

**System Benefits Charge
Distributed Generation/Combined Heat and Power Program
Program Logic Model Report**

FINAL REPORT

Prepared for

**The New York State
Energy Research and Development Authority**

Prepared by

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New York State ENERGY Research and Development Authority
Distributed Generation/Combined Heat and Power Program
Program Logic Model Report
(Final Draft March 23, 2011)

INTRODUCTION

This report identifies and documents key elements (inputs, market actors, barriers, goals, activities, outputs, outcomes, potential external influences and researchable issues) associated with the Distributed Generation/Combined Heat and Power Program. This logic model addresses NYSERDA's ongoing activities occurring under the **New York Energy \$martsm** program as funded by the Systems Benefits Charge.

This document provides:

- 1) A table showing a list of documents relating to NYSERDA's Distributed Generation/Combined Heat and Power Program that were used to provide insight during development of this program logic model report;
- 2) A high level summary of the program, and the context of the markets within which this program operates. Information is also presented in this section on other complementary NYSERDA programs and the relationship between the program and those offered by investor owned utilities in New York and the NY-ISO. Available market characterization information is also presented in this section, including a description of baseline conditions, technical energy and potential for demand reductions, and the portion of that potential that the program is expected to achieve;
- 3) Key program-specific elements, including the ultimate goals of the program, market barriers, targeted market actors, program activities, inputs, anticipated outputs/outcomes, and potential external influences. Information on how program activities are expected to change the behavior of market(s)' actors is also presented in this section;
- 4) A program logic model diagram showing the linkages between inputs, program activities, outputs and outcomes, and identifying potential external influences;
- 5) A table listing the key outputs and outcomes, including identification of relevant measurement indicators and potential data collection approaches to guide later prioritization, and development of a monitoring and evaluation plan, and
- 6) A list of potential researchable issues for consideration within evaluation planning.

Section 1: **RELATED NYSERDA DOCUMENTS**

Table 1 identifies NYSERDA and other potentially relevant documents that were reviewed for this report:

Table 1. Relevant Documents Reviewed

NYSERDA Document Description
American Council for an Energy-Efficient Economy, <i>States Stepping Forward: Best Practices for State-Led Energy Efficiency Programs</i> , September 2010.
Distributed Generation/Combined Heat and Power Website and Information: http://www.nyserda.org/Programs/dgchp.asp .
GDS Associates, Inc., NYSERDA Distributed Energy Resources Program Logic Model, September 2007.
NYSERDA, <i>New York Energy \$martsm Program Evaluation and Status Report</i> , March 2010.
NYSERDA, <i>New York Energy \$martsm Program Evaluation and Status Report</i> , Quarter ending September 30, 2010.
NYSERDA, Systems Benefits Charge Proposed Plan for New York Energy \$martsm Programs (2006-2011), As Amended March 2, 2006.
Program Opportunity Notice (PON) No. 1931, http://www.nyserda.org/funding/1931pon.asp , December 2010.
Program Opportunity Notice (PON) No. 1241, http://www.nyserda.org/Funding/1241pon.asp , April 2009.
Program Opportunity Notice (PON) No. 1178, http://www.nyserda.org/funding/1178pon.asp , January 2008.
Program Opportunity Notice (PON) No. 1043, http://www.nyserda.org/funding/1043pon.pdf , August 2006.
Skumatz Economic Research Associates, Inc., Summit Blue Consulting LLC and Quantec LLC, <i>Distributed Generation/Combined Heat and Power (DG/CHP) Program MCAC Report</i> , May 2005.
<i>Value-Cost Assessment of New York Energy \$martSM Research and Development Program, Draft Final Report</i> , prepared for NYSERDA, November 2006, Hescong Mahone Group, Ridge & Associates, GDS Associates.

Section 2: **CONTEXT AND PROGRAM DESCRIPTION**

2.1 Program Description

The Distributed Generation as Combined Heat and Power (DG/CHP) Program is a NYSERDA initiative implemented through the **New York Energy \$martsm** program to support projects that contribute to the growth of combined heat and power installed as distributed generation applications in New York State. The program provides funding for single site and multi-site (fleet) demonstrations and seeks to improve awareness by end-users and project developers of CHP. The program also seeks to address DG-related issues such as DG permitting, Standard Interconnection Requirements (SIR), utility standby service tariffs, technology risks, renewable fuel options such as biomass and landfill gas, and the impact of fluctuating natural gas prices. Program staff act as peer reviewers of US Department of Energy (DOE) and US Environmental Protection Agency (EPA) reports. The program is also a USEPA Combined Heat and Power Partnership Program founding member, with staff participating at numerous joint conferences.

In 2010, the American Council for an Energy-Efficient Economy (ACEEE) awarded the DG/CHP demonstration program with one of the council's first ever awards for exceptional state-led energy efficiency programs. The DG/CHP demonstrations program was among five state-administered programs acknowledged by the Council, earning an award in the Research and Development (R&D) category.

In general, projects selected for funding under the DG/CHP program are those that increase end user awareness, document performance (e.g. hours of operation, thermal and electrical power output), address institutional impediments, and those that support the expansion of the industry. Projects are also selected based on their ability to demonstrate and evaluate opportunities for DG systems, and the resulting impacts on utilities, New York Independent System Operator (NYISO), and distribution system reliability, power quality, and environmental improvement..

The program uses financial incentives to demonstrate and validate advanced features (such as synchronous-parallel interconnection) of customer-sited CHP using commercially available CHP technologies such as reciprocating engines and gas turbines, and emerging DG technologies such as microturbines, fuel cells, Stirling engines, and organic Rankine cycle systems. Once validated, commercial CHP technologies are supported by NYSERDA through an incentive approach that co-exists with similar offerings from the Customer-Sited Tier Renewable Portfolio Standard (CST-RPS) and other programs discussed in more detail in Section 2.3.¹ In its most current iteration, the program offers higher incentives to projects that are:

- Located in Consolidated Edison (Con Edison) service territory, or connected to a “spot network” (as opposed to “radial grid”) outside of Con Edison service territory,
- Directly powered by a renewable or opportunity fuel, or waste heat, and are not eligible under any NYSERDA CST-RPS program,
- An integral part of a documented and verifiable “facility of refuge”²,

¹ NYSERDA, *New York Energy \$martsm Program Evaluation and Status Report*, March 2010.

² A facility of refuge is a structure or facility capable of providing shelter for a significant portion of the local population during times of man-made or natural disaster, and is cooperating and coordinated with county or city emergency management officials, as appropriate.

- Designed to provide a seamless, flicker free transition between normal and backup power operation using the DG/CHP prime mover to serve priority loads during periods of grid outage, and
- Pre-engineered, pre-packaged, factory tested, DG/CHP systems that integrate electric generation and thermal systems.³

2.1.1 Program History

The Distributed Generation/Combined Heat and Power Program was initiated as a NYSERDA R&D program in 2000 (PON 554). This program was offered using statutory funds, but some of the resulting projects were eventually funded using SBC 2 funds. Since then, there have been nine additional R&D solicitations released, all of which have included a demonstration element and were SBC-funded. These solicitations have resulted in over 100 DG/CHP demonstration projects, about half of which are currently operational. Of the operational projects, 35 are funded by SBC 3.

The initial series of solicitations (PONs 536, 669, 750, 800, 914) combined the DG/CHP Demonstration focus with a Power Systems New Product Development focus to provide a single access point for the potential proposer (often referred to as the “mega-PON”). The two programs existed and were funded together under the title Distributed Energy Resources. Starting in 2006, the Power Systems focus was broadened, and additional categories were added to the DG/CHP Demonstration focus. As the two programs have grown in scope, it has made sense to split the “mega-PON”, with each program now issuing its own distinct solicitations. As such, this program logic model focuses on the DG/CHP Demonstration Program and its related outreach activities, starting with PON 1043. The Power Systems Product Development Program continues to function in parallel to the DG/CHP Demonstration Program, supporting New York technology companies in all aspects of product development to create and commercialize new distributed generation and storage products that are clean, efficient, reliable, and cost-effective, as well as other products that reduce peak demand or improve end user power quality.

The DG/CHP program has evolved throughout its history in its effort to continuously push the technology. For example, PON 1241 added a new Fleet Demonstration category, which sought to install nearly identical CHP systems at a number of similar sites under common ownership or control.

2.1.2 Program Budget

The 2006-2011 SBC 3 funding for the Distributed Energy Resources program is \$72.5 million, which includes both the Power Systems Product Development Program and the DG/CHP Demonstration Program. The SBC 3 DG-CHP Demonstration portion of the budget was \$37.5 million. In addition to this figure, about \$6 million of the \$10 million budgeted for the DG/CHP Incentive Program was used for DG/CHP demonstration projects, the remaining \$4 million having been absorbed into projects in NYSERDA’s Multifamily Performance Program and Existing Facilities Program.⁴ An annual breakdown of the SBC 3 budget is presented in Table 2 below, broken out by individual program.⁵

³ Program Opportunity Notice (PON) No. 1913, <http://www.nyserdera.org/funding/1931pon.asp>, December 2010.

⁴ The DG/CHP Incentive Program was the precursor to other NYSERDA CHP deployment programs. In an effort to jumpstart CHP activity within deployment programs that initially had no funds budgeted to support CHP, funds were re-directed from DG-CHP demonstration activity and allocated to a “DG/CHP Incentive Program.” Funds not spent under that incentive program (\$6 million) were then returned for use by the DG/CHP Demonstration Program.

⁵ NYSERDA, Systems Benefits Charge Proposed Plan for **New York Energy Smartsm** Programs (2006-2011), As Amended March 2, 2006.

Table 2. System Benefits Charge (SBC 3) Funding (Millions of Dollars)

Program	2006	2007	2008	2009	2010	Through June 30, 2011	Total
DG/CHP Demonstration	\$3.75	\$7.5	\$7.5	\$7.5	\$7.5	\$3.75	\$37.5
DG/CHP Incentive Program ⁶	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$1.0	\$6.0
Total	\$4.75	\$8.5	\$8.5	\$8.5	\$8.5	\$4.75	\$43.5

Source: NYSERDA, Systems Benefits Charge Proposed Plan for **New York Energy Smartsm** Programs (2006-2011), As Amended March 2, 2006.

¹ The total SBC 3 budget for the DG/CHP Incentive Program was \$10 million, of which, \$6 million total was used in the DG/CHP Demonstration Program. This annual breakout is approximate.

2.2 Market Assessment

Market assessment reports prepared in the past for NYSERDA’s Distributed Generation/Combined Heat and Power (DG/CHP) Program have included characterization of the relevant markets for DG/CHP demonstration installations. The most recent full Market Characterization, Market Assessment and Causality Evaluation (MCAC) report for DG/CHP was completed in 2005. All data in this section, unless otherwise noted, are from Section 4 of this report, and describe the state of the DG/CHP market in New York in 2005.

2.2.1 Description of Baseline Condition

Savings Already Achieved⁷

As of September 30, 2010, the Distributed Generation/Combined Heat and Power program reported cumulative annual savings of 367.2 GWh and 87.6 MW of on-peak demand reduction. More details on the savings by sector will be developed during the upcoming 2011 MCA data collection, analysis and reporting activities, to the extent that this information has been measured by the program.

Awareness

The DG/CHP Program seeks to increase awareness and knowledge of distributed generation and combined heat and power systems across a number of industries in New York. In the course of the 2005 evaluation, the MCAC team examined a number of topics that help assess the progress of the DG/CHP Program toward achieving these goals.

The majority of DG/CHP Program participants (75%) and partial non-participants (71.4%) stated that they were somewhat familiar with DG/CHP systems. The 2005 MCAC report defines partial non-participants as sites that applied for the DG/CHP Program, were not selected for funding by the program, and yet installed a DG/CHP system anyway. More than one-quarter of partial non-participants reported that they were extremely familiar with DG/CHP systems, a higher average level of reported familiarity than participants. The relatively high average level of reported familiarity of partial non-participants is consistent with the characteristics used to define this group, suggesting that in order to proceed with the installation of a DG/CHP system, either partial non-participants need to feel extremely comfortable with the investment, or only those end-users who are most familiar with the technology are likely to proceed with an installation without NYSERDA assistance.

⁷ NYSERDA, New York System Benefits Charge Programs Evaluation and Status Report, Quarter ending September 30, 2010.

Regarding the change in familiarity with DG/CHP measures and equipment:

- The majority of end-use customer participants (91.7%) and partial non-participants (66.7%) reported their familiarity with DG/CHP measures and equipment either increased or stayed the same. Twenty-five percent of the participants who reported an increase in familiarity attributed it to involvement with a NYSERDA project.
- Most developers (75%) also realized an increase or significant increase in their familiarity with DG/CHP systems.

Furthermore, most manufacturers (67%) reported that they were aware of demonstration installations in New York. Of those manufacturers that were aware of the demonstration installations, one third reported having made changes to their products or product development as a result of the demonstration project.

Availability of DG/CHP

One of the goals of the DG/CHP Program is to reduce the market barriers to the installation of systems. Market barriers often cited as impediments to the selection of these systems include cost factors, availability, technology issues, permitting, lack of information or end-user awareness, approval processes, rate and tariffs, and cost of studies to select the system.

Participating end-users, developers and manufacturers were asked whether each of these factors were increasing or decreasing as a barrier. All market actor groups indicated that market barriers as a whole have been decreasing. The notable exception to the decreasing market barriers include: rates and tariffs, permitting, and the cost of studies to select a system.

2.2.2 Statewide Technical Potential

The DG/CHP Program, as a demonstration effort, is not seeking to implement a large number of projects and accomplish a high penetration rate. Instead, the program seeks to help establish a track record for DG/CHP systems that will have the long-term effect of transforming the market and increasing penetration. As this is primarily a long-term objective, the measurement of program success in achieving this goal was not assessed by the short-term perspective of the 2005 MCAC team's survey efforts.

However, according to a 2002 market potential study conducted by NYSERDA, DG/CHP is an electricity generating resource in New York with approximately 5,000 MW of capacity installed at 210 sites. "The industrial sector accounts for 78% of the existing CHP capacity in the State and is represented by a few facilities that have very large CHP systems."⁸

This report presented estimates for market growth and potential in three parts: the base case, the accelerated case, and technical potential. The report identifies nearly 8,500 MW of technical potential for new CHP in New York at 26,000 sites. While existing CHP in New York is concentrated in very large plants, only 16 sites remain that could support a plant size greater than 20 MW for internal power use. Close to 74% of remaining capacity is below five megawatts and is primarily at commercial and institutional facilities.⁹ This technical potential is believed to be an unattainable level for penetration (100%).

⁸ *CHP Market Potential for New York State*. Energy Nexus Group Onsite Energy Corporation and Pace Energy Project. October 2002.

⁹ *Ibid*

The study however, goes on to define two other scenarios, the base case and the accelerated case. The base case is a projection of business as usual with the market factors influencing DG/CHP adoption in 2002 held constant. The base case technical potential is the estimation of the remaining market size constrained only by technological limits – the ability of CHP technologies to fit existing customer energy needs.¹⁰ The accelerated case is a projection of DG/CHP adoption assuming that several changes favoring market growth occur. Specifically, the accelerated case assumes a reduction by one-half of the 2002 standby charges, an implementation of a tax credit equal to 10% of the initial cost of systems, an increase in awareness and adoption rates and a shift to the adoption of more advanced technology. The installed capacity projected by these two cases is presented in Table 3 below.

Table 3. MW Capacity Installed Base Case and Accelerated Case

	2007	2012
Base Case	279.4	763.6
Accelerated Case	642.1	2,196.1

Source: Energy Nexus Group Onsite Energy Corporation and Pace Energy Project, *CHP Market Potential for New York State*, October 2002.

It is important to note that these technical potential numbers represent the potential for *all* DG/CHP projects implemented in New York State, not just NYSERDA-funded projects. As an R&D program, the intention of NYSERDA’s DG/CHP Demonstration Program is not to achieve significant market penetration, but to install demonstration systems in order to encourage adoption by other potential end users.

2.3 Other Relevant NYSERDA, ISO-Sponsored and NY Utility Programs

In addition to NYSERDA’s DG/CHP Program, there are a number of other potentially relevant and complementary programs implemented in New York, including other NYSERDA programs, potential ISO-Sponsored programs, and programs offered through New York utility companies. These programs are summarized briefly below and are included in Section 3.5 - Program Inputs and Potential External Influences and are identified as factors with the potential to impact (help or hinder) achievements of NYSERDA’s Distributed Generation/Combined Heat and Power Program goals.

2.3.1 NYSERDA Programs

Existing Facilities Program¹¹

NYSERDA’s Existing Facilities Program (EFP) promotes energy efficiency and demand management by offering incentives for a variety of energy projects, including combined heat and power. To increase awareness for potential energy cost savings, EFP targets sectors of customers that include commercial and industrial businesses, healthcare facilities, agriculture, universities and colleges, State and local governments, and mission critical facilities such as data centers and communications facilities. In contrast to the DG/CHP Demonstrations Program, incentives offered through the EFP are performance-based. Whereas DG/CHP projects funded through the demonstrations program are selected based on their

¹⁰ Energy Nexus Group Onsite Energy Corporation and Pace Energy Project. *CHP Market Potential for New York State*. October 2002.

¹¹ NYSERDA, *New York Energy \$martsm Program Evaluation and Status Report*, Quarter ending September 30, 2010.

potential to demonstrate new DG/CHP technologies and broad benefits of such, The EFP program emphasizes the potential for demand reduction cost savings through the installation of CHP systems. The CHP component of EFP is slated to end in June 2011.

Flex Tech Program

NYSERDA's FlexTech Program provides New York State commercial, industrial, institutional, government, and not-for-profit sectors with objective and customized information to help customers make informed energy decisions. FlexTech's goal is to increase productivity and economic competitiveness of participating facilities by identifying and encouraging the implementation of cost-effective energy efficiency, carbon reduction measures, peak-load curtailment, and combined heat & power (CHP) and renewable generation projects.

MultiFamily Program (MPP) This program addresses the needs of the multifamily sector by working with developers, building owners and representatives to improve the energy efficiency, health, safety, and security of the residential buildings with five (5) or more residential units in a cost effective manner. This program consists of the *New Construction* and the *Existing Building components*, serving all combinations of market-rate and low- to moderate-income projects through a common process and varying schedule of incentives. The MPP program included a CHP component to the program, but this element was discontinued in 2008.

Customer-Sited Tier Renewable Portfolio Standard (CST-RPS) Program

Most broadly, NYSERDA's CST-RPS program supports active open-enrollment incentives for photovoltaics (PV), anaerobic digester gas (ADG) systems at farms and wastewater treatment facilities, fuel cells and small wind turbines. The specific CST-RPS program offers financial incentives in the form of capacity buy-down payments, performance-based incentives, or some combination of the two to self-generation, behind-the-meter facilities. In terms of overlapping technologies, the CST-RPS program focuses efforts on mature fuel cells while the DG-CHP program focuses its efforts on experimental fuel cells. The DG-CHP program can use ADG, but most projects have some other "innovative" component that makes it inappropriate for the CST-RPS program.

2.3.2 New York Independent Service Operators (NYISO) Programs

It is possible that participants in the DG/CHP Program are eligible to participate in several demand-response programs offered by the NYISO. Indeed, interaction with the NYISO's demand-response programs is encouraged.¹² When evaluating proposals for DG/CHP Demonstrations, preference is given to projects that also participate in NYISO's demand response programs.

The NYISO has four Demand Response programs: the Emergency Demand Response Program (EDRP), the ICAP Special Case Resources (SCR) program, the Demand Side Ancillary Services Program (DSASP), and the NYISO's Day-Ahead Demand Response Program (DADRP). These programs can be deployed in energy shortage situations to maintain the reliability of the bulk power grid.¹³

- The Emergency Demand Response Program is designed to reduce power usage through the *voluntary* shutting down of electrical end-uses (or turning on on-site electric energy generators) within businesses and large power users. Companies, mostly industrial and commercial, sign up to take part in the EDRP. The companies are paid by the NYISO for reducing energy consumption when asked to do so by the NYISO.

¹² NYSERDA, Program Opportunity Notices (PONs) No. 1043, 1178, 1241.

¹³ [NYISO Website: http://www.nyiso.com/public/products/demand_response/index.jsp](http://www.nyiso.com/public/products/demand_response/index.jsp)

- Special Case Resources is a program designed to reduce power usage through the *mandatory* interruption of large electrical end users within participating businesses and large power users' facilities. Companies, mostly industrial and commercial, sign up to become SCRs. The companies must curtail power usage as part of the agreement, usually by shutting down non-critical end uses (or turning on on-site electric energy generators) when asked by the NYISO. In exchange, they are paid in advance for agreeing to cut power usage upon request.
- The Demand Side Ancillary Services Program (DSASP) allows demand side resources to participate in the NYISO's Ancillary Services Markets for Regulation Service and Operation Reserves. For DSASP Reserve resources, there is a minimum 1 MW reduction, sustained for 1 hour, on a five-minute periodicity. For Regulation, the resource must be capable of a 1 MW reduction capable of Regulation response, supplying regulation service continually in both up and down directions for intervals in the scheduled hour, on a six-second periodicity.
- The NYISO's Day-Ahead Demand Response Program (DADRP) also allows energy users to bid their load reductions, or "negawatts", into the Day-Ahead energy market as generators do. Offers determined to be economic are paid at the market clearing price. DADRP allows flexible loads to effectively increase the amount of supply in the market and moderate prices.

2.3.3 Consolidated Edison (Con Edison) Demand Reduction Programs

Participants in the DG/CHP program in the Con Edison service territory may be eligible to participate in an array of demand-reduction incentives programs.

Con Edison offers four Demand Reduction programs: the Emergency Demand Response Program (EDRP), Installed Capacity Program (ICAP), Day-Ahead Demand Reduction Program (ADARP), and Distribution Load Relief Program (DLRP).¹⁴

- The Emergency Demand Response Program is designed to reduce power usage through the *voluntary* shutting down electrical end-uses (or turning on on-site electric energy generators) within businesses and large power users. This program is activated through the NYISO's Emergency Demand Response Program; however, Con Edison offers the incentives to companies that can reduce their energy consumption when asked to do so by the NYISO.
- The Installed Capacity Program (ICAP) is a program designed to reduce power usage through the *mandatory* interruption of large electrical end uses within participating businesses and large power users' facilities. This program is activated through the NYISO's Special Case Resources program.
- In the Day-Ahead Demand Reduction Program (DADRP) Con Edison submits aggregated load reduction nominations to the NYISO on behalf of DADRP participants. When wholesale electric markets exceed a predetermined "strike" price, NYISO accepts these load reduction nominations as needed. Con Edison then alerts participating customers to these "day-ahead" reduction offers, which are for specific times of the day. Participants can then decide whether to reduce demand at the offered rate.
- Participants in the Distribution Load Relief Program (DLRP) may either elect to participate in the voluntary option or the summer reservation payment option. Those that take part in the voluntary option are paid incentives to *voluntarily* curtail load during critical peak event hours as announced by Con Edison. Those that participate in the summer reservation payment option are

¹⁴[Con Edison Website: http://www.coned.com/dg/incentive_programs/incentivePrograms.asp](http://www.coned.com/dg/incentive_programs/incentivePrograms.asp).

paid a monthly energy payment in exchange for the *mandatory* curtailment of load during the same critical peak hours.

A Con Edison System-wide Demand Reduction Program was also available in 2006. This Public Service Commission-mandated program made funds available for use in a joint effort involving participation by both NYSERDA and Con Edison. This one-time program is no longer available.¹⁵

¹⁵ On March 24, 2005, the New York State Public Service Commission (PSC) issued *Order Adopting Three-Year Rate Plan* (Order) in Case 04-E-0572 regarding a rate plan for Consolidated Edison Company of New York, Inc. (Con Edison) electric customers. The Order established Demand Side Management (DSM) programs that are to be administered by NYSERDA and by Con Edison. The objective of the DSM programs is to enable demand reduction to supplant a portion of the load growth anticipated to take place in the Con Edison service territory over the term of the rate plan. NYSERDA. 2006. Evaluation of Con Edison System-Wide Demand Reduction Program Request for Proposals (RFP 977)

Section 3: **KEY ELEMENTS SUMMARY**

Based on a review of relevant NYSERDA documents, below is a summary of some key elements of the DG/CHP Program.

3.1 Ultimate Goals:

The Distributed Generation/Combined Heat and Power Program is part of NYSERDA's Research and Development program. The DG/CHP Program operates within the R&D program to accomplish the following program goals:

- Demonstrate the viability, cost effectiveness, reliability, and replicability of CHP systems.
- Increase the demand for, and thereby accelerate the development, availability and market adoption of CHP systems in New York State.
- Increase developer familiarity with CHP and selection of subcontracting with the electrical, mechanical, and plumbing trades to: 1) minimize change orders, which otherwise turn into cost overruns; 2) minimize the need to inflate the contingency components of budgets and; 3) minimize the extensiveness of the marketing challenge to get a customer to "yes" - all of these making CHP a more cost effective over the long term.
- Disseminate objective information about CHP power systems, which helps to improve decision-making and the selection of technologies by stakeholders and customers.
- Support studies of existing NYSERDA funded CHP systems to identify cost-effective changes that could be implemented that would increase the value of the system to the CHP demonstration site.
- Provide end-users additional options for improved reliability, power quality, and competitive electric cost using equipment with superior environmental attributes.
- Reduce dependence of fossil fuels by improving fuel-use efficiency for societal consumption and increasing the use of renewable fuels in power generation.
- Reduce traditional institutional barriers and support government regulations that promote the utilization of CHP technologies.

Specifically, the program plans to achieve the following quantifiable outputs for the period 2006 through 2011¹⁶:

- ✓ Fund 50 or more CHP demonstrations with a cumulative capacity of 100 MW and associated efficiency and environmental benefits, with 50 MW downstate;
- ✓ Hold workshops and publish at least 10 final technology transfer reports; and
- ✓ Maintain a portfolio of projects that achieve at least a 60% higher heating value (HHV) overall annual fuel energy utilization.

¹⁶ NYSERDA, Systems Benefits Charge Proposed Plan for **New York Energy \$martsm** Programs (2006-2011), As Amended March 2, 2006.

DG/CHP Program cumulative key outputs and near-term program goal achievement are summarized in Table 4 and Table 5 below.

Table 4. DG/CHP Demonstration Program – Key Program Outputs (2000-2009)

Outputs	Cumulative through December 2006	Cumulative through December 2007	Cumulative through December 2008	Cumulative through December 2009
Number of operational DG/CHP systems	28	45	49	54
Total funds awarded for DG/CHP systems	\$8.9 million	\$21.8 million	\$24.6 million	\$27.4 million
Total cost of operations DG/CHP systems	\$39.4 million	\$81.3 million	\$93.0 million	\$123.4 million

Source: NYSERDA, *New York Energy Smartsm Program Evaluation and Status Report*, March 2010.

Table 5. DG/CHP Demonstration Program Near-term Goals (2006-2011)

Activity	Program Goals (July 1, 2006 through June 30, 2011)	Achieved July 1, 2006 through September 30, 2010	% of Goal Achieved
Issue annual solicitations and incentives offers	Fund 50 or more CHP demonstrations with a cumulative capacity of 100 MW and associated environmental benefits, and with 50 MW downstate.	PON 914 was issued in September 2006. Sixteen projects were awarded and nine have resulted in projects. PON 1043 was issued in June 2006. Six CHP demonstration projects resulted, one of which has since dropped out. PON 1178 was issued in October 2007. Five CHP demonstration projects resulted. PON1241 was issued in August 2008 with three due dates (August 14, 2008, December 11, 2008 and April 16, 2009) Twenty-two demonstration projects resulted, six of which have dropped out.	74% (Number of projects funded)
Technology transfer	Conduct technology transfer and outreach activities to broaden acceptance of DG and CHP. Hold annual workshops and publish at least 10 final reports per year.	Currently, site-specific performance data is posted on http://chp.nyserda.org for 44 projects. A U.S. Environmental Protection Agency (EPA) CHP Partnership meeting was held in October 2009 and NYSERDA sponsored a CHP Roundtable. A CHP Programs Brochure has been developed and is distributed at appropriate conferences.	N/A

Source: NYSERDA, *New York Energy Smartsm Program Evaluation and Status Report*, Quarter ending September 30, 2010.

3.2 Market Barriers/Issues the Program Attempts to Address (“the Problem”)

There are significant opportunities for the cost-effective use of DG/CHP installations in New York State. The **New York Energy \$martSM** DG/CHP program funds the demonstration of DG/CHP applications to increase awareness and help to identify and reduce critical market barriers in the short run such that over time, these barriers can be eliminated and a sustainable market for DG/CHP can be created.

Table 6 below provides a list of DG/CHP market barriers, grouped by those that affect the supply-side (S), mid-market/infrastructure (M), and demand-side (D) areas. Supply-side and mid-market/infrastructure barriers include business practices and policies that deter the development or delivery of DG/CHP systems, or indicate an insufficient availability or commitment to such products and systems. Demand-side barriers in commercial (including multifamily) and industrial sector primarily revolve around competing needs for capital, performance uncertainties, and information or search costs.

Within these groupings, the barriers are numbered for identification purposes; the numbering sequence does not represent a rank ordering. Associated market actors within each grouping are also presented. Each barrier has been coded (S1, M1, D1, D2, etc.)

Table 6. DG/CHP Market Barriers and Associated Market Actors

Market Area	Barriers	Market Actors
Supply-side (upstream actors)	<p>S1 - Technical barriers that require further research and testing to produce functional and viable DG/CHP systems</p> <p>S2 - Lack of funding for DG/CHP development, testing and evaluation, due to market and technical risk</p> <p>S3 - High installation, operation, and maintenance costs of DG/CHP system demonstrations</p> <p>S4 - Lack of experience of installers/contractors with DG/CHP technologies</p>	<p>Product installers and technicians</p> <p>R&D organizations</p> <p>Product developers, and manufacturers in areas of distributed generation and combined heat and power</p> <p>Private sector investors</p>
Market structure / policy (midstream actors)	<p>M1 - Prohibitively high standby rates and flex rates, which hinder the cost effectiveness of DG/CHP systems, particularly for smaller projects</p> <p>M2 - Resistance to DG/CHP installations from utilities that have not found a way to benefit from them</p> <p>M3 - Lack of uniform interconnection standards for systems >2 MW or interconnecting to the spot network outside of Con Edison’s service territory</p> <p>M4 - Codes and regulations (permitting, tariffs, etc.) may not favor DG/CHP systems</p> <p>M5 - Lack of architect/engineer knowledge and experience with DG/CHP systems</p> <p>M6 - Lack of knowledge or access to quality information regarding existing load profiles</p> <p>M7 - Uncertainty of future variabilities associated with : electricity prices, fuel costs, tariffs, longevity of other mechanical systems of site, building load profiles with expansions or contractions</p>	<p>Utility companies</p> <p>Regulatory agencies</p> <p>Policy makers</p> <p>Architects, engineers and designers</p> <p>Energy service companies</p> <p>R & D organizations</p>

Market Area	Barriers	Market Actors
Demand side (downstream actors)	D1 - Technical complications in replicating DG/CHP systems across different facilities, and a lack of pre-packaged equipment options D2 - Lack of end-user/facility owner awareness and knowledge of DG/CHP technologies and their potential applications D3 - Lack of technology “best practice” information for DG/CHP systems (e.g. optimal end-user characteristics, required complementary technologies, recommended product “templates”) D4 - Proven energy efficiency/load management benefits of DG/CHP are not widely disseminated or perceived by customers D5 - Limited private investment in DG/CHP project installations D6 - Uncertainty regarding DG/CHP system performance due to a lack of verification D7 - Confusion caused by overlapping NYISO, NYSERDA, and utility programs D8 - Compatibility of CHP with existing building infrastructure (chaseways, thermal distribution loops, multi-metering vs. master and sub meters). D9 - Difficulty of assessing monetary value associated with increased reliability and ability to run during grid outages. D10 - High installation, operation, and maintenance costs of DG/CHP system D11 - Lack of uniform interconnection standards for systems >2 MW or interconnecting to the spot network outside of Con Edison’s service territory	Owners of facilities that have both electric and thermal energy loads Service providers

3.3 Targeted Market Actors

NYSERDA’s DG/CHP Program targets the broadly defined categories of facility owners; energy service companies; architects, engineers and designers; and energy consultants.¹⁷ The outreach and information dissemination side of the program also focuses on policymakers and regulatory agencies.

According to the market characterization study conducted in 2005, the five most common site types in the DG/CHP Program were, in order, multifamily buildings, health care, education, agriculture, and wholesale/retail. In 2005, these site types together represented more than half of the participating operational and “in progress” sites. As of March 2011, the five most common site types are multifamily buildings (including assisted living facilities), agriculture, healthcare, office buildings, and wastewater

¹⁷ Skumatz Economic Research Associates, Inc., Summit Blue Consulting LLC and Quantec LLC, *Distributed Generation/Combined Heat and Power (DG/CHP) Program MCAC Report*, May 2005.

treatment facilities.¹⁸ Although the most common site types have not changed much since 2005, it is worthy to note that there has been increased focus on installations at wastewater treatment facilities.

3.4 Distributed Generation/Combined Heat and Power Program Implementation Approach (“Activities”)

NYSERDA’s Distributed Generation/Combined Heat and Power Program provides a number of activities that produce outputs that lead to short- and longer-term outcomes supporting the goals of the program.

As shown in Table 7 below, these activities can be aggregated into three main areas:

1. DG/CHP Demonstration Projects;
2. Information Dissemination; and
3. Information for Policymakers.

Table 7. DG/CHP Program Activities

DG/CHP Demonstration Projects
Identifying, implementing and monitoring DG/CHP system demonstrations, including single-site and fleet demonstrations
Providing financial incentives for installation of DG/CHP projects that possess unique market path-breaking features
Information Development and Dissemination
Maintaining the Integrated Data System website, producing white papers and case studies, holding stakeholder conferences and workshops
Conducting technology transfer studies to examine the potential transfer of various technologies and products from demonstration to market adoption
Making presentations at industry association conferences and workshops
Information for Policymakers
Coordination and communication with policy makers, utility managers, DPS staff and other stakeholders to improve understanding, overcome critical market barriers and resolve other issues that might be preventing broad installation of DG/CHP systems (e.g., the need for uniform interconnection standards, the establishment of favorable emissions limits, permitting, ¹⁹ technology risk, and lowering standby rates)
Key recipients of information about program lessons learned include the New York Department of Environmental Conservation (DEC), the National Association of Regulatory Utility Commissioners (NARUC), the Federal Energy Regulatory Commission (FERC), the U.S. Environmental Protection Agency (EPA), the U.S. Department of Energy (DOE), and the U.S. CHP Association (USCHPA)

NYSERDA’s DG/CHP program staff competitively solicits and reviews a diverse array of proposals and is charged with funding projects that offer the best opportunities for meeting the program goals. Over time, as technologies and applications supported by the program become commercially viable and in widespread use, the program will shift emphasis to new technology areas, applications and business models. When possible, program-supported technologies that have achieved new commercial status will

¹⁸ Distributed Generation/Combined Heat and Power Integrated Data System, <http://chp.nyserda.org/home/index.cfm>, queried March 7, 2011.

¹⁹ Standard interconnection rules were established recently for systems <2 MW and interconnecting to radial systems (not spot network systems found in urban areas).

be included in other NYSERDA deployment programs to encourage adoption, as has occurred in the past.

3.5 Program Inputs and Potential External Influences

The ability of NYSERDA’s Distributed Generation/Combined Heat and Power Program to accomplish the outputs and outcomes likely to result in the program reaching its ultimate goals is dependent on the level and quality/effectiveness of inputs that go into these efforts. There are also external influences that can help or hinder the development of anticipated outcomes. Key Distributed Generation/Combined Heat and Power Program inputs and potential external influences are presented below in Table 8 and Table 9, respectively.

Table 8. Distributed Generation/Combined Heat and Power Program Inputs

Program Inputs
SBC 3 funding
NYSERDA’s program staff resources and prior experience implementing SBC-funded R&D programs
NYSERDA’s program staff technical qualifications and experience with DG/CHP systems
NYSERDA’s credibility and relationship with key stakeholders, policy makers and key market actors
Staff experience implementing the New York Energy \$martSM Program
Coordination with other NYSERDA programs
Relationship between this program and other NYSERDA programs (cross /coordination) (Including: Multifamily Performance Program, Existing Facilities Program, RPS Customer-sited Tier)
Existing awareness of NYSERDA among market actors
Expertise of trade allies and contractors

Table 9. Distributed Generation/Combined Heat and Power Program Potential External Influences

External Influences and Other Factors
Perceptions of energy and global climate change issues
Blackouts and no synchronous connection
Codes and standards (ie. permitting and interconnection standards)
End-use customer competing priorities
Electric standby and flex rates
Broad economic conditions that affect capital investment and energy costs (rapidly changing economic conditions)
<ul style="list-style-type: none">• Energy prices and regulation (volatility in fuel and energy prices)• Activities of public and institutional purchasers and projects
Activities of non-NYSERDA energy efficiency and renewable energy programs (See specific programs listed in section 2.3)
Persistence of a site champion employed at the facility and a developer champion that stays with the project from conception through operation
Technology advancements
Policy advocacy by other DG-technology market actors including the PV and small wind (e.g., interconnection and net metering policy support)
Federal policy developments and financial incentives
Availability of high-quality, reliable equipment
Availability of qualified service providers
Each utility company's treatment of DG (e.g., consistency and fairness of treatment of DG projects when determining infrastructure upgrade fees, etc.)

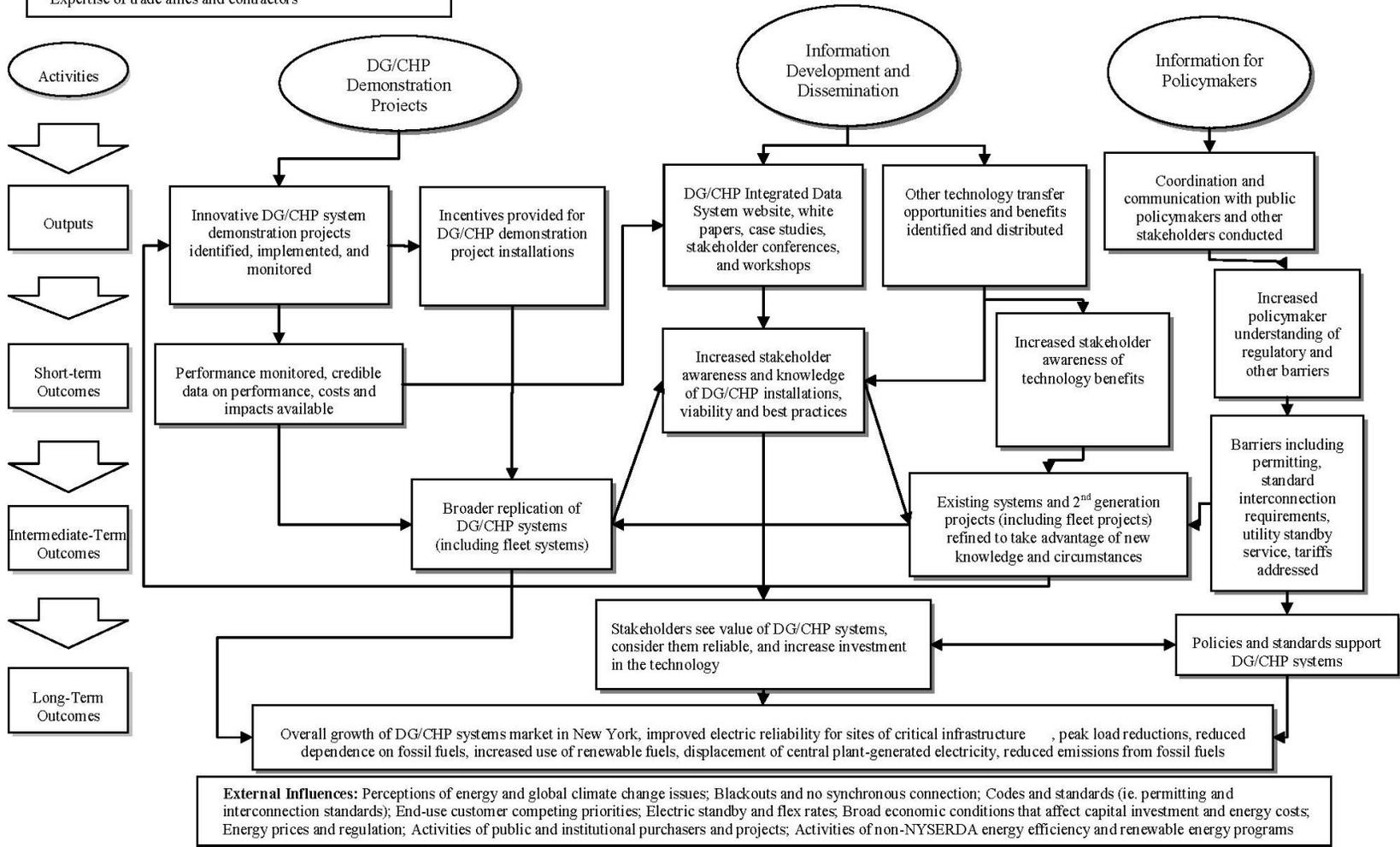
Section 4: PROGRAM LOGIC MODEL DIAGRAM

The following page (Figure 1) contains NYSERDA's Distributed Generation/Combined Heat and Power Program logic model diagram showing the linkages between activities, outputs and outcomes, and identifying inputs and potential external influences. The diagram presents the key features of the program. The logic diagram presented here is at a slightly higher level than the tables in this report, aggregating some of the outcomes, in order to provide a logic model that is easier to read. (Evaluation research should use the more detailed tables, in addition to the diagram, when examining the anticipated linkages and performance through the various outcomes.)

Figure 1.
Distributed Generation as Combined Heat and Power
Logic Model Diagram

March 2011

Inputs: SBC 3 funding; NYSERDA's program staff resources and prior experience implementing SBC-funded R&D programs; NYSERDA's credibility and relationship with key stakeholders, policy makers and key market actors; staff experience implementing the New York Energy SmartSM Program; coordination with other NYSERDA programs, relationship between this program and other NYSERDA and non-NYSERDA programs. Existing awareness of NYSERDA among market actors Expertise of trade allies and contractors



Section 5: OUTPUTS, OUTCOMES AND ASSOCIATED MEASUREMENT INDICATORS

It is important to distinguish between outputs and outcomes. For the purposes of this logic document, outputs are defined as the immediate results from specific program activities. These results are typically easily identified and can be counted; often by reviewing program records.

Outcomes are distinguished from outputs by their less direct (and often harder to quantify) results from specific program activities. Outcomes represent anticipated impacts associated with NYSERDA’s program activities and will vary depending on the time period being assessed. On a continuum, program activities will lead to immediate outputs that, if successful, will collectively work toward achievement of anticipated short, intermediate and long-term program outcomes.

The following tables list outputs (Table 10) and outcomes (Table 11), taken directly from the logic model and associated measurement indicators. For each indicator, a proposed data source or collection approach is presented. When required, the need for baseline data is also noted. Items in this table should be prioritized and subsequently considered as potential areas for investigation as part of a formal program evaluation plan.

Table 10. DG/CHP Program Outputs, Associated Indicators and Potential Data Sources

Outputs (<1 year)	Indicators	Data Sources and Potential Collection Approaches
Outputs from DG/CHP Demonstration Projects Activities		
Innovative DG/CHP system demonstration projects identified	Number and type of innovative demonstrations identified (by technology and facility type and location)	Program files, project reports
Innovative DG/CHP system demonstration projects implemented	Number and type of innovative demonstrations installed (by technology and facility type and location)	Program files, project reports
Innovative DG/CHP system demonstration project monitoring reports created	Number and type of monitoring reports	Program files, project reports
Incentives provided for DG/CHP demonstrations	Dollar amount of incentives provided in total and by project	Program files, project reports
Outputs from Information Development and Dissemination Activities		
DG/CHP Integrated Data System website updated	Type of data available on website	Program files, project reports
White papers, case studies, stakeholder conferences and workshops presented	Number and nature of informational materials and presentations developed Number and type of conferences and workshops held (by topic, stakeholder target and location)	Program files, project reports
Technology transfer studies developed	Number and type of technology transfer studies completed and adoption opportunities identified	Program files, project reports
Outputs from Information for Policymakers Activities		
Coordination and communication with policymakers, utility managers, DPS and other stakeholders on DG/CHP market barriers and regulatory topics conducted	Number and types of meetings held, and attendance by stakeholder group and topic area	Program files, project reports, Meeting attendance records

Table 11. DG/CHP Program Outcomes, Associated Indicators and Potential Data Sources

Outcomes	Indicators	Data Sources and Potential Collection Approaches
Short -Term (1-3 years) Outcomes		
Performance monitored, credible data on performance, costs, and impacts available	Volume and type of performance data available, and credibility of data collected and presented	Program files, project reports Information on the DG/CHP Integrated Data System website
Broader replication of successful DG/CHP systems across the state (including fleet systems)	Number and type of sites where NYSERDA-supported DG/CHP systems, including fleet systems have been replicated in New York State (by technology and facility type and location)	Program files, project reports; stakeholder interviews
Stakeholders have increased awareness and knowledge of DG/CHP installations, results, best practices	Change in awareness and knowledge among DG/CHP stakeholders (by stakeholder type and location)	Stakeholder interviews
Increased stakeholder awareness of technology transfer benefits	Change in awareness among DG/CHP stakeholders of technology transfer benefits (by technology and stakeholder type)	Stakeholder interviews
Increased policymaker understanding of regulatory and other barriers	Change in understanding of barriers among policymakers and other stakeholders (by stakeholder group, policy and barrier topic)	Stakeholder interviews
Intermediate-Term (3-5 years) Outcomes		
Broader replication of successful DG/CHP systems (including fleet systems) across the state	Change in number of sites statewide where DG/CHP systems, including fleet systems, have been installed using models (building types, system configurations, etc.) that have been demonstrated to be successful through earlier program activity	Program files, project reports Information on the DG/CHP Integrated Data System website Databases of installed capacity Stakeholder interviews (participants and non-participants)
Existing DG/CHP systems refined to take advantage of new knowledge and circumstances	Number and types of refinements implemented (by technologies transferred and projects implemented)	Stakeholder interviews (participants and non-participants)
Second generation DG/CHP systems (including fleet projects) refined to take advantage of new knowledge and circumstances	Number and types of refinements implemented (by technologies transferred and r projects implemented)	Program files, project reports Information on the DG/CHP Integrated Data System website Market characterization and assessment study of participants and non-participants
Barriers including permitting, standard interconnection requirements, utility standby service, tariffs, technology performance addressed	Number and description of barriers addressed (by type and stakeholder group) Development lead-time shortened	Survey of policymakers and other stakeholders Review of government records and regulations
Increased recognition by policy makers, developers	Change in awareness and attitude among policy makers, developers, and facility owners	Self-reported attitudes toward DG/CHP systems, before/after

Distributed Generation/Combined Heat and Power Program Logic

Outcomes	Indicators	Data Sources and Potential Collection Approaches
and facility owners of the value and benefits of DG/CHP systems		surveys of stakeholders Interviews with policy makers, developers, and facility owners
Increased stakeholder investment in DG/CHP technology	Change in number of producers, suppliers and end users participating in market for DG/CHP power systems Change in dollar amount of new investments in DG/CHP technologies Change in sales and percentage of statewide electric demand served by DG/CHP technologies	Interviews with program staff, product manufacturers and other key stakeholders Market characterization and assessment research including review of Industry financial reports
Policies and standards support DG/CHP power systems	Change in New York regulations to support DG/CHP power systems Change in utility policies to provide more consistency and transparency in treatment of all DG projects	Government records and regulation documentation Utility policy documents Interviews with utility representatives and policymakers
Long-Term Outcomes (5+ years)		
Overall growth in the DG/CHP power systems markets in New York	Change in market size for DG/CHP systems Expansion of available equipment options (increase in diversity of options available, and competition among suppliers)	Interviews with stakeholders Review of installed capacity datasets
Improved electric reliability for sites of critical infrastructure through appropriate application of CHP	Reduced power outages in sites of critical infrastructure	Impact analysis, macroeconomic study, surveys of key stakeholders
Peak load reductions	kW savings	Impact analysis, macroeconomic study, surveys of product end users
Reduced dependence on fossil fuels by improving fuel-efficiency for societal consumption	Change in measured fuel efficiency of installed demonstration projects: 1) absolute efficiency of systems and; 2)delta of CHP versus the status quo.	Impact analysis, macroeconomic study
Increased use of renewable fuels	Change in number and types of sites using renewable fuels	Impact analysis, macroeconomic study, surveys of product end users
Displacement of central plant-generated electricity, which permits decrease of central plant fuel use and reduced transmission losses	Change in kWh electric generation displaced from central plants	Impact analysis, macroeconomic study, surveys of product end users

Section 6: TESTABLE HYPOTHESES (RESEARCHABLE ISSUES) FOR EVALUATION EFFORT

Based on this program logic model assessment for NYSERDA's Distributed Generation/Combined Heat and Power Program, a number of researchable issues have been identified and are noted below. Some of these have been investigated and continue to be investigated through NYSERDA evaluation activities.

Research addressing these questions will help to validate the reasonableness of the associated theories and will help inform NYSERDA program staff of progress and potential areas for program enhancement and refinement.

Based on recognition of key underlying program hypotheses, the following issues are proposed for potential testing. These issues are grouped into short-, intermediate-, and long-term periods to represent when they are expected to become important or verifiable.

Short/Intermediate Term:

- Have the program approaches resulted in effective DG/CHP system demonstrations being installed?

- How effective has the program been at graduating technologies to the deployment programs?

- How effective are incentives in encouraging the installation of DG/CHP demonstrations?

- Is the program funding a range of promising technology applications? Are certain technology applications worthy of merit having difficulty obtaining funding?

- Are the results from DG/CHP demonstrations, including associated direct and indirect benefits, being collected and quantified accurately?

- Are key outreach and information dissemination approaches increasing stakeholder awareness of technology applications and opportunities and benefits of DG/CHP?

- Has increased awareness resulting from program activities led to DG/CHP system refinements in existing projects and innovative new demonstration projects?

- Have coordination and communication efforts with policymakers and other stakeholders increased understanding of regulatory and other barriers?

- Has increased understanding of regulatory and other barriers amongst policymakers and other stakeholders resulted in these barriers being addressed?

- Has the combination of DG/CHP demonstration projects, information development and dissemination, and information for policymaker activities resulted in the broader replication of DG/CHP systems, both within and outside NYSERDA's program efforts?

Long Term:

- Are policies and standards being developed to support DG/CHP systems?
- Are program efforts leading to stakeholders seeing the value of DG/CHP systems, considering them reliable and increasing investment in the technologies?
- Are program activities leading to long-term benefits including:
 - increased electric reliability for critical infrastructure sites,
 - peak load reductions,
 - decreased dependence on fossil fuels,
 - increased use of renewable fuels,
 - and the displacement of central plant-generated energy.
- To what extent are external influences helping or hindering achievement of NYSERDA's DG/CHP program goals?