

R&D Demonstration Survey Round 3: Projects Completed from 2011-2013

Executive Summary

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EXECUTIVE SUMMARY

ES.1 OVERVIEW AND PURPOSE

The New York State Energy Research and Development Authority's (NYSERDA) Innovation Program employs a variety of approaches designed to advance the development and market acceptance of innovative, efficient, and clean energy technologies, and increase their market acceptance and adoption. R&D demonstration projects are largely conducted within the Innovation Program and are one of NYSERDA's best-established strategies for promoting these goals. These projects aim to demonstrate and obtain objective information on the technical performance, cost, and environmental impacts of emerging clean and energy-efficient technologies. Demonstration projects are designed to showcase the value and effectiveness of a new technology or process, or application of an existing technology in a commercial setting.

Demonstration projects cover a wide variety of technology areas and project types, and the types of impacts associated with these projects are equally far-reaching. While demonstration projects often generate impacts in their own right, these projects are designed to achieve additional impacts through successful replications. Replication projects involve an additional installation or scaling up of the technology or process demonstrated under the NYSERDA-funded project, or additional sales of the technology that was used in the demonstration.

This evaluation assesses the impacts of NYSERDA's R&D demonstration portfolio based on projects completed in 2011 – 2013.¹ The evaluation has the following objectives:

- Estimate the resource savings (e.g., kW, MWh, etc.), revenues, cost savings, and other impacts resulting from NYSERDA-funded demonstrations and replication projects.
- Characterize the number, scale, and type of replication projects.
- Determine the factors that helped or hindered replication.
- Assess the cost-effectiveness of NYSERDA's R&D demonstration portfolio.
- Evaluate participant satisfaction with NYSERDA's R&D Program.
- Determine whether projects from the previous study have attained additional benefits or replications.

ES.2 METHODS

The primary data source for this evaluation was a survey of R&D participants who completed demonstration projects between 2011 and 2013. The evaluators aimed to survey the individual that was most knowledgeable about each project. Since each project was unique, the type of person most knowledgeable about the impacts varied. The Principal Investigator (PI) listed in NYSERDA's R&D Metrics Database was assumed to be most knowledgeable and was the intended point of contact, but the survey allowed for a different respondent if the original PI was no longer with the firm, as long as that person was knowledgeable about the demonstration project. Depending on the project, the PI may be the integrator, vendor, or site owner. Integrators bring together the other market actors to create or "package" the demonstration project. Vendors supply the technology for the project. Site owners own the location where the project is demonstrated, and may or may not be involved with implementing the project at their site. Three separate survey instruments were developed for integrators, vendors, and site owners;

¹ This evaluation follows two previous studies that assessed the results of demonstrations completed in 2004-2007 and 2008-2010. Please refer to NYSERDA's *R&D Demonstration Survey Report*, prepared by Megdal & Associates, September 2012 and *R&D Demonstration Survey Round 2: Projects Completed from 2008-2010*, prepared by Industrial Economics, Inc., March 2014.

however, most of the questions in the three surveys were identical or extremely similar. The main difference between the surveys was in the replication section; specifically, integrators and site owners were asked about additional technology installations, while vendors were asked about additional sales.

The survey population was drawn from NYSERDA's R&D Metrics Database, which includes basic project information for all of NYSERDA's R&D demonstration projects. In addition to the screening criteria used in the previous two surveys, the current survey excluded project types that will be a smaller focus of NYSERDA's R&D efforts after 2015; these include: Combined Heat and Power (CHP), Industrial Products, and Industrial Process Efficiency projects. Additionally, NYSERDA excluded all customer-sited tier (CST) projects from the current survey. IEC developed the sample frame in steps. First, IEC compiled a list of projects to be surveyed that included all product demonstration, on-site process improvement, and on-site power production projects with close dates of 2011-2013 from NYSERDA's Contracts Report spreadsheet. Then, IEC excluded CHP demos, CHP Incentives, Industrial Process Efficiency, and Industrial Products projects. Finally, IEC excluded any projects that were funded through the CST of the Renewable Portfolio Standard program or terminated. This process resulted in 79 unique projects to be surveyed. NYSERDA asked IEC to remove ten projects from the sample frame, including all four of the on-site power production projects identified and three Department of Transportation funded projects not intended for replication. Therefore, the final sample frame for this study consisted of 69 demonstration projects. Of the 69 eligible projects, 48 completed the survey, yielding a response rate of 70 percent.²

In addition to the survey, the evaluation team also drew on the following data sources:

- **R&D Metrics Database.** NYSERDA requires demonstration participants to submit an annual summary of metrics addressing the energy, environmental, and economic benefits of their projects, during and after project implementation.³ Since 2009, NYSERDA has been collecting benefits data in an R&D Metrics Database. While the creation of the database is a positive development, the data are not as comprehensive as they could be. Out of 79 projects in the initial survey sample, 11 had resource savings (energy, non-energy, or air emissions) captured in the database. Nine of the 11 projects were in the final 69-project sample frame. Seven of these nine projects also reported net dollars (revenue generation or cost savings). Six projects reported jobs created or retained. The evaluators used this information as a starting point, and attempted to verify the figures with survey respondents.
- **Project Reports.** NYSERDA requires most demonstration participants to submit final reports that describe the demonstration project and the benefits realized at the end of the project. NYSERDA provided the evaluators with final project reports for 59 projects in the initial 79-project sample frame. In addition, the evaluation team obtained a limited number of reports prior to conducting the surveys, either directly from the respondent or through a targeted Web search. Reports that were found prior to conducting a survey were used as a starting point for the discussion.

ES.3 DEMONSTRATION IMPACTS AND NYSERDA CONTRIBUTION

The survey asked respondents to describe the types of impacts that the demonstration projects generated, and to quantify these impacts where possible. Table ES-1 shows the number and percent of respondents who identified each benefit type as a direct benefit by project type.

² Of the 21 non-completions, one PI refused, 10 were unresponsive, and 10 were no longer with the same firm or had no project knowledge. Excluding the 10 PIs in the latter category from the sample frame would increase the response rate to 81%.

³ The post-implementation reporting period varies by type of project.

Table ES-1. Direct Benefits by Project Type

Project Type	Number of Projects	Direct Benefit Type**	Number of Projects Reporting Direct Benefit*
Transportation	15	CO ₂ Emissions Offset	8
		Gasoline Saved	5
		Diesel Fuel Saved	2
		Electricity Saved	2
		Electricity Produced	1
		NO _x and PM Emissions Offset	1
		Vehicle Miles Traveled Avoided	1
Solar	8	CO ₂ Emissions Offset	7
		Electricity Produced	3
		Electricity Saved	3
		Heating Fuel Saved	1
		SO ₂ Emissions Offset	1
		NO _x and PM Emissions Offset	1
		Natural Gas Displaced	1
		Propane Displaced	1
Heating/Cooling	6	CO ₂ Emissions Offset	6
		Electricity Saved	6
		Promotion of Energy Efficient Technologies	1
Biofuel	4	CO ₂ Emissions Offset	3
		Heating Fuel Saved	2
		Electricity Produced	1
		SO ₂ Emissions Offset	1
		Promotion of Energy Efficient Technologies	1
Waste Management	5	CO ₂ Emissions Offset	3
		Electricity Saved	2
		Gasoline Saved	1
		Decrease in Runoff	1
		Nitrogen and Phosphorus Reduction	1
Lighting	4	CO ₂ Emissions Offset	4
		Electricity Saved	3
Monitoring	2	None - only indirect benefits reported	0
Server Efficiency	2	CO ₂ Emissions Offset	2
		Electricity Saved	2
Other	2	NO _x and PM Emissions Offset	1
		Promotion of Energy Efficient Technologies	1
		Vehicle Miles Traveled Avoided	1
		CO Emissions Offset	1
		VOC Reduction	1

Note: (*) Multiple responses were allowed.

Note: (**) IEc calculated or re-calculated CO₂ benefits based on energy numbers provided by respondents. If respondents provided CO₂ benefits without energy benefits, the CO₂ benefits provided were used. CO₂ emissions offsets were considered a direct benefit for all project types that reported energy-related benefits.

Given the broad range of projects and benefit types, summarizing the benefits of NYSERDA's R&D demonstration projects in a limited number of metrics is challenging. The challenge is compounded by the time that elapsed since projects were completed, which makes it difficult for respondents to recall the precise benefits that their projects produced. Respondents with data in the R&D Metrics Database or final project reports were asked to confirm or amend the data; however, most respondents did not have metrics data. Therefore, respondents were asked to provide their best estimate of the impacts.

Respondents were asked an additional series of questions to ascertain NYSERDA's contribution to the reported impacts. NYSERDA's contribution to each project is based on a composite of five factors, which are in turn based on the respondent's answers to a number of survey questions and calculated based on an algorithm, as outlined in Table ES-2.

Table ES-2. Method for Calculating NYSERDA’s Demonstration Contribution Score

Component	Survey Questions	Calculations
Novelty	<p>Is this the first time your firm used this technology?</p> <p><i>If no:</i></p> <p>How many times had your firm used this technology prior to the demonstration project?</p> <p>How did the demonstration project differ from previous uses of the technology?</p>	<p>Calculation #1: If the firm had used the technology before, <i>and</i> the NYSERDA demonstration project was the same or smaller than the previous demonstrations, adjust downward by -1. Otherwise, the adjustment factor is 0.</p>
Importance	<p>On a scale of 0 to 5, where 0 = “not at all important” and 5 = “very important,” how important or unimportant was NYSERDA’s <i>financial</i> assistance in your decision to do this project?</p> <p>On a scale of 0 to 5, where 0 = “not at all important” and 5 = “very important,” how important or unimportant was NYSERDA’s <i>technical</i> assistance in your decision to do this project?</p>	<p>Calculation #2: Take the <i>higher</i> of the respondent’s ratings for the importance of NYSERDA’s financial assistance and NYSERDA’s technical assistance.</p>
Likelihood	<p>What is the likelihood that your firm would have completed this project in New York without NYSERDA’s <i>financial</i> assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.</p> <p>What is the likelihood that your firm would have completed this project in New York without NYSERDA’s <i>technical</i> assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.</p>	<p>Calculation #3A: Take the <i>lower</i> of the respondent’s ratings for financial assistance and technical assistance. <i>If the firm did not receive technical assistance from NYSERDA, use financial assistance rating only.</i></p> <p>Calculation #3B: Now, take the inverse (e.g., 0 becomes 5, 1 becomes 4, etc.).</p>
Magnitude	<p>Overall, without NYSERDA’s involvement, would the magnitude of the impacts for this project have been of the same size, smaller, or larger?</p>	<p>Calculation #4A: If the respondent indicates that the impacts of the demonstration project would have been <i>the same or larger</i> without NYSERDA’s assistance, adjust downward by -1. Otherwise, make no further adjustment.</p>
Timing	<p>Without NYSERDA’s support, would you have carried out this project earlier, at about the same time, or later?</p>	<p>Calculation #4B: If the respondent indicates that the project would have occurred earlier without NYSERDA, adjust downward by -1. If the project would have occurred at the same time, make no further adjustment. If the project would have occurred later, the adjustment factor is +1.</p>
Demonstration Contribution Score	<p>This is a composite score based on the previous questions.</p> <p>This calculation averages the respondent’s assessment of the significance of NYSERDA’s contribution and the likelihood of completing the project without NYSERDA, and adjusts by the factors noted above (i.e., comparable previous projects, magnitude of benefits, and timing).</p>	<p>Calculation #5: Take the average of calculations #2 and #3B, then add Calculations #1, #4A, and #4B to the total.</p>

The composite contribution score (Calculation #5 in Table ES-2) can range from -3 to +6. IEC converted the score to a percentage to estimate NYSERDA's contribution, as follows:

- **-3, -2, -1, or 0:** NYSERDA contributed to *none* of the reported benefits (0%).
- **1 or 2:** NYSERDA contributed to a *modest* portion of the reported benefits (25%).
- **3:** NYSERDA contributed to a *moderate* portion of the reported benefits (50%).
- **4 or 5:** NYSERDA contributed to a *substantial* portion of the reported benefits (75%).
- **6:** NYSERDA contributed to *all* of the reported benefits (100%).⁴

As discussed in the main report, the responses suggest that NYSERDA played an important role in catalyzing and accelerating the development of the demonstration projects. Table ES-3 presents the results of this analysis.

Table ES-3. NYSERDA's Contribution to Quantifiable Direct Benefits

Direct Benefit Type	Amount	NYSERDA Contribution
Electricity Produced (kWh)	157,767	118,325
Electricity Saved (kWh)	2,342,192	1,838,347
Diesel Fuel Saved (gallons)	51,958	38,969
Heating Fuel Saved (gallons)	4,000,000	3,000,000
Gasoline Saved (gallons)	1,494,081	70,560
CO ₂ Emissions Offset (lbs.)	82,208,511	41,775,969
SO ₂ Emissions Offset (lbs.)	168	126
NO _x and PM Emissions Offset (lbs.)	58,860	60
Vehicle Miles Traveled Avoided	34,199,759	1,284,964
Natural Gas Displaced (therms)	1,080	810
Propane Displaced (gallons)	1,014	761

The study also evaluated revenues and cost savings that the demonstration projects achieved. Revenues and cost savings were calculated either through projects' decommissioning date or through 2015 (the year the survey was conducted) if the project was reported to still be in use.

Of the 48 projects surveyed, 11 projects (23 percent) reported that they generated revenues. As shown in Table ES-4, five projects (10 percent) were able to estimate revenue figures and reported that a total of \$11,190,000 was generated to date, with NYSERDA contributing approximately \$8.3 million. The total revenue figure is mostly due to two projects that reported \$2.8 million and \$8 million each in sales revenue. This type of revenue distribution is typical for R&D portfolios, where one or two successful projects often account for the majority of the portfolio's financial benefits.

⁴ If the contribution score was not an integer, the evaluators calculated the percentage as the midpoint between the two closest integers. For example, a contribution score of 5.5 was translated to 87.5% (the midpoint between 5 = 75% and 6 = 100%).

Table ES-4. Summary of NYSERDA’s Contribution to Revenue Generated from Demonstration Projects

Project Type	Number of Surveyed Projects with Estimated Revenue	Revenue Generated	NYSERDA Contribution
Transportation	2	\$2,850,000	\$2,100,000
Biofuel	1	\$8,000,000	\$6,000,000
Waste Management	1	\$300,000	\$150,000
Server Efficiency	1	\$40,000	\$15,000
Total	5	\$11,190,000	\$8,265,000

Out of the 48 projects, 28 projects (58 percent) reported that they realized cost savings. As shown in Table ES-5, 11 projects (23 percent) were able to estimate their cost savings.⁵ These 11 projects estimated total cost savings of \$21,068,716, with NYSERDA contributing approximately \$719,406. Cost saving figures include energy cost savings as well as cost savings resulting from enhanced productivity and efficiency.

Table ES-5. Summary of NYSERDA’s Contribution to Cost Savings Generated from Demonstration Projects

Project Type	Number of Surveyed Projects with Estimated Cost Savings	Cost Savings Generated	NYSERDA Contribution
Solar	2	\$20,448	\$15,336
Heating/Cooling	2	\$55,900	\$41,925
Server Efficiency	2	\$477,485	\$377,799
Transportation	2	\$20,324,283	\$141,396
Biofuel	1	\$31,000	\$23,250
Lighting	1	\$3,600	\$2,700
Waste Management	1	\$156,000	\$117,000
Total	11	\$21,068,716	\$719,406

ES.4 REPLICATION IMPACTS AND DEMONSTRATION INFLUENCE

Replications are a primary goal of NYSERDA’s R&D demonstration projects. The survey included questions regarding the number and type of demonstration projects that were replicated, the total number of replications, impacts associated with the replications, and the contribution of the demonstration projects to developing the replications.

Key findings include the following:

- Thirty-six of the 48 surveyed projects (75 percent) reported replications of the technology or process used in the NYSERDA-funded demonstration project.

⁵ Two projects reported revenues and cost savings.

- Twenty-five of the 48 projects surveyed (52 percent) reported at least one replication in New York. Of these 25 projects, six reported that NYSERDA provided funding for one or more replications, while the other 19 projects indicated that NYSERDA did not provide funding.
- Of the 25 projects with replications in New York, only eight were able to provide quantifiable benefits. This does not mean that the remaining projects lacked benefits; however, the survey respondents were unable to quantify them.
- Overall, respondents reported 493,605 replications in New York; however, 400,000 of these replications were individual sales (units sold) from one project.⁶
- Respondents provided a range of reasons for being able to replicate the NYSERDA project in New York. Demonstrable savings and technical expertise gained from the demonstrations were the most frequently mentioned factors.
- Respondents who have not replicated their projects in New York were asked to identify the barriers to replications in the state. The two most commonly cited barriers to replication were cost and absence of a market to take advantage of the demonstrated technology.

Table ES-6 below summarizes the quantifiable benefits reported by replication projects as well as NYSERDA’s contribution to these benefits. Replication contribution scores were derived using a similar method as the demonstration contribution scores described in section ES.3.

Table ES-6. Demonstration Contribution to Quantifiable Benefits from Replications

Benefit Type	Number of Projects Surveyed (n=48)*	Number of Projects with Replications in NYS (n=25)*	Number of Projects with Replications and Quantifiable Benefits (n = 8)**	Amount	NYSERDA Demonstration Contribution
Electricity Produced (kWh)	5	2	1	196,560	147,420
Electricity Saved (kWh)	18	13	3	2,169,222	1,163,306
Fuel Oil Saved (gallons)	3	1	1	10,000	7,500
Gasoline Saved (gallons)	6	4	2	182,513	136,885
Diesel Fuel Saved (gallons)	2	1	1	720,000	540,000
CO ₂ Emissions Offset (lbs.)	33	18	8	22,463,771	16,310,039
Vehicle Miles Traveled Avoided	2	1	1	489,510	367,133

Notes: (*) Projects reported multiple benefit types. Not all demonstration projects with direct benefits reported replications.

(**) For replication projects that did not have quantitative benefits data, the evaluators attempted to estimate replication impacts assuming they were the same size and scale as the original demonstration impacts. However, if the survey respondent did not provide a start date for the replication project, replication impacts were not estimated.

⁶ The respondent who reported the 400,000 units sold was not able to provide the sales volume in dollars. This project did not report any quantitative benefits.

In addition, the replications generated an estimated \$806,667 in revenues, with NYSERDA contributing to \$601,667. Two replication projects were able to estimate revenue and fell in the server efficiency and transportation categories. Replications generated an estimated \$3,678,499 in cost savings, with NYSERDA contributing to \$2,510,717. Eight replication projects were able to estimate cost savings; three fell in the transportation category, two in solar, two in server efficiency, and one in biofuel.

ES.5 PROCESS EVALUATION RESULTS

Overall satisfaction with NYSERDA’s R&D Program was high, with 85 percent of respondents agreeing or strongly agreeing that they were satisfied overall with the R&D Program. Respondents also gave very high ratings for NYSERDA staff’s adequacy of communication with participants and comprehensiveness of knowledge. The majority of respondents stated that they were satisfied with every characteristic of NYSERDA’s R&D Program with more than 50 percent of respondents stating they there were very satisfied with NYSERDA’s adequacy of communication, comprehensiveness of knowledge, and sufficiency of resolution.

Respondents were asked a series of open-ended questions about potential improvements that NYSERDA could undertake to encourage more demonstrations and replications. The most common suggestions for how NYSERDA could encourage more demonstration projects included: provide more technical assistance from the solicitation phase through the project’s end (n=10), and advertise funding opportunities at entrepreneurial events, via the internet, and by sending solicitations directly to potential candidates (n=10). The most frequent suggestion for how NYSERDA could encourage more replication projects was to post project reports online and offer an online database of project results (n=13).

ES.6 COST EFFECTIVENESS

The study assessed the cost effectiveness of the 48 demonstration projects surveyed. Cost-effectiveness was assessed on three dimensions: (1) revenues generated and costs saved per NYSERDA dollar of investment in the demonstration projects; (2) electricity and fuel savings per NYSERDA dollar invested in the demonstration projects; and (3) a qualitative assessment of whether participants considered their investments in the demonstrations to be worthwhile.

Table ES-7 shows the cost-effectiveness figures for combined demonstration and replication benefits. Overall, the demonstration and replication projects saved or generated \$0.98 for every dollar that NYSERDA invested in the 48 surveyed demonstration projects for all project types. It should be noted that the revenue and cost savings figures represent the totals achieved through 2015 for all revenues and cost savings reported; in some cases, these benefits will continue into the future. In those cases, the benefits per NYSERDA dollar will grow over time.

Table ES-7. Cost Effectiveness for Combined Demonstration and Replication Benefits

Benefit Type	Cost Effectiveness
Demonstration and Replication Project Revenues per NYSERDA \$	\$0.72
Demonstration and Replication Cost Savings per NYSERDA \$	\$0.26
Demonstration and Replication Total Dollars (Revenues and Cost Savings) per NYSERDA \$	\$0.98

The goals of NYSERDA’s R&D Program include public benefits ranging from improved system reliability to health and environmental improvements. While some demonstration projects may result in lower energy costs, cost-effective energy savings is not the only reason for NYSERDA funding these projects. Nonetheless, it can be useful to consider energy-cost savings within the context of the overall

cost-effectiveness analysis. The analysis estimated NYSERDA's cost-effectiveness based on electricity savings (MWh) and fuel savings (therms). The analysis was conducted using a variety of scenarios, as shown in Tables ES-8 and ES-9. The scenario analysis considers two variables that determine the value of future energy savings: energy prices and technology lifespan. Forecasted energy prices are taken from the EIA's *Annual Energy Outlook 2015* for the U.S. Middle Atlantic region, which includes New York State.⁷ The "medium" energy prices represent the EIA's reference case; the "low" and "high" cases represent the EIA's forecast under a lower-economic growth scenario and higher-growth scenario, respectively. The benefits also reflect whether the systems or processes demonstrated in the NYSERDA projects operate for five years, 10 years, 15 years, or 20 years.

⁷ The *Annual Energy Outlook 2013* report expresses energy prices in 2011 dollars.

Table ES-8. Estimated Electricity Savings from Demonstrations and Replications

Lifespan (Years)	Energy Prices		
	Low	Medium	High
5	\$270,466	\$270,824	\$271,050
10	\$447,167	\$450,590	\$452,859
15	\$529,973	\$540,330	\$547,165
20	\$693,093	\$708,419	\$716,626

Table ES-9. Estimated Fuel Savings from Demonstrations and Replications

Lifespan (Years)	Energy Prices		
	Low	Medium	High
5	\$8,758,094	\$8,775,195*	\$8,759,757*
10	\$16,510,152	\$16,594,142	\$16,597,580
15	\$24,562,048	\$24,763,556	\$24,832,806
20	\$33,321,000	\$33,715,908	\$33,924,934

*Note: Estimated fuel savings are actually lower in the high economic growth case when compared to the reference case. This is because higher economic activity leads to short-term reduced energy prices due to a number of interacting market factors (e.g., renewable energy production, immigration, labor force, capital stock, and productivity changes, etc.) For more information, see: [http://www.eia.gov/outlooks/aeo/pdf/0383\(2015\).pdf](http://www.eia.gov/outlooks/aeo/pdf/0383(2015).pdf)

The estimated electricity and fuel savings were summed to derive aggregate savings, and the aggregate savings were divided by NYSERDA's investment to calculate cost effectiveness. As shown in Table ES-10, the demonstration and replication projects could together save between \$0.73 and \$2.82 for every dollar that NYSERDA invested in the demonstration projects, depending on project lifespan and future energy prices. Given the uncertainties and limitations of this analysis, the figures should be interpreted as a general indication, rather than a precise estimate, of energy-cost savings. It should also be noted that total savings (and therefore, cost effectiveness) may be understated as a result of some respondents not being able to quantify their energy savings. Therefore, the actual savings and cost effectiveness are likely higher than the figures suggest.

Table ES-10. Cost Effectiveness of Electricity/Fuel Savings from Demonstrations and Replications

Lifespan (Years)	Cost Effectiveness		
	Low	Medium	High
5	\$0.73	\$0.74*	\$0.73*
10	\$1.38	\$1.39	\$1.39
15	\$2.04	\$2.06	\$2.06
20	\$2.77	\$2.80	\$2.82

*Note: Estimated fuel savings are actually lower in the high economic growth case when compared to the reference case. This is because higher economic activity leads to short-term reduced energy prices due to a number of interacting market factors (e.g., renewable energy production, immigration, labor force, capital stock, and productivity changes, etc.) For more information, see: [http://www.eia.gov/outlooks/aeo/pdf/0383\(2015\).pdf](http://www.eia.gov/outlooks/aeo/pdf/0383(2015).pdf)

The study also included a qualitative assessment of the project's cost-effectiveness from its perspective. Key findings include the following:

- Out of 48 respondents, 13 had considered alternative investments to the demonstration project. Ten of these 13 respondents (77 percent) indicated that the demonstration was the best choice relative to the alternatives.
- A very strong majority of all 48 respondents (96 percent) indicated that the demonstration project was a good investment.
- A strong majority (74 percent) indicated that their return on their portion of the demonstration investment was positive, 17 percent breakeven, and 9 percent indicated that their return was negative.

The findings indicate that a strong majority of respondents considered the demonstration projects to be worthwhile investments.

ES.7 RECOMMENDATIONS

Continue to utilize the electronic survey instrument developed in this round. The two previous rounds of the R&D demonstration survey used paper survey instruments to conduct the phone survey, and transferred the data from the paper survey to an electronic database following survey administration. For the current round, IEC developed a Microsoft Access-based electronic survey database to enter, store, and sort survey data. While this database required an initial development investment, it eliminated the data entry step required in previous rounds. Future rounds of the R&D survey should continue to leverage this electronic survey instrument as there will not be an upfront cost to develop the database, but there will continue to be substantial data entry savings.

Continue to re-survey demonstration projects from prior rounds. The evaluation team surveyed select projects from 2008-2010 that were surveyed in the previous round. These surveys were able to quantify substantial additional benefits. Not only do these surveys allow for additional quantification of benefits, but they provide evidence to support a primary theory driving the R&D demonstration program – that projects may continue to provide benefits for many years after NYSERDA’s involvement in the project has ended.

Continue to survey replication projects identified during the primary survey. The first two rounds only surveyed demonstration participants, and asked if they were aware of any replication projects. In this round, the evaluators specifically asked for contact information of project managers at replication sites and followed up directly with the replicators. These follow-up surveys helped to verify the number of replications, quantify benefits, and identify new replication projects.

Provide definitions to survey respondents. The previous round of the survey (March 2014) asked respondents whether they produced 15 specific types of benefits. The evaluators found that asking respondents about each of these 15 benefits was time-consuming and unnecessary, as most benefits coalesced around a smaller number of benefit types. Therefore, in the current survey, we condensed these questions to ask for the three most common specific benefits reported from the previous round: power production, demand reduction, and energy efficiency. The evaluators then asked respondents to provide all other benefits produced by the project to ensure all energy and environmental benefits were reported. However, there was some concern that the benefits were not uniformly defined to the respondents. Prior to the next round, the evaluators and NYSERDA should work together to develop definitions for each benefit type to read to the respondent.

Calculate CO₂ benefits solely based on energy benefits. A few projects this round reported CO₂ benefits, but did not report energy benefits. Asking respondents to report CO₂ offsets directly led to some gaps and inconsistencies. Going forward, we recommend that instead of asking respondents to estimate

their CO₂ savings, the evaluators should calculate CO₂ savings solely based on energy savings reported by respondents using NYSERDA's emission factors.

Focus surveys on the Principal Investigator if at all possible. This round of the survey attempted to survey multiple project team participants, particularly in cases where the PI was a vendor. The previous survey had found that vendors were not able to sufficiently answer many of the survey questions. The evaluation team was not able to locate secondary contacts for any of the eight projects surveyed where the PI was a vendor. In each case the vendor was unable to provide any contact that would be able to answer the survey questions. However, the eight vendor surveys did not stand out as lower quality surveys this round. Overall we found that the most important determinant of the quality of the interview was not the type of participant (integrator, site owner, or vendor), but whether the respondent was the NYSERDA PI for the project. PIs are responsible for reporting to NYSERDA so they often remember or can locate key project data. Furthermore, these respondents are often the only project team members interacting with NYSERDA R&D staff, and can most accurately answer questions regarding NYSERDA's R&D demonstration process.

The next survey should include additional questions to determine overall project success. The current survey reports total benefits and cost effectiveness of demonstrations and their replications. However, many projects are unable to quantify benefits. Furthermore, the cost effectiveness figure relies on revenues and cost savings that do not necessarily reflect increases in profit. For example, a product demonstration may lead to the formation of a company with \$20 million in annual revenues, but \$30 million in expenses. The current cost effectiveness measure would only include the revenues. Similarly, a product may cost 95 percent less to produce after the NYSERDA demonstration, but it may still cost more to make than existing alternatives. The current cost effectiveness measure would capture all of the cost savings, but would not reflect the fact that the technology is not economically viable. One way to deal with the revenue issue would be to ask questions about profitability, such as: "Do your revenues exceed your costs currently? If so, by how much do revenues exceed cost? If not, do you anticipate that your revenues will exceed your costs in the future?" The next round of the survey could also include a number of more qualitative questions to understand whether the project produces a new technology or process that produces environmental benefits or energy savings. Some examples of such questions might include, "Are there existing alternatives to this technology or process being offered by your competitors that are more cost effective or produce additional benefits compared to your technology or process?," or for projects that have been replicated, "Do you believe this process or technology will continue to be replicated in the future?" The answers to these questions could be compiled into a score similar to the NYSERDA contribution score featured in the main report. The score could then be used to assess project success.

NYSERDA should require demonstration projects to report to NYSERDA when operations cease. NYSERDA does not currently track when project operations conclude. The proxy for this information is the "ClosedDate" field in the R&D Metrics Database, which tracks when projects are financially closed in NYSERDA's accounting system. This date is often many years after operations conclude. The ideal time to survey R&D demonstration projects is two to five years after the project operations are completed – enough time for benefits to accrue and for replications to occur, but not so long that companies dissolve, contact information changes, or project participants forget key details about the project. In order to ensure that all survey participants fall within that two to five year window, NYSERDA should track the actual date that each demonstration concludes its operations.