New Construction Evaluation Plan

Market and Impact Evaluation

Final

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Evaluation in the Context of Covid-19

Since late 2019, the world began facing the Covid-19 pandemic. This pandemic has had and will have profound impacts on the world in general and New York specifically. As of November 2020, non-essential businesses in New York State (and elsewhere) have made dramatic shifts in how they do their business including requiring employees to work from home or ceasing operations altogether. Although the State has entered Phase 4 of reopening as part of NY Forward, social distancing is still recommended, and it is uncertain as to when or if people's lives and businesses will ever return to pre-Covid normal.

These changes will require the NYSERDA and the Contractor to monitor the impacts of Covid-19 and adjust evaluation activities accordingly. It is uncertain how the pandemic will affect response rates for interviewees. The data collection plans herein take into account these considerations but are subject to change based on guidance from NYSERDA and other stakeholders.

The Contractor will continue to monitor New York's response to Covid-19 and will monitor responses to all data collection activities. Contractors and partner organizations might be undergoing hardships due to the pandemic and be unable to respond to interview requests or surveys. The Contractor will reevaluate data collection activities if respondents provide pushback about the appropriateness of fielding a survey or if response rates are notably lower than expected.

The Contractor has conducted several primary research efforts since spring 2020, including surveys of nonparticipating residential and business customers in upstate New York as well as surveys with HVAC, lighting, mechanical designers, and other contractors. The response rates and customer engagement with surveys is still moderately strong. For the segments of the population more affected by Covid-19 (e.g., K-12 schools, health care facilities), the response to and engagement with surveys and interviews has slowed down. The Contractor will actively consider the Covid-19 challenges and potential impact on research by carefully selecting the outreach strategy for research and tailoring research scripts and instruments in consideration of customer challenges.

In light of the Covid-19 Pandemic, the Contractor shall make adequate precautions to ensure completion of a methodologically sound evaluation while ensuring appropriate health and safety protocols are in place. Procedurally, Covid-19 precautions for impact evaluation comprise:

1. Minimizing or eliminating field data collection, replacing this with virtual assessments or other approaches.
2. Establishing safety procedures for on-site data collection.

The following table summarizes the risk mitigation strategies to be taken under the above two paradigms, with the advantages and disadvantages of each:

Risk Mitigation Strategy	Advantages	Disadvantages
Minimization of Field Data Collection		
■ **Virtual Assessments.** Virtual assessments comprise guided walkthroughs of the premise, with the appropriate facility contact assisting via use of the Streem application. Streem is	■ This approach allows for reliably verification of key inputs (such as equipment	■ Contractor cannot verify key inputs pertaining to building envelope and HVAC improvements (such as air infiltration, duct leakage, or

Risk Mitigation Strategy	Advantages	Disadvantages
browser-enabled, and allows for continuous video recording, snapshots, and notes taken via stylus by Contractor or facility contact staff.	nameplates, saturation of efficient lighting)	window Solar Heat Gain Coefficient). ▪ May be more suitable for commercial facilities where contact may be knowledgeable about systems being examined.
▪ **Model Desk Review.** Under model desk reviews, Option D analyses are completed based on existing energy model documentation (such as HERS files developed in REM/Rate or Ekotrope).	▪ This approach is the lowest-cost model-based approach as it removes all customer contact and data collection requirements.	▪ This approach inherently has the greatest uncertainty as it does not allow for verification of key inputs. ▪ When this approach is selected, Contractor's preference is to increase sample size to reduce uncertainties in M&V results.
▪ **Whole Program Billing Data Analysis.** This approach omits analysis of building-specific performance and instead compares the billed use of program-incented projects to similar residences/facilities that have not received incentives that are otherwise (to the extent knowable) similar in building type, weather zone, and use.	▪ This approach provides a measurable energy impact compared to a counterfactual of naturally occurring adoption, and a below-average cost as it does not include field data collection.	▪ Energy impacts are compared against naturally occurring adoption, and not prevailing energy code (thus are inherently net impacts rather than gross). ▪ Model estimates will state "what" but not "why"; shortfalls in energy savings compared to expected values will in many cases not be readily explainable.
Establishing Safety Procedures for Field Data Collection		
▪ **Application of guidelines from the Center for Disease Control and New York State Department of Health to ensure safety for Contractor staff and NYSERDA customers.** The Contractor will perform a risk assessment regarding the health and safety situation in New York prior to conducting site visits. The Contractor will follow strict safety protocols, including but not limited to face masks, tight fitting gloves, and appropriate social distancing. Should equipment need to be touched, it will be sanitized before and after our team has touched the equipment. The Contractor recognizes that health considerations	▪ Contractor will ensure best-in-class field data collection in support of this evaluation.	▪ Risk can be mitigated but not negated entirely. ▪ Risk is higher in residential rather than commercial facilities, due to higher occupancy per square foot. ▪ If applied unevenly, there is a risk that results will be biased. An assessment based solely on risk profile of a given site may result in better rigor on results in single family new construction, as density and associated risk are traditionally higher in multifamily settings.

Risk Mitigation Strategy	Advantages	Disadvantages
surrounding the COVID-19 pandemic is a very fluid situation. The best way to deal with a fluid situation is with a strong yet flexible approach to problem solving.		

The Contractor recognizes that health considerations surrounding the Covid-19 pandemic is a very fluid situation. The best way to deal with a fluid situation is with a strong yet flexible approach to problem solving. For this effort, the Contractor offers extreme flexibility to adjust and readjust audit scopes to best fit this evolving situation.

Program/Initiative Background

This Evaluation Plan includes tasks related to the investment plans listed below. Specific portions of the investment plan are highlighted in this section. Full investment plans are available on the NYSERDA website. For a visual representation of the strategy, please see the logic model on the last page of the investment plans.

New Construction – Market Rate[1]

New Construction – LMI[2]

Resource Acquisition Transition Chapter[3]

The New Construction program has included funding for Commercial,[4] Low-rise Residential,[5] Multifamily,[6] the Buildings of Excellence Competition,[7] Net Zero Portfolio Support,[8] and Support Services.[9] For the most up-to-date information on the initiative's progress, please refer to the CEF quarterly report.[10]

The New Construction program is currently shifting priorities. Future programmatic efforts will be aimed at focusing on incentivizing planning stages and all-electric projects, compared to their previous work.

Roles of Project Team

The Contractor team ("Contractor") includes Energy & Resource Solutions (ERS), a DNV group, and ADM Associates, Inc. (ADM).

[1] CEF New Construction Chapter
[2] CEF Low-to-Moderate Income Chapter
[3] CEF Resource Acquisition Chapter
[4] PON 3609
[5] PON 3717
[6] PON 3716
[7] RFP 3928
[8] PON 3843
[9] PON 3771
[10] Clean Energy Fund Performance Reports

ADM, "Impact Contractor," was selected as the top ranked firm and shall execute this evaluation plan in consultation with NYSERDA and in accordance with the Impact tasks identified within this plan.

ERS, "Market Contractor," was selected as the top ranked firm and shall execute this evaluation plan in consultation with NYSERDA and in accordance with the Market tasks identified within this plan.

ERS will serve as the prime contractor for this scope of work, leading the market tasks and assessments of indirect impacts. ADM will lead the impact tasks and will support ERS with several market tasks.

A NYSERDA Project Manager (NYSERDA) will serve as the main point of contact for this evaluation, serving in a project management role, and shall assist the selected contractor in developing and implementing this evaluation plan.

Testable Hypotheses

Testable hypotheses are listed in the Theory of Change section of the attached investment plans.

The Contractor shall work with NYSERDA to ensure indicators and data collection processes align with the initiative's hypotheses testing. Deliverables shall include a methodology memo to test hypotheses which includes a summary of how the progress of indicators supports the initiative's hypotheses testing.

Goals Prior to Exit

Goals prior to exit are listed in the Theory of Change section of the attached investment plans.

Anticipated Impacts

Direct and indirect impacts expected from this initiative are included in the Progress and Performance Metrics section of the investment plans. Direct impacts are defined as those impacts expected from pilots/projects directly funded by NYSERDA, either immediate or lagged. Indirect impacts are defined as market effects that are expected to accrue over the longer term from follow-on market activity that results from NYSERDA's investments. Indirect impacts across NYSERDA initiatives may not be additive due to multiple initiatives operating within the same market sectors. This evaluation will measure both direct and indirect impacts.

For projects that include renewable measures potentially supported through other NYSERDA programs, NYSERDA will develop approaches to identify these measures, where feasible, and to represent them in the evaluation for the corresponding program (e.g., NY-Sun). This evaluation will not claim savings from renewable projects, with the exception of the Net Zero Energy for Economic Development program, nor review renewable measure installations completed leveraging funds from other NYSERDA programs. However, renewable measure installations will be assessed to determine if they lead to zero net energy consumption in a building and if the installation is occurring without aid from other NYSERDA programs.

Initiative Schedule and Budget

The annual schedule and budget allocation for this initiative is listed in the Budget & Expenditures section of the attached investment plans.

EM&V Approach

The evaluation objectives and main research topics are listed in the table below.

Table 1: Evaluation Objectives and Main Research Questions

Objective	Evaluation Questions	Data Sources & Analytic Methods
Calculate the percentage of trained building professionals (Architects, Engineers, Code Officials, etc.) knowledgeable about clean energy Integrated Designs.	Has the market participant taken part in a NYSERDA training offered as part of the New Construction initiative?; If no, why not?; If yes, have they used their training on real live projects; and how? If so, what percentage of their projects is influenced by the training? Does the market participant have an adequate knowledge of the subject? What are the remaining knowledge gaps in the industry?	Participating and non-participating Architects, Engineers, and building developers via a self-reporting phone interview or web survey (Market Contractor)
Determine the incremental cost of building an advanced clean energy building (this would include all buildings which qualify for program participation: ENERGY STAR Homes to Passive House to Net Zero Energy performance) over a standard building[11]	Did the NZE project(s) utilize integrated design?; If not, why not? What is the average cost of building a Net Zero Energy project utilizing integrated design?; What is the average cost of technology solutions selected to develop NZE projects?; What is the average total cost of building a standard construction project?; (note that this cost information will likely not be highly specific in either web or phone surveys) What is the average difference in time it takes to design an	Participating and non-participating building developers via a self-reporting phone interview or web survey (Market Contractor)

[11] A standard building will be defined in this initiative as a construction project built to meet the current year's applicable minimum code requirements.

	advanced clean energy building over a standard building?; What is the average difference in time it takes to review an advanced clean energy building over a standard building? What are the incremental costs of different solution sets?	
Determine the percent of new construction projects in the NYS market utilizing integrated design and construction practice outside of the program	What is the total number of new construction projects in NY, by sector (residential, commercial, or multifamily)?; How many new construction projects are utilizing integrated design and construction practices to produce Net Zero Energy buildings?; How many new construction projects are utilizing integrated design and construction practices to produce Net Zero Energy-capable buildings?	Participating and non-participating building developers via a self-reporting phone interview or web survey. Secondary data may also be used as a data source, especially in determining the denominator of this calculation. (Market Contractor)
Determine the percent of new construction projects in the NYS market that utilize model measure packages outside of NYSERDA programs	How many new construction projects are utilizing model measure packages outside of NYSERDA programs?	Participating and non-participating building developers via a self-reporting phone interview or web survey (Note that this may require collecting contract information of users that download measure packages for this follow-up). (Market Contractor)
Count the number of LMI RFPs that specify use of integrated design and construction practices	How many LMI Public Housing solicitations specify use of integrated design and construction practices and third-party QA/QC standards?	Program LMI Funding Agency outreach. (Market Contractor)
Determine the number of advanced clean energy buildings in NYS	How many advanced clean energy housing units are in NYS?; How many advanced clean energy commercial buildings are	Secondary Data Analysis. (Market Contractor)

	in NYS? In what sectors (office, education, etc.), are there more clean energy commercial buildings in NYS?	
Determine the prevalence of integrated design practices, advanced clean energy equipment and construction practices in new construction specifications	What is the percent of all new construction specifications including Integrated design practices? What is the percent of all new construction specifications including advanced clean energy equipment and construction practices?	Participating construction project developers, architects and engineers, and code officials via a self-reporting phone interview or web survey. (Market Contractor)
Determine the main drivers of market actors' decision-making process and choices	What factors influence the inclusion of advanced clean energy measures in a project? Are customers able to find qualified vendors and products to meet the NZ design spec.? Do customers and vendors understand the difference between Net Zero Energy and Net Zero Carbon? If they are not building to NZ standard, do we know why? Even if they are building to NZ performance, what do they find most challenging? What are they still looking for assistance support on or what are they looking to tackle next? Are customers ready to start tackling refrigerants and/or imbedded carbon issues?	Building owners, construction project developers, and architects and engineers via a self-reporting phone interview or web survey (Market Contractor)
Determine the existing challenges in the development process (including, but not limited to, 1). planning and construction and 2). working with clients and the trades on clean energy advanced buildings) for Architects and Engineers	What are the biggest challenges Architects and Engineers face during the development process?	Architects and engineers via a self-reporting phone interview or web survey (Market Contractor)

Determine what information could best inform code advancement (i.e., data needed to show that advanced buildings practices should be adopted into Code)	What information could best inform code advancement?	Code officials via a self-reporting phone interview or web survey (Market Contractor)
Determine the level of planning activity cities and communities are undertaking in pursuit carbon neutrality.	What, if any, planning efforts are communities engaging in to reduce greenhouse gas emissions or to achieve carbon neutrality? What actions are communities taking to move the community to carbon neutrality?	City Planners and municipal leaders via a self-reporting phone interview or web survey (Market Contractor)
Determine which challenges or barriers communities face in reducing greenhouse gas emissions and achieving carbon neutrality.	What are the biggest challenges communities face in reducing GHG emissions?	City Planners and municipal leaders via a self-reporting phone interview or web survey (Market Contractor)
Determine the level of involvement that Economic Development Agencies have in outreach activities that pursue net zero energy performance.	What, if any, outreach activities are Economic Development Agencies engaging in to pursue net zero energy performance? What level of awareness do Economic Development Agencies have of the benefits and costs of pursuing net zero energy performance? For what reasons do Economic Development Agencies choose not to promote NYSERDA program incentives for economic development projects? What are the biggest challenges for economic development projects in setting net zero energy or carbon neutrality goals?	Economic Development Agencies (Market Contractor)
Evaluate verified gross energy impacts	What is the annualized evaluated gross energy savings based on electric (kWh) and fuel savings (MMBtu) at customer sites?	Energy modeling (IPMVP Option A or D) with inputs from survey data, secondary data, billing data, and operational data supplied by building control systems (Impact Contractor)
Verified gross savings realization rate (VGS RR)	What is the ratio of the sum of evaluated savings divided by the sum of the program-reported savings?	

Evaluation Methodology

This evaluation effort will include market research and longitudinal market progress studies that identify and assess the theory of change and market progress associated with this specific intervention conducted by the Market Contractor. This study will include baselining and monitoring key market indicators over time to inform program design and operation, quantification of outcomes and impacts due to the program, and program evolution and exit decisions.

In an attempt to capture broader impacts of this intervention, the market evaluation will assess program influence through theory-based evaluation. Specifically, the indicators associated with each of the identified outcomes will be tracked to then draw causal inferences about the influence of the program.

Surveys, either conducted as in-depth interviews, phone interviews, or web-based surveys, of key market actors will be used to establish baseline metrics for the identified market indicators. Where appropriate, multiple surveys or sources of data will inform the baseline metrics listed in Table 4 below.

In addition to the primary data collection activity, analysis of secondary data will be necessary to understand, for example but not limited to, how other public housing entities are operationalizing the use of integrated design and construction practices and third-party QA/QC practices into public housing solicitations. The secondary research will also inform the estimate(s) of incremental cost of building an advanced clean energy building.

ADM will conduct evaluation M&V for a sample of project sites, according to International Performance Measurement & Verification Protocol (IPMVP) method(s) most appropriate given the project scope. Evaluation M&V will validate program estimated savings. NYSERDA aims to implement an incremental sampling approach to this evaluation. Incremental sampling means taking independent samples from successive cohorts of participants in a program over time, to meet certain confidence/precision targets for the combined sample over several consecutive cohorts. An incremental sampling approach will allow for early results (from initial cohorts) that are able to be effectively leveraged to meet longer term evaluation goals (from the eventual combined sample over multiple cohorts). The incremental approach is described in greater detail in Task 4.

Each site participating in these programs may lend themselves to a different M&V method to help determine the evaluated energy savings. ADM, working as part of the ERS team, will work with NYSERDA to determine the most effective M&V method per IPMVP protocol for each type of participant and program offer. Emissions reductions calculations are not included within the scope of this evaluation.

Buildings built precisely to code are the appropriate baseline, and thus the difference between the energy consumed by the participant building and a similar building built precisely to code represents the energy impact of the program.

The Contractor shall use energy modeling (Option A or D) with a calibrated simulation developed for the as-built participant building and then modified to represent the built-precisely-to-code situation. Details are presented in *Methodology for Primary Data Collection*, below.

Where possible, ADM shall provide estimated savings by major measure group and assess whether specific measure groups are more or less likely to achieve estimated savings. The Contractor

understands that NYSERDA does not expect measure group savings estimates at a specific level of precision or confidence; however, the Contractor will identify the obtained precision estimates.

Some billing data may be used to calibrate energy models. Thus, the following three types of data may be required for analyses:

- Program data on measures installed in each building
- Utility consumption history
- Weather data (source to be decided in consultation with NYSERDA)

The Contractor shall format evaluated impacts to be input into the NBI Getting to Zero Database.

Currently, the New Construction program has 28 completed commercial buildings projects, with another 165 committed of 285 expected through the complete plan. For the residential sector, the program has 6,391 dwelling units completed and an additional 21,754 committed of 31,918 units expected through the complete plan. For this reason, this evaluation should use a staggered approach, shifting focus between sectors as participant numbers change.

In addition to evaluation responsibilities, ADM will conduct a concurrent evaluation of portfolio projects part of the New Construction program. There are currently 6 portfolio projects under contract and are much larger in scope than traditional New Construction projects, containing several buildings each. The concurrent evaluation will provide real time feedback on the plans produced by these portfolio projects to find inefficiencies, inaccuracies, and areas of potential improvement in future plans, as well as verify estimated savings in original plans.

The Contractor shall keep NYSERDA informed throughout the data collection process and will provide an immediate notification if findings, interim or otherwise, are drastically different than originally anticipated.

Timeframe for Long-Term Data Collection

The approach outlined in this evaluation plan includes baseline and follow-up measurements for the market evaluation and a phased incremental sampling approach for the impact evaluation. After the initial measurements, NYSERDA will decide whether to move forward with the Contractor to conduct the follow-up market assessments and additional phases of impact measurements. No assumption shall be made by the Contractor on implementing measurements beyond the market baseline and first phase of the impact evaluation without prior written approval from NYSERDA.

If approved by NYSERDA, the Contractor shall conduct additional research in 2022 and 2023 based on the data collection activities outlined above. A market baseline study will be completed for the indicators listed in this evaluation plan in 2021, comprehensive market baseline updates are planned for 2023. Incremental sampling phases of the impact evaluation are planned for 2021, 2022, and 2023. The table below outlines the data collection activities that will be conducted in each year.

Table 2: Data Collection Activities by Year

Data Collection Activity	2021 Initial Market Baseline and Impact Phase 1	2022 Impact Phase 2	2023 Market Baseline Update and Impact Phase 3
Building Owner Surveys	✓		✓
Construction Project Developer Surveys	✓		✓
Architects and Engineers Surveys	✓		✓
Economic Development Agency Survey	✓		✓
Energy Modelers Surveys	✓		✓
Code Official Surveys	✓		✓
EDI Data Pulls	✓	✓	✓

Methodology for Primary Data Collection

Primary data collection will rely on social science methods including surveys, interviews, and sampling approaches to collect data on the current and evolving state of the market. The Contractor shall develop and conduct surveys outlined in Table 3 to understand the benefits to New York State of demonstrating cost-effective construction techniques. NYSERDA will collaborate with the Contractor during the development of the survey instrument. The Contractor shall also work with NYSERDA to conduct EDI requests to obtain utility billing histories for program participants to conduct billing analysis.

NYSERDA uses Qualtrics survey software and can provide the Contractor with the ability to use the software for this study, if needed. The Contractor uses and frequently programs web-based surveys in Qualtrics and will use its licensed Qualtrics software to implement surveys. Task 6 provides more details related to survey implementation methods.

NYSERDA will provide the Contractor with a data pull from Salesforce to assist in compiling a sample. Salesforce data includes information on program participants.

NYSERDA may provide contact information for a portion of the survey sample and may assist with introductions to improve the response rate. Task 4 (Sample Strategy) provides more details on the sampling strategy. Key customer data sources of interest are described below.

- Program records, including descriptions of projects/buildings, packaged measures, or design approach, as well as billing data and contact information.
- Program stakeholder contact information NYSERDA collected to date (The Contractor is aware that NYSERDA program staff has met with members of the design community, industry and government stakeholders, New York economic development agencies, and possibly other stakeholders).
- List of code officials/inspectors (ERS recently completed numerous interviews with code officials in New York for the NYSERDA's CEC Code Officials Training evaluation study and will leverage code official contact lists from that project).
- Data-Axle (formerly Infogroup) or Dunhill International (Dunhill) contact lists of architects, engineers, construction contractors, and builders/developers in New York.

- Data-Axle list of newly constructed residential homes
- Dodge data on multifamily and commercial new construction starts and major renovation bids (ERS is currently leveraging Dodge data in New Jersey and Massachusetts and can extend that subscription to New York. The Contractor knows how to scrub the Dodge data to identify new construction starts and collect available contacts for owners, developers, architects, engineers, and a variety of contractors associated with new construction and/or major renovation bids.)
- Primary Land Use Tax Lot Output (PLUTO) New York City (NYC) database (This database includes a list of all NYC buildings, along with the year built and name of the owner/property management firm. PLUTO was developed by the NYC Department of City Planning from NYC tax lot and financial data, making it the best source of building and lot data for NYC.)
- Tax assessor/lot data for the entire state of New York from the New York State Office of Real Property Tax Services (ORPS) Assessment Roll (ERS has this data in-house. This data include the year built of the residential and commercial building(s) on the property, and ERS has already partially matched this data to PLUTO, Infogroup, and a few other data sources. The Contractor will leverage this prior work for this study.)
- CoStar property level data (In the past, NYSERDA had a subscription to CoStar. If NYSERDA still pays for the subscription, the Contractor will leverage NYSERDA's subscription to gather additional building owner information of newly built commercial, mixed use, or multifamily buildings.)
- New Building Institute (NBI) database of zero energy commercial and multifamily buildings (Its database includes 28 zero energy buildings in New York, mostly in education, office, public assembly, and multifamily sectors.
- Passive House Database (This database includes 37 single family, multifamily, or mixed-use passive house/buildings in New York.)
- List of high-performing buildings in the 2019 New York Getting to Zero Status Report (This report includes an appendix with a location information of 132 zero energy, passive house, and high-performance buildings in New York.)
- If needed, Zillow (Zillow's search engine allows users to filter home sales by sale date and by year built. The Contractor can use Python to scrape the addresses associated with New York sales of single-family homes constructed between 2018 and 2021.) The Contractor understands that Zillow is not the best source for identifying newly constructed homes. Thus, the Contractor will rely on the tax lot data and DataAxle list of newly constructed home, and only use Zillow to supplement these sources of data if needed.

As noted above, the Contractor will not conduct a billing analysis, NYSERDA will require the use of customer utility account numbers to collect energy use billing data. The Contractor further acknowledges that NYSERDA recognizes the importance of protecting the confidentiality of the consumer's data and will comply with the DPS guidance[12] for the proper collection and handling of customer energy consumption data for program evaluation purposes.

The Contractor shall to use energy modeling (Option A or D) with a calibrated simulation developed for the as-built participant building and then modified to represent the built-precisely-to-code situation. The difference in performance between the two models represents the gross savings. The specific

[12] Contracts of consultants qualified to conduct billing analysis under RFQL 4162 include a Data Security Memorandum of Understanding Addendum that required consultant signature.

methods and inputs used to generate models for specific buildings will vary depending on the types of information that are obtainable.

In some cases, billing data may be used to calibrate the as-built model. However, that may not be feasible in the evaluation of new commercial sector buildings. Many commercial buildings see a slow ramping of occupancy and use following their construction, which complicates the interpretation and use of any available billing history. This is true even in normal economic periods and is exacerbated by severe economic shocks (such as COVID-19) as they cause a reduction in the demand for commercial real estate.

On-site data logging may not be necessary in most cases. As discussed below, on-site monitoring is not needed for the residential analyses and often can be done using commercial participants' own on-site control systems. ADM shall use the following as the optimal modeling approach for each sector:

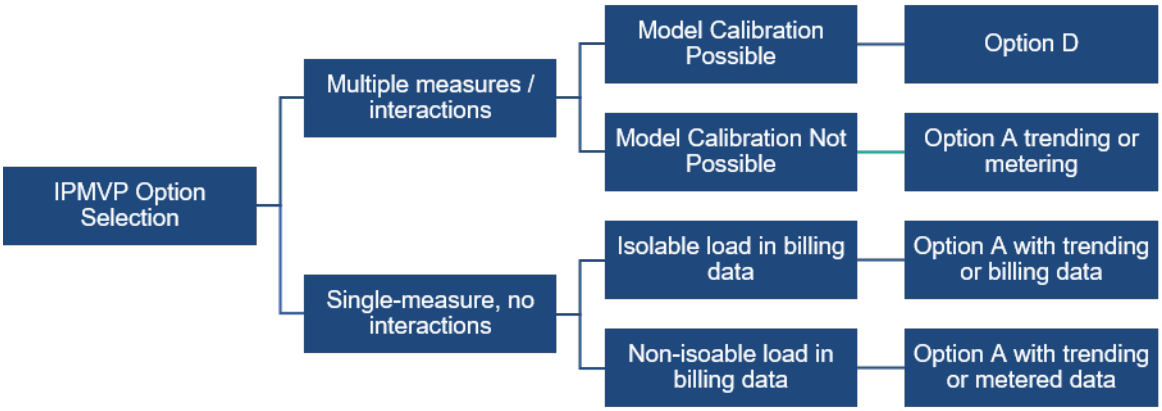
Residential. No monitoring is required. ADM shall develop code compliance simulation models. However, ADM shall not conduct a follow-up analysis of post-construction billing data of the new homes to compare the per-square-foot consumption predicted by the models against that which actually occurred. This may come closest to the idea of a billing analysis with a built-precisely-to-code counterfactual. To the extent that the impact sample overlaps with the sample for the market evaluation, this analysis can incorporate occupancy totals collected during the survey. This would allow for a more precise analysis as simulation tools use an assumed number of occupants per bedroom.

Multifamily. Again, no monitoring shall be required in most buildings. Monitoring may be applicable for multifamily buildings that have centralized systems. However, in other buildings, the variances in schedules and occupancy would necessitate sampling a large number of units within each building to capture end-use profiles through monitoring, which would be cost prohibitive. The key to these buildings is gathering an understanding of a building's occupancy and schedules. Therefore, ADM shall develop prototypical models that are normalized on a per-square-foot basis, using billing data (whether master meter or individual) to define building operation.

Commercial. Modern commercial facilities typically have integrated control systems (EMS/BMS), which allow for trending control points. For example, HVAC fan run-times, chiller power, chilled water loop flowrates, etc. ADM's first efforts shall be to attempt to facilitate data collection through such systems as it is less costly and easier for site staff. Further, it does not require ADM staff to be present in person, and so it mitigates the risk of transmitting COVID-19. The necessity of end-use monitoring will vary significantly based on the complexity of the building and systems. A warehouse, for example, probably would not need any end-use monitoring, whereas a high-rise office could use end-use information on its HVAC systems.

Residential and unit-metered multifamily projects will thus be analyzed via IMPVP Option D. This will incorporate billing data where viable. On-site metering is not anticipated unless it is concluded in evaluation planning with NYSERDA that there is a compelling research interest in specific end-use metering. No on-site metering does not mean no on-site data collection, however, as discussed below. The flowchart shown in Figure 1 specifies the selection process for IPMPVP approaches for commercial projects (including master-metered central systems for multifamily).

Figure 1: IPMVP Approach Decision-Making Flowchart for Commercial & MF Projects



Prior to modeling, the Contractor shall conduct data cleaning of program data and billing data. Separate gas and electric models will be developed. All consumption data will be weather-normalized.

The Contractor shall carry out on-site data collection in all strata – single-family, multifamily, and commercial – to provide inputs to the models. For all strata, the Contractor shall visit buildings that are in various states of construction, including occupancy ready, to verify energy efficient construction practices and installation/operation of energy efficiency measures. The Contractor anticipates that the 2021 samples will include relatively more completed and occupied buildings than will the 2022 and 2023 samples, and so there will be less opportunity for conducting on-site visits of ongoing construction projects. The cost estimates for 2021, 2022, and 2023 reflect this fact.

In the multifamily and commercial strata, on-site observations may also include measure settings or operating parameters. Staff conducting on-site visits will take photos to document and support the on-site observations; photo filenames will include the measure, site ID, and date to assist in searching the photos.

Field technicians will complete on-site data collection, using instruments designed for tablet devices. This will facilitate data entry and help ensure consistent results. The electronic survey instrument will be programmed to restrict data entry within selected expected ranges, which will allow field staff to confirm the completeness and accuracy of each survey before they leave the survey site.

To the extent possible, the Contractor shall use the same samples for the impact evaluation and building owner surveys for the market evaluation research and will coordinate impact data collection with the building owner interviews.

Contractor staff shall generate a data collection plan for each sampled project. The data collection plan template includes:

- Name of the applicable stratum;
- Category of data collection type;
- Lists of the parameters to be collected;
- Whether the data are static or time varying and the time interval if varying;
- Whether the data collection requires on-site visits;

- Whether the data are primary or secondary data;
- The required level of rigor level;
- The methods of data collection and/or documentation;
- The names and dates associated with data collection;
- Contract method, including name of contact;

Primary sampling unit: The project will be the primary sampling unit.

Upper level Stratification: At a minimum, the populations will be stratified by fuel type for all initiatives, market sector, and all-electric projects.

Lower level stratification: Additional post-stratification may be done for program information purposes such as size, location, program offer type, low-to-moderate income vs market rate, etc. For the commercial stratum, the Contractor proposes to further stratify by program-reported energy savings, as this will improve precision, allowing for smaller samples.

Confidence and Precision: The number of completed on-site evaluations are expected to meet a target of 10% precision level at 90% confidence at the program/initiative level, or can be projected to meet this confidence and precision using an incremental sampling methodology. 90/10 is required for upper level stratification, however it is not required for lower level stratification.

As the program is shifting focus towards all-electric projects, it is vital that these types of projects which are already completed be sampled adequately as part of this evaluation to provide useful feedback for program development.

Table 3: Overview of Primary Data Collection Activities

Research Approach	Target Group/ Population	Expected Start Date	Estimated Population Size	Estimated Sample Size	Expected Sampling Confidence & Precision	Sampling Method	Primary Sampling Unit	Stratification
Primarily web surveys with some phone surveys [a]	Residential single Family (SF) Participant Home-owners	Q2 2021	[13]Residential SF: 3000 with 2477 completed	>= 67	90/10 per sector	Random	Building Owner	Construction Type, Building Type, If LMI or not, Type of participant
Primarily web surveys with some phone surveys [a]	Residential Multifamily (MF) Participant Building Owners	Q2 2021	MF: 400 with 141 completed	>= 58	90/10 per sector	Random	Building Owner	Construction Type, Building Type, If LMI or not, Type of participant

[13] These numbers represent the estimated number of new projects for 2019 and 2020.

Research Approach	Target Group/ Population	Expected Start Date	Estimated Population Size	Estimated Sample Size	Expected Sampling Confidence & Precision	Sampling Method	Primary Sampling Unit	Stratification
Phone interview and/or web survey [b]	Commercial Participant Building Owners	Q2 2021	Commercial: 149 with 24 completed	>= 47	90/10 per sector	Random	Building Owner	Construction Type, Building Type, If LMI or not, Type of participant
Primarily web surveys with some phone surveys [a]	Residential SF Non-Participant Home-owners	Q2 2021	Residential SF (New homes, built 2016-2021): Large	68	90/10	Random	Home-owner	Construction Type, Building Type
Primarily web surveys with some phone surveys [a]	Residential MF Non-Participant Building Owners	Q2 2021	MF/ Mixed Use (New Buildings or major Renovations in 2016-2021): Large	68	90/10	Random	Building Owner or Develop-er (if they own the bldg.)	Construction Type, Building Type, Market Rate/LMI
Phone interview and/or web survey [b]	Commercial Non-Participant Building Owners	Q2 2021	Commercial (New Buildings or Major Renovations in 2016-2021): Large	68	90/10	Random	Building Owner or Develop-er (If they own the bldg.)	Construction Type, Building Type, Market Rate/LMI
Phone interview and/or web survey [b]	Non-Participant High-performing Building Owners [c]	Q2 2021	TBD	~30	85/15	Random	Home-owner or Building Owner	None (As many as we can interview within each sector)
Phone interview and/or web survey [b]	Participant Construc-tion Project Developers	Q2 2021	~250	>= 54	90/10	Random	Construc-tion Project Develop-er	Construction Type, Building Type
Phone interview and/or web survey [b]	Non-Participant Construc-tion Project Developers	Q2 2021	3252 Builders & Design-Build Firms[12]	>= 67	90/10	Random	Construc-tion Project Develop-er	Construction Type, Building Type

Research Approach	Target Group/ Population	Expected Start Date	Estimated Population Size	Estimated Sample Size	Expected Sampling Confidence & Precision	Sampling Method	Primary Sampling Unit	Stratification
Phone interview and/or web survey [b]	Participant Architects and Engineers	Q2 2021	TBD[14]	TBD	90/10	TBD	Architect or Engineer	Construction Type, Building Type (Residential, Multifamily, Commercial)
Phone interview and/or web survey [b]	Non-participant Architects and Engineers	Q2 2021	18,000[15] 2,776 Architects and Design-Build Firms[16]	68 67	90/10	Random	Architect or Engineer	Construction Type, Building Type
In-depth interviews	Participant Economic Develop-ment Agencies	Q2 2021	>= 10	>= 10	NA	Census	Econom-ic Develop-ment Agency	Economic Development Region

Where possible each segment and response will be stratified by:

- Market rate vs LMI sectors
- Construction type (new building vs substantial renovation)
- Building type
    - Residential-Single Family: no substrata
    - Residential-Multifamily: 3 stories or less, and 4+ stories
    - Commercial: offices, hotels, retail, etc.
- Type of participant (Buildings of Excellence Competition Participant, Training Participant, etc.)
- Region/location of project/participant (if necessary)

The Contractor shall also additionally sample for high-performing buildings (net zero, passive house, LEED/above code) and project savings stratification (where appropriate, such as for commercial and multifamily samples) for impact purposes. Further details on the topics of interest among the various groups are described below.

Participant Building Owners:

The Contractor shall conduct mixed-mode (email, mail-push-to-web, and/or phone) surveys with Building Owners participating in the Buildings of Excellence and Net Zero Energy for Economic Development Competitions or other components of the program. These interviews will include, but not

[14] Architects and Engineers are not consistently tracked by program for standard offer projects.

[15] https://www.ncarb.org/press/number-us-architects-2016

[16] https://www.nyserda.ny.gov/-/media/Files/Publications/PPSER/Program-Evaluation/2016ContractorReports/Net-Zero-Low-Rise-Report.pdf

be limited to, discussion of the awareness and knowledge of advanced clean energy buildings and design, current market penetration of projects utilizing integrated design and construction practices to achieve Net Zero Energy and Net Zero Energy-capable performance, building operation in comparison to modeled building performance, the incremental cost of building an advanced clean energy building, and the number of projects utilizing integrated design, construction practice, and model measure packages outside of NYSERDA programs.

Building Owners shall also be surveyed to explore the decision-making process behind including advanced clean energy measures or not including them, selecting financing for clean energy building projects, assessing risks of and selecting mitigation strategies while implementing net zero elements into a building, how much construction is led by owners vs developers, and how energy code impacts their decisions. They will also be asked about the suite of high-performance measures installed at the building.

When needed, the Contractor shall reach out to multiple contacts within the organization that owns the property to ensure the appropriate decision-maker(s) take the survey.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Non-Participant Building Owners:

The Contractor shall conduct mixed-mode (email, mail-push-to-web, and phone) surveys with Building Owners not participating in the program.

Survey topics will be similar to those covered during surveys with Participant Building Owners. They will also be asked about the suite of high-performance measures installed at the building.

Details on the recruitment approach are provided in Task 6: Administer Data Collection Instruments, below.

Participant Construction Project Developers:

The Contractor shall conduct mixed-mode (email, mail-push-to-web, and telephone) surveys with Construction Project Developers participating in the Buildings of Excellence and Net Zero Energy for Economic Development competitions and also those associated with incentivized projects and with using NYSERDA tools and training. These interviews will include, but not be limited to, discussion of the incremental cost of building an advanced clean energy building, and the number of projects utilizing integrated design, construction practice, and model measure packages outside of NYSERDA programs.

These interviews may also include Process Evaluation questions to improve future solicitations for and iterations of the competition. At a minimum, the Process Evaluation questions will assess the Developer's level of satisfaction with the program and reasons for dissatisfaction.

Construction Project Developers will also be surveyed to explore the decision-making process behind pursuing advanced clean energy measures or not pursuing them, selecting financing for clean energy building projects, assessing risks of and selecting mitigation strategies while implementing net zero elements into a building, how much construction is led by owners vs developers, and how energy code

impacts their decisions. They will also be asked about the installation rate of high-performance measures.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Non-participant Construction Project Developers:

The Contractor shall conduct mixed-mode (email, mail-push-to-web, and if needed telephone) surveys with Construction Project Developers not participating in NYSERDA new construction offerings.. These interviews will include, but not be limited to, discussion of the number of projects utilizing integrated design, construction practice, and model measure packages, and the difference between predicted savings produced by modeling software and actual estimated savings calculations.

These interviews may also include questions related to why a Developer chose not to compete in the Buildings of Excellence and Net Zero Energy for Economic Development completions. If applicable, the interviews could also be used to follow up with Developers who were not selected in the Buildings of Excellence and Net Zero Energy for Economic Development competitions.

Construction Project Developers will also be surveyed to explore the decision-making process behind including advanced clean energy measures or not including them, selecting financing for clean energy building projects, assessing risks of and selecting mitigation strategies while implementing net zero elements into a building, how much construction is led by owners vs developers, and how energy code impacts their decisions. They will also be asked about the installation rate of high-performance measures.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Participant Architects and Engineers:

The Contractor shall perform mixed-mode (email, mail-push-to-web, and if needed telephone) interviews, whichever is determined to be the most effective at reaching the target segment, with Architects and Engineers participating in trainings, the Coaching program, the Buildings of Excellence and Net Zero Energy for Economic Development Competitions, and/or the online platform in 2021 and 2023. The Contractor shall also speak with architects and engineers involved with new construction or major renovation projects for which NYSERDA provided an incentive and/or technical assistance in the past five years.

These interviews will include, but not be limited to, discussion of participation in NYSERDA's clean energy Integrated Design trainings, level of knowledge on clean energy integrated design, knowledge gaps or desired topics for additional learning, and satisfaction with and effectiveness of the online platform's ability to enable the submission of documentation for code review. The Contractor shall also ask these contacts whether they have participated in any training offered by NYSERDA's partners (listing partners by name) to ensure that contacts recognize training and can answer any questions on the training in the survey.

Further, the Contractor shall explore how integrated design works in practice and what are the costs associated with integrating technologies and/or design choices that push buildings above code.

Architects and Engineers will also be surveyed to determine their pain points during the development process and to discuss the main drivers of their decision-making process (e.g. owners, costs, codes, etc.).

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Non-participant Architects and Engineers:

The Contractor shall perform mixed-mode (email, mail-push-to-web, and if needed telephone) surveys, whichever is determined to be the most effective at reaching the target segment, with non-participant Architects and Engineers in 2021 and 2023. These interviews will include, but not be limited to, discussion of participation in clean energy Integrated Design trainings, level of knowledge on clean energy integrated design, reasons for not participating in NYSERDA trainings, and knowledge gaps or desired topics for additional learning.

The Contractor shall also explore how integrated design works in practice and what are the costs associated with integrating technologies and/or design choices that push buildings above code and/or the net zero energy status.

Architects and Engineers will also be surveyed to determine their pain points during the development process and to discuss the main drivers of their decision-making process (e.g. owners, costs, codes, etc.).

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Economic Development Agencies:

The Contractor shall perform in-depth interviews, with participant Economic Development Agencies in 2021 and 2023. These interviews will include, but not be limited to, discussing the Economic Development Agency's level of involvement in outreach activities, the Economic Development program requirements and processes, awareness of benefits and costs of pursuing net zero energy projects, performance of NZE projects, the number of NZE projects being completed and/or promoted outside of the program, reasons for not contributing to outreach efforts in coordination with NYSERDA programs and/or pursuing NZE projects, and awareness of benefits and costs of pursuing net zero energy projects.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Energy Modelers:

The Contractor shall perform mixed-mode (email, mail-push-to-web, and if needed telephone) surveys with energy modelers such as HERS Raters and Residential Energy Services Network (RESNET)-accredited Providers, as well as Multifamily and Commercial New Construction Primary Energy Consultants, in 2021 and 2023. These interviews will include, but not be limited to, the use and penetration of integrated design by developers and the use of market-based approaches to high performance buildings.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Participant Code Officials:

The Contractor shall perform semi-structured interviews with NYS Code Officials. These code officials represent the limited number of code officials in NYS that are invited to pilot the online platform, and then any code officials that are platform users after the pilot period has concluded. This population could also include the code development and enforcement stakeholders at the Department of State.

The Contractor shall focus on semi-structured interviews with code officials based on our years of experience with code training in New York and throughout the Northeast. Live interviews better allow officials to consider how clean energy design and construction practices integrate with their overall responsibilities. Although it varies by jurisdiction, code officials typically report that they are charged with many tasks that limit what time they can devote to advanced energy issues.

These interviews will include, but not be limited to, discussion of awareness and knowledge of integrated design practices, advanced clean energy equipment and construction practices, the number and percent of new construction specifications that include integrated design practices, advanced clean energy equipment and construction practices, and satisfaction with and effectiveness of the online platform's ability to enable quality assurance checks on designs. In addition, the interviews will ask code officials to report on the relative priorities they place and are asked to place on clean energy practices and equipment.

Code officials will also be surveyed to determine what market information could best inform code compliance advancement. For example, we will explore issues surrounding the role that beyond code building protocols have in improving code compliance and best-practice approaches. Market information on the penetration levels of programs such as Passive House, Zero Energy Ready Homes, and USGBC protocols have interest for code officials as the latest model codes allow compliance with such protocols to be used for compliance determination, lessening the burden on code officials.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Non-participant Code Officials:

The Contractor shall perform IDIs or web-based interviews with Code Officials not participating in the program. Survey topics will be similar to those covered during surveys with Participant Code Officials.

The Contractor shall ask Code Officials about their current code compliance reviewing methods and ask them to reflect on specific pain point in this process. For example, the Contractor understands that Code Officials often feel pressed for time, and incorporating new compliance standards can be time intensive. In order to go deeper, therefore, the questions shall ask officials to reflect on specific functions in their review process and how the processes could be improved through the use of software that could automate some of the quality assurance review process.

These interviews shall also include a discussion on awareness and knowledge of integrated design practices, advanced clean energy equipment and construction practices, the number and percent of

new-construction specifications that include integrated design practices, advanced clean energy equipment and construction practices, and satisfaction with their current process quality assurance and design review processes. In addition, the interviews shall ask code officials to report on the relative priorities they place and are asked to place on clean energy practices and equipment.

As with the participant group, non-participant Code Officials will also be surveyed to determine what market information could best inform code compliance advancement and the penetration level of various beyond-code building protocols.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Participating Coaches/Advisors:

If deemed appropriate and useful by NYSERDA, the Contractor may perform IDIs with participating coaches/advisors working with builders and developers. These Coaches will be technical contractors that NYSERDA engages with through a Task Work Order. NYSERDA Program staff will be receiving feedback from these contractors in real time to understand market needs. These interviews will include, but not be limited to, inquiry regarding information on trade experience and needs to get to NZE, the relationship between architects and trades, implementation of Integrated Design, and information on how large portfolio owners are implementing net zero energy into their business models.

Details on the recruitment approach are provide in Task 6: Administer Data Collection Instruments, below.

Data Sources for Secondary Data Research

The data sources listed below includes those that NYSERDA is familiar with.

- Recent NZE reports completed by NYSERDA[17,18]
- 2019 New York Getting to Zero Status Report[19]
- Infogroup – Identify contact information for newly constructed residential homes
- Dunhill International – Identify contact information for non-participant Architects and Engineers, as well as Developers
- If needed, scraped Zillow data of newly built homes sold in New York
- Dodge Data - New Construction and Existing Renovation Data
- New Building Institute database
- Passive House databases
- New York tax lot data – Identify newly constructed buildings in New York

[17] Residential Net Zero Energy: Performance Assessments (2008-2015)

[18] Net Zero Energy for the Low-Rise New Construction Residential Program: Market Characterization and Evaluation Baseline

[19] 2019 New York Getting to Zero Status Report

Direct Impacts Calculation Methodology

Direct impacts are defined as those impacts expected from pilots/projects directly funded by NYSERDA, either immediate or lagged.

Direct impacts constitute the direct gross verified energy savings resulting from the New Construction initiative activities and will be subject to measurement and verification (M&V) over time. ADM shall complete M&V of direct impacts, as described in *Methodology for Primary Data Collection*, above.

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Verified Gross Savings Realization Rate Calculation

The following equation will be used to calculate realization rates (RRs):

$$VGS\ RR = \frac{Savings\ (evaluated)}{Savings\ (reported)}$$

VGS RR = Verified gross savings realization rate

Savings (evaluated) = Savings as per measurement and verification (M&V) evaluation

Savings (reported) = Savings as reported by the Program

In analyzing realization rates, ADM shall investigate for possible issues that can be addressed through programmatic changes. For example, ADM shall investigate whether realization rates differ among various subgroups in a manner that suggests that either an error in the calculation of the reported savings or failure to implement efficient construction as planned. Aggregated RRs will be calculated at the post-stratified levels for public reporting.

Indirect Impacts Calculation Methodology

Indirect impacts are defined as market effects that are expected to accrue over the longer term from follow-on market activity that results from NYSERDA's investments.[20] Indirect impacts across NYSERDA initiatives may not be additive due to multiple initiatives operating within the same market sectors.

The Contractor shall conduct a specific methodology (e.g., variables and algorithm), to describe how data, including, but not limited to the indicators outlined in this evaluation plan, results from pilot projects, and other information will be used to assess the indirect impacts or replication in the market in terms of energy savings and leveraged investment. See Task 3 for the description of this methodology.

A credible forecast of naturally occurring market adoption of practices supported by the New Construction program, and of the availability and adoption of these practices among developers, building owners, architects, and engineers, will allow NYSERDA to quantify long-term, indirect energy savings impacts (i.e., market effects) attributable to the New Construction initiative. While the interviews with building owners, developers, architects and engineers, code officials, energy modelers, and economic development agencies will qualitatively investigate perceptions of market trends, industry best practice for quantifying market effects requires a more structured, robust forecasting approach.

[20] Measuring and Evaluating Indirect Benefits

Toward that end, the Contractor shall develop a market adoption approach to be implemented and updated throughout the course of this evaluation to assess the market effects occurring in this space.

Non-Energy Impacts

Non-energy impacts (NEIs) are features inherent in a high efficiency/low carbon projects that indirectly reduce the cost of a technology (by reducing operation and maintenance or O&M costs, for example), improve user experience (by increasing comfort, for example), or add to the owner's value (by commanding higher rents, for example). NEIs can contribute to a measure's cost-effectiveness and can help sell a technology.

The Contractor shall tap into its proprietary and comprehensive database as the basis for monetized NEIs that will apply on per installed measure basis. The database of NEI values is populated with 50 individual NEIs spanning a wide range of benefits including O&M, experience quality, property value impacts, and life/safety impacts. The dataset reflects research in Massachusetts, Ohio, and Ontario and supplementary secondary research from around the country. The NEIs have been developed using a theoretically sound approach appropriate for each NEI, and high-quality inputs for monetizing NEIs ensuring the results are credible and defensible. Values in the database will be updated to account for New York-specific economic conditions including labor rates and avoided medical costs.

Outputs/Outcomes/Indicators

The table below lists the outputs, outcomes and indicators to be assessed through this evaluation, with all of the initiative's outputs, outcomes and indicators, some of which will be derived from sources other than this evaluation, listed at the end of the investment plans.

For the purposes of this evaluation, program activity/output indicators represent measurable, quantifiable direct results of activities undertaken in the initiative. Outputs are a key way of regularly tracking progress, especially in the early stages of an initiative, before broader market changes are measurable. Outcome indicators can encompass near-term through longer-term changes in market conditions expected to result from the activities/outputs of an intervention. Outcome indicators will have a baseline value and progress will be measured periodically through market evaluation. Only some of these initiatives will be provided in annual reporting to the NYS Department of Public Service, as indicated in the table.

Direct impacts are defined as those impacts expected from pilots/projects directly funded by NYSERDA, either immediate or lagged.

Indirect impacts are defined as market effects that are expected to accrue over the longer term from of follow-on market activity that results from NYSERDA's investments. Indirect impacts across NYSERDA initiatives may not be additive due to multiple initiatives operating within the same market sectors.

The Contractor shall work with NYSERDA to ensure indicators and data collection processes align with initiative hypotheses testing. Deliverables shall include a hypothesis testing summary within the Contractor's reporting of evaluation results.

Table 4: Outputs, Outcomes, and Indicators

The Performance Metrics listed in Table 4 are those that will be assessed in this study.

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
Market participants attending workshops or training	Number of participants attending workshops and trainings (by participant type)	Program data	Yes	X		Program	X	X	X
	Number of architects and engineers knowledgeable about Integrated Design	Program data	No	X		Program	X	X	X
	Number of code officials knowledgeable about Integrated Design	Program data	No	X		Program	X	X	X
Measure packages available	Number of model measure packages available	Program data	Yes		X	Program	X	X	X

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
	Number of projects built using each measure package	Survey of people who download the measure packages from NYSERDA's website	No	X		Market evaluation	X		X
Market participants (builders and developers) receive guidance from coach/advisor	Number of projects that utilize coach/advisor	Program data	Yes		X	Program	X	X	X
Projects recognized for Exemplary Building and Net Zero Energy for Economic Development Competition	Number of units recognized through Buildings of Excellence competition	Program data	Yes	X		Program	X	X	X
	Number of projects awarded through the Net Zero Energy for Economic Development Competition	Program data	Yes	X		Program	X	X	X
	Number of case studies developed and distributed	Program data	Yes	X		Program	X	X	X

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
Number of advanced clean energy buildings	Number of advanced clean energy housing units in NYS	Contractor survey for non-participants, secondary data, and program data for participants	Yes	X	X	Market evaluation and program	X		X
	Number of advanced clean energy commercial buildings in NYS	Contractor survey for non-participants, secondary data, and program data for participants	Yes	X	X	Market evaluation and program	X		X
Qualitative study of performance for completed projects	Number of projects that complete a Performance Analysis through the program	Program data	Yes	X		Program	X	X	X
Reduce incremental cost of building an advanced clean energy building	Incremental cost of building a Net Zero Energy building over standard construction practices	Program data for participants, contractor survey for more in-depth information and non-participants	Yes	X	X	Market evaluation and program	X		X

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
	Average time of design completion (by building type, participants, and non-participants)	Program data for participants and contractor survey for time analysis	No	X	X	Market evaluation and program	X		X
	Average time of building code review completion	Contractor survey	No	X	X	Market evaluation	X		X
Percent of projects utilizing Integrated Design and construction practices increases	Percent market penetration of projects utilizing integrated design and construction practices to achieve Net Zero Energy and/or Net Zero Energy-capable performance	Contractor survey for non-participants and program data for participants	Yes	X	X	Market evaluation and program	X		X
Projects utilize model measure packages outside of the program	Number of model measure packages available	Program data	Yes	X		Program	X	X	X

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
	Number of projects that utilize model measure packages and not accessing incentive programs	Contractor survey of developers	Yes		X	Market evaluation	X		X
Increase in number of LMI RFP's that specify use of Integrated Design and construction practices	Number of LMI Public Housing Solicitations that specify use of Integrated Design and construction practices, and third-party QA/QC standards	Secondary data analysis of sources and program data for identification of sources	Yes		X	Market evaluation and program	X		X
Reduction in discrepancies between predicted and actual savings; improve accuracy of predicted energy consumption and cost	Reduction in discrepancies between predicted and actual savings	Program data	Yes		X	Program	X	X	X

Outputs/Outcomes	Indicators	Data Source	Annually Reported to DPS?	Used to Estimate Impacts?		Data Collector	Data Collected in Years		
				Direct	Indirect		2021	2022	2023
Integrated design practices, advanced clean energy equipment and construction practices will routinely be included in new construction specifications	Percent of all new construction specifications including Integrated Design practices, advanced clean energy equipment and construction practices	Contractor survey	No	X	X	Market evaluation	X		X
Increase in utilization of market-driven solutions	Percent of projects leveraging market-driven solutions	Contractor survey	No	X	X	Market evaluation	X		X
Number of NZE projects being completed or promoted outside of the program	Number of NZE projects completed outside of incentive programs	Contractor survey	No		X	Market evaluation	X		X

Tasks, Budget and Schedule

Timeliness and ability for quick turnaround on the indicators outlined in this plan, especially those for which NYSERDA has no baseline values (e.g., denoted as "TBD"), is crucial. For purposes of this evaluation, the tasks are defined as follows:

Task 1: Project Kick-Off and Evaluation Plan Finalization

Project kick-off and the evaluation plan are critical for setting the foundation of the study. As part of this task, the Contractor shall conduct a complete background review of initiative. The Contractor shall finalize evaluation plan and general/high-level sampling plan in consultation with NYSERDA. The Contractor shall participate in kick-off meeting with NYSERDA to discuss project details, priority issues, availability of contact lists and databases, and project schedule. During this meeting, the Contractor shall review and discuss the objectives/indicators, tasks, and timeline, and finalize the survey and site counts and study objectives. The primary intention is ensuring a common understanding of the work to be completed and identifying any potential challenges that may affect the evaluation. The Contractor shall engage and take into consideration NYSERDA feedback to ensure that all parties are aligned on the goals and desired project deliverables.

One topic to address at the kick-off meeting will be the timeframe for selecting new construction buildings to discuss with various market actors. NYSERDA noted wanting to evaluate participant projects since 2016 to present. The Contractor presumes the same timeframe is to be applied to the nonparticipant new construction sample frames. The Contractor would like to posit that there is less value in speaking with owners, developers, architects, or engineers of buildings that were completed in 2016 and started in 2013 about project decision making compared to speaking with those market actors about buildings started in 2016 and completed later. The Contractor shall propose to differentially sample, focusing more heavily toward the present for both participant and non-participant surveys and will look to NYSERDA for guidance.

Another topic to address at the kick-off meeting will be the definition of participants and nonparticipants. The Contractor shall consider those involved with new construction or major renovation projects for which NYSERDA provided an incentive and/or technical assistance in the past 5 years as well as those participating in the Coaching program and the Buildings of Excellence and Net Zero Energy for Economic Development Competitions as participants. The Contractor shall, however, discuss with NYSERDA how to consider those who downloaded tools from the program online platform since it is unclear to the Contractor whether the tools are an engagement strategy to generate interest in the new construction incentives (which would imply that downloading a tool may indicate a lead and not a participant) or whether the engagement with the tools has a much different purpose.

Prior to the project kick off, the Contractor shall develop a memo for hypothesis testing, which will include a mapping of indicators in support of each initiative's hypotheses. This mapping will illustrate whether all hypotheses are addressed by the indicators and to what extent. The Contractor shall present these findings during the kick-off meeting.

Also note that the Contractor will adhere to NYSERDA's definition of Low- to Moderate-Income (LMI) households. NYSERDA defines the low-income market segment as households with annual incomes at or below 60% of the State Median Income (SMI), and the moderate-income market segment as households

with an annual income between 60% and 80% of the SMI or the Area Median Income (AMI), whichever is greater.

- Deliverables – Final evaluation plan and sampling plan, agenda and other material associated with kick-off meeting, methodology memo to test hypotheses

Following successful completion of Task 1, the project manager will notify the contractor in writing that the evaluation plan has been finalized.

Task 2: Secondary Data Analysis

Analysis of secondary data sources involves review of existing studies or research and data to identify trends in key market indicators that can support primary data collection activities. This study may require secondary data analysis to supplement data that cannot be collected from non-participants, particularly in determining what measures at what efficiency are being installed in new construction and net zero energy projects. Dodge Data should be leveraged, to the extent possible, to answer research questions.

The secondary data sources will aid in the following:

- The development of the workplan
- The development of the participant and nonparticipant survey instruments
- The identification of the contact information for participants and nonparticipants
- The development of a sampling strategy for participants, nonparticipants, and impact analysis
- The identification of information from secondary research to use for estimating the program baseline program performance indicators

The Contractor shall also leverage the review of project documents from the impact sample to assess what building owners and/or developers are doing to make a home or building high-performance. This review together with survey responses on the suite of high-performance measures installed at the building will allow the Contractor to assess the market readiness for investing in technologies that result in a building above code or a net zero energy building.

- Deliverables – Summary of secondary data analysis and other similar documents resulting from secondary data reviews, as applicable. The summary should include additional data sources with references, as appropriate.

Task 3: Indirect Impacts Methodology & Baseline

Develop a market adoption approach to be implemented and updated throughout the course of this evaluation to assess the market effects occurring in this space. The baseline will be collected as part of subsequent tasks.

The adoption model will estimate year-by-year indirect savings generated by the new construction programs. The model will be initialized with the number of new construction builds from the data sources outlined in the *Methodology for Primary Data Collection* section. The model will be updated through the course of the study with primary data results including program metrics, such as program participation rates, the direct impacts determined in this study, and other survey and interview findings. The primary output of the model is a 10-year forecast of indirect energy impacts attributable to the

evaluated program as well as other metrics like forecasted participation rates and naturally occurring high performance construction. The model can be updated with actual program data to estimate achieved indirect savings.

The direct savings will be associated with a site; the indirect savings are associated with the market actors that carry the learning from participation or exposure to the program to non-participating sites. This savings estimate is a function of the first-year gross savings, the number of participating market actors, and survey findings quantifying the rate of learning transfer. Surveys will explore non-participant and partial participant market actor's exposure to program outreach (competition applicants, users of NYSERDA tools, webinars, training) and its influence on the design of non-participating buildings. This will be a conservative, but more defensible, estimate of indirect savings potentially undercounting the diffusion of program exposed stakeholder knowledge to other stakeholders.

Model structure. The year-by-year model will be populated with the estimated number of builds by year by sector (commercial, MF/SF and market/LMI residential) using the historical tax record data for the period 2016 through 2019 and New York state new construction forecasts through 2025. The percentage of builds meeting the program performance standards will be estimated each year for both participating and naturally occurring high performance buildings. This fraction will be developed from the inventories of high-performance buildings noted in Table 3 and New York forecasts. Naturally occurring adoption will be informed by the surveys of non-participants. The model will also be populated with a count of market actor pool doing business in the state using the datasets for market actors noted in the *Methodology for Primary Data Collection* section.

Program data is another core element of the model, primarily defining past and projected activity rates by sector. Finally, the impact analysis and evaluation surveys and interviews will provide further modeling parameters including differentiation between participants and non-participants, specific metrics for unit savings, and other characterizations such as the reported number of non-participant buildings impacted by program learning as reported by stakeholders.

The contractor shall discuss the methods and data sources used to forecast the direct and indirect impacts projected in the table above and work collaboratively with NYSERDA to refine an approach to this market model.

- Deliverables – Estimated baseline; market adoption forecast methodology and progress update approach

Task 4: Sample Strategy

The contractor shall develop and implement strategies to select appropriate samples. Below, the Contractor describes procedures to reach respondents including call back procedures which address the number of attempts or callbacks to be made as part of a screening procedure and the schedule of making them, if a specific schedule is planned. Expected completion rates take multiple contact attempts into account. The Contractor has taken care in determining the most appropriate manner to contact market actors such that research questions are assessed while ensuring an efficient interaction with the actor(s). The Contractor shall consult with NYSERDA staff on identifying appropriate populations.

The estimated sample sizes identified below are based on the population and sample sizes NYSERDA provided in Table 3, above. The Contractor notes that, in some cases, the 2021 population may be smaller than that identified in Table 3. For example, Table 3 identifies a sample of 58 participant multifamily building owners, based on an expected total population of 400 participant owners. However, it is the Contractor's understanding that fewer than 400 multifamily building owners will have completed projects in 2021. It can be argued that the 2021 sample should be based on the 2021 population. The Contractor's sampling plan and costs estimates are based on the information in Table 3. However, the Contractor will be happy to discuss modifications with NYSERDA.

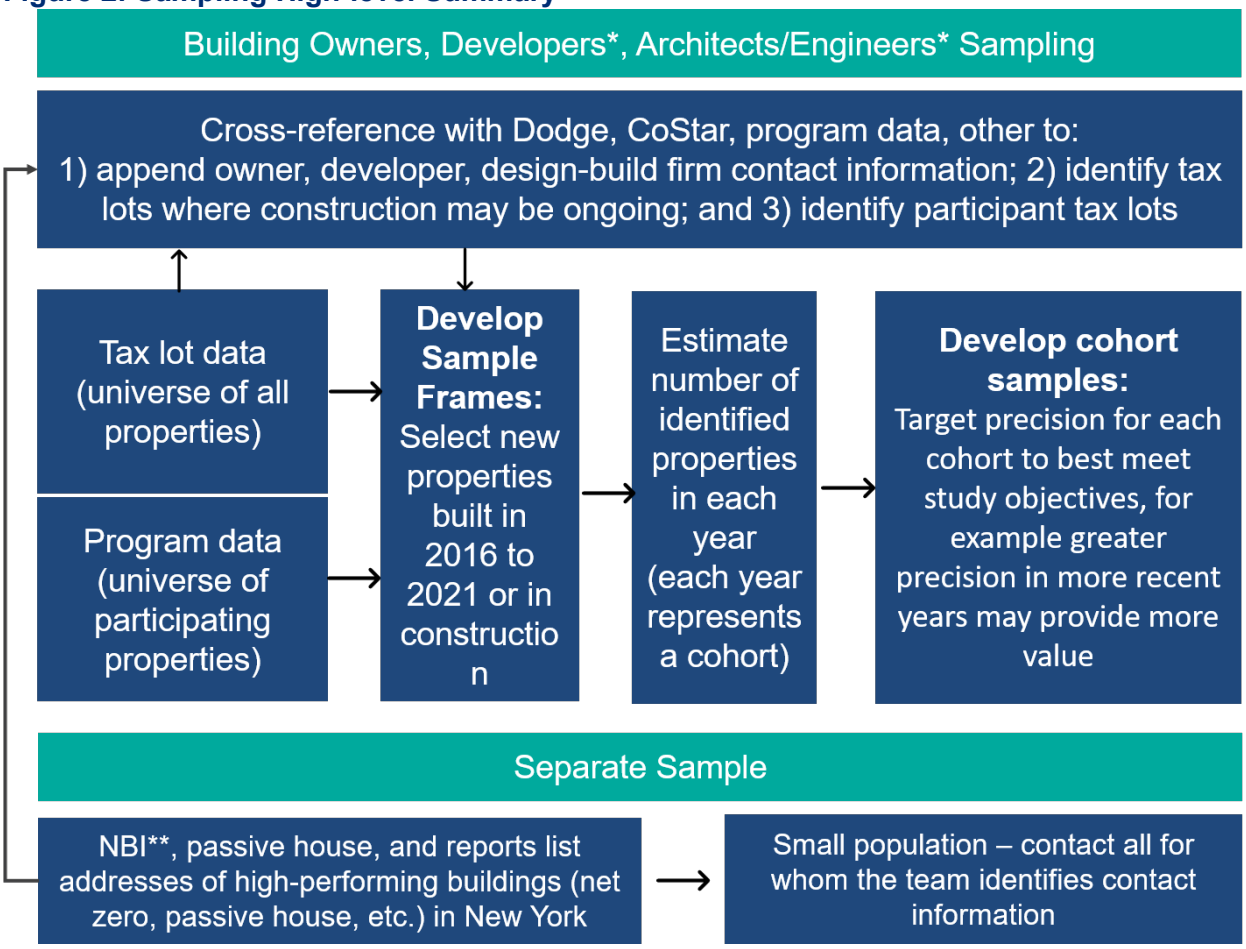
Sampling Overview for Building Owners, Developers, and Architects/Engineers

The Contractor shall first identify new and/or substantially renovated buildings and append building owner, developer, and design-build (architect/engineering) contact information to the extent possible (see Figure 1).

The Contractor shall use an incremental sampling approach, which means taking independent samples from successive cohorts of target population over time, to meet certain confidence/precision target for the combined sample. The Contractor shall sample more properties that are constructed/renovated recently (recent cohorts) than further in the past (see Figure 2, below). This approach favors recent changes in the market, which is important to consider. The market effects from the Covid-19 pandemic could increase barriers for integrating efficiency into building design (e.g., higher overall project costs, uncertainty for business in general, and new focus on indoor air quality). The Contractor shall test these hypotheses.

The Contractor shall also develop a separate sample for high-performing (net zero energy, passive house, LEED, etc.) buildings because the probability of speaking with owners of such properties is very small given the low incidence of those buildings in the New York marketplace (see Figure 2).

Figure 2: Sampling High-level Summary



* If the Contractor does not identify enough Developer and Architect/Engineer contacts, the Contractor shall then purchase a list of these market actors from Dunhill to develop samples for these groups. The Contractor discusses this alternative sampling approach in relevant subsequent sections below.

** NBI=New Buildings Institute

Note that the Contractor shall discuss with various market actors the properties/projects identified as new construction or major renovation. Thus, there is the potential for following up with market actors about those projects, especially if the Contractor identifies projects at varying stages of construction. For example, design decisions made in 2019 or 2020 can be undone in 2023 – a year when this study will be repeated. Following up with contacts about projects discussed in this study when this study is repeated in 2023 could reveal this pattern.

The following subsections discuss additional sampling details, such as list sources, stratification, and estimated survey completion counts.

Participant Building Owner Sample Strategy

The Contractor shall leverage NYSERDA's program data to first characterize the participant building owner population by sector, location, construction type, and program participation, as well as size, type, and stage of building construction if feasible. The Contractor shall also consider survey inputs needed for

the impact evaluation to ensure that the survey sample supports the impact evaluation needs. Impact evaluation sampling details are discussed in *Impact Evaluation Sample Strategy*.

At minimum, the Contractor shall stratify the participant sample into three strata: residential, multifamily, and commercial program participants. The Contractor shall target the number of survey completions to meet and/or exceed 10% precision level at 90% confidence per each participant group. The Contractor shall explore further stratification options based on the Contractor's characterization of the participant population, LMI designation, as well as NYSERDA's target group priorities. When the stratification strategy is acceptable to NYSERDA, the Contractor will draw a stratified random sample.

The Contractor assumes at least 172 participant building owner surveys will be conducted (see Table 3 above).

Nonparticipant Building Owner Sample Strategy

The Contractor shall use a combination of several available data sets to find homeowners as well as multifamily, mixed use, and commercial building owners of newly constructed buildings who had not participated in NYSERDA's prior and current new construction programs.

To identify homeowners, the Contractor shall leverage tax lot data and, if needed, Zillow[21] data repository of sold homes, as well as Data-Axle listing of newly constructed homes in New York. All three sources of data only include an address field for contact information. The Contractor will leverage address data to send three rounds of postcards inviting occupants in sampled homes to take the survey over the web. The survey instrument will include screening questions to ensure only those homeowners who purchased their home from a developer take the survey.

Zillow search resulted in over 13,000 single family homes built between 2016 and 2021 and sold in the past five years. Data-Axle database includes over 18,000 single family homes in New York built and sold in 2019.

To identify owners of ongoing or recently renovated or built multifamily, mixed use, and commercial buildings, the Contractor will leverage four commercially available datasets: 1) CoStar commercial property data, 2) Dodge construction bid management platform, 3) PLUTO NYC tax lot data, and 4) the tax lot data for the entire state of New York. The Contractor will first cross-reference the PLUTO NYC tax lot data with the tax lot data for the entire state of New York, which ERS already has in-house, to develop a preliminary sample frame. Tax lot data include property address, year built, type of building, and limited building owner information. To this dataset, the Contractor shall add owner or developer contact information from CoStar and Dodge to the extent possible. Note that the Contractor has already added contact information to the tax lot dataset from Data-Axle from a prior project.

The Contractor assumes NYSERDA has kept its subscription to CoStar and will leverage that subscription to access CoStar property owner data. The Contractor shall also purchase a Dodge subscription for New York (unless NYSERDA already has that subscription) to identify owner, developer, and contractor

[21] The Contractor shall use a python script tool (Apify Zillow Real Estate Scraper) to extract the address, home features, year built, and sale price of each single-family home sold in the past three years and built between 2018 and 2021 in New York from Zillow.

contacts of multifamily and commercial new construction and major renovation projects in New York. The Contractor shall cross-reference identified projects and contacts from Dodge with the tax lot dataset. Dodge dataset includes contacts on ongoing (not only completed) projects, which is highly valuable for this study. The Contractor is looking to speak with owners of ongoing construction projects as well as completed projects.

None of the lists referenced above will identify participants versus non-participants. The Contractor shall cross reference all purchased or scraped lists with program data to identify participants and non-participants.

The Contractor estimates that it will need to complete a total of 204 surveys to ensure sample design and strategy for this survey will meet and/or exceed a target of 10% precision level at 90% confidence per each critical sector-based target group (see Table 3 above).

The strategy for developing the sample of non-participant building owners must take into consideration the likelihood that participants do not represent the building owner population as a whole – at least as far as commercial building owners and possibly multifamily building owners go. Given the likely implementation strategies for the NYSERDA programs and self-selection in response to program offerings, the participant populations for those groups likely own larger and more energy-intense buildings than average.

The Contractor shall make the nonparticipant sample as similar as possible to the overall nonparticipant market. This strategy provides a glimpse into possible broader market effects over time. However, it will not be possible to determine whether any differences between the responses provided by participants and nonparticipants reflect NYSERDA's interventions or pre-existing differences between the samples.

Separate Sample for Non-participating High Performing Buildings

The principal goal of NYSERDA's new construction offerings is to accelerate the adoption of high-performing and net zero energy buildings. Thus, it is valuable to gather insights from those who opted to build a high-performing building.

In New York, there are approximately 132 high-performing commercial and multifamily buildings (i.e., buildings with energy consumption below the current energy code), 27 of which are classified as net zero energy, according to the 2019 New York Getting To Zero Status Report.[22] This indicates that less than 1% of all multifamily and commercial buildings in New York are high-performing buildings. This pattern is likely similar on the residential side. Given the low incidence of these buildings in the population, the Contractor is proposing a separate sample for the owners of high-performing buildings.

The Contractor shall conduct up to 30 surveys with owners of high-performing buildings across all target sectors (residential, multifamily, and commercial). The Contractor shall rely on three sources of data to identify the location and age of high-performing buildings in New York: 1) the New Buildings Institute zero energy building data; the Passive House database; and the listing of all high-performing buildings in the 2019 New York report referenced above (which includes partial location information).

[22] This NYSERDA-funded study, which was fielded by New Buildings Institute, can be retrieved from: 2019 New York Getting to Zero Status Report.

The Contractor shall not sample but reach out to all identified high-performing properties.

The Contractor shall leverage address data to send three rounds of postcards inviting occupants in single-family high-performing homes to take the survey over the web. For multifamily and commercial buildings, the Contractor shall leverage multiple survey recruitment strategies (mail-push-to-web, email, or telephone recruiting). The Contractor will cross-reference multifamily and commercial high-performing properties with tax lot, Dodge, and CoStar data to identify any contact information other than address.

The survey instrument will include screening questions to ensure only those owners who are the original owners of the property (who interacted with the developer or developed the property) take the survey.

Participant Construction Project Developers Sample Strategy

The Contractor shall use NYSERDA's program data to first characterize the participant construction project developer population by construction type (new footprint versus substantial renovation) and building type of projects. The Contractor also will examine other characteristics – such as number of completed and planned projects, sectors represented (single-family residential, multifamily, and commercial), and geographic location of projects – to assess whether those should be included in the sampling plan as well.

The Contractor shall target the number of survey completions to meet or exceed 10% precision level at 90% confidence. Based on NYSERDA's estimate of about 250 participant developers, at least 54 survey completions will deliver this level of confidence and precision. The basis for that estimated population size is one of the Contractor's expected agenda items for the project kick-off meeting. The Contractor's working assumption is that NYSERDA has awarded or expects to award contracts to 250 developers under the existing PONs. If that population increases after contract award, the Contractor shall notify NYSERDA of any impacts that increase has on the sample and costs.

At minimum, the Contractor shall consider the distribution of construction types and building types across the developer population when developing the sample. As noted above, the Contractor may also consider other factors.

Three issues are important to note here. The first two are closely related. First, it is not clear whether NYSERDA's count of about 250 participant developers represents all *current* participants or all *expected* participants; the fact that NYSERDA has indicated the count is *approximately* 250 ("~250") suggests the latter. Second, the Contractor anticipates that, at the time that the sample plan is being developed, the exact distribution of construction types and building types across all eventual projects will not yet be known. A sample plan based entirely on the population of completed projects may not perfectly represent the final project population. Third, the various "stratification" variables are not exclusive categories. Developers likely will have done both new footprint and substantial remodels. Also, while some developers may focus on certain building types, it is likely that at least some if not all have developed buildings across more than one type. The Contractor will take both of these issues into consideration when developing the initial sample.

The Contractor shall discuss the first two of the above issues with NYSERDA before beginning sample development. The discussion will cover NYSERDA's expectations regarding the degree to which the existing population of participant developers represents the expected total population, and whether the

existing population of completed and started projects represents the expected total population. If NYSERDA staff have good reason to expect that the distribution of developers, construction types, and building types (or other sampling considerations) in the final population will differ in some expected fashion from the existing population, the Contractor shall take that information into consideration when developing the sample. If needed, the Contractor will adjust the sample as needed when new developers and/or new projects are added to the respective populations.

With respect to the third of the above issues, it may not be feasible to stratify the participant population into meaningful groupings. Thus, the best approach may not be a stratified random sample but to draw iterative simple random samples, comparing the distribution of each sample's characteristics with those of the population and abandoning samples that do not produce a good fit.

Nonparticipant Construction Project Developers Sample Strategy

The Contractor shall examine multiple sources in developing the sample frame. As for the architect and engineer sample frames (see below), the Contractor shall search the Dodge construction database for names of construction project developers. Other applicable sources may include Dunhill and Data-Axle as well as sources that NYSERDA may be familiar with.

The Contractor shall follow the same general sample strategy for the nonparticipant project developers as for the participant developers. A sample of 67 will provide 90/10 confidence/precision, assuming that the population is at least as large as that NYSERDA estimated.

Participant Architects and Engineers Sample Strategy

The Contractor will leverage NYSERDA's program/training data to draw a random sample of architects, engineers, and/or design-build firms involved with participating new construction or major renovation projects in the past five years as well as those participating in trainings, the Coaching program, the Buildings of Excellence and Net Zero Energy for Economic Development Competitions, and/or the online platform. The Contractor understands that these market actors are not consistently tracked by program for standard offer projects. Thus the Contractor, when surveying a general population of architects, engineers, and/or design-build firms (see the next section), will ask those respondents whether they worked on any new construction and/or major renovation projects in the past five years for which the owner or developer received a NYSERDA program incentive. If any respond affirmatively, then the Contractor will capture their feedback as well.

At minimum, the Contractor shall stratify this market actor group into two subgroups to the extent possible: architects and engineers. The Contractor anticipates that supplied contact information may not clearly indicate whether the contact is an architect or an engineer. Thus, the Contractor will rely on questions in the survey to identify whether contact and their firm offers architectural and/or engineering build services.

The Contractor shall ensure that the number of contacts per firm are minimized since there could be instances of multiple contacts per firm.

Finally, the Contractor shall monitor responses to ensure there is sufficient number of survey completions in each subgroup to meet 10% precision level at 90% confidence. In collaboration with NYSERDA, the Contractor will explore additional quotas based on the project(s) contacts were involved

with (construction type, building type) as well as location and stage of construction (in design, in-construction, completed).

Nonparticipant Architects and Engineers Sample Strategy

The Contractor shall cross-reference Dodge data with New York tax lot data to identify: 1) new construction projects that materialized into a built building from 2016 to present and 2) properties that may have ongoing construction. This task will be performed during the building owner survey sampling subtask referenced above. The Contractor shall extract any information for architects, engineers, or design-build firms for the identified properties from the Dodge data and possibly other sources (e.g., Dunhill). If enough architect, engineer, or design-build contacts are identified, the Contractor shall proceed with reaching out to those contacts to gather their insight on the topics of interest.

The Contractor shall draw a random sample of identified contacts.

In case the aforementioned approach does not work (not enough architect and engineer contacts identified), the Contractor shall then use Dunhill contact list of architects, engineers, and/or design-build firms to sample from. Specifically for New York, Dunhill database includes contact information for:

- **2,100** building design and architecture firms (The Contractor estimates that the Dunhill list covers a notable proportion of architects in New York. The National Council of Architectural Registration Boards notes that there are a total of 18,000 architects in New York. Dunhill list represents building design and architecture firms in both residential and commercial sector based on NAICS code designation. Some of these firms have multiple architects on staff, thus a list of 2,100 firms likely represents 5,000 or more architects in the state of New York.)
- **885** firms that offer engineering build services (NYSERDA estimated over 2,000 design-build firms that may offer engineering services – see Table 3 population assumptions above.)
- **2,343** building and remodel construction firms that may have architects and engineers on staff

The Contractor shall randomly sample from the Dunhill list of firms referenced above.

The Contractor shall rely on the questions in the survey instrument to confirm whether contacts are architects or engineers who have been involved with new construction or major renovations to ensure survey completion quotas are met.

The Contractor assumes at least 135 architect and engineer market actor surveys will be conducted (see Table 3 above).

Participant Economic Development Agencies Sample Strategy

The Contractor understands that NYSERDA program staff has met with members of the New York economic development agencies to engage them on construction projects that are in the early stage of design and that these agencies can influence. The Contractor shall attempt to speak with all economic development agencies that NYSERDA is collaborating with.

Energy Modelers Sample Strategy

The Contractor shall examine multiple sources in developing the sample frame. These may include the program data, Dodge construction database as well as Dunhill, Data-Axle, and that NYSERDA may be familiar with. The sample will be stratified by region (e.g., West, Central, North, East, Southeast, and NYC) roughly in proportion to the number of projects done in each region.

Participant and Nonparticipant Code Officials Sample Strategy

The Contractor shall utilize an existing contact list from a recently completed NYSERDA Clean Energy Communities Code Official Training impact evaluation study. The Contractor shall be cognizant of officials on the list that have recently participated in an evaluation study where necessary.

The Contractor anticipated interviewing up to 10 code officials from participating communities of municipalities.

With regard to code officials from nonparticipating municipalities, the Contractor anticipates identifying a leads list of approximately 40 local municipalities and up to 100 code official individuals as targets for these interviews. The Contractor will develop a sample from this list, designed to include both large and small municipalities with varying levels of above-code efforts.

- Deliverables – List of proposed survey respondents and documentation of how samples were selected and final sample strategy

Impact Evaluation Sample Strategy

The Contractor shall achieve single-family, multifamily, and commercial new construction samples that will achieve 90% confidence of 10% precision (90/10) at the program level as well as for all-electric buildings and buildings that use any natural gas. The estimated sample sizes assume a coefficient of variation (CV) of 0.5 for the single-family residential stratum but assume that a slightly lower CV of 0.45 will be achievable in the multifamily and commercial samples through stratification on program-reported energy savings. The top stratum of projects with the largest reported savings will be sampled with certainty, yielding precision of ±0% for that stratum. The remaining projects will be put into three to four strata, each with a CV of 0.3 to 0.5. The above yields a lower pooled standard error than would be achieved without this level of stratification and, thus, a lower CV.

The above CVs would produce 90%/10% confidence/precision sample sizes of 68 and 55, respectively, drawn from infinite populations. The sample size ranges shown below (Table 5) incorporate the finite population correction (*fpc*) factor, based on NYSERDA's estimates that 40% to 60% of projects in each sector will be all-electric.

Table 5: Impact Evaluation Sample Plan

Stratum	Target Project Population	Estimated Population Each Sub-stratum [a]	Sample Size, Each Sub-stratum	% of Sub-stratum Population	Total Sample	% of Total Population
Residential SF	3,000	1,200-1,800	65-66	4%-5%	131	4%
Residential MF	500 [b]	200-300	44-47	16%-22%	91	18%
Commercial	285	114-171	38-42	25%-33%	80	28%
Total	3,863	1,545-2,318	148-156		304	

[a] The sub-strata in this table are All-Electric and Any Fossil Fuel. Since the share of All-Electric is 40% to 60% of the total population of each stratum, then so must also be the share of Any Fossil Fuel. Therefore, the estimated population and sample sizes of each substratum have the same ranges.

[b] The Contractor's estimate of 500 MF projects is near the median of NYSERDA's projected number of participants (400), which represents the minimum number of projects, and NYSERDA's projected number of

buildings (590), which represents the maximum number of projects (per NYSERDA's statement in response to questions, Jan. 15, 2021). If any of the above estimates are incorrect, the Contractor will consult with NYSERDA concerning the effect on the impact evaluation.

Note that achievement of the 90/10 target will require successful data collection for one-quarter to one-third of the commercial projects.

Note also that the above sample sizes are for the total project populations, which the Contractor understands will be completed into 2023. The Contractor's cost estimate for the impact evaluation assumes that the Contractor shall complete the evaluation for about one-third of the total sample in 2021. If the actual number of projects available for sampling and analysis is larger or smaller, the Contractor will be happy to consult with NYSERDA on adjusting the plan and budget.

Incremental sampling shall occur over the lifecycle of this evaluation effort. The incremental sampling effort will draw single-family, multifamily, and commercial sample points in "batches" on pre-set time intervals (monthly, quarterly, etc.). The size of the batch drawn will be determined based on a cross-section of factors:

1. **Percent of annual goal of participants in batch period.** Given an *a priori* expected population of *N* and sample size *n*, for a Batch Period *P* with total participation N_P, the batch sample size n_P is calculated as:

$$n_P = n \times \frac{N_P}{N}$$

   For example, given an expected single-family population of 3,000 projects, of which approximately 2,500 have been completed, an expected evaluation sample of 131, and a new batch of 500 single-family homes occurring in the batch period, the sample to be drawn would be:

$$n_P = 131 \times \frac{500}{3000} = 22$$

   This will be completed on an iterative basis throughout the concurrent evaluation as this will ensure representativeness across the home builder business cycle. Oversampling earlier in a concurrent evaluation period may bias results as it can result in oversampling of builders that complete projects earlier in a calendar year while the mix of builders overall may not align with this schedule.

2. **Prevalence of high-impact commercial or multifamily projects.** Based on the initial set of participant data (comprising 60% of expected commercial and 33% of expected multifamily), the Contractor will draw stratum boundaries that define high, mid, and low-saving projects. The Contractor then will project this quantity of projects to an annualized basis within each savings stratum. This will be used to forecast how many projects within each savings stratum will be required to align with evaluation goals. The procedure defined in Item #1 above then will be applied *to each stratum individually*. This means that new batch sampling may be uneven when a batch is added to the program as not all batches will share the same distribution of skewness in savings as observed in the program year overall.

A secondary check may be needed to address if a new batch differs in such a categorical manner as to necessitate redrawing of sample strata boundaries. This may occur in new construction programs if one builder submits multiple projects of similar size at the same time. In an instance where strata boundaries are required to be redrawn in response to the content of a batch population update, the Contractor will author a memo detailing sampling strata boundary update that defines its impact on the work scope and content of the final sample. The Contractor notes that this manner of revision and variation is a common occurrence in concurrent evaluation and revisions as-described here are highly unlikely to affect EM&V sample size overall; rather, they are to affect the distribution of sample sites across different savings-impact strata.

The Contractor shall keep NYSERDA informed of any adjustments and their impacts on sampling in 2022 and 2023.

Task 5: Develop Primary Data Collection Instruments

The contractor shall design and develop surveys, questionnaires, interview guides and other forms of data collection. Drafts will be submitted to NYSERDA for review and feedback.

The instruments will address research topics and questions discussed in Table 1 and 4, above, as well as additional priority topics discussed during the kick-off meeting and not documented in this draft evaluation plan. The Contractor also noted additional topics in the sections where NYERDA lists topics of most interest (see below Table 3 above).

The Contractor shall use a strategic approach to instrument design, beginning with a matrix that matches the research objectives/topics with the survey questions. The Contractor anticipates the building owner, developer, and architect/engineer instruments will have a set of core survey questions – to provide consistency and allow us to compare answers across groups – as well as unique questions for each group. For other groups, the questions will be more unique.

The Contractor shall will work closely with NYSERDA to carefully develop the questions. If needed, the Contractor will refine the objectives based on discussions with NYSERDA.

- Deliverables – Draft and final instruments, advance letters to respondents

Task 6: Administer Data Collection Instruments

The contractor shall conduct pretests of survey instruments to ensure maximum effectiveness and will conduct interviews according to the finalized sampling plan. Between all team members, the Contractor has the capability and flexibility to use a variety of survey modes (web, phone, and, if needed, mail) and survey platforms (Qualtrics and other) to complete the research.

As noted in *Methodology for Primary Data Collection*, above, the Contractor team plans to use multiple survey recruitment strategies and data collection modes:

1. Mail-push-to-web – i.e., sending a postcard or a letter survey invitation.
2. Email-push-to-web.
3. Outbound telephone survey.

The Contractor shall have addresses for all identified newly constructed homes or buildings in the sample frame. As detailed in *Task 4: Sample Strategy*, above, the Contractor shall cross-reference multiple contact list sources – Dodge, InfoUSA, CoStar – with tax lot building data to identify any email and/or telephone information for the buildings in the sample frame.

The Contractor shall conduct pretests of survey instruments to ensure that the language of the questions conveys the intended meaning. The pretests will be done by both email-push-to-web and phone approaches. The former will provide quick and easy administration, while the latter will allow the Contractor to obtain a better feel for what may not be understood well and what might be a better way to word a question. In addition, the Contractor shall conduct a "soft launch" of each survey using a small sample of customers. The soft launch will allow the Contractor to review the data and correct for any programming and/or skip issues and resolve them prior to fielding the full survey. The Contractor will review with NYSERDA any changes to the instrument based on the pretest.

The Contractor anticipates using different mixes of recruitment approaches and data collection modes for the various survey populations based on considerations of what will provide the best response rates and data quality for each group.

The Contractor anticipates using primarily email and mail-push-to-web survey modes for single-family building owners (i.e., homeowners), with little phone surveying for this group. Recent experience shows rapidly decreasing response rates to phone surveys, even when the sample includes mobile phones, with much better responses to both email and mail contacts. For example, the 2020 Energy Trust of Oregon Customer Insights Study achieved 7% response rates for both mail-push-to-web and email-to-web recruitment efforts, but only 3% response rate for phone surveying. In addition, the Contractor believes that a largely quantitative, close-ended survey will be appropriate for homeowners, for which an online survey is entirely suitable. However, the Contractor may use phone follow-up to the online survey as needed to achieve completion targets. Thus, the Contractor suggests the following recruitment protocol for homeowners:

- The Contractor shall send an email invitation to sampled homeowners for whom email addresses are available, or a mailed invitation otherwise. The invitations will explain the purpose of the data collection and offer recipients a link to an online survey. The invitation will identify NYSERDA as the sponsor of the survey and explain that NYSERDA selected the ERS/ADM team to carry it out as an independent evaluator. It will explain that the team will report only aggregate survey data. The invitation will state the goal number of survey responses and will ask if the respondent can be one of the people who help the Contractor reach that goal, which has been shown to increase survey responses.[23] The invitation will provide contact information for an ERS/ADM team member who can answer any questions about the survey or conduct the survey by phone. In addition, if NYSERDA agrees, the invitation also will provide contact information for a NYSERDA employee who can attest to the legitimacy of the survey and answer questions about it. The invitation will offer a $15 incentive to complete the survey. The invitation will include a link the recipient can follow to opt out of receiving any further invitations to take the survey.

[23] J. Loomis, E. Focella, A. Weaver, and R. Bliss 2019. "Increasing Response Rates to Web Surveys: No Tote Bag Required." Informing Innovation: Research and Evaluation in a Changing Energy Landscape, Denver, CO: International Energy Program Evaluation Conference, August 2019.

- For homeowners for whom email addresses are available, the Contractor shall send up to five reminder emails, spaced 3 to 4 business days apart, to sampled homeowners who do not opt out of receiving further contacts. The Contractor shall vary the wording of each successive reminder but each will state that the Contractor has not yet reached the required number of survey responses, will ask if the respondent can be one of the people who help the Contractor reach the survey goal, and will again promise the $15 incentive. The final reminder will state that the survey will close in 3 days. The ERS/ADM team has found that these approaches increase response rates.
- For homeowners for whom email addresses are not available, the Contractor shall consider sending two follow-up mailings, if needed to achieve the target number of responses and if doing so is cost-effective.[24]
- If needed, the Contractor shall call a subset of the sampled homeowners who do not respond to the online survey.

A largely close-ended survey may also be applicable for some or all multifamily building owners as well as some commercial building owners. While the Contractor will still attempt to achieve the majority of these by mail- or email-push-to-web, it is likely that the share of these survey completions achieved by phone will be higher than for homeowners. The recruitment protocol for this group will be similar to that for homeowners.

The Contractor believes that a combination of semi-structured phone interviewing with mail/email-push-to-web surveying is the appropriate approach for several other groups, including large commercial building owners, construction project developers, architects and engineers, and energy modelers. Experience shows that many of these types of professionals are challenging to reach and interview or survey. Attempting contact through two or more modes provides a greater opportunity to collect the needed data. Combining an online survey and phone survey also will allow the Contractor to obtain more detailed responses from those who complete the survey by phone.

The Contractor shall use the following recruitment protocol for the above groups:

- NYSERDA makes advance contact with sampled professionals to advise them of and explain the purpose of the upcoming survey and ask for their cooperation.
- The Contractor will send emails or letters (depending on availability of email addresses) to sampled professionals to again explain the purpose of the data collection. The invitations will offer them a link to an online survey but additionally will alert them that the Contractor also will contact them by phone if they do not complete the online survey or may contract them with follow-up questions. As with the homeowner and multifamily recruitments, the invitation will: identify NYSERDA as the sponsor of the survey; explain that NYSERDA selected the ERS/ADM team to carry it out as an independent evaluator and that the team will report only aggregate survey data; state the goal number of survey responses and ask if the respondent can be one of the people who help the Contractor reach that goal; and provide contact information for an ERS/ADM team member and (if NYSERDA agrees) a NYSERDA employee to provide bona fides

[24] The aforementioned Energy Trust Customer Insights Study found a 6% response rate to an initial letter, mailed to all sampled customers (regardless of availability of other contact information), with a 1% response rate to a postcard mailed about one week later to letter nonrespondents. A second postcard, mailed only to customers for whom phone number and email address were not available, achieved a 3% response rate.

and answer questions about the survey. The email will offer a $50 incentive to complete the survey and will include a link to allow recipients to opt out of further contacts about the survey.

- For those for whom email addresses are available, the Contractor will send up to four reminder emails, spaced 3 to 4 business days apart, to sampled professional who do not opt out of receiving further contacts. As with the reminder emails for other groups, wording for each successive reminder will vary but will state that the Contractor has not yet reached the required number of survey responses, ask if the respondent can be one of the people who help the Contractor reach the survey goal, and again promise the $50 incentive. The final reminder will state that the survey will close in 3 days.
- For those for whom email addresses are not available, the Contractor will consider sending one follow-up mailing, if needed, to achieve the target number of responses and if doing so is cost-effective.
- The Contractor will call sampled professionals who do not respond to the online survey.

For the above groups, the Contractor shall attempt to conduct approximately one-third of the surveys by phone and the rest online. To achieve this outcome, the Contractor shall carry out the contacts in waves – that is, the Contractor will send emails first to a subset of the sample. If contact efforts do not produce the expected proportions of phone interviews and online completions, the Contractor will modify the recruitment protocol for subsequent waves – for example, sending an advance email without an online link followed by calls or, alternatively, increasing the number of reminder email and reducing phone follow-up.

The Contractor shall attempt to use the same survey methodologies for the non-participants as with the participants to maximize the comparability of results. However, the Contractor will adjust the contact protocols as needed to obtain the desired response. For example, reaching non-participants may require more intensive use of phone contacts. If so, the Contractor will determine whether the data collection mode (online or phone) was related to responses and will weight responses as needed.

The Contractor shall interview economic development agency contact and code officials by telephone. The Contractor believes that other approaches will not achieve target completions and/or will adversely affect response quality.

The Contractor and its survey partner shall attempt to maximize responses by leaving voicemail messages when calling to explain the reason for the call and provide potential respondents options for responding within their schedule by providing a call-in number as well as arranging call-backs that work in respondents' schedules. Also note that the Contractor and its survey partner will leverage email as much as possible to schedule a time with willing contacts to complete the survey.

The Contractor recommends offering an incentive to nonparticipant survey respondents: $15 to residential and $50 to non-residential respondents. The Contractor successfully uses various incentive strategies, ranging from sweepstakes drawings to providing gift cards to all respondents to sending pre-incentives as part of the advanced notification. The Contractor budgeted for gift cards but is open to alternate incentive strategies. The Contractor will discuss with NYSERDA in the kick-off meeting to determine the final incentive strategy.

The Contractor has the capability to export data into various formats, which can then be imported into various software for analysis, including SAS, R, and SPSS. The Contractor will work with NYSERDA to determine the optimal data format and provide a final data codebook for use in analysis.

The Contractor shall offer confidentiality to the extent permitted by law when recruiting survey and interview respondents . That is, the Contractor will report all responses in aggregate and will not attribute any comments to an individual. When the Contractor provides survey data files to NYSERDA, the Contractor will strip any identifiable information from the data sets.

- Deliverables – Survey disposition and methodology reports

Task 7: Data Analysis

The Contractor shall conduct analysis of primary data to assess and measure research objectives and associated indicators. Transform data into a usable format, assess quality and consistency through editing and cleaning.

During this task, an interim report (3-5 pages) summarizing data collection and analysis progress, project challenges, and remaining work required to meet DPS requirements is required. This interim report shall be produced no later than mid-way through the Task 7: Data Analysis execution so that course corrections needed for project success can be made. It is anticipated that this interim report shall be confidential to NYSERDA and used solely for project guidance.

Data analysis will commence from day one of this project, from assessment of secondary data to analyzing the survey, interview, metering and billing and/or project data. The Evaluation Objectives Table (Table 1) illustrate how the Contractor will draw from the various data sources to inform the key findings.

Below, the Contractor describes the following analytic activity: survey analysis and direct impacts methodology. In Task 3 (Indirect Impacts Methodology), the Contractor discusses indirect impact analysis for the programs.

Survey Analysis: The Contractor shall complete the survey analysis using SPSS and will provide delimited files or Excel files of survey responses to allow for the files to export into other statistical packages like SAS. The analysis will be guided by an analysis plan, which the Contractor will develop prior to the analysis stage. The plan will document survey variables and the type of analysis and purpose of analysis (e.g., to inform outputs, indicators, market characterization). The plan will also specify any cross-sectional analysis or subgroups for tabulations (e.g., by location, sector). Also note that even with the most rigorous sampling methods and exhaustive outreach, survey non-response can result in final survey data not representing the population of interest. Thus, survey weighting may be an important consideration. Weighting helps to correct the survey data so that the data set is more aligned with the population of interest in terms of key characteristics. For the nonparticipant populations, this may be location, sector, or certain demographic or firmographic variables. That said, not all survey results can or should be weighted, especially if population characteristics are less certain. The Contractor will discuss weighting if appropriate with NYSERDA during sampling as well as analysis stage.

Impact Analysis: The Contractor shall conduct analyses as detailed in IPMVP Options A and/or D, and as described above. Once savings estimates and realization rates are developed for each sampled project,

the Contractor will extrapolate these results to develop gross savings at the program level for each stratum (single-family, multifamily, and commercial) as well as by fuel type and all-electric buildings and major measure groups. Extrapolation will use stratum weights derived in the sample design (a form of ratio estimation). The Contractor will report each set of results with corresponding precisions.

NEI Analysis. The Contractor shall inventory the measures installed and other project attributes and identify the NEI streams associated with the project from the NEI database. The net NEI benefits will be calculated as the product of the NEI values and the installed implementation units (typically kWh or therms saved). The output of the analysis will be the annual and lifetime net benefits attributable to the program.

Cost Analysis. The Contractor shall assess the incremental cost of the above code and/or high-performance building (e.g., ENERGY STAR Homes, Passive House, Net Zero Energy), identifying typical cost difference for critical measures that define a building as above code. Survey feedback and project file data will inform this analysis and potentially other sources of data.

The Contractor recognizes the importance of sharing early findings with NYSERDA. In addition to the draft report and findings presentation, the Contractor will draft an Early Findings Memo (for Year 1) in August 2021 (about halfway through the study) to share results with NYSERDA. If applicable, the schedule for Year 2 and Year 3 work will be provided in January of 2022 and 2023, respectively.

- Deliverables – Interim report, data and analysis files, tabulations and other statistical analysis outputs, survey disposition reports, methodology reports

Task 8: Draft Report and Preliminary Findings Presentation

The Contractors shall follow the format and guidance as set forth in NYSERDA's Evaluation Report Guidelines. Draft reports and presentations shall be submitted to NYSERDA in advance for review and input.

The Contractor shall provide the draft report for the market baseline and Year 1 impact results in November 2021. The report will include a concise executive summary of all critical findings, followed by a more detailed narrative (which will include an introduction, methodology, detailed findings, and conclusions / recommendations). The report will clearly:

- Illustrate the Contractor's findings related to the study objectives
- Document the baseline, progress metrics, and impacts in appropriate tables
- Discuss findings addressing testable hypothesis
- Provide programmatic improvement insights related to market, baseline, barriers, and anticipated outputs and outcomes

The Contractor believes in developing reports that are actionable for clients and their stakeholders.

To ensure that reporting reflects NYSERDA's high standards, the Contractor will meet with the NYSERDA study manager to discuss the outline and the format of the report and will engage their production team to ensure report adheres to established expectations. Also note that the Contractor's technical team will

validate numbers and analysis while the editorial team will ensure that the report and presentation slide deck are carefully edited before delivery.

- Deliverables – Draft report and presentation with slide deck

Task 9: Final Report

The Contractor shall incorporate feedback and prepare final report(s) in accordance with the NYSERDA Evaluation Report Guidelines. The final report(s) will be a publicly available document(s). The report(s) will be made available by end of December 2021, provided the review and response period assumptions documented in the timeline below are largely correct.

- Deliverables – Final report and final version of presentation materials

Task 10: Data Transfer

The Contractor shall transfer data files and associated analysis files to NYSERDA via SharePoint. Includes tasks to prepare data for dissemination.

- Deliverables – All project-related data files

Task 11: Data Destruction

Upon conclusion of the project (or contract in the case of multi-year studies), and after transferring all data files to NYSERDA, the Contractor shall destroy any confidential utility customer data used as part of the project and will countersign a letter to NYSERDA certifying this has occurred. The Contractor shall destroy all other data associated with the project and will send NYSERDA an e-mail stating this has occurred.

- Deliverable – Countersigned letter sent to NYSERDA upon destruction of utility data; e-mail sent to NYSERDA upon destruction of all other project data

Task 12: Project Management

The Contractor shall attend conference calls and meetings with NYSERDA, management, staff and NYSERDA-designated parties and presentations to such groups. The Contractor will also participate in bi-weekly (once every two weeks) calls with NYSERDA project managers, as well as develop memoranda stating any issues, project status and actions items discussed during the calls. These calls will be scheduled in consultation with NYSERDA. The Contractor also will provide bi-weekly progress reports demonstrating activity over the prior week and will submit these reports to NYSERDA in advance of the bi-weekly status calls. These reports will submit monthly progress reports with invoices.

- Deliverables – Bi-weekly and monthly progress reports

Task 13: Draft Workplan for Following Year Evaluation Activities

The approach outlined in this evaluation plan includes baseline and follow-up measurements. The Contractor understands that after the baseline study, NYSERDA will decide whether to move forward with the Contractor to conduct the follow-up assessment(s). The Contractor will make no assumption on implementing follow-up measurements without prior written approval from NYSERDA. The Contractor will prepare a draft work plan for the follow-up measurements and research activities at the end of each evaluation period, submitting to NYSERDA for consideration. The Contractor will finalize the workplan at the outset of each evaluation year.

- Deliverables: Draft subsequent year work plan submitted to NYSERDA

Budget Summary

The total budget for this study is $2,007,165.00.

Invoicing Guidelines

Invoices should be structured to clearly delineate the staff hours and costs associated with each of the individual tasks included in this section. Any potential deviations from the agreed-upon task budgets must be discussed with the NYSERDA project manager as soon as possible and prior to the continuation of work. In general, small changes to original task-level budgets will be acceptable following discussion with NYSERDA, while larger task-level budget changes that substantially affect the overall study budget will require written justification and NYSERDA approval.