Measuring and Evaluating Indirect Benefits

NEW YORK STATE | NYSERDA

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Acronyms and Abbreviations

BAB	Budget and Benefits
CEF	Clean Energy Fund
CSCNB	Codes and Standards for Carbon Neutral Buildings
EM&V	Evaluation, Measurement, and Verification
EMP	Energy Management Practices
EMT	Energy Management Technology
MPI	Market Progress Indicator
MPTA	Metrics, Tracking, and Performance Assessment
NEEA	Northwest Energy Efficiency Alliance
NOMAD	Naturally Occurring Market Adoption
NYSERDA	New York State Energy Research and Development Authority
OsEM	On-site Energy Manager
SEM	Strategic Energy Management
UEB	Unit Energy Benefit

Glossary of Terminology

Baseline market adoption or naturally occurring market adoption (NOMAD): Market adoption that would have occurred in the absence of a market transformation program.

Direct benefits: Benefits that result from measures, projects, or practices implemented with direct NYSERDA assistance.

Direct influence participant adoption: Units of adoption by participant end users, during or after program engagement, not associated with incentives or direct support from NYSERDA. (Contributes to NYSERDA indirect benefits.)

Direct involvement participant adoption: Units of adoption associated with incentives or direct support from NYSERDA, as part of direct end-user engagement with the program. (Contributes to NYSERDA direct benefits.)

Indirect benefits: Energy savings and other benefits resulting from measure adoption associated with indirect program influence.

Leveraged funds: Private-sector investment mobilized by the initiative that otherwise would not have occurred.

Market transformation: The strategic process of intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of all cost-effective energy efficiency as a matter of standard practice.

Midstream initiatives: NYSERDA's collaboration with retailers and distributors to increase the availability and promotion of energy-efficient equipment and reduce the final price to consumers.

Measure: Any product, service, technology, or practice that is intended to produce clean energy or energy efficiency benefits.

Nonparticipant adoption: Units of adoption by targeted end users who have adopted the technology or practice but have not engaged directly with NYSERDA. (Contributes to NYSERDA indirect benefits.)

Program-induced market adoption: The number of measure units adopted that were influenced by the program activities.

Total market adoption: The units of a measure adopted or implemented by both program participants and nonparticipants.

Upstream initiatives: NYSERDA's collaboration with manufacturers and producers of energy-efficient equipment to increase the availability and promotion of energy-efficient equipment and reduce the final price to consumers.

Unit energy benefits: Energy savings (MWh or MMBtu) or renewable energy (MWh) per end user resulting from the measure adoption.

1 Introduction

The New York State Energy Research and Development Authority (NYSERDA) has deployed approximately 80 market transformation initiatives as part of its Clean Energy Fund (CEF) portfolio and expects to add more initiatives in the future. NYSERDA has set targets—in terms of energy efficiency (MWh, MMBtu), renewable energy (MWh), carbon reduction (CO2e metric tons), and leveraged funds (dollars)—for the expected direct and indirect benefits impacts of each initiative in the portfolio. With these market transformation initiatives, NYSERDA aims to create sustained market change that will substantially accelerate and increase the long-term market adoption of clean, energy-efficient technologies and practices. In many cases, indirect benefits targets exceed expected direct benefits. NYSERDA tracks the direct benefits for each initiative that result from energy projects implemented with NYSERDA assistance. Indirect benefits arise from NYSERDA's influence to spur adoption without NYSERDA's assistance and are not directly tracked by the initiatives.

NYSERDA will estimate direct benefits for each initiative using appropriate impact evaluation methods. Estimating initiative-specific indirect benefits, however, typically relies upon a combination of (1) impact (measurement and verification) evaluation activities to determine unit energy savings and the renewable energy and carbon reduction impacts associated with technologies and practices, and (2) market evaluation activities to estimate the increase in market adoption induced by the initiative, beyond the participant adoption resulting from direct NYSERDA involvement. While market diffusion and associated indirect impacts generally occur over the mid-to-long term, it is critical that NYSERDA have specific plans in place at the start of each initiative to capture the data necessary for credible, defensible analysis and quantification of indirect benefits as they are realized. An indirect benefits framework is also necessary to ensure consistency and transparency among evaluation, measurement, and verification (EM&V) contractors' data collection and analysis efforts.

1.1 Framework Objectives

Indirect benefits are critically important to NYSERDA being able to achieve its CEF goals. Indirect benefits comprise a substantial proportion of NYSERDA's energy efficiency, electrification, and renewable energy goals (estimated at nearly 50% of NYSERDA's 105 TBtu contribution to the State's acquired energy efficiency savings in 2030). There are several objectives of the indirect benefits framework:

- Ensure a solid foundation for the credible evaluation of indirect benefits in two ways:
  - Outline a common approach to estimating indirect benefits that conforms with market transformation program evaluation best practices.
  - Provide a resource for NYSERDA and evaluators to plan, design, and implement market evaluation activities in a manner that helps to ensure timely collection of the data required to reliably estimate and claim indirect benefits.

- Provide guidelines on how to identify and avoid or adjust double-counting of indirect benefits.
- Create a well-documented methodological approach that can help NYSERDA communicate with stakeholders.

This document is an update to the NYSERDA indirect benefits evaluation framework developed in 2018, consistent with the New York State Department of Public Service's evaluation guidance document;[1] the Clean Energy Advisory Council's Metrics, Tracking, and Performance Assessment (MPTA) Working Group's document, *Market Transformation Metrics and EM&V Coordination Report*;[2] and other documented best practices for evaluating market transformation programs cited herein. This update builds on the original framework in four ways:

- Highlights approaches to ensure that evaluations fully capture large, transformative impacts that may not be captured by program-level evaluations
- Expands the discussion of unit energy benefits (UEBs), including estimation approaches and the importance of using values that are appropriate for market projection
- Increases the usability of the framework by presenting key evaluation activities at each stage of the program lifecycle and adding two practical tools to support indirect benefits evaluation
- Updates content to reflect changes in the CEF portfolio and associated benefits

The framework and tools outlined below will help NYSERDA ensure that it achieves reliable indirect benefits evaluation results that are comparable across programs,[3] evaluators, and program implementers. By employing the framework, NYSERDA can easily compare, analyze, and aggregate evaluations from different EM&V vendors across different sectors, programs, and delivery methods. This framework is intended to provide general methodological guidance and serve as a reference document; it is not a specific evaluation plan.

1.2 Market Transformation Indirect Benefits Evaluation Challenges

Whereas the methods and protocols for evaluating direct energy savings impacts from traditional utility resource acquisition programs are well-established and documented in numerous EM&V protocols,[4] the market transformation impact evaluation body of knowledge is less formal and not as well-established. However, best practices for evaluating market transformation programs are reasonably well-documented in the *California Energy Efficiency Evaluation Protocols* and several other papers and public documents on this subject.[5] They are also addressed to some extent in impact evaluation frameworks under the topic of market effects estimation.

One key difference between resource acquisition and market transformation program evaluations is that resource acquisition studies seek to measure and verify energy savings associated with technology measures and practices among known customer program participants, while market transformation studies must estimate adoption of the targeted technology or practice among a population of end users who are

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[1] See DPS 2016.
[2] See MPTA 2018.
[3] In this document, programs and initiatives are used interchangeably.
[4] For example, see NREL 2004, NREL 2002, and EM&V Working Group 2012.
[5] See TecMarket Works 2006, Rosenberg and Hoefgen 2009, Vine 2013, NMR 2019, and SAG 2022.

typically unknown to the program administrator. In both cases, statistical methods are used to estimate measure adoption and savings. However, the nonparticipating end users for market transformation programs are different from those for resource acquisition programs in two ways:

- The program administrator of a market transformation program often has no direct relationship with the end user, which has three implications:

  - The administrator does not have access to customer data, including contact information and energy consumption data.
  - There is a less compelling reason for end users to provide information to evaluators because they have not explicitly signed up or participated in anything.
  - UEB estimates must be based on secondary sources (verified or evaluated values, if possible) or on market-representative studies of the energy savings associated with the technology or practice in question; measurement and verification of nonparticipating market adoptees is unlikely to be an option.

- End users who have adopted the technology or practice promoted by the market transformation initiative are unlikely to be able to directly attribute actions or motivations to program interventions because the influence is typically indirect and designed to permanently change market practices at large, such as by working to change building codes, product standards, and the practices of market actors and decision-makers.

In fact, market transformation programs are defined by strategically removing market barriers and exploiting market opportunities and points of leverage to achieve lasting, structural market changes that effectively change standard practice.[6] This characteristic of market transformation programs has implications for the methods used to establish program causality. More specifically, because market transformation programs deliberately seek points of market leverage to influence end users, it is not reasonable, as it is for resource acquisition programs, to expect an end user to be able to directly attribute their adoption decision to an initiative activity. This framework discusses the different methods required to establish appropriate market transformation program causality, known as program-induced market adoption.

1.3   Indirect Benefits Estimation

The evaluation of indirect benefits typically relies on estimating two key components:

- The change in market adoption induced by the initiative
- The savings (or other benefit) impact of the adopted technology or practice

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[6]   See ACEEE 2018.

The following equation shows the relationship between these variables and indirect benefits:

Indirect Benefits = *(Program-Induced Market Adoption * UEB) - Direct Benefits*

Where:

Indirect Benefits	=	Energy savings and other benefits resulting from measure[7] adoption associated with indirect program influence
Program-Induced Market Adoption	=	The number of measure units adopted that were influenced by program activities
UEB	=	Unit energy benefits; energy savings (MWh or MMBtu) or renewable energy (MWh) per end user resulting from adopting the measure
Direct Benefits	=	Energy savings (MWh or MMBtu) or renewable energy (MWh) resulting from measure adoption associated with direct program engagement

Protocols for estimating energy impacts for a wide range of technologies and practices are comprehensively addressed in numerous documents and are not the focus of this framework. It is important to note, however, that direct benefits impact evaluations, which focus on participant impacts, may not produce UEBs that represent the market or market segments at large. The importance of identifying UEBs that can be extrapolated to the market is discussed in the *Key Activity. Develop Evaluation Plan* section.

Figure 1 illustrates the concept of program-induced market adoption. The graphic depicts an increase in the market adoption of a technology or practice over time:

- The blue line represents total market adoption.
- The grey area represents baseline market adoption (also known as naturally occurring market adoption, or NOMAD). NOMAD is the market adoption that would have occurred in absence of the market transformation program. It is important to acknowledge that the NOMAD curve is a counterfactual set of values, making it challenging to estimate.
- The light blue area—the difference the between total market adoption and NOMAD—is program-induced market adoption.

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[7] This document uses "measure" as a generic term that refers to products, services, technologies, or practices (or any combination thereof) promoted through a Market Development initiative.

Figure 1. Total, Program-Induced, and Baseline Adoptions over Time
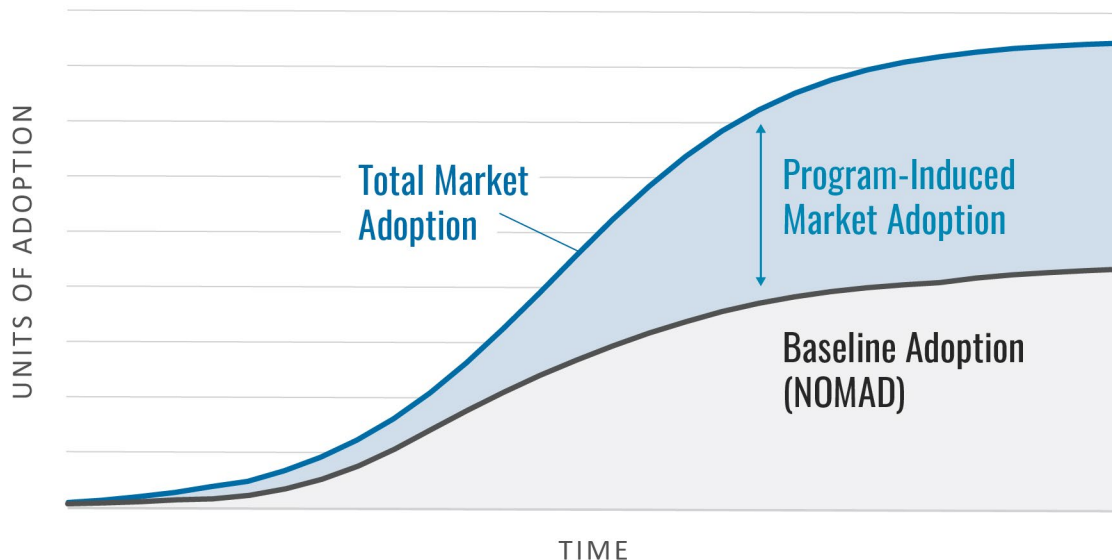
The following equation describes the concept presented in Figure 1 and represents a general approach to estimating market transformation program-induced market adoption:

Program-Induced Market Adoption = *Total Market Adoption – NOMAD*

Total market adoption comprises adoption by both program participants and nonparticipants, as shown in the expanded equation:

Program-Induced Market Adoption = *Participant Adoption + Nonparticipant Adoption – NOMAD*

NYSERDA counts benefits resulting from direct program engagement as direct benefits, and it counts benefits resulting from participant adoption that occurs ***outside of*** direct program engagement as indirect benefits. This distinction has evaluation implications: market evaluators must assess ongoing adoption among nonparticipants (that is, the general target market) as well as adoption among direct participants that occurs during and after direct involvement has ceased. In this framework, we refer to end-user adoption using three terms:[8]

- ■ *Direct involvement participant adoption:* Units of adoption associated with direct end-user engagement with the program. (Contributes to NYSERDA direct benefits.)
- ■ *Direct influence participant adoption:* Additional units of adoption by participant end users not associated with the incentives or direct support from NYSERDA, including adoption by former participants who are no longer engaged with NYSERDA. (Contributes to NYSERDA indirect benefits.)

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[8] Heschong Mahone Group (2008) originally developed this nomenclature to describe these three types of market adoption in evaluating market effects for the Northwest Energy Efficiency Alliance's (NEEA) Integrated Design Labs initiative, which intended to accelerate the market adoption of commercial integrated design practices.

- **■** *Nonparticipant adoption:* Units of adoption by targeted end users who have adopted the technology or practice but have not engaged directly with NYSERDA. (Contributes to NYSERDA indirect benefits.)

The next section of this document describes the indirect benefits evaluation framework and discusses the planning and evaluation activities that support indirect benefits estimation at each stage of an initiative's lifecycle. The appendix of this framework includes links to three practical tools that help initiative teams ensure that evaluations include the activities necessary to comprehensively assess indirect benefits: (1) an *Indirect Benefits Evaluation Checklist*, (2) an *Evaluability Mapping Tool*, and (3) an *Initiative Typology and Associated Evaluation Considerations* guide.

2 Indirect Benefits Framework

This section presents a framework and roadmap to estimate indirect benefits. It begins by introducing the framework and continues with a discussion of the required activities for each stage of an initiative's lifecycle.

This framework will assist NYSERDA program management teams and evaluators with ensuring the evaluability and reliable measurement of impacts resulting from CEF program investments. Figure 2 summarizes three lifecycle stages of initiatives funded by NYSERDA's CEF, along with the key research questions to answer at each stage to ensure evaluability and reliable measurement of indirect benefits.

Figure 2. NYSERDA Initiative Lifecycle and Key Questions Informing Indirect Benefits Evaluation
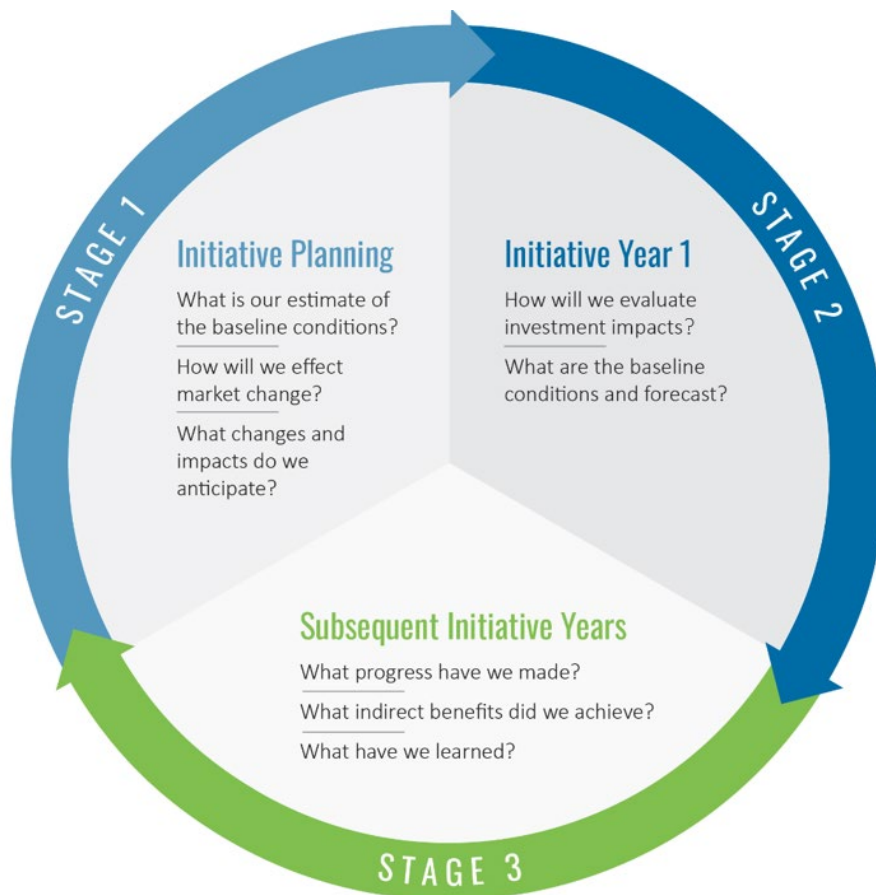
Figure 3 identifies specific activities that must be completed at each lifecycle stage, along with the purpose of each activity with respect to indirect benefits evaluation. *Appendix A* includes a more detailed checklist that program teams can use to help ensure they are completing the steps necessary to estimate indirect benefits. The sections that follow provide detail on best practices and methods for each stage and activity. The *Stage 2. Initiative Year 1* section identifies methodological considerations for different program types.

Figure 3. Key Activities and Purpose for Each Lifecycle Stage

Indirect Benefits Framework

INITIATIVE LIFECYCLE STAGES & ACTIVITIES	IMPLICATIONS FOR INDIRECT BENEFITS
STAGE 1: EVALUATION PLANNING (PRE-FILING)	
✓ Clarify market transformation theory (targeted market actors, pathways of influence, hypothesized outcomes)	• How will the initiative catalyze market change and generate indirect benefits?
✓ Create logic model	• What are all the direct and indirect pathways of influence?
✓ Create evaluability map by pathway of influence	• What are the theorized pathways of causal influence and what data is needed to validate those pathways?
✓ Develop benefits forecast	• What are the direct and indirect benefits targets and forecasts?
STAGE 2: INITIATIVE YEAR 1 (BASELINE YEAR)	
✓ Review initiative documentation	• Does the logic model reflect how the initiative actually operates?
✓ Develop evaluation plan (sources, methods, and granularity for assessment of UEBs, market adoption, and causality)	• How will we estimate indirect benefits calculation components (such as UEBs and an increase in market adoption resulting from initiative activities)?
✓ Coordinate with internal and external stakeholders	• Have we identified and incorporated all the theorized pathways of influence into evaluation plans?
✓ Characterize market baseline conditions and forecast	• What are the market conditions prior to initiative launch? What are the expected future conditions absent the initiative?
STAGE 3: SUBSEQUENT YEARS	
✓ Evaluate market progress, adoption, and causal influence per evaluation plan	• What are the direct and indirect benefits per unit of adoption? How many units were adopted as a result of the initiative?
✓ Estimate indirect benefits	• Are estimated indirect benefits reasonable and within a realistic order of magnitude? Was potential for double-counting accounted for?
✓ Review benefits forecast model assumptions; refine forecast	• Are the benefits forecast assumptions valid? What assumptions, if any, should be updated?
✓ Review/refine logic model	• Is the market transformation theory valid? What, if any, activities, logic model elements, or pathways of influence should be updated?
✓ Update evaluation and data collection plan	• How should the evaluation and data collection plans be updated to ensure the evaluation provides data required for timely, accurate estimation of benefits?

2.1   Stage 1. Initiative Planning (Pre-Filing)

The evaluability of indirect benefits begins at the initiative planning stage, with NYSERDA's development of the program theory, logic model, and benefits forecast. Evaluators use the hypothesized pathways of market influence documented in the program theory and logic model to assess the influence and impact of the initiative. In addition, a well-documented benefits forecast allows evaluators to identify assumptions that should be validated to estimate indirect benefits.

2.1.1   Key Activity. Clarify Market Transformation Theory

To determine indirect benefits, an evaluator depends on the program theory, which explains the theory of market change, and on the logic model, which documents the program's intended targeted activities, outputs, and outcomes. Together, the program theory and logic model describe the current market situation (barriers, opportunities, and existing [if any] programs targeting the same market), a theory and strategy for how the program's market interventions will induce sustained market changes that will accelerate market adoption (pathways of market influence), and the outcomes that are expected over the short, medium, and long term. The program theory and logic model provide the basis upon which the evaluator can assess market progress and the impact of the initiative and validate the theory of market transformation.

As part of its CEF investment plan, NYSERDA has developed program theories and logic models for Market Development and Innovation and Research initiatives, along with key market progress indicators (MPIs) and the data sources expected to be used for the assessment. The evaluator should be able to identify direct and indirect impacts from examining the program theory and logic model, and an evaluation plan for indirect benefits should include a logic model that highlights or annotates the primary pathways of influence.

To develop credible estimates of indirect benefits, it is necessary to identify three key components of the market transformation theory, each discussed below:

- Market definition and targeted market actors
- Causal logic/pathways of influence
- Hypothesized market outcomes and effects

2.1.1.1   Market Definition

Because market transformation programs seek to change markets, evaluations must be structured to measure program-induced market changes.[9] Generally, a market is defined as of a set of entities that supply a product or service and the buyers of that product or service. While there is no universally accepted taxonomy of energy efficiency markets, there is consensus about the characteristics that delineate and define markets. If a clean energy technology or practice share the following list of characteristics, they are likely in the same market:

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[9]   This discussion is adapted from TecMarket Works 2004.

- Same or similar product functions or categories of functions (for example, HVAC, water heating, appliances, and energy management systems)
- Overlapping distribution chains
- Same or competing manufacturers
- Same or competing service providers
- Demographically or firmographically similar buyers

NYSERDA's CEF portfolio includes a mix of initiatives that target a single market (such as Greenhouse Lighting and Systems Engineering) and those that target multiple markets. For example, NYSERDA's New Construction initiative operates in the residential homebuilding market and in the commercial and multifamily building markets. These markets are distinct because they have different suppliers of building services—designers, builders, and real estate professionals. In addition, the CEF portfolio includes initiatives that target overlapping markets. For example, the New Construction and the Codes and Standards for Carbon Neutral Buildings (CSCNB) initiatives both seek to influence the practices of building owners and developers, as well as those of design and construction professionals.

Because market effects and the associated indirect benefits must be estimated at the market level, it is an essential first step to identify the discrete market(s) that the initiative seeks to transform and which population it will measure to estimate adoption. In addition, for initiatives that target the same market, NYSERDA should consider the extent to which each initiative's activities may contribute to market transformation and evaluation research efforts should be deliberately coordinated. Initiatives that target the same market should acknowledge other relevant programs or initiatives in the program theory and logic model.

Market transformation strategies typically seek to accelerate end-user adoption of the desired technology or practice by targeting multiple market actors engaged on the supply and demand sides of the technology or practice, and may also seek to influence codes, standards, and local policies and practices. In addition to identifying the market(s) each initiative seeks to transform, it is also important for NYSERDA and the evaluator to create an inventory of the market actors to engage for each initiative. NYSERDA's *Compiled Investment Plan* (2023) includes a list of the market participants targeted by each initiative. This information allows NYSERDA and market evaluators to identify the markets and the specific market actors who are targeted by more than one initiative. Market actors who are not directly involved with the program are often difficult to reach for research purposes; this mapping will enable NYSERDA to identify research activities that can benefit from coordination between the market evaluations (such as for commercial building manager surveys or interviews).

2.1.1.2   Causal Logic/Pathways of Influence

The program theory and logic model must include the theorized linkages and causality between initiative activities and outputs and the hypothesized market outcomes. An example using the CSCNB initiative is provided in Appendix B.

2.1.1.3   Hypothesized Market Outcomes and Effects

The initiative logic model should identify the anticipated short- and long-term market outcomes expected to result from the initiative market interventions. To establish which market changes to assess, the evaluator must first identify hypothesized market effects resulting from interventions. These hypothesized outcomes must be sufficiently clear to develop associated, measurable MPIs.

When a key goal of the market intervention is to attract additional outside investment (leveraged funds), the logic model should identify that investment as an output, along with the market actor(s) who are hypothesized to make those investments. Doing so will ensure that the evaluation research plan includes an investigation of stimulated investment with directly targeted market actors. The *Compiled Investment Plan* identifies leveraged funds' targets as *direct* benefits only, representing direct private investments made by initiative participants.

2.1.2   Key Activity. Create Logic Model and Evaluability Map

Logic models document initiative resources, activities, outputs, and outcomes. A logic model should also include context about any relevant NYSERDA or external initiatives to capture the complete state of the market. A logic model is critical for defensible market transformation program evaluations because it documents the theorized pathways of market influence and outcomes, along with a holistic accounting of relevant market actors, which informs potential savings while avoiding double-counting. While the logic model provides a roadmap for the initiative and a framework for its market evaluation, two additional elements are required to ensure the evaluability of indirect benefits: MPIs and the identification of data sources to assess MPIs and initiative influence. MPIs allow for an objective measurement over time of the market status and its progress toward desired initiative goals.

Best practice in market transformation initiative and evaluation planning includes developing MPIs for each theorized pathway of influence and identifying viable data sources to assess the MPIs and causality. *Appendix A* includes an *Evaluability Mapping Tool* that the program and evaluation teams can use to ensure that the evaluation fully assesses all pathways of influence.

Appendix B provides an example evaluability map for NYSERDA's CSCNB initiative.

2.1.3   Key Activity. Develop Benefits Forecast with Documented Assumptions

In addition to the program theory, logic model, and MPIs, NYSERDA develops forecasts for direct and indirect benefits during the planning stage for each initiative in its CEF Market Development portfolio. These forecasts are documented in a Budget and Benefits (BAB) workbook,[10] which NYSERDA updates annually for each initiative using implementation experience and research conducted as part of its market and impact evaluations.

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[10]   See NYSERDA 2017.

The assumptions used to develop the forecast must be clearly identified with documented sources and calculations—particularly for market size, market baseline, and UEBs. The evaluator(s) should review these assumptions annually and make sure they are updated as needed to reflect the best available data. A BAB workbook includes several sections:

- Cover page summarizing key inputs and considerations, date that NYSERDA began influencing the market, and a list of other programs that target the same market (if applicable)
- Definition of the market and "unit of adoption" (how to count instances of measure adoption)

  - Unit of adoption could be a building, a system, an appliance, or a single or set of business practices.
  - This definition should include calculations and data sources to support a market size estimation and forecast.
  - This definition should also include market segments, if needed (such as large business or small business), and rationale. For example, UEBs for certain equipment installed at large businesses are expected to differ from those installed at small businesses.

- Adoption rates

  - NOMAD (historic and forecasted), ideally for each market segment and measure combination
  - Direct impacts claimed by programs

- UEBs and extrapolation considerations

  - UEBs developed from small sample sizes should be noted and updated as more impact evaluation research is completed, especially for measures with high variability.
  - UEBs must correspond to the unit of adoption. For example, the UEB for a single heat pump system should not be used if the unit of adoption is a whole multifamily building.

- Adjustments for other program or external influences

  - Explanation of how double-counting may occur and where else the savings are being reported
  - Calculations and sources used to quantify the size of indirect benefits' overlap

2.2   Stage 2. Initiative Year 1

During the initial year of initiative funding, NYSERDA works with a third-party evaluation contractor to develop or refine an evaluation plan for each initiative. NYSERDA typically drafts an evaluation plan and asks evaluators to propose methods and modifications, where appropriate, as part of the evaluator solicitation process. The draft plan should include a task to estimate indirect benefits. This section of the framework begins with an overview of the evaluation plan elements that are necessary to evaluate indirect benefits and introduces an initiative typology with associated evaluation planning considerations. Next, it discusses the importance of coordinating plans with internal and external stakeholders. It concludes with a discussion of the baseline assessment, which the evaluator typically completes during the initiative's first year.

2.2.1 Key Activity. Review Initiative Documentation

To ensure that the evaluation plan includes all research necessary to evaluate indirect benefits, the evaluation team should begin by reviewing initiative documentation, including the program theory, logic model, and BAB workbook. During this review, evaluators should verify the clarity of several elements:

- Hypothesized causal linkages between program activities and outcomes, which will determine the research approach to establishing causality
- Hypothesized initiative outcomes that correspond with measurable MPIs
- UEBs assumed in the BAB and documented source(s) of those values
- Definition of what constitutes "adoption" (such as which types of equipment, which practices, or which combination of technologies and practices)

NYSERDA creates a BAB workbook for each initiative that documents how it estimated indirect benefits for the CEF plan. The market evaluator and impact evaluator should collaborate to carefully review the initiative BAB workbook and underlying BAB estimation algorithms and assumptions, flag any questions or issues with respect to the assumptions, and incorporate research to update the assumptions in the evaluation plan, as needed.

Once the evaluator has clarified any questions about the program theory, logic model, and BAB assumptions, it must develop or refine an evaluation plan that identifies research questions and methods, data sources, and the timing for each evaluation activity required to estimate program-induced market adoption and benefits. This section of the roadmap is focused on essential evaluation plan components, while the *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)* section discusses research methods and considerations for executing the evaluation plan.

2.2.2 Key Activity. Develop Evaluation Plan

NYSERDA drafts evaluation plans for its CEF initiatives and asks third-party evaluators to elaborate on those draft plans as part of the proposal selection process. Once an evaluation contractor is selected, one of the first tasks is to finalize the evaluation plan. To ensure the evaluability of indirect benefits, evaluation plans should include all the components described below. At the conclusion of each program year, it is best practice for the evaluation team to review the evaluation plan and revise it as necessary to reflect the development and evolution of the initiative strategy.

2.2.2.1 Research Questions

At the most fundamental level, estimating indirect benefits requires estimating two values: units of program-induced market adoption and UEBs. The research questions associated with quantifying these values are common to all market transformation program evaluations. However, other research questions will vary according to the specific program theory and type of initiative. Table 1 shows research questions that are common to all market transformation program evaluations, along with examples of initiative-specific research questions.

Table 1. Example Research Questions

Common Research Questions	Initiative-Dependent Research Questions
What market progress is being achieved?	• Are the outcomes specified in the logic model observable? • Is there evidence to support the causality between activities and outcomes hypothesized in the program theory and logic model?
What is total market adoption by nonparticipants?	• How many units have been shipped, installed, or purchased? • What proportion of targeted end users have adopted the technology or practice? • What proportion of targeted end users have changed their behavior, and to what degree have they changed their behavior?
What proportion of market adoption was the result of program interventions? [a]	**Naturally Occurring Market Adoption** • What is the baseline market adoption forecast? **Program Causality** • Is there evidence to support the causality between initiative activities and market adoption? • Of the units adopted/installed, what proportion can be traced to specific initiative activities or outputs (such as participating supply chain market actors, training, and other materials or resources provided to the market)? • What proportion of end users changed their behavior as the result of initiative activities or outputs? • Of the entities that adopt the approach or set of practices, what proportion did so because of specific initiative activities or outputs? • Which and what proportion of projects or measures implemented can be traced to specific initiative activities or outputs? • Did other initiatives contribute to market adoption?
How much participant market adoption has the program influenced?	• Among program participants, how many additional units have been adopted or installed since participating in the program?
What is the estimated impact of adoption?	• What are the energy saving, carbon reduction, and other impact per unit of adoption, by end user segment and/or measure characteristics?

[a] Note that the evaluation plan should identify initiative-specific research questions based on the type of program and its specific theory of change. [a] There are often multiple programs influencing market adoption. For example, NYSERDA may have multiple programs that address the same market, and NYSERDA, utility, and government programs may all seek to influence the adoption of energy-efficient technologies or practices in a particular market. Various approaches can be used to estimate or assign the impact of each program. These approaches are discussed in the *Assessing Causality When Multiple Programs Exist* and *Avoiding Double-Counting* sections of this document.

2.2.2.2 Market Progress Indicators

Quantifying market adoption is foundational to estimating indirect benefits and is an important indicator of market progress. However, given the long-term nature of market transformation initiatives, indirectly influenced market adoption may not be observable for several years and may continue for years after the initiative activities have ended. For these reasons, it is crucial that market evaluators focus early market progress evaluation research on expected shorter-term market progress outcomes, as indicated in the initiative logic model.

MPIs are important for estimating program-induced adoption: in order to credibly substantiate causality between program activities and outcomes, the evidence of that causality must be well-documented from early program stages.

The evaluation plan should specify, for each hypothesized outcome, the associated MPI or evidence of market progress and the method that will be used to evaluate that indicator or obtain that evidence. Table 2 lists examples of typical MPIs and associated research methods.

Table 2. Example Market Effects, Indicators, and Research Approach

Market Effect/Outcome	Market Progress Indicator	Research Approach
Increased awareness among target audience(s)	Awareness of technology or practice	• Target audience survey
Increased availability	Supply chain decisions (such as production decisions or retailer buying decisions)	• Supply-side market actor interviews or surveys • Shelf surveys, web scraping
Targeted market actor(s) promote the technology or practice	Salespeople communicate benefits and value proposition and marketing materials reflect benefits and value proposition	• Mystery shopping • Marketing materials review • Market actor interviews
Increased market capability or capacity	Number of service providers offering technology or services and number of certified building operators	• Industry association data and interviews • Market actor interviews • Business databases (such as Data Axle)
Voluntary standard upgraded to reflect technology or practice	Voluntary standard adopted	• Direct observation • Interviews with standards-setting organization
Increased stringency of energy code	Adoption of energy code developed and/or advocated by initiative activities	• Direct observation • Interviews with targeted codes organizations and policy makers

2.2.2.3   Causality

In addition to identifying how an evaluator will measure each MPI, it is critical that the market evaluation plan specify the approach the evaluator will use to establish causality between the initiative activities and the observed outcomes. It is important to identify both the research activities (for example, surveys, interviews, or expert judging) and the specific methods the evaluator will use to establish causality (for example, the sampling approach, specific survey and/or interview questions, expert judging methods, experimental methods, or historical tracing). There are several benefits from defining these methods as part of the evaluation plan:

■ Research instruments for the market and impact evaluations can be coordinated and designed to include the necessary questions in the first survey wave, allowing causal linkages to be documented from the earliest stages of the initiative.

■ Program teams can review the sampling approach and confirm that targeted market actors are adequately represented in research efforts.

■ Program teams can vet the methods to establish causality with stakeholders before finalizing the research plan.

Methods for assessing causal influence are discussed in *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)*.

2.2.2.4 Research Methods and Data Sources

The evaluation plan must specify the research activities, methods, and data sources the evaluator will conduct and use to inform each research question. Research activities typically comprise a variety of secondary and primary research efforts and may include industry data, when available, and interviews or surveys with end users and market actors. The evaluation plan should also describe the sampling approach for primary research activities, including the sample frame, stratification, sample size, and confidence and precision (per the *Uniform Methods Project*).[11] *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)* further describes typical methods.

After determining specific research activities and data sources, the market evaluator and NYSERDA project manager should determine whether opportunities exist to coordinate this research with impact evaluations, evaluations for other initiatives operating in the same market, and/or with top-down market evaluation activities (such as statewide baseline and market assessment studies).

2.2.2.5 Timeline

The evaluation plan must also include the timing for each planned research activity. This component of the plan will help to ensure a logical sequence of research activities and will facilitate coordination with other evaluation efforts.

2.2.2.6 Analysis Plan

To ensure that the research will provide all information necessary to estimate indirect benefits, the market evaluation plan should include an analysis plan with the initiative-specific algorithms and approaches that will be used to estimate program-induced market adoption. The evaluation plan should fully specify all UEBs, estimation algorithms, data sources, and unit of adoption so that these variables are determined **prior to** the beginning of data collection. Doing this will help to ensure that the evaluator collects the data needed to calculate indirect benefits from the outset.

When developing the analysis plan and initiative-specific algorithms, the evaluator should consider and verify several elements with the NYSERDA project manager:

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[11]   See NREL 2018.

- **Units of Adoption Definition.** To estimate indirect benefits, the evaluation team must clearly define the measure(s) or actions associated with the benefits. This may seem obvious in the case of a specific technology, such as a heat pump space heater or a heat pump water heater. However, in other cases it may not be so obvious to determine what constitutes a unit of adoption. For example, in the case of the Energy Management Practices (EMP) initiative, benefits are associated with and driven by implementing a combination of strategic energy management (SEM) practices at New York State industrial facilities. As part of the original evaluation plan, the evaluation team used the Consortium for Energy Efficiency's SEM minimum elements and developed a corresponding market survey questionnaire and scoring rubric as the basis to estimate the number of facilities adopting SEM.[12] The EMP impact evaluation, however, found energy savings at facilities that had not adopted all the Consortium for Energy Efficiency minimum elements—leading the evaluation team to revise the definition of units of adoption.
- **Unit Energy Benefits.** To quantify indirect savings, evaluators must assign a savings value (unit energy savings) to the technology, practice, or combination thereof being promoted by the market transformation initiative.[13] The UEB value or values assumed for planning should be included in the initiative BAB with documented source(s). The initiative evaluation plan should specify the approach and research activities to evaluate or update those assumptions. If the evaluation team plans to use initiative impact evaluation results (direct impacts) to update the UEB values, then the impact evaluation should be designed to produce estimates of savings based on a statistically representative sample of the target market.

  Note that impact evaluations focused on quantifying direct impacts achieved by program participants may not produce UEB values that can be projected to estimate indirect market benefits if they are not based on the same unit of adoption or if the sample of participants does not represent the target market. In that case, the evaluation plan should include another approach to evaluating UEBs, such as secondary research or a market-wide impact study, like the New York Department of Public Service's current study for heat pumps.
- **Different UEB Values by Type of End User.** The existence of different UEB values for different types of end users (such as large versus medium industrial firms or residential versus commercial users) will have implications for the research plan. Programs that assume or evaluate different unit benefit values for more than one end-user type should also calculate program-induced market adoption for each type of end user. For example, the On-site Energy Manager (OsEM) description in the Industrial Focus Area of the *Compiled Investment Plan* and the corresponding BAB workbook specify different measure savings values for medium and large facilities, so the market evaluation team should estimate program-induced market adoption separately for each of those two end-user types. In addition, if the evaluation team plans to use initiative impact evaluation results to update the UEBs, then it should design the impact evaluation to estimate savings based on a statistically representative sample of each end-user segment.

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[12] See CEE n.d.

[13] This discussion is focused on energy savings but is applicable to renewable energy and carbon dioxide reduction as well.

■ ***UEB Values for Multiple Measures.*** Several NYSERDA initiatives encourage end users to adopt multiple measures, some of which may produce overlapping or synergistic benefits. For example, a facility that adopts SEM may also hire an OsEM. To develop an indirect benefits analysis plan, the market evaluator must understand whether to estimate UEB values for different combinations of measures or for each measure individually. If there are different UEB values for each measure or combination of measures, the evaluator should estimate program-induced market adoption separately for each measure or measure combination. Similar to the discussion on multiple end users, if the evaluation team plans to use initiative impact evaluation results (direct impacts) to update the UEBs, then the impact evaluation plan should include details of how to estimate statistically reliable savings for various measure combinations.

2.2.2.7 Considerations by Program Type

NYSERDA's portfolio includes a wide variety of market transformation programs. Although the indirect benefits evaluation framework is broadly applicable to NYSERDA's portfolio, the recommended and practical evaluation methods vary by program type. Table 3 presents a program typology showing six program types, their characteristics, and example initiatives.

Table 3. Program Typology

Program Type	Key Characteristics	Example Initiatives
1. Clean Energy Products or Technologies (midstream/upstream)	Increase market availability and attractiveness by providing incentives and other resources to midstream and upstream market actors	Heat Pump Phase 2
2. Enabling Technologies	Advance the market uptake of technologies that enable decarbonization by providing support to technology providers and resources to end users to reduce soft costs and support the business case for adoption	Energy Management Technology (EMT); Advancing Agricultural Energy Technologies
3. New Construction	Provide technical assistance, design tools, and financial incentives to building owners, developers, and builders to overcome initial design challenges, costs, and risks associated with high-performance building	New Construction
4. Codes and Standards	Support the adoption of more stringent product standards and energy codes, and increase compliance and enforcement	CSCNB; Product and Appliance Standards
5. Training, Technical Services, Practices, and Challenges	Provide resources and/or encouragement to end users to support their successful adoption or implementation of clean energy practices, leading to further adoption beyond direct program engagement	EMP; Clean Green Campuses (formerly Rev Campus Challenge); Clean Energy Communities; Building Operations and Maintenance Partnerships
6. Innovation and Research	Invest in research, business support, product development support, demonstration projects, and contracts with incubators	ClimateTech Commercialization Support; NextGen Buildings

There are important indirect benefits evaluation methodological considerations for each program type. Key considerations are highlighted below, and *Appendix A* includes a summary reference guide: *Initiative Typology and Associated Evaluation Considerations*.

Type 1. Clean Energy Products or Technologies (midstream/upstream)

These initiatives work primarily with supply chain market actors to increase the availability, affordability, and promotion of a product or technology. The market adoption for these initiatives is best assessed and tracked using sales or shipment data and assortment data. Initiative causality and influence are best assessed via interviews with targeted market actors. End-user surveys are useful to assess end-user awareness, motivations, barriers, and attitudes, but cannot be relied upon to estimate initiative influence because end users do not have insight into the supply chain interventions that drove changes in product availability or recommendations from vendors.

Type 2. Enabling Technologies

These initiatives seek to advance market uptake of technologies that enable decarbonization by providing support to technology providers and resources to end users to reduce soft costs and support the business case for technology adoption. Market adoption of these enabling technologies can be estimated using

sales or installation data obtained from vendors. Evaluators can assess causality via surveys of targeted vendors and end-use decision-makers using questions that investigate adoption and implementation influences. Note that end-user research is useful to gain insights into decision-making, but end users may not be aware of NYSERDA's indirect influence on decisions via market interventions targeted to vendors.

Type 3. New Construction

Through its New Construction initiative, NYSERDA aims to increase the adoption of high-performance building practices and technologies by providing technical assistance, design tools, and financial incentives to building owners, developers, and builders to overcome initial design challenges, costs, and risks. The market adoption of high-performance buildings and practices can be estimated using building permit data and/or data gathered from builder surveys. Evaluators can assess causality via surveys of targeted market actors and decision-makers using questions that investigate adoption and implementation influences. Note that nonparticipating builders may not be aware of NYSERDA's influence on the increased market demand for or supply of high-performance building practices.

Type 4. Codes and Standards

Through its Codes and Standards initiatives, NYSERDA aims to influence federal, state, and regional regulations to adopt new or improved energy efficiency requirements or increase compliance with existing regulations. Product sales, shipment, and/or installation data are key to estimating indirect benefits impacts from efficient and clean equipment standards; evaluators can use building permit and construction data and code compliance estimates to estimate impacts from Codes and Standards initiatives. To assess causality, evaluators must examine the influence of NYSERDA interventions on codes and standards adoption processes, which can be accomplished via interviews with decision-makers and influencers, document review, and historical tracing.

Type 5. Training, Technical Services, Practices, and Challenges

These initiatives provide resources and encouragement to end users to identify, provide experience in, or otherwise support the successful adoption and implementation of clean energy technologies and practices, with the objective of influencing additional adoption beyond direct program engagement. These initiatives may also target and support service and technology providers and industry associations as points of market leverage to transform standard practice. Service providers or associations can be good sources for assessing market adoption and tracking data, as well as for assessing initiative influence. For initiatives where the primary engagement is with end users, evaluators may need to rely on end-user surveys to estimate and track market adoption, as well as to substantiate the influence of initiative activities and resources. The best way to design end-user surveys that assess influence is discussed in the *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)* section.

Type 6. Innovation and Research

NYSERDA's Innovation and Research portfolio includes initiatives to accelerate the development and commercialization of innovative technologies, solutions, and market approaches designed to advance decarbonization. These initiatives focus on providing resources to early- and mid-stage companies, investors, manufacturers, entrepreneurs, solution adopters, and policy makers and regulators.[14] Given their early-stage nature, these initiatives do not currently have indirect benefits targets. Nonetheless, it is important that the program teams document and assess the program theory, strategies, baseline conditions, and hypothesized market impacts of these programs: this will ensure the future evaluability of indirect benefits for successful initiatives.

2.2.3 Key Activity. Coordinate with Internal and External Stakeholders

Before finalizing the evaluation plan, the evaluation team should communicate with internal and external stakeholders about proposed evaluation activities in order to coordinate related research activities that may be planned or under consideration by NYSERDA or external stakeholders.

2.2.3.1 Coordination within NYSERDA

The market evaluation team should share and coordinate evaluation activities with program management, impact evaluation, and reporting, as well as with any other NYSERDA teams working in the same markets. Specifically, the market evaluator should communicate with these internal stakeholders:

- **Initiative Management Team.** The evaluator should review the proposed evaluability map with the initiative management team to ensure that all the theorized pathways of influence are represented and that the data collection and sampling plans fully represent market activities. For some initiatives where NYSERDA executives have the most complete knowledge about market influence activities, such as CSCNB, it is important to obtain executive-level feedback regarding the evaluability map.[15]

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[14] See NYSERDA 2022.
[15] Cadmus facilitated two workshops with NYSERDA executives and selected initiative managers (on April 12, 2022 and April 20, 2022) to discuss indirect benefits and needs for this revised framework. This example surfaced in those workshops.

After reviewing the BAB, the market evaluator should clarify questions regarding indirect benefits planning assumptions and estimates with the person who developed the BAB. The program team updates benefits estimates annually, using findings from the evaluation, so it is important that the evaluation plan includes any research required to update planning assumptions.

- **Initiative Impact Evaluation Team.** The impact evaluation and market evaluation teams should share pre-final evaluation plans with each other to ensure consistency of definitions (unit of adoption and targeted market), and to ensure that any research required to support each other's analysis is identified, planned, and coordinated.[16] In the EMP initiative, for example, the market evaluator needs the impact evaluator to collect data from direct participants about adoption at nonparticipating company facilities. Another important area of coordination is evaluating the UEBs used to estimate indirect benefits. The two evaluation teams must assess and agree on whether impact evaluation results can be used to update the UEB assumptions in the BAB and on the important characteristics that drive UEBs, such as customer or facility size or type.

- **Other NYSERDA Teams.** The evaluation team should share the pre-final evaluation plan with other NYSERDA teams that are working on programs or research activities in the same or overlapping market(s). Communication and coordination between teams working in same markets provides several benefits:

  - Allows for identifying, coordinating, and streamlining activities that may be targeting the same end users or market actors
  - Provides the information necessary to ensure that the research fully captures NYSERDA's influence
  - Provides the information needed to avoid double-counting of indirect benefits

    - When multiple initiatives target the same market, the default practice should be that the last initiative to enter the market accounts for savings claimed by existing initiatives.

For example, NYSERDA's Residential New Construction and Buildings of Excellence initiatives have arguably contributed to the success and impact of the NYSERDA's Codes and Standards initiative. Deliberate conversations between the Codes and Standards initiative evaluator and the Residential New Construction and Buildings of Excellence initiatives teams would allow the evaluator to design market actor interview guides that better capture the influence of those programs on policymakers' willingness to adopt codes with building requirements that are similarly stringent to those in the successful new construction programs.

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[16] In 2021, NYSERDA began soliciting proposals for joint impact and market evaluations, which should eventually diminish the required coordination since a single team will be planning both evaluations.

2.2.3.2 Coordination with External Stakeholders

The evaluator should also coordinate with other program administrators (utilities or municipalities) or energy advocacy entities (such as the Northeast Energy Efficiency Partnerships, NEEA, and the Association of Energy Service Professionals) conducting studies in the same markets. Coordination may not be possible, but it offers several potential benefits, including streamlining activities, maintaining consistency with research approaches, if appropriate, and staggering the timing for research that targets the same market actors or end users.

2.2.4 Key Activity. Characterize Baseline Conditions and Forecast

As discussed previously and illustrated in Figure 1, program-induced market adoption is the difference between total adoption and adoption that would have occurred absent program intervention (NOMAD). To estimate these values, the evaluator must begin by establishing current practice and the level of market adoption prior to initiative market intervention. The evaluator should review NYSERDA's estimate of the pre-initiative market adoption, conducted as part of the BAB. In addition, to determine what part of total market adoption over time is program induced, the evaluator must use one or more approaches:

- Develop a baseline (NOMAD) forecast prior to market intervention.
- Include questions in a representative survey of market adopters designed to detect and quantify program influence.
- Include questions in market actor surveys to assess program influence.

This section addresses methods to assess baseline conditions and to develop a NOMAD forecast, while *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)* addresses the latter two approaches.

2.2.4.1 Baseline Conditions

Market transformation program evaluation best practices call for conducting research to characterize the market prior to market intervention. Baseline market characterization comprises straightforward market research approaches and typically includes several research activities:

- Secondary research and interviews with supply-side market actors (such as manufacturers, distributors, builders, installers, service providers, and industry organizations) to characterize the structure of the supply chain; determine the mix of current products and services; quantify the market size and volume moving through various channels, along with prices and industry trends; and identify potential opportunities and points of leverage.
- Interviews and surveys with supply-side market actors and end users to understand their awareness and perceptions, motivations, preferences, and barriers to adoption.
- Primary and secondary research activities to quantify baseline levels for MPIs.

2.2.4.2 Baseline Forecast

As opposed to baseline market characterization, which describes the current state of the market at the time it is conducted, a baseline forecast requires the evaluator to establish a counterfactual estimate of what would happen without program intervention. A counterfactual estimate, by definition, cannot be substantiated by observation because it describes a scenario that never occurs if the initiative is implemented. As such, baseline forecasts necessarily have a high level of uncertainty, raising the questions of whether to develop them and what makes them worthwhile.

When and Why a Baseline Forecast is Advisable

It is generally advisable to develop a baseline forecast for market transformation programs when indirect benefits are significant[17] and when the evaluator can determine and implement a reasonable method for determining those benefits within the evaluation budget. As mentioned previously, one defining characteristic of a market transformation program is that it produces lasting structural changes in the market and accelerates the adoption of energy-efficient technologies and practices so that they become standard practice. Once structural market changes have occurred, particularly on the supply side of the market (such as widespread availability and new or more stringent standards), it can become increasingly challenging, if not inappropriate, to attribute additional market adoption of the technology or practice in question to the market transformation initiative that induced those structural market changes. NEEA's experience with its CFL market transformation initiative, described below, provides an illustrative example of this challenge.

In the late 1990s NEEA invested in an initiative to transform the residential lighting market, focused on working with supply-side market actors to increase the market availability of high-quality CFLs at an affordable price. After several years of working toward those goals, product availability and quality had increased substantially, but CFL market saturation remained low. In 2002, however, the West Coast energy crisis prompted a spike in CFL sales. Following this dramatic increase, evaluators were challenged to establish that a high proportion of market adoption was attributable to program activities. Without historical context and evidence of NEEA's influence on manufacturers, retailers, and product quality, it appeared that the increase in market adoption was attributable to the energy crisis. However, detailed documentation and evaluation of the initiative's logic model revealed that the CFLs would not have been available for purchase during the energy crisis if not for NEEA's extensive market interventions.[18] An industry forecast dating from the start of the initiative would have loaned additional credibility to program causality and likely would have resulted in lower estimated NOMAD and higher estimated indirect benefits.
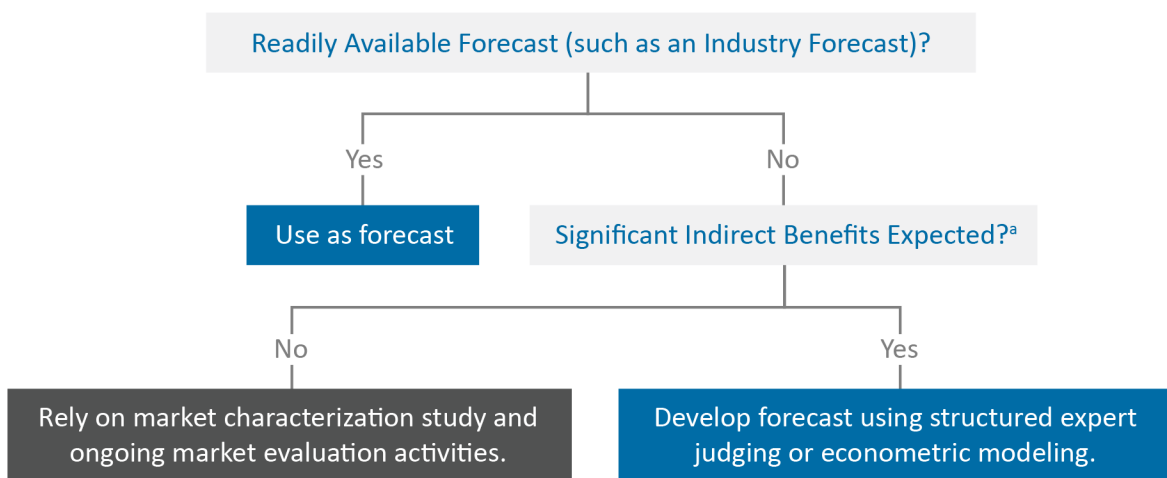
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[17] "Significant" is used here in the context of the total expected benefits for the portfolio. For example, an analysis of NYSERDA's CEF portfolio indirect benefits forecast as of May 20, 2022 found that two initiatives (Product and Appliance Standards and EMT) were forecasted to deliver approximately 50% of indirect energy efficiency benefits (MMBtu energy savings). NYSERDA could consider setting a threshold for which programs require a baseline forecast, using this or another analysis of contribution to indirect benefits.

[18] NEEA's CFL and other initiative market progress evaluations are well-documented and publicly available on the NEEA website: www.neea.org.

Baseline Forecasting Methods

There are three primary methods to develop baseline forecasts of market adoption: industry forecasts, econometric modeling, and structured expert judging (such as a Delphi panel). Each of these methods is described in more detail below. Figure 4 presents a decision tree as guidance for determining the most appropriate method.

Figure 4. Baseline Forecast Decision Tree

^a   "Significant" is used here in the context of the total expected benefits for the portfolio.

Industry Forecasts

Industry forecasts, if they exist, generally serve as the best approach to establishing a credible baseline forecast. Industry forecasts represent the collective expectations of the market actors who are most knowledgeable about the market because they participate in it as manufacturers, distributors, and retailers. These market actors have a strong interest in producing the most accurate forecast possible.

Industry forecasts are most likely to be available for specific technologies but are unlikely to exist for practices or management approaches. If forecasts do exist, they may not be publicly available; however, industry partnerships and relationships should help NYSERDA to identify and gain access to existing forecasts.

Econometric Modeling

If industry forecasts are not available, but historical sales or production data are available, it may be possible to develop a forecast using econometric modeling. This approach uses historical sales or production data, combined with economic variables, to develop a model that predicts the pattern of past sales with a reasonable degree of accuracy, using a model that may look like the following:

Sales t = *f (weather, economic variables, time)*

Like industry forecasts, historical sales or production data are only likely to exist for discrete technologies but may be expensive to acquire or be unavailable. The other significant drawback to using econometric models is that they cannot factor in anticipated future changes—even those that may be known to industry experts, such as changes in a policy, market, or technology, or an updated production cost.

Structured Expert Judging (Delphi Panel)

For programs with significant forecasted indirect benefits,[19] if industry forecasts are not available, structured expert judging is a good method to develop a credible NOMAD forecast.

In general, this approach involves assembling a panel of individuals with close working knowledge of the targeted market. The Delphi technique is a widely used and accepted expert judging method for forecasting by gathering information and converging opinions to gain consensus. With this method, researchers convene a panel of experts to provide individual forecasts of market adoption, often through a web-based tool. Experts—who represent diverse perspectives—provide forecasts and accompanying explanations individually. Anonymous results are shared with the group, and panelists are invited to either agree with the median forecast or provide a new forecast in the second or later round of questions. Once over half of the experts agree on a forecast, group consensus is considered to be reached.

Alternatives to Developing a Baseline Forecast

There are two alternatives to developing a baseline forecast, discussed below.

Cross-Sectional Comparisons

Cross-sectional comparisons rely on comparing market conditions and adoption in the program geographic area with conditions in comparable areas that do not have programs. In effect, market adoption in the comparison region defines the NOMAD curve. As noted in the MPTA Working Group report (2018), the use of this approach has declined due to the difficulty of finding comparison areas that have not experienced any program activity or market effects. Cross-sectional comparisons also cannot control for regional or national market effects that may result from programmatic activities in other jurisdictions. For example, if a program seeks to influence the buying decisions of big-box retailers, as in the case of the ENERGY STAR® Retail Products Platform, product assortment will be affected nationally.

Ongoing Market Progress Assessments

A baseline forecast is one of two approaches used to validate hypothesized causality between the program interventions and a long-term indicator of market adoption. Regardless, if a baseline forecast is developed, the evaluation of indirect benefits will depend upon rigorous, ongoing research and documentation to establish and quantify program-induced market effects, following methods outlined in the *Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)* section.

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[19] "Significant" is used here in the context of the total expected benefits for the portfolio. For example, when Cadmus began developing this framework, it identified 14 initiatives in the Market Development portfolio that accounted for approximately 95% of total indirect benefits. Similarly, the most recent CEF Quarterly Performance Report identifies 15 initiatives in NYSERDA's Market Development and Innovation and Research portfolios that currently account for approximately 85% of the expected lifetime carbon dioxide equivalent (see NYSERDA 2019).

2.3 Stage 3. Subsequent Initiative Years (Annual Evaluation Activities)

During the second and subsequent years of the initiative, the evaluator conducts research activities, per the evaluation plan, that support indirect benefits estimation, including research to assess market progress, causal influence, and the market and impact assumptions that drive NYSERDA's benefits forecast. To ensure that the evaluation fully aligns with the initiative's implementation strategy and activities, the evaluator should review the initiative logic model and evaluation plan annually and recommend refinements as appropriate. This section of the framework discusses each of these topics.

2.3.1 Key Activity. Assess Market Adoption and Causal Influence

This section is focused on best practices and methods to assess market adoption and causal influence for market transformation programs, both of which are necessary to reliably estimate program-induced market adoption.

2.3.1.1 Market Adoption

Quantifying market adoption is foundational to estimating indirect benefits. NYSERDA's CEF initiatives anticipate two types of indirectly influenced market adoption:

- Nonparticipant adoption
- Participant adoption (direct influence, as defined above in the *Indirect Benefits Estimation* section)

Total Market and Nonparticipant Adoption

A variety of sources and methods exist to estimate total and nonparticipant market adoption, each with associated pros and cons, as summarized in Table 4. Evaluators will generally estimate market adoption using one or more of these sources and methods, based on whether the initiative promotes a specific measure or technology (such as an air-source heat pump) or a practice or set of practices (such as EMP).

Table 4. Market Adoption Estimation Sources

Source	Pros	Cons	Program Type Applicability
Sales or shipment data (purchased or negotiated)	Avoids several types of bias associated with end-user self-reporting	• May be unavailable or expensive • May be compiled from sources that do not represent the complete market	• Clean Energy Products or Technologies • Enabling Technologies • Codes and Standards
Public/government data	Reliable	• Not available for many measures [a]	• Clean Energy Products or Technologies • Codes and Standards • New Construction
Certification and voluntary standards organizations	Reliable source for certification or standards-based programs	• Not applicable for most programs	• Technologies/Products • Enabling Technologies • New Construction • Codes and Standards

Source	Pros	Cons	Program Type Applicability
Statewide on-site research/saturation studies	Highly reliable because saturation is observed rather than reported	• Expensive • Infrequent or may not exist • May not provide sufficient opportunity to investigate practices	• Clean Energy Products or Technologies • Codes and Standards (code compliance) • New Construction
Industry association research	Generally reliable, if available	• May be unavailable	• Clean Energy Products or Technologies • Enabling Technologies • Codes and Standards
Quantitative end-user surveys	Generally feasible	• Expensive, but less than on-site methods	• Enabling Technologies • New Construction • Training, Technical Services, Practices, and Challenges
Supply-side market actor surveys	Generally feasible	• Difficult to compile reliable quantitative estimates • Market actors may be hard to engage	• Clean Energy Products or Technologies • Enabling Technologies • New Construction • Training, Technical Services, Practices, and Challenges

ᵃ   Examples of available data include the U.S. Environmental Protection Agency ENERGY STAR® product database (EPA n.d.), the U.S. Energy Information Administration's renewable energy database (EIA 2018), and local government building permit data.

Sales or shipment data, government data, and on-site studies, when available, are generally considered more reliable than end-user self-reported adoption, which is prone to potential bias. Supply-side entities, such as installers, distributors, and service providers, can also serve as credible sources of market adoption data, but they are typically difficult to reach, making it challenging to obtain sufficiently detailed market adoption data from a representative sample.

When possible, the market evaluators should use multiple sources and methods to estimate market adoption and triangulate results to develop the most accurate results possible.

Participant Adoption
NYSERDA considers direct benefits to result from measures, projects, or practices implemented with direct NYSERDA assistance. It is likely that the program may also influence participants to implement additional measures, projects, or practices during or after they are no longer directly engaged with the program. Thus, it is important to estimate program-influenced (also known as direct influence) participant adoption and include the associated benefits in the calculation of indirect benefits.

Although it may be possible to estimate combined nonparticipant adoption and direct influence participant adoption by assessing total market adoption and subtracting known participant market adoption (direct involvement), the best method to estimate indirect, program-influenced market adoption is via longitudinal participant surveys designed to identify measure adoption that occurs following program participation. Several of NYSERDA's Market Development initiatives with the

greatest expected indirect benefits may induce significant direct-influence participant adoption, which may not be well-represented by a market-wide saturation study that relies on sampling. For example, the EMT initiative could generate substantial direct influence participant adoption. An evaluation of NEEA's Integrated Design Labs initiative found that direct influence participant adoption was the primary source of indirect energy savings.[20]

2.3.1.2 Causal Influence

As discussed in the *Introduction*, program influence cannot be evaluated using the same tools that are used for resource acquisition programs because market transformation program influence is intentionally indirect: market transformation programs rely on identifying market opportunities and points of leverage to catalyze change, rather than on direct engagement with end users. In addition, the impact of market transformation program activities can occur over a long period of time that happens a long time from the market intervention(s). For example, NYSERDA's New Construction initiative seeks to change building practices, but the impact of those changes will only be realized as new buildings are constructed over time. Another factor complicating causality assessment is that observed market changes may result from other NYSERDA and/or non-NYSERDA program interventions, such as utility programs.

This section discusses research practices to assess causal influence.

Approaches

The *California Energy Efficiency Evaluation Protocol* "Market Effects" chapter describes two primary approaches to estimate causal effects: a preponderance of evidence approach and a modeling approach.[21] A preponderance of evidence approach is generally best to assess market transformation program causality. With this approach, the evaluator relies on triangulation from multiple data sources to estimate the proportion of market adoption that can or cannot be attributed to market transformation program activities. Data sources generally include surveys and interviews with market actors and end users, combined with direct observation and historical tracing methods. When possible, evaluators should quantitatively assess causal influence using the sources and methods discussed below.

A modeling approach requires the evaluator to have access to longitudinal sales data (or data for another unit of adoption) or energy consumption data as the dependent variable and to develop an econometric model to estimate the impact of market development investments and other explanatory variables. This approach is discussed further in the *Top-Down Methods* section of this framework. Notably, however, there are no examples of successfully using this approach to quantify indirect benefits or market effects at the program level: all the examples have been accomplished at the policy or portfolio level.

Sources and Methods

Table 5 summarizes the typical sources and methods for assessing causality using the preponderance of evidence approach. More details on the methodology for end-user surveys are provided immediately after the table.

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[20]   See Van Den Wymelenberg et al. 2013.
[21]   See TecMarket Works 2006.

Table 5. Causality Assessment Sources and Methods

Source/Method	Approach	Considerations
End-User Surveys	• Design and incorporate questions to detect and quantify the timing and influence of program activities. • Apply sampling best practices to achieve required levels of confidence and precision.	• Influence questions must ask about the possible influence of program outputs and outcomes, rather than activities.
Market Actor Surveys and In-Depth Interviews	• Conduct research with targeted market actors per program theory. • Research is qualitative for smaller groups of market actors, such as manufacturers, but can be quantitative for market actors such as installers. • Ensure that sampling represents directly engaged market actors.	• Influence questions must ask about the possible influence of program outputs and outcomes, in addition to activities.
Document Review	• Collect, review, and assess available documentation over time, such as program documentation, correspondence, and market actor marketing materials and communications.	• This is often one component of the historical tracing method.
Structured Expert Judging	• Collect evidence from a range of sources, such as rulemaking dockets, stakeholder interviews, and program theories. • Assemble a panel of independent experts to review evidence and reach consensus on program influence.	• Has been used effectively to establish causality for market transformation programs focused on codes and standards. [a]

Historical Tracing (Case Study Method)	• Reconstruct events that led to the outcome of interest, using information from a wide range of sources, to substantiate the causal logic:
	  • Compile, compare, and weigh the merits of narratives of the same set of events and outcomes provided by individuals with different points of view and interests.
	  • Compile detailed chronological narratives of the events in question to validate hypotheses regarding patterns of influence.
	  • Posit alternative causal hypotheses and examine their consistency with the narrative fact pattern
	  • Assess the consistency of the observed fact pattern with linkages predicted by the program logic model. [b]
		• It is difficult or impossible to determine the magnitude of the effects, so the evaluator cannot assign statistical precision to the estimate.
		• Best suited to causality assessment of major events, such as the adoption of new building codes or policies.

Econometric Modeling	• Develop a regression model to estimate the impact of market development investments and other explanatory variables on units of adoption or energy consumption.	• Dependent on the availability of longitudinal data. • There are no known successful examples of this approach at the program or portfolio level.

[a]   For example, see DNV GL and Cadmus 2017.
[b]   See Rosenberg and Hoefgen 2009.

End-User Survey Questions to Assess Influence

For market transformation programs with limited supply-side interventions and hypothesized outcomes, quantitative surveys of end users may be the most practical and defensible method available to assess program influence on nonparticipant adoption. For example, EMP and Clean Green Campuses (formerly Rev Campus Challenge) program activities are primarily focused on building capability and providing resources and encouragement to end users. In these cases, the assessment of market transformation program influence requires evaluators to design survey questions to quantify the proportion of adoptions influenced by the program.

The general approach to assess a market transformation initiative's influence on end-user adoption of energy efficiency equipment and practices is illustrated in Figure 5. The first step is to (1) ask whether the nonparticipant adopted the measure and, if yes, to then ask about the (2) timing and (3) decision-making context leading to adoption. Table 6 illustrates example questions about experiences, activities, and sources of information that influenced the adoption decision. If the respondent affirms any factors linked to the program, then the respondent is considered an influenced nonparticipant adopter. The evaluator must work with the program team to identify all possible sources of influence (program and nonprogram) before writing the survey to ensure that they probe all relevant sources of influence.

After identifying whether a respondent is an influenced nonparticipant adopter, the evaluator counts those that were *not* an influenced adopter as NOMAD for the purposes of calculating indirect benefits. However, the question remains as to whether end-user adopters who were influenced based on one or more NYSERDA-funded activities or resources would have adopted practices or completed projects absent those interventions. The estimate of how much end-user adoption the initiative influenced has significant implications for indirect benefits estimation. When the assessment of adoption and causality depends on an end-user survey, evaluators should include a follow-up question to assess the importance of each factor identified as an influence and use the responses to assign a proportion of UEBs to program-induced market adoption, as illustrated in Figure 5.[22]

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[22] The approach illustrated in Figure 5 draws from well-accepted questionnaire batteries and algorithms to assign net-to-gross values for resource acquisition programs. Such methods are not well-established for market transformation programs and are also more difficult to implement for such programs because end users are not program participants and are difficult to reach for surveys.
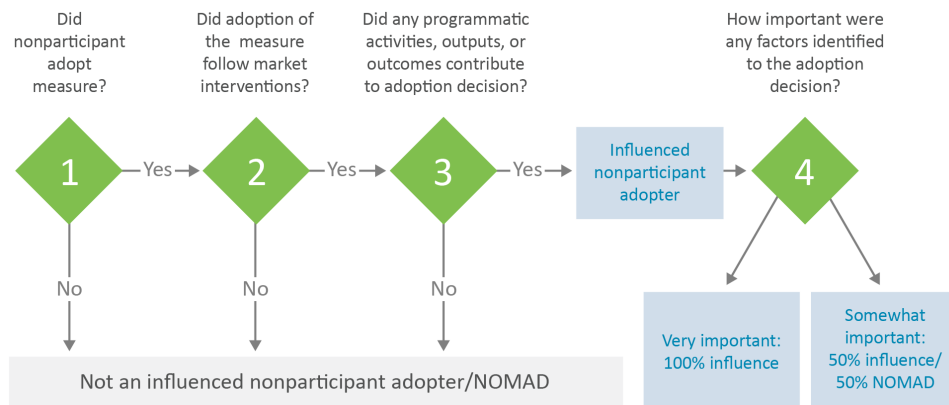
Figure 5. Program Influence Assessment Approach

Table 6. Example Questions to Substantiate the Influence of Market Transformation Program Interventions

Influence of Market Transformation Interventions
• Which of the following factors, if any, contributed to your decision to implement SEM?
• Information from an industry association (specify)
• Information from a consultant or provider of these services (specify)
• Information from utility, NYSERDA, or other entity (specify)
• Information from colleagues, competitors, or friends who also implemented SEM
• Training, workshop, webinar, or another event (specify)
• A case study or report (specify)
• Another source (specify)
On a 1 to 4 scale, with 1 meaning not at all important and 4 meaning very important, how important was [any factor identified] in your decision to implement SEM?

Assessing Causality for "Permanent" Market Effects

The ultimate market transformation goal is to effect market changes that are permanent or would be difficult or costly to undo. For example, NYSERDA has market transformation initiatives that pursue deliberate strategies to accelerate the adoption of more stringent building codes (CSCNB) and mandatory product standards (Product and Appliance Standards). The indirect benefits from such changes are typically very large (since changes to codes and standard substantially impact the whole market). To credibly claim influence from program interventions, it is critical to clearly establish the intent and pathways of influence in the logic model from the outset and substantiate causality using the

methods described above and detailed in the market evaluation plan. Though the sources and methods to accomplish this are the same as those described in Table 5, the methods can be more straightforward for codes and standards programs: market adoption can be quantified by acquiring data on the total number of new products, buildings, or certifications that have been sold, permitted, or earned since the change; and influence can generally be assessed using retrospective expert judging methods (in the case of codes and standards) and via interviews with key market actors.[23]

Assessing Causality When Multiple Programs Exist

Multiple local, utility, state, and/or federal energy efficiency and clean energy programs may co-exist and influence the markets that NYSERDA seeks to transform with its CEF Market Development initiatives. This situation presents a challenge for program administrators and evaluators seeking to quantify the impact of individual market interventions—this challenge can be addressed by taking three actions during evaluation planning and execution:

- Identify program influences up front via interviews and research as needed (evaluators should include this research in the evaluation plan and should repeat it annually to identify new initiatives and other potential influences)
- Develop and gain consensus on an approach to assign shares of the indirect benefits impacts to the program being evaluated versus other programs (if needed)
- Incorporate possible influences from other programs into the survey causality question battery (like the one shown in Table 6)

Approaches to quantifying indirect benefits impacts for multiple programs are further discussed below in the *Avoiding Double-Counting* section.

2.3.2   Key Activity. Perform Analysis and Estimate Indirect Benefits

As previously described in the *Indirect Benefits Estimation* section of the introduction, the following generic algorithm represents a bottom-up estimation approach that generally applies to all market transformation initiatives:

Indirect benefits =$\sum$ *[(Nonparticipant Adoption - NOMAD] + Direct Influence Participant Adoption]t * UEB*

Note that to calculate cumulative benefits, indirect benefits must be summed over the duration of the initiative; that is, in each time period (t), some indirect benefits occur, and they last for the duration of the measure useful life. To account for the cumulative nature of these indirect impacts as well as the duration of the measures' lives, we expand that equation:

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[23]   For example, see DNV GL and Cadmus 2017.

Cumulative Indirect benefits = $\sum l / \sum t$ *[(Nonparticipant Adoption - NOMAD) + Direct Influence Participant*
Adoption]t * UEB

This way the indirect benefits are cumulative over the cycle of the program (t) and annual values last for the duration of measures' lives (l).

Table 7 summarizes the steps for estimating indirect benefits.

Table 7. Summary of Indirect Benefits Estimation Activities by Roadmap Step

Roadmap	Indirect Benefits Estimation Activities
Review Documentation	Review BAB and supporting investment plan documentation: identify underlying BAB estimation algorithms and assumptions, flag any questions or issues with respect to the underlying assumptions, and incorporate updates as needed.
Develop Evaluation Plan	Determine which values and assumptions will be estimated through evaluation research activities; specify the estimation approaches and equations to determine each value in the indirect savings algorithm.
Develop Baseline Forecast	Conduct baseline research to inform the quantification of program influence.
Establish UEB Values	Review UEB values assumed in the BAB; identify and conduct research to validate or revise those values, as agreed upon and reflected in the evaluation plan.
Assess Causal Influence	Conduct market adoption and causality research to inform the program-influenced-market adoption calculation.
Perform Analysis; Estimate Indirect Benefits	Calculate indirect benefits over time (t1 through tl) based on research, using algorithms agreed on in the evaluation plan.

2.3.2.1 Example: Industrial Energy Management Practices

NYSERDA's EMP initiative has multiple measure types (SEM adoption, OsEM adoption) and various end-user types (such as medium and large industrial facilities and wastewater treatment facilities for SEM). The evaluator will use the algorithms outlined below to estimate the total units of adoption from: nonparticipant market adoption, direct influence participant adoption, and NOMAD. Estimating these three values, along with the deemed or evaluated UEB values, will allow the evaluator to estimate indirect savings for each measure.

Strategic Energy Management

The following equations describe how the market evaluator should estimate each of the three components of program-induced market adoption for SEM.

SEM Nonparticipant Market Adoption

Nonparticipant Market Adoption (t) =

% New York–based nonparticipating facilities in targeted industries that have adopted SEM minimum elements [from facility survey] * total New York–based nonparticipating industrial facilities in targeted industries [from Data Axle database]

SEM Direct Influence Market Adoption
Participant Adoption (direct influence) (t) =

Facilities of industrial firms that were directly involved with the initiative and implemented SEM without further NYSERDA support

SEM NOMAD
NOMAD (t) =

*(1 - % influenced nonparticipant facilities in targeted industries that adopted SEM minimum elements) * total New York–based nonparticipating industrial facilities in targeted industries [from Data Axle database]*

Facilities that meet three criteria, based on end-user surveys, are considered to have been influenced by the initiative:

- Adopted SEM after the initiative entered the market
- Was influenced by at least one pathway or source connected to NYSERDA
- Rated the influence of at least one pathway or source as *very important* (100% influence) or *somewhat important* (50% influence)[24]

OsEM

The following three equations describe how the market evaluator will estimate program-induced market adoption for OsEM.

OsEM Nonparticipant Market Adoption
Nonparticipant Market Adoption (t) =

*(% large New York–based nonparticipating facilities in targeted industries that have adopted OsEM * total New York–based nonparticipating large industrial facilities in targeted industries) + (% medium New York–based nonparticipating facilities in targeted industries that have adopted OsEM * total New York–based nonparticipating medium industrial facilities in targeted industries)*

OsEM Direct Influence Market Adoption
Participant Adoption (direct influence) (t) =

Facilities of industrial firms that were directly involved with the initiative and implemented OsEM without direct involvement

OsEM NOMAD
NOMAD (t) =

*(1 - % influenced facilities that adopted OsEM) * total New York–based nonparticipating market facilities in targeted industries [from Data Axle database]*

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[24] As noted in the previous section, this approach of assigning influence based on self-reported importance (100% credit, 50% credit, 0% credit) draws from accepted methods for estimating net-to-gross energy-savings impacts for resource acquisition programs. This method would not be appropriate for initiatives that seek to create lasting structural market changes by targeting supply-side market actors, such as manufacturers, distributors, retailers, construction professionals, service providers, and industry associations, which represent points of market leverage. For those more traditional market transformation initiatives, evaluators should rely on market actors to assess program influence.

Uncertainty

Estimating indirect benefits is essentially estimating four variables: nonparticipant adoption, direct influence participant adoption, NOMAD, and UEB. Some of these inputs will be estimated using statistical methods, which produce uncertainty (such as standard errors). If, for example, the method involves surveys of nonparticipants and participants, then the sample size will determine the range of error. Assuming the UEB values also have an error margin (provided by the impact evaluator), then the total error is calculated by combining the sampling error from the surveys with the UEB error from the impact evaluation. If the input is estimated through a qualitative process with no statistical assessment, then the standard error may be assumed to be zero. However, potential bias should be explicitly recognized for any such estimates. For example, if the NOMAD estimate is based on a Delphi panel, the evaluator should present evidence that the panel represents an unbiased group. The *Uniform Methods Project* chapter for estimating error from combined random variables provides detailed guidance on this topic.[25]

In general, as the errors in estimating indirect benefits are likely to be additive, the proper equation is:

SE Indirect Benefits =

$$\sqrt{SE^2_{\text{nonparticipant adoption}} + SE^2_{\text{direct influence participant adoption}} + SE^2_{\text{NOMAD}} + SE^2_{\text{UEB}}}$$

Surveys to estimate nonparticipant adoption and direct influence adoption can be designed to achieve the 90% confidence and ±10% precision that is typical of evaluation studies, or higher confidence and precision, if preferred. However, evaluations of indirect impacts may have greater overall uncertainty than resource acquisition evaluation studies if they rely on counterfactual estimates (such as NOMAD forecasts) or when a statistically reliable sample of end users is not available. For example, while an indirect benefits evaluation end-user survey can be used to estimate influence with confidence and precision similar to resource acquisition studies (as discussed in the *End-User Survey Questions to Assess Influence* section), reliance on a NOMAD forecast to quantify program-induced market adoption introduces a potential source of error that is not present in resource acquisition studies. Using multiple sources of data to estimate market effects and causal influence is considered a best practice for reducing the uncertainty of estimates.

2.3.2.2   Top-Down Methods

This framework is focused on program- and market-level (bottom-up) estimations of indirect benefits. Another approach to estimating indirect benefits is to develop an econometric model to estimate the influence of market development investments (by NYSERDA and others) and other variables on macro-level observed energy consumption over the targeted sector. This type of model can be developed at any macro level for which data are available.[26] In its recent report, the Clean Energy

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[25]   See NREL 2018.

[26]   For a discussion and overview of top-down methods, see Haeri and Stewart 2013.

Advisory Council's MPTA Working Group recommended top-down analysis for major energy efficiency portfolios like those that exist in New York State.[27] This is the more common approach. However, it is also theoretically possible to apply a top-down model for a specific intervention in a particular sector if data were available. Primarily, consumption data from utilities would need to be used. Top-down analysis can provide verification and lend credibility to the bottom-up approaches described in this framework.

Assuming such data are available, the econometric model can take on the following form:

Energy Consumption (t) =
$$\alpha + \beta_1 Weather\ t + \beta_2 Econ\ Variables\ t + \beta_3 Program\ t + \varepsilon$$

Where energy consumption (natural gas, electric, and delivered fuels) for time period t is obtained or estimated for all customers in targeted segment.[28]

This model may be run as an aggregate of total consumption or as a pooled model of customers across time. The latter may prove to be a more reliable approach. The model needs to account for the impact of weather (likely in the form of heating and cooling degree days) and economic variables (such as the unemployment rate). The evaluator will estimate the program impact through β_3, which is likely best expressed in term of dollars spent. The evaluator should use other available variables (such as production levels) that prove useful for improving the model fit.

2.3.2.3 Avoiding Double-Counting

There is significant potential to double-count indirect benefits associated with NYSERDA's portfolio of CEF Market Development initiatives because the portfolio includes more than one program in some markets and because various local, utility, and/or federal energy efficiency and clean energy programs also target the same markets. NYSERDA currently assumes that double-counting exists in its indirect benefits forecasts and has discounted the total estimated indirect benefits by 50%.[29] As evaluations are completed, NYSERDA may refine these assumptions. The market mapping and top-down study activities summarized below would help NYSERDA to either avoid double-counting or develop a refined estimate of double-counting.

Market Mapping
The *Stage 1. Initiative Planning (Pre-Filing)* section discussed the importance of identifying and mapping markets, market actors, and measures or source of benefits. This mapping is a critical first step to avoid double-counting—within NYSERDA and between NYSERDA and other program administrators. To the extent that NYSERDA or any New York program administrator is working in markets where other entities are also intervening, coordination between program administrators will be essential to avoid the double-counting of benefits toward CEF goals.

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[27] See MPTA 2018.
[28] In fact, complete energy consumption data are generally unavailable, and it is necessary to use a proxy for this value, such as energy sales or energy sales intensity, as the dependent variable in the model.
[29] See NYSERDA 2018 (p. 6).

Cross-Cutting Initiatives

NYSERDA's CEF portfolio includes initiatives that cut across markets, such as the Building Operations and Maintenance Partnerships program. It is important to identify all the markets touched by each cross-cutting initiative—both to coordinate research and to avoid the double-counting of benefits.

Quantification of Benefits when Multiple Programs Exist

NYSERDA can use one or more of the three general approaches to quantify or assign indirect benefits to programs in a manner that avoids double-counting:

- **■** ***Evaluate collaborative impacts.*** With this approach, program administrators would agree to evaluate the total indirect benefits produced by their collective efforts. As an example, NEEA takes this approach and calls the collective impact "co-created savings." It then subtracts direct benefits claimed by the utilities in its jurisdiction to avoid any double-counting and allocates co-created savings to utilities according to an agreed-upon method. This approach works well to quantify total market transformation savings in a defined jurisdiction, such as the State of New York, but is not helpful for determining individual program return on investment.
- **■** ***Adopt an agreed-upon benefits assignment approach.*** As part of evaluation planning, program administrators in a jurisdiction could agree on a method to assign causation to different program interventions. For example, the causality assessment could identify and include all the potential market influences in surveys and interviews, and administrators could agree to assign credit based on responses to those questions.
- **■** ***Adopt an agreed-upon allocation approach.*** Once NYSERDA and program administrators identify overlapping market development efforts, they can adopt a benefits allocation or reporting approach based on their relative investments or some other agreed-upon method.[30]

Statewide coordination will be critical to avoid double-counting of benefits and will also provide a mechanism to streamline and improve the efficiency of evaluation efforts. The program administrators in New York (the Department of Public Service, NYSERDA, and investor-owned utilities) identified and discussed this topic in the Clean Energy Advisory Council's MPTA Working Group (disbanded in 2018) and continue to collaborate on this issue.

Top-Down Studies

Top-down research and analysis approaches can help to avoid double-counting of market adoption and indirect benefits estimates that may occur when program-specific estimates are added together.

Market Adoption

Statewide studies, including on-site saturation studies and quantitative surveys, can provide a comprehensive estimate of market adoption. NYSERDA conducts periodic statewide residential and commercial saturation studies, and utilities have conducted some independent market studies to assess energy savings and clean energy potential. Evaluators should reference these studies to cross-check their market adoption estimates for individual measures.

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[30] One proposed approach to assign benefits among multiple program administrators was for California's pilot of the Retail Product Platform program (see EMI and Ridge 2015).

<u>Energy Savings</u>

As discussed in the *Top-Down Methods* section, evaluators have developed econometric models to estimate the influence of program investments on observed energy consumption and renewable energy. This type of analysis could help NYSERDA to estimate the overall indirect benefits resulting from investment in any sector for which data were available.

2.3.3   Key Activity. Review Benefits Forecast Model Assumptions and Refine Forecast

NYSERDA updates the benefits forecast annually for each initiative. As mentioned earlier, the evaluation team should support that update by conducting the appropriate evaluation research activities—per the evaluation plan. The evaluation team should review and make recommendations for updating the BAB assumptions annually based on research findings.

2.3.4   Key Activity. Review/Refine Logic Model

The logic model provides the framework for each initiative's market and indirect benefits evaluation. Because the logic model is critical, the initiative evaluation plan should include a review of the logic model and creation of recommended updates based on research findings, initiative evolution, and portfolio evolution.

- New activities should be added to the model as well as new or expanded pathways of influence.
- Activities that have ceased and were not linked to pathways of influence may be removed from the logic model (such as a radio ad campaign for a rebate program).
- Activities that have ceased but were linked to a pathway of influence should be noted but kept in the logic model. Changes in the market that are expected to persist may still be assessed, such as the impact of contractor trainings on equipment recommendations.

2.3.5   Key Activity. Update Evaluation Plan

NYSERDA takes an adaptive management approach with its initiatives, continuously incorporating learning from market experience and research. As such, it is important for the evaluation team to review and update the evaluation plan annually to reflect initiative evolution, new research questions that arise from research learnings, and identified needs to refine or change evaluation approaches. For example, the evaluation plan should incorporate research to investigate the causal relationship between the CSCNB initiative and the New Construction and Buildings of Excellence initiatives and the acceleration of more stringent building energy code adoption.

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Appendix A. Indirect Benefits Evaluation Tools

The Indirect Benefits Evaluation Tools can assist initiative teams in planning and executing indirect benefits evaluation.

Initiative Typology and Associated Evaluation Considerations

NYSERDA's CEF portfolio includes a wide variety of market transformation programs. Although the indirect benefits evaluation framework is broadly applicable to NYSERDA's portfolio, the recommended and practical evaluation methods can vary by program type.

Table A-1 summarizes evaluation considerations by program type.

Table A-1. Indirect Benefits Evaluation Methodological Considerations by Program Type

Characteristics	Example Initiatives	Data Sources	Typical MPIs	NOMAD	Causality Assessment	Indirect Benefits Estimation Considerations
1. Clean Energy Products or Technologies (midstream/ upstream)						
Increase market availability and attractiveness by providing incentives and other resources to midstream and upstream market actors	Heat Pump Phase 2	• Sales data (purchased, negotiated with supply chain actor, or self-reported via surveys) • Retailer assortment/ stocking data • Manufacturers, distributors, installers, retailers	• Availability • Stocking practices • Recommendation practices • Awareness • Price • Market share	• Industry forecasts • Structured expert judging (Delphi panel)	• Midstream/upstream market actor interviews on program influence • Analysis of pre- and post-intervention stocking or assortment data (midstream programs)	• Analysis of sales trends is the gold standard for tracking market adoption • It is critical to identify the source of stocking and sales data • Causality cannot be assessed via end-user research
2. Enabling Technologies						
Advance the market uptake of technologies that enable decarbonization by providing support to technology providers and resources to end users to reduce soft costs and support the business case for adoption	EMT; Advancing Agricultural Energy Technologies	• Tool and platform developers and vendors • Technology and service providers • Industry associations • Property management firms • End-use customer decision-makers	• Program participation • Awareness of value proposition or business case • Technology availability • Availability of resources to support practice adoption • Market adoption	• Industry forecasts • End-user surveys • Structured expert judging	• Targeted market actor interviews and surveys to investigate adoption and implementation influence • End-user surveys (to investigate motivations and decision-making)	• Research design must include representative sample of targeted and directly engaged market actors to assess causality • Consider whether initiative contributes to the success of other initiatives targeting the same market; if so, reflect that in the logic model and decide on approach to avoid double-counting • End-user research is useful to gain insights into decision-making, but end users may not be aware of NYSERDA's indirect influence on vendors and technology or solution availability
3. New Construction						
Provide technical assistance, design tools, and financial incentives to building owners, developers, and builders to overcome initial design challenges, costs, and risks associated with high-performance building	New Construction	• Building characteristics (from field studies) • Building permit data • Owners, developers, designers, and builders • Home purchaser/real estate industry or affordable housing agencies	• Program participation • Price premium or time on market of participating buildings • Leveraged funds • Design tool usage • Industry standard practices	• Interviews and surveys with builders, developers, and/or building owners • Structured expert judging	• Targeted market actor interviews and surveys • Historical tracing (compile and assess documentary evidence) • Review of evidence to determine program impact on adoption of high-performance building practices by disinterested market experts	• Consider whether initiative contributes to the success of other initiatives, particularly the—Codes and Standards initiative; if so, reflect that in the logic model and decide on approach to avoid double-counting • Nonparticipating builders may be unaware of NYSERDA program influence; causality assessment should rely on targeted market actors
4. Codes and Standards						
Support the adoption of more stringent product standards and energy codes; increase compliance and enforcement	CSCNB; Product and Appliance Standards	• Product sales/shipment/ installation data • Rulemaking documents • Policy makers • Market experts • Code training participants • Product specifications • Product test data • Building permit data • Building characteristics (from code compliance studies)	• Number of trainings • Training participation • Number of jurisdictions adopting stretch codes • Number of standards supported • Program staff participation in rulemaking processes	• Structured expert judging (Delphi panel) • Pre-initiative compliance studies	• Historical tracing (compile and assess documentary evidence) • Review of evidence to determine program impact on adoption and development of code or standard by disinterested market experts • Surveys with trainees	• Must characterize the whole market subject to the regulation to identify units affected and UEBs. Causality may be related to program influence on the adoption of regulations or influence on code compliance rates.

Characteristics	Example Initiatives	Data Sources	Typical MPIs	NOMAD	Causality Assessment	Indirect Benefits Estimation Considerations
5. Training, Technical Services, Practices, and Challenges						
Provide resources and/or encouragement to end users to support their successful adoption or implementation of clean energy practices, leading to further adoption beyond direct program engagement	EMP; Clean Green Campuses (formerly Rev Campus Challenge); Clean Energy Communities; Building Operations and Maintenance Partnerships	• Market actors • Trainees/practitioners • Practitioner data (numbers certified/practicing) • Tool usage data • End-user decision-makers	• Program participation • Availability of resources (such as curricula and tools) • Awareness of resources • Usage of resources (such as tools and training) • Adoption of practices beyond direct participants • Trained workers • New jobs or advancement of trained workers • Worker/practitioner certifications	• End-user decision-maker surveys to determine the influence of new approach on adoption • Service provider or professional association interviews or surveys	• Targeted market actor interviews and surveys to investigate adoption and implementation influence • End-user surveys	• The direct influence category is likely to be significant: ongoing tracking of participants' subsequent practices is crucial for estimating indirect benefits • Consider whether the initiative contributes to the success of other initiatives targeting the same market; if so, reflect that in the logic model and decide on an approach to avoid double-counting
6. Innovation and Research						
Invest in early stage research, business support, product development support, demonstration projects, and contracts with incubators	ClimateTech Commercialization Support; NextGen Buildings	• Market partners • Business/organization performance data • Project performance data	• Not applicable, since these are early stage investments	• Develop NOMAD using guidelines for other program types when product, technology, or approach proceeds to market development	• Targeted market actor interviews to substantiate initiative influence • End-user interviews, if relevant, to investigate motivations and decision-making	• Innovation and Research initiatives currently have no indirect benefits targets because they are early stage and may not be scalable. However, it is important to document baseline conditions and assess influence to establish potential long-term initiative-induced impacts

Appendix B. Evaluability Map: Codes and Standards for Carbon Neutral Buildings

This example is for CSCNB, which seeks to accelerate advanced code adoption and impact via five pathways of influence: (1) development and deployment of training and resources, (2) development of policies and regulations, (3) community outreach and implementation of pilot codes, (4) outreach and analytical support to state and local policymakers, and (5) engagement with design and construction professionals via the new construction initiative.

Click to access the mapping tool.

		WHAT are your strategies for accelerating adoption of the technology/practice/policy you are targeting?	WHAT evidence do we expect to see in the market If we conduct these interventions? In 1-2 years? In 3-4 years? In 5 years (List All)	WHAT will we count/estimate/track to know we're making progress?	WHAT data sources will we use to count/estimate/track?

MPI #	LINKAGE (cause and effect)	MARKET PROGRESS INDICATOR	TIMEFRAME	METRICS	
				DEFINITION	DATA SOURCE
1	Develop, deploy, and support training, tools and resources to increase code and policy compliance and support authorities having jurisdiction with their enforcement duties	Code officials trained	ST	Number trained	Training registration data
2		Trained professionals demonstrate increased capability and expertise	MT	Self-reported number/ proportion trained making code implementation changes	Training follow-up surveys
3		Increased code compliance	LT	Estimated compliance	Expert panel
4	Develop stretch energy codes and uniform codes revisions to promote efficiency, flexibility and decarbonization. Develop and advance other policies and regulations to promote similar outcomes.	Regulations/policies developed by NYSERDA and shared with policymakers	ST, MT	Number developed and shared	NYSERDA program documentation
5		Regulations/policies updated	MT, LT	Number updated	Jurisdiction policy documents
6	Use pilots to test, refine, and scale new approaches to code and policy development, advancement, enactment, compliance and enforcement	Communities adopt pilot approaches	MT	Number of communities piloting	- Targeted community decision makers (interviews) - Official documentation of pilot implementation
7	Work with partners and stakeholders to support adoption and enactment of State & local policies to promote efficiency, flexibility, and decarbonization in buildings	Stakeholders/influencers support adoption/ enactment	MT	Number of targeted stakeholders/influencers supporting (X of Y)	- Targeted SH/influencer interviews - Code proceedings
8		Policies/codes adopted at the state or local level	LT		Policy documents
9	Engage and develop capabilities of design and construction professionals via New Construction and Buildings of Excellence initiatives, to prove the feasibility, performance, and cost-effectiveness of CNB	Design & construction professionals engaged	ST	Number of builders engaged	- Program documentation - Builder survey - Design professional survey
10		Buildings constructed	MT	Buildings built	- Program data - [Source data]
11		Performance data provided to policymakers	LT	- Documentation of data submitted - Self reported data influence	- Code proceedings - Targeted decision-maker Interviews
12	Codes and policies are adopted and enacted faster than they would without NYSERDA's intervention	N/A	N/A	Policies/compliance rate/% impact that would have been achieved without CSCNB	Delphi panel (expert judging)

Appendix C. Indirect Benefits Evaluation Checklist

Click to access the interactive checklist.

Indirect Benefits Framework

INITIATIVE LIFECYCLE STAGES AND ACTIVITIES	IMPLICATIONS FOR INDIRECT BENEFITS	NOTES
STAGE 1: EVALUATION PLANNING (PRE-FILING)		

☐ **Clarify market transformation theory**
 	
☐ What market actors does this initiative seek to influence?
 	
☐ How will the initiative influence each type of market actor?
  ☐ What are the key market activities?
  ☐ What outputs will result from each activity?
  ☐ What market outcomes are expected?
    ☐ In 1 to 2 years?
    ☐ In 3 to 4 years?
    ☐ In 5 or more years?
 	
☐ What other NYSERDA initiatives target these market actors?
 	
☐ How will other initiatives influence these market actors?
	• How will the initiative catalyze market change and generate indirect benefits?	

☐ **Create logic model** ☐ Do the activities in the logic model reflect all expected NYSERDA market transformation influences—even the influence from other initiatives (such as the Buildings of Excellence influence on CSCNB)?		
☐ **Create an evaluability map by pathway of influence** ☐ What is the evidence of each influence for each pathway? (How will you test if the NYSERDA initiative influenced the sought-after outcome?) ☐ What research activities will provide evidence of influence?	• What are the theorized pathways of causal influence and what data are needed to validate those pathways?	
☐ **Develop benefits forecast** ☐ Are assumptions clearly identified (where anyone could easily find all the assumed values)? ☐ Are assumptions fully documented (with sources that are clearly identified and referenced)?	• What are the direct and indirect benefits targets and forecasts? What are the assumed baseline conditions?	

Indirect Benefits Framework

INITIATIVE LIFECYCLE STAGES AND ACTIVITIES	IMPLICATIONS FOR INDIRECT BENEFITS	NOTES
STAGE 2: INITIATIVE YEAR 1 (BASELINE YEAR)		
☐ **Review initiative documentation**		
☐ Review initiative documentation		
☐ Review BAB; clarify assumptions and sources		
☐ Review draft evaluability map		
☐ **Develop evaluation plan (sources, methods, and granularity for assessment of UEBs, market adoption, and causality)**		
☐ Research questions		
☐ Research methods and data sources	• How will we estimate indirect benefits calculation components (such as UEBs or an increase in market adoption resulting from initiative activities)?	
☐ To assess market progress		
☐ To assess causality		
☐ Timeline		
☐ Analysis plan		
☐ Define UEB units of adoption		
☐ Determine how many and which UEBs are needed (such as for different segments)		
☐ Determine how UEBs will be evaluated		
☐ Create NOMAD estimation approach		
☐ **Coordinate with internal and external stakeholders**	• Have we identified and incorporated all the theorized pathways of influence into evaluation plans?	
☐ Initiative team		
☐ NYSERDA teams working in same market	• How will we coordinate research with other stakeholders?	
☐ Other New York stakeholders working in and researching the same markets		
☐ **Characterize market baseline conditions**	• What are the market conditions prior to initiative launch? What are the expected future conditions absent the initiative?	
☐ Current conditions (update BAB assumption)		
☐ Forecast		

Indirect Benefits Framework

INITIATIVE LIFECYCLE STAGES AND ACTIVITIES	IMPLICATIONS FOR INDIRECT BENEFITS	NOTES
STAGE 3: SUBSEQUENT YEARS		
☐ **Evaluate market progress, adoption, and causal influence per evaluation plan**	• What are the direct and indirect benefits per unit of adoption? How many units were adopted as a result of the initiative?	
☐ **Estimate indirect benefits**		
☐ **Review benefits forecast model assumptions; refine forecast**	• Are the benefits forecast assumptions valid? What assumptions, if any, should be updated?	
☐ **Review/refine logic model**	• Is the market transformation theory valid? What activities, elements, or pathways of influence should be updated, if any?	
☐ **Update evaluation and data collection plan**	• How should the evaluation and data collection plans be updated to ensure that the evaluation team obtains data required for the timely, accurate estimation of benefits?	