
Memorandum

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FROM: TIM WOOLF, JENN KALLAY

DATE: **UPDATED FEBRUARY 5, 2014**

RE: **FINDINGS AND RECOMMENDATIONS FROM RHODE ISLAND RATE, BILL, AND PARTICIPANT ANALYSIS**

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1. Summary of Findings

We compare a Base Case scenario for the 2015 – 2017 Three-Year Plan, keeping the system benefits charge fixed at its current rate, with a hypothetical No Energy Efficiency scenario. Our analysis identifies short-term and long-term rate impacts, bill impacts and participation rates by comparing these two scenarios. A separate memo provides documentation of the methodology and assumptions used.

Figure 1 provides a high-level summary of our results.

Figure 1. High-Level Summary of Results

	Highest Single-Year Rate Increase	Average Long-Term Rate Increase	Range of Participant Bill Savings	General Participation Conclusions For Cumulative Participation 1998-2017
Residential	6.4%	1.5%	-1% to 8%	Vast majority of customers participate.
Low-Income	7.5%	1.6%	-1% to 11%	Undetermined.
Small C&I	6.6%	1.2%	34% to 43%	Roughly 30% of customers participate.
Large C&I	8.7%	0.7%	0% to 3%	Majority of customers participate.



Impacts of the Three-Year Plan Only

Our analysis looks at the rate and bill impacts of the 2015 – 2017 Three-Year Plan only. In order to capture the long-term rate impacts of the Three-Year Plan, we apply a study period that extends well beyond 2017 to include the average measure life of the efficiency measures.

Our analysis does not include any energy efficiency investments by the Company after 2017. This is not meant to represent the energy efficiency investments that will actually occur after 2017; it is simply a methodology that we use to isolate the impacts of the Three-Year Plan from the impacts of future energy efficiency plans. Note that there will likely be additional rate, bill and participant impacts beyond those identified here, as a result of energy efficiency activities after 2017.

Rate Impacts

Our analysis of how electricity rates are likely to change as a result of the Three-Year Plan energy efficiency activities, relative to no efficiency at all, indicates that:

- The highest *short-term* rate impacts (experienced in a single year) range from 6.4 percent for Small C&I customers to 8.7 percent for Large C&I customers.
- The average *long-term* rate impacts range from 0.7 percent for Large C&I customers to 1.6 percent for Low-Income customers.
- The long-term rate impacts are significantly smaller than the short-term rate impacts, as they account for the downward pressure on rates over time from efficiency savings.
- The impacts on rates for Residential, Low Income and Small C&I customers is similar in shape and magnitude.

Bill Impacts

Our analysis of how much the bills are likely to change as a result of the Base Case level of efficiency activities, relative to no efficiency at all, indicates that:

- Participants in energy efficiency programs are likely to experience bill reductions that will often outweigh the rate increases resulting from the Three-Year Plan. The one exception is the Home Energy Reports program, where the bill reductions offset roughly half of the rate impact, on average.
- Bill impacts vary widely by program and customer type, with participant bill savings ranging from -1 to 43 percent.
- Comprehensive new construction and retrofit programs offer significant bill reductions for participating customers across sectors, but these programs typically reach relatively few customers per year.
- Customers frequently participate in multiple programs in a single year, and will also participate in programs in more than one year over time. Customers who participate in multiple programs or in multiple years will see higher bill savings than what we find here.



Participation Rates

Our analysis of participation rates from 1998 through the Three-Year plan, indicates that:

- The vast majority of Residential customers will likely participate in at least one program. Much of this activity is in the lighting program, but nearly 30 percent of participants will experience significant savings through the EnergyWise home retrofit program. Many residential customers will likely participate in multiple programs, and/or in programs multiple times across years.
- We are not able to draw conclusions about the participation rates for low-income customers, as we have not yet adequately defined the number of eligible customers.
- Roughly 30 percent of Small C&I customers will likely participate in at least one program.
- A majority of Large C&I customers will likely participate in at least one program. Many businesses and industrial customers will likely participate in the upstream buy down program, but there will likely also be a significant number of business retrofits.

Limitations to the Analysis

There are several limitations to this analysis, summarized below.

- Our analysis considers only the rate and bill impacts of the Three-Year Plan. There will likely be additional rate, bill and participant impacts beyond those identified here, as a result of energy efficiency activities after 2017.
- The long-term rate forecasts in all scenarios are rough estimates, and do not take into account short-term details (e.g., the timing of rate cases).
- The bill impact estimates are based on average customer consumption levels and typical program participants. Customers with consumption levels that are significantly different from the average consumption level, and/or customers whose savings levels are significantly different from typical participants, will experience different bill impacts from the results presented here.
- Our estimates of participants and participation rates should be seen as preliminary and approximate. The Company has maintained reasonably good data for program participation in any one year, and the Company has been helpful in working with us to make the most of the participant information available. However, the information currently available is limited, particularly with regard to the extent to which customers will participate in multiple programs in one year or in multiple programs across years. As described in the following section, we recommend that additional steps be taken to improve the analysis of program participation rates.

Consequently, these results should not be seen as detailed predictions of rate or bill impacts for any one year, or for any one customer. Instead, they are meant to be illustrative of typical impacts on average customers over the long-term. These results are meant to be used to provide a high-level indication of how well customers are being served by the energy efficiency programs, and to identify opportunities to improve the way that customers are served by the efficiency programs.



2. Recommendations

We recommend that National Grid and other Rhode Island energy efficiency stakeholders consider these results in planning for and designing energy efficiency programs and budgets. In particular, we recommend paying more attention to customer participation rates as a way to promote customer equity and mitigate rate impacts.

We also recommend National Grid follow our analysis with its own analyses and research on these topics. This could include the following elements.

Rate and Bill Impacts

We encourage National Grid to work out any questions or fill in any missing parts to our rate and bill impact analysis, and to take it as their own for future use. This could include (a) developing parallel workbooks for the gas rate and bill impacts; (b) modifying some of the assumptions in these workbooks upon the request of members of the collaborative; and (c) updating the workbooks in the future to estimate the impacts with future energy efficiency plans.

Participant Impacts

Estimating participant impacts is extremely important for understanding equity issues across customers, program design, program planning, and setting program budgets and goals. We recommend National Grid give this topic significantly more attention than it has to date. This includes the following elements.

Data Collection

We recommend National Grid obtain and track customer participation data in a way that allows for a thorough understanding of cumulative total participation, and addresses some of the questions that we were not able to answer in our analyses above. This means: carefully tracking participation for all programs in each year; identifying where customers participate in more than one program each year; and identifying where a customer participates in programs across different years. It also means developing a methodology to estimate total participation within each sector in a way that produces logical results (i.e., participation rates equal to or less than 100 percent).

Reporting

We recommend National Grid provide a more comprehensive set of historical participation data in its Energy Efficiency Year-End Report. This would include not only actual customer participation (in terms of number of customers), but also customer participation rates (in terms of the percent of the eligible population). It would also include participation information (numbers and rates) in total, as well as participation information after the Company has addressed double participation issues. Furthermore, it would include a presentation of cumulative participation rates for the last several years, to provide an indication of the participation impacts over time.

We also recommend National Grid provide a more comprehensive set of future participation data in its annual Energy Efficiency Plans. This would include not only projected customer participation (in terms of



number of customers), but also customer participation rates (in terms of the percent of the eligible population). It would also include forecast participation information (numbers and rates) in total, as well as participation information after the Company has addressed double participation issues. Furthermore, it would include a presentation of cumulative participation rates from the past along with forecasted participation rates, to provide an indication of the expected participation impacts over time.

Additional Research

We recommend National Grid conduct further research to support its ability to collect and report participation data. The nature of this research should be determined on an ongoing basis, as the Company proceeds to collect and report data in more detail. Goals of this type of research could include a better understanding of: how customers participate in upstream buy down programs; customer participation in the Home Energy Reports program; and how customers participate in more than one program and/or in more than one year.

3. Detailed Results

3.1. Rate Impacts

Residential

The impacts of the rate adjustments are presented in Figures 2 and 3, for the Residential sector. Figure 2 presents the impacts of each component separately, in terms of ¢/kWh. Figure 3 presents the net impacts of all the components combined, in terms of percent of a typical bill.

Both Figures 2 and 3 also present the average long-term rate impacts, with a dashed black line. The average long-term rate impact represents the average impact over all the years of the study period, capturing both the upward and downward pressure on rates.

As indicated in the figures, the recovery of lost revenues represents a significant portion of rate increases, especially over the long term. The highest single-year rate impact is 6.4 percent in 2015, 2016 and 2017, but the average long-term rate impact is 1.5 percent, or 0.2 ¢/kWh.

The impacts on rates for the Low-Income and Small C&I sectors have essentially the same shape and similar magnitudes as the impacts presented in Figures 2 and 3 for the Residential sector. Therefore, we have not presented those figures here. Additional information is summarized in the Summary of Impacts section below.

Figure 2. Rate Impacts by Component - Residential (¢/kWh)

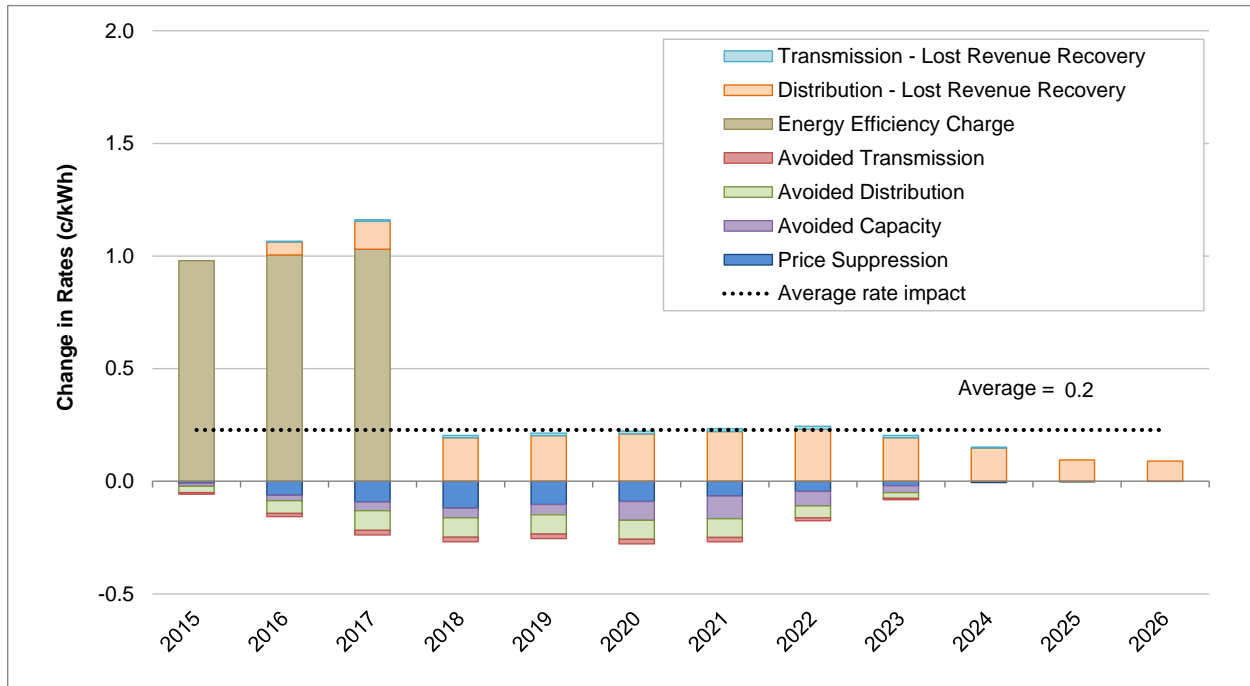
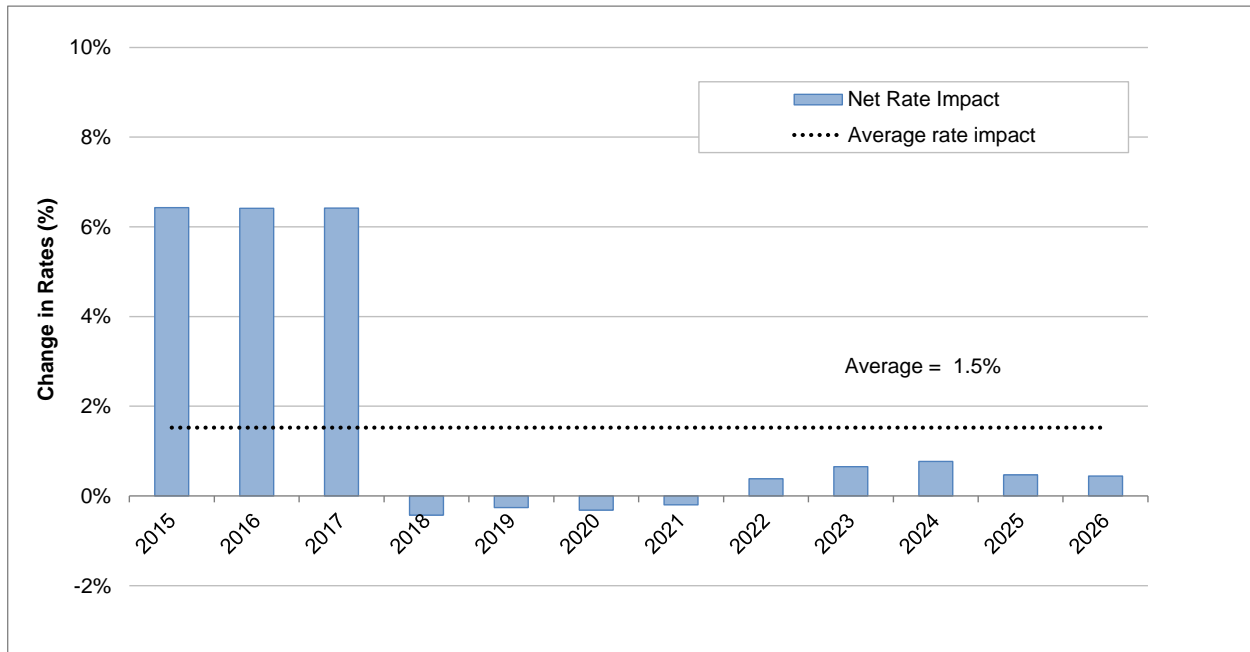


Figure 3. Net Rate Impacts - Residential (percent of bill)



Large C&I

Figure 4 shows the impacts of each component of the rate adjustments, in terms of ¢/kWh, for the Large C&I sector. As for the Residential sector, the average long-term rate impact is shown with a dashed black line.

The impacts on rates for the Large C&I customers are lower than for the other sectors, as indicated in Figure 4. This is due to higher avoided capacity and avoided T&D costs for Large C&I than the other sectors. As a result, we estimate that the average long-term rate impact for the Large C&I sector is 0.7 percent.

Figure 4. Rate Impacts - Large C&I (¢/kWh)

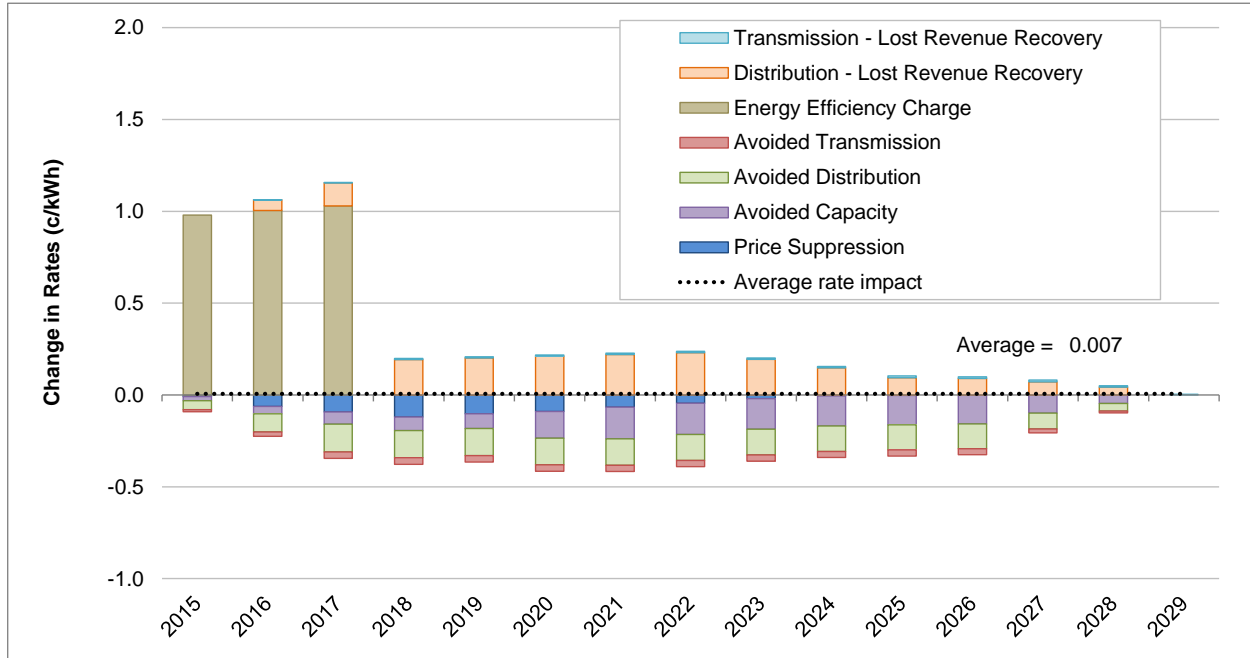


Figure 5. Summary of Average Change in Rates by Customer Type – Percent Increase in Rates

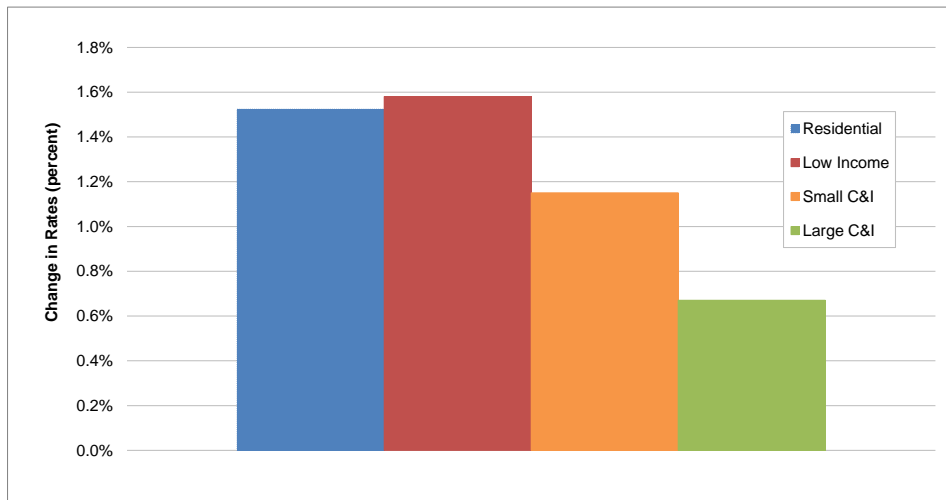
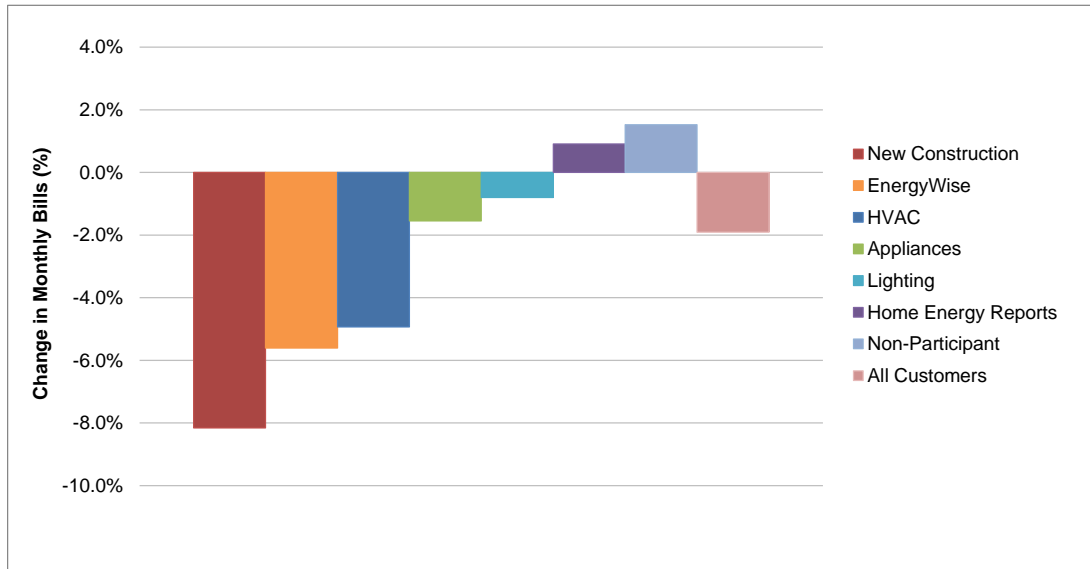


Figure 5 summarizes the average long-term impacts on rates for the four sectors that we analyzed. As indicated, the percent impact on rates is roughly 1.5 percent for Residential and Low-Income, a little more than one percent for Small C&I, and a little less than one percent for Large C&I.

3.2. Bill Impacts

While all customers will experience the rate impacts described above, different customers will experience different bill impacts, depending upon whether they participate in any of the efficiency programs, and which program they participate in. Therefore, we estimate the bill impacts separately for each of the programs offered by the Company. Figure 6 below presents the bill impacts for the Residential sector.

Figure 6. Residential Change in Bills



The New Construction program offers the largest bill reduction—roughly eight percent—and the EnergyWise home retrofit program offers the next largest bill reduction, roughly 5.5 percent. Note that these bill reduction estimates do not account for the water, gas, and other-fuel savings offered by the EnergyWise home retrofit program.

The Appliances and Lighting programs offer smaller bill savings, while the participants in the Home Energy Reports program see an average increase in bills because the amount of energy savings is not sufficient to overcome the increase in rates. Non-participants see an increase in bills of 1.5 percent, as a result of their rates increasing by this amount. The “all customers” result indicates that all customers on average, including both participants and non-participants, will see bill reductions of roughly two percent.

Note that customers frequently participate in multiple programs in a single year, and will also participate in programs in more than one year over time. For example, many customers participate in the Lighting program as well as the EnergyWise home retrofit program. (We address this issue in more detail in the next section.) For those customers that participate in more than one program, their bill savings will be higher than those presented in Figure 6.

Additional bill impact information for the other sectors is provided in the Summary of Impacts section, below.

3.3. Participation Rates

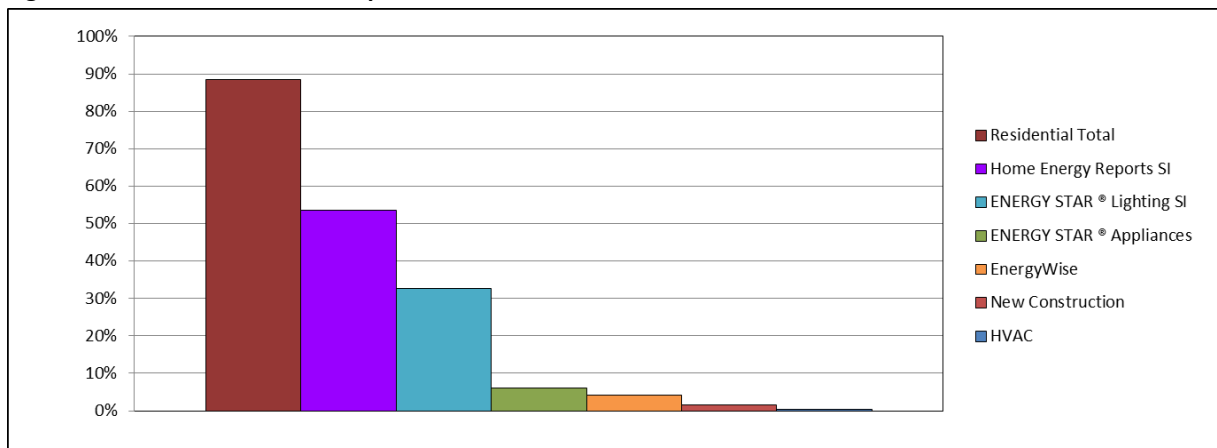
As customers that participate in energy efficiency programs have lower bills than customers that do not participate, a key component in the understanding and use of the bill impact analysis workbooks is the breadth of participation. Our participant analysis was developed with support from National Grid staff, and is based entirely on customer participation data by program provided by the Company.

We assess the breadth of participation using both annual and cumulative participation rates. Annual participation rates are the percentage of the eligible customers that participate in an energy efficiency program in a given year. Cumulative participation rates are the percentage of eligible customers that have participated in an energy efficiency program since 1998, which is the first year that participation data is readily available.

In order to produce an accurate representation of the percentage of customers that participate in programs, it is necessary to account for those customers that participate in more than one program, both within a year and across years. This type of “double participation” occurs frequently within a year, e.g., when a Residential customer purchases lighting products more than one time within a year, and when a Residential customer participates in the lighting program as well as a home retrofit program. Our analysis indicates that double participation also occurs frequently across years, when a participant participates in the same program in several consecutive or non-consecutive years.

Figure 7 presents the annual participation rates for 2015, the first year of the next Three-Year Plan.

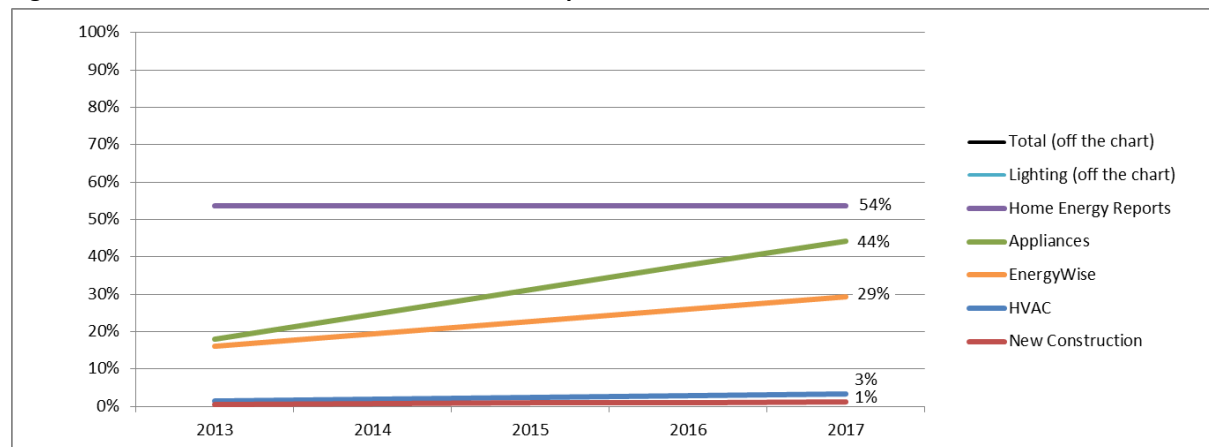
Figure 7. Residential 2015 Participation Rates – Base EE Case



The Home Energy Reports program has the highest annual participation rate, as National Grid plans to reach 54 percent of eligible Residential customers each year. National Grid estimates that 33 percent of eligible Residential customers will purchase at least one lighting product in 2015. The Appliance and EnergyWise home retrofit programs are estimated to reach 6 percent and 4 percent of eligible Residential customers, respectively. The New Construction and HVAC programs are estimated to reach 2 percent and 0.5 percent of eligible Residential customers, respectively.

Figure 8 presents cumulative participation rates through 2020. These are estimated by combining the participation estimates from the past (through 2012) with those for 2013 and 2014 and those estimated for the Three-Year Plan.

Figure 8. Residential 1998-2020 Cumulative Participation Rates – Base EE Case



The Appliance and EnergyWise home retrofit programs are estimated to reach 44 percent and 29 percent of eligible Residential customers, respectively. The New Construction and HVAC programs are estimated to reach three percent and one percent of eligible Residential customers, respectively. The Home Energy Reports program has a different pattern of cumulative participation, in that the same customers are expected to repeat the program year after year. While there might be new customers added each year, and some customers that drop out each year, we have not accounted for those effects.

The participation rates for the Lighting program and the total Residential sector are not included in Figure 8, because those results are implausibly high and would skew the graph for the rest of the programs.

These participation estimates account for double participation, as described above. Therefore, customers that participate in more than one program, within a year or across years, are only accounted for once—in theory. However, as indicated in Figure 8 the sum of all these participant rates in 2017 exceeds 100 percent. This suggests that our participation estimates still include a lot of double participation, i.e., some customers are accounted for here more than once.

This is especially true for the Lighting program. As indicated in Figure 7 above, this program is expected to reach roughly 30 percent of customers each year, even after double participation is taken into account. This means that over four or more years, the participation rate will exceed 100 percent. Using our methodology and the Company’s assumptions, we estimate that the cumulative participation rate from the Lighting program through 2017 could reach 240 percent—an impossible result if we have properly accounted for double participation. We conclude from this result, and from the fact that the totals in 2017 exceed 100 percent, that we are not adequately accounting for double participation. In Section 2 above we recommend that this issue be addressed further in future investigations.

As noted above, there is an important relationship between the double participation and the savings per customer values that we use to estimate bill impacts. Whenever there is double participation in a program, the savings per customer and the bill reductions per customer will be higher than what we present in this memo. Given the significant amount of double participation indicated by our analysis, we expect that the bill savings by program are significantly higher than those presented in this memo.

3.4. Summary of Results by Sector

Figures 9 through 12 below summarize the rate, bill, and participation results for each of the four customer types modeled. Each table presents the impacts for each of the different types of programs offered to that customer type. The rate impacts summarized here are the average long-term rate impacts described above.

The bill impacts represent the combination of the rate impacts and the average energy savings for the program participants. The average energy savings per participant are very different across different programs, resulting in different bill impacts across the programs.

The figures also present the participation rates expected for each program, for two different time periods. The 2015 – 2017 column presents a forecast of the participation rates expected as a result of the efficiency programs proposed in the Three-Year Energy Efficiency Plan. The 1998 – 2017 column presents the cumulative participation rates from historic programs through 2012, as well as the programs in 2013 and 2014, and the programs in the Three-Year Energy Efficiency Plan.

As discussed above, some of the participation results are implausibly high (i.e., over 100 percent). These are highlighted in red font. These results are high for a variety of factors, especially customer participation in more than one program and in more than one year—above what has been identified by the Company. In Section 2 above we recommend that these implausible results be investigated further.

Residential

Figure 9. Summary of Impacts – Residential

Base EE Case					
	Rate Impacts	Energy Savings	Bill Savings	2015-2017 Participation	1998-2017 Participation
	(% of Total Rate)	(% per Participant)	(% of Total Bill)	(New % of Customers)	(% of Customers)
New Construction	1.5%	14.8%	8.2%	0.5%	1.2%
HVAC	1.5%	9.8%	4.9%	1.5%	3.3%
EnergyWise	1.5%	10.9%	5.6%	9.8%	29.2%
Home Energy Reports	1.5%	0.9%	-0.9%	0.0%	53.5%
Lighting	1.5%	3.5%	0.8%	97.5%	240%
Appliances	1.5%	4.7%	1.5%	19.7%	44.2%
Non-Participant	1.5%	0.0%	-1.5%	0.0%	0.0%
All Customers	1.5%	2.3%	1.9%	94.7%	273%

In the Residential sector the average long-term rate impact is expected to be 1.5 percent. The average participant savings will vary widely by program type, with savings on the order of one to 3.5 percent for Home Energy Reports and the Lighting program, and up to 11 to 15 percent for the EnergyWise home



retrofit program and New Construction program. Note that the EnergyWise home retrofit program savings do not include the gas and other-fuel savings from that program, only the electric savings.

The Residential participation rates also vary widely depending upon the program type. In general, the programs with high participation rates (e.g., Home Energy Reports, Lighting) tend to have relatively low savings per participant, and vice versa.

As described above, the Residential Lighting program and the Residential totals are implausibly high, and require further analysis to account for double participation. If this double participation is accounted for, the participation rates will be lower than those in Figure 9, but the energy and bill savings will be higher.

Despite the uncertainties in our analysis as a consequence of the double participation, it appears from these results that the vast majority of Residential customers will be served by one program or another over this time period, and that many of them will participate in more than one program.

Note that the New Construction program participation rates are relative to the entire customer base, and not the much more narrow number of new homes constructed in that year. An estimate of the participation rate relative to new homes would provide a better indication of how well this customer type is being served.

Low-Income

Figure 10. Summary of Impacts – Low-Income

Base EE Case					
	Rate Impacts	Energy Savings	Bill Savings	2015-2017 Participation	1998-2017 Participation
	(% of Total Rate)	(% per Participant)	(% of Total Bill)	(New % of Customers)	(% of Customers)
Single Family	1.6%	16.6%	10.5%	32.5%	72.4%
Multi Family	1.6%	5.8%	2.6%	196%	634%
Home Energy Reports	1.6%	0.9%	-1.0%	53.5%	53.5%
Lighting	1.6%	3.6%	1.1%	87.7%	216%
Non-Participant	1.6%	0.0%	-1.6%	0.0%	0.0%
All Customers	1.6%	3.6%	4.6%	117%	420%

For the Low-Income sector the average long-term rate impact is expected to be 1.6 percent. The average participant savings are highest for the Single Family program (16.6 percent) and the Multi Family program (5.8 percent).

We estimate the eligible population for the low-income programs by using the number of customers that are on the Company's discounted low-income rate. In fact, the population of eligible customers for the low-income programs is much greater than this estimate, because the definition of low-income is more stringent for the discounted rate than for the efficiency programs. Consequently, all of the participation rates presented in Figure 10 are overstated.¹ Therefore, we do not recommend that these participation rates be used at this time.

¹ For the same reason, the Residential sector participation rates are understated.

Small C&I

Figure 11. Summary of Impacts – Small C&I

Base EE Case					
	Rate Impacts	Energy Savings	Bill Savings	2015-2017 Participation	1998-2017 Participation
	(% of Total Rate)	(% per Participant)	(% of Total Bill)	(% of Customers)	(% of Customers)
Upstream Buydown	1.1%	37.2%	33.8%	1.2%	2.3%
Retrofit	1.1%	46.9%	42.9%	9.8%	27.0%
Non-Participant	1.1%	0.0%	-1.1%	0.0%	0.0%
All Customers	1.1%	1.6%	2.7%	10.7%	28.4%

The average long-term rate impact for the Small C&I sector is estimated to be slightly higher than one percent. The two programs in this sector offer significant average savings per customer—roughly 37 percent and 47 percent for the Upstream Buy Down and Retrofit programs, respectively. However, the participation rates for this sector are generally lower than for all of the other sectors, both within the Three-Year Plan and for the cumulative period.

Note that a single Upstream Buy Down program is offered to both Small C&I and Large C&I customers. The Company tracks the customer participation by customer size. We have allocated the small customers to the Small C&I sector, and the large customers to the Large C&I sector (see below). The number of eligible customers used to calculate penetration rates for the Small Upstream Buy Down program is based on the total number of Small C&I customers, and the eligible customers for the Large Upstream Buy Down program is the total number of Large C&I customers.

Large C&I

Figure 12. Summary of Impacts – Large C&I

Base EE Case					
	Rate Impacts	Energy Savings	Bill Savings	2015-2017 Participation	1998-2017 Participation
	(% of Total Rate)	(% per Participant)	(% of Total Bill)	(% of Customers)	(% of Customers)
New Construction	0.7%	2.0%	1.2%	3.8%	18.6%
Upstream Buydown	0.7%	0.5%	-0.2%	34.3%	64.7%
Retrofit	0.7%	3.7%	2.8%	13.1%	38.2%
Non-Participant	0.7%	0.0%	-0.7%	0.0%	0.0%
All Customers	0.7%	2.9%	6.3%	50.3%	120%

The average long-term rate impact for the Large C&I sector is estimated to be 0.7 percent.

The participant savings appear to be relatively low for the programs serving this sector, ranging from 0.5 percent for the Upstream Buy Down program to 3.7 percent for the Retrofit program. However, we caution that these average savings per customer might not be indicative of the savings that are actually experienced by Large C&I customers. In this sector, the amount of energy consumption per customer can vary dramatically across customers. Those customers with significantly different consumption levels might experience significantly different savings per customer.

Furthermore, the total participation rate for the entire period is an implausibly high number. This suggests that there is some double participation across programs, and therefore the actual energy



savings for customers that participate in more than one program will be higher than the energy savings presented below.

Note that the New Construction participation rates are relative to the entire customer base, and not the much more narrow number of new buildings constructed in that year. An estimate of the participation rate relative to new buildings would provide a better indication of how well this customer type is being served.

