Combined Heat and Power Acceleration Program: Logic Model

Final Report

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Table of Contents

List of Tables

List of Figures

Introduction

The System Benefits Charge (SBC) Plan funds public policy initiatives not expected to be adequately addressed by New York's competitive electricity markets, including energy programs targeting efficiency measures, research and development, and the low-income sector. The New York Public Service Commission (PSC) issued an order continuing SBC funding for and approving the Technology and Market Development (T&MD) Portfolio proposed by the New York State Energy Research and Development Authority (NYSERDA) for the five-year period of January 1, 2012, through December 31, 2016. That order approved a budget of almost $60 million for a Combined Heat and Power (CHP) initiative for the five-year period. Subsequent Program Opportunity Notices (PONs) provided $36 million for the initiative's CHP Performance Program (PON 2701) and $20 million for the initiative's CHP Acceleration Program (PON 2568).

The Purpose of this document is to present the overarching logic model for the Combined Heat and Power Acceleration Program. This document's organization is as follows:

1. **Program Context:** Describes the problems and issues the Program is attempting to address and the regulatory and stakeholder environment within which the Program is working.

2. **Program Objectives**: Describes, at a high level, the Program's ultimate purposes and targets.

3. **Program Resources**: Also known as "inputs," these are the funding and other resources the Program provides.

4. **Program Activities**: Describes the Program's direct contributions to the accomplishment of the Program's goals. These activities produce quantifiable results or "outputs."

5. **Program Outputs**: Describes the anticipated, quantifiable, immediate results of Program activities.

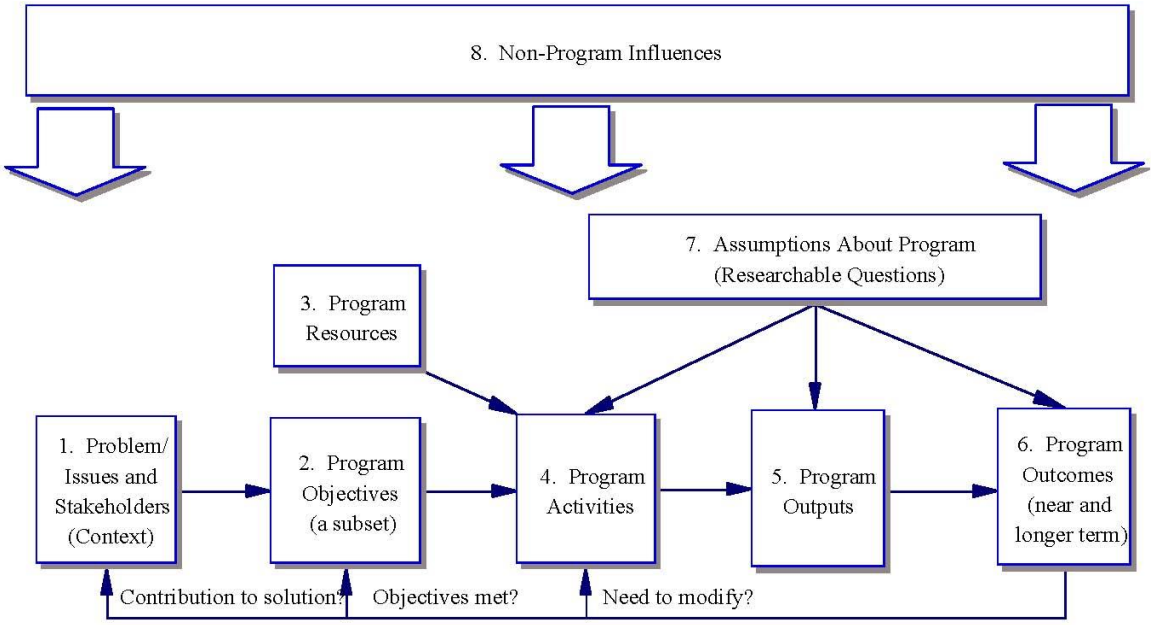
6. **Program Outcomes**: Describes expected Program achievements and their expected occurrence in the near, intermediate, and longer term.

7. **Assumptions about Program**: Also known as "researchable issues" and "testable hypotheses," these are assumptions about how Program activities and outputs will lead to the desired near, intermediate, and longer-term outcomes.

8. **External Influences**: Describes factors outside the Program that may drive or constrain the achievement of outcomes.

Figure I-1 details the relationship between these eight items.

Figure I-1. Program Design Template



1 Program Context and Design

This section describes the regulatory and stakeholder context for NYSERDA's CHP Acceleration Program, including a discussion of circumstances that limit the adoption of CHP in New York State. The section concludes with an overview of Program design considerations.

1.1 Context

Deployment of CHP is widely recognized as a successful approach to reduce site energy costs and grid constraints, to enhance site power-supply reliability and flexibility, and to support economic development and overall energy efficiency. Achieving these benefits is constrained by barriers, risks, and limited market experience with CHP technologies. More specifically, widespread implementation is hindered by interconnection and environmental challenges, the complexity and cost of projects, and the need for proof of performance and persistence. The CHP Acceleration Program responds to these challenges by seeking to advance CHP technologies and systems, reduce investment risk, accelerate marketplace adoption, drive and prove high levels of energy and environmental performance, and open pathways to integrated economic development and renewable energy use. Techniques employed by the Program to ensure system performance and persistence of savings include metering, verification, commissioning, and re-commissioning.

The United States Department of Energy (DOE) has made significant investment in U.S. manufacturers of CHP components to ensure individual components can be properly matched to create overall systems.[1] These pre-engineered systems, including those assembled at New York factories, span all types of prime movers, including induction engines, inverter engines, synchronous engines, and microturbines. Many modules include pre-selected chillers that improve a CHP system's overall thermal usage and efficiency, and reduce electric demand by offsetting electric chiller use at the site.

Anticipated load growth in New York State, particularly in the state's densest urban areas, will increase demands on already stressed distribution grids. With dollar-per-megawatt-hour costs to electric ratepayers comparable to cost-effective commercial and industrial energy-efficiency programs, CHP programs can provide an alternative to new central generation plants.[2] Because CHP can operate during periods of peak

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[1] For example, DOE awarded $18.5 million in 2001 for development of first generation modular units, http://www.edcmag.com/articles/integrated-chp-offers-efficiency-gains-to-buildings-market; see also http://web.ornl.gov/sci/eere/PDFs/No1_2002p9.pdf and http://www1.eere.energy.gov/industry/distributedenergy/pdfs/itp_foa_awards.pdf for DOE Funding Awards announced in 2010 for U.S.-based equipment manufacturers to engineer packaged CHP modules,

[2] CHP funded through T&MD will be more energy efficient than incremental, electric-grid-supplied power due to the program required minimum fuel conversion efficiency and the elimination of electric transmission and distribution losses.

electric demand, these systems can provide efficient, reliable, clean power and peak-load reduction. CHP can also play a role in development of micro-grids to provide resiliency through redundancy within the power sector. This advantage was highlighted in the draft interim reports of the Commissions established by Governor Cuomo in the wake of Super Storm Sandy.

While CHP opportunities exist throughout New York State (up to 8,500 MW of technical potential), there is an abundance of opportunities concentrated in New York City. A 2002 study assessing opportunities to construct new CHP systems determined the technical potential in the New York City area to be 1,000 MW of capacity for systems greater than 5 MW, and an additional 3,500 MW of capacity for systems less than 5 MW. Of the latter, 2,000 MW of capacity reflects systems less than 1 MW.[3] Nevertheless, there are several critical barriers that need to be addressed to increase CHP substantially throughout the five boroughs of New York City. These barriers include lack of a well-coordinated approval process to allow firing-up newly-installed systems, and the overlapping jurisdictions of numerous regulatory authorities, such as the electric and various natural gas utilities, the steam utility where applicable, and the building and fire departments, each providing short-duration temporary approvals while awaiting comparable approvals from the others.

The skill sets required for CHP project development generally span three areas of expertise – financial, regulatory, and technical issues. Key market actors for CHP installations include manufacturers and distributors, Energy Service Companies (ESCOs), developers, engineers and owners' agents, contractors, and installers, operations and maintenance contractors, New York Independent System Operators, policymakers, NYSERDA, and third-party financiers. Some firms, especially ESCOs and developers, may offer customers some degree of integrated project services, including contractual arrangements where the firm owns and operates the system for the customer. Other firms, such as mechanical contractors, specialize in a particular discipline related to system design or installation.[4]

Wide-ranging factors, including federal tax policies, emissions regulations, state interconnection requirements, and local building codes, all affect the viability of installing CHP systems. According to the American Council for an Energy-Efficient Economy (ACEEE), New York State has some of the most favorable policies and incentives in the nation, ranking best in the area of financial incentives.[5]

Interconnection is one of the most critical policy-related issues for CHP. In 2009, New York simplified interconnection requirements for systems 2 MW and smaller, significantly reducing barriers to the

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3 *Combined Heat and Power Market Potential for New York State*, Energy Nexus Group – Onsite Energy Corporation, 2002

4 Casten, S. Recycled Energy Development. 2008. "Opportunity and Pitfall Trends Identified through NYSERDA's Involvement in a Large Portfolio of Projects." NYSERDA CHP in NYS: Past, Present, and Future Conference.

5 Molina et al. 2010. *The 2010 State Energy Efficiency Scorecard*. American Council for an Energy-Efficient Economy.

development of smaller CHP systems. However, issues surrounding interconnection of CHP in urban spot networks remain significant.

Standby rates are another key area of policy focus for the CHP market. Standby rates are utility tariffs that apply to customers with on-site generation who rely on the utility for a supplemental power supply. New York's standby rates, revised in 2003, address the need for CHP system owners to contribute to system-wide costs associated with ensuring that adequate generation and distribution capacity exists to serve load in the event CHP systems cannot.[6] While New York's standby rates are less onerous than some other states, the complexity of the rates may cause the perception they hurt the economic viability of some CHP systems.

The City of New York has taken a number of policy-related steps to improve market conditions for CHP, including setting an 800-MW target for clean CHP development by 2030, requiring a review of CHP viability for larger new construction and passing laws requiring efficiency upgrades in existing commercial buildings.

There is risk and uncertainty associated with virtually every factor that drives CHP project economics. Risk factors most commonly cited by market actors include commodity price uncertainty, regulatory risk, persistent economic recession and reduced incentives, and infrastructure-related barriers in New York City.

Market barriers to CHP development generally fall into the following categories: technical (infrastructure, logistics, and CHP complexities), financial (payback and competing investments), informational (knowledge and awareness), and institutional (policy and regulatory).

Financial barriers include the simple payback on CHP projects, that is, the number of years it takes for a project to generate cumulative savings that equal the project investment, which is often too long to attract investment. Other financial barriers include poor economic conditions and perceived risks associated with CHP technology. Although many decision-makers acknowledge a financial value for CHP-provided power during a grid outage, they are often unable or unwilling to monetize that value and incorporate it in their pro forma economic calculations.

Policy and regulatory barriers span a broad spectrum. They include utility-related issues such as interconnection and standby charges, air emissions permitting, building and fire code issues in the City of

[6] The following orders established standby rates for New York utilities: Case 02-E-1108, Central Hudson Gas & Electric Corporation (issued December 4, 2003); Case 02-E-0551, Rochester Gas & Electric Corporation (issued July 29, 2003); Cases 02-E-0780 and 02-E-0781, Orange & Rockland Utilities, Inc. and Consolidated Edison Company of New York, Inc. (issued July 29, 2003); and Case 02-E-0779, New York State Electric & Gas Corporation (issued July 30, 2003). National Grid's standby rates were set as part of the utility's general rate proceeding in Case 01-E-0075, Niagara Mohawk Power Corporation - Merger and Rate Plan, Opinion No. 01-6 (issued December 3, 2001). These rates differ from those that apply to other utilities.

New York, and uncertainty about the future of regulations and the availability of financial incentives. Certain clean CHP systems are exempt from standby rates through the end of 2015. When the exemption expires, standby rates may become a greater area of concern among CHP market actors. For projects in New York City, uncertain and often unexpectedly high costs for Con Edison to upgrade the natural gas line serving a facility have prevented several otherwise viable CHP projects from moving forward.

Emissions' permitting is also a barrier, primarily due to the risk the permitting process introduces to the development timeline, as well as the administrative burdens associated with regulatory compliance. Other barriers include:

- Uncertainty about the availability of financial incentives and the nature of regulatory requirements that may exist in the future.
- Low levels of knowledge and awareness of CHP opportunities.
- Siting, infrastructure, and logistical barriers.
- The fact that CHP is a non-essential investment competing with other investment priorities.
- Complexity of the CHP market and its development process.

Table 1-1 sets forth the issues or barriers to be addressed by the CHP Acceleration Program and the stakeholders affected by the barriers.

Table 1-1. Issues to be Addressed by NYSERDA's CHP Acceleration Program

Problem Area and Barriers	Stakeholders Impacted or Involved
1. Technical Barriers	
• Siting and infrastructure issues	Owners, developers, architects, engineers, contractors, installers, utilities, public agencies
• Complexity of the CHP market	Owners, developers, manufacturers, distributors
• Complexity of CHP projects	Owners, developers, manufacturers, distributors, engineers, contractors, installers
2. Economic Barriers	
• Length of Payback	Owners, developers, third-party financiers
• Macroeconomic conditions	Owners, developers, third-party financiers
• Competing investment priorities	Owners, developers
	Continued

Problem Area and Barriers	Stakeholders Impacted or Involved
3. Informational Barriers	
• Perceived risk	Owners, developers, third-party financiers
• Uncertainty of incentive availability	Owners, developers
• Low levels of knowledge and awareness	Owners, developers, architects, engineers, contractors, installers, utilities, public agencies
4. Institutional Barriers	
• Interconnection and standby charges	Owners, developers, utilities, public agencies
• Emissions permitting	Owners, developers, public agencies
• Building and fire code issues (NYC)	Owners, developers, public agencies
• Regulatory change and uncertainty	Owners, developers, public agencies

Earlier CHP projects demonstrated that addressing known barriers can reduce the time required for new system implementation. CHP modules in capacities of approximately one megawatt and less are commercially available and can be grouped to meet thermal and electric loads for a variety of building types and operating schedules. For end-use sectors with lower generating needs, more streamlined approaches may compensate projects that install megawatt-scale and smaller modules for the loss of "economy-of-scale." In particular, the New York State Standardized Interconnection Requirement (SIR) enhances the ability to accelerate the installation of new distributed generators of 2MW or less connected in parallel with utility distribution systems.

1.1.1 NYSERDA Initiatives to Facilitate Adoption of CHP

The distributed nature of CHP provides the opportunity to advance diversity and reliability, minimize risk, provide efficiency, leverage non-utility private financing, and promote opportunities to integrate economic development, and renewable fuel. NYSERDA has long been at the forefront of efforts to promote and advance the adoption of CHP, and has provided financial support for CHP since 2000.[7] Beginning that year with PON 554, the CHP Demonstration Program used a competitive selection approach to enable intentional selection of a diverse portfolio of projects that would demonstrate CHP in a wide array of building types, sizes, and thermal needs. Consistent with the purpose of acquiring a diverse portfolio, it became evident that certain CHP configurations were ideally matched with certain buildings. However, the

[7] NYSERDA's first PON for CHP was issued in 2000 (PON 554). As part of the second round of public benefits programs (SBC2), four additional PONs were released that supported CHP (536, 669, 750, and 800). PONs released to support CHP projects under the third round of SBC funding (SBC3) in 2006 through 2010 included PONs 914, 1043, 1178, 1241, 1931, and 2373. PONS 2568 and 2701 issued under the CHP initiative's SBC4 funding, complete the list of NYSERDA's financial support to promote CHP.

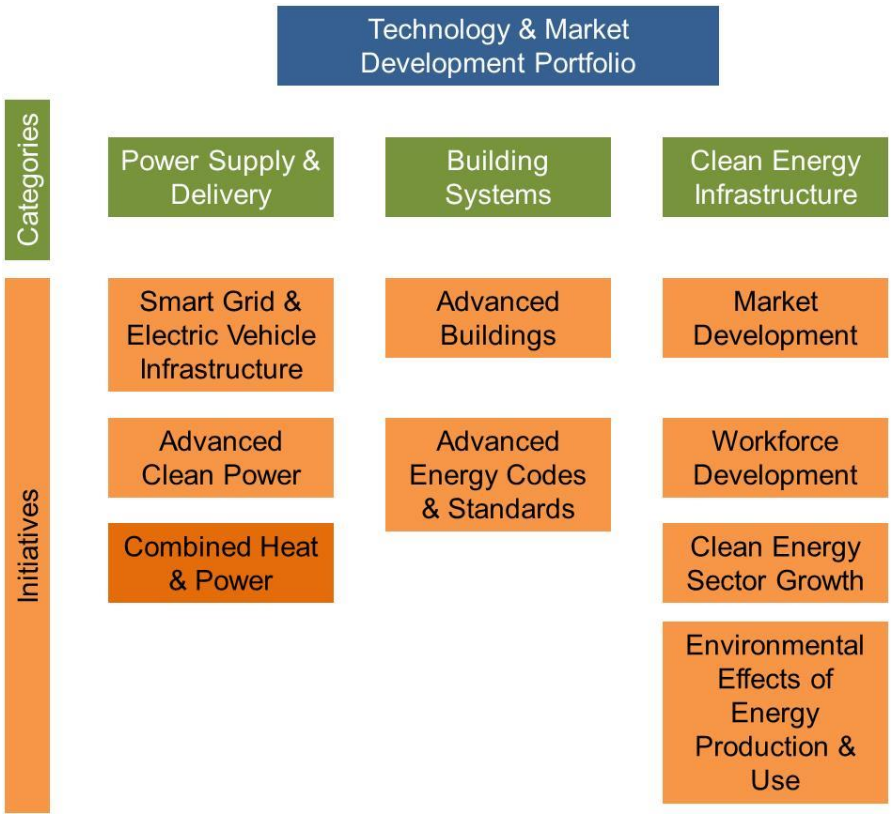
Demonstration Program, designed for portfolio breadth, was not suited to fund replications of those ideal configurations.

To support replication and further adoption of optimal CHP configurations, NYSERDA launched the CHP Performance Program approximately six years ago as a companion to the CHP Demonstration Program. The overall success of the CHP Demonstration Program in amassing an extensive and diverse portfolio and in identifying a suite of ideal system and building configurations has diminished the need to demonstrate additional configurations. Thus, the CHP Demonstration Program has sunset, and the CHP Acceleration Pilot Program has begun. While the CHP Demonstration Program used a competitive selection format based on an episodic call for proposals, the CHP Performance Program and the CHP Acceleration Pilot use standard-offer approaches as described in greater detail in the following section on program design.

1.2 Design

The CHP Acceleration Program is part of NYSERDA's T&MD Portfolio. That portfolio contains nine initiatives in the following three categories: Power Supply and Delivery, Building Systems, and Clean Energy Infrastructure. The Power Supply and Delivery category includes three of the portfolio's nine initiatives. One of the three Power Supply and Delivery initiatives is Combined Heat and Power (Figure 1-1).

Figure 1-1. Technology and Market Development Portfolio



The Combined Heat and Power initiative is statewide, except for parts of Long Island, and is focused on Consolidated Edison's service territory.[8] The initiative is intended to reduce market barriers to the use of CHP technologies and to increase customer acceptance of CHP systems. It includes two programs: the CHP Performance Program provides performance incentives to gas-fired CHP systems, with an aggregate nameplate greater than 1.3 MW, that provide summer on-peak-demand reduction; the CHP Acceleration Program provides incentives for the installation of certain pre-qualified and conditionally qualified, modular CHP systems by approved CHP system vendors. The CHP Performance Program is administered by NYSERDA's Deployment staff, and the CHP Acceleration Program is administered by NYSERDA's Research and Development staff. Only the CHP Acceleration Program is addressed by this logic model report.

NYSERDA employs three types of standard offer programs. The simplest of the three formats is a menu-driven rebate structure, which might be used for a motors program where purchase and installation of specific motors qualifies the end user for a standard rebate scaled to the horsepower of the motor. These incentives would typically be on the order of hundreds of dollars.

A more complex type of standard-offer program is one with a pseudo-performance design; efficiency measures undergo computer modeling of their anticipated performance under site-specific conditions and the predicted performance is used to calculate an incentive. NYSERDA's Renewable Portfolio Standard On-site Wind Program uses this model; a customer selects from a list of pre-approved wind turbines and chooses the height of the tower to which it will be mounted; the turbine's performance is modeled based on the turbine's power curve and the known variations of wind speed at the turbine's mounted elevation in the customer's location, yielding a prediction of annual kilowatt-hours of electric generation. The incentive is a standard offer scaled to the modeled annual kilowatt-hour production. These incentives might be on the order of tens of thousands of dollars.

The most complex standard offer format is wholly performance based; energy consumption is metered at the proposed site to determine baseline energy use. Following implementation of efficiency measures, additional metering occurs. The incentive is scaled to the actual annualized energy use reduction that results from the implemented measures. This is the format the CHP Performance Program has used. Its incentives might be on the order of one to two million dollars.

[8] Operating Plan for Technology and Market Development Programs (2012-2016), Second Revision, February 15, 2013, p. 9-25.

The CHP Acceleration Program is a pilot effort to explore whether the simplest type of standard-offer prescriptive-rebate program can effectively accelerate the adoption of an efficiency measure as complex and expensive as CHP. Key features of the Program include:

- Pre-approval of select makes and models of pre-engineered, packaged (modular) CHP units,
- Identification of a single party (the module vendor) to whom both the building-site owner and NYSERDA can look for resolution of all issues pertaining to the purchase, installation, maintenance, and performance of each system installed with Program assistance,
- Assignment of a specific rebate amount to each pre-approved module,
- Development of a sizing guideline for streamlined matching of site needs to pre-approved modules,
- System commissioning and re-commissioning events,
- Financial incentives that support flexible implementation of multiple combined modules so long as their combined generating capacity in a given setting does not exceed the 1.3 MW Program limit, and
- Bonus financial incentives for CHP systems installed to support "critical infrastructure," including but not limited to a facilities of refuge, and/or bonus financial incentives for CHP systems installed in "Target Zones" within the Con Edison territory.

2 Program Goals

This section describes, at a high level, the purpose and objectives of the CHP Acceleration Program.

As mentioned above, the CHP Acceleration Program is a pilot research-and-development effort to explore whether the simplest type of standard-offer prescriptive-rebate program can effectively accelerate the adoption of an efficiency measure as complex and expensive as CHP. Two key ancillary goals follow from this fundamental goal.

As the Program's name indicates, one of the key ancillary goals is to accelerate the adoption of CHP systems in New York State. The Program expects to do this by providing vendor incentives for the installation of appropriately sized, packaged CHP systems. More specifically, the incentivized systems are pre-qualified, modular systems that fall within the size range of 50 kW through 1.3 MW.[9] Pre-qualified systems are listed in an online catalog that includes system sizing guidelines for common building types, an overview of each included system's technical specifications, and a predetermined, or prescriptive, incentive for each system.

The second key ancillary goal follows from the first. The CHP Acceleration Program seeks to increase awareness of and familiarity with modular CHP systems by providing outreach and education, demonstration and testing, and dissemination of performance data and lessons learned from the increased deployment of these systems. In short, the CHP Acceleration Program is intended to reduce technical, financial, and informational market barriers to the use of CHP technologies, resulting in increased acceptance and use of CHP systems.

Achievement of these goals will directly address circumstances that limit the adoption of CHP.

The use of pre-engineered packages will eliminate concerns about compatibility and integration of system components, and direct the focus of a project's design team to remaining challenges, such as proper matching of a site's needs to an appropriate package. Program development of a sizing guideline will streamline and address that concern. The identification of the system vendor as solely responsible for resolution of all issues pertaining to the purchase, installation, maintenance, and performance of each system, will address uncertainties about, and even avoidance of, those responsibilities that can occur when separate parties undertake each of those steps.

[9] In its July 25, 2011 response to questions from DPS Staff, NYSERDA stated that all projects under both programs will be required to have a design-basis of at least 60% fuel conversion efficiency, and all equipment will be required to meet environmentally clean emissions ratings. "NYSERDA Response to June 23, 2011, Department of Public Service Letter," p. 45.

Assigning sole responsibility for the systems to system vendors will also result in a restructuring of this marketplace. By placing the equipment vendor "at the center of the universe" for a CHP project, vendors will become part of the design team earlier in the project design process, diminishing the opportunity for incompatible or sub-optimal designs by consulting engineers who have sometimes unwittingly proceeded based on incomplete or inappropriate building or system information that could occur if a CHP system is being procured from a vendor at an "arm's length" transaction. This approach will also establish the equipment vendor as an appropriate repository for lessons learned regarding their equipment.

The use of pre-engineered packages will also address institutional barriers to the use of CHP. According to NYSERDA staff, utility personnel have indicated over the past decade that each CHP project appeared to be one-of-a-kind, requiring extensive scrutiny. Standardization that will occur from replication of packages will provide an opportunity for utility personnel, and building and fire-department inspectors, to gain familiarity and comfort with specific repeatable designs. To facilitate this beneficial objective, the two utilities in New York State whose service territories have seen most of the installations of CHP systems (Con Edison, and National Grid), have been enlisted to review package designs for Program pre-approval. Thus, subject to site-specific conditions, the pre-approved packages will be free from inherent attributes that would cause those utilities to reject them.

An additional benefit of designing the CHP Acceleration Program in the standard offer format, as distinguished from the competitive program format used in the CHP Demonstration Program, is the resulting repositioning of NYSERDA's role relative to CHP projects. From previously judging the competitions upon receipt of a project proposal, NYSERDA's role in the CHP Acceleration Program becomes one of endorsing a cadre of equipment vendors prior to receipt of a project application. This new role enhances NYSERDA's ability to conduct outreach and assist the vendors with customer acquisition, such as through a series of "CHP Expo" events used to introduce interested building owners to the pre-approved vendors. These Expos, aimed at customer engagement, will complement NYSERDA's traditional CHP conferences, which are intended to help actors in the CHP market (such as equipment vendors and consulting engineers) understand the latest trends in the marketplace.

Finally, the Program will further the public policy goals of increased grid reliability and resiliency. Specifically, CHP systems supported by the Program must have the ability to run in parallel with the utility grid to save energy and reduce energy costs on an every-day basis, and must also have the ability to run independently during a grid outage to provide power to priority loads at the site. Program supported sites that are subject to flooding require the CHP system to be sited in a "high and dry" location.

3 Program Resources and Activities

This section describes the resources or inputs available to the Program, and the Program activities that will be generated and supported by those inputs.

3.1 Resources

The ability of NYSERDA's CHP Acceleration Program to produce the expected outputs and to achieve its desired outcomes (Section 4) is related to the level and effectiveness of the Program's inputs, that is to the level and effectiveness of the resources available to the Program. The CHP Acceleration Program's inputs fall into four broad categories: funding, NYSERDA staff resources, external resources, and other intangible resources.

3.1.1 Funding

At the time of the October 2011 PSC order approving the T&MD Portfolio proposed by NYSERDA for the five-year period of January 1, 2012, through December 31, 2016, projected SBC4 funds were inadequate to underwrite the portfolio of programs in full. The order approved a budget of almost $60 million for a CHP initiative for the five-year period, but only funded about one-third of that amount. The difference in annual CHP program costs between this authorization and projected SBC collections was to be derived from a source or sources other than the SBC.[10] A subsequent PSC order on December 17, 2012, authorized NYSERDA to use funds made available by reductions to the budgets of two EEPS programs to fund the CHP initiative in full within the T&MD Portfolio.[11]

An annual budget of $5 million for a five-year total of $25 million was authorized for the Acceleration Program.[12] PON 2568 offers $20 million of that amount as available for incentives over the Program's five-year duration.

3.1.2 Staff Resources

NYSERDA staff who manage and oversee the CHP Acceleration Program have been involved with designing and issuing 10 of the 11 CHP PONs (that is, the 10 PONs that constituted the CHP Demonstration Program) preceding the current CHP initiative, and have actively participated in the

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10 *Case 10-M-0457, In the Matter of the System Benefits Charge IV, Order Continuing the System Benefits Charge and approving an Operating Plan for a Technology and Market Development Portfolio of Systems Benefit Charge Funded Programs*, October 24, 2011, p. 14.

11 *Case 10-M-0457, In the Matter of the System Benefits Charge IV, Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*, December 17, 2012, p. 59.

12 NYSERDA, *Operating Plan for Technology and Market Development Programs* (2012-2016), Second Revision, February 15, 2013, p. 9-29.

management of the CHP Demonstration Program associated with those 10 PONs. During the 2000 through 2010 time frame, NYSERDA staff were involved with 95 completed, program-funded projects with a total generating capacity of 111 MW.

CHP Acceleration Program staff have participated in and gained insights from earlier process and impact evaluations of NYSERDA's CHP programs, and have participated in the creation of a 2011 market characterization assessment of CHP in New York State. NYSERDA staff brings this background of program management experience, market knowledge, and experience specifically with the details of an array of CHP installation sizes, types, and locations to the administration of the CHP Acceleration Program.

3.1.3 External Resources

An external Program resource that will contribute to the achievement of the Program's goals is the expertise of qualified CHP vendors. In addition to requiring pre-qualification of the vendors' CHP modules, the CHP Acceleration Program requires vendors to undertake all aspects of vending, installing, servicing, maintaining, and warranting their pre-qualified systems for a minimum of five years from the date of electric grid interconnection approval.

To augment staff experience, the Program expects to contract with third parties who can provide additional specialized expertise in the areas of customer outreach and education, assisting customers to identify appropriate systems from the Program's extensive catalog of pre-approved CHP modules, and for system recommissioning.

Other external resources available to support Program activities are the Environmental Protection Agency (EPA) and the DOE's Northeast CHP Technical Assistance Partnership.

3.1.4 Intangible Resources

Intangible resources underpinning the CHP Acceleration Program include NYSERDA's credibility with its many stakeholders. This credibility is based substantially on longstanding relationships of NYSERDA and its staff with those stakeholders who include other public agencies, utilities, both for-profit and nonprofit private businesses and organizations, and end-use customers among other stakeholders.

Table 3-1 provides a list of the Program resources that will contribute to the Program's results.

Table 3-1. Program Resources (Inputs)

Funding
• Funding
NYSERDA Staff Resources
• Program management experience • Market knowledge • CHP experience
External Resources
• Vendor expertise • Third-party contractor expertise • Other agency expertise
Intangible Resources
• NYSERDA's credibility • Staff and agency relationships with key stakeholders

3.2 Activities

The CHP Acceleration Program's goals are expected to be achieved through the implementation of five categories of activities. These categories include:

- Development and ongoing updating of a catalog of pre-qualified modularized CHP systems.
- Customer outreach and education.
- Providing financial and technical assistance.
- Monitoring and proving persistence of savings.
- Technology transfer efforts.

As mentioned earlier, the Program's catalog includes system sizing guidelines for common building types, an overview of each included system's technical specifications, and a predetermined, or prescriptive, incentive for each system.

The simplicity of the Program's prescriptive standard-offer approach to incentivizing CHP systems is novel. To ensure that prospective customers become aware of this straightforward approach and are encouraged to undertake a project with a technology that may be new to them, the Program will provide customer outreach and education through a third-party contractor.

The incentives listed in the CHP Acceleration Program catalog comprise the financial support provided by the Program. Those incentives are intended to address financial barriers to the installation of CHP.

Technical assistance for building owners (customers) offered by the Program includes providing referrals to agencies and programs such as the EPA, the DOE's Northeast CHP Technical Assistance Partnership, NYSERDA's FlexTech Program, and other resources that can assist analysis of the applicability and sizing of CHP for a given site. Project scoping will be facilitated by an "ombudsperson," that is, a third-party expert who can assist a customer to sort through the extensive array of modules available in the Program catalog and identify a set of the most appropriate systems for their building. Further technical assistance will be provided by facilitating an invitation for prospectuses from the identified vendors and assisting the customer to interpret the differences between project prospectuses furnished by the selected vendors. This assistance includes system comparisons based on overall economics and other features of importance to the customer such as ownership versus leasing.

The CHP Acceleration Program will monitor and prove persistence of savings by requiring all CHP systems installed through the Program to be instrumented so their performance, including thermal use, can be measured on 15-minute intervals. Site owners must also provide a phone line or Internet connection so the performance data can be automatically uploaded to NYSERDA's CHP performance website on a daily basis for at least three years, where the data are available to the public. In addition to this required automated CHP system performance monitoring and reporting, the system vendor must also submit annually for three years a report that summarizes the performance metrics of the system. Further, to assure persistence of savings, NYSERDA requires each system to be re-commissioned at NYSERDA's expense between its 12^{th} and 24^{th} month of operation.

Technology transfer activities to broadcast Program experiences and lessons learned will be broad-based, and will include the development of case studies and best-practices guidebooks, demonstration and testing events, analyses of barriers that may continue to hinder CHP policy and technology initiatives, presentations at conferences and seminars, and publication of web-based materials.

4 Outputs, Outcomes, and External Influences

This section describes program outputs, program outcomes, and influences that are external to the program that can facilitate or impede the achievement of a program's outcomes. At the outset, it is important to distinguish between outputs and outcomes. Outputs are the immediate measurable results of program activities. These results are typically easily identified and quantified, often by reviewing program records. Outcomes are the expected market effects of a program. They are anticipated by, and frequently the same as program goals and objectives. Outcomes vary depending on the time period being assessed. On a continuum, program activities lead to immediate program outputs that, if successful, collectively work toward achievement of anticipated short-term, intermediate-term, and long-term program outcomes.

4.1 Outputs

The following table lists the CHP Acceleration Program's activities as described in section 3.2 above, and shows the corresponding outputs that will be produced by those activities.

Table 4-1. Program Activities and Associated Outputs

Activities	Outputs
A1: Pre-qualification of CHP vendors and modules	• OP1: RFI 2568 • Catalog of pre-approved modules • List of pre-qualified vendors • Sizing guidelines
A2: Customer outreach and education	• OP2: PON 2568 • Outreach events (especially "CHP expo" events) • Website and marketing collateral • Project scoping
A3: Financial and technical assistance	• OP3: Incentives • Application assistance • System selection assistance • References to other resources
A4: Technology transfer	• OP4: Demonstration and testing events • Case studies • Best-practices guidebook
A5: Monitor and prove persistence of savings*	• OP5: Commissioning events • Performance data • Vendor reports • Recommissioning events

* The outputs from this activity will also contribute to the technology transfer outputs.

4.2 Outcomes

Outcomes are the less certain, theoretical results of program activities. Outcomes can occur as soon as program activities begin and can continue to occur after a program ends. For the CHP Acceleration Program, we define short-term outcomes as those that occur in 2012 through 2014 (three years), intermediate-term outcomes as those that will occur in 2015 and 2016, and long-term outcomes as those that will occur after the end of the program cycle in 2016 (the out years). Program spillover can occur at any point, but is typically most evident in the long term.

Outcomes should be prioritized and considered as potential areas for investigation as part of formal program evaluation plans. A focus on the Program's fundamental and key ancillary goals, described in Section 2 above, will facilitate that prioritization. Briefly, those goals are:

- To explore whether the simplest type of standard-offer prescriptive-rebate program can effectively accelerate the adoption of an efficiency measure as complex and expensive as CHP;
- To accelerate the adoption of CHP systems in New York State; and
- To increase awareness of and familiarity with modular CHP systems by providing outreach and education, demonstration and testing, and dissemination of performance data and lessons learned from the increased deployment of these systems.

The following numbering scheme corresponds with the numbering on the logic model diagram that follows this section. That simplified representation of the CHP Acceleration Program also shows linkages between the Program's activities, outputs, and outcomes.

Short-term outcomes:

- STO1: Improved site matchmaking.
- STO2: Pool of pre-approved vendors and systems available for Program projects.
- STO3: Increased demand for Program participation.
- STO4: More building owners become informed of standard rebate offer and of CHP.
- STO5: Expedited CHP installation schedules.

Intermediate-term outcomes:

- ITO1: Increased demand for CHP modules.
- ITO2: More capital made available to fund CHP projects.

- ITO3: More modular CHP systems installed, especially in New York City.
- ITO4: Utility personnel and building inspectors become more familiar and comfortable with CHP modular systems.

Long-term outcomes:

- LTO1: Increased availability of CHP modular systems; CHP module costs decrease.
- LTO2: Deferred distribution upgrades and new central power plant construction, reducing ratepayer costs.
- LTO3: Flexible energy scheduling; more emergency shelter options.
- LTO4: System-wide kWh, kW, MMBtu savings, related cost savings, environmental and health benefits; improved grid reliability.
- LTO5: Simple standard-offer program shown to be effective to increase installations of CHP.

4.3 External Influences

The broader social, economic, and political context into which the CHP Acceleration Program is launched holds influences that may facilitate or impede the achievement of the Program's outcomes. At a high level, these external influences include the following items.

Changes in political priorities:

- Perceptions of energy and global climate change issues.
- Codes and standards.
- Federal energy policies, including energy related tax credits and the Federal Energy Policy Act of 2005 as amended.
- State and local actions and requirements.

Broad economic conditions that affect capital investment and energy costs:

- Energy prices (changes in fuel and energy prices).
- Utility rate structures.
- Perceptions of the value of energy efficient buildings.
- Building owners' competing priorities.

- Activities of public and institutional facility managers and projects.

Cost, performance, and availability of CHP technologies:

- Emerging technologies.
- Production economies-of-scale.

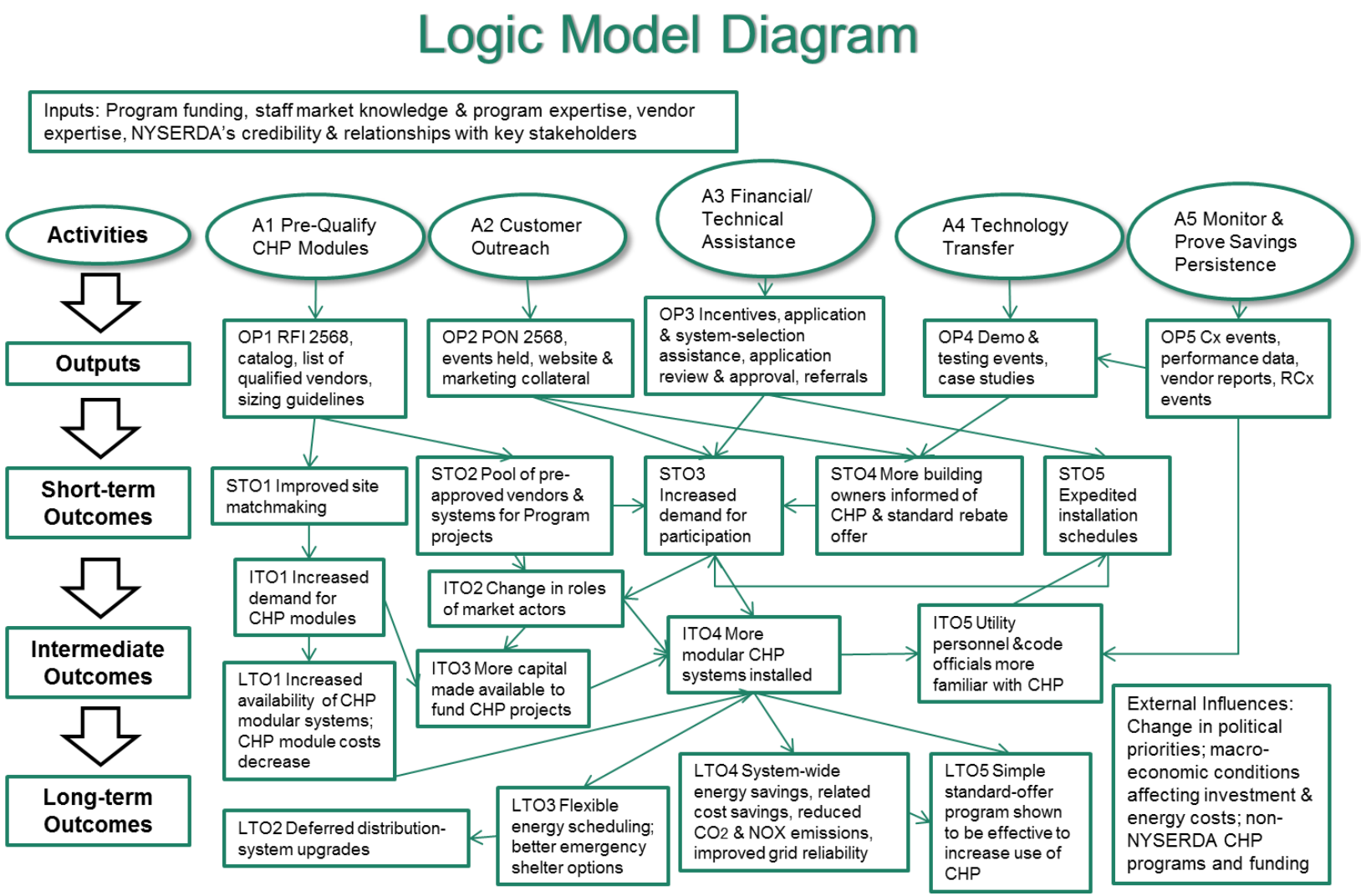
Non-NYSERDA CHP programs and funding:

- New York area utilities' programs and requirements.
- Federal and state tax credits.

5 Logic Model Diagram

The following page contains a diagrammatic representation of the CHP Acceleration Program logic model. The diagram identifies Program inputs and external influences, and shows the linkages between activities, outputs, and outcomes. The logic-model diagram presented here is at a higher level than the tables in this report. Evaluation research should use the more detailed tables in Section 6 below, in addition to the diagram, to examine the theoretical linkages and the Program's effectiveness in achieving the anticipated outcomes.

Figure 5-1. Logic Model Diagram



6 Measurement Indicators and Testable Hypotheses

Determination of the actual results of a program requires identification of indicators and metrics that demonstrate the occurrence of the program's theoretical outputs and outcomes. This section describes possible indicators of the occurrence of the CHP Acceleration Program's intended results. To aid determination of those results, possible data sources and data collection approaches for those indicators are also provided.

6.1 Output Indicators

The following table lists the Program's logic model outputs, and describes indicators and data sources that can verify the occurrence of each output. Items in this table should be prioritized and considered as potential areas for investigation as part of formal Program evaluation plans.

Table 6-1. Program Outputs, Associated Indicators, and Potential Data Sources

Outputs	Indicators	Potential Data Sources and Collection Approaches
Outputs from CHP Module Prequalification Activities		
OP1: RFI 2568, catalog of prequalified vendors and modules, sizing guidelines, and updates to these documents	• The listed documents and their publication dates	• Review of Program website and related files and documents
Outputs from Customer Outreach Activities		
OP2: PON 2568, events held, website, and marketing collateral	• The listed PON and its publication date • Number and types of promotional events and activities, and attendance by customer type • Number and types of marketing collateral developed • Number of end-user impressions from marketing collateral by type	• Review of Program database, website information, and related files and documents • Interviews with Program staff and third-party contractors • Surveys of participants and participating trade allies
Outputs from Financial and Technical Assistance Activities		
OP3: Incentives provided	• Number and amount of incentives paid • Number of projects that received incentives by building type and location	• Review of project database, and related files and documents

Continued

Outputs from Technical and Financial Assistance Activities		
OP3: Application and system-selection assistance provided	• Number of projects assisted by system size and building type	• Review of Program database, and related files and documents • Interviews with Program staff and third-party contractors • Interviews with Program participants and partial participants (drop-outs)
OP3: Referrals provided	• Referrals to EPA website, DOE's Northeast CHP Technical Assistance Partnership, and other external resources	• Review of Program database, and related files and documents • Interviews with Program staff and third-party contractors • Interviews with Program participants
Outputs from Technology Transfer Activities		
OP4: Demonstration and testing events, case studies, and other technology-transfer activities and media, perhaps including a best-practices manual	• Number and types of events held, attendance by customer or organization type, audiences targeted • Number and types of educational materials developed (brochures, case studies, etc.), estimates of related impressions	• Review of Program database, website information, and related files and documents • Interviews with Program staff and third-party contractors • Event attendance sheets
Outputs from Monitoring and Activities to Prove Persistence of Savings		
OP5: Commissioning and recommissioning events, performance data, vendor reports	• Numbers of commissioning and recommissioning events by system size and building type • Number of systems providing performance data • Number of vendor reports	• Review of website information, database, and related files and documents

6.2 Outcome Indicators

Table 6-2, Table 6-3, and Table 6-4 respectively, set forth the logic model's short-term, intermediate-term, and long-term outcomes. Associated measurement indicators for each outcome are also described in the tables, and for each indicator, a proposed data source or collection approach is presented. As with the preceding table, items in these tables should be prioritized and considered as potential areas for investigation as part of formal Program evaluation plans.

Table 6-2. Short-Term Program Outcomes, Associated Indicators, and Potential Data Sources

Outcomes	Indicators	Potential Data Sources and Collection Approaches
STO1: Improved site matchmaking	• Participants and their design teams report shorter project schedules • Participants and their design teams satisfied with system selection process	• Review of Program database, related files, and documents • Interviews with Program staff and third-party contractors • Interviews with Program participants and their design teams
STO2: Establishment of a pool of pre-approved vendors and systems for Program projects	• Lists (catalog) of pre-approved vendors and systems • Number of projects completed through the Program	• Review of Program database and website information
STO3: Increased demand for Program participation	• Staff reports of increased number of Program inquiries; increasing number of Program applications • Increasing number of projects completed through the Program	• Review of Program database, related files, and documents • Interviews with Program staff and third-party contractors • Interviews with pre-approved CHP vendors • Design-team and energy-consultant market actor interviews
STO4: More building owners and design-team market actors informed of CHP and of NYSERDA's standard rebate offer	• Staff reports of increased number of Program inquiries; increasing number of Program applications • Increasing number of nonparticipating design-team and energy-consultant market actors aware of Program • Increasing number of nonparticipating building owners aware of Program	• Review of Program database, related files, and documents • Interviews with Program staff and third-party contractors • Interviews with pre-approved CHP vendors • Design-team and energy-consultant market actor interviews • Surveys of nonparticipating building owners
STO5: Expedited installation schedules	• Straightforward and uneventful project installations • Participants and their design teams satisfied with project installation processes	• Review of Program database, related files, and documents • Interviews with Program staff and third-party contractors • Interviews with Program participants and their design teams

Table 6-3. Intermediate-Term Program Outcomes, Associated Indicators, and Potential Data Sources

Outcomes	Indicators	Potential Data Sources and Collection Approaches
ITO1: Increased demand for CHP modules in New York State	• Increasing number of CHP modules incorporated in project designs • Change/trends in number of modules purchased within and outside of the Program	• Design-team and energy-consultant market actor surveys • Interviews with CHP vendors
ITO2: Realignment of market actors' roles	• Consulting engineers provide system selection as their principal service to Program participants • Customers depend on consulting engineers for system selection	• Interviews with Program participants and their design teams (including consulting engineers)
ITO3: More capital made available to fund CHP projects	• Increasing number of third-party financed CHP projects completed (with and without Program assistance)	• Interviews with Program participants • Surveys of nonparticipating CHP owners • Market assessment surveys of capital and finance market actors
ITO4: More modular CHP systems installed in New York State	• Increasing number of modular CHP systems installed in New York State (with and without Program assistance)	• Review of Program database, related files, and documents • Surveys of CHP vendors
ITO5: Utility personnel and code officials more familiar with CHP	• Faster permitting and interconnection processes • Project owners and their design teams (with and without Program assistance) satisfied with jurisdictional permitting and interconnection requirements and processes	• Interviews with Program staff and third-party contractors • Interviews with utility staff, department of buildings staff • Interviews with Program participants and their design teams • Surveys of nonparticipating CHP project owners • Market assessment of jurisdictional permitting, and interconnection requirements

Table 6-4. Long-Term Program Outcomes (Spillover), Associated Indicators, and Potential Data Sources

Outcomes	Indicators	Potential Data Sources and Collection Approaches
LTO1: Increased availability of CHP modular systems; CHP module costs decrease	• Increasing number of CHP vendors apply for prequalification of their modular systems • Increasing number of modular systems on the market • Decreasing cost of CHP modules	• Interviews with Program participants and their design teams • Surveys of nonparticipating CHP project owners and their design teams • Surveys of CHP vendors • CHP manufacturer website analysis
LTO2: Deferred distribution system upgrades	• Deferral of utility plans for distribution-infrastructure investments • Capacity and number of modular CHP systems installed in Con Edison's targeted zones by targeted years	• Interviews with NYISO staff • Review of New York State Energy Plan • Review of relevant PSC filings • Interviews with utility staff • Review of New York utility annual reports • Economic studies of net impacts of deferred upgrades
LTO3: Flexible energy scheduling; better emergency shelter options	• Number of "critical facility" bonus incentives • Increasing demand response capability by commercial and industrial customers • Increasing number of emergency shelters with stand-alone power capability	• Review of Program database, related files, and documents • Interviews with participating building owners • Surveys of "critical facility" managers and building owners • Surveys of nonparticipating owners of CHP modular systems
LTO4: System-wide energy savings, related cost savings, environmental & health benefits; improved grid reliability	• kW, kWh and therm savings, energy-cost savings, reduced CO_2 and NOX emissions, corresponding environmental, health, and community benefits	• Impact evaluation study for kW, kWh, therm savings (with and without Program assistance), and changes in CO_2 and NOX emissions
LTO5: Simple standard-offer program shown to be effective to increase use of CHP	• CHP standard offer program becomes an ongoing deployment program	• Review of NYSERDA program offerings • Interviews with Program staff and third-party contractors

6.3 Testable Hypotheses

Based on this logic model, certain additional fundamental Program hypotheses have been identified for evaluation and are noted below.

- **Customer Outreach:** Are new outreach efforts, specifically, the "expos," effective? Are there other new outreach efforts to pursue?
- **Market Actor Roles:** Have the roles of consulting engineers and other market actors changed, and do they provide added but different value, particularly regarding the new paradigm of consulting engineers as "matchmakers/personal shoppers."
- **Market Effects:** Has the Program contributed to changing the perception of CHP system installations from that of a complex process of integrating multiple components from multiple vendors to a perception of CHP modular installations as somewhat analogous to one-stop shopping such as that for "plug and play" technologies?
- **Program Adaptation:** Are mechanisms in place to determine when the Program is sufficiently mature (successful enough) to become an ongoing deployment program? What level of supply/market infrastructure support is needed to maintain a sustainable market for CHP modular systems?

Evaluation research addressing these hypotheses will help to validate the program theory and will inform NYSERDA Program staff of Program progress and potential areas for Program refinement.

Appendix A: Related Documents

- US DOE, *Combined Heat and Power, A Clean Energy Solution,* August 2012, http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf
- U.S. DOE Funding Awards announced in 2010 for US-based equipment manufacturers to engineer packaged CHP modules, http://www1.eere.energy.gov/industry/distributedenergy/pdfs/itp_foa_awards.pdf
- Energy Nexus Group – Onsite Energy Corporation, *Combined Heat and Power Market Potential for New York State,* 2002
- NYSERDA, *Operating Plan for Technology and Market Development Programs (2012-2016), Second Revision,* February 15, 2013
- Bourgeois, Tom, and Bruce Hedman, *Clean Distributed Generation in New York State: State and Local Siting, Permitting and Code Issues,* Prepared for NYSERDA, May 2003 http://energy.pace.edu/sites/default/files/publications/Pace_CHP_Siting_Guidebook.pdf
- Navigant Consulting, Inc., *Distributed Generation—Combined Heat and Power Demonstration Program Market Characterization and Assessment Report,* Prepared for NYSERDA, 2011
- NYSERDA, PON 2568
- NYSERDA, RFI 2568