

R&D Methods and Approaches: Impact Evaluation of an R&D Demonstration Program

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ABSTRACT

This evaluation was an initial effort to estimate impacts from Research and Development (R&D) demonstration projects implemented by the New York Energy Research and Development Authority (NYSERDA). The program provided funding for demonstration efforts with the goal of inducing replications. The evaluation was based on a participant survey designed to collect data on replications of the technology at other sites. The program supported demonstrations of technologies associated with power production, energy efficiency products, and process improvements leading to energy savings and non-energy benefits.

The results provided insights into the demonstration process that could prove useful for the development of future impact evaluations of R&D demonstration programs. Another focus of the paper is drawing comparisons between the methods for conducting the impact evaluation of more mature energy efficiency programs and assessing the impacts of R&D demonstration programs. This paper covers the evaluation design, including a description of the components of the survey, the results and recommendations.

Introduction

The New York State Energy Research and Development Authority's (NYSERDA) Research & Development (R&D) Program employs a number of different strategies that are designed to encourage the adoption of energy efficient and environmentally sound technologies. While the individual R&D programs are targeted toward specific markets and technologies, the approaches used to achieve the program objectives cut across all of the markets and technologies.

A key approach used within the R&D Program is the support and strategic use of demonstration projects. Through demonstration projects, participants have an opportunity to showcase new technologies or new applications of existing technologies and develop the expertise that is critical to promote these innovative products or processes in the market. Demonstration projects cover a wide range of applications, including environmental protection, waste management, energy product development, and renewable energy technologies.

The primary objective of NYSEDA's R&D demonstration effort is to achieve replications. The demonstration projects seek to provide evidence for innovative technologies and process improvements as the foundation for creating replications. The largest impacts from demonstration projects are generated by the replication of these technologies and process improvements in a variety of applications. The definitions of the two key terms, demonstration project and replication, are provided below.

- *Demonstration project* is the demonstration of a new technology, process or the application of an existing technology in a commercial setting designed to showcase its value and effectiveness.
- *Replication* is the additional installation of the technology or process demonstrated under the NYSEDA-supported project. The replication could be at the same NYSEDA

demonstration site and/or at another site and could be in the same application area or apply to a different application.

The broad array of projects makes reporting and estimating impacts for the NYSERDA demonstration projects complicated. While the key metrics for assessing the impacts of energy efficiency programs are typically energy (kWh or MMBtu) and demand (kW) savings achieved, the demonstration projects have impacts ranging from reducing pollutants to minimizing the waste stream or lowering production costs. In addition, the goal of the R&D demonstration program is to achieve replications, and direct reporting on the projects receiving NYSERDA support does not provide any information on this critical indicator of the success of the program.

The two phase structure of initial demonstrations designed to generate replications also complicates the attribution of impacts to the program. In the context of mature (non R&D) energy efficiency programs, NYSERDA defines the program impacts as follows:

- Gross savings are the verified change in energy consumption and/or demand that results directly from program-related actions taken by participants in the program, regardless of why they participated.
- Free ridership is the percent of savings attributed to customers who participate in an energy efficiency program but would have installed the same measure(s) on their own if the program had not been available.
- Spillover represents the energy savings associated with energy efficient equipment installed by consumers who were influenced by an energy efficiency program, but without support from the program.
- Net savings are the total savings that can be attributed to the program, accounting for both free riders and spillover.¹

Free ridership and spillover are often estimated as a percentage of the program savings.

While the concept of free ridership translates well from energy efficiency programs to the R&D demonstration projects, estimating spillover for the demonstration projects does not fit as neatly into the structure developed for other types of efficiency programs. From the perspective of energy efficiency program evaluation, there may be a tendency to equate replications with spillover. However, replications are a direct and intended outcome of the funded projects and the savings associated with these activities are likely to be a major component of the direct program impacts. Since replications were not directly tracked by program staff, the impacts of replications were estimated through survey questions that compared the scope of the replication to the scope of the demonstration project.

This evaluation represents an initial effort to estimate impacts for these R&D demonstration projects, including the estimation of net savings. In the process, a wide range of information was collected about the demonstration projects and replications. The remainder of this paper covers the background and context, approach, results, R&D policy implications and recommendations for R&D demonstrations and future evaluations.

Background and Context

This evaluation was complicated by the depth and breadth of the types of activities promoted through NYSERDA's R&D programs. Demonstration projects are one of the several approaches promoted by NYSERDA to support R&D activities in NYS. R&D program activities at the time were organized into seven overarching program areas: energy resources, transportation and power systems, energy and environmental markets, industry, buildings, transmission and distribution, and environmental research. NYSERDA also divided its R&D demonstration projects into three categories: power production, process improvements, and product demonstration. As part of the NYSERDA R&D

¹ These terms may be used differently in the context of some R&D impact assessments.

demonstration program, participants receive a report estimating the potential savings from the demonstration at their sites.

In addition, during the period covered in this evaluation, a centralized program tracking system was not yet fully developed and the types of impacts recorded in the program tracking records were highly specific to the project, ranging from annual kWh saved to labor costs to percent reduction of a pollutant. The R&D market can be volatile, in that companies may go out of business or merge with other firms and many technologies never make it to market. Consequently, it can be difficult to track the progress of R&D efforts and to characterize the program population. As a result of this and other evaluations, NYSERDA built a database to track the outcomes of its research projects and bring together disparate data about its large portfolio of R&D projects that could be used for impact assessment as well as a tool for managing progress of research projects.

In comparison to the methods of evaluation impacts for mature energy efficiency programs, the R&D demonstration program presented numerous challenges and a re-orientation of perspective. A comparison of the characteristics of NYSERDA's R&D demonstration program and its energy efficiency programs is provided in Table 1 below.

Table 1. Comparison of Program and Evaluation Characteristics of Energy Efficiency and R&D Programs

	Non-R&D Energy Efficiency Program	R&D Demonstration Program
Technologies	Tested, known to be effective, readily available	In the process of being tested and some may never make it to market
Types of Impacts	Energy and demand savings (electric, natural gas, fossil fuels)	Energy, demand, waste water reduction, emissions reductions, waste management, productivity, operations and maintenance, cost improvement, product quality and reliability improvement and water quality, etc.
Savings	Savings are tracked by program staff for specific efficiency measures	Some types of projects have savings estimated from project reports; savings from replications were not tracked during the evaluation period
Key Measurement Units	kWh, kW, therms, MMBtu	kWh, kW, therms, MMBtu, gallons of waste water treated, pollutant reduction, labor costs, renewable energy credits, amount of wood saved, energy dollars saved, percent reduction in energy use, quantity of production, etc.
Impact Evaluation Method	Engineering and M&V, billing analysis	Complexity of projects require methods beyond those used for standard efficiency program evaluations; initial effort to estimate savings based on telephone surveys
Trade Allies/Installation Contractors	More mature businesses, a small number of participating businesses may go out of business or change hands	More likely to be in start up mode; businesses merge, change names or go out of business

Approach

The first task in the evaluation process was to set up a framework to estimate and report program savings. Given the wide range of technologies and metrics, the evaluators decided to report impacts by

the broad R&D approach defined by NYSERDA and to attempt to quantify savings for those metrics that were most frequently reported in the program tracking records, which were found to be kWh saved, kW capacity reduction and gallons of waste water treated. Economic impacts, such as determining investment costs and quantifying the monetary impacts of the R&D demonstration projects, were not analyzed as part of this evaluation.

The following paragraphs describe the sample frame, survey development, the estimation of gross savings and determining attribution to the program conducted as part of the impact evaluation of the NYSERDA's R&D demonstration efforts.

Sample Frame and Survey

R&D demonstration impacts were estimated through a telephone interview combined with program records. Program staff identified projects that were still viable. The initial sample frame for this study was a census of 56 projects that had completed demonstrations between 2004 and 2007 and had contact information. Due to the methods used to develop the sample frame, the study results were applied only to the projects in the sample frame.

Since one of the primary goals of the evaluation was to identify the impact of replications, the most recent demonstration projects were not included (those completing in the last two years). Projects older than six years were also not included given prior evaluation work found little information could be obtained from surveys of projects this old. There was an extensive effort to minimize non-response bias by contacting and completing surveys for as many of the 56 projects as possible. This process yielded completed surveys for 43 projects, a response rate of 77%.

The objectives of the survey instrument are described below:

- identify and estimate the various types of impacts observed by program participants resulting from the demonstration projects
- identify and obtain participant estimates of the replication impacts that resulted from the NYSERDA-supported demonstrations
- determine the reasons for, and number of, replications from the NYSERDA-supported demonstrations and the associated NYSERDA attribution
- assess the factors that create barriers to demonstration projects and the replications impacts
- estimate net effects for demonstration and replication projects

A key issue with fielding the survey was identifying the respondent best able to answer questions regarding the impacts of the project and replications from the R&D demonstrations. There were three types of participants in the R&D demonstration projects: 1) integrators, 2) vendors, and 3) site owners or contractors. As is consistent with the R&D program design, projects could be designed and proposed by any one of these three market actors. This approach resulted in a situation where some projects had integrators but the vendor was not identified and others might have no integrator but be led by a vendor or a site owner.

Only one of these three types of participant was solicited for each project and the interviewees were prioritized by their likelihood of having the most information on replications. In general, integrators are likely to have the greatest potential for in-depth knowledge of replications, as they brought together market actors in order to create the demonstration. Vendors were targeted as the next knowledgeable about the market and the occurrence of replications. Thus, the first attempt was to contact the integrator, followed by the vendor. The lowest priority was given to interviewing the site owners or contractors. The evaluation team created three survey instruments to ensure that the wording of the questions was appropriate for each set of respondents, i.e., integrators, vendors and site owners/contractors. These three survey instruments were designed to allow the responses to be compiled and analyzed together.

Estimation of Gross Savings

Gross savings from the demonstration projects were estimated by asking survey respondents to compare the actual achieved savings to the program reported savings. If the respondent indicated the actual savings were higher or lower than the values recorded by the program, the respondent was asked to provide an updated estimate of the actual savings.² Savings from replications were benchmarked to the savings for the original demonstration projects, *i.e.*, respondents were asked to estimate the savings from the replications in comparison to the savings from the demonstration project.

This approach is likely to underestimate the actual program savings for two reasons, as described below.

1. Savings are based on combining program data with survey responses, and for many diverse projects, the program data contained estimated savings for only one metric (such as energy or installed capacity or another site-specific indicator)
2. Survey responses were collected for 43 of the 56 projects completed within the time frame and another seven (7) projects were outside of the time frame (and sample frame) for the survey. The savings estimated provided included only the results for the 43 projects.

Since the projects are so diverse, it was not possible to extrapolate from the survey data to the wider population.

Attribution of Savings to the Program

To estimate net savings attributable to the program, free ridership and spillover needed to be redefined in the context of NYSERDA's R&D demonstration projects. The definitions are provided below, followed by a table comparing definition of net savings for the R&D demonstration program to the definition used for more mature, energy efficiency programs.

- Free riders are demonstration projects that would have occurred without any assistance from the NYSERDA program.
- Free riders among replication projects are those that would have occurred without the NYSERDA-induced demonstration project

Table 2. Comparison of Net Savings from Energy Efficiency and R&D Demonstration Programs

Net Component	Non-R&D Energy Efficiency Program	R&D Demonstration Program
Free Ridership	Savings associated with measures installed by participants who would have taken the same action in the absence of the NYSERDA program	Demonstration projects or replications that would have occurred in the absence of the NYSERDA program
Spillover	Savings associated with measures installed by participants or non-participants outside of the program but due to program influence	Not applicable for demonstrations as replications are a direct result of the program

A modified battery of questions, consistent with impact evaluations of other NYSERDA programs to the extent possible, was administered to estimate net affects. Respondents were asked to assess NYSERDA's influence on the original demonstration and the replications. The magnitude of savings from the replications was benchmarked to the known savings for the original demonstration projects. Survey respondents were asked to assess whether the savings from the replication were greater

² The savings tracked in the program database were based on projects reports. Actual implementation of the project may have been different than initially planned, and thus, estimates of actual savings may vary from the program records.

than, the same or less than the savings from the demonstration project, and then to estimate the percentage increase (or decrease) in savings.

Results

An initial part of the analysis was to assess the range of types of R&D demonstration projects reflected in the completed surveys. A summary of these are described below.

- 40% of the surveyed projects were product demonstration, 37% process improvement demonstrations and 23% were demonstrations of power production.
- Energy savings were the most common type of impact, as 33% of the demonstration projects reported energy savings, followed by power production at 23%.
- Types of impacts beyond these two major categories covered a wide range, including environmental quality, waste management, productivity, operations and maintenance (O&M), cost improvement, product quality/reliability improvement and water quality.
- Savings were quantified for the vast majority (89%) of projects with energy (kWh), installed capacity (kW) or waste treatment (gallons of waste) impacts.

Thirty-five percent of projects did not have savings in any of these three categories, and the savings for these projects cannot be easily aggregated.

Since R&D efforts are often trial and error, the survey included a question to ascertain whether the demonstration projects themselves were considered to be successful by the individuals who planned and implemented the projects. Survey respondents were requested to rate the success of the demonstration project supported by the NYSERDA R&D program on a scale from zero to five where zero was not successful and five was very successful.³ Eighty-five percent of respondents rated the project at four or above, indicating that the self reported success rate was quite high.

The remainder of this section covers barriers to R&D demonstrations, gross savings from the demonstrations, replications and sales, impacts from replications, net savings and integration of results.

Barriers and Demonstrations Prior to the NYSERDA-Supported Project

Respondents were also asked about the challenges they faced as they implemented the demonstration project to provide additional insight to program staff regarding the barriers to conducting demonstration projects and replications. This question elicited the following responses:

- 42% of respondents identified technological barriers
- 33% found regulatory barriers
- 21% had problems with lack of funding or reported that the technology or application was cost prohibitive

The initial set of questions covered familiarity with demonstrating the specific technology and a comparison of prior demonstration projects of the same technology (if any) to the NYSERDA-supported project. For the majority (63%) of respondents, the NYSERDA project was the first demonstration project for the technology. Sixteen (16) of the forty-three (43) surveyed projects (37%) involved the demonstration of a technology that had been the subject of a prior demonstration project. Out of the 14 projects with prior demonstrations and complete responses, half were demonstrated once or twice prior to the NYSERDA project and about 20% had been demonstrated many times (ten times or more).

³ Survey respondents were allowed to define "success" from their own perspective.

Gross Savings from the Demonstration Projects

Where sufficient data existed, savings were aggregated for energy (MWh/year), installed capacity (kW) and waste treatment (gallons of waste treated). In most cases, the program reported savings for each project included either energy or installed capacity savings, but not both.

In aggregate, the demonstration projects achieved net impacts of 152,656 MWh saved and 1,357 kW of installed capacity, and an additional 36,031 million gallons of waste were treated. Examples of other gross impacts achieved include the following:

- a transportation project was estimated to save 2,142 gallons of oil annually
- an estimated \$223,829 in annual energy savings was associated with water recycling at a paperboard recycling plant
- a wash water recycling system saved \$40,000 in labor cost each year
- a hydropower project generated 10,255 renewable energy credits
- a vegetable oil producer got production costs down to \$3.46 per gallon to \$2.49 per gallon
- a carbide producer that saved 4,880 board feet of tropical hardwood since 2005

One of the challenges with this evaluation is that impacts could not be estimated for all projects in a way that could be compared or aggregated. For example, some projects involved technologies designed to reduce energy savings, but there was no estimate of the energy savings. Respondents were asked to fill in missing estimates, but not all were able to do so. Thus, savings could only be estimated for projects with sufficient information. Table 3 provides a clearer picture of this issue.

Table 3. Gross Impacts by Project Type

Project Type	Power Production Demonstration	Demonstration of Process Improvements	Product Demonstration	Total
Total Number of Projects	10	16	17	43
Projects with Energy Savings	9	7	7	23
Projects with Estimated Energy Savings	9	5	6	20
Gross Estimated Energy Savings (MWh/year)	12,116	178,097	250	190,463
Projects with Installed Capacity	4	1	5	10
Projects with Estimated Installed Capacity	3	0	4	7
Total Gross Installed Capacity (kW)	117	0	1,576	1,693

In addition, there were five waste treatment projects and four of the five had estimated waste treatment impacts.

Replications and Sales

The survey respondents reported that replications are common among the demonstration projects, as explained below.

- Of the 43 respondents, 32 (74%) reported that they have replicated the technology or process used in the NYSERDA demonstration project.
- A large majority (29 or 67%) replicated the technology in a similar market or for a similar application and 10 respondents (24%) reported replicating the technology or process in a different market or application.
- 21 respondents (49%) reported replicating the technology or process in New York State, suggesting that the NYSERDA program is achieving impacts both inside and outside the state.

Integrators and site owners provided a range of reasons for being able to replicate the NYSERDA project in New York State. Available financing and the success of the demonstration combined account for almost half of the responses. Two of the respondents directly mentioned NYSERDA's involvement, with one mentioning the incentives and the other the importance of the NYSERDA report. Table 4 shows the reasons given for proceeding with replications.

Table 4. Reasons for Replications

Reasons for Replications	Number of Projects (n=18)	Percent of Projects	Adjusted Percent of Projects
Financing Available	4	22%	27%
Success of Demonstration	3	17%	20%
Technical Experience Gained	2	11%	13%
Willing Participants	2	11%	13%
Other	4	22%	27%
No Answer	3	17%	--
Total ¹	18		

¹ These responses reflect the 18 integrator and site owner surveys with replications in New York State. This question was not included in the vendor surveys, which account for the remaining three projects with replications.

Almost half of the firms (45%) reported using NYSERDA funding to achieve project replications, with a smaller number (19%) relying on technical assistance from NYSERDA.⁴ These responses suggest that involvement by NYSERDA was also a key component for many of the replications. The survey did not inquire about the details of NYSERDA program participation for the replications, which may be a useful line of inquiry in future evaluations. Other non-NYSERDA sources of assistance were provided by federal grants and/or subsidies, other state agencies, utility companies, private corporations, and building owners.

Impacts from replications were approximated by benchmarking the scope of the replications to the original demonstration projects. A series of questions was asked to determine whether the scope of the replication was smaller, the same, larger than, or not comparable to the original NYSERDA demonstration projects. Of the 21 projects with replications in New York State, sixteen (76%) were able

⁴ Of the 18 surveys with integrators and site owners who reported replications in New York State, 16 provided information regarding NYSERDA funding and technical assistance. Seven reported using NYSERDA funding for replications and three stated that they benefited from NYSERDA's technical assistance.

to provide an indication of how the replications compared to the original NYSERDA demonstration project. As shown in Table 6 below, 63% responded that the replication was the same or larger in scope as the original NYSERDA demonstration projects and 25% indicated that the replication(s) were not comparable. Notes from the projects that were identified as not comparable to the NYSERDA demonstration projects indicated that there were still substantial similarities in the types of savings that would be expected.

Table 5. Scope of Replications in Comparison to NYSERDA Demonstration Project

Scope of Replications	Number of Projects (n=21)	Percent of Projects	Adjusted Percent of Projects
Smaller than NYSERDA demonstration	2	10%	13%
Same as NYSERDA demonstration	7	33%	44%
Larger than NYSERDA demonstration	3	14%	19%
Not Comparable to NYSERDA demonstration	4	19%	25%
Don't Know/No Answer	5	24%	--

Vendors were seen as more likely to be knowledgeable about demonstration projects that went to commercialization and had sales, whereas integrators may have more information about individual replications. To address this issue, the survey instrument to vendors was modified to inquire about sales versus replications. However, less than one-third of the survey projects had vendors associated with them.

Given interviews with vendors were second in priority to integrators, a total of five interviews with vendors were conducted. The results of the vendor surveys show that the projects with subsequent sales had substantially larger impacts in comparison to the reported replications from the integrator surveys, suggesting that acquiring information from the vendors provides a more complete picture of the impacts associated with replications. With this in mind, impacts from replications are reported excluding and including sales reported by vendors.

Impacts from Replications

Savings were aggregated for the replication projects based on the savings from the demonstration projects and the assumption that the replications were generally of the same scope as the demonstration projects for MWh, kW and gallons of waste reduction. This approach is supported by the results of the analysis discussed earlier and shown in Table 4 above.

The replication projects achieved gross savings of 96,527 MWh per year and 10,999 kW. Table 6 provides detail on number of projects by demonstration project type (power production, process improvement and product demonstration) that had replications, the number of replications excluding vendor estimates, the number with vendor sales, the gross impacts with and without vendor estimates, and the total gross replication impacts. These impacts include the savings from replications that received NYSERDA funding.

Table 6. Replication Impacts by Project Type

Project Type	Power Production	Process Improvements	Product Demonstration	Total
Total Number of Projects	10	16	17	43
Projects with Replications	8	8	5	21
Projects with Replications and Energy Savings	7	3	2	12
Number of Replications Excluding Vendor Estimates	51	19	14	84
Number of Replications with Vendor Estimates	84	19	44	147
Gross Savings from Replications Excluding Vendor Estimates (MWh/year)	49,586	58,164	0	107,750
Gross Savings from Replications with Vendor Estimates (MWh/year)	58,426	58,164	5,180	121,770
Projects with Replications and Installed Capacity	3	0	3	6
Number of Replications Excluding Vendor Estimates	31	5	2	38
Number of Replications with Vendor Estimates	56	5	32	93
Gross Installed Capacity from Replications Excluding Vendor Estimates (kW)	51	0	3,000	3,051
Gross Installed Capacity from Replications with Vendor Estimates (kW)	10,051	0	3,825	13,876

Integration of Results

The survey was used to estimate net savings. The free ridership rate was found to be 20% for demonstration projects and 21% for replications, indicating that about 80% of the gross impacts are expected to be due to the NYSERDA R&D effort. Combining the impacts of the demonstration projects with the replications produces the following results:

- net savings from demonstration projects are 152,656 MWh per year, and the replications produced an additional 96,527 MWh per year (including vendor sales), for total net savings of 249,183 net annual MWh
- the kW impacts from the demonstration came to 1,380 net kW, and the replications account for 10,999 net kW including vendor sales; approximately 8,000 net kW are associated with the vendor sales from a single demonstration project

Thus, the replications increased net program energy savings by about 62%. Estimates of installed capacity were increased by approximately eight times (800%), largely due to the high level of sales associated with one demonstration project.

Table 7. Replication Impacts by Project Type

	Estimated Net Impacts by Project Type			Total Estimated Net Impacts
	Power Production Demonstrations	Demonstrations of Process Improvement	Product Demonstration	
Program Net Savings (MWh)	9,711	142,744	200	152,655
Replication Net Savings (MWh)	46,314	46,107	4,106	96,527
Total Net MWh Savings	56,025	188,851	4,306	249,182
Program Net Installed Capacity (kW)	94	0	1,263	1,357
Replication Net Installed Capacity (kW)	7,967	0	3,032	10,999
Total Net kW Installed Capacity	8,061	0	4,295	12,356
Total Net Waste Water Savings (gallons)	509	35,522	0	36,031

Based on the surveys of integrators and site owners, almost half of the firms (45%) reported using NYSERDA funding to achieve project replications, with a smaller number (19%) relying on technical assistance from NYSERDA. These responses suggest that involvement by NYSERDA was a key component for many of the replications. Vendors were unable to provide this information as the survey was focused primarily on sales and the vendors would not be expected to know whether individuals were using NYSERDA funds to purchase the equipment.

R&D Policy Implications

One of the key differences between an R&D demonstration and energy efficiency program is the scope of the impacts. In energy efficiency programs, specific measures are typically installed in known locations; efficiency upgrades outside of these known installations are classified as spillover and alternative strategies are developed to estimate these net effects. In contrast, the R&D demonstration program is designed to encourage replications by supporting a variety of types of demonstration projects. While the effects of the replications are not directly tracked by the program staff, these impacts are an integral part of the program design.

As NYSERDA invests in the demonstration project and the results of this evaluation show that potential magnitude of the impacts of successful replications can be substantial, the cost-effectiveness of NYSERDA's R&D investments can be strongly influenced by the level and success of R&D demonstration efforts. While some projects may not generate any replications, a small number of projects may result in wide spread replications with substantial savings. Thus, only a handful of projects may fully justify NYSERDA's investment in the R&D program.

This situation highlights the need to develop more comprehensive methods to measure impacts from R&D demonstration projects and to continue to evaluate impacts from both demonstration and replication projects. Due to the nature of R&D projects, there is likely to be high level of attrition and many projects will not make it past the demonstration stage. Without a full accounting of the replication savings, the potential benefits of the R&D demonstrations will be substantially underestimated.

Recommendations for Demonstration Efforts and Future Evaluations

This initial impact evaluation provided a strong base for ongoing evaluation of the R&D demonstration projects. Recommendations for future evaluations are summarized below.

- Given that the replication impacts of the R&D efforts are likely to occur over a long period, continuing to field demonstration surveys on a periodic basis, such as every two or three years, would provide key information for estimating savings on an ongoing basis.
- Interviewing both integrators and vendors for the same projects would provide a more complete picture of the impacts of the demonstration projects; this approach may allow for separate estimates of the impacts of replications and additional sales of the technology, although care will need to be taken to assess the potential for overlap between the two sources of information.
- Prior to claiming savings for replications through the R&D demonstration efforts, further research on the potential overlap between R&D demonstration replications and projects claimed in other R&D or efficiency programs should be conducted to ensure that savings are not double-counted.
- Future evaluations should be designed to measure both savings and investments costs from both the demonstrations and replications to allow for economic analysis of benefits and costs.

In addition, comments from survey respondents suggest that some had difficulty in understanding the terminology within the context of their demonstration projects, particularly the definition of "replication." Future surveys should include a comprehensive review of the types of projects and consider expanded definitions that would be relevant to a variety of project scenarios, making it easier for respondents to answer the questions with greater reliability.

This evaluation identified the need for more standardized definitions of demonstration impacts and improved tracking of demonstration projects, which directly influenced the design of the database in an effort to continue to explore the full impacts of demonstration programs. The foremost benefit derived from the creation of this database is the system's ability to quickly and accurately report out detailed metrics regarding the efforts of R&D projects.

This study lays a firm foundation for future evaluation efforts and addressing these issues should improve the reliability of the estimated impacts in the next round of evaluation.

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