

2016-2018 Strategic Evaluation Plan Update

Massachusetts Program Administrators and EEAC Consultants

May 24th, 2017



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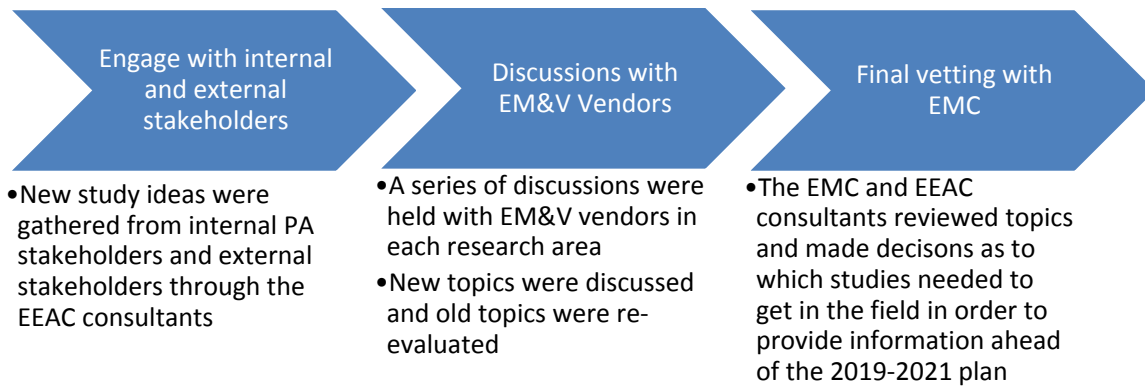
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Introduction

As part of the 2016-2018 Three Year Plan filing, the Program Administrators (PAs) developed a Strategic Evaluation Plan (SEP) that outlined the framework and key considerations used when assessing which evaluations to undertake. As part of that process, an evaluation planning summit was held in February 2015 to identify and prioritize key researchable questions. Numerous study plans were developed in order to address the researchable questions identified at the planning summit and were included in the SEP as Stage 1 plans¹. Guided by the plans in the SEP, a multitude of evaluation activities were undertaken throughout 2016 and 2017.

As the PAs approach the midpoint of the 2016-2018 Three Year Plan cycle, a re-examination of study topics is being undertaken to ensure that the appropriate priority is put on certain topics and to make sure pertinent information is gathered ahead of the 2019-2021 Three Year Plan. A series of meetings were held throughout the first part of 2017 with the PAs, the Energy Efficiency Advisory Council's (EEAC) Evaluation, Measurement, and Verification (EM&V) consultants, and the EM&V vendors to suggest new study topics and either re-affirm previously suggested ideas or drop them from consideration. The study topics that are included in this document represent a "refresh" of evaluation study topic ideas. The PAs, through the Evaluation Management Committee (EMC), have worked in close collaboration with the EEAC's EM&V consultants to develop and vet these ideas.

The SEP refresh process is illustrated below:



The result of the SEP refresh process is the enclosed list of study topics and Stage 1 plans that represent a prioritized research agenda to guide evaluation activities for the remainder of the 2016-2018 term and help inform the development of the 2019-2021 Three Year Plan. The SEP refresh serves as a guide for the EMC, but the PAs note that additional studies that have yet to be identified may be added as a priority during the remainder of the 2016-2018 term.

¹ A description of planning stages can be found on pages 11-12 of the Strategic Evaluation Plan (pages 1842-1843 in the PDF) at <http://ma-eeac.org/wordpress/wp-content/uploads/Exhibit-1-Gas-and-Electric-PAs-Plan-2016-2018-with-App-except-App-U.pdf>

Residential Research Area

Study Name: RES 17 – Wi-Fi Thermostat Technology and Literature Review
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Research/technology review
Applicable Fuel(s): Electricity/Gas

Overall Study Goal:

The goal of the study is to understand the current and future state of thermostat technology and impact on energy use. The study will look at the demonstrated impacts of current technologies such as Wi-Fi and learning thermostats. In addition, since thermostat technologies are rapidly changing, we will explore the direction of future technologies to consider the possible impacts on future home energy management and use. Through a review of research on thermostat impacts and leveraging Navigant technology reports, this study will synthesize the current state of the research and technology and determine whether the PAs should invest in deeper, targeted research on savings attributable to Wi-Fi and learning thermostats.

High-Level Description of Approach/Methodology:

In recognition of this goal, Navigant recommends the following approach.

Review of existing research on thermostat savings: The evaluation team will complete a literature review to understand and synthesize the existing research on savings related to Wi-Fi and learning thermostats. The review will include studies conducted by manufacturers, third-party EM&V studies, technical resource manuals (TRMs), ENERGY STAR research reviews, and other sources. The review will carefully document the features of the thermostats as there is a range of “smartness” of thermostats in level of control, learning features, or other software that attempts to optimize usage on cost or other factors. Savings results will be interpreted in the context of the feature set included in the study.

Review of technology: Navigant Research completed two reports in mid to late 2016 that describe the current and future state of connected and smart thermostat technology. This scope will include delivery of one or both reports, including, as an option, a customized presentation on key report findings.

1. *Communicating Thermostats, Smart Thermostats, and Associated Software and Services: Global Market Analysis and Forecasts* analyzes the global market opportunities for communicating and smart thermostats. The study provides an analysis of the market issues, including the current market drivers, barriers, and business segments, utility and vendor activity, and broad industry trends, associated with communicating and smart thermostats. Global market forecasts for unit shipments, average selling prices, and revenue, including revenue for related software and services, extend through 2025. The report also examines the key technologies related to communicating and smart thermostats and profiles the major industry players.

<https://www.navigantresearch.com/research/smart-thermostats>

2. *Leaderboard Report: Smart Thermostats* examines the strategy and execution of 17 manufacturers and software and services providers that are active in the global communicating and smart thermostat market. The vendors are rated on 12 criteria: vision; go-to-market strategy; partners; production strategy and roadmap; technology; geographic reach; sales, marketing, and distribution; product performance; product quality and reliability; product portfolio; pricing; and staying power. Using Navigant Research’s proprietary Leaderboard methodology, vendors are profiled, rated, and ranked with the goal of providing industry participants with an objective assessment of these companies’ relative strengths and weaknesses in the global smart thermostat market.

<https://www.navigantresearch.com/research/navigant-research-leaderboard-report-smart-thermostats>

Develop Conclusions and Recommendations: The evaluation team will work with the PAs to review findings and determine whether to pursue primary research on the impacts of Wi-Fi or learning thermostats. To assist with that decision the evaluation team will provide a high-level outline of an impact study approach, summarizing the type of data needed and modeling approach.

Potential budget: \$30,000 - \$50,000
Potential Timeline: July 2017 – September 2017

Study Name: RES 18 –Gas Condensing Boilers Losses and Savings Potential
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Impact Evaluation
Applicable Fuel(s): Gas

Overall Study Goal:

The goal of the study is to determine whether any of the areas for further research identified in the Gas Condensing Equipment Barriers study (RES16) have sufficient savings potential to warrant in-depth research. This study will conduct additional literature review and interviews with experts to determine whether the PAs should invest in deeper, targeted research in either area.

High-Level Description of Approach/Methodology:

In recognition of this goal, Navigant recommends the following approach.

Additional Research on Available Smart Control Technologies: The evaluation team will complete an additional literature review to better understand the Tekmar controls which modulate supply temperature based on indoor and outdoor temperature feedback. This could also include further interviews with Tekmar staff to better understand the mechanisms driving possible savings.

Explore Feasibility of a Study to Assess Savings Potential for Simultaneous Envelope and Control Improvements: This exploration would include two components.

- Using HES and HEHE data to assess the realistic market potential for implementing combined envelope and high-efficient boiler control improvements
- Exploring study design options to determine likely costs of field research in this area

Develop Conclusions and Recommendations: The evaluation team will work with the PAs to review findings and determine whether to pursue additional research

(Optional) Reach Out to Potential Regional Partners: If this study finds opportunities for further research that would be more effective at the regional level, this optional task would include interviews with possible regional partners to gauge interest in joint research.

Potential budget: \$20,000 - \$30,000
Potential Timeline: June 2017 – August 2017

Study Name: RES 19 – Water Heating, Boiler, and Furnace Cost Study
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Gas

Overall Study Goal:

The goal of the study is to provide the PAs with an understanding of the total and incremental costs associated with high efficiency water heater, boiler, and furnace equipment, compared to a retrofit/early retirement baseline and to a replace on burnout (ROB) baseline. This study will identify the equipment capacities that are most relevant to the PAs’ service area and then determine the dual-baseline incremental equipment and labor costs using data from the U.S. Department of Energy, from web scraping, and from a phone survey of HVAC contractors.

High-Level Description of Approach/Methodology:

Analyze Program Data to Determine Representative Sizes and Baselines: The evaluation team will use PA program data to determine the typical capacity installed in the service area for all three product types for different fuels that are available. This will enable the evaluation team to focus our data collection on the equipment sizes that are most relevant.

Adapt and Localize DOE Cost-Efficiency Curves to Determine Incremental Equipment Costs of Boilers and Furnaces: Over the past two years, the U.S. Department of Energy (DOE) has published detailed analyses of the incremental cost of efficiency for residential boilers and furnaces. Navigant assisted in producing these analyses, and our deep understanding of the DOE’s methodology enables us to thoughtfully extract and adapt relevant information from the DOE’s public analysis documentation. The evaluation team will adapt publicly-available DOE data for residential boilers and furnaces, updating the data to current dollar values and estimating the incremental equipment costs that would exist under a non-mandatory incentive program (as compared to DOE’s mandatory efficiency standards program). The result will be cost-efficiency curves for the product capacities and fuel types, identified as appropriate for Massachusetts, that depict how consumer costs change as efficiency increases.

Webscrape of Retail Prices to Determine Incremental Equipment Costs of Water Heaters: The most recent DOE analysis of water heaters was completed in 2010 and it is out-of-date for the purposes of this study because the water heater market has changed since 2010. As examples of these changes, Rheem has adjusted its heat pump water heaters (HPWHs) product offerings and GE has exited the HPWH market entirely. Because of these and other changes, the DOE’s cost analysis from 2010 does not represent the current market. Fortunately, ample retail price data is available from online retailers for water heaters. The evaluation team will use web scraping to gather data on retail prices (being sure to include costs of requisite installation hardware) and performance for residential gas and electric water heaters.

Phone Survey of HVAC Contractors to Determine Incremental Installation Costs: Installation costs vary with geography, so rather than relying on national DOE cost data, the evaluation team will interview HVAC contractors across the PAs’ service area, concentrating on the contractors with the largest number of jobs in the most recent tracking data. The evaluation team expects that for all three product types, the primary incremental change in installation costs will occur at the shift from non-condensing equipment to condensing equipment.

Potential budget: \$100,000 – \$120,000

Potential Timeline: June 2017 – November 2017

Study Name: RES 37 – HEAT Loan Analysis
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Electric and Gas

Overall Study Goal:

Countless evaluations have confirmed that the most significant barrier to residential customers making energy efficiency improvements to their home is the “initial” or “first” cost of the improvements. The PAs address this persistent barrier through core initiative-specific incentives, as well as through the HEAT loan. Since the PAs buy-down the interest associated with loans for eligible HES, HEHE, and Cool Smart measures, HEAT loans allow qualified customers to spread the initial cost of their projects, up to \$25,000 and over as many as seven years, without paying interest.² HES customers can also take advantage of the expanded HEAT Loan, which is funded by DOER and covers deeper energy retrofits, multi-unit single family properties, and offers grants to remove common pre-weatherization barriers.³

However, customers must complete several steps to secure a HEAT loan. These steps include: obtaining an estimate of measure installation costs from a contractor, submitting that estimate, as well as loan request documentation, to a PA vendor that verifies the measure is eligible for financing, taking the HEAT loan authorization form provided by that vendor to a participating lender, completing the lender’s application process, and being approved by the vendor for the loan. Some customers are unwilling to complete these necessary steps and fall out of the process midway, while others are not approved by participating lenders once they complete the process.

This study will focus on understanding how many customers go through the HEAT loan process but, for a variety of potential reasons, do not secure financing. By analyzing customer-specific data collected by the vendor that authorizes customer to seek a HEAT loan, as well as aggregated data from participating lenders indicating the number of customers that eventually received a HEAT loan, the team will determine the number of customer that fall out of the HEAT loan process.

We will also use surveys and/or interviews, to explore the following topics related to the PA’s HEAT loan and DOER’s expanded HEAT Loan:

- What are the primary reasons they are declined?
- Who are these customers? Are they disproportionately from a specific customer segment or geography?
- At what rate do these customers move forward with efficiency improvements without the HEAT loans?
- Are there opportunities to adjust delivery of the existing PA HEAT loan or DOER expanded HEAT loan that will enable increased adoption of core initiative measures? Relatedly, would a complementary financing offer, targeting lower participation customer segments, yield additional, cost-effective savings?

As currently scoped, this study will focus exclusive on nonparticipating HEAT loan customers. If determined to be beneficial, the team could expand the scope to include HEAT loan participants during the next planning phase. Another possibility would be to assess the feasibility of extending the HEAT loan to measures installed in multifamily buildings.

Potential budget: \$40,000 – \$120,000
Potential Timeline: June 2017 – November 2017

² <http://www.masssave.com/en/residential/heating-and-cooling/offers/heat-loan-program>

³ <http://www.masssave.com/residential/expanded-heat-loan>

Study Name: RES 38 – Low Income Process Evaluation
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Process Evaluation
Applicable Fuel(s): Electric and Gas

Overall Study Goal:

The PAs, in collaboration with the Low-Income Energy Affordability Network, have implemented a successful low income program for two decades. The program serves both single family and multifamily buildings, helping to improve the building stock and reduce the energy costs in buildings occupied by families living under 60% of the state's median income (SMI).

The most recent process evaluation of the Low-Income program was completed in 2012 and covered the 2010-2012 three-year implementation period. During that period, Massachusetts received funding through the American Recovery and Reinvestment Act of 2009 (ARRA), which was supplemental to state, federal weatherization, and PA funding and expanded weatherization assistance services to low income households across the state. According to Mass.gov, these funds enabled the formation of at least 30 new weatherization contracting firms and the hiring of 200-300 new workers to do this work.⁴

Given the different landscape facing the program today, the PAs are interested in a process evaluation of their single family and multifamily low income initiatives. Through a variety of primary and secondary research tasks including agency interviews, customer surveys, and comparative analysis with customers in other income groups, the evaluation team will complete the following tasks.

- Describe the current economic landscape for the two low income initiatives in the post-ARRA era, as well as PA and partnering agencies' abilities to meet customers' needs.
- Characterize the low income population and its current set of needs and attitudes around energy.
- Document the PAs' activities to meet the current needs of this population, including opportunities for program design, outreach, and educational enhancements.

For efficiency, this Low-Income program process evaluation will coordinate with the moderate income and multifamily studies that are also currently being proposed as Stage 1 plans.

Potential budget: \$160,000 – \$220,000
Potential Timeline: June 2017 – February 2018

⁴ <http://www.mass.gov/eea/docs/doer/arra/sep-eeccbg-wap-update.pdf>

Study Name: RES 39 – Low Income Market Assessment
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Electric and Gas

Overall Study Goal:

The PAs, in collaboration with the Low-Income Energy Affordability Network, have implemented a successful low income program for two decades. The program serves both single family and multifamily buildings, helping to improve the building stock and reduce the energy costs in buildings occupied by families living under 60% of the state’s median income (SMI).

The PAs are interested in better understanding how building owners, particularly those that own and operate multi-unit single family buildings (2-4 units) and medium to large multifamily buildings (5+ units), come to participate in the Low-Income program. To what extent is the program effective in identifying building owners and encouraging them to make an unplanned energy efficiency retrofit? What is the initiative’s process for doing so? Conversely, to what extent are building owners approaching the program seeking financial and/or technical assistance to make additional energy upgrades as part of a cyclical maintenance program? Are there ways to leverage the building owners’ interest in the initiative to maximize savings?

The evaluation team will explore how building owners engage with the Low-Income initiative and seek insight, likely through in-depth interview and/or focus groups, into the following topics:

- What is the best way to engage building owners?
- How does the program, in terms of timing, technical support, and financial incentives, optimize participation and energy savings?
- The initiative has historically covered the full cost of eligible energy efficiency measures. Would building owners consider installing additional efficiency improvements – beyond the program’s core measures – if the initiative covered a portion of the cost? In other words, are there opportunities to go further?
- What is the best timing to engage owners and provide initiative support, such as prior to or during cyclical maintenance retrofits?
- Would any of the engagement practices currently employed by the Low-Income initiative benefit other residential core initiatives?
- How would potentially expanding eligibility to moderate income customers (up to 120% of the SMI) affect the program’s implementation, as well as its savings potential? And how, if at all, would the program’s engagement strategies and incentive approaches change to serve this customer segment?

Potential budget: \$50,000 – \$100,000
Potential Timeline: July 2017 – December 2017

Study Name: RES 40 – Moderate and Low Income Market Characterization
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Electric and Gas

Overall Study Goal:

Under the Home Energy Services (HES) initiative, the PAs provide enhanced incentives to Moderate Income households, defined as 1-4 unit households with incomes between 60% to 80% of the state median income (SMI). The PAs are assessing the potential for expanding the offering to households from 81%-100% and 101%-120% of the SMI and are interested in research with the following objectives:

1. Estimate the size of the eligible population within the existing and potentially expanded moderate income classifications (60% to 80% SMI, 80% to 100% SMI, and 80% to 120% SMI) overall, by geographic boundaries (specific boundaries to be determined), and by building size and type.
2. Describe customer characteristics, such as tenure, relationship with energy provider, awareness of Mass Save and GasNetworks, and awareness of and participation in other initiatives (HES, Low-income Initiative, and Weatherization Assistance).
3. Assess customer response to the Moderate Income offering, including: interest and/or need for the Moderate Income services; perception of initiative services (e.g., incentive values, assessment) in motivating participation, barriers to participation (e.g., rental, time, and financial constraints), and; reaction to application and eligibility verification requirements.

To meet these objectives, the evaluation team will conduct a quantitative survey with income qualifying households to investigate customer characteristics, participation in programs, and perception of the Moderate Income offer. The study also includes optional qualitative tasks, including customer in-person or phone in-depth interviews, customer focus groups, and/or interviews with community action agencies. This exploratory qualitative research would provide additional depth and insight into these customers' circumstances and how those translate to potential participation in the Moderate Income offering.

The study will also mine survey data collected from Residential Baseline Study (RES1) for preliminary population characterization and sampling and incorporate findings from the HES Process Evaluation (RES 35).

Residential Baseline Study (RES 1): Survey data collected as part of RES 1 will serve as a sample source for a follow-up survey of potentially moderate income eligible customers as well as be mined to provide an initial population size estimate and building characterization. The survey will allow the evaluation team to loosely determine the proportion of the surveyed population that are within the Moderate Income ranges. The evaluation team will map American Community Survey (ACS) federal poverty level data (in ratio to income tables) to SMI categorizations to ensure the RES 1 data does not significantly under represent the Moderate Income population. A separate sample source may be purchased if systematic biases are apparent.

HES Process Evaluation (RES 35): Research conducted as part of this study will provide valuable context related to the Moderate Income offer, including early process barriers for participation. Interim findings will inform this research plan, survey design, and analysis.

Moderate Income customers may face different financial and hardship barriers than those eligible for low-income offerings. To contextualize Moderate Income characteristics, the survey and analysis of RES 1 data will also include customers identified as eligible for the low-income initiative (up to 60% SMI). This analysis will also be used for the Low-Income Process Evaluation (RES 38), if approved.

Potential budget: \$110,000 – \$220,000
Potential Timeline: June 2017 – November 2017

Study Name: RES 44 – Multifamily Lighting Impact and Program Net-to-Gross Evaluation
Study Manager/PA: TBD
Evaluation Vendor: Navigant
Primary Contact @ Vendor: TBD
Type of Study: Impact and NTG Evaluation
Applicable Fuel(s): Electric and Gas

Overall Study Goal:

The overall goals of this multifamily core initiative study include developing an updated common area lighting hours of use realization rate, updated lighting in-service rates for both common areas and in-unit, and an overall program net-to-gross (NTG) ratio. The evaluation will additionally assess updated vendor project reporting and quality assurance procedures. Historical strategic recommendations to improve the multifamily program will be tested through surveys with market stakeholders, through the NTG assessment, to assist the PAs in prioritizing and refining those strategies.

High-Level Description of Approach/Methodology:

Impact Evaluation & QA/QC Site Visits: The impact evaluation will rely onsite visits to verify installed measures to develop lighting in-service rates and install lighting loggers to develop lighting hours of use realization rates both of which are planned to be developed at 90/10 confidence/precision levels. During the site visits the evaluation team will also assess the comprehensiveness of Lead Vendor recommendations. As part of this process, the evaluation team will visit a sample of completed project sites with the QA/QC vendor. These site visits will be used to support the development of in-service rates for in-unit and common area lighting, the development of a realization rate for common area lighting hours of use, and to inform the NTG analysis. The evaluation team expects to complete additional on-sites, beyond what is available through the QA/QC vendor, to meet the confidence/precision requirements. This portion of the study will result in an updated common areas lighting hours of use realization rate, an updated in-service rate for both common area and in-unit lighting, an assessment of Lead Vendor project recommendation comprehensiveness, as well as analysis of the updated project reporting and communication procedures between the PAs, Lead Vendors, and the QA/QC vendor.

Net-to-Gross Surveys and Analysis: A sample of multifamily program participants and non-participants will be surveyed to explore participant intent; and to inform the NTG analysis. The survey will also explore with the surveyed market actors the suitability of recommended program strategies identified in previous Massachusetts multifamily program research projects. Decision makers will be segmented into three categories: renters (for lower cost measures such as lighting, smart power strips, televisions, etc.), property managers/owners (for higher cost measures such as thermal envelope, common area lighting, etc.), and condominium residents (combining both high and low cost measures). To ensure the results are valid across multifamily participant categories, outreach strategy will be tailored to effectively gather data from each. Renters and condominium residents will be surveyed through phone or web surveys. To gain additional insights into condominium owner and rental property owner/manager actions, focus groups will be conducted with a sample of stakeholders within these specific categories.

NTG ratios will be calculated from the research results outlined above. The analysis will apply techniques recommended in the 2011 Cross-Cutting Free-Ridership and Spillover Methodology Study Final Reports for both the residential and C&I sectors; the recent Net-to-Gross Methodology Research (TXC08) will be incorporated. The evaluation team will coordinate with the Special and Cross Cutting evaluation team with expertise in NTG methodologies. The analysis will survey customers who have been impacted within six months of participation and utilize findings from multiple actors or through self-reporting by participating customers, vendors, or other market actors that serve them. This portion of the study will result in an overall program NTG ratio and analysis of market stakeholder feedback on historical strategic recommendations around multifamily program improvement.

Potential budget: \$350,000 – \$500,000
Potential Timeline: May 2017 – February 2018

Study Name: RLPNC 17-3 – Smart Power Strip Metering Study
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Impact Evaluation
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

The Residential Baseline Study includes plug load metering of whole power strips at approximately 120 homes to establish baseline power usage (March – May 2017). After the baseline measurement period, Navigant will return to the homes and install smart strips (Tier level to be determined) at a subset of these 120 homes. Navigant will log these smart strips until September or October of 2017 and then return to collect the metering data. This study design should allow the PAs to calculate estimated energy savings for smart power strips. Data collection for this study is being handled under the Residential Retrofit contract (Navigant) and data analysis is being handled under the Residential Lighting and Products contract (NMR). NMR will work closely with Navigant on sample design and on-site protocols.

Potential budget: \$85,000 - \$110,000⁵
Next Steps/Owners: Develop Stage 3 Plan
Potential Timeline: May 2017 – Feb 2018

⁵ Note: We only include the Residential Lighting and Products portion of the budget. All data collection costs are budgeted separately under the Residential Retrofit contract.

Study Name: RLPNC 17-4 – Smart Power Strip Literature Review [Fast Track Study] and Customer Survey
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Impact Evaluation
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

The focus of this study will be on developing estimates for key impact evaluation inputs for smart strips including: in-service rates, persistence, and NTG ratios. We will begin with a limited literature review; to help control the total cost of this study we will place a cap on the number of hours dedicated to identifying sources. We anticipate conducting the literature review portion of this study as a Fast Track Study #FTS, perhaps completing it after approval of the Stage 1 Plan. Insofar as possible, we will differentiate findings related to Tier I Smart Strips from those related to Tier II Smart Strips.

After completing the literature review, we will begin to develop a customer survey designed to capture self-reported data to support the development of in-service rates, persistence, and NTG ratios. The sample frame for the customer survey is anticipated to include both upstream participants (identified via program records) and direct install participants. Careful coordination with the Residential Retrofit team will be necessary for the direct install customer survey (and which contractor will field the surveys is yet to be determined). We will also coordinate our efforts with the 17-5 General Products Consumer NTG Survey, described below.

Potential budget: \$90,000 - \$115,000 (Including Survey Costs)
Next Steps/Owners: Develop Stage 3 Plan
Potential Timeline: April 2017 – Oct 2017

Study Name:	RLPNC 17-5 – General Products Consumer NTG Survey
Study Manager/PA:	TBD
Evaluation Vendor:	NMR
Primary Contact @ Vendor:	TBD
Type of Study:	Market Effects
Applicable Fuel(s):	Electric
Study Status:	Scoping

Overall Study Goal:

The specific electric products offered as part of the PAs' portfolio tend to change over time. Offerings are updated frequently in response to changing standards, market conditions, consumer needs, and product availability. In addition, individual product offerings tend to represent only a small fraction of overall portfolio savings. Because of the evolving nature of the program, it does not make sense to spend a great deal of time, effort, and money to perform impact studies for individual measures. However, the PAs and EEAC agree that there is a need to establish a method for determining key impact evaluation inputs such as in-service rate, persistence, and NTG for products offered through the program now and in the future.

This study will seek to develop such a method and establish rules and procedures for the program as it moves forward. We will begin by conducting surveys with current product program participants to collect self-reported in-service, persistence, and NTG data. In addition, we anticipate in-depth interviews with key stakeholders including manufacturers, suppliers, and retailers to help determine the appropriate counterfactual. We will examine the data to look for patterns in key parameters based on the length of time since product requirements have existed. We may also be able to coordinate with the 16-10 What's Next for Products Study by incorporating questions to serve this study in the stakeholder in-depth interviews.

Ultimately, we hope to develop a general products program market adoption curve for current and future product program measures. Note that we may be able to coordinate survey efforts with the 17-4 Smart Power Strip Literature Review and Customer Survey Study, depending on product overlap, which could reduce total costs.

Potential budget:	\$150,000 - \$200,000
Next Steps/Owners:	Develop Stage 3 Plan
Potential Timeline:	May 2017 – Nov 2017

Study Name: RLPNC 17-6 – 2019 to 2021 Planning and 2017 Annual Report Market Adoption Models
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

We anticipate that the 2017 MAM effort will consist of four tasks: 1) Four meetings of a MAM Planning and Coordination Team and interim email discussions, 2) Revising the streamlined version of the 2016 A-line Annual Report MAM to reflect updated market share info, 3) Revising the 2016 Interim Reflector MAM, including adjusting inputs to reflector-specific data when appropriate and available, and 4) Revising the 2016 to 2018 Planning MAM based on updated market and program scenarios. The source and nature of the market share data and market and program scenarios will be decided by the planning and coordination team, but we anticipate drawing on information from the following studies: 16-2 Supplier Interviews, 16-5 Sales Data Analysis, 16-6 Web Scraping, 17-7 ENERGY STAR Partners Meeting, 17-9 On-site Saturation Panel, and market intelligence (press releases, news stories, etc.).

Potential budget: \$65,000 - \$105,000
Next Steps/Owners: Hold Planning Team Meeting in April or May
Potential Timeline: April 2017 – Feb 2018

Study Name: RLPNC 17-8 Market Scan Memos
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Process
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

Through the 16-11 Logic Model and Market Scan Study, NMR has been providing quarterly market scan update memos. June of 2017 will mark the last scheduled market scan update memo. This project will extend the market scan effort, aimed at identifying and summarizing evaluation findings from other jurisdictions on market trends, current and future market share, socket saturation and penetration, and NTG ratio estimates.

Potential budget: \$15,000 (Assumes three additional quarterly updates: September 2017, December 2017, and March 2018)
Next Steps/Owners: Develop Stage 3 Plan
Potential Timeline: July 2017 – March 2018

Study Name: RLPNC 17-9 – Massachusetts and New York On-site and Consumer Surveys
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Market Research
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

This study would continue the long time series of nearly annual examination into the lighting market from a consumer perspective. Results will also feed into other planned studies. For the past few years, these studies have included three main elements:

- Consumer survey
- On-site visits with new households (recruited via the consumer survey)
- On-site visits with panel households (recruited via consumer surveys in previous years)

While the in-home lighting inventories have been viewed as extremely valuable to the PAs, the consumer surveys have been less valuable, primarily serving as a vehicle for recruiting new households. New households have been important to the study for two main reasons: 1) as a means of testing for Hawthorne-like effects among panelists, and 2) as replacements to combat attrition. However, as of 2017, we have not detected any strong signs of Hawthorne-like effects among the panelists, and our panelist retention rate has been very high—in fact, in the past we have had to turn panelists away because we already met our quotas. As we begin to plan the next wave of this study, we have a pool of 465 active panelists in Massachusetts and 255 in New York. Based on historical retention rates, we anticipate we could complete about 345-365 Massachusetts visits and 185-200 New York visits in 2017 without the need to recruit additional households.

Therefore, for the stage 3 Plan this year, we will outline two sampling approaches:

1. The first will be our traditional approach of collecting panel data along with new visits recruited through a consumer survey.
2. The second, will be reducing the scope of the study to include only panelists and not fielding a consumer survey component.

The pros and cons of each approach will be outlined in the Stage 3 Plan—including budget. If the PAs choose to go with option 2, additional consumer surveys and new on-site visits could always be added to future on-site studies in 2018 if the PAs decide to field another wave of on-site visits in the future. Note that we have moved fielding of this study up by one additional month (as per the 2016 stage 3 plan) to allow for reporting to be completed by end of March 2018. We expect to deliver a preliminary results memo January 2018. #NTG

Potential budget: \$750,000 to \$1,600,000
Next Steps/Owners: Develop Stage 3 Plan
Potential Timeline: August 2017 – March 2018

Study Name: RLPNC 17-10 – Sales Data LED NTG Modeling
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Market Effects
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

Using the IRI Panel and Point-of-Sale data purchased from CREED under Study 16-5, the team will work with other CREED Initiative members and analysts to develop a national model of program impact on LED sales, with model specification dependent on the data available to the CREED initiative. The national model allows for state-level estimation of sales in the presence and absence of the program, which will then be used to develop a NTG ratio. Because this effort leverages funds with other PAs across the nation, the expected incremental cost beyond the data purchase is relatively small, and covers NMR participation in and review of the modeling process and results, Massachusetts-specific reporting, and any changes to the model requested by the PAs and EEAC consultants.

Potential budget: \$75,000 to \$125,000, with the high end of the range assuming the need to develop a Massachusetts specific model, should the PAs and EEAC Consultants reject the CREED Initiative Model.

Next Steps/Owners: Develop Stage 3 Plan

Potential Timeline: April 2017 – August 2017

Study Name: RLPNC 17-11 – Net-to-Gross Consensus Estimation Process
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Market Effects
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

NMR will compile a spreadsheet and related Word document summarizing the results and information gained from the various studies labeled #NTG. When possible, we will provide NTG estimates and market information separately for A-line, reflector, other specialty, and HTR bulbs. We will circulate the spreadsheet and Word document to the PA evaluators, PA implementers, EEAC Consultants, evaluation team members, and possibly lighting experts from outside of MA (the consensus team). The consensus team will review the available information, assess the strengths and weaknesses of each approach, rank the importance of the approaches. Each member will provide their own retrospective estimates of NTG for 2017 and prospective estimates of NTG through 2021. NMR will summarize the individual perspectives and deliver them to the consensus team, whose members will then take part in two separate webinars with the goal of developing consensus estimates of retrospective NTG for 2017 and prospective estimates through 2021.

Potential budget: \$50,000 to \$80,000, with the range reflective of the number of other studies the PAs and EEAC consultants approve that provide information to this effort.

Next Steps/Owners: Develop Stage 3 Plan

Potential Timeline: August 2017 – March 2018

Study Name: RLPNC 17-12 Lighting Decision Making
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: TBD
Type of Study: Market Assessment
Applicable Fuel(s): Electric
Study Status: Scoping

Overall Study Goal:

In 2016, using a panel of recent bulb purchasers supplied by InfoScout, NMR investigated what factors influence consumers' decisions to purchase efficient lighting and what barriers lead some consumers to continue purchasing inefficient alternatives. Results showed that program support for efficient bulbs continues to have a positive influence on the retail lighting market in Massachusetts. The results also provided insights into how the PAs can most effectively market efficient lighting going forward. In addition, this study should help provide useful context to NTG discussions. #NTG
For 2017, we anticipate taking a similar approach but will update the questions asked based on lessons learned from the 2016 study.

Potential budget: \$100,000 to \$175,000
Next Steps/Owners: Develop Stage 3 Plan
Potential Timeline: Sept 2017 - Dec 2017

C&I Research Area

Study Name: LED Market Monitor
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Geoff Barker
Type of Study: Baseline
Applicable Fuel(s): Electric
Status: Stage 3 Planning

Overall Study Goal:

The primary objective of this study will be to provide the PAs and the EEAC consultants, on an ongoing basis, with information and data that can be used to update the characterization of the baseline for LED lamps and fixtures. The proposed scope of work is motivated by our observation in the LED Market Effects Study (and echoed by the PAs and consultants) that important national and regional LED market developments are occurring so quickly that they are difficult to capture in the normal cycle of study approval, detailed design, research, analysis, and reporting. This information is needed on a more timely basis for effective program and evaluation study planning.

The principal activity of the project will be to compile information on LED lamp and fixture adoption, pricing, technology development, and promotion at the customer level and at various levels and channels of the supply chain. We will also compile information on changes in the structure of the supply chain as larger numbers of manufacturers enter the market for LED light sources and fixtures. This project will not involve new primary data collection from market actors in Massachusetts and the established comparison areas. The PAs have recently pursued extensive primary data collection on LEDs from these firms, and these efforts will soon be augmented by creation of a distributor panel to collect lamp and fixture sales data. Rather, we will use it to develop assessments key baseline elements specified by the PAs, which will likely include:

- Customer adoption of LEDs (saturation, sales, market share by product category, event (retrofit, replacement, new construction), and market segment)
- Promotion and specification practices among distributors, contractors, lighting service contractors, and designers
- Volume and technical characteristics of available products
- Manufacturer product development, distribution, and promotion strategies
- Product pricing
- Other characteristics as specified by the PAs

We anticipate that the sources for this information will include interviews with manufacturers and other well-informed market observers, secondary data sources such as NEMA Shipment Reports, market research project reports from program sponsors nationwide, including MA, and the U. S. Department of Energy, product qualification programs, such as the Design Lights Consortium, “web-scraping” for in information on product availability and pricing, and industry publications.

The deliverables for this project will be quarterly memoranda summarizing findings on key commercial LED market indicators.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

DNV GL will work with the PAs and EEAC Consultants to refine the project work plan, focusing on definition of the market indicators to be developed and the information and data sources to be developed and applied.

Task 2: Data Compilation and Analysis

DNV GL will proceed to compile and analyze the data and information needed to develop the market indicators specified in the Work Plan. We will assess the suitability and quality of that information (reliability of sources, appropriateness of sample approaches for survey data, vintage) on an ongoing basis. We will provide periodic updates of progress, including assessment of the suitability and quality of the data, to the PAs and EEAC consultants, and will adjust methods as needed based on feedback received from those parties. Any data collection efforts will be coordinated with other on-going lighting research and proposed evaluations. DNV GL has already convened an internal working group made up of key lighting evaluation staff.

Task 3: Reporting

DNV GL will prepare memos summarizing the results of the data compilation and analysis every three months for review by the PAs and the EEAC. Based on feedback received, we will propose potential changes and improvements to the data collection and reporting practices. After three quarterly rounds, we will conduct a workshop with the PAs and EEAC consultants to assess the value of this effort and decide whether and how it should be continued.

Budget: ~ \$120,000

Next Steps/Owners: Stage 3 Work Plan Development

Timeline: April 2017-January 2017 (This work is targeted to be completed in time to inform the next 3-year plan)

Study Name: Impact Transition Planning
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Dan Barbieri
Type of Study: Impact
Applicable Fuel(s): Electric and Gas
Status: Stage 3 Planning

Overall Study Goal:

The primary objective of this study will be to build and maintain momentum on implementing the principles set forth in the Massachusetts Commercial and Industrial Gross Impact Evaluation Framework (“Impact Framework”). The Impact Framework represented a fundamental reexamination of traditional impact evaluation methodologies, the changing needs of programs and program administrators, and the role of evaluation in responding to those needs. The framework document articulated some opportunities, both general and specific, for transitioning the Massachusetts impact evaluation paradigm, including:

1. Initiate a Traditional⁶ evaluation of Custom measures soon and consider evolving it into a longer duration structure such as Multiyear staged or continuous Rolling.
2. Alternatively, perform Reconnaissance on some Custom offerings to investigate whether the previous evaluation results appear to be stable.
3. Lay the groundwork for Multiyear staging with a year one effort for Small Business Lighting, followed by non-lighting plus a small supplemental sample of lighting in year two, and subsequent lower precision samples to build a three to five-year “sliding window” multiyear evaluation.
4. Test quarterly data delivery as a proof of concept of the Staged evaluation structure.
5. Explore the feasibility of continuous data delivery for Rolling evaluation current with the aforementioned quarterly data delivery test.
6. Identify candidates for Reconnaissance work, such as variable speed drives or prescriptive gas measures.
7. Revisit desk reviews as an evaluation technique and consider developing an evaluation file review protocol to define the manner in which file review findings may trigger research or serve as a basis for unbiased tracking correction.

Building and maintaining momentum on this impact evaluation transition may benefit from division into “tracks” not unlike the Baseline Transition plan. A list of Impact Transition tracks may include, but not be limited to, the following:

- A. Evaluation Planning. The current paradigm tends to have numerous studies starting concurrently and racing to finish by the PAs’ annual reporting deadline. Advance and/or continuous planning can provide relief, and the Impact Framework proposes an updated planning process, which would be operationalized on this track.
- B. Sampling Methods. This track would convene statistical experts on sampling and opportunities to apply multiyear techniques or otherwise innovate on sampling approaches. This also may include retrospective examination of prior data for homogenous study groups that may deviate from the recent end-use dominant paradigm.
- C. Data Delivery. Timely results benefit from quicker starts, so this track would engage PA and evaluator data teams to examine and test more expeditious transfer and cleaning of tracking data.
- D. Tool Development/Refinement. The Impact Framework developed a tool box that is an integral component of the impact planning process. This track will own the maintenance and development of this resource as the processes evolve.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development. DNV GL will work with the PAs and EEAC to develop a work plan and project schedule that ensure that the study objectives are met. Tracks, track members, and any new tasks will be defined at this time.

Task 2: Transition Activities. The tracks will proceed according to the work plan, and this task will encompass the majority of research, planning, and analytical effort defined therein.

Task 3: Stakeholder Engagement. A study manager will host orderly and regular check-ins within the various tracks, and an overall study manager will coordinate communications and feedback from the tracks with the full stakeholder group.

Task 4: Reporting. Each track will have reporting objectives such as periodic PowerPoint briefings and annual published summaries.

Budget: ~ \$150,000, Time and Materials
Next Steps/Owners: Stage 3 Work Plan Development
Timeline: May 2017 – December 2017 (This work is targeted to be completed in time to inform the next 3-year plan)

⁶ Terminology such as Traditional, Staged, Multiyear, Reconnaissance, and Rolling are defined in the Impact Framework.

Study Name: Impact Evaluation of Custom Gas Installations
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Chad Telarico
Type of Study: Impact Evaluation
Applicable Fuel(s): Natural Gas
Study Status: Stage 1 Proposed - Scoping

Overall Study Goal:

The objective of this impact evaluation is to provide verification or re-estimation of natural gas energy savings estimates for a sample of Custom electric projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine the final realization rates for Custom gas energy efficiency offerings installed in 2016. Realization rates will be separately determined for Columbia Gas, National Grid and Eversource, as well as at the statewide level. The evaluation sample for this study will be designed in consideration of the 80% confidence level for therms savings.

Traditionally, Custom gas measures have been evaluated as a whole program. The last custom gas impact evaluation was completed on the 2013 program year. The Impact Evaluation Framework, currently being completed, may result in alternative impact evaluation segmentation and selection strategies. The final measure offerings or customer segments have not yet been selected for evaluation as of the time of this document. In mid-2017, the evaluation team will begin discussions on the next Custom gas evaluation.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Develop Sample Design
- Develop Group Measurement and Evaluation Plans
- Data Gathering and Analysis
- Report Writing and Follow-up

High-Level Description of Approach/Methodology:

Task 1: Develop Sample Design

The goal of the study is to design a sample to estimate realization rates for natural gas therm savings. The target for annual therm savings will be set at the traditional $\pm 10\%$ at 80% confidence at the statewide level.

Task 2: Develop Site Measurement and Evaluation Plans

DNV GL will develop site specific measurement, verification and analysis (MVA) plans for each sampled site. The plans outline on-site methods, strategies, monitoring equipment placement, calibration and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized.

Task 3: Data Gathering and Analysis

Data collection will include physical inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, short-term metering of usage and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each energy conservation measure (ECM). On-site evaluation procedures and site analysis will be presented in a site report for each sampled site. DNV GL will apply the model-assisted stratified ratio estimation methodology to aggregate the site results and expand to the study population and other segments of interest.

Task 4: Report Writing and Follow-up

DNV GL will provide the PAs with a written report containing the evaluation results and key findings.

Budget: TBD (Dependent on selected evaluation strategy and sample size)
Next Steps/Owners: Continued Scoping Discussions
Timeline: May 2017 – April 2018 (This work is targeted to be completed in time to inform the next 3-year plan, it is understood that P63 will likely influence this study)

Study Name: Impact Evaluation of Custom Electric Installations
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Chad Telarico
Type of Study: Impact Evaluation
Applicable Fuel(s): Electric
Study Status: Stage 1 Proposed - Scoping

Overall Study Goal:

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for a sample of Custom electric projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine the final realization rates for Custom Electric energy efficiency offerings installed in 2016. Realization rates will be separately determined for National Grid and Eversource, as well as at the statewide level. The evaluation sample for this study will be designed in consideration of the 90% confidence level for energy (kWh) and the 80% confidence level for coincident peak summer and winter demand (kW).

Traditionally, Custom electric measures have been evaluated as part of a rotation. The Impact Evaluation Framework, currently being completed, may result in alternative impact evaluation segmentation and selection strategies. The final measure offerings or customer segments have not yet been selected for evaluation as of the time of this document. In mid-2017, the evaluation team will begin discussions on the next Custom electric evaluation.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Develop Sample Design
- Develop Group Measurement and Evaluation Plans
- Data Gathering and Analysis
- Report Writing and Follow-up

High-Level Description of Approach/Methodology:

Task 1: Develop Sample Design

The goal of the study is to design a sample to estimate realization rates for a number of measurements (annual kWh, percent of kWh savings on-peak, summer on-peak kW, and winter on-peak kW). While the primary variable of interest for the sample design is annual kWh savings, the PAs are also interested in coincident peak summer and winter kW because it is used in the ISO-NE Forward Capacity Market (FCM). The target for annual kWh will be set at the traditional $\pm 10\%$ at 90% confidence, while the target for summer and winter kW will be set at $\pm 10\%$ precision at 80% confidence during the design.

Task 2: Develop Site Measurement and Evaluation Plans

DNV GL will develop site specific measurement, verification and analysis (MVA) plans for each sampled site. The plans outline on-site methods, strategies, monitoring equipment placement, calibration and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized.

Task 3: Data Gathering and Analysis

Data collection will include physical inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, short-term metering of usage and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each energy conservation measure (ECM). On-site evaluation procedures and site analysis will be presented in a site report for each sampled site. DNV GL will apply the model-assisted stratified ratio estimation methodology to aggregate the site results and expand to the study population and other segments of interest.

Task 4: Report Writing and Follow-up

DNV GL will provide the PAs with a written report containing the evaluation results and key findings.

Budget: TBD (Dependent on selected measures and sample size)
Next Steps/Owners: Continued Scoping Discussions
Timeline: May 2017 – April 2018 (This work is targeted to be completed in time to inform the next 3-year plan, it is understood that P63 will likely influence this study)

Study Name: Upstream Water Heater Deemed Savings Impact Evaluation
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Jeremiah Robinson
Type of Study: Impact
Applicable Fuel(s): Natural Gas
Status: Stage 3 Planning

Overall Study Goal:

The primary objective of this study will be to develop deemed gross natural gas savings values for the recently revamped C&I Upstream Water Heater program offering. The primary pieces of information required to achieve this objective are as follows:

- Program billing & tracking data;
- Baseline equipment/fuel;
- Performance curves;
- Equipment operating efficiency;
- Water heating & other loads on equipment.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

DNV GL will work with the PAs and EEAC Consultants to ensure this effort will meet the needs of the 2019-2021 three-year plan. We will develop a work plan and project schedule that ensures we this project will be complete by the end of 2017. We will discuss with the PAs and EEAC Consultants the appropriate role for this evaluation to take in determining or applying the baseline in coordination with the Baseline Framework.

Task 2: Planning

DNV GL will interview program managers to understand the program logic, discuss how to recruit participants for interviews and/or metering, and to help determine what kind of metering is feasible. We will leverage the billing and tracking data for the 2016 program and explore gathering water usage data in order to characterize the population by building, sector, and equipment type, and to determine if a billing analysis is a viable method for estimating savings. In discussion with the PAs and EEAC, we will also evaluate the options for gas and/or proxy metering. This initial fact finding exercise will determine the course of the evaluation, and which bulleted items in the flow chart are included.

Task 3: Baseline Research

Depending on the data collection approaches selected in task 2, the team will determine the appropriate research methods to verify or establish measure baselines. This may include market actor interviews, literature review, or other data collection methods consistent with the Baseline Framework document.

Task 4: Field Data Collection

DNV GL will perform field data collection on approximately (100) 2016 participating businesses, performing equipment verification, participant interviews, and on-site metering (if cost-effective). The interviews will be designed to inform standard practice and facility operating characteristics with respect to hot water use for estimating operating efficiency and EFLH.

Task 5: Analysis and Reporting

The team will analyze the data collected to produce forward-looking deemed savings values for the Upstream Water Heating program offering, and report on the findings of the data collection efforts and associated analysis. The analysis methods will be determined during the Planning task, and will depend on information gathered through Research and Field Data Collection. This effort is expected to produce retrospective results, which will also be used to inform future program savings estimates. We will work with the PAs to ensure they understand the how to interpret the results for use in the next three-year plan.

Budget: ~ \$250,000 to \$400,000 (dependent on methods and sample sizes)
Next Steps/Owners: Stage 3 Work Plan Development
Timeline: April 2017—December 2017 (This work is targeted to be completed in time to inform the next 3-year plan)

Study Name: C&I Deep Dive Analyses
Study Manager/PA: Riley Hastings, Eversource
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Tony Davis
Type of Study: Market Characterization
Applicable Fuel(s): Gas and Electric
Study Status: Stage 1 Proposed - Scoping

Overall Study Goal:

The deep dive analysis and report mechanism has been designed using feedback from the PAs and EEAC Consultants concerning the need for a rapid response analysis and reporting mechanism that can be implemented on a more compressed timeline than traditional studies.

- Data driven but do not fit within the scope of the annual C&I Customer Profile analysis and reporting structure or timeline.
- Provide in-depth context and deep analysis on compressed timelines.

High-Level Description of Approach/Methodology:

Task 1: Idea Identification and Investigation

Potential topics for deep dive analyses will be submitted by the PAs and EEAC Consultants. As topics are submitted DNV GL will engage with the PA Data Management lead, C&I Customer Profile lead, and the topic submitter to clarify the proposed deep dive topic and identify initial questions and primary areas of interest. Per PA guidance in the design of the deep dive process, DNV GL will conduct an initial feasibility assessment to ensure that the MA C&I Evaluation database contains the require data to answer the proposed deep dive topic.

Once the PA Study Managers have approved the potential deep dive idea as feasible DNV GL will expand the engagement group to include the EEAC Consultants and any other identified stakeholders to ensure that the currently proposed deep dive topic and basic and base questions identified are in line and approved to continue to Task 2.

Task 2: Analysis Plan Creation

Once approval is provided by the PA Study Managers and EEAC Consultants an analyses plan will be developed for submission to the stakeholder group. A unique analysis plan will be developed for each potential deep dive topic and will include the following items:

- Overall deep dive goal
- Key questions and metrics
 - Including approach/methodology for each item
- Detailed budget
- Detailed timeline

The draft analyses plan will be submitted to the stakeholder group for comments. A working group meeting will be held to discuss the analysis plan and determine next steps for the potential deep dive topic. The development of the analysis plan is not considered a guarantee that the deep dive will occur and the PAs and EEAC will have multiple potential next steps including Proceed to Analysis, Place Deep Dive on Hold, and Propose Deep Dive as Study. DNV GL will keep all analyses plan to be used later if the PAs and EEAC Consultants place a Deep Dive on Hold.

Task 3: Deep Dive Analysis and Reporting

The analysis, feedback, and communication details for each deep dive will be unique depending on the question being investigated. Each unique process will be detail in the analysis plan submitted and approved prior to work being started on the project. It is anticipated that, as work is completed on each Deep Dive analysis, additional questions which were not detailed in the analysis plan may be occur. These questions will be reviewed by DNV GL, the PAs, and the EEAC consultants to determine if:

- The question should be answered under the current deep dive analysis plan.
- The question is a new deep dive topic idea and should be included in the list of potential deep dives for further review

Budget: TBD (individual deep dive analyses are expected to range from \$15,000 to \$40,000)

Next Steps/Owners: Continued Scoping Discussions

Timeline: The deep dive process is a continuous timeline going live on April 2017

Study Name: LED Net-to-gross Analysis
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Kristina Kelly
Type of Study: Net to Gross
Applicable Fuel(s): Electric
Status: Stage 3 Planning

Overall Study Goal:

The primary objective of this study will be to develop net-to-gross (NTG) ratios for Commercial and Industrial (C&I) LED products in Massachusetts. The 2015 LED Spillover Analysis study found a NTG ratio of 1.42 for upstream non-linear C&I LED lighting and this study will build upon that research to develop an updated NTG ratio that can be used in the 2019-2021 three-year plan for LED screw-based lamps as well as linear LEDs.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

DNV GL will work with the PAs and EEAC Consultants to ensure this survey effort and analysis will meet the needs of the 2019-2021 three-year plan.

Task 2: Data Collection

Through task 1, DNV GL will work with the PAs and EEAC consultants to determine the appropriate data collection methods to support the development of NTG ratios for C&I LED products. This may include phone interviews with end-users and/or market actors, leveraging existing data collected via previous evaluation work, on-site inventories, or other data collection methods consistent with evaluation best practices and recommended NTG methodologies.

Any data collection efforts will be coordinated with other on-going lighting research including project 53, project 58 and the proposed market monitor and upstream lighting process evaluations. DNV GL has already convened an internal working group made up of key lighting and NTG evaluation staff.

Task 3: NTG Analysis

The results of the on-site inventories and NTG surveys will be analyzed for use in the 2019-2021 three-year plan. We propose to use question sequences and scoring approaches similar to those used in the 2015 Study.

Task 4: Reporting

The team will report on the findings of the survey and associated analysis. We will work with the PAs to ensure they understand the how to interpret the results for use in the three-year plan.

Budget: \$150,000-\$500,000
Next Steps/Owners: Stage 3 Work Plan Development
Timeline: May 2017- December 2017 (This work is targeted to be completed in time to inform the next 3-year plan)

Study Name: Impact Evaluation of Prescriptive Gas Installations
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Chad Telarico
Type of Study: Impact Evaluation
Applicable Fuel(s): Natural Gas
Study Status: Under Consideration

Overall Study Goal:

The objective of this impact evaluation is to provide verification or re-estimation of natural gas energy savings estimates for a subset of Prescriptive gas projects. The results of this study will be used to determine new deemed savings values and/or savings parameters for selected Prescriptive gas energy efficiency offerings installed in 2015/2016. Evaluation results will be determined at the statewide level. The evaluation sample for this study will be designed in consideration of the 80% confidence level for therms savings.

Traditionally, Prescriptive gas measures have been evaluated at the end-use level. Recent Prescriptive impact evaluations include pre-rinse spray valves, steam traps and programmable thermostats. The Impact Evaluation Framework, currently being completed, may result in alternative impact evaluation segmentation and selection strategies. The final measure offerings or customer segments have not yet been selected for evaluation as of the time of this document. In mid-2017, the evaluation team will begin discussions on the next Prescriptive gas evaluation.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Develop Sample Design
- Develop Group Measurement and Evaluation Plans
- Data Gathering and Analysis
- Report Writing and Follow-up

High-Level Description of Approach/Methodology:

Task 1: Develop Sample Design

The goal of the study is to design a sample to provide new statewide deemed savings values and/or savings parameters for selected end-uses and/or program offerings. The primary variable of interest for the sample design is annual therms savings. The target for annual therms savings will be set at the traditional $\pm 10\%$ at 80% confidence during the design.

Task 2: Develop Site Measurement and Evaluation Plans

DNV GL will develop end-use specific measurement, verification and analysis (MVA) plans for each selected measure type. The plans outline on-site methods, strategies, monitoring equipment placement, calibration and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized.

Task 3: Data Gathering and Analysis

Data collection will be dependent on the end-uses or program offerings selected for evaluation. Analysis methods may include billing analysis or engineering analysis. Engineering analysis will include physical inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, short-term metering of usage and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each energy conservation measure (ECM). DNV GL will apply the model-assisted stratified ratio estimation methodology to aggregate the site results and expand to the study population and other segments of interest.

Task 4: Report Writing and Follow-up

DNV GL will provide the PAs with a written report containing the evaluation results and key findings.

Budget: TBD (Dependent on end-uses, program offerings to be evaluated)
Next Steps/Owners: Continued Scoping Discussions
Timeline: 11 months (This study is targeted for completion by the end of the current 3-year plan, it is understood that P63 will likely influence this study)

Study Name: Impact Evaluation of Prescriptive Electric Installations
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Chad Telarico
Type of Study: Impact Evaluation
Applicable Fuel(s): Electric
Study Status: Under Consideration

Overall Study Goal:

The objective of this impact evaluation is to provide verification or re-estimation of electric energy and demand savings estimates for a subset of Prescriptive electric projects through site-specific inspection, monitoring, and analysis. The results of this study will be used to determine new deemed savings values and/or savings parameters for selected Prescriptive electric energy efficiency offerings installed in 2016. Evaluation results will be determined at the statewide level. The evaluation sample for this study will be designed in consideration of the 90% confidence level for energy (kWh) and the 80% confidence level for coincident peak summer and winter demand (kW).

Traditionally, Prescriptive electric measures have been evaluated as part of a rotation. Recent Prescriptive impact evaluations include Prescriptive Chillers and Air Compressors. One of the possible candidates is Lighting as it has not been evaluated for some time. The Impact Evaluation Framework, currently being completed, may result in alternative impact evaluation segmentation and selection strategies. The final measure offerings or customer segments have not yet been selected for evaluation as of the time of this document. In mid-2017, the evaluation team will begin discussions on the next Prescriptive electric evaluation.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Develop Sample Design
- Develop Group Measurement and Evaluation Plans
- Data Gathering and Analysis
- Report Writing and Follow-up

High-Level Description of Approach/Methodology:

Task 1: Develop Sample Design

The goal of the study is to design a sample to provide new statewide deemed savings values and/or savings parameters for selected end-uses. While the primary variable of interest for the sample design is annual kWh savings, the PAs are also interested in coincident peak summer and winter kW because it is used in the ISO-NE Forward Capacity Market (FCM). The target for annual kWh will be set at the traditional $\pm 10\%$ at 90% confidence, while the target for summer and winter kW will be set at $\pm 10\%$ precision at 80% confidence during the design.

Task 2: Develop Site Measurement and Evaluation Plans

DNV GL will develop end-use specific measurement, verification and analysis (MVA) plans for each selected measure type. The plans outline on-site methods, strategies, monitoring equipment placement, calibration and analysis issues. The PAs and EEAC will provide comments and edits to clarify and improve the plans prior to them being finalized.

Task 3: Data Gathering and Analysis

Data collection will include physical inspection and inventory, interview with facility personnel, observation of site operating conditions and equipment, short-term metering of usage and EMS trends. At each site, evaluators will perform a facility walk-through that focuses on verifying the post-retrofit or installed conditions of each energy conservation measure (ECM). DNV GL will apply the model-assisted stratified ratio estimation methodology to aggregate the site results and expand to the study population and other segments of interest.

Task 4: Report Writing and Follow-up

DNV GL will provide the PAs with a written report containing the evaluation results and key findings.

Budget: TBD (Dependent on end-uses, program offerings to be evaluated)
Next Steps/Owners: Continued Scoping Discussions
Timeline: 11 months (This study is targeted for completion by the end of the current 3-year plan, it is understood that P63 will likely influence this study)

Study Name:	Commercial Plug Load Market Assessment
Study Manager/PA:	TBD
Evaluation Vendor:	DNV GL team
Primary Contact @ Vendor:	Tom Mauldin, NMR
Type of Study:	Market Assessment
Applicable Fuel(s):	Electric
Status:	Under Consideration

Overall Study Goal:

The primary objective of this study will be to characterize the commercial plug load market, which includes any device or appliance that is plugged into a standard electrical outlet located in a commercial building. Assessing this market is challenging because it cycles quickly and transforms in different increments depending on the technology, and because user patterns and behaviors can vary considerably. Moreover, while the installed base is specific to Massachusetts, the market and its future direction are national in scope—suggesting a possible upstream or midstream program focus. We anticipate that the study will assess the prevalence, energy consumption, and savings opportunities of key plug load end uses in Massachusetts. In addition, the study will explore the key market trends and actors as well as identify the barriers to and possible strategies for achieving savings.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

The DNV GL team will work with the PAs and EEAC Consultants to develop a scope of work that meets their needs.

Task 2: Literature Review

A literature review will help identify saturation, energy consumption, and savings potential estimates of the various plug load technologies (preferably by building type) and then extrapolate those estimates to Massachusetts based on the square footage in those building types. A literature review may also help identify market trends and key market actors related to the various plug load technologies; however, the rapid changes in the market and differences between Massachusetts and other areas may limit the usefulness of a market trend analysis.

Task 3: Analysis of On-site Inventory Data

The data already collected through the Existing Building Market Characterization Study includes counts of office equipment, in particular monitors, as well as vending machines, kitchen equipment, and miscellaneous devices. However, because plug loads were lower priority than other major end uses, the plug load data was not consistently collected, especially at larger sites; therefore, the plug load data is generally more comprehensive for small and medium facilities. Due to the inconsistent nature of the data, we will restrict the analysis to those sites that have more comprehensive plug load data and only analyze results across the entire market rather than for individual sectors. In addition to estimating the penetration and saturation of different plug load end uses, we will apply deemed annual usage and savings estimates (where available) based on secondary data to estimate the annual consumption and potential savings from plug load devices across the Massachusetts commercial market.

Task 4: In-depth Telephone Interviews

We recommend conducting 30 in-depth telephone interviews with the following groups: PA program staff; national IT equipment vendors such as Dell, HP, and IBM; national value-added resellers; corporate energy managers, facility managers, and IT managers; and industry experts as identified in other interviews. In these interviews we will seek to understand the key market actors and how they influence potential energy savings associated with key equipment, ascertain emerging market trends, identify barriers to achieving savings, and identify possible strategies to overcome those barriers. These qualitative findings will provide insights and context to help understand the quantitative findings from the other tasks.

Task 5: Syndicated Data Analysis (Optional)

The IT equipment market is heavily studied, and many data sources could provide valuable information for this assessment. Our team will purchase and analyze data from Harte Hanks, which provides estimated counts for 63 categories of technology at the individual business-location level. These data would help us to identify key IT end uses and trends by building type. Moreover, merging the individual-location data with the C&I Evaluation Database would provide a valuable tool for targeted marketing.

Task 6: Overall Reporting

The team will provide interim reports on the findings of each task. In addition, we will develop an overall report that integrates the results across all tasks and provides strategic recommendations for programs as well as possible future research.

Budget:	\$175,000 to \$225,000 for core tasks; \$300,000 to \$400,000 with optional task
Next Steps/Owners:	PA/EEAC to review for approval of Stage 2 or Stage 3 Work Plan Development
Timeline:	Nine months (This study is targeted for completion by the end of the current 3-year plan)

Study Name: Process Evaluation of Upstream Lighting Program
Study Manager/PA: TBD
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Christopher Dyson, DNV GL
Type of Study: Process
Applicable Fuel(s): Electric
Study Status: Stage 1 Proposed

Overall Study Goal:

The last process evaluation of the MA C&I Upstream Lighting Program (Upstream Lighting) was conducted as part of the first evaluation of the program (2012-2013). Now an impact evaluation of the program is underway and is planned to wrap up in May 2017. Preliminary results of this impact evaluation and new changes that are being implemented suggest that the timing for a process evaluation of the program within the next 6 to 12 months is good to help inform and assess program delivery. A new process evaluation would also be useful to provide additional insights on the linear LED market, including both the barriers and the opportunities. At the time of the last process evaluation, this important technology was not part of the upstream program.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

The work scope in this document builds off of the original process evaluation conducted for Upstream Lighting (Project 17) while also exploring process-related issues identified during recent impact evaluations of the program (Projects 49 and 58). It also addresses current EEAC and PA interest in the linear LED market, including both barriers and the opportunities. Under this task, we will develop a detailed work plan that would include additional detail such as sampling approaches, researchable questions, and more detailed budgets.

It should be noted that any data collection efforts will be coordinated with other on-going lighting research including project 53, project 58 and the proposed market monitor and upstream LED NTG evaluations. DNV GL has already convened an internal working group made up of key lighting evaluation staff.

Task 2: In-Depth Interviews with Program Managers, Implementation Contractors

These in-depth interviews will explore: 1) any changes in the design or implementation of the program since the last evaluation; 2) some of the process evaluation issues (e.g. erratic reporting from some participating lighting distributors) which have been identified by recent impact evaluations of this program; 3) their observations about the character and future direction of the MA linear LED market in particular and the C&I LED market in general; 4) how the program is adjusting incentive levels in the fact of recent rapid declines in LED prices; 5) whether participating customers are aware that they are receiving incentives from the program (this was an issue of great interest in the previous evaluation because it can impact program attribution); 6) any lingering barriers to program participation; and 7) Any lessons learned from program delivery.

Task 3: In-Depth Interviews with Lighting Market Actors

These in-depth interviews will explore: 1) their levels of activity within the program and possible barriers to more active participation; 2) if and how they make participating customers aware that they are receiving incentives from the program; 3) their levels of satisfaction with the incentive levels, program requirements, and program management; 4) their suggestions for program improvements; and 5) their observations about the character and future direction of the MA linear LED market in particular and the C&I LED market in general. Project 53 last interviewed the lighting distributors in the early fall of 2016 and so adequate time will have passed to allow for the collection of new market information from this lighting market actor group without raising concerns about respondent fatigue.

Task 4: Surveys of Participating Customers

The Upstream Lighting Program is relatively unique among upstream/midstream programs in collecting contact information for end user customers who participate in the program. We will survey a representative sample of these customers to explore: 1) their motivations for undertaking their lighting projects and choosing the lighting technologies; 2) their level of awareness of the fact that they were receiving price discounts from the program; 3) their levels of satisfaction with any program processes or requirements they may have encountered; and 4) their suggestions for program improvements.

Task 6: Analysis and Reporting

The team will provide the EEAC and the PAs with a written report containing the analysis results. The format of this report will be consistent with other DNV GL reports.

Budget: \$130,000 - \$150,000
Next Steps/Owners: Work Plan Development
Timeline: May 2017 – August 2017 (this schedule may be adjusted based on the roll-out of planned program changes)

Cross Cutting Research Area

Study Name: MA Cross-Cutting Codes and Standards: Immediate Surveys and Follow-up Interviews
Study Manager/PA: William Blake, National Grid
Evaluation Vendor: NMR Group, Inc. and Cadmus Group
Primary Contact @ Vendor: Betty Tolkin, NMR Group
Type of Study: Process Evaluation
Applicable Fuel(s): Electric and Gas
Study Status: Scoping

Overall Study Goal:

The objective of immediate surveys is to document the CCSI training efforts and the immediate reactions of the trainees; while the follow-up interviews explore how much the trainees have made use of what they have learned a few months after the trainings. Findings from both the immediate surveys and follow-up interviews may be factored into assessing attribution of savings from code compliance to the CCSI.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Develop Immediate Survey Instruments and Follow-up Interview Guides
- Data Gathering and Analysis
- Report Writing

High-Level Description of Approach/Methodology:

Task 1: Develop Immediate Survey Instruments and Follow-up Interview Guides

NMR and Cadmus will modify the immediate survey instruments currently in use to cover the areas included in future trainings and any other issues the PAs and EEAC wish to address. Similarly, NMR and Cadmus will modify the follow-up interview guides used in the 2016 study to focus on how the attendees have used information from the 2015 IECC trainings. This task will include reviewing the previous IDI report to make sure the new guide asks questions addressing any issues raised, evaluating what information PAs are interested in, and making sure the interview guide thoroughly addresses researchable questions without overburdening the interviewees with questions that do not provide valuable feedback.

Task 2: Data Gathering and Analysis

NMR will interview 40 individuals who have attended residential trainings on the 2015 IECC; 20 who work as code officials and 20 who work in the building trades. Similarly, Cadmus will interview 40 different individuals who have attended commercial trainings on the 2015 IECC, again, aiming for 20 code officials and 20 building trade workers. These 80 interviews will take place approximately six months after training attendance. Massachusetts adopted the 2015 IECC at the start of 2017, so the respondents will likely have had some experience with the new code.

The immediate survey paper forms will be filled out and collected at the end of each classroom training.

Task 3: Report Writing

NMR (residential) and Cadmus (commercial) will provide the PAs and EEAC written reports summarizing the findings from the follow-up interviews. The findings from the follow-up interviews will also be used to inform attribution of savings from code compliance to the CCSI, possibly through presentation to a Delphi panel. NMR (residential) and Cadmus (commercial) will also provide memos summarizing the findings from the immediate surveys at the end of every six trainings, or at different intervals, if desired by the PAs and EEAC. The budget assumes six immediate survey memos are provided—three residential and three commercial.

Potential budget:

\$140,000 - \$180,000 for Follow-Up Interviews; \$100,000 - \$150,000 for Immediate Survey Analyses based on plans to continue the trainings after June 2017; the budget assumes three residential and three commercial memos are provided.

Next Steps/Owners:

Initial Scoping Discussions (NMR Group and Camus Group/PAs/EEAC)

Potential Timeline:

July 2017 – December 2018 for Immediate Survey Analyses; July 2017 – November 2017 for Follow-up Interviews

Study Name: Stretch Code Baseline Study and Compliance Assessment
Study Manager/PA: Bill Blake, National Grid
Evaluation Vendor: NMR
Primary Contact @ Vendor: Zack Tyler
Type of Study: Baseline/Compliance Assessment
Applicable Fuel(s): All
Study Status: Scoping

Overall Study Goal:

The objective of this study is to measure the baseline characteristics and calculate code compliance rates for Stretch Code homes that were permitted under the 2015 Stretch Code Update that went into effect on January 1, 2017. In a recent report, NMR identified what may be significant savings opportunities for the CCSI in stretch code municipalities given the increased stringency of the new stretch code requirements. This is a placeholder work plan and any work related to this task would likely take place in 2018.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

NMR will work with the PAs and EEAC Consultants to develop a scope of work that meets their needs.

Task 2: Conduct a Baseline Study of Stretch Code Homes

NMR will conduct a baseline study of 50 single-family homes in stretch code municipalities that were permitted and built under the 2015 Stretch Code Update.

Task 3: Calculate Baseline Characteristics, Compliance Values, and Potential Savings

After completion of the site visits, NMR will analyze the baseline characteristics associated with the sample. As part of this effort NMR will create REM/Rate models for each of the sampled homes. The REM/Rate models will then be leveraged to calculate compliance for the sample using two different approaches. Compliance will be assessed using the MA-REC compliance methodology and also by comparing the measured HERS scores to the HERS score requirements specified in the 2015 Stretch Code Update.

NMR will assess the gross potential savings associated with compliance enhancement efforts in stretch code municipalities based on the sampled homes. Compliance enhancement potential will be assessed in two ways. First, NMR will compare the baseline characteristics for measures included in the MA-REC approach to the prescriptive requirements of the 2015 IECC (this is the code that stretch code requirements are now based on). Second, NMR will identify the potential savings associated with decreasing the HERS scores (i.e., increasing the efficiency of homes) in non-compliant homes until they meet the minimum HERS score requirements of the 2015 Stretch Code Update. This is the same approach that was used in the recent assessment of stretch code compliance enhancement potential.

Task 4: Report Writing and Follow-up

NMR will provide the PAs with a written report containing the evaluation results and key findings.

Potential budget: \$150,000 - \$300,000
Next Steps/Owners: Initial scoping discussions (NMR Group/PAs/EEAC)
Potential Timeline: March 2018 – August 2018

Study Name: Attribution Study of the Residential New Construction Program and the Code Compliance Support Initiative
Study Manager/PA: Bill Blake, National Grid
Evaluation Vendor: NMR
Primary Contact @ Vendor: Zack Tyler
Type of Study: Net to Gross
Applicable Fuel(s): All
Study Status: Scoping

Overall Study Goal:

The objective of this net to gross evaluation is to estimate the savings in single-family residential new construction that may be attributed to the Residential New Construction Program (RNC Program) and the Code Compliance Support Initiative (CCSI) for the 2019-2021 program period. Because the RNC Program and the CCSI both address the single-family residential new construction market, there would likely be overlaps in any estimates of net savings developed separately for the two efforts. The study will therefore develop a single estimate of savings that may be attributed to the CCSI and the RNC Program, and will attribute above-code savings to the latter and savings from getting to code (or closer to code) to the former.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

NMR will work with the PAs and EEAC Consultants to develop a scope of work that meets their needs.

Task 2: Develop Materials for Delphi Panel

The study will rely on a Delphi panel to estimate the counterfactual for the energy efficiency values of key building components. NMR will develop a Delphi panel questionnaire designed to produce inputs to REM/Rate modeling of RNC Program single-family homes and non-program homes, under the assumption that the RNC Program and CCSI had not existed in the 2012 to 2017 period. The panel will be provided with 2010-2011 and 2015-2016 energy-efficiency values for RNC Program homes (from program records) and non-program homes (from baseline studies), documentation of the RNC Program's and CCSI's activities between 2011 and 2017 and into the future, results from surveys of participants in CCSI training, code changes during the period, expected future code changes, a summary of expected changes in the lighting market, and market background information. Panelists will be asked to estimate both retrospective and prospective counterfactual values, and prospective with-RNC Program/CCSI values.

Task 3: Delhi Panel Data Collection

NMR will recruit a panel of approximately 15 experts in residential new construction to serve on the Delphi panel. There will be two rounds of surveys. In the first round, panelists will be asked to review the information and provide retrospective estimates of different practices without the RNC Program and CCSI, and prospective estimates of different practices both with and without the RNC Program and CCSI. In the second round, panelists will review a summary of responses from the first round, including reasoning for responses, and will have a chance to revise their first-round responses.

Task 4: Analysis

As-built REM/Rate files provide records of actual building practices. To model the counterfactual building practices—what they would have been if the program had not existed—NMR will change the REM/Rate values of practices in 2015-2016 RNC Program homes (from program files) and 2015-2016 non-program homes (from the baseline study) to match the Delphi panel's estimates of the percentages of program and non-program homes with specific above-code or energy-efficient practices in the absence of the RNC Program and the CCSI. Separately, NMR will change REM/Rate values to match panelists' estimates of prospective counterfactual and with-RNC Program/CCSI values. The prospective estimates will be for the 2019-2021 program period.

NMR will calculate the overall energy use with the as-built REM/Rate files (separately for program and non-program homes), and also with counterfactual changes in building practices. The difference between the as-built energy use and the counterfactual energy use will be the estimate of net savings. Net savings for program and non-program homes will then be multiplied by the corresponding numbers of single-family homes built in 2016-2017. These savings will be divided by REM/Rate-derived savings from the sample of program homes to calculate the NTG ratio. NMR will follow a similar process for prospective estimates, in that case using panelists' counterfactual and with-RNC Program/CCSI values. Above-code savings will be attributed to the RNC Program and savings from getting to code (or closer to code) will be attributed to CCSI.

Task 5: Report Writing and Follow-up

NMR will provide the PAs with a written report containing the evaluation results and key findings.

Potential budget: \$200,000 - \$250,000
Next Steps/Owners: PA/EEAC Go-ahead for developing Stage 1 work plan
Potential Timeline: August 2017 – February 2018

Study Name: Attribution Study of the Code Compliance Support Initiative – Non-Residential New Construction
Study Manager/PA: Bill Blake, National Grid
Evaluation Vendor: NMR
Primary Contact @ Vendor: Zack Tyler
Type of Study: Net to Gross
Applicable Fuel(s): All
Study Status: Scoping

Overall Study Goal:

The objective of this net to gross evaluation is to estimate the savings in non-residential new construction that may be attributed to the Code Compliance Support Initiative (CCSI) for the 2019-2021 program period. While the Non-Residential New Construction (NRNC) Program and the CCSI both address the non-res new construction market, the planned net savings from the NRNC Program are much greater than those of CCSI (50 times more electric savings and 71 times more gas savings), so it would be inappropriate to address them together. The study will therefore develop an estimate of savings that may be attributed solely to the CCSI.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

NMR will work with the PAs and EEAC Consultants to develop a scope of work that meets their needs.

Task 2: Update Savings Calculator

NMR will update the savings calculator previously developed by the PAs. This will consist of incorporating new gross technical potential savings estimates by comparing prescriptive code requirements to baseline practices.

Task 3: Develop Attribution Estimates

There are two options for developing attribution estimates. In the first option, NMR, informed by secondary research and conversations with program staff, will develop estimates of baseline compliance (beginning of code cycle), natural compliance (end of code cycle/NOMAD), and compliance w/CCSI (end of code cycle with influence) to adjust gross savings estimates.

In the second option, similar to an approach currently being implemented in Rhode Island, NMR will identify building practices that have improved over time and determine which have been targeted by the CCSI. NMR will analyze CCSI survey responses (follow-up interviews and immediate surveys), interviews with program staff, and baseline findings to make qualitative judgements about attribution at the measure level. Overall attribution will be a function of measure-level attribution and the relative importance of various building components.

Under either of these options a Delphi panel of experts could be substituted for NMR to make the attribution assessments.

Task 4: Report Writing and Follow-up

NMR will provide the PAs with a written report containing the evaluation results and key findings.

Potential budget: \$50,000 - \$150,000
Next Steps/Owners: Continue scoping discussions (NMR Group/PAs/EEAC)
Potential Timeline: August 2017 – February 2018

Study Name: C&I NTG Data Collection
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: Monica Nevius
Type of Study: Impact Evaluation
Applicable Fuel(s): Electric and Gas
Study Status: Scoping

Overall Study Goal:

The objective of this impact evaluation is to provide NTG ratios for prescriptive and custom (non-unique) electric and gas projects incentivized by the PAs in 2016. The results of this study will be used to determine the prospective NTG ratios to be applied to the programs for these end-uses in the next three-year cycle. For both custom and prescriptive measures NTG ratios will separately determined for each PA and program, as well as at the statewide level. The evaluation sample for this study will be designed in consideration of the 90% confidence level for energy (kWh or therm) where samples of projects, rather than a census of projects, are to be selected.

Tetra Tech staff will be responsible for data collection and calculation of the NTG ratio, and providing the C&I team with a clean data set and documentation. The C&I evaluation team will be responsible for the sample design, sample selection, prioritization of projects for implementation via Tetra Tech’s CATI survey lab (vs. interviews with unique custom projects by DNV GL engineers), weighting and analysis, and final reporting. Given the involvements of different evaluation teams, this will require close coordination among the teams throughout this study.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives include the following:

- Data collection with participating customers (to estimate free-ridership and participant spillover)
- Data collection with influential vendors (to confirm or adjust participating customers’ self-reports of free-ridership)
- Data collection with trade allies (to estimate nonparticipant spillover)
- Determination of a NTG ratio for each customer, and an estimate of nonparticipant spillover by PA and statewide.

High-Level Description of Approach/Methodology:

Task 1. Re-program CATI surveys to incorporate revised NTG questions

The C&I evaluation team (under Project 73) is tasked with reviewing and adjusting the questions and algorithms for both prescriptive and custom measures to account for baselines. Tetra Tech staff will closely coordinate with the C&I team during this review (this coordination for the cross-cutting team is already funded under TXC45). Tetra Tech will re-program the survey instruments and update the analysis code to reflect these revisions.

Task 2: Data Gathering and Analysis

Using the sample provided by DNV GL, Tetra Tech will reach out to participating customers and trade allies to collect the survey data following the approach documented in the NTG methodology framework. Tetra Tech will also provide weekly response rate reports and a summary of any issues encountered.

Task 3: Determine NTG ratio for each customer and nonparticipant spillover

Tetra Tech will calculate the NTG ratio for each surveyed customer and the nonparticipant spillover rate for vendors and provide clean datasets with the survey data to DNV GL for weighting, analysis, and reporting.

Potential budget: TBD (Dependent on selected measures and sample size)
Next Steps/Owners: Initial Scoping Discussions (Tetra Tech/DNV GL/PAs/EEAC)
Potential Timeline: May 2017 – January 2018

Study Name: Low-Income MF Health NEI Study
Study Manager/PA: Beth Delahajj
Evaluation Vendor: NMR Team
Primary Contact @ Vendor: Bruce Tonn, Three³, Inc.
Type of Study: Impact Evaluation
Applicable Fuel(s): Natural Gas, Electric
Study Status: Scoping

Overall Study Goal:

The purpose of this study is to evaluate the health NEIs attributable to improving the energy efficiency of low-income, affordable multifamily (MF) buildings funded by the PAs in the Commonwealth of Massachusetts (MA). We propose a phased approach to the study. In Phase I, a residential occupant survey would be administered to three groups of randomly selected LIMF households: a pre-weatherized group (treatment), a group weatherized one year previously (comparison), and a control group of nonparticipants. Changes in health outcomes will be estimated by comparing the pre-weatherized group to the comparison group and the control group. This phase can be completed by February 2018. The second phase, to be conducted one year after weatherization of the treatment group, will involve follow-up surveys with the treatment group and the control group. We estimate that the second phase can be completed by August 2019, but the timeline depends on the time required to complete the weatherization of the treatment group.

Monetary impacts of improvements in health will be estimated for both project phases using current medical expenditure and healthcare utilization data specific to MA/New England (NE). Study results will produce estimates of monetary impacts to households that complement values developed for the single-family (SF) housing sector. This project will be led by Three³ with assistance from NMR Group and Tetra Tech. This project will benefit from synergies with national research on this topic being conducted by Three³ through grants from The JPB Foundation.

Secondary Evaluation Goal(s)/Objective(s):

Specific research objectives may include the following:

- Complement LISF health and safety NEI estimates
- Gain insights into how health impacts may differ across MF building types
- Gain insights into how health impacts may differ across MF building functions (e.g., senior vs. supportive housing)
- Gain insights into how different utility bill paying schemes (e.g., heat costs included in rent vs. individually subsidized utility bill payments) may impact health impacts

High-Level Description of Approach/Methodology:

Below we present a high-level description of the key tasks involved in our proposed approach

Task 1: Develop Sample Design

This task entails specifying how many MF buildings of what type (treatment, comparison, and control) to include in the sample.

Task 2: Recruit Treatment and Comparison Group Buildings

Contact building owners to gain consent to include their buildings in the study.

Task 3: Collect Household Contact Information and Recruit Potential Respondents

Acquire household contact information for the residential survey. Market survey participation, (e.g., placing flyers in common areas).

Task 4: Develop Data Collection Instruments

The residential occupant survey will be developed and pre-tested. Questions will be added that pertain to the MF sector (e.g., health benefits of installing EE lighting in outdoor areas and common areas).

Task 5: Data Gathering and Analysis

Administer a mixed methods survey (e.g., web/paper survey or web/phone survey, depending on available contact information) in late summer or fall 2017 and identify statistically significant changes in health and other related variables. Administer the surveys again one-year post weatherization to the sampled buildings and units (estimated to take place in winter or early spring of 2019).

Task 6: Information Gathering for Monetization

Update MA/NE specific health care costs, wage rates, etc. Revise SF monetization approaches as needed to make them align with the MF context, as needed (e.g., the baseline fire ignition data from the SF sector will need to be replaced with MF data).

Task 7: Report Writing and Follow-up

The evaluation team will provide the PAs with a written report containing the evaluation results and key findings.

Potential budget: Phase I: \$270,000 to \$330,000; Phase I + II: \$480,000 to \$540,000

Next Steps/Owners: Scoping discussions (NMR & Three³/PAs/EEAC)

Potential Timeline: Phase I: June 2017 to February 2018; Phase II: February 2018 to August 2019

Study Name: Residential Lighting Health & Safety NEI Study
Study Manager/PA: TBD
Evaluation Vendor: NMR Team
Primary Contact @ Vendor: Greg Clendenning, NMR
Type of Study: Impact Evaluation
Applicable Fuel(s): Natural Gas, Electric
Study Status: Scoping

Overall Study Goal:

The purpose of this study is to evaluate the health and safety NEIs attributable to installing both energy efficient and improved lighting in residential buildings. This is a placeholder work plan which will depend, in part on the results of the NEI Framework Study. Any work related to this task would likely take place in 2017 or 2018.

High-Level Description of Approach/Methodology:

Installing longer-lasting, energy-efficient lighting in residential settings, especially in hard-to-reach locations, may result in fewer falls and injuries because the lighting will have to be replaced less frequently. This is likely to have more of an effect on the elderly population, but applies to the residential sector in general. In addition, exterior energy efficient lighting may result in reduced risks of crime. Additional impacts that could be explored are: improved school performance, improved mental health and well-being, and a decrease in frequency of headaches.

Because there has been very little research conducted on the impacts of the installation of energy efficient and improved lighting on reducing falls and crime, the team proposes conducting an initial scoping study in order to explore the sample sizes and methods that will likely be needed to detect an effect of the lighting measures and produce statistically defensible results. We have begun preliminary research into the incidence rates of household trips and falls as well as the impacts of interventions to reduce falls.⁷ However, further research is needed to determine estimated incidence rates among the non-senior population in order to develop the sample design. With respect to reductions in crime attributable to improved lighting, the team has not found evidence of crime reduction beyond anecdotal evidence. Therefore, the team proposes an initial study to assess the feasibility of incorporating reductions in crime into this evaluation.

To improve the feasibility of the study, the team proposes limiting the study to the PAs residential programs with directly installed lighting, such as low-income programs (single and multifamily), HES audits and residential multifamily retrofits, and, if NEIs are found, develop a method to extrapolate the findings to upstream lighting.

The team notes that these potential NEIs could cover a wide range of applications and sectors, including the entire multifamily (MF) sector as well as parking lots, universities and commercial buildings.

Task 1: Scoping Study and Sample Design

NMR and Three³ will conduct further research on household trips and falls, the impacts of interventions to reduce falls, and reductions in crime attributable to improved lighting. After completing further research the team will develop a proposed sampling plan and methods.

Task 2: Memo and Recommendation

The team will produce a written memo presenting the findings of the scoping study, sample design and recommendation as to the feasibility of a full study

Potential budget: \$25,000 to \$30,000 (scoping only)
Next Steps/Owners: Scoping discussions (NMR & Three³/PAs/EEAC)
Potential Timeline: June 2017 to December 2018

⁷ For example, according the Center for Disease Control, 28.6% of seniors in Massachusetts have experienced a fall in the past year, while 10.6% of seniors have experienced an injury due to a fall in the past year. Further, some research suggests that household interventions that include modifications of the home environment (e.g., installation of guardrails and grab-bars), minimizing medications, and exercise routines can reduce falls by 24%. See: Center for Disease Control. 2016. Falls and Fall Injuries Among Adults Aged >= 65 Years – United States, 2014. Morbidity and Mortality Weekly Report. September 23, 2016

Study Name: C&I Non-energy impact study
Study Manager/PA: TBD
Evaluation Vendor: NMR
Primary Contact @ Vendor: Noel Stevens
Type of Study: Impact Evaluation
Applicable Fuel(s): All
Study Status: Scoping

Overall Study Goal:

The objective of this study is to update, and expand on the past C&I NEI research to provide a comprehensive set of NEI values for use in regulatory cost-benefit analysis and program sales and marketing. This is a placeholder work plan and any work related to this task would likely take place in 2018.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

DNV GL will work with the PAs and EEAC Consultants to develop a scope of work that meets their needs.

Task 2: Update and expand the existing set of NEI estimates to cover all C&I programs and NEIs

Based on the results of the on-going NEI framework study, the team will select the most appropriate and cost-effective techniques for estimating NEIs for all program and NEI types. The study would likely revise and update NEIs associated with the current measure mix in the PAs retrofit, and new construction programs, as well as provide NEI estimates for replace on failure and upstream programs. In addition, this research may expand the range of NEI estimates for retrofit and new construction measures to provide estimates for additional NEIs such as increased comfort, worker productivity and health and safety impacts for the range of program types. The research will likely employ a range of estimation techniques that include primary research, life-cycle cost analysis, and avoided cost analysis.

Task 3: NEI Marketing analysis

This task study will leverage the body of exiting MA C&I NEI research to provide program implementation staff and trade allies with relevant and usable information for selling and marketing NEI programs to C&I customers. The research will identify NEI information that is important to different stakeholder groups, explore the most effective means of communicating NEI information to customers, and develop resources for presenting NEI information to stakeholders. This research will likely consider a range of alternatives for the means of delivering NEI information to stakeholders such as white papers, marketing materials, or a web-hosted application.

Task 4: Report Writing and Follow-up

DNV GL will provide the PAs with a written report containing the evaluation results. The results of the NEI marketing study may include webinars, power-points, marketing materials, or a web-hosted tool to be determined through the project scoping.

Potential budget: \$500,000 - \$1,300,000
Next Steps/Owners: Initial scoping discussions (DNV GL/PAs/EEAC)
Potential Timeline: March 2018 – June 2019

Study Name: 2016 Residential Customer Profile
Study Manager/PA: Riley Hastings, Eversource
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Rich Crowley
Type of Study: Market Characterization
Applicable Fuel(s): Gas and Electric
Study Status: Stage 1 Conceptual Framework

Overall Study Goal:

The goals of the 2016 Residential Customer Profile Study (RCPS) are to collect, extract, transform, and load (ETL) and analyze the energy efficiency program tracking data and billed usage data for all Residential gas and electric customers served by the Massachusetts Program Administrators (PAs).

The principal research objectives of the RCPS are to:

- Integrate the 2016 billing and tracking data into the PA's Residential Evaluation Database to provide a standardized source of program tracking and billing data to support ongoing evaluation efforts
- Document the processes used to compile and standardize PA data using the Phased Logical Data Map (LDM)
- Characterize the Massachusetts Residential energy efficiency market by analyzing recent customer usage, savings, and program participation data—using charts, tables, and geographic analyses
- Provide an Expedited, Draft, and Full Residential Customer Profile Report summarizing the data contained in the Residential Evaluation Database
- Enable linking and integration of data collected by the Residential and Cross-Cutting evaluation teams over the course of ongoing projects

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

The DNV GL team will develop the work plan for the RCPS with guidance and direction from the PAs and Massachusetts Energy Efficiency Advisory Council (EEAC) Consultants, and in accordance with stakeholders' reporting priorities (i.e. preferred report length, reporting timelines, reporting metrics, depth of analysis, summary or interim reports, etc.). We will work with the stakeholders to define and present metrics in the draft Stage 3 work plan, and will respond to the guidance provided by the PAs and EEAC in the work plan development and review.

Task 2: Data Collection, ETL, Evaluation Database Development, and Ongoing Database Management

On March 22, 2017, The DNV GL team submitted a data request for the 2016 PA data for all Residential customers. We are compiling the PAs billing and tracking data for integration into the Residential Evaluation Database and will develop the logical data map and accompany summary documentation on the data provided by the PAs. The DNV GL team will follow the weekly update process and facilitate the monthly data user group coordination call with the PA Lead, EEAC Consultants, and Evaluation Contractor team. DNV GL will coordinate with individual Evaluation Firms at the approval of the PA lead on any ad hoc data requests or analyses.

Task 3: Expedited Preliminary Analysis Results and Logical Data Map reporting

The DNV GL team will use phased LDM documentation and the Expedited Preliminary Analysis report for the PAs and EEAC to ensure the data provided by the PAs has been accurately loaded by DNV GL. We will present preliminary analysis results to the PA data management lead during the weekly progress meetings, and will give monthly working group presentations to provide opportunities for timely PA and EEAC feedback. Revisions to the PAs data and additional data supplied by the PAs in response to the LDM and Expedited Preliminary Analysis report will be integrated into the database for the full Customer Profile Report.

Task 4: Residential Customer Profile Analysis and Reporting

The in-depth analysis and reporting will be modeled after the previous Residential Customer Profile report, taking into account any guidance from the PAs and EEAC Consultants received over the course of that report.⁸

Potential budget: TBD

Next Steps/Owners:

- 1.) PAs provide the 2016 tracking and billing datasets (*request issued March, 2017*)
- 2.) DNV GL populates the evaluation database
- 3.) DNV GL works with PAs and EEAC consultants to draft a Stage 2 or 3 scope of work.

Potential Timeline: March 2017–March 2018

⁸ The 2013-2015 Residential Customer Profile report is ongoing as of 5/10/2015.

Study Name: 2016 C&I Customer Profile
Study Manager/PA: Whitney Brougher, National Grid
Evaluation Vendor: DNV GL
Primary Contact @ Vendor: Tony Davis
Type of Study: Market Characterization
Applicable Fuel(s): Gas and Electric
Study Status: Stage 3 Planning

Overall Study Goal:

The goal of the 2016 C&I Customer Profile is to collect, organize and analyze the energy efficiency program tracking data and billed usage data for all Massachusetts C&I gas and electric customers served by the Massachusetts Program Administrators (PAs).

The principle research objectives of the 2016 study are similar to the 2011, 2012, 2013, 2014, and 2015 Profile reports:

- Characterize the continued evolution of the Massachusetts C&I energy efficiency market by analyzing recent customer usage and program participation data.
- Update C&I Customer Profile reports to include the 2016 data and update time series charts and tables.
- Update and maintain a single evaluation database to minimize the burden of data requests for PA teams and provide a consistent source of program tracking and billing data to support ongoing evaluation efforts.
- Document the processes used to consolidate and normalize PA data, and recommend enhancements to tracking systems to improve accuracy of results.
- Continue to enable linking of collected data from PA studies.

New research objectives proposed for the 2016 study include:

- Include analysis and reporting for completed MA C&I Deep Dives as approved by the PAs and EEAC Consultants.
- Revisions of the layout and content of the 2016 Customer Profile reports in order further enhance overall readability, navigation, and usability of the reports across the multiple stakeholder groups.
- With the PAs and EEAC consultant’s guidance, create a standard definition of “Outlier” and add outlier analysis to the Comprehensive C&I Customer Profile report where appropriate.
- Modify all tables so that the same totals (savings, usage, incentives, etc.) are shown in all tables provided throughout the Expedited and Comprehensive reports.

High-Level Description of Approach/Methodology:

Task 1: Work Plan Development

DNV GL will develop the work plan for the 2016 C&I Customer Profile Report with guidance and direction from the PAs and EEAC Consultants. DNV GL will engage the PAs and EEAC Consultants to discuss stakeholders’ reporting priorities. Topics to be discussed include but are not limited to report length, reporting timelines, depth of analysis, and summary or interim reports.

Task 2: Data Collection, ETL, Evaluation Database Development, and On-going Database Management

The billing data request for 2016 PA data for all C&I customers was submitted on March 22, 2017; the tracking data request is upcoming. The 2016 database build will follow a similar process as in prior years. On-going database management will provide expanded support for current and future C&I project and will also aid in the continued improvement of the database over the course of the entire year.

Task 3: Evaluation Database Summary and Expedited C&I Analysis and Report

To ensure the data provided is as accurate as possible, DNV GL will continue refining the Summary of Data Completeness (SDC) memo and documentation in 2016. Upon submission of the SDC memo, work will begin on the 2016 Expedited C&I Customer Profile report. The analysis included in the Expedited report will be considered preliminary pending PA approval that the data summarized in the report is correct. The report will be updated as needed with additional/clarifying PA data provided during the review process.

Task 4: Comprehensive C&I Customer Profile Analysis and Report

The in-depth analysis and report will be similar to previous C&I Customer Profiles with the changes and enhancement outline during the meeting proposed in Task 1.

Budget: \$450,000+

Next Steps/Owners: Stage 3 Work Plan Development

Timeline: April 2017 – March 2018 (This work is targeted to be completed in time to inform the next 3-year plan)

