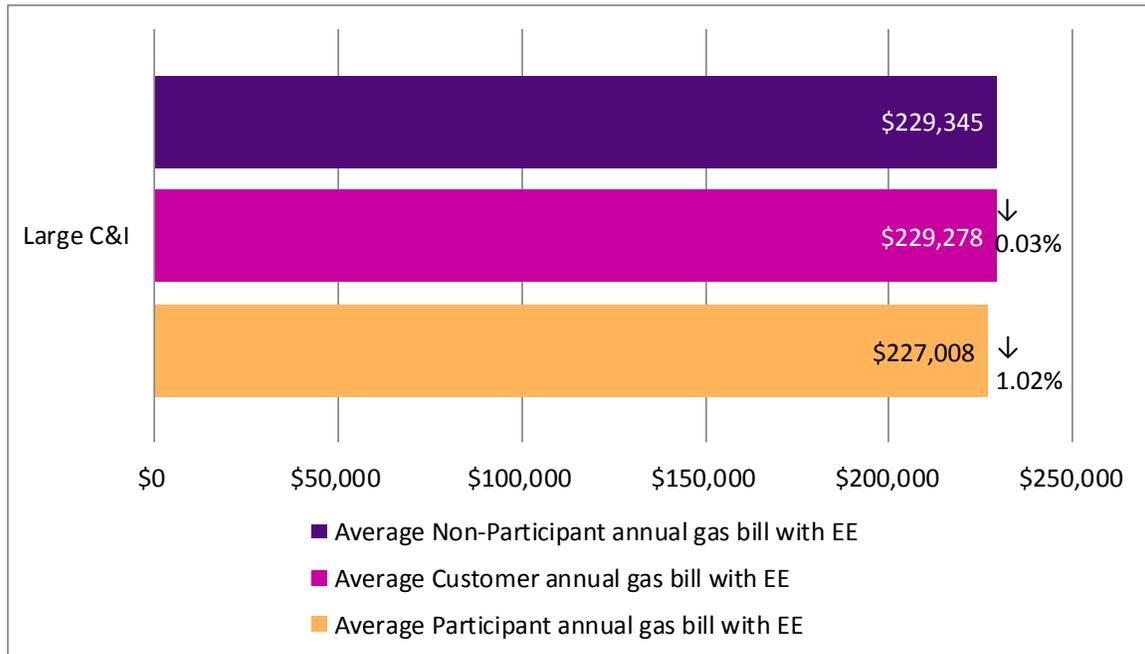


Figure 9. Example of Annual Gas Bill Impact on Average Customers and Participants in the Large Commercial Group, compared to Non-Participants



Potential for Enhanced Modeling in the Future

In general, the gas bill impacts analysis should be considered an approximation of the bill impacts resulting from average participant implementation of energy efficiency measures. Moving forward the Company anticipates further refining the analysis to more closely align with the purpose-built bill impact methodology applied to the electric sector.

In contrast to the electric bill impacts model utilizes avoided costs from the latest AESC 2018 study¹¹ including avoided energy costs, avoided capacity costs, avoided transmission costs, avoided distribution costs, and energy and capacity price suppression effects commonly called Demand Reduction Induced Price Effects (DRIPE). In the future, the Company will work with stakeholders to determine if there is additional value in updating the gas bill impacts analysis to more closely align it with the electric bill impacts model.

¹¹ Avoided Energy Supply Components in New England: 2018 Report, Re-released on October 24, 2018. <https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf>

Using a more robust model, with a similar set of inputs compared to the electric bill impacts model, would generate a more comparable and complete analysis of bill impacts of the gas energy efficiency portfolio. The natural gas avoided cost from the AESC 2018 study is an all-in cost that accounts for variable and fixed costs, including infrastructure expenditures. In addition, there are also natural gas DRIPE values and cross-fuels DRIPE values that could be applied in a more robust modeling framework to illustrate the lifetime impact of gas energy efficiency on rates, as the electric model currently does.

In addition, it should be noted that the bill impacts analysis is an analysis of limited scope. In contrast to the Rhode Island Test benefit cost framework (which is the basis of evaluating the cost effectiveness of energy efficiency programs and measures in the planned program portfolio), this bill impacts analysis models only the short-term bill impacts of the Company's proposed energy efficiency plan. A wider set of benefits, as captured in the RI Test, illustrates a more complete picture of the full impacts to Rhode Island customers from energy efficiency programs.