

# NYSERDA Distributed Generation-Combined Heat and Power

## DRAFT Evaluation, Measurement and Verification Plan

October 7, 2010

### I. Introduction

The detailed evaluation plan presented in this document builds upon prior evaluation activities conducted for the Distributed Generation-Combined Heat and Power (DG-CHP) Program.<sup>1</sup> In developing this evaluation plan, NYSERDA has incorporated feedback provided by the Department of Public Service (DPS), and has worked closely with its team of independent evaluation contractors to select the most appropriate evaluation approaches based on the current design of the program. This plan was developed to conform to the DPS evaluation guidelines released on August 7<sup>th</sup>, 2008 and to provide the highest level of rigor possible within the available resources.

This evaluation plan is designed to provide actionable feedback to improve the efficiency and effectiveness of the DG-CHP Program supported by SBC funding. As the program continues to reach its current SBC program goals, NYSERDA and its evaluation contractors will closely monitor progress and adapt this plan, as needed, to provide the most relevant and useful evaluation. For example, adjustments may be needed to sample sizes or research issues if assumptions about the program do not develop as initially anticipated. As such, NYSERDA views this plan as a flexible, living document that will be updated, as necessary, with appropriate notice to DPS and other interested parties.

### II. Summary of Goals, Cost and Schedule for Evaluation Activities

The overarching goals of NYSERDA's **New York Energy \$mart<sup>SM</sup>** program evaluation efforts are to conduct credible and transparent evaluations, and provide NYSERDA program staff and managers, the New York State Public Service Commission (PSC), DPS staff, and other stakeholders with timely and unbiased information regarding program implementation. Three types of evaluation are addressed in this plan: process evaluation, market characterization and assessment, and impact evaluation.

The objectives of the process evaluation are:

- Assess the degree to which program activities are in alignment with program goals
- Assess the barriers to achievement of program goals
- Assess the influence of program activities on participant and nonparticipant perception of DG-CHP technology and options

The objectives of the market characterization/assessment (MCA) evaluation are to:

- Enhance understanding of current and emerging markets (*e.g.*, market structure and market actors)
- Compare current market conditions against baseline conditions

The objectives of the impact evaluation are to:

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<sup>1</sup> This evaluation plan was developed for projects funded through the R&D SBC Research and Development (R&D) program.

- Estimate the program’s electricity, peak demand, and the fossil fuel impacts
- Determine the net effects of the program (*i.e.*, separate the outcomes attributed to the program from naturally occurring outcomes)

The 5-year SBC3 DG-CHP program budget (including both spent and unspent funds) is \$149.3 million. The program evaluation budget for activities included in this plan totals \$897,000 and includes \$42,300 for data collection support (*e.g.*, sample frame identification, sample development, question refinement, etc.) through NYSERDA’s Survey Data Collection contractor. The total DG-CHP evaluation budget proposed is approximately 1.5% of the approximately \$55.6 million of unspent DG-CHP program funds<sup>2</sup> as of June 30, 2010.<sup>3</sup> Annual budgets and planned schedules for each evaluation component are shown in Table 1.

**Table 1. DG-CHP Program Evaluation Schedule and Budget**

Evaluation Element	Estimated Budget and Completion					% of Total Evaluation Budget
	2010	2011	2012	2013	Total	
Joint Market Characterization & Assessment/Process Evaluation <sup>1</sup>	--	\$300,000	--		\$300,000	33%
Impact Evaluation <sup>2</sup>	\$394,000	\$203,000	--	--	\$597,000	67%
<b>Total</b>	\$394,000	\$503,000			\$897,000	100%

<sup>1</sup> Includes logic model development and Market Effects Pilot Study. Of the total, \$160,000 is allocated to process evaluation activities and \$15,000 is allocated to the Survey Data Collection Contractor for assistance with survey development.

<sup>2</sup> Includes \$27,300 for Survey Data Collection Contractor.

### III. Program Description

The goal of the SBC-funded DG-CHP Program is to contribute to the growth of combined heat and power in New York. The program provides funding for single site and multi site (fleet) demonstrations and seeks to improve end-users’ and project developers’ awareness and knowledge of CHP. The program also seeks to address DG-related issues such as DG permitting; Standard Interconnection Requirements (SIR); utility standby service tariffs; technology risk; and renewable fuel options such as biomass and landfill gas; and impact of fluctuating prices of natural gas.

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, other benefits/issues that provide learning, etc.); address institutional impediments; and those that support the expansion of the industry. Projects are also selected based on their ability to demonstrate and evaluate

<sup>2</sup> As of June 30, 2010, \$81.8 million of the Distributed Energy Resources (DER) Program budget, which includes DG-CHP and Power Systems product development, was unspent. The DG-CHP portion of unspent funds was estimated to be 68% of the unspent DER budget, or \$55.6 million.

<sup>3</sup> This evaluation budget includes only external contractor costs. Other overarching evaluation costs, including NYSERDA’s internal evaluation management and statewide study costs, are additional; however, the total evaluation costs will not exceed 5% of program funding at the portfolio level.

opportunities for aggregation of DG systems, and the resulting impacts on utilities, NYISO, and distribution system reliability and power quality.

The program provides financial incentives facility owners 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 and organic Rankine cycle systems. Once validated, commercial CHP technologies are supported by NYSERDA through an application-based incentive approach that co-exists with similar offerings from the RPS Customer-Sited tier.

The status of R&D funded DG-CHP demonstration projects is shown in Table 2 below<sup>4</sup>:

**Table 2. Status of R&D DG-CHP Demonstration Projects as of June 2010**

Project Stage	Number of Systems
Operational systems	60
Installed and undergoing commissioning	6
Undergoing installation	10
Design phase	6
Contracting phase	10

In addition to the above demonstration projects, the DG-CHP Program has funded approximately 20 CHP feasibility studies and 25 technology transfer projects designed to increase public awareness of CHP.

While the current SBC3 funding for the DG-CHP program ends in June 2011, it is expected that distributed generation and CHP will be an important element of NYSERDA's ongoing program portfolio. The research described in this evaluation plan will help inform future program offerings in these areas.

#### IV. Logic Model

The logic model for DG-CHP demonstrations, developed in 2005, is presented in Figure 1.<sup>5</sup> The logic model helps guide NYSERDA's evaluation activities; thus, an initial activity will be to conduct a comprehensive review of the existing logic model to ensure the document accurately reflects the current program design and state of the market.

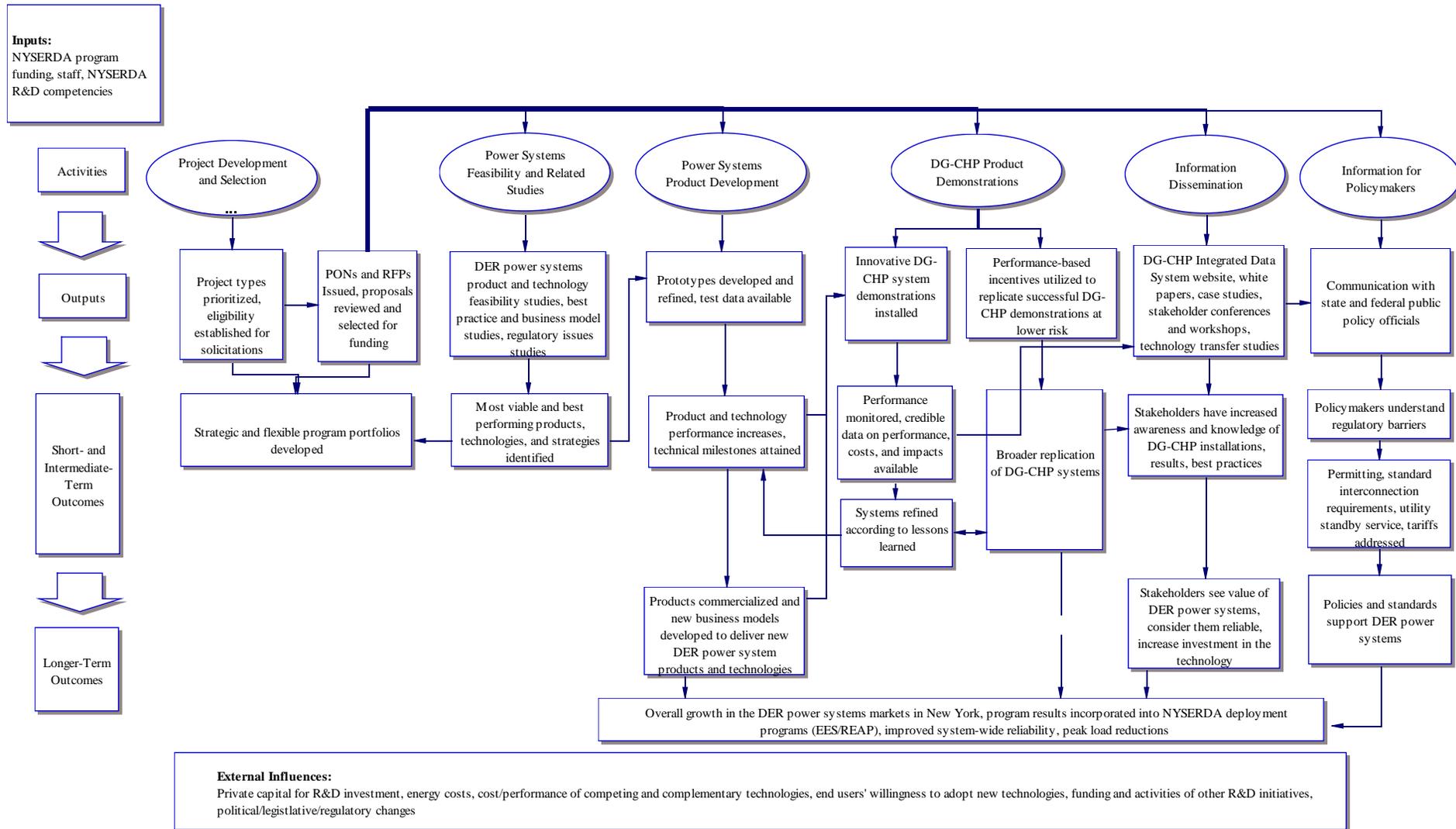
Logic modeling activities will occur early in the evaluation process after completion and approval of the Detailed Evaluation Plan. Workshops with program staff will be conducted to discuss program inputs, activities, outputs, outcomes, external influences and other elements that need to be documented in the logic model. In addition, in-depth interviews will be conducted with key market actors in order to develop a clear understanding of how they perceive the program and the current environment, and the top three or four barriers to adoption of both distributed generation and CHP. These discussions will then be summarized in a brief program theory/logic report, which includes a logic model diagram for the program. NYSERDA will invite DPS Staff to participate in logic model workshops and review draft program theory/logic reports.

Once the logic model is updated, the evaluation team's prioritization of measurement indicators and researchable issues will be summarized in a memorandum and will be discussed with NYSERDA staff and other project stakeholders to reach consensus on the proposed indicators.

<sup>4</sup> Source: NYSERDA, Master.xls, June 21, 2010.

<sup>5</sup> Also depicted in the program logic model is the product development component, which is a separate activity within the Distributed Energy Resources Program, that complements the DG-CHP demonstration component.

**Figure 1. Distributed Energy Resources Logic Model as of 2005**



The next several sections provide additional details regarding the Joint Process/MCA evaluation and the Impact evaluation plans.

## V. Joint Process/MCA Evaluation

For the 2011 evaluation of the DG-CHP program, the Process and MCA components will be conducted together. This will be the second process and MCA evaluation of the DG-CHP Program. The first process evaluation, completed in 2004, documented program history and provided an assessment of the solicitation process<sup>6</sup>. The first MCA evaluation of the program was conducted in 2005<sup>7</sup>.

### **Research Objectives**

The objectives of the Process/MCA evaluation are listed below. In order for the evaluation to provide the greatest value, other relevant objectives may be added, or the objectives listed below may change somewhat in accordance to the updated logic model.

- 1) Document program history and progress to assess:
  - a. Reasons for the current mix of program options
  - b. Steps taken to design and develop program components for DG-CHP
  - c. The role NYSERDA's DG-CHP program staff fulfill relative to other NYSERDA CHP options (*i.e.*, in relation to CHP funding by deployment programs)
- 2) Assess the barriers to program participation for each component including:
  - a. Awareness of NYSERDA CHP options
  - b. Developers' and end users' perceptions of other NYSERDA CHP options
  - c. Reasons for participation and nonparticipation
- 3) Assess the program processes for participants, partial participants (*i.e.*, program drop outs), and nonparticipants for each program component including:
  - a. Experience of the solicitation and selection process
  - b. Experience of the contracting process
  - c. Experience of the project review and approval process
- 4) Assess the value of services to program participants and nonparticipants including:
  - a. Developers' perceived value of the program
  - b. The role developers expect NYSERDA to fulfill
  - c. End users' perceived value of the program
  - d. The role end users expect NYSERDA to fulfill
- 5) Assess impact and value of the NYSERDA CHP website
- 6) Assess program assumptions
  - a. Provide information on market structure and opportunities
  - b. Examine whether current perceptions of market characteristics are valid

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<sup>6</sup> *Process Evaluation of Distributed Generation and Combined Heat & Power (DG-CHP) Program*, Research Into Action, Inc. June 2004.

<sup>7</sup> *Distributed Generation/Combined Heat and Power (DG/CHP) Program – Market Characterization, Market Assessment and Causality Evaluation*, Summit Blue Consulting, LLC. May 2005.

- 7) Develop a comprehensive understanding of current and emerging markets (*e.g.*, market structure and market actors)
- 8) Provide baseline and background information required by NYSERDA to define and deliver programs to target markets
- 9) Track changes in markets over time with a specific focus on market indicators that are likely to be impacted by program offerings
- 10) Research similar programs in other jurisdictions and review performance indicators

### ***Project Planning***

This task encompasses a variety of project planning activities including:

- review of available program documentation;
- review of prior program evaluation results;
- meetings and discussions with NYSERDA evaluation staff and other evaluation contractors;
- a project kick-off meeting with DG-CHP Program staff and other project stakeholders; and
- the development of the MCA/Process work plan.

An important component of this initial phase of the DG-CHP evaluation project is providing DG-CHP Program staff an opportunity to discuss research items of interest to ensure that the research agenda addresses existing gaps in staff's knowledge of current market conditions and opportunities. The collaboration with NYSERDA program and evaluation staff and other project stakeholders will continue throughout the evaluation as iterative processes are used to review and finalize interim and final project deliverables (*e.g.*, survey instruments, summary memos and reports, *etc.*).

### ***Research Activities***

Where possible, results will be segmented on an upstate-downstate regional basis.

The research will make use of primary and secondary data sources to generate information on a number of qualitative inquiries relevant to the DG-CHP Program including, but not limited to:

- staff, participants, nonparticipant, contractor/developer perceptions of the DG-CHP Program;
- staff, participants, nonparticipant, contractor/developer perceptions of the CHP market environment;
- staff, participants, nonparticipant, contractor/developer perceptions of barriers to CHP adoption (*e.g.*, first cost concerns, lack of awareness and knowledge of CHP opportunities, perceived deficiencies in relevant market infrastructure, difficulties meeting utility interconnection regulations and requirements, *etc.*);
- relationships and dynamics among relevant market actor groups;

- CHP service delivery channels (*i.e.*, equipment manufacturers, project developers, commissioning/recommissioning providers, *etc.*) and identification of most active service providers;
- customer motivations and decision-making criteria related to distributed generation systems, including impact of factors such as organizational structure and non-energy impacts;
- level of utility support for CHP applications, including favorable standby rates being made available to customers with CHP projects and utility support for uniform interconnection standards; and
- value of CHP to society including factors such as environmental considerations, grid reliability, energy security, fuel diversity, *etc.*

Primary and secondary data sources will be used to generate information on a number of quantitative indicators relevant to the DG-CHP Program including:

- CHP adoption rate segmented by region (upstate vs. downstate), market sector, and key market actor groups;
- participation in NYISO and utility demand response program offerings;
- market demand for CHP applications and supporting technical services including recommissioning services;
- CHP service provider awareness of existing market opportunities; and
- availability of trained providers to capitalize on those opportunities.

Care will be taken to ensure continuity of longitudinal measurements in order to build on prior research findings and to facilitate measurement of progress towards public policy goals. These indicators will be further defined and revised in the evaluation work plan. Indicators may be added or deleted.

Various secondary data sources to be examined include:

- DG-CHP Program tracking database;
- NYSERDA's DG-CHP Integrated Data System website<sup>8</sup>;
- previous program evaluation reports prepared for NYSERDA<sup>9</sup>;
- membership lists and other publicly-available data from relevant professional organizations (*e.g.*, the U.S. Combined Heat and Power Association (USCHPA) and the Northeast CHP Application Center);
- McGraw-Hill Construction Dodge databases (*e.g.*, to examine the degree of participation by market sector);

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<sup>8</sup> <http://chp.nyserda.org/home/index.cfm>

<sup>9</sup> Including the CHP market potential study completed by NYSERDA in 2002 (Energy Nexus Group, et al, *Combined Heat and Power Market Potential for New York State, Final Report*, October, 2002).

- U.S. DOE's Commercial Buildings Energy Consumption Survey (CBECS) data;
- U.S. Census County Business Patterns Reports; and
- other sources identified and deemed valuable during a scan of relevant literature.

### ***Surveys/Interviews***

Current estimates regarding sample sizes, expected sampling precision, and anticipated fielding dates for the 2011 Process/MCA evaluation surveys are summarized in Table 3. These estimates will be finalized prior to undertaking the planned evaluation after examining program participation data in detail.

Due to the small sample sizes and the complexity of the program, the evaluation will use in-depth interviews rather than structured surveys for data collection. The Process/MCA evaluation team will conduct the interviews with NYSERDA program staff, program support contractors, program participants, partial participants and nonparticipants, and with CHP developers. The interviews will address the objectives outlined above. The evaluation will specifically seek information on program experiences from program staff, participants and partial participants. Nonparticipants will be asked about program awareness and accessibility. Participating, nonparticipating and partial participating facility owners and project developers will be queried about market perceptions. Interviews with program staff and support contractors will last about one hour, while those with participating developers and end users will last about 30-45 minutes. Interviews with partial participating and nonparticipating developers and end users will last about 20 minutes. NYSERDA's Survey Data Collection contractor will provide data collection support (*e.g.*, sample frame identification, sample development, question refinement, etc.).

**Table 3. Targeted Survey Populations for DG-CHP Program Process/MCA Evaluation**

Target Group	Estimated Population Size	Estimated Sample Size	Expected Sampling Precision <sup>1</sup>	Data Collection Mode	Survey Administration By <sup>2</sup>	Expected Start of Fielding
NYSERDA staff and program support contractors	8	4	NA	In-depth Interviews	Process Evaluation Team	Fall/Winter 2010
Participating Facility Owners	~70	33	90/10	In-depth Interviews	Process Evaluation Team	Spring 2011
Participating Project Developers	~40	24	90/10	In-depth Interviews	Process Evaluation Team	Spring 2011
Non-participating Facility Owners	~30	21	90/10	In-depth Interviews	Process Evaluation Team	Spring 2011
Non-participating Project Developers	~30	21	90/10	In-depth Interviews	Process Evaluation Team	Spring 2011
Partial Participating facility owners	<30	21	90/10	In-depth Interviews	Process Evaluation Team	Spring 2011

<sup>1</sup> Assumes finite populations, two-tailed test with absolute precision.

<sup>2</sup> The Process Evaluation team will administer the interviews. Instruments will be developed jointly between the Process and MCA teams.

The sampling plan includes both facility owners and project developers for participating projects. In the previous evaluations some facility owners did not possess sufficient knowledge of the project and referred the evaluation team to the project developer. The evaluation team anticipates this will likely occur again, in which case the actual distribution of responses may be different than the sampling plan assumptions presented here.

The populations relevant to this program are small. In developing the samples the evaluation goal will be to develop final sample sizes for all market actor groups to meet 90/10 absolute confidence/precision criteria on an upstate-downstate regional basis, if possible. When this is not possible this sampling precision level will be met for the state as a whole and will include projects from throughout New York State.

NYSERDA evaluation staff will send advance letters to potential respondents informing them of the evaluation and encouraging their participation. Interviews will be scheduled at times convenient to the respondents.

The Process/MCA Team will coordinate with NYSERDA’s impact evaluation contractor to the extent possible and ensure that lessons learned from this effort will be communicated to the impact evaluation contractor as they subsequently develop their work plan.

## ***Analysis and Reporting***

Data analysis and reporting will be conducted using methods approved by NYSERDA. As discussed above, the analytic process will make use of both primary and secondary data sources to generate comprehensive and unbiased information regarding market sectors eligible to participate in the DG-CHP Program as well as the success of program intervention strategies. All data sources used in the analysis and reporting phase of the project will be clearly cited to ensure a transparent record of activities undertaken. In addition, evaluation findings will be related back to the outputs and outcomes anticipated by the program logic model to help NYSERDA staff and other program stakeholders better assess program accomplishments to date.

## **VI. Impact Evaluation**

The last measurement and verification study of the DG-CHP program (beyond an engineering record review) was performed by Nexant in 2005<sup>10</sup>. The 2005 study evaluated nine (9) of the 28 completed CHP projects. The site work focused on verification of equipment installation and did not include metering.

### ***Research Objectives***

The purpose of the impact evaluation is to establish rigorous and defensible estimates of the electricity generation (and associated fuel input) and electric peak load reduction that can be attributed to the program. The evaluation will also address net savings which are savings after accounting for naturally occurring adoption.

Sample sizes will be designed to target 90/10 precision for the statewide program.<sup>11</sup> Methods will be selected to minimize self-selection, non-response, and other sources of bias, to the extent possible. For both gross and net impacts, impacts will be estimated using multiple methods (triangulation) whenever feasible to establish construct validity and improve the reliability of the results.

### ***Research Activities***

#### **Gross Savings**

By the end of 2010, there should be 70 systems completed under the DG-CHP Program as presented in Table 4. Projects that are on-line or will be on-line before the end of 2010 will be included in the impact evaluation sample frame. The on-site data collection will occur in Fall 2010 and Summer 2011. This two-stage approach has several benefits, including:

- the results will reflect the substantial activity of 2010 which accounts for about 2/3 of all program activity to-date;
- the 2010 on-site activity will leverage the work of another contractor, hired by the DG-CHP program, working with a subset of the sites; and
- the Summer 2011 on-site activity will allow sufficient time to pass for a “settling in” period for projects commissioned in 2010.

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<sup>10</sup> *M&V Evaluation – Distributed Generation – Combined Heat and Power Demonstration Program*, Nexant, July 2005.

<sup>11</sup> The sample size depends on the type of statistical analysis being conducted and the variability of the specific parameters to be estimated.

**Table 4. Population of DG-CHP Program Projects**

	Number of Projects	Peak Capacity
Installed and operational through 2009	56	46 MW
Projected to be completed in 2010	14	62 MW
Total	70	108 MW

NYSERDA has established protocols for metering of CHP systems and has established a web site to capture and display CHP performance data. A portion of participants have or are currently using the protocols to upload 15-minute interval data to the web site, resulting in a potentially rich source of CHP operational data. This web-based data will be used, where available, after a quality assurance review by the Impact Evaluation Team. Sites with sufficient web-based data may require only verification of installation with no additional on-site metering.

Additionally, DG-CHP Program staff recently contracted with a firm (the Data Assessment Contractor) to analyze the performance of CHP systems installed through the DG-CHP Program. The scope of work includes on-site assessment of existing meters, verification of metered values, and an assessment of the CHP system performance. The Data Assessment Contractor will assess all sites currently uploading data to the website. This activity presents an opportunity to leverage data collection costs. Some of the sites targeted by the Data Assessment Contractor may require additional on-site data collection to measure the performance of non-metered systems such as absorption chillers. Furthermore, nine recent DG-CHP Program projects were included in the NYSERDA “Largest Savers” impact evaluation conducted in 2008-2009.<sup>12</sup> The onsite verification and analysis work completed for the Largest Savers evaluation can be directly applied to the gross savings evaluation results for the greater DG-CHP Program. A site activity summary is provided in Table 5, showing the total population of 70 projects and the sampling that is expected to occur by the evaluation and data assessment contractor.

**Table 5. Summary of Site Activities for Projects Installed through 2011**

	Projects Completed	Peak Capacity	Percent of Peak kW
<b>Program Population</b>			
Anticipated Installed/Operational Projects (by 2011)	70	108MW	100%
<b>Evaluation Activity</b>			
Selected M&V Sites (this evaluation)	15	70MW <sup>a</sup>	64%
“Largest Savers” M&V Sites (prior evaluation)	9	10MW	10%
Total Evaluated M&V Sites	24	80MW	74%
<b>Data Assessment Contractor Activity</b>			
Data Assessment Contractors	13 <sup>b</sup>	21MW	19%
a. This total only includes projects funded by the DG-CHP Program. The CHP website includes sites funded through other NYSERDA programs.			
b. Two Largest Savers projects overlap with the projects targeted by the Data Assessment Contractor.			

Sites targeted for verification that do not have existing metered data will require on-site metering of electrical generation, thermal heat recovery, and gas usage (or its proxy). Metered results will be supplemented with customer billing data and operational logs.

Understanding operation of CHP units during the cooling season is critical to computing the system efficiency. Some units may operate at a higher efficiency in the winter because the waste heat can be used for space heating. Furthermore, units supplying energy to absorption systems are best examined during the cooling season.

<sup>12</sup> *Impact Evaluation of Largest Energy Savers*, Megdal & Associates, LLC. September 2010.

Customer pre- and post- installation utility consumption data will be requested for all evaluated sites to compare the metered data with utility bills. Utility billing data may not be available for earlier projects because utilities generally archive their billing histories after two years. Request to the utilities for billing data should be made as soon as possible.

Where monitored data are available, the evaluator needs only to review the study information (also available on-line), analyze parasitic loads, assess the accuracy of the instrumentation, and calculate the net energy impact of the CHP plant on the customer's utility energy use. In this scenario the requested / necessary data includes the following:

- CHP plant on-line hourly fuel use,
- CHP plant on-line gross and parasitic or net generated electricity,
- CHP plant on-line heat generated and used on-site,
- Report information on instrumentation accuracy, and
- Telephone interviews with developer and participants.

If, as is common in downstate projects, an absorption-chiller based cooling system is installed with the CHP plant to enable low-grade (under 200 degrees Fahrenheit) heat recovery, the evaluation engineer will need measured chilled water flow and temperature, not just CHP plant performance, to determine net impact at the participant's meter..

Even for projects that have been monitored, data gaps may exist due to instrument failure or participant staff turnover. This DG-CHP evaluation budget includes funds to perform short-term on-site instrumentation for fifteen sites. In such instances, the on-site data collection protocol follows the same general procedure as described for IPMVP Option B for other programs, with the exception that the evaluator will initially attempt to contact the project developer first and then the host participant, rather than the reverse. In the event additional metering is required, permission will be needed to instrument the CHP plant. This plan does not include gas instrumentation. Gas input will be estimated from gross electric output and known CHP plant part-load performance curves. The evaluation engineer will measure steam and/or hot water and/or chilled water temperatures and liquid flow rate if necessary.

Once the sample is drawn, the selected sites will be examined and a determination made as to whether the site visit will occur in 2010 or in 2011. The sites selected in common with the Data Assessment Contractor will be visited in the fall, in coordination with that contractor. Sites that became operational in 2010 will be deferred to 2011 to allow for systems to settle in after commissioning. Other sites will be distributed to balance the level of effort, the need for summer load monitoring and other considerations.

At the conclusion of the 2010 site assessment work, the team will produce a summary of preliminary results and findings.

#### Forward Looking System Performance Factors

For reporting purposes, NYSERDA currently applies a single set factors to the on-peak KW reduction of installed systems to estimate energy and natural gas impacts. One of the activities of this impact evaluation is to develop additional factors to characterize performance base that are customized by variables such as type of fuel input, type of prime mover, size, and customer characteristics.

While gross impact evaluation will provide 90/10 precision at the program or regional levels, the precision of the forward looking factors that can be used by NYSERDA to report energy and natural gas impacts of systems installed in the future will be limited by the number of sites analyzed in the current study. In order to provide the most robust estimation methodology possible, all operational sites will be reviewed and those with sufficient metered data will be included in the development of the factors.

### Feasibility Study Site Disposition

Feasibility studies have been funded by the R&D DG-CHP program for 20 sites. In order to determine the outcome of these studies, the sites will be cross checked with other NYSERDA programs. Those sites that have not participated in any evaluated NYSERDA program will be contacted to determine if installation has occurred, type of system, the study's role in the project development, and to conduct a condensed net to gross survey.

### Net Savings

The savings attributed to a program should be the savings induced by the program effort, above and beyond what would have occurred in the absence of the program. For program participants, assessing attribution involves estimating the energy savings/generation that would have occurred during the same time frame without the NYSERDA financial incentives (free-ridership). Program participants can also take additional efficiency actions due to what they learned or experienced through the program (spillover). There are two types of participant spillover:

- "Inside" spillover occurs when, due to the program, additional actions (both CHP and non-CHP measures) are taken to reduce energy use at the same project site, but these actions had not been included in the DG-CHP Program reported results.
- "Outside" project spillover occurs when a participant in the program initiates additional actions that add CHP projects at other sites or reduce energy use through other measure implementation at other sites and were not part of the DG-CHP program reported results or any other NYSERDA program, but were caused by what the participant learned through the DG-CHP Program participation.

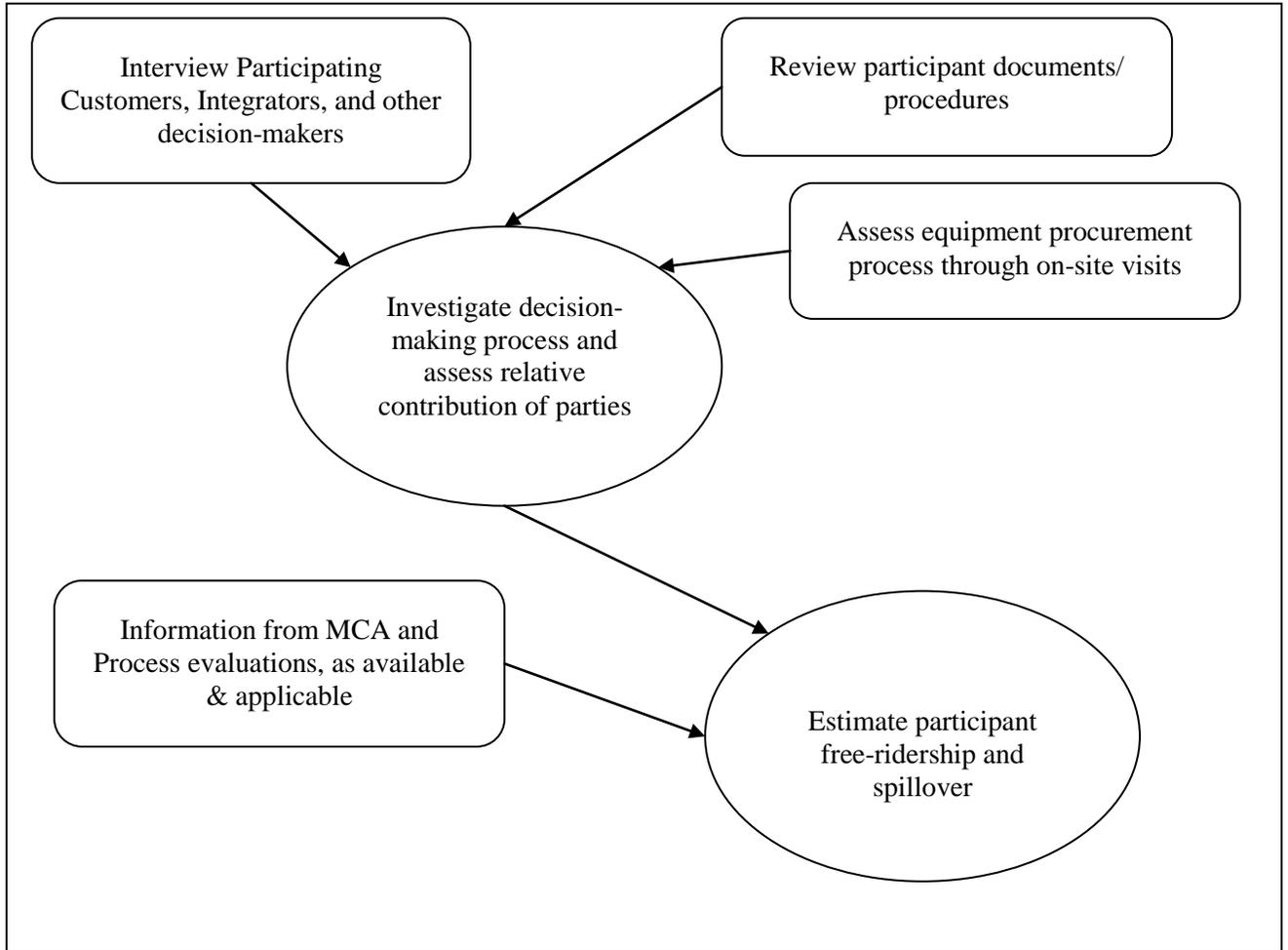
In addition, non-participants can also be influenced by the program. The influence of NYSERDA's DG-CHP Program on the commercial, industrial and institutional sectors can easily overlap with the influence of NYSERDA's Existing Facilities and Flex Tech/Technical Assistance programs. Recognizing this, NYSERDA conducted a commercial and industrial (C/I) non-participant spillover study applicable across C/I programs in 2005. NYSERDA plans to conduct a similar but expanded study in 2010-2011 to derive updated non-participant spillover rates for both the DG-CHP Program and other commercial/industrial programs serving existing facilities/buildings. Consequently, this component of the DG-CHP spillover effects will not be addressed in this evaluation plan. Capturing the spillover from this program will require that the C/I non-participant spillover study take into account the unique set of vendors and developers in the CHP market.

The Impact Evaluation Team intends to explore participant free-ridership and spillover for the DG-CHP program with participating customers and firms that provide the CHP services through an enhanced self-report survey process. The decision-making process will be investigated from both the site owner and developer viewpoints. Various decision-makers, such as chief financial officers or vendors, may also be interviewed if they are found to be influential in the decisions to invest in CHP.

The reliability of attribution estimates depends more on construct validity than on sampling precision. The alternative of what would have occurred without the program cannot be known with certainty. Survey inquiry can be tricky as we are asking about conjecture of a theoretical alternative. Careful wording of questions based on prior survey experience, use of multiple methods to measure free-ridership, and use of control groups are several ways to increase construct validity and reliability of the attribution estimate.

Figure 2 illustrates the sources of information that the Impact Evaluation Team will use to analyze attribution.

**Figure 2. Participant Free-Ridership and Spillover Analysis**



### ***Samples and Surveys***

Current estimates regarding sample sizes, expected sampling precision, and anticipated survey fielding dates for the 2010 to 2011 impact evaluation are summarized in Table 6. All participating sites will receive a telephone survey to assess the current operational status (persistence) of the DG-CHP projects, as well as free-ridership and spillover. In addition, 15 of the completed projects will be selected for on-site measurement and verification, with approximately 7-10 of the sites completed in 2010 and the balance of the sites in 2011. Thirty participating developers will be surveyed by phone.

The quality of available data, the status of the projects, project size, and prior evaluation data will be considered in the development of the final sampling plan. To the extent that specific projects must be dropped from the analysis due to lack of available data, inability to obtain on-site measurements, or other reasons, the evaluation team will compare the sites included in the analysis to those that were omitted to assess the potential for non-response bias.

**Table6. Targeted Survey Populations for DG-CHP Impact Evaluation**

Target Group	Estimated Population Size	Estimated Sample Size	Expected Sampling Precision	Data Collection Mode	Survey Administration By	Expected Start of Fielding
<b>2010 Activities</b>						
Participating Facility Owners with Completed Projects: Persistence & NTG Survey	~70 from program inception through 2010	60 <sup>a</sup> (Census attempt for persistence and net to gross)	90/10	Telephone Survey	Survey Contractor	Winter 2010
Participating Facility Owners with Completed Projects: Gross Savings Assessment	~70 from program inception through 2010	10	90/10	On-site M&V	Impact Evaluation Team	Fall/Winter 2010
Participating Facility Owners with Completed Projects: Forward Looking Factors Assessment	~56 from program inception through 2009	~45	NA	Analysis of file and metered data with customer verification, as needed	Impact Evaluation Team	Fall 2010
Participating Project Developers of Completed Projects: NTG Survey	~40	30 (Census attempt)	NA	Telephone Survey	Impact Evaluation Team	Fall 2010 through Spring 2011
<b>2011 Activities</b>						
Participating Facility Owners with Completed Projects: Gross Savings Assessment	~70 from program inception through 2010	5	90/10	On-site M&V	Impact Evaluation Team	Summer 2011
Facility Owners with NYSERDA-funded Feasibility Studies: Confirm Installations	~20 from program inception	20	90/10	Telephone Survey to confirm disposition	Impact Evaluation Team	Fall 2011

a This assumes 45 from the primary contacts for the participating sites and an additional 15 completes assumed for other decision-makers for the largest sites.

## VII. CHP Pilot Market Effects Study

A market effects case study will be conducted jointly by the Impact and MCA evaluation teams. The case study will examine the success of deriving near-term energy production through demonstration projects and longer-term accomplishments through development of the CHP market. Market development efforts include NYSERDA funding for the CHP website and CHP funding through deployment programs. Theoretically, the comprehensive spillover measurements with participants and non-participants, and mid-stream market actors should capture all the impacts that would be generated by the program in the market. However, market transformation is based on complex interactions and it is entirely possible that the overall program effects go beyond what can be easily measured using spillover categories discussed in the previous section. For example, site owners could indicate that actions they took would have occurred even without NYSERDA's program. However, they may not know that without the Program, their

choice of actions would have been limited. This evaluation component could use secondary data as well the Delphi method of eliciting expert responses. Specific research questions methodologies for this pilot study are still to be developed and will be further defined at the workplan stage.

### VIII. Sample Frames

As a first step in creating participant sample frames, the Evaluation Team (Process, MCA, and Impact teams) will work with program staff to develop lists of active and inactive projects, solicitation respondents that were not approved for funding, participating facility owners and, participating project developers. For non-participants, the evaluation team will work with NYSERDA's survey data collection contractor to develop appropriate facility owner and developer frames.

### IX. NYSERDA Evaluation Process

This evaluation plan is an important step in NYSERDA's evaluation planning and implementation process. It is NYSERDA's understanding that DPS Staff wish to be involved as a reviewer/participant in the following parts of the evaluation process: detailed evaluation plans, project kick-off meetings, workplans (including sampling, statistics and modeling issues), data collection instruments, interim results reports (as applicable), presentation of evaluation results, and draft evaluation reports. NYSERDA will conduct evaluation planning and implementation in an open and transparent manner, and will invite DPS Staff participation in the designated aspects of the process and any others upon DPS' request.<sup>13</sup> Should DPS Staff choose to modify the level or manner of their involvement, NYSERDA should be notified about the change(s). DPS Staff should also choose when and how to involve their evaluation advisor consultant team in NYSERDA's evaluation processes, should directly provide any materials and information necessary for their advisor consultant team to fulfill this role, and should notify NYSERDA about the type and level of advisor consultant involvement.

An important goal of NYSERDA's evaluation effort is to provide feedback to program staff to help inform and improve program implementation. NYSERDA accomplishes this goal in several ways:

- 1) Ongoing communications between the NYSERDA evaluation staff and evaluation contractors to identify issues that need to be brought to the attention of NYSERDA program staff, DPS Staff, and other involved parties
- 2) Ongoing communications between the NYSERDA evaluation staff and evaluation contractors to identify issues that need to be brought to the attention of NYSERDA program staff, DPS Staff, and other involved parties.
- 3) Interim results reports may be generated, sometimes at the request of NYSERDA program staff and sometimes by initiative of NYSERDA's evaluation team and contractors, where results are required or deemed useful prior to completion of the full evaluation effort.
- 4) Presentations of draft evaluation results held with NYSERDA evaluation contractors, evaluation team, program staff, and DPS Staff before evaluation reports are written provide

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<sup>13</sup> In order to maintain transparency, and allow for confirmation checking and follow-up analysis, evaluation data will be maintained by NYSERDA and made available to DPS on an as-needed basis. NYSERDA will continue to maintain its secure "data warehouse" which includes data files, code books, and analysis files which can be made available in electronic form to DPS upon request. In order to provide a comprehensive record of each study conducted, the data warehouse also holds copies of final evaluation reports and appendices, including blank survey instruments, although these documents will be made available to DPS and publicly upon completion of each evaluation project.

feedback on the programs as soon as possible, and provide evaluation contractors with additional perspective and context that will be useful in reporting final recommendations.

Upon completion of final evaluation reports, the NYSERDA evaluation team will also provide support and assistance to program staff with regard to implementation of recommendations and program improvements.

## X. Reporting

Final reports will align with requirements set forth in the DPS evaluation guidelines, and will include: methodology, key results, recommendations, summary and conclusions, and appendices with detailed documentation.

Upon completion of each major evaluation study effort, findings and results will be communicated by NYSERDA's evaluation contractors and evaluation staff to NYSERDA program staff. Actionable recommendations and information on program progress toward goals will be provided as input to the program design and improvement process. NYSERDA's evaluation staff will follow up regularly with program staff on recommendations arising from the evaluation and the status of their consideration or adoption of these recommendations.

NYSERDA's evaluation staff will prepare quarterly and annual reports to the Public Service Commission, DPS and the EAG summarizing the results of all programs and from all evaluation studies occurring in the most recent quarter or year. The latest evaluated program savings, realization rates, and net-to-gross ratios will be used in compiling data for these overarching reports. Quarterly reports will be provided to the Commission within 45 days of the end of each calendar quarter. The annual report will substitute for the fourth quarterly report, summarizing program and portfolio progress throughout the calendar year. The annual report will be submitted to the Commission within 60 days of the end of the calendar year.