Reinvigorating SCE&G's Energy Efficiency Programs

Prepared for the SC Coastal Conservation League

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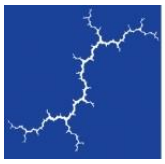
AUTHORS

Alice Napoleon
Kenji Takahashi
Avi Allison



Synapse
Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

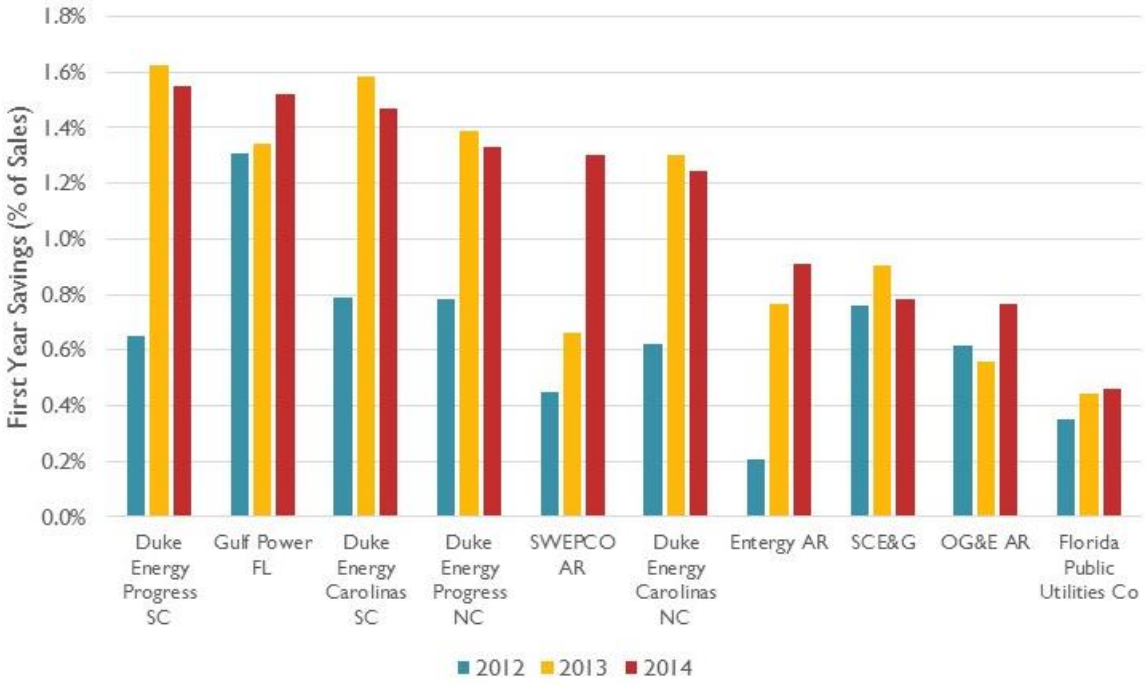
CONTENTS

EXECUTIVE SUMMARY

Energy efficiency yields substantial benefits to utilities and their customers by lowering electricity costs and customers' bills, reducing financial and power supply risks, improving the overall reliability of the electricity system, reducing the costs and risks of complying with current and future environmental regulations, and others. Despite these benefits, South Carolina Electric and Gas's (SCE&G) once-promising electric energy efficiency programs have faltered. After an encouraging start in which the initial portfolio of programs ramped up to achieve 111 gigawatt-hours (GWh) of annual incremental savings in the second program year, the current outlook is bleak: In the fifth year of SCE&G's programs (Program Year 5) savings declined to only 81 GWh, and SCE&G's forecast for Program Year 6 is just 74 GWh. Residential savings have seen an even steeper decline: From a high of 84 GWh in Program Year 2, Program Year 6 savings are forecast to amount to only 28 GWh—a 66 percent decline. SCE&G's most recent Integrated Resource Plan (IRP) reveals that it plans to actually reduce its annual incremental residential energy savings down from roughly 0.54 percent to just 0.28 percent of residential sales per year through 2030. Its commercial sector savings will drop to 0.10 percent of commercial sales, and for both sectors combined annual incremental savings will be reduced to 0.19 percent per year. The result of this decline is likely to be markedly increased electricity costs and bills.

SCE&G can do much more to harvest its energy efficiency savings potential. SCE&G's achievement in 2014 ranks it in eighth place among investor-owned utilities (IOUs) in the Southeast, as shown in Figure ES 1 below. In contrast, Duke Energy Progress and Duke Energy Carolinas both ramped up annual incremental residential energy efficiency savings to more than 1.5 percent of residential retail sales in 2013 in their South Carolina service areas, while maintaining the same level of cost of saved energy. Farther afield, other program administrators are achieving and maintaining even higher levels of cost-effective energy efficiency savings. Program administrators in Massachusetts and Rhode Island are currently reaching roughly 2.5 to 3 percent savings as a percent of total annual sales. These achievements demonstrate that the aggressive pursuit of energy efficiency through utility-sponsored programs is an entirely feasible and cost-effective approach to resource planning.

Figure ES 1. Historical Residential EE Savings by Top 10 IOUs in the Southeastern Region (2012 - 2014)



Source: EIA 861.

In this report, Synapse analyzes the impacts of a stronger energy efficiency program for SCE&G. We draw on the utility's assumptions from its IRP to develop a base case, which we compare with a more aggressive energy efficiency case (the Alternative Case). In this more aggressive case, the residential savings target ramps up to 1.5 percent of annual residential sales by 2023 and remains at that level through 2030. We find that customers as a whole could experience, on average, roughly 1.6 percent long-term electricity bill savings between now and 2037 with higher efficiency savings under the Alternative Case. This is relative to only about 0.5 percent bill savings on average in the Base Case. The increased lifetime net benefits of the higher efficiency savings in the Alternative Case are roughly $214 million. Further, the increased energy efficiency would provide additional benefits such as reducing exposure to fuel price and construction delay risks, increasing reliability, increasing system stability, and reducing distribution costs, among others. And, importantly for those concerned about bill impacts, all or a vast majority of residential customers would have opportunities to participate in SCE&G's energy efficiency programs to experience bill reductions and other benefits in this higher efficiency scenario.

Throughout the report, we suggest that SCE&G can improve its efforts to increase participation in its efficiency programs. Although energy efficiency is cost-effective even without valuing externalities, the economics alone may not motivate customers to alter their purchasing and decision-making. Virtually all customers are subject to market barriers, including lack of access to capital, first-cost bias, imperfect information, split incentives, high transaction costs, lack of access to products, and more. Regulatory policies enabling energy efficiency programs are designed to overcome these barriers. SCE&G has a number of available options that have proven effective elsewhere in increasing participation.

Another area that is ripe for improvement is the range of offerings to different types of customers. For equity reasons, energy efficiency programs need to reach all market and customer types and are particularly beneficial for low-income customers, for whom energy costs as a portion of income are high. As an example, low-income customers not only face high barriers to participation, but they also are generally neglected by private energy service companies driven by market forces. Low-income customers are susceptible to higher bills and could stand to benefit the most from bill reductions associated with participating in energy efficiency programs. However, market forces alone tend to capture only the lowest-cost efficiency savings, resulting in many lost opportunities for cost-effective energy efficiency improvements.

By addressing these points and several others, SCE&G can immediately and cost-effectively ramp up its energy efficiency programs. Our recommendations for SCE&G's portfolio are as follows:

- Expand or modify existing programs
- Reinstate core efficiency programs
- Provide incentives for high efficiency manufactured housing
- Study or pilot additional offerings for commercial and industrial customers

With appropriately aggressive energy efficiency programs under the Alternative Case, there can be sufficient programs and funding so that fully all ratepayers could experience the benefits of participating in SCE&G's energy efficiency programs by early 2024. While not every customer will be interested in deploying cost-effective energy efficiency, in the Alternative Case every single ratepayer will have the opportunity to reduce their bills by 2024. In contrast, the Base Case based on SCE&G's latest IRP affords far fewer customers the opportunity to reduce electricity expenditures in the current environment of rising rates.

1. INTRODUCTION

The Coastal Conservation League commissioned Synapse Energy Economics (Synapse) to assess the opportunity for South Carolina Electric and Gas (SCE&G) to revitalize its energy efficiency strategy to help customers save money with energy efficiency. Despite an encouraging beginning, SCE&G's current suite of energy efficiency programs is flagging. This study assesses the costs and benefits of a more aggressive pursuit of energy efficiency, compared to the energy efficiency plan detailed in SCE&G's 2016 integrated resource plan (IRP). It also addresses many of the concerns that policymakers typically express regarding energy efficiency's impacts on electricity bills.

The cost of energy efficiency measures is typically much less than the cost of generating, transmitting, and distributing electricity. Said another way, it is easier and less expensive to save a kilowatt hour than to create and deliver it using existing resources. Thus, energy efficiency programs offer a huge potential for lowering system-wide electricity costs and reducing customers' electricity bills.

In addition to lowering electricity costs and customers' bills, energy efficiency offers a variety of benefits to utilities, their customers, and society in general:

- Energy efficiency can reduce risks, including the financial risks associated with the construction of generating and transmission plants, the supply and price risks associated with fossil fuels, and the planning risk inherent in load forecasting.
- Energy efficiency can improve the overall reliability of the electricity system by reducing peak demand when reliability is most at risk. It also slows the rate of growth of electricity peak and energy demands, thus allowing more time and flexibility to respond to and plan for changing market conditions.
- Energy efficiency helps reduce the costs and risks of complying with current and future environmental regulations, including the Clean Power Plan.
- By reducing peak demand, energy efficiency can reduce the stress on local transmission and distribution (T&D) systems, potentially deferring expensive T&D upgrades or mitigating local transmission congestion problems.
- Energy efficiency reduces T&D losses, and does so at times of peak demand by an even greater amount than it does on average.
- By reducing electricity produced, energy efficiency reduces the pollution associated with electricity generation.
- Energy efficiency can promote local economic development and job creation by increasing the disposable income of citizens and making businesses and industries more competitive.
- Energy efficiency can provide a variety of non-energy benefits for all customers, including, but not limited to, improved comfort, improved health and safety, water savings, noise reduction, lower maintenance costs, increased property durability, and increased property value.
- Energy efficiency can provide additional and substantial non-energy benefits for low-income customers as well as the public service organizations and utilities that serve them. This includes,

but is not limited to, reductions in service terminations, reductions in bad debt, reductions in safety-related emergencies, and reduced stress on public assistance of all kinds including Medicare.

With all of these ancillary benefits, energy efficiency is a win-win resource strategy. Indeed, investment in energy efficiency has taken off in the last decade. Within that time, total spending on programs has quadrupled from $1.4 billion to about $5.9 billion. Many programs across the country are well established and can provide critical data for informing successful energy efficiency strategies.

SCE&G is well-positioned to benefit from the many valuable lessons learned by program administrators throughout this period of rapid growth in ratepayer-funded energy efficiency programs. The following pages provide an overview of the utility's existing energy landscape and efficiency programs, and an analysis of the impacts if SCE&G were to ramp up its energy efficiency efforts.

1.1. Energy Use and Housing Characteristics in South Carolina

To optimize energy efficiency programs, program administrators need a clear understanding of the major energy end uses within their geographical area. According to SCE&G's 2016 IRP, residential electricity sales represent about 34 percent of total sales in its service territory. The commercial and industrial sectors account for another 32 percent and 27 percent of sales, respectively. Sales for public street lighting and to public authorities, municipalities, and electric cooperatives comprise roughly 7 percent of sales.[1] The 2016 IRP projects an annual average growth rate of 1.5 percent for the residential sector and 2.1 percent for the commercial sector through 2030.

Turning to the residential sector, space heating represents the largest residential energy use category in the Carolinas at 34 percent, according to U.S. Energy Information Administration (EIA) Residential Energy Consumption Survey (RECS) data. Space heating is followed by "other energy uses" primarily consisting of lighting, appliances and electronics[2] (33 percent), water heating (16 percent), air conditioning (10 percent), and refrigerators (6 percent).[3]

In the South, single-family homes represent the largest share (71 percent) of homes, followed by multi-family homes (20 percent) and then mobile homes (9 percent).[4] Compared to an average of 6 percent nationally, mobile homes make up a significant portion of housing units in the South.[5] Residents of

[1] South Carolina Electric & Gas Company. 2016. *2016 Integrated Resource Plan.* Available at: www.dms.psc.sc.gov/Attachments/Matter/5f23e5f8-8054-4f99-967d-a2cd9f7441ce.

[2] The "other" category includes end uses not shown separately, such as cooking appliances, clothes washers, dryers, dishwashers, televisions, computers, small electronic devices, pools, hot tubs, and lighting.

[3] U.S. Energy Information Administration (EIA). *2009 Residential Energy Consumption Survey (RECS) data*, Table CE3.4: Household Site End-Use Consumption in the South Region.

[4] EIA defines a mobile home as "a housing unit built on a movable chassis and moved to the site. It may be placed on a permanent or temporary foundation and may contain one room or more. If rooms are added to the structure, it is considered a single-family housing unit. A manufactured house assembled on site is a single-family housing unit, not a mobile home." (www.eia.gov/tools/glossary/index.cfm?id=M)

[5] EIA. *2009 Residential Energy Consumption Survey (RECS) data*. Available at: www.eia.gov/consumption/residential/data/2009/index.cfm?view=consumption#undefined.

mobile homes tend to experience disproportionately high energy burdens.[6] On average, energy use per square foot for mobile homes is almost twice as much as traditional single family homes use.[7]

In South Carolina, manufactured housing (a subset of single-family homes) is common. Over the past five years, South Carolina has seen an average annual 14 percent increase in shipments of new manufactured housing units. The state was in the top decile of states for receipts of shipments of manufactured housing from 2012 to 2015.[8] Manufactured homes tends to have some of the same problems as mobile homes do. On average, manufactured housing residents spend about 70 percent more on energy per square foot than their counterparts in site-built, traditional homes.[9] Like mobile homes, many residents of manufactured homes fall within the low income category: over half of mobile and manufactured housing residents have annual incomes of less than $30,000.[10] Manufactured housing residents account for 98 percent of all high-bill complaints to South Carolina's electric co-ops. Residents of manufactured housing units are the most likely to have high electric bills but are the least likely to be able to pay them, leading to increased utility costs for collections and charge-offs.[11]

As discussed in the following sections, SCE&G can use these characteristics to prioritize and plan for higher energy efficiency savings that are more in line with those proven feasible and cost-effective in the surrounding region and throughout the country.

2. SCE&G Energy Efficiency Program Performance: Recent and Forecast

2.1. Background

On July 15, 2010, the South Carolina Public Service Commission (PSC) issued Order No. 2010-472, approving SCE&G's proposed demand-side management programs with modifications, and establishing the Energy Efficiency Advisory Group.[12] By Order No. 2013-826, the PSC approved 11 demand-side

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[6] DOE defines energy burden as the ratio of energy expenditures to household income. (DOE. 2012. Buildings Energy Data Book. www.buildingsdatabook.eren.doe.gov/TableView.aspx?table=2.9.2).

[7] U.S. Department of Energy, "2.3 Residential Sector Expenditures," *Buildings Energy Sector Data Book*, available at http://buildingsdatabook.eren.doe.gov/TableView.aspx?table=2.3.11 (Mobile homes use almost twice as much energy per square foot as traditional single family homes use, according to the Department of Energy).

[8] U.S. Census Bureau. Shipments of New Manufactured Homes: Manufactured Housing Annual Shipments to States, 2011-2016. www.census.gov/data/tables/time-series/econ/mhs/shipments.html.

[9] Christine Grant and Patrick Keegan, "Best Practices for Energy Efficient New Manufactured Homes," *NRECA* (Oct. 2015).

[10] "2012 Mobile Home Market Facts," *Foremost Insurance Group.* (2012), available at http://www.foremost.com/mobile-home-market-facts/2012-Market-Facts.pdf.

[11] Eric Cody, "Retrofitting Manufactured Homes for Improved Energy Efficiency," *The National Rural Electric Cooperative Association Cooperative Research Network* (June 2011), available at http://www.nreca.coop/wp-content/uploads/2015/10/RetrofittingManufacturedHomesforImprovedEnergyEfficiency.pdf

[12] South Carolina Public Service Commission. 2010. Order No. 2010-472 in Docket No. 2009-261-E.

management programs for implementation by SCE&G.[13] In Order No. 2014-381, the PSC approved the elimination of two programs—the ENERGY STAR New Homes and the Energy Information Display programs. In December 2015, SCE&G discontinued the ENERGY STAR New Homes program based on the recommendation of its evaluation, measurement and verification (EM&V) contractor.

Currently, SCE&G's residential programs consist of the following six programs: Home Energy Reports, Home Energy Check-up, Neighborhood Energy Efficiency Program, Appliance Recycling, Heating and Cooling, and ENERGY STAR Lighting.

SCE&G's commercial and industrial programs currently include two programs, the EnergyWise For Your Business and Small Business Energy Solutions programs.[14] Pursuant to Order No. 2015-307, the utility conducted a survey to investigate the cause of large, non-residential opt-outs from SCE&G's DSM programs.[15] The results of that survey indicated that 21 percent of respondents were not aware of SCE&G's non-residential DSM programs. Forty percent of respondents indicated that they might choose to participate in SCE&G's energy efficiency programs if SCE&G offered incentives for combined heat and power (CHP). Higher measure incentives would influence the decision to participate for 36 percent of respondents. Over one-third noted that access to project financing might entice them to participate.[16]

2.2. Program Performance and Changes

By the second program year, SCE&G's initial portfolio of programs had ramped up to achieve 111 GWh of annual incremental savings. Since that time, performance has faltered and declined to 81 GWh in Program Year 5. As shown in Table 1, much of the decline in savings over that period can be traced to two programs: the residential ENERGY STAR Lighting program and the residential Heating, Cooling, and Water Heating program (HCWH). The HCWH program experienced a roughly 47 percent decline over that period, while the lighting program saw a whopping 71 percent decline.[17]

[13] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, p. 2.

[14] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.

[15] South Carolina Office of Regulatory Staff's Review of South Carolina Electric & Gas Company's 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider. Docket No. 2016-40-E.

[16] SCE&G. 2015. Demand Side Management Energy Efficiency Advisory Group Meeting, November 18, 2015.

[17] South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. 2016. April 1, 2016 Comments in Docket No. 2016-40-E; SCE&G. 2016. EnergyWise Program Year 5: Evaluation, Measurement and Verification Report.

Table 1. SCE&G program savings, Program Year 1 to 6

		MWh Savings					
		Actual					Forecast
Sector	Program Name	PY1	PY2	PY3	PY4	PY5	PY6
Residential	Home Energy Reports	9,311	3,723	12,350	12,541	12,967	11,620
Residential	Energy Information Display	200	303	356	337	-	-
Residential	Home Energy Check-up	585	1,919	2,423	1,554	1,752	2,902
Residential	ENERGY STAR Lighting	37,320	65,919	54,311	48,401	19,201	7,560
Residential	Heating & Cooling and Water Heating	1,586	10,027	4,660	6,211	5,327	3,290
Residential	Heating & Cooling Efficiency Improvement	38	501	832	-	-	-
Residential	ENERGY STAR New Homes	196	910	344	286	305	85
Residential	Home Performance w/ ENERGY STAR	80	502	285	680	177	-
Residential	Neighborhood Energy Efficiency Program	-	-	449	1,161	1,187	1,372
Residential	Appliance Recycling	-	-	-	12	1,773	1,301
Commercial	EnergyWise for Your Business	8,017	26,820	29,368	25,209	36,447	41,600
Commercial	Small Business Energy Solutions	-	-	-	-	2,157	4,000
Residential	Total	49,316	83,804	76,010	71,183	42,689	28,130
Commercial	Total	8,017	26,820	29,368	25,209	38,604	45,600
All	Total	57,333	110,624	105,378	96,392	81,293	73,730

Sources: SCE&G Response No. 1-32 Revised to ORS First Audit Information Request in Docket No. 2016-040-E; Opinion Dynamics. 2016. South Carolina Electric and Gas EnergyWise Program Year 5: Evaluation Measurement, and Verification Report. May 2016. Docket No. 2013-208-E.

Much of the decline in the ENERGY STAR Lighting program savings is likely due to a program design change. The program was changed from a point-of-purchase program to an online retail service in order to mitigate concerns that non-SCE&G customers were purchasing the discounted bulbs (a phenomenon known as "leakage").[18] The website, called the EnergyWise Savings Store, launched in September 2015. The new program design incorporates a supplemental lighting program offered at business office locations to reach customers who may not participate in the online store.[19] The change in program design was a drastic solution to the concern over non-SCE&G customers receiving the benefits of product discounts. While the Program Year 2 evaluation found a leakage rate of 14.5 percent for the lighting program before the switch to the on-line store,[20] the cost-effectiveness of the program is very high. In Program Year 4, ENERGY STAR Lighting had a utility cost test (UCT) ratio of 6.14 and a total resource cost (TRC) test ratio of 4.13.[21] The program's net benefits are more than enough to offset the leakage. Furthermore, leakage of 14.5 percent is comparable with the leakage associated with upstream programs in other jurisdictions. In PacifiCorp's service territory, for example, the leakage rate was determined to range from a low of 1 percent in its geographically isolated California service area to a high of 24 percent in Washington State, where its service area is similar to SCE&G's territory in that it is

[18] Ibid.

[19] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.

[20] Opinion Dynamics. 2014. South Carolina Electric and Gas EnergyWise Program Year 3: Evaluation, Measurement, and Verification Report. Docket 2013-208-E.

[21] Attachment No. 2 to Response of SCE&G to SC Coastal Conservation League and Southern Alliance for Clean Energy's First Data Request in Docket No. 2016-40-E.

more dispersed.[22] Finally, upstream product models can result in large, sometimes dramatic, increases in participation relative to more traditional, downstream program delivery models.[23]

Savings from HCWH declined after SCE&G stopped accepting applicants for the water heating portion of the program.[24] Presumably, SCE&G discontinued incentives for hot water heaters due to the very low net-to-gross ratio (0.16) found in the Program Year 3 evaluation.[25]

SCE&G terminated three programs in 2014 and 2015, including Home Performance with Energy Star, Energy Information Display, and ENERGY STAR New Homes.

- **Home Performance with Energy Star (HPwES)**: While the cost-effectiveness of this program was poor in the first years, it became cost-effective with a UCT ratio of 1.19 during Program Year 4. The TRC test ratio for Program Year 4 was 0.85.[26] However, SCE&G's avoided costs do not include the benefits of avoided CO_2 emissions. Further, it appears that SCE&G does not account for non-energy benefits (e.g. avoided water, health and safety benefits, increased productivity) in the cost-benefit analysis. Given these omissions, it is possible that HPwES's TRC ratio in Program Year 4 would be above one, if even a portion of these benefits were taken into account.

- **Energy Information Display**: This program has suffered low cost-effectiveness since inception. We have not reviewed the technical and program design elements of this program but note that getting these elements right is critical for the success of programs like this one.

- **ENERGY STAR New Homes**: SCE&G terminated this program in December 2015 based on the recommendation of its third-party EM&V provider.[27] This program was highly cost-effective after initial program launch during Program Years 2 through 4, with TRC test ratios ranging from 1.54–2.15 and UCT ratios ranging from 1.68–3.33.[28] The decline in participation in the New Homes program from Program Year 4 to Program Year 5 warrants further investigation but does not by itself support closing the program. A change in program design or required energy

[22] Moore, S., G. Braman, G. Stiles, and B. Stull. 2014. "Conquering Leakage, Breakage and Equitable Allocation by Dialing-Up Big Data" 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: www.aceee.org/files/proceedings/2014/data/papers/2-144.pdf.

[23] Neme, Chris, and Jim Grevatt. 2016. "The Next Quantum Leap in Efficiency: 30 Percent Electric Savings in Ten Years." Energy Futures Group.

[24] Response of SCE&G to Office of Regulatory Staff's First Continuing Audit Information Request in Docket No. 2016-40-E, Request No. 1-37.

[25] Opinion Dynamics. 2014. South Carolina Electric and Gas EnergyWise Program Year 3: Evaluation Measurement, and Verification Report. May 2014. Docket No. 2013-208-E.

[26] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.

[27] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.

[28] Attachment No. 2 to Response of SCE&G to SC Coastal Conservation League and Southern Alliance for Clean Energy's First Data Request in Docket No. 2016-40-E.

efficiency performance of new homes, or a change or increase in advertising or other marketing strategies could increase participation. Information provided to the Energy Efficiency Advisory Group suggests that contractors would have built to ENERGY STAR requirements even without the program. However, SCE&G should investigate providing incentives for meeting more stringent efficiency standards than ENERGY STAR or consider outreach to builders who were not in the program. Further, SCE&G should analyze or provide the results of any existing studies that consider the cost-effectiveness of the program if savings are discounted to reflect free ridership.

The Neighborhood Energy Efficiency Program (NEEP) was cost-effective in Program Year 3, with a TRC ratio of 1.18 and a UCT of 1.42. In Program Year 4, its cost-effectiveness declined, with a TRC ratio of 0.94 and a UCT ratio of 0.94.[29] SCE&G plans to expand this program to mobile and modular housing.[30] Consistent with how this program has been implemented in other jurisdictions, SCE&G's NEEP targets neighborhoods with high poverty rates[31] but does not require that individual participants fall into specific income categories. Without more data, it is difficult to know whether NEEP is effectively channeling benefits to low-income populations. Furthermore, NEEP may only be addressing the most cost-effective measures (sometimes called the "low-hanging fruit") while leaving other cost-effective opportunities untouched. In the past, for example, measures have included the following:

- CFL light bulbs
- Electric water heater wraps and insulation for water pipes
- Smart-Strip power strips
- Winterization kits for window/wall units
- Adjustment of electric water heater temperature
- HVAC filter installation[32]

It appears that other measures that are generally cost-effective and are often provided by low-income energy efficiency programs, such as caulking, weather-stripping, insulation, faucet aerators, and low-flow shower heads, are not offered. This suggests that there may be room for deeper savings than NEEP is currently pursuing.

Overall, our examination of SCE&G's existing programs indicates that there is ample opportunity for improvement and reassessment of poorly performing programs, as well as expansion of core programs with which other utilities are finding success. Below we discuss some of the likely barriers to success and recommendations for increasing customer participation.

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[29] Ibid.

[30] SCE&G. 2015. Demand Side Management Energy Efficiency Advisory Group Meeting, November 18, 2015.

[31] SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.

[32] SCE&G. 2015. "SCE&G Launches Energy Efficiency Program in West Columbia Neighborhood." Press release available at: www.sceg.com/about-us/newsroom/2015/01/28/sce-g-launches-energy-efficiency-program-in-west-columbia-neighborhood.

3. THE IMPORTANCE OF UTILITY-SPONSORED EFFICIENCY PROGRAMS

3.1. Market Barriers and Solutions

It is widely recognized that there is a vast potential of untapped energy efficiency in every state. This is especially true in South Carolina, where customer-funded energy efficiency programs were developed relatively recently. These energy efficiency resources generally cost significantly less than the cost of generating, transmitting, and distributing electricity.

This raises the question: If energy efficiency is so plentiful and cost-effective, why are public policies needed to support it? Why should utilities and others implement and deliver energy efficiency programs, rather than relying on market forces to deliver these services? Economic theory holds that fully functional markets will cause the economically efficient amount of a good to be delivered to consumers without intervention and in the most cost-effective manner.

The answer to these questions lies in the fact that the markets for energy and for energy efficiency goods and services are imperfect, meaning that the market fails to produce the efficient outcome on its own. Although energy efficiency is cost-effective even without valuing externalities, the economics are often not strong enough to motivate customers to alter their purchasing and decision-making. Many market barriers continue to hinder electricity customers from adopting energy efficiency measures on their own. Examples of market barriers include:

- **Lack of capital access.** Residential customers, businesses, and industries may lack the up-front capital for an energy efficiency product. This is particularly true for low-income customers and for many agencies that provide low-income affordable housing.
- **First-cost bias.** Many buildings are constructed, products purchased, and facilities renovated on the basis of minimizing short-term costs, not on minimizing the long-term costs of operating the facility.
- **Positive externalities.** The societal benefits of energy efficiency—particularly the environmental, health, and economic development benefits—are often not considered by customers and producers seeking to minimize their own costs.
- **Imperfect information.** Electricity consumers and building contractors are frequently unaware of the full range of energy efficiency options, or they lack information on the economic, productivity, and environmental benefits of those efficiency measures.
- **Uncertainty and risk avoidance.** Customers may be skeptical of potential energy efficiency savings or may have doubts about whether an unfamiliar energy efficiency measure will work properly.
- **Bounded rationality.** For many customers, electricity costs represent a small portion of the total costs of maintaining a home or running a business. Consequently, they pay little or no attention to opportunities to reduce these costs.
- **High transaction costs.** An investment of time, money, and effort may be required to obtain information, make an informed purchase, and install energy efficiency measures. This is

especially problematic in the context of construction, renovation, or equipment replacement situations, which generally require that decisions be made and products obtained quickly.

- **Limited product availability.** Many energy efficiency measures are produced and distributed on a limited scale and are not readily available to customers, builders, contractors, or industries. For example, limited product availability has hindered the transformation of the heating, ventilation, and air conditioning (HVAC) market, because most HVAC equipment is replaced on an emergency basis as a result of equipment failure. In these situations, customers usually install whichever equipment contractors or distributors have in stock or can easily access, often standard efficiency equipment.[33]

- **Split incentives.** Those in a position to implement energy efficiency measures sometimes have different financial interests than those who would benefit from the installation of those measures. For example, at the time of new construction, the builder has incentive to minimize short-term costs, while the new owner would benefit from lower electricity bills over the long term. Likewise, landlords make capital purchases and maintain buildings, while tenants frequently pay the energy bills.

Regulatory policies are necessary to overcome these market barriers, and energy efficiency programs can play a vital role in overcoming the barriers. However, if energy efficiency programs are poorly designed, the effect of the programs on reducing market barriers may be limited. Thus energy efficiency programs should be carefully designed to explicitly address market barriers so that they can effectively overcome as many market barriers as possible. Table 2 shows market barriers side-by-side with solutions commonly and successfully implemented by program administrators across the country.

[33] Quaid, M. and H. Geller. 2014. *Upstream Utility Incentive Programs: Experience and Lessons Learned*. Southwest Energy Efficiency Project. Available at: www.swenergy.org/data/sites/1/media/documents/publications/documents/Upstream_Utility_Incentive_Programs_05-2014.pdf; Sondhi, R. N. Strong, and G. Arnold. 2014. *The End of Prescriptive Rebate Forms? Massachusetts Moves Upstream*. Proceedings of 2014 ACEEE Summer Study on Energy Efficiency in Buildings. Available at: www.aceee.org/files/proceedings/2014/data/papers/4-618.pdf.

Table 2. Market barriers and common approaches for addressing them

Market Barrier	Solutions
Lack of capital access	• Low or no-cost financing from utilities, third parties, or public entities. Sources of capital can include utilities, bond issuances, public benefit funds, bank loans (including home equity line of credit and mortgage re-financing), private sector investor capital, and public loan funds, among others. • On-bill financing, provided by (or in partnership with) a utility that allows customers to repay the loan on their monthly utility bills. On-bill financing can be more effective than traditional financing products at reaching hard-to-reach markets such as low-income, multi-family, and small business markets. • Pay-as-you-save (PAYS), a model that allows utility customers to purchase and install energy efficiency measures without upfront payment, loans, or property liens. Under the PAYS model, utilities recover the costs of energy efficiency upgrades through a tariff.[34]
First-cost bias	• Program incentives to lower upfront costs • Support for building, equipment, and appliance labeling or codes
Positive externalities	• Quantification of external benefits to the extent possible for inclusion in cost-effectiveness testing. These benefits should include avoided costs of generation, transmission, distribution, environmental compliance, and emissions; as well as health, risk reduction, and operations and maintenance benefits.[35] • Cost-screening exemptions or adjustments, where quantification is difficult. For example, Vermont assumes a 15 percent adder for non-energy benefits and a 10 percent adder for risk avoidance benefits.[36]
Imperfect information, uncertainty and risk avoidance, and bounded rationality	• Customer outreach and education efforts such as advertisements, bill inserts, presence at community events, and point-of-purchase displays with information on expected energy performance improvements

[34] Wise, Jahi. *Rural Middle-Income Energy Efficiency Project Catches a Spark*. Clean Energy Finance Forum. May 8, 2015.

[35] Non-energy benefits that generally warrant quantification for low-income programs include reduced arrearages, reduced customer calls and collection activities, reduced safety related emergency calls, higher comfort levels, increased property values, and health benefits. Massachusetts has extensively studied and quantified non-energy benefits. (Optimal Energy 2015. Potential for Energy Savings in Affordable Multifamily Housing.)

[36] Synapse Energy Economics (2012). *Energy Efficiency Cost-Effectives Screening: How to Properly Account for 'Other Program Impacts' and Environmental Compliance Costs*, available at http://www.synapse-energy.com/sites/default/files/SynapseReport.2012-11.RAP_.EE-Cost-Effectiveness-Screening.12-014.pdf.

Market Barrier	Solutions
	• Contractor outreach and education, covering energy efficiency measure benefits, proper installation and safety considerations, and incentives available to the contractor or customer (including financing) • Support for building, equipment, and appliance labeling or codes
High transaction costs	• Direct install programs • Midstream and upstream incentives • Easy-to-access financing, with a streamlined process and short turnaround time between the loan application and approval
Limited product availability	• Outreach to suppliers, distributors, and retailers • Midstream and upstream incentives
Split incentives	• On-bill financing and PAYS (see "Lack of capital access" above) • Program support for adoption and upgrades of building, equipment, and appliance codes • Programs targeting common multi-family areas separately from individual units

3.2. Addressing All Customer and Market Types

Another reason why utility-sponsored energy efficiency programs are so important is that they are necessary to reach all market and customer types. The cost of serving different market and customer types can vary dramatically. Programs targeting low-income customers tend to be more expensive, on average about 7 cents/kWh levelized according to a 2014 Lawrence Berkeley National Laboratory (LBNL) report. In contrast, the study found that programs targeting the commercial and industrial sectors average 2.1 cents/kWh levelized, and residential programs cost 1.8 cents/kWh levelized nationally.[37] Programs targeting low-income customers usually provide incentives that cover a larger portion of the cost of the efficiency project to address the financial constraints facing this customer segment and thus generally cost more than other program types.

Market forces alone will focus on the lowest-cost efficiency savings and thus tend to result in significant lost opportunities for cost-effective energy efficiency improvements. Because of the higher cost, market mechanisms tend to ignore hard-to-reach customers (including low-income, multi-family residential, and

[37] Billingsley, M., I. Hoffman, E. Stuart, S. Schiller, C. Goldman, and K. LaCommare. 2014. The Program Administrator Cost of Saved Energy for Utility Customer-Funded Energy Efficiency Programs. Ernest Orlando Lawrence Berkeley National Laboratory.

small businesses). Analysis of historical market-based energy efficiency data shows that hard-to-reach customers tend to be left behind.[38] LBNL found that over 80 percent of market-driven energy service company (ESCO) investment targeted institutional customer facilities (including universities, schools, hospitals, and federal, state, and local government). Commercial and industrial facilities represented a much smaller portion of ESCO investment (9 percent and 6 percent, respectively), while investment in public housing and residential facilities was just 5 percent.[39]

Although programs targeting low-income customers tend to be more expensive on average, there is considerable variation in the cost of saved energy of these programs. Synapse research found that the levelized cost of saved energy for ratepayer-funded programs targeting the low-income sector range from as low as 1 cent to as high as 31 cents per kWh.[40]

Furthermore, the cost of low-income programs can be reduced with innovative approaches, including financing such as PAYS and on-bill financing. Financing can help to mitigate ratepayer impacts by shifting away from incentives or rebates to greater participant contributions over time. Financing in general, and on-bill financing or PAYS in particular, also has the potential to increase participation if structured properly. These mechanisms, which allow customers to pay off their energy efficiency loans through their energy bills, can enable customers who would otherwise be unable to pay the upfront costs of energy efficiency investments to participate without increasing their energy bills. Other strategies for reducing the cost of low-income efficiency programs include building partnerships with other organizations including Community Action Agencies, food banks and food shelf networks, which can enable efficiency program administrators to better leverage funding sources and access participants that are more trusting of local organizations.[41,42]

4. EXPANSION OF SCE&G'S ENERGY EFFICIENCY PORTFOLIO

In this section, we describe improvements that can be made to SCE&G's energy efficiency portfolio, considering the results of our review of SCE&G's efforts to date on energy efficiency and our experience with energy efficiency programs across the country.

Our preliminary recommendations for SCE&G's residential portfolio are as follows:

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[38] Kushler, M. and P. Witte. 2001. *Can we Just 'Rely on the Market' to Provide Energy Efficiency?: An Examination of the Role of Private Market Actors in an Era of Electric Utility Restructuring.* American Council for an Energy-Efficient Economy. www.aceee.org/sites/default/files/publications/researchreports/u011.pdf.

[39] Hopper, N., C. Goldman, D. Gilligan, T. Singer, and D. Birr. 2007. *A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006*. Ernest Orlando Lawrence Berkeley National Laboratory. LBNL-62679.

[40] Kallay, J., A. Napoleon, and M. Chang. 2016. *Opportunities to Ramp Up Low-Income Energy Efficiency to Meet State and National Climate Policy Goals*. ACEEE: 2016 Summer Study on Energy Efficiency in Buildings.

[41] Nowak, S., M. Kushler, P. Witte, and D. York. 2013. *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs*. Washington DC: ACEEE.

[42] Cluett, R., J. Amann and S. Ou. 2016. *Building Better Efficiency Programs for Low-Income Households.* Washington, DC: ACEEE. www.aceee.org/research-report/u1601.

- Expand or modify existing programs
- Reinstate core efficiency programs
- Provide incentives for high-efficiency manufactured housing
- Study or pilot additional offerings for commercial and industrial customers

Each of these items are discussed in the following subsections.

4.1. Expand or Modify Existing Programs

Lighting: Upstream incentives that provide incentives to retailers and distributors can be highly successful. They can increase customer adoption of energy efficiency measures not just for lighting, but also for HVAC equipment.[43] Delivery mechanisms should minimize customer transaction costs as much as possible. The change in the delivery mechanism for the lighting program violated this principle, resulting in higher effort and transaction costs to customers. SCE&G should investigate other ways to modify program delivery in order to minimize leakage associated with point-of-sale discounts. SCE&G should also consider a shift toward LED products.

NEEP: SCE&G should investigate, document, and communicate the extent to which NEEP is addressing customers with the lowest income levels, and to what extent the program is leaving other cost-effective opportunities untouched. It is important to address as many cost-effective end uses as possible once SCE&G is "in the door." This will help to balance the program benefits against the cost of obtaining participants and reduce the energy burdens faced by low-income customers. End uses that are less expensive (i.e., lighting) can enable end uses that are more expensive to install: By packaging various measures together, SCE&G could achieve more energy savings. Also, savings from programs targeting low-income populations will become all the more important, as properly documented low-income program savings may provide higher credit for emissions reductions under the Clean Power Plan's Clean Energy Incentive Program.

All programs: SCE&G should increase marketing and advertising budgets, in line with states leading in energy efficiency efforts. For Program Year 4, advertising costs comprised less than 1 percent of total expenditure.[44]

4.2. Reinstate Core Efficiency Programs

A key goal of the program mix should be to reach all customers and serve as many customers as possible over time. This includes addressing new and existing homes and buildings. It also calls for considering the range of characteristics of the people who live and work there. For example, homes can hold one or many families, and can be inhabited by customers with different levels of income who either own or

[43] York et al. 2013; Sondhi, Strong, and Arnold 2014; Neme and Grevatt 2016.

[44] South Carolina Coastal Conservation League and Southern Alliance for Clean Energy. 2016. April 1, 2016 Comments in Docket No. 2016-40-E.

rent. Some customers only use electricity, and others use both electricity and other types of fuel for heating.

All ratepayer-funded energy efficiency portfolios should include a set of core programs that help to overcome key market barriers to all customer and market segments. Core programs are standard programs that are offered by many utilities and that collectively form the basis of a balanced portfolio of energy savings opportunities. In our experience, residential portfolios usually include programs that target the following facilities, end uses, and customer types:

- existing single-family buildings (many jurisdictions consider buildings with fewer than five units to be eligible for single-family programs)
- lighting
- products (including heating and cooling equipment such as heat pumps and central air conditioners)
- appliances (including refrigerators, clothes washers, dishwashers, humidifiers, and room air conditioners)
- home electronics (including advanced power strips, computers, monitors, and televisions)
- new construction
- multi-family
- behavior (such as home energy reports)
- recycling of inefficient appliances (such as secondary refrigerators)
- low-income customers

For the commercial and industrial sector, programs targeting new construction, small business, large business prescriptive, large business custom, and multi-family buildings are common and can be considered to be core programs.

In general, new residential construction and home energy retrofit programs like HPwES should be included among the set of core programs. If there is clear evidence of distinct reasons why some of these core programs should not be implemented, then alternative program approaches should be considered for addressing the relevant customer types and market segments.

As noted above, SCE&G has terminated its residential new construction and Home Performance with ENERGY STAR programs. No other SCE&G program addresses the distinct needs of the new construction market sector, and this termination leaves many lost opportunities in its wake. And while some of the offerings associated with the HPwES program are still available through other programs, it is not clear why SCE&G is not able to improve the program's cost-effectiveness. Other jurisdictions have been able to offer the HPwES program cost-effectively, which raises questions about whether changes to marketing and program delivery could increase participation and reduce costs. Moreover, it highlights that SCE&G is not considering all of the policy and program benefits that these programs offer.

The New Homes and HPwES programs are important for many reasons. They help to avoid lost opportunities by capturing efficiency savings when it is least-cost to do so. They help to promote customer equity by serving customer sectors and types that would otherwise be under-served. Extending core programs over time is necessary to maintain continuity, which is important for promoting market transformation, maintaining customer satisfaction, and supporting the state and regional energy efficiency infrastructure and trade allies. They provide important non-energy benefits that many other jurisdictions take into account, including improved comfort and avoided emissions.

For these important policy reasons, SCE&G should reinstate these programs and follow best practices to ensure that they are cost-effective. SCE&G could take steps to increase participation so that the programs' administrative costs are spread over a larger number of units. Larger advertising expenditures likely have an important role here. For the HPwES program in particular, offering financing (on- or off-bill) can leverage third-party capital, enable participants to cover a greater portion of program costs, and increase program participation.

Another approach might be targeting these programs to underserved sectors, such as limited-income populations. If taking this approach, it would be particularly important to account for all relevant program benefits, such as avoided T&D costs, in the cost-effectiveness testing, or to exempt the programs from strict cost-effectiveness testing thresholds.

A reinstated Home Performance with ENERGY STAR program should provide incentives for efficiency improvements in manufactured and mobile homes to broaden the reach beyond the geographic areas targeted by NEEP. The National Renewable Energy Laboratory conducted experiments on pre-1976 manufactured homes and found that the following retrofit measures resulted in a 31 percent reduction in heating fuel usage:

- Install energy-efficient windows and doors
- Add insulation to the belly
- Make general repairs (caulking, ducts, etc.)
- Add insulation to walls
- Install insulated skirting
- Install a belly wrap
- Add insulation to roof or install a roof cap[45]

With such an offering, it will be important to ensure that contractors and installers are properly trained in order to avoid structural damage and personal injury. Another possible avenue is to require that a BPI Certified Manufactured Housing Professional install or supervise the installation of measures in

[45] DOE. 2016. Energy-efficient Manufactured Homes. Available at: www.energy.gov/energysaver/energy-efficient-manufactured-homes.

manufactured homes, as the New York State Energy Research and Development Authority has done for its Home Performance program.[46]

In addition, SCE&G should consider implementing a program for residential high-efficiency appliances, which are not incentivized under other programs but represent a significant energy use in the South.[47] Such a program could be mid-stream (providing incentives to distributors to reduce prices) and include incentives to promote market transformation for refrigerators, clothes washers and dryers, dishwashers, humidifiers, and dehumidifiers.

4.3. Provide Incentives for New High-Efficiency Manufactured Housing

The energy burden for residents of manufactured homes is high. Most occupants of this type of housing qualify as low-income: the median income of families in manufactured homes is only about $30,000. At the same time, the average cost of energy per square foot for manufactured homes is more than twice the average for single-family homes.[48]

Almost 10 years in the making, the U.S. Department of Energy (DOE) released draft energy standards for manufactured homes in June 2016. Compared to a home that meets the current Department of Housing and Urban Development code, DOE estimates that a typical manufactured home meeting the proposed standards will lower energy use by 27 percent. [49]

In the meantime, some program administrators have stepped up efforts to improve energy efficiency in the manufactured housing sector. Tennessee Valley Authority's Manufactured Homes program provides incentives to manufactured home builders and HVAC distributors for ENERGY STAR Certified Manufactured Homes. Also, higher incentives are available for even higher efficiency, "Plus" level units.[50] These incentives allow manufactured-home builders and HVAC distributors to lower the prices charged to the ultimate homeowner.

While the proposed federal standard would leave less room for a utility-run program to produce savings from new manufactured homes, there are still many opportunities. The proposed standard does not address HVAC equipment or appliance efficiency at all. Also, there is potential for improving insulation levels and for addressing air leakage after the units are in place. Finally, the proposed standards require

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[46] New York State Energy Research and Development Authority. *Treating Manufactured Homes in the Home Performance with ENERGY STAR® Program*. Available at: www.hpwescontractorsupport.com/wp-content/uploads/2014/09/13.4-Treating-Manufactured-Homes_12.28.2015.pdf.

[47] As noted previously, the "other" category of energy use constitutes 33 percent of total residential energy use in the South Region according to the EIA. The other category includes end uses such as cooking appliances, clothes washers, dryers, dishwashers, televisions, computers, small electronic devices, pools, hot tubs, and lighting.

[48] Ungar, L. 2016. *Mobile homes move toward efficiency*. August 3. American Council for an Energy Efficient Economy (ACEEE). Available at: www.aceee.org/blog/2016/08/mobile-homes-move-toward-efficiency.

[49] Ibid.

[50] Systems Building Research Alliance. "Rebate Program for ENERGY STAR Manufactured Homes Tennessee Valley Authority's Service Area." Last accessed August 2016.Available at: www.research-alliance.org/pages/es_TVA.htm.

lower efficiency levels in the Southeast to address the first-cost barrier to the region's low-income buyers.[51]

Mobile homes make up a large share of housing units in the South.[52] Incentives supporting efficiency improvements in these areas may offer substantial energy savings and bill reductions for residents. Coupled with other strategies for addressing barriers to low-income sector participation in energy efficiency programs, such as low- or no-interest financing and targeted outreach efforts, programs targeting this housing type can gain considerable traction.

4.4. Study or Pilot Additional Offerings for Commercial and Industrial Customers

While energy efficiency generally costs much less than the cost of new electricity resources for all sectors, commercial and industrial energy efficiency tends to be even more cost-effective than efficiency programs targeting other sectors.[53] In spite of this, much industrial energy efficiency in particular has yet to be harnessed. A 2009 McKinsey study estimated the national potential to reduce industrial energy use by 2020 using implementation of energy efficiency measures to be as high as 18 percent, despite reductions in energy use per unit of output (i.e., energy intensity) over recent decades.[54] A more recent McKinsey report shows that industries can save 10 to 20 percent of energy with operational improvement efforts alone, and that investment in energy efficiency technologies can boost that to 50 percent or more.[55] Furthermore, some have found that more industrial energy savings potential can be harvested from energy efficiency programs than would likely be achieved if industrial energy users pursued energy efficiency on their own, with limited program assistance.[56]

SCE&G has two programs targeting the commercial and industrial sectors. Only one program—EnergyWise for Your Business—addresses large commercial and industrial customers. More than half of the savings from the EnergyWise for Your Business program (58 percent) derives from lighting measures, while 88 percent of savings from the Small Business Energy Solutions program comes from lighting.[57] It is notable that all of the respondents to the opt-out survey indicated that they had already implemented

[51] Ungar, L. 2016.

[52] EIA. 2009 Residential Energy Consumption Survey (RECS) data.

[53] State and Local Energy Efficiency Action Network (SEE Action). 2014. Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector. p. 6.

[54] Ibid, p. 3.

[55] Choudhry, H., M. Lauritzen, K. Somers, and J. Van Niel. 2015. *Greening the future: New technologies that could transform how industry uses energy*. McKinsey & Company.

[56] SEEAction. 2014. Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector, p. ES-1.

[57] Opinion Dynamics. 2016. South Carolina Electric and Gas EnergyWise Program Year 5: Evaluation Measurement, and Verification Report. May 2016. Docket No. 2013-208-E. p. 42.

lighting efficiency measures.[58] SCE&G should consider other strategies and measures to reach these sectors.

For example, SCE&G should consider providing financing in support of the existing commercial and industrial offerings, as over one-third of opt-out survey respondents noted that access to project financing might entice them to participate. [59] Another opportunity for tapping commercial and industrial customers lies with CHP. Forty percent of survey respondents indicated that they might choose to participate in SCE&G's energy efficiency programs if incentives were available for CHP.[60] Other programs that SCE&G should consider include: upstream HVAC, LED troffers (if not currently included in offerings), and strategic energy management.

5. ATTAINABLE EFFICIENCY TARGETS

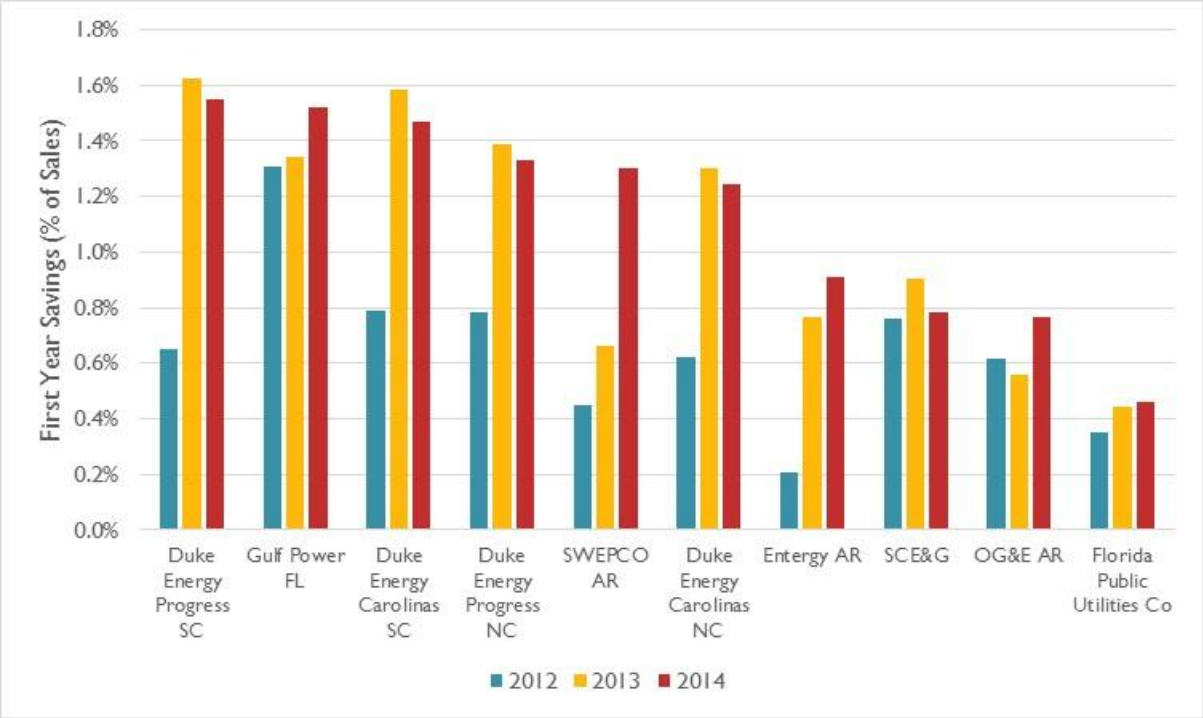
Based on U.S. Energy Information Administration (EIA) 861 data, SCE&G's residential energy efficiency programs achieved between 58 and 68 GWh of annual incremental savings between 2012 and 2014, or from 0.75–0.9 percent of residential retail sales. SCE&G's savings achievement in 2014 ranks in eighth place among investor-owned utilities (IOUs) in the Southeast, as shown in Figure 1 below. Annual incremental savings achieved by all of the IOUs that achieved higher savings than SCE&G—except Entergy Arkansas—were significantly higher, ranging from 1.2–1.6 percent of residential retail sales. Many of these IOUs increased energy savings substantially in 2013 and maintained a high level of savings in the following years.

[58] SCE&G 2015. Demand Side Management Energy Efficiency Advisory Group Meeting, November 18, 2015.

[59] Ibid.

[60] Ibid.

Figure 1. Historical Residential EE Savings by Top 10 IOUs in the Southeastern Region (2012 - 2014)



Source: EIA 861.

Note: The top 10 IOUs are those with the largest 2014 residential first-year savings, according to EIA 861 data. The states considered in this analysis include: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

Despite the fact that these neighboring utilities achieved significantly higher levels of savings, SCE&G's most recent IRP reveals that it plans to actually reduce its annual incremental energy savings down to just 0.28 percent of residential sales per year for the residential sector, 0.10 percent of commercial sales for the commercial sector, and 0.19 percent per year for both sectors combined through 2030.

6. RATE AND BILL IMPACTS OF EXPANDED ENERGY EFFICIENCY

To analyze the potential rate and bill impacts of SCE&G ramping up its residential efficiency programs, Synapse developed two energy efficiency program scenarios—a base case and an alternative case. Based on our review of SCE&G's filings and numerous energy efficiency programs from other jurisdictions, we used the following energy savings and cost projections:

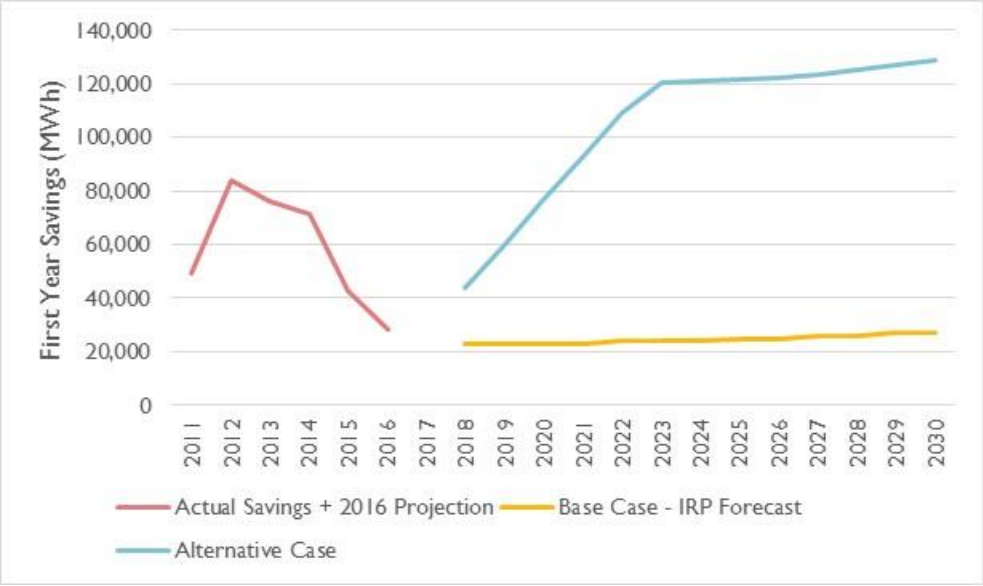
- **The Base Case**: We assumed annual incremental residential electricity savings equal to 0.28 percent of residential retail sales per year through 2030, corresponding to the forecast of SCE&G's energy efficiency program impacts included in its 2016 IRP. The cost of saved energy

for the residential sector is assumed to be 18 cents (in $2016) per kWh of first-year savings.[61] This estimate is based on the highest first-year cost of saved energy achieved by SCE&G's residential programs over the past five years, ranging from roughly 13–18 cents per kWh.

- **The Alternative Case**: We assumed increasing annual incremental electricity savings to 1.5 percent of retail sales from the current level. The annual savings are assumed to increase by 0.2 percent per year. The cost of saved energy is assumed to be the same as the cost for the Base Case, and maintained at the same level even when programs are expanded. This is based on our observation of existing program performance by SCE&G and many other leading utilities and states.

Historical actual first-year savings, projected 2016 savings, and our projection of the two cases are presented in Figure 2 below.

Figure 2. First-Year Electricity Savings: Historical, and 2016 (Projected) and under Two Energy Efficiency Program Scenarios



Source: EIA 861 for historical savings.

Highlights of our findings on expected rate and bill impacts are presented below.

- For the Base Case, the bill impacts for all customers (assuming bill savings benefits are spread out amongst all customers) are negative 0.5 percent, meaning a 0.5 percent

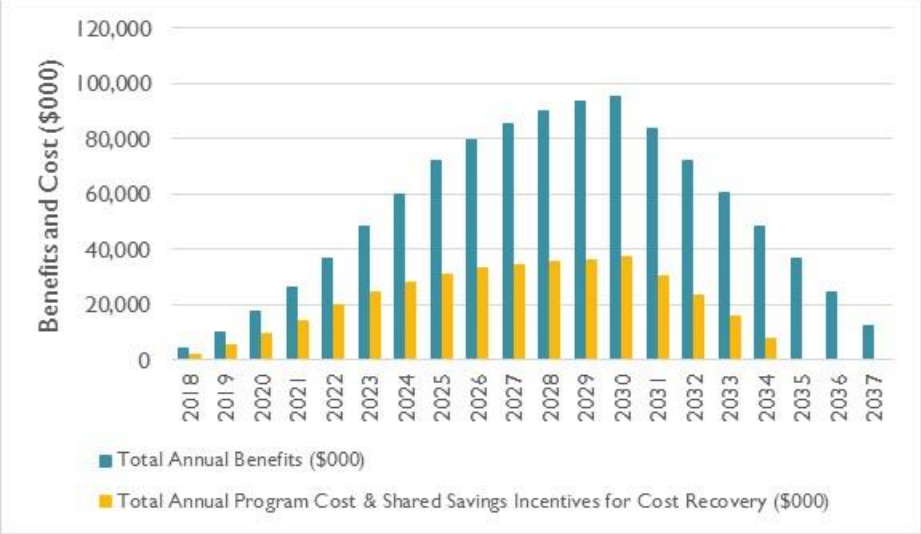
[61] The first-year cost of saved energy is the cost in the first year over its savings in the first year, not allocated over the lifetime of energy efficiency programs. The equivalent lifetime cost of saved energy is just 2.2 cents per kWh if we assume that the energy savings impacts from one year of programs last for eight years.

energy bill savings relative to a case without SCE&G's programs (No EE Case).[62] Projected cumulative net benefits in the Base Case are roughly $92 million.

- For the Alternative Case, bill impacts for all customers are negative 1.6 percent relative to the No EE Case. Figure 3 shows the difference between annual benefits and costs under this scenario. Projected cumulative net benefits in the Alternative Case are about $305 million.

- The difference in total cumulative net benefits between the Base Case and the Alternative Case is roughly $214 million. This means that $214 million in benefits to SCE&G's customers would be foregone if SCE&G pursues the lower levels of energy efficiency assumed in the Base Case.

Figure 3. Projected Annual Cumulative Benefits and Costs under the Alternative Case



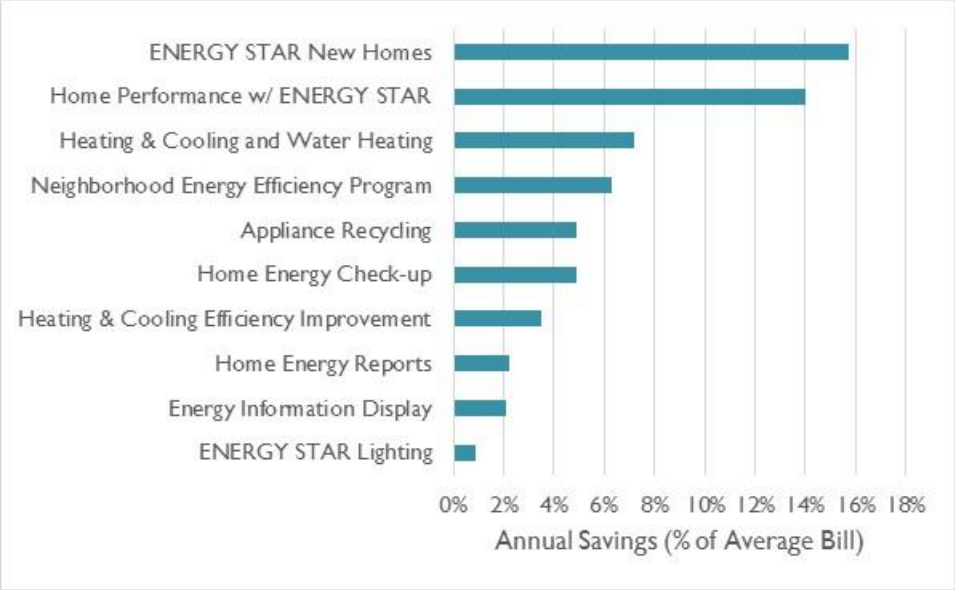
7. PARTICIPATION FORECAST

Customers will have opportunities to participate in SCE&G's energy efficiency programs and experience the associated bill reductions in either case, although as discussed below, the portion of customers that can be served by energy efficiency programs over the term of the IRP varies by scenario. Figure 4 shows average annual energy savings experienced by SCE&G's residential program participants over the past five years as a percentage of average annual residential consumption, by program. This figure reveals

[62] On average, long-term rate impacts for the Base Case and for the Alternative Case are approximately 1 percent and 4.5 percent, respectively; however, rate increases under the Alternative Case are more than offset by bill savings for the vast majority of customers participating in the expanded energy efficiency programs under that scenario. The average long-term rate impacts on a net present value basis are 0.2 cents per kWh for the Base Case and 0.9 cents per kWh for the Alternative Case. These are the levelized values of a stream of nominal rate impacts from 2018 through 2037, using a nominal discount rate of 7.1 percent, which was derived based on a WACC of 8.19 percent and an income tax rate of 40 percent. The WACC is based on SCE&G's recent rate filing titled "Annual Request for Revised Rates" under Docket No. 2016-224-E, Exhibit C on June 27, 2016.

that customers can experience energy bill savings over the long term if they participate in any one of four of SCE&G's residential efficiency programs: ENERGY STAR New Homes, Home Performance with ENERGY STAR, [63] Heating & Cooling and Water Heating, and Neighborhood Energy Efficiency Program. [64] Annual energy savings for each of these programs range from slightly above 6 percent to 16 percent per year. Customers can also participate in multiple programs with smaller energy savings impacts, such as the Appliance Recycling and the Heating & Cooling Efficiency Improvement programs, to achieve total bill savings.

Figure 4. Historical Average Annual Energy Savings by Program



Source: SCE&G Response No. 1-32 Revised to ORS First Audit Information Request in Docket No. 2016-040-E; SCE&G Reponses to First Data Request of CCL and SACE in Docket No. 216-040-E; SCE&G EM&V Report for Program Year 5.

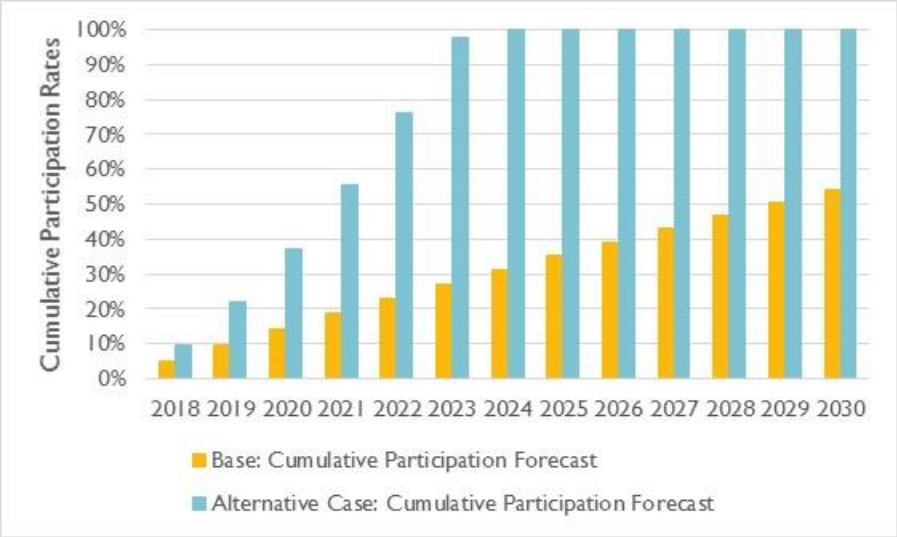
We also have estimated expected cumulative program participation rates for the Base Case and the Alternative Case in Figure 5 below.[65]

[63] Two of these programs—ENERGY STAR Homes and Home Performance with ENERGY STAR—were terminated by SCE&G in 2015 and 2014 respectively. (SCE&G's January 29, 2016 Annual Update on Demand Side Management Programs and Petition to Update Rate Rider, Exhibit 1.)

[64] Our analysis used a top-down methodology (assuming energy efficiency portfolio performance consistent with what is widely achieved in other jurisdictions) and therefore did not assume that specific programs would be offered in either case.

[65] A key input to estimate potential participation counts is 1.4 participants per MWh first-year savings, which we derived from SCE&G's 2015 performance and 2016 program projection for savings and participants. Because there are customers who may participate in multiple programs, we took a conservative approach to avoid double-counting the same participants in one year. That is, we excluded from our analysis participants in the Home Energy Check-up program and the Appliance Recycling program based on the simplified assumption that their participants are likely to participate in some of the other programs (e.g., Home Energy Reports, Heating & Cooling and Water Heating). Likewise, we excluded participants from the ENERGY STAR lighting program because the participant counts for this program are likely to be stated in terms of the number of bulbs. We applied the participant per first-year savings factor (i.e., 1.4 per MWh) to the projection of first-year

Figure 5. Projection of Potential Cumulative Program Participation Rates



Source: SCE&G Response No. 1-32 Revised to ORS First Audit Information Request in Docket No. 2016-040-E; SCE&G Reponses to First Data Request of CCL and SACE in Docket No. 216-040-E; SCE&G EM&V Report for Program Year 5.

Figure 5 shows that with appropriately aggressive energy efficiency programs under the Alternative Case, there can be sufficient programs and funding so that more than half of all residential ratepayers could be participants by 2021, and fully all ratepayers could be participants by early 2024. What's more, some customers will participate more than once over time, even after cumulative participation caps at 100 percent. Of course, not every customer will be interested in deploying cost-effective energy efficiency. However, this chart demonstrates that energy efficiency in South Carolina need not be just for a small group. In the Alternative Case, every single ratepayer will have the opportunity to reduce their electricity bills by 2024. In contrast, in the Base Case, it will be many years—well over the timeframe of the IRP—until all ratepayers have that opportunity.[66]

This analysis of expected program participation also implies that if SCE&G's energy efficiency programs are well-designed and sufficiently funded to reach all customers, all customers could potentially save on their monthly energy bills. In the Base Case, the average bill impact for all customers would be annual bill savings of 0.5 percent, or customers would experience almost no change to their bills while SCE&G

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energy savings under both cases, and estimated participation rates by dividing the expected participation counts by the forecast of residential customer counts.

[66] There may be always customers who opt not to participate. If SCE&G's programs reach 100 percent of SCE&G's customers, it is reasonable to assume that there would be a growing number of customers who come back and participate again to undertake deeper and more comprehensive energy savings measures, and also new customers who move into SCE&G's jurisdiction. An example of one of such cases is a customer who participates in the Home Energy Report program in one year, and later decides to participate in a more comprehensive program such as the Home Performance with ENERGY STAR or the Heating & Cooling and Water Heating program.

would save energy and emissions. In comparison, under the Alternative Case, the long-term average bill impact would be annual energy bill savings of 1.6 percent, and SCE&G's programs would save more energy and reduce more pollution from power plants.

APPENDIX: RATE AND BILL IMPACTS ASSUMPTIONS AND ANALYSIS

This appendix describes two energy efficiency program scenarios—a base case and an alternative case—that Synapse used in its analysis of the potential rate and bill impacts of SCE&G ramping up its residential efficiency programs. Based on our review of numerous energy efficiency programs, we used the following energy savings and cost projections:

- **The Base Case**: We assumed annual incremental residential electricity savings equal to 0.28 percent of residential retail sales per year through 2030, corresponding to the forecast of SCE&G's energy efficiency program impacts included in its 2016 integrated resource plan (IRP). The residential cost of saved energy is assumed to be 18 cents (in $2016) per kWh of first-year savings. This estimate is based on the highest first-year cost of saved energy achieved by SCE&G over the past five years, ranging from roughly 13–18 cents per kWh.

- **The Alternative Case**: We assumed increasing annual incremental residential electricity savings to 1.5 percent of retail sales from the current level. The annual savings are assumed to increase by 0.2 percent per year. The cost of saved energy is assumed to be the same as the cost for the base case, and maintained at the same level even when programs are expanded. This is based on our observation of existing program performance by SCE&G and many other leading utilities and states.

Methodology

We first created a revenue forecast for a scenario without any energy efficiency programs—the "No EE Case"—based on SCE&G's forecast of residential sales from its 2016 IRP and our projection of retail rates. To forecast retail rates for the No EE Case, we escalated the current full residential retail rate by 3 percent annually, based on the electricity price growth rate for the South Atlantic region from the 2016 EIA Annual Energy Outlook.

Second, we estimated new revenue forecasts for the Base Case and the Alternative Case by adjusting the No EE Case revenue forecast for expected annual avoided costs, program costs, and shared savings incentives. Estimates of avoided costs, program costs, and shared savings incentives are discussed below under the section *Key Assumptions and Scenario Development*.

Third, we estimated the average retail rate for all residential customers for the Base Case for each year by dividing the new revenue forecast for the Base Case by the corresponding Base Case sales forecast. Similarly, the average residential retail rate in the Alternative Case was calculated by dividing Alternative Case revenues by sales for that scenario. Because the revenue stream was adjusted for avoided costs, program costs, and shared savings incentives, the resulting retail rates also reflect those factors. Further, the resulting rates reflect the expected lost revenues from lower sales, because the rates were derived by dividing the new revenue forecasts by lower sales estimates due to energy efficiency.

Fourth, we compared the new residential rates for the Base Case and the Alternative Case with the expected No EE Case rates to estimate average rate impacts.

Finally, we estimated the average bill impacts for the Base Case and the Alternative Case using the estimated average rate impacts for each scenario and our projection of annual average residential bills over time for the No EE Case scenario. Annual average bills for the No EE Case were estimated as the product of the escalated residential retail rate and our forecast of annual average residential electricity consumption. Average residential consumption was estimated by dividing the No EE Case sales by our projection of residential customer counts. The number of residential customers is assumed to increase from the 2015 level by 2 percent per year. The 2 percent rate was set to be close to the trend over the past five years (which is a 1 percent annual growth rate) while resulting in a forecast of decreasing consumption per customer over time.[67]

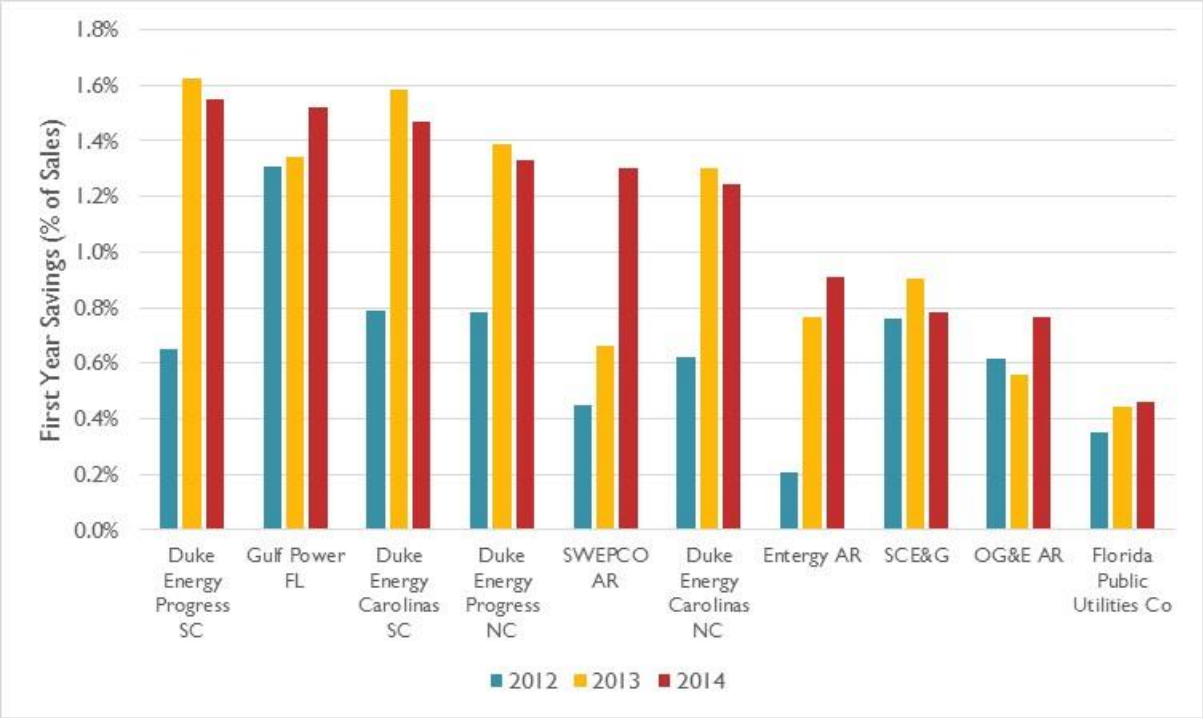
Key Assumptions and Scenario Development

Historical and projected energy savings

Based on EIA 861 data, SCE&G's residential energy efficiency programs achieved between 58 and 68 GWh of annual incremental savings between 2012 and 2014, or from 0.75–0.9 percent of residential retail sales. SCE&G's achievement in 2014 placed it in eighth place among IOUs in the southeast, as shown in Figure A- 1 below. Annual incremental residential savings achieved by all of the IOUs that achieved higher savings than SCE&G—except Entergy Arkansas—were significantly higher, ranging from 1.2–1.6 percent of residential retail sales. Many of these IOUs increased energy savings substantially in 2013 and maintained a high level of savings in the following years.

[67] We did not use a 1 percent annual growth rate because it would increase average per customer consumption over time, and because EIA's Annual Energy Outlook predicts that per household electricity use is expected to further decline partly due to improving appliance and equipment standards. See slide 57 of EIA's presentation titled "Annual Energy Outlook 2016 Early Release: Annotated Summary of Two Cases" available at https://www.eia.gov/forecasts/aeo/er/pdf/0383er(2016).pdf.

Figure A- 1 Historical Residential EE Savings by Top 10 IOUs in the Southeastern Region (2012 - 2014)



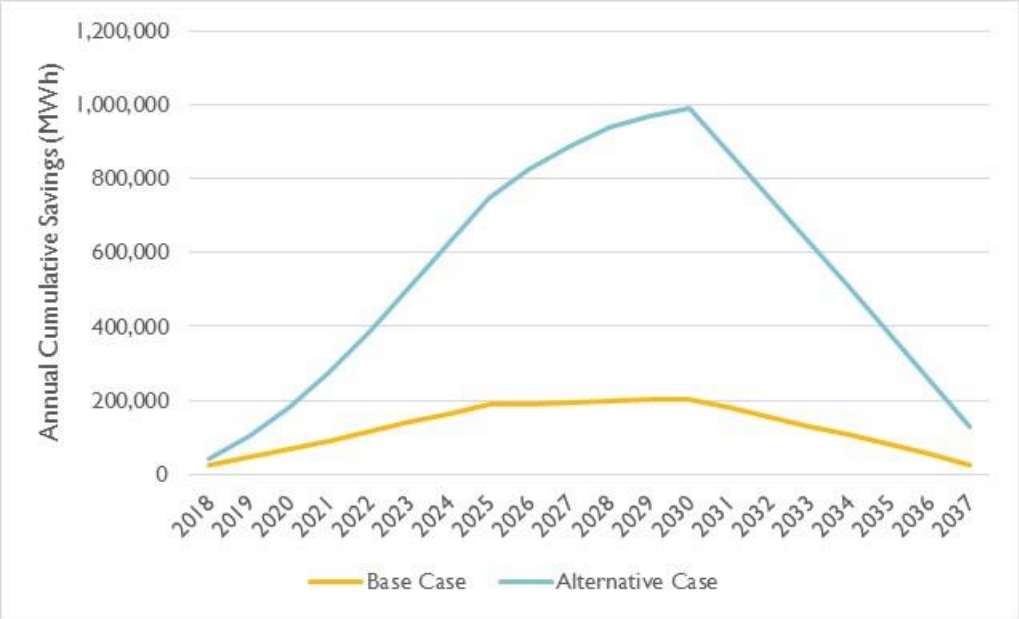
Source: EIA 861.

Note: The top 10 IOUs are those with the largest 2014 residential first-year savings, according to EIA 861 data. The states considered in this analysis include: Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia.

Despite the fact that these neighboring utilities achieved significantly higher levels of savings, SCE&G's most recent IRP reveals that it plans to actually reduce its annual incremental residential energy savings down to just 0.28 percent of residential sales per year for the residential sector, 0.10 percent of commercial sales for the commercial sector, and 0.19 percent per year for both sectors combined through 2030.

Our forecasted annual cumulative energy savings assumed that program savings last for eight years on average, based on SCE&G's lifetime energy savings performance reported on EIA form 861. The resulting annual cumulative energy savings are presented in Figure A-2 below. Annual cumulative energy savings start to decrease gradually starting in 2031 because no new participation in the programs is assumed after 2030, to coincide with the end of the IRP.

Figure A- 2 Projection of Annual Cumulative Savings under Two Energy Efficiency Program Scenarios

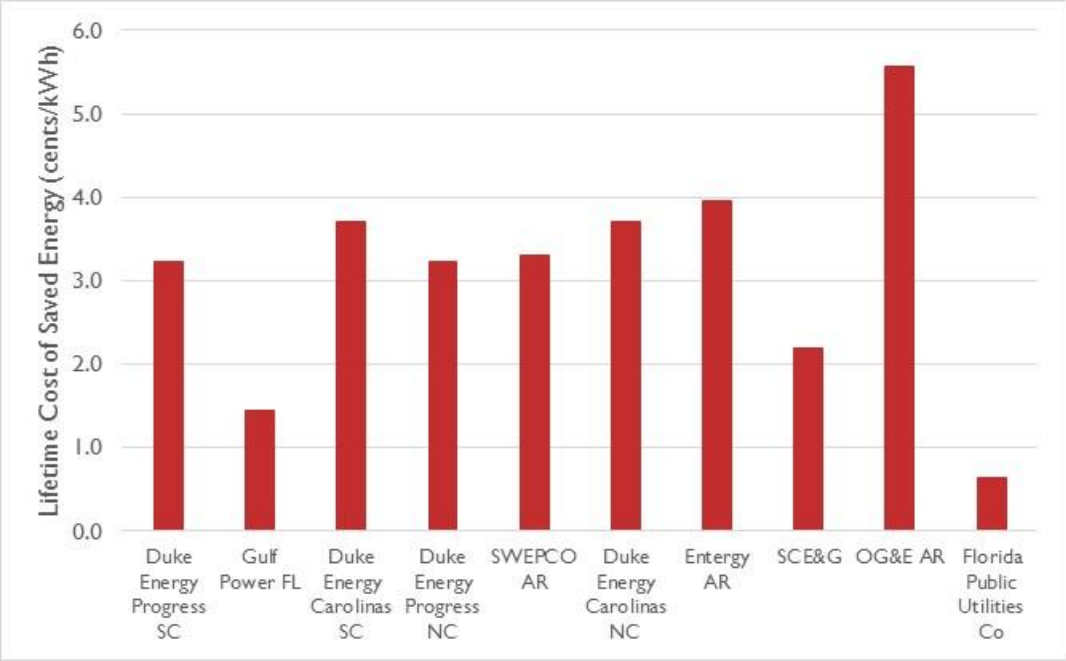


Cost of energy efficiency

The costs of saved energy for energy efficiency programs by the top 10 IOUs in the region are extremely cost-competitive. Based on residential program cost and measure life data from EIA's 861 database, we estimate that the lifetime cost of saved energy (also called the levelized cost of saved energy) for SCE&G was only about 2 cents per kWh for its residential programs in 2014, in comparison to an average retail residential rate of 14.4 cents per kWh for SCE&G's residential customers in the same year.[68] As shown in Figure A- 3 below, the lifetime costs of residential energy efficiency programs for the rest of the top 10 IOUs range from 0.6 cents per kWh to 5.5 cents per kWh. The lifetime residential program costs for Duke Energy Progress and Duke Energy Carolinas in South Carolina are 3.2 and 3.7 cents per kWh respectively.

[68] We used a 7.1 percent nominal discount rate for this calculation based on an assumed 2 percent inflation rate and a weighted average cost of capital of 8.19 percent from SCE&G's recent rate case under Docket No. 2016-224-E.

Figure A- 3 Lifetime Residential Cost of Saved Energy by Top 10 IOUs in the Southeastern Region in 2014

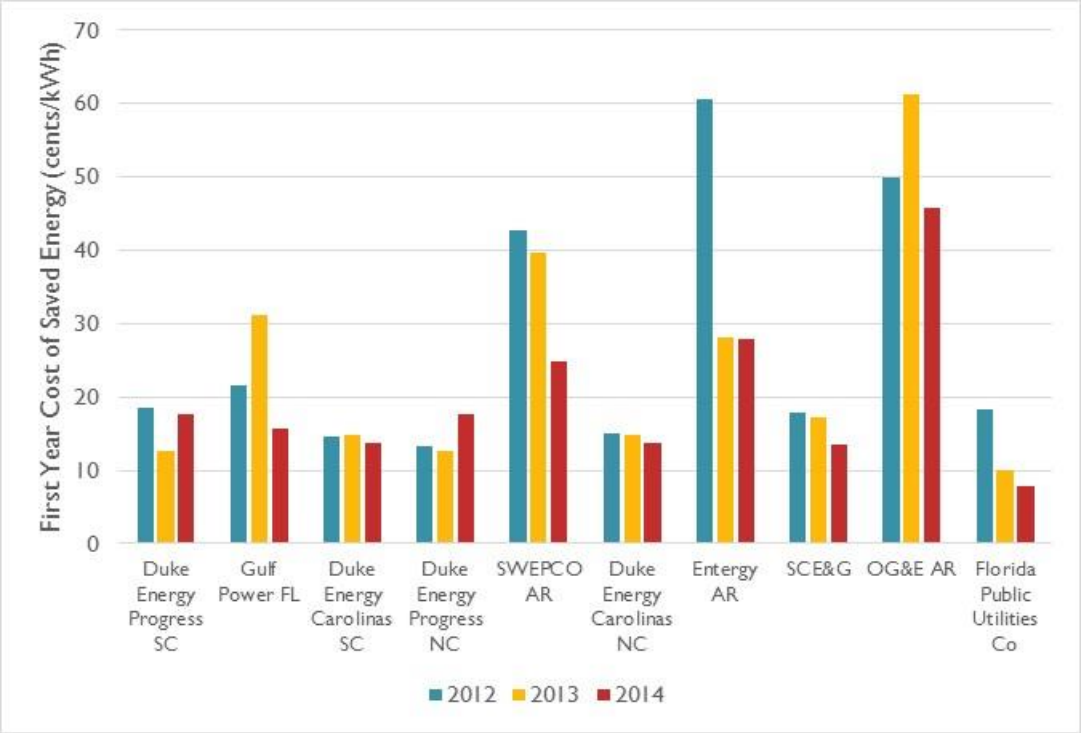


Source: EIA 861.

To compare program cost data over multiple years across different jurisdictions, we present the cost of energy efficiency programs in terms of the "first-year" cost of saved energy in Figure A- 4 below. The first-year cost of saved energy is the cost in the first year over its savings in the first year, not allocated over the lifetime of energy efficiency programs. While the levelized cost of saved energy better reflects the cost of the energy efficiency assets promoted within a portfolio over their lifetimes, there is significant uncertainty about measure life estimates, and EIA just started to collect utilities' projections of lifetime energy savings in 2013. As shown in Figure A-4, the first-year cost for SCE&G's residential programs has been less than 20 cents per kWh, ranging from about 13–18 cents/kWh. The lifetime costs of saved energy would be just 1.7–2.2 cents per kWh if we assume that the energy savings impacts from one year of programs last for eight years.[69] Further, most of the residential programs among the top 10 IOUs are equally low-cost, ranging from 10–30 cents per kWh saved in the first year. Indeed six of the IOUs saved energy at below 20 cents per kWh first-year savings, or 2.5 cents per kWh lifetime savings, assuming an 8-year average measure life.

[69] A 2014 study by the American Council for an Energy Efficient Economy (ACEEE) found residential programs have on average an 8-year measure life across all programs in 10 states reviewed. ACEEE. 2014. *The Best Value for America's Energy Dollar: A National Review of the Cost of Utility Energy Efficiency Programs.* Available at www.aceee.org/research-report/u1402.

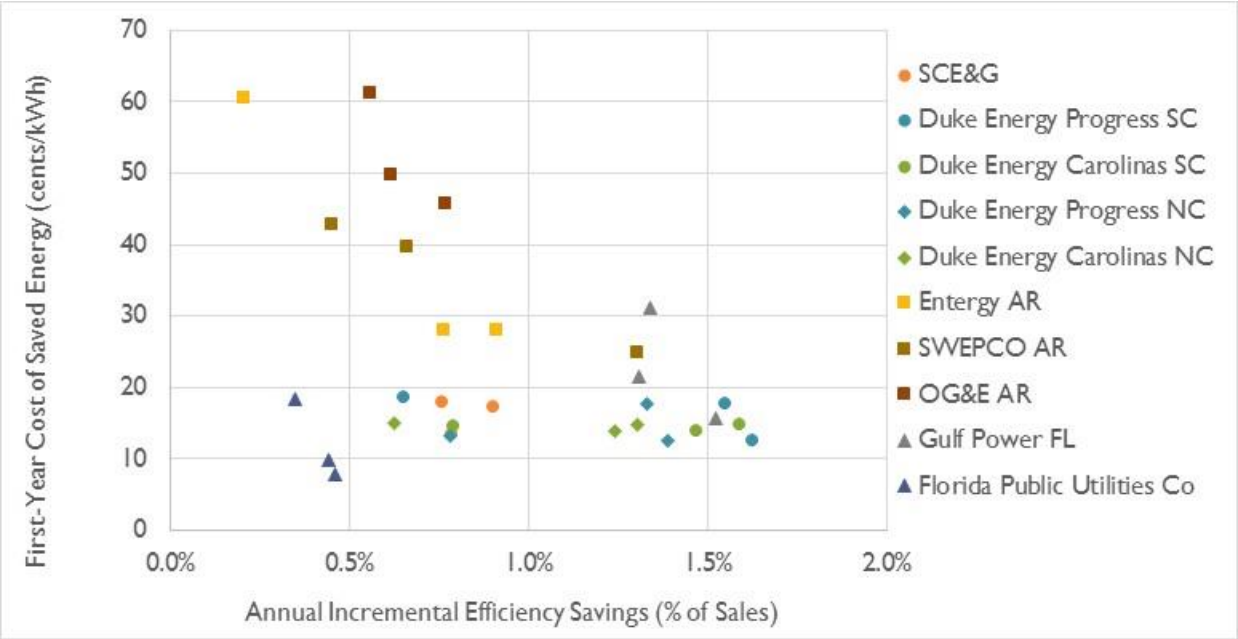
Figure A- 4 First-Year Residential Cost of Saved Energy by Top 10 IOUs in the Southeastern Region



Source: EIA 861.

Notably, we observed no trend of increasing costs among these IOU programs even when the programs were expanded in scale. Instead, the first-year program costs have either remained flat or slightly decreased when the programs were expanded, as shown in Figure A- 5. The X-axis in this figure shows annual incremental energy savings as a percentage of retail sales, and the Y-axis shows first-year program costs. Among all of the utilities, it is also noteworthy that Duke Energy Progress and Duke Energy Carolinas have increased annual incremental residential energy savings from a level of around 0.6–0.7 percent per year to 1.3–1.7 percent per year of residential sales while maintaining the same level of cost of saved energy.

Figure A- 5 First-Year Cost of Saved Energy vs. Annual Incremental Cost Savings among Top 10 IOUs in the Southeastern Region



Source: EIA 861.

For program costs, we assume that both the Base Case and the Alternative Case will cost $0.18 per first-year kWh savings for the residential programs (in 2016 constant dollars). This cost of saved energy is based on the highest actual program cost experienced by SCE&G over the past five years, according to EIA 861 data. This value is equivalent to a levelized program cost of 2.7 cents per kWh.[70]

We then adopt SCE&G's actual cost recovery methodologies for program costs and shared savings incentives based on the Commission's 2010 order that established SCE&G's cost recovery mechanisms.[71] For program cost recovery, we assume the annual total program cost is recovered over five years with a weighted average cost capital (WACC) of 8.2 percent based on the most recent rate filing by SCE&G.[72] For the shared savings incentive calculations, we first estimated net lifetime benefits from energy savings under the two scenarios for each year. Net lifetime benefits consist of avoided energy, capacity, transmission and distribution costs (T&D), less annual program costs (without the 5-year amortization). We applied a 6 percent factor to the net benefits to estimate the shared savings incentives for each year.

[70] The levelized cost was calculated using an 8- year measure life and a 5 percent real discount rate. The real discount rate was calculated based on SCE&G's latest weighted average cost of capital estimate of 8.19 percent and Synapse' own assumption of a 2 percent annual inflation rate.

[71] South Carolina Public Service Commission, Docket No. 2009-261-E: Order No. 2010-472, July 15, 2010. Order Approving SCE&G's Request for the Establishment and Approval of DSM Programs and Rate Rider.

[72] SCE&G, Annual Request for Revised Rates, Docket No. 2016-224-E, Exhibit C, June 27, 2016.

Avoided costs

For estimating program benefits, we used the avoided energy cost estimates prepared by SCE&G for a PURPA avoided cost case, and the avoided generation capacity and T&D costs estimated by ICF Consulting for SCE&G. Our assumptions for levelized avoided energy, capacity, and T&D are presented below:

- Avoided energy: $28.78 per MWh (levelized)[73]
- Avoided capacity and T&D: $157 per kWh-year (levelized)[74,75]

Generally, we view these avoided cost estimates as conservative, because other important benefits such as non-energy benefits and avoided carbon dioxide emissions are not included in our analysis. This implies that our estimates of rate and bill impacts are likely to be higher than expected.

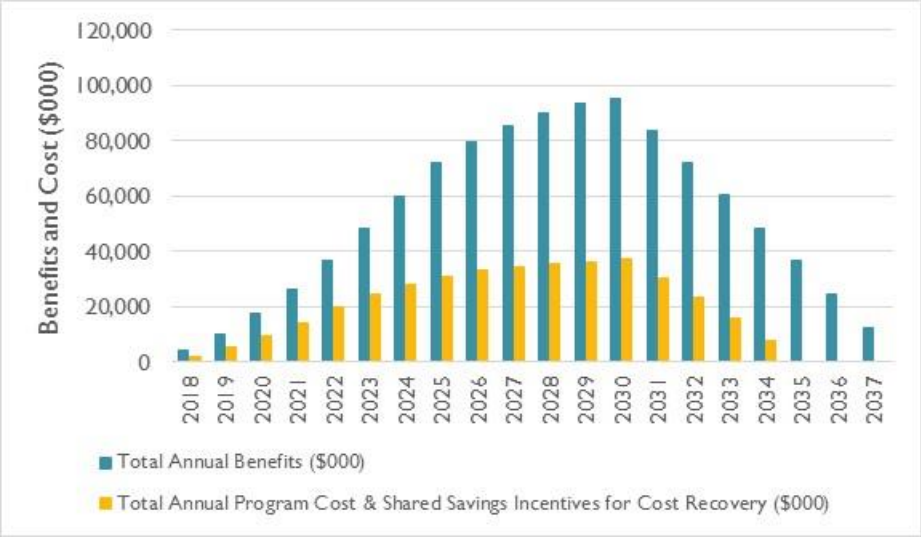
Figure A- 6 presents costs and benefits for the Alternative Case scenario using these conservative avoided cost estimates.

[73] "SACE#1a" file, SCE&G's Responses to First Set of Data Requests of CCL and SACE. Docket No. 2016-2-E.

[74] ICF (May 2013). South Carolina Electric & Gas: Comprehensive Report and Demand Side Management Portfolio Plan: Program Years 4–6, page 5.

[75] $157 per kWh-year is equivalent to $180.68 per kW-year with a 15 percent reserve margin. The ICF study provides a value of $129.84 per kW (in 2013 dollars) per year based on the value of a simple cycle combustion turbine and ICF's assumed avoided transmission and distribution cost. ICF adjusted this for a 15 percent reserve margin factor, resulting in $149 per kWh (in 2013 dollars). We estimated a levelized cost of capacity and T&D for the 2018 to 2030 timeframe using a nominal discount rate of 7.1 percent, which was developed based on a WACC of 8.19 percent and a 40 percent income tax rate.

Figure A- 6 Projected Annual Cumulative Benefits and Costs under the Alternative Case

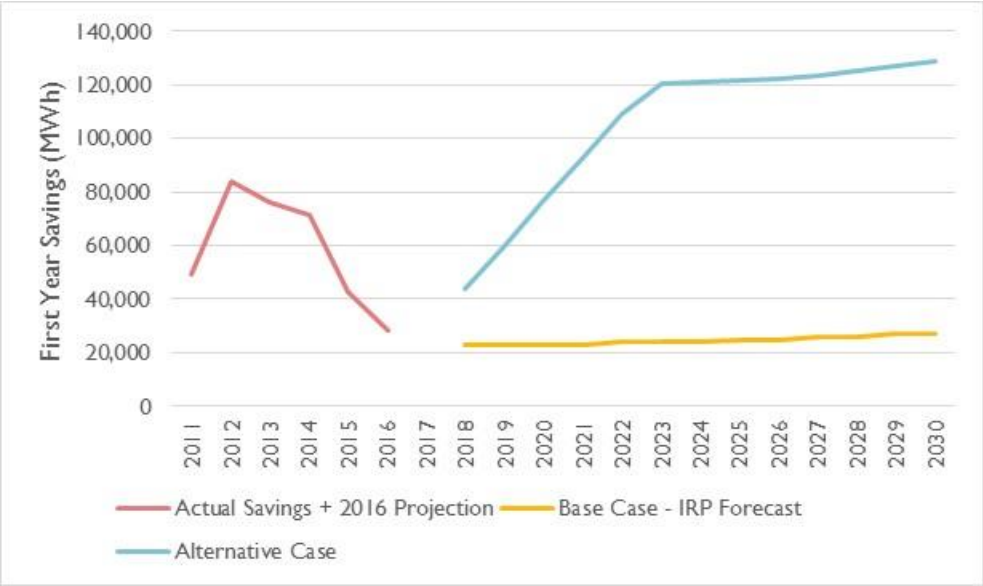


Scenario Development: Business as Usual and Expanded Energy Efficiency

Our analysis assumes that the Base Case follows SCE&G's IRP for its energy efficiency programs. The Alternative Case ramps up annual energy savings from the current level by 0.2 percent of annual retail residential sales per year, to 1.5 percent in 2023. We assume that the first-year savings (or annual incremental savings) in 2017 are equal to SCE&G's residential savings projection of approximately 0.35 percent of residential sales in 2016. We then project energy savings to increase starting in 2018 under the Alternative Case, which will set SCE&G on a track to achieve by 2023 an assumed maximum level of first-year residential savings as a percent of residential sales, 1.5 percent.

Historical actual first-year savings, projected 2016 savings, and our projection of the two cases are presented in Figure A- 7 below.

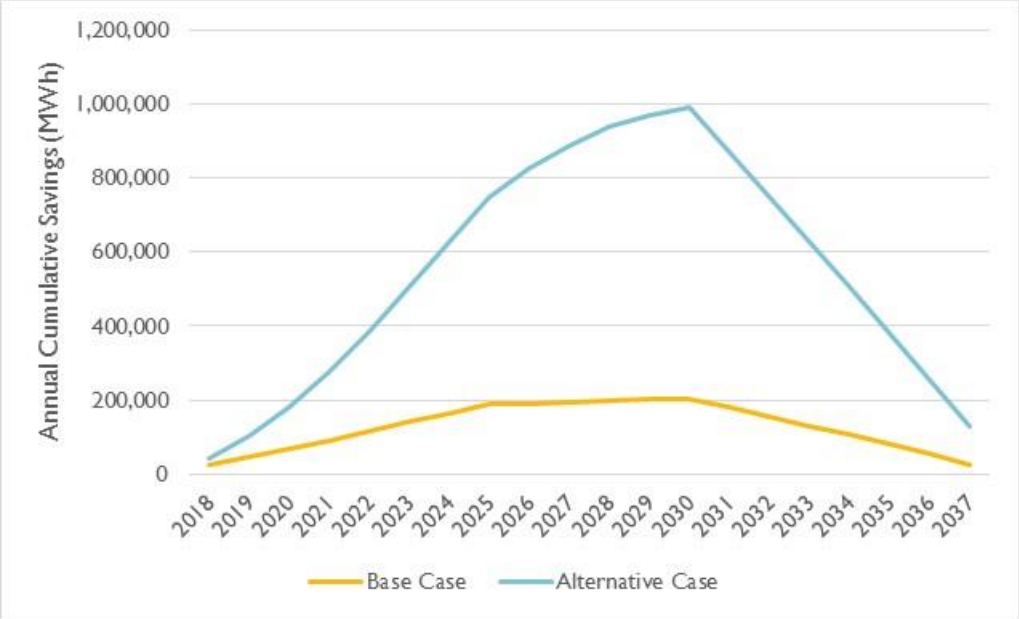
Figure A- 7 First-Year Residential Electricity Savings: Historical, and 2016 (Projected) and under Two Energy Efficiency Program Scenarios



Source: EIA 861 for historical savings.

We then forecasted annual cumulative residential energy savings, assuming program savings last for eight years on average based on SCE&G's lifetime energy savings performance reported on EIA form 861. The resulting annual cumulative energy savings are presented in Figure A- 8 below. Annual cumulative energy savings start to decrease gradually starting in 2031 because no new participation in the programs is assumed after 2030, to coincide with the end of the IRP.

Figure A- 8 Projection of Annual Cumulative Savings under Two Energy Efficiency Program Scenarios



The Base Case Scenario

As discussed above, SCE&G's 2016 IRP proposed significantly lower energy savings than the utility has achieved in the past few years. Based on our review of existing energy efficiency programs, proposed programs, and potential studies, we believe that SCE&G should be able to achieve a much greater level of energy savings. However, for the Base Case we simply assume that the utility follows its latest IRP, as this will be compared to an Alternative Case scenario. The exact levels of proposed energy savings are provided separately for residential and commercial customers in Table A- 1 below. Our analysis of residential bill impacts use the savings projection for the residential sector.

Table A- 1 Proposed Annual Incremental Energy Savings by SCE&G in its 2016 IRP

	Residential			Commercial		
	Baseline Sales (GWH)	Incremental Reductions (GWH)	Inc. %	Baseline Sales (GWH)	Incremental Reductions (GWH)	Inc. %
2016	7,906	-	-	7,374	-	-
2017	7,976	-	-	7,468	-	-
2018	8,070	-23	-0.28%	7,633	-7	-0.10%
2019	8,166	-23	-0.28%	7,780	-8	-0.10%
2020	8,265	-23	-0.28%	7,974	-8	-0.10%
2021	8,359	-23	-0.28%	8,137	-8	-0.10%
2022	8,431	-24	-0.28%	8,298	-8	-0.10%
2023	8,580	-24	-0.28%	8,490	-8	-0.10%
2024	8,745	-24	-0.28%	8,674	-9	-0.10%
2025	8,907	-25	-0.28%	8,863	-9	-0.10%
2026	9,074	-25	-0.28%	9,054	-9	-0.10%
2027	9,239	-26	-0.28%	9,240	-9	-0.10%
2028	9,404	-26	-0.28%	9,432	-9	-0.10%
2029	9,575	-27	-0.28%	9,625	-10	-0.10%
2030	9,746	-27	-0.28%	9,815	-10	-0.10%

Source: SCE&G 2016 Integrated Resource Plan, pp. 6-7.

As a conservative assumption, we used 18 cents per kWh first-year residential program savings for the cost of saved energy for the Base Case. This estimate is based on the highest cost of saved energy achieved by SCE&G over the past five years. As shown in Table A- 2 below, SCE&G's first-year cost of saved energy for the residential sector ranged from roughly 13–18 cents per kWh in the past five years.

Table A- 2 Historical First Year Costs of Saved Energy by SCE&G

Year	First Year Cost ($/kWh 1st yr.)	First Year Cost ($2016/kWh 1st yr.)
2011	0.17	0.18
2012	0.13	0.14
2013	0.15	0.16
2014	0.12	0.13
2015	0.13	0.13

Sources: SCE&G Response No. 1-32 Revised to ORS First Audit Information Request in Docket No. 2016-040-E; Opinion Dynamics. 2016. South Carolina Electric and Gas EnergyWise Program Year 5: Evaluation Measurement, and Verification Report. May 2016. Docket No. 2013-208-E.

The Alternative Case Scenario

Projection of Energy Savings

We used a residential annual incremental energy efficiency savings level of 1.5 percent of sales for our alternative scenario as the maximum annual incremental energy savings. This level of savings is highly attainable. According to EIA data, the two other major IOUs in South Carolina had already achieved residential savings of over 1.5 percent of residential sales per year by 2013. In that year, Duke Energy Progress had annual incremental residential savings of 1.62 percent in South Carolina, and Duke Energy Carolinas reached residential savings of 1.59 percent of residential sales in its South Carolina service area.

We then assumed that SCE&G ramp up to this level of annual residential savings over about four years, by increasing the annual incremental energy savings level by 0.2 percent per year.[76] As shown in Table A- 3 below, many of the top 10 IOUs in the region have demonstrated an annual savings ramp rate of 0.3 to 0.4 percent. The average annual residential savings ramp-up is 0.24 percent per year among the 10 utilities.

[76] The exact year to achieve this maximum incremental savings depends on the current annual energy savings level. We will finalize this assumption after we obtain and examine the 2015 energy savings forecast by SCE&G.

Table A- 3 Annual Incremental Residential Energy Savings Ramp Rate by Top 10 Utilities

Parent Company	Annual Inc. EE Savings (%) 2012	2013	2014	Ramp Rate (%/year)
Duke Energy Progress SC	0.65%	1.62%	1.55%	0.45%
Gulf Power FL	1.31%	1.34%	1.52%	0.11%
Duke Energy Carolinas SC	0.79%	1.59%	1.47%	0.34%
Duke Energy Progress NC	0.78%	1.39%	1.33%	0.27%
SWEPCO AR	0.45%	0.66%	1.30%	0.43%
Duke Energy Carolinas NC	0.62%	1.30%	1.24%	0.31%
Entergy AR	0.20%	0.76%	0.91%	0.35%
SCE&G	0.76%	0.90%	0.79%	0.01%
OG&E AR	0.62%	0.56%	0.77%	0.08%
Florida Public Utilities Co	0.35%	0.44%	0.46%	0.05%
Average				0.24%

Source: EIA 861.

Lastly, it is important to note that leading utilities and states outside of the southeastern region (e.g., Massachusetts, Rhode Island, Vermont, Hawaii, and Arizona) have achieved higher levels of savings for many years and are planning to continue achieving a high level of savings in the future. Among them, Massachusetts has been a front-runner in energy efficiency for the past few decades and has ranked as number one in energy efficiency programs and policies by the American Council for an Energy-Efficient Economy (ACEEE) for the past several years.[77] Massachusetts, which has successfully tapped into its savings potential over the past two decades,[78] has not only maintained high levels of savings for the past several years, but also increased energy savings beyond 1.5 percent per year for the residential, commercial, and industrial sectors during the same time period. During the 2010 to 2012 program cycle, all program administrators in the state achieved 1.6 percent annual energy savings as a percent of total retail sales. During the 2013 to 2015 program cycle, the program administrators together have achieved 2.57 percent of annual energy savings. Further, for the next three-year cycle, the program administrators are planning to save on average 2.9 percent annual incremental energy savings as a percent of sales.[79]

[77] ACEEE's State Energy Efficiency Scorecard reports. Available at www.aceee.org/state-policy/scorecard.

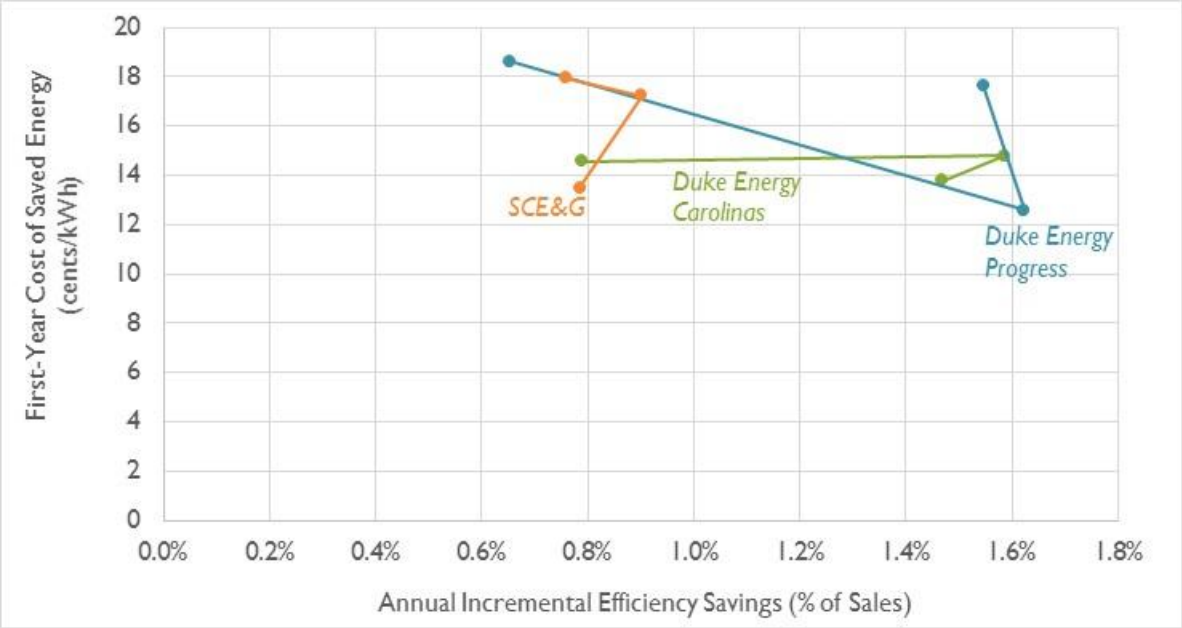
[78] For example, annual cumulative savings achieved by Massachusetts program administrators reached about 6,650 GWh over a course of nine years from 2006 to 2014, according to ACEEE's State Energy Efficiency Scorecards reports. This amount is equal to about 12 percent of the 2014 state retail sales.

[79] Mass Save. 2015. *2016-2018 Massachusetts Joint Statewide Three-Year Electric and Gas Energy Efficiency Plan* (September 25, 2015 Draft). Page 12. Available at www.ma-eeac.org/wordpress/wp-content/uploads/Gas-and-Electric-PAs-Plan-2016-2018-9-25-2015-Final-WITH-Appendices.pdf.

Projection of Energy Savings Costs

We used 18 cents per kWh as the first-year residential program cost for the Alternative Case—the same cost of saved energy estimate that we developed for the Base Case—based on our observation that leading utilities and states have demonstrated increasing energy savings while keeping the cost of saved energy around the same level. For example, the Duke utilities did not sacrifice cost-effectiveness in the process of expanding their residential efficiency programs in South Carolina. Figure A-1 shows that the Duke utilities maintained roughly the same residential cost of saved energy as they rapidly increased their saving levels between 2012 and 2013. In 2013 and 2014, SCE&G and the two Duke utilities all spent between 12 cents per kWh of first-year savings and 18 cents per kWh of first-year savings on their South Carolina residential energy efficiency investments, but the Duke utilities achieved much greater energy savings.

Figure A- 9 Residential Program Costs vs. Savings Among South Carolina IOUs (2012-2014)

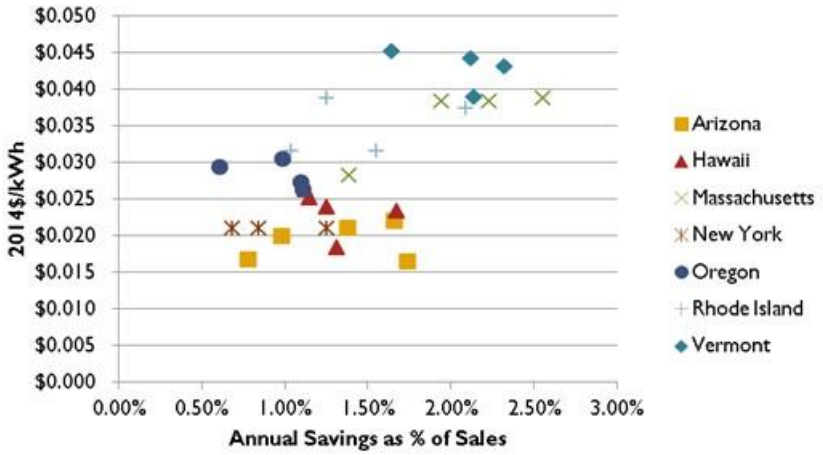


Source: EIA-861.

A similar program cost trend was observed in a study Synapse conducted in 2015 with regard to Tennessee Valley Authority's 2015 IRP. This study examined lifetime costs of saved energy for seven leading states that offer comprehensive energy efficiency programs and found that "the majority of such states have actually maintained their costs around the same level over 2009-2013, even when their annual savings levels increased dramatically."[80] The result of this analysis is shown in Figure A- 10 below.

[80] Synapse Energy Economics. 2015. *Review of TVA's Draft 2015 Integrated Resource Plan*. Page 7. Available at www.synapse-energy.com/sites/default/files/Review-TVA-Draft-2015-IRP-14-022.pdf.

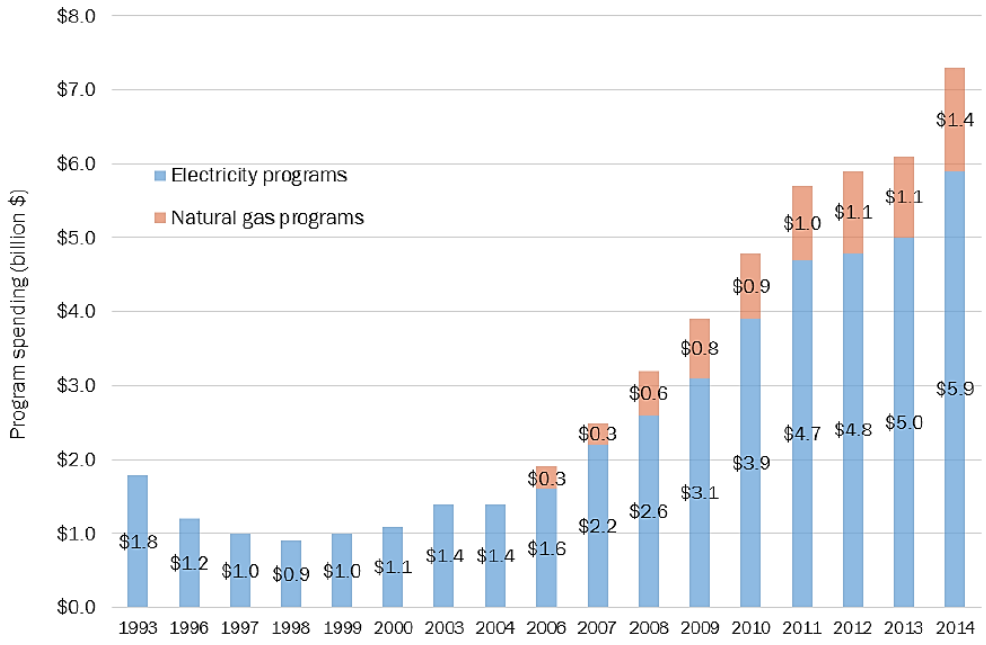
Figure A- 10 Lifetime Cost of Saved Energy and Annual Savings by Leading States from 2009 to 2013



Source: Synapse Energy Economics (April 2015). Review of TVA's Draft 2015 Integrated Resource Plan, available at http://www.synapse-energy.com/sites/default/files/Review-TVA-Draft-2015-IRP-14-022.pdf

Further this cost trend has been observed at the national level. As shown in Figure A- 11, many states across the nation have expanded their electric energy efficiency programs over the past decade. Within that time, total spending on programs has quadrupled from $1.4 billion to about $5.9 billion. Contrary to popular expectation, the cost of saved energy has remained constant during this period. ACEEE examined trends in the cost of saved energy for many states in 2004, 2009, and 2014 and found that the average lifetime costs of saved energy across all states have remained consistently at $0.025-$0.030 per kWh.

Figure A- 11 History of Annual Electric and Natural Gas Energy Efficiency Program Spending or Budgets



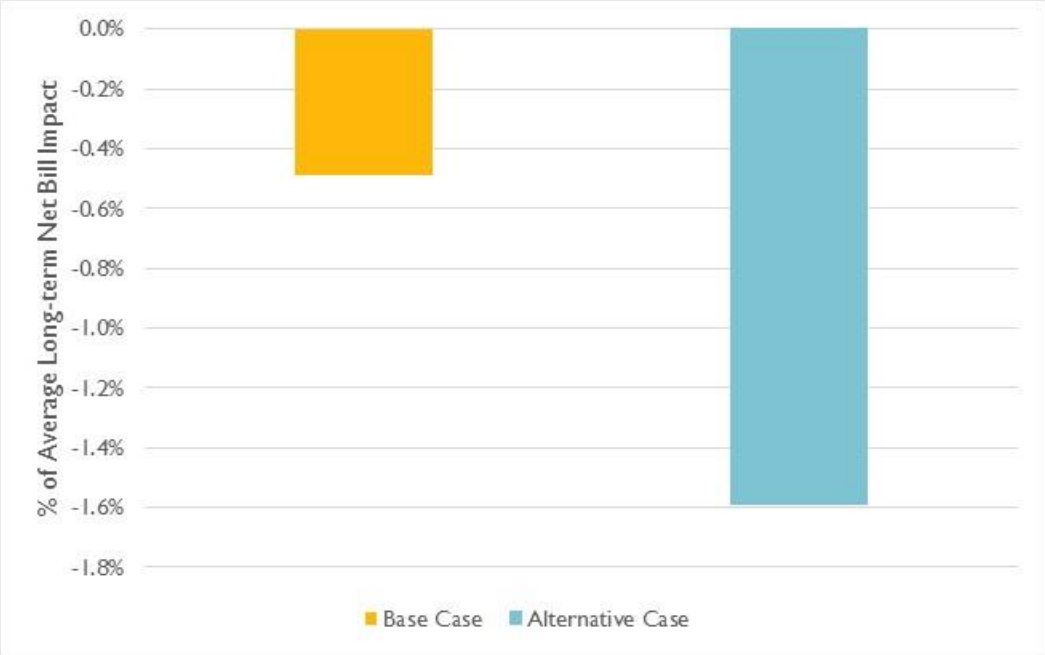
ACEEE (2015). The 2015 State Energy Efficiency Scorecard.

Results

Highlights of our findings on expected long-term bill impacts are presented below and in Figure A- 12.

- For the Base Case, the bill impacts for all customers (assuming bill savings benefits are spread out amongst all customers) are negative 0.5 percent, meaning a 0.5 percent of energy bill savings relative to a case without SCE&G's programs (No EE Case). [81]
- For the Alternative Case, bill impacts for all customers are negative 1.6 percent relative to the No EE Case.

Figure A- 12 Average Long-Term Net Bill Impacts for All Customers for the Base Case and the Alternative Case



[81] On average, long-term rate impacts for the Base Case and for the Alternative Case are approximately 1 percent and 4.5 percent, respectively; however, rate increases under the Alternative Case are more than offset by bill savings for the vast majority of customers participating in the expanded energy efficiency programs under that scenario. The average long-term rate impacts on a net present value basis are 0.2 cents per kWh for the Base Case and 0.9 cents per kWh for the Alternative Case. These are the levelized values of a stream of nominal rate impacts from 2018 through 2037, using a nominal discount rate of 7.1 percent, which was derived based on a WACC of 8.19 percent and an income tax rate of 40 percent. The WACC is based on SCE&G's recent rate filing titled "Annual Request for Revised Rates" under Docket No. 2016-224-E, Exhibit C on June 27, 2016.