R&D Demonstration Survey Round 2:

Projects Completed from 2008-2010

Final Report

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EXECUTIVE SUMMARY

ES.1 OVERVIEW AND PURPOSE

The New York State Energy Research and Development Authority's (NYSERDA) Research & Development (R&D) Program employs a variety of approaches designed to advance the development and market acceptance of innovative, efficient, and clean energy technologies. R&D demonstration projects are one of NYSERDA's best-established strategies for promoting these goals. 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, including advanced materials, air and waste remediation, building systems, electric power delivery, energy storage, industrial products, heating and cooling, transportation, waste management, wastewater treatment, and others. 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. Replications may be carried out at the same site or different site as the original demonstration project, as well as by the same firm or a different firm.

This evaluation assesses the impacts of NYSERDA's R&D demonstration portfolio based on projects completed in 2008 - 2010. 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.

ES.2 METHODS

The primary data source for this evaluation was a survey of R&D participants who completed demonstration projects between 2008 and 2010. 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; however, most of the questions in the three surveys were identical or extremely similar. The main

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¹ The evaluation follows a previous study that assessed the results of demonstrations completed in 2004 - 2007. Please refer to NYSERDA's R&D Demonstration Survey Report, prepared by Megdal & Associates, September 2012.

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. Because a primary goal of the evaluation was to identify replications, projects were subjected to two screening criteria: (1) The project demonstrated a technology or process that could conceivably be replicated (i.e., it was not basic research, and the project was not terminated prior to implementation); and (2) the project was completed at least two years ago, giving sufficient lead time for replications. Based on these screening criteria, NYSERDA provided IEc with a sample frame containing 88 demonstration projects that were completed between 2008 and 2010. Two projects had incorrect contact information (and no new contact information was found), another six companies went bankrupt, and another project was later determined not to be a demonstration project; these projects had to be dropped from the sample frame. Therefore, the final sample frame consisted of 79 demonstration projects. The evaluation team attempted to conduct a full census rather than drawing a sample. Of the 79 eligible projects, 61 completed the survey, yielding a response rate of 77%.

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. 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 datasets are not as comprehensive as they could be. The evaluators used the available information as a starting point to collect benefits data. Data obtained prior to conducting the survey were validated with survey respondents.
- **Project Reports.** NYSERDA requires most demonstration participants to submit final reports that describe the demonstration project and the benefits realized by the end of the project. However, these reports do not seem to be archived in a central location, and the evaluators were only able to obtain a limited number of the documents. Reports obtained prior to conducting a survey were used as a starting point for the discussion; in addition, 10 reports that were obtained for non-surveyed projects contained useable benefits data. The evaluators incorporated these data in the analysis of demonstration benefits.
- Research Project Updates (RPUs). The RPUs describe the status of NYSERDA's R&D demonstration projects, and in some cases, information about actual or expected benefits. The evaluators reviewed the RPUs prior to conducting each survey and drew on relevant information.

² In total, NYSERDA supported 124 R&D demonstrations that closed in 2008-2010. Of these 124 projects, 36 projects did not meet the screening criteria, leaving 88 projects in the initial sample frame.

³ The R&D Metrics Database does not include the project completion date; therefore, the contract closed date was used as a proxy. This is consistent with the methodology from the previous survey. In some cases, project activities ended well before the contract was closed.

⁴ Of the 18 non-completions, five PIs refused, four were unresponsive, and nine were no longer with the same firm and could not be reached. Excluding the nine PIs in the latter category from the sample frame would increase the response rate to 87%.

⁵ On-site power production projects are not typically required to submit a final report.

ES.3 DEMONSTRATION IMPACTS AND NYSERDA CONTRIBUTION

The initial section of the survey sought information about the characteristics of demonstration projects, prior experience with demonstrations before NYSERDA, and the benefits and challenges associated with planning and executing demonstrations. Key findings include the following:

- Out of 61 respondents, 28 projects were product demonstrations (46%), 18 were on-site power production (29%), and 15 were on-site process improvement projects (25%).
- A solid majority of respondents (73%) stated that the NYSERDA project was their first time demonstrating the technology. Of the 16 projects that had demonstrated the same technology before, most were demonstrated once or twice prior to the NYSERDA project.
- Since R&D efforts involve new and previously untested technologies, the survey included a question about whether projects accomplished their objectives. Ninety percent (90%) of respondents stated that the demonstration projects met "all" or "most" of their objectives, with over half of all projects meeting all of their objectives.
- Benefits from planning and executing the projects included (among others): knowledge about a different technology or process; experience working with manufacturers, regulators, and market actors; contacts with the local community and potential business partners; and enhanced reputation. The most common challenges included: cost, lack of interest among potential end users, and difficulty finding an appropriate site for the demonstration.

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, overall and by project type.

Table ES-1. Direct Benefits by Project Type

	Number of		By Project Type			
Benefit Type	Projects (n = 61)*	Percent	On-site Power Production	On-site Process Improvement	Product Demonstration	
Knowledge Creation	38	62%	12	11	15	
Energy Efficiency	34	56%	8	10	16	
Demand Reduction	30	49%	14	5	11	
Environmental Quality Improvement	28	46%	10	6	12	
Power Production	23	38%	15	1	7	
Marketability	23	38%	6	6	11	
Product Quality/Reliability Improvement	21	34%	5	8	8	
Productivity	20	33%	3	10	7	
Air Emissions	19	31%	9	4	6	
Operations & Maintenance	18	30%	3	6	9	
Waste Management	15	25%	6	6	3	
Reduced Material Costs	11	18%	3	5	3	
Reduced Labor Costs	10	16%	1	5	4	
Water Quality	9	15%	1	1	7	
Water Reductions	7	11%	2	2	3	
Other	18	30%	3	2	13	

Notes: (*) Multiple responses were allowed. Percentages were calculated out of the 61 projects.

As shown in the previous table, 30% of respondents identified "other" benefits. Other benefits were very wide-ranging and included the following (among others): improved safety; increased tax base for the town; end-user behavioral changes; public health; media visibility; and a favorable regulatory ruling.

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 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. In addition, the limited number of project reports found online was used to supplement the survey data.

Based on the responses, benefits were quantified using three metrics: installed capacity (kW), energy savings (MWh/year), and fuel savings (therms/year). Respondents were asked an additional series of questions to ascertain NYSERDA's contribution to the reported impacts. 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.

Tables ES-2 – ES-4 present the results of this analysis. The tables show the projects that reported quantitative impact data, such as annual MWh of energy savings. It is possible that additional projects beyond those shown in the tables had impacts, but did not have data to quantify their benefits.

Table ES-2. Summary of NYSERDA Contribution to Energy Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Energy Savings*	Energy Savings of Surveyed Projects (MWh/ Year)	Number of Non-Surveyed Projects with Estimated Energy Savings	Energy Savings of Non-Surveyed Projects (MWh/ Year)	Total Energy Savings (MWh/ Year)	NYSERDA Contribution (MWh/ Year)
On-site Power Production	18	7	21,098	0	0	21,098	17,062
On-site Process Improvement	15	1	685	1	3	688	88
Product Demonstration	28	4	400	1	5,800	6,200	4,688
Total	61	12	22,183	2	5,803	27,986	21,838

Note: (*) This table shows the projects that reported quantitative impact data (MWh/year).

Table ES-3. Summary of NYSERDA Contribution to Installed Capacity

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Installed Capacity*	Installed Capacity of Surveyed Projects (kW)	Number of Non-Surveyed Projects with Estimated Installed Capacity	Installed Capacity of Non- Surveyed Projects (kW)	Total Installed Capacity (kW)	NYSERDA Contribution (kW)
On-site Power Production	18	6	4,568	0	0	4,568	3,988
On-site Process Improvement	15	1	100	0	0	100	75
Product Demonstration	28	1	2	1	715	717	538
Total	61	8	4,670	1	715	5,385	4,601

Note: (*) This table shows the projects that reported quantitative impact data (installed kW).

Table ES-4. Summary of NYSERDA Contribution to Fuel Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Fuel Savings*	Fuel Savings of Surveyed Projects (Therms/ Year)	Number of Non- Surveyed Projects with Estimated Fuel Savings	Fuel Savings of Non- Surveyed Projects (Therms/ Year)	Total Annual Fuel Savings (Therms/ Year)	NYSERDA Contribution (Therms/ Year)
On-site Power Production	18	0	0	0	0	0	0
On-site Process Improvement	15	2	41,600	2	30,582	72,182	44,137
Product Demonstration	28	3	17,204	0	0	17,204	13,729
Total	61	5	58,804	2	30,582	89,386	57,866

Note: (*) This table shows the projects that reported quantitative impact data (therms/year).

The study also evaluated revenues and cost savings that the demonstration projects achieved through 2013. As shown in Table ES-5, 10 surveyed projects and one non-surveyed project quantified the revenues associated with the demonstration project, with total revenues exceeding \$1.2 billion. This impressive figure is mostly due to a single project that reported \$1.2 billion in sales that the respondent attributed to the demonstration project. This type of result is typical for R&D portfolios, where one or two very successful projects often account for the majority of the portfolio's benefits. As shown in Table ES-6, 25 surveyed projects and seven non-surveyed projects quantified the cost savings associated with the demonstrations. Total cost savings were estimated at \$38.2 million.

Table ES-5. Summary of NYSERDA Contribution to Demonstration Revenues

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Revenue	Total Revenue of Surveyed Projects	Number of Non- Surveyed Projects with Estimated Revenue	Total Revenue of Non- Surveyed Projects	Total Revenue	NYSERDA Contribution
On-site Power Production	18	5	\$5,742,841	0	\$0	\$5,742,841	\$3,194,233
On-site Process Improvement	15	2	\$1,200,090,000	1	\$120,000	\$1,200,210,000	\$1,050,180,000
Product Demonstration	28	3	\$15,260,000	0	\$0	\$15,260,000	\$9,590,000
Total	61	10	\$1,221,092,841	1	\$120,000	\$1,221,212,841	\$1,062,964,233

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⁶ Given the magnitude of the reported revenue for this one firm, the evaluators validated the figure by: (1) following up directly with the respondent after the initial survey to ensure that the respondent had understood the question and answered it correctly; and (2) cross-checking the survey data with the information contained in the final project report.

Table ES-6. Summary of NYSERDA Contribution to Demonstration Cost Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Surveyed Projects	Number of Non-Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Non- Surveyed Projects	Total Cost Savings	NYSERDA Contribution
On-site Power Production	18	9	\$14,680,938	1	\$2,000,000	\$16,680,938	\$11,748,933
On-site Process Improvement	15	6	\$13,857,392	4	\$2,046,229	\$15,903,621	\$8,514,463
Product Demonstration	28	10	\$5,332,558	2	\$325,700	\$5,658,258	\$3,545,264
Total	61	25	\$33,870,888	7	\$4,371,929	\$38,242,817	\$23,808,660

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:

- Of the 61 respondents, 40 projects (65%) reported replications of the technology or process used in the NYSERDA demonstration project.
- A majority of respondents (54%) reported replications for similar applications alone or in combination with different applications. Another seven projects (11%) reported replications for different applications only.
- Twenty-eight respondents (46%) reported at least one replication in New York. Thirteen of the 28 reported that NYSERDA provided funding for one or more replications, while the other 15 projects indicated that NYSERDA did not provide any funding.
- Overall, integrators and site owners reported 116 replication projects in New York and vendors reported \$2.4 million in replication sales.
- A majority of respondents characterized the replication impacts as the same or higher compared to the original demonstrations.
- Responses indicate that the original demonstration projects catalyzed and accelerated the development of the replication projects.
- Respondents provided a range of reasons for being able to replicate the NYSERDA project in New York State. Technical expertise and demonstrable savings achieved 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 most commonly cited barrier was absence of other
 companies, institutions, or sites in New York to take advantage of the demonstrated technology,
 followed by cost and unproven technology.

The replication projects generated an estimated 16,704 MWh/year in electricity savings, 4,138 kW installed capacity, and 30,318 therms/year in fuel savings. In addition, the replications generated an estimated \$73.2 million in revenues and \$41.9 million in cost savings.

Combining the demonstration and replication impacts produces the results in Table ES-7.

Table ES-7. Summary of NYSERDA Contribution to Demonstration and Replication Impacts

	Estima			
Benefits Type	Power Production	Process Improvement	Product Demonstration	Total Benefits
Demonstration Installed Capacity (kW)	3,988	75	538	4,601
Replication Installed Capacity (kW)	4,075	63	-	4,138
Total Installed Capacity (kW)	8,063	138	538	8,739
Demonstration Electricity Savings (MWh/year)	17,062	88	4,688	21,838
Replication Electricity Savings (MWh/year)	16,558	-	146	16,704
Total Electricity Savings (MWh/Year)	33,620	88	4,834	38,542
Demonstration Fuel Savings (Therms/Year)	0	44,137	13,729	57,866
Replication Fuel Savings (Therms/Year)	-	1,000	29,318	30,318
Total Fuel Savings (Therms/Year)	0	45,137	43,047	88,184
Demonstration Cost Savings	\$11,748,933	\$8,514,463	\$3,545,264	\$23,808,660
Replication Cost Savings	\$36,160,752	\$5,435,000	\$274,719	\$41,870,471
Total Cost Savings	\$47,909,685	\$13,949,463	\$3,819,983	\$65,679,131
Demonstration Revenue	\$3,194,233	\$1,050,180,000	\$9,590,000	\$1,062,964,233
Replication Revenue	\$12,515,540	\$202,500	\$60,480,000	\$73,198,040
Total Revenue	\$15,709,773	\$1,050,382,500	\$70,070,000	\$1,136,162,273

ES.5 PROCESS EVALUATION RESULTS

Overall satisfaction with NYSERDA's R&D Program was quite high, with 92% of respondents agreeing or strongly agreeing with the statement: "Overall, I am satisfied with my participation in NYSERDA's R&D Program." Respondents also gave very high ratings (greater than 80%) for communications with project participants and qualifications of program staff.

The lowest scores were providing marketing information (36%) and market intelligence (23%) that supports the demonstration process. However, several respondents commented that they do not view it as NYSERDA's role to provide this type of information; therefore, disagreements with these statements do not necessarily imply dissatisfaction with the program.

ES.6 COST EFFECTIVENESS

The study assessed the cost effectiveness of NYSERDA's R&D demonstration portfolio for projects completed in 2008 – 2010. Cost-effectiveness was assessed on three dimensions: (1) revenues generated

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⁷ These values reflect NYSERDA's estimated contribution.

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 (this is a subset of the first metric); and (3) a qualitative assessment of whether participants considered their investments in the demonstrations worthwhile.

Table ES-8 shows the cost-effectiveness figures for combined demonstration and replication benefits. Overall, through 2013, the demonstration and replication projects saved or generated more than \$52 for every dollar that NYSERDA invested in its R&D demonstration portfolio. The revenue figure includes a single project that reported \$1.2 billion in sales. Even after removing this project from the analysis, cost-effectiveness is still positive, with \$6.69 in benefits for every dollar that NYSERDA spent. These figures represent the total cost savings and revenues achieved through 2013; in some cases, these benefits will continue into the future. However, the analysis was not able to account for costs that NYSERDA incurred for some of the replication projects. As such, the cost-effectiveness calculations in Table ES-8 only account for the \$22.7 million that NYSERDA invested in the demonstrations. If NYSERDA's replication costs were included, this would lower the cost-effectiveness figures.

Table ES-8. Cost Effectiveness for Combined Demonstration and Replication Benefits

	•	Cost Effectiveness
Benefit Type	Cost Effectiveness	Adjusted (Outlier Removed)
Demonstration and Replication Cost Savings per NYSERDA \$	\$2.90	\$2.90
Demonstration and Replication Revenues per NYSERDA \$	\$50.09	\$3.80
Demonstration and Replication Dollars (Revenues and Cost Savings) per NYSERDA \$	\$52.98	\$6.69

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 main 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. Therefore, 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-9 and ES-10. 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 U.S. Energy Information Administration (EIA) *Annual Energy Outlook 2013* for the U.S. Middle Atlantic region, which includes New York State. 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 technologies or processes operate for one year, five years, 10 years, or 20 years. The survey did not ask about years of operation; however, NYSERDA's experience has shown that many projects stay online longer than one year, while a 20-year lifetime might be longer than average.

⁸ NYSERDA spent \$22.7 million on 124 R&D demonstration projects that closed in 2008-2010, including surveyed and non-surveyed projects.

⁹ The study was not able to conduct a similar analysis for installed capacity (kW) given the available information. Installed capacity does not represent actual energy generated, but rather the ability to generate energy. Estimating the quantity of energy generated would require detailed information about each industry and each firm beyond the data collected in the survey,

¹⁰ The Annual Energy Outlook 2013 report expresses energy prices in 2011 dollars.

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

	Energy Prices					
Lifespan (Years)	Low	High				
1	\$3,085,079	\$3,977,218	\$3,969,997			
5	\$15,341,045	\$18,640,532	\$18,989,436			
10	\$30,996,681	\$37,215,246	\$38,395,173			
20	\$61,751,985	\$74,688,518	\$77,979,418			

Table ES-10. Estimated Fuel Savings from Demonstrations and Replications

	Energy Prices					
Lifespan (Years)	Low Medium High					
1	\$91,911	\$101,175	\$101,175			
5	\$450,535	\$496,131	\$500,795			
10	\$930,576	\$1,023,183	\$1,042,365			
20	\$2,000,873	\$2,195,079	\$2,264,397			

The estimated electricity and fuel savings were summed to derive aggregate savings, and the aggregate savings were divided by NYSERDA's costs to calculate cost effectiveness. As shown in Table ES-11, the benefits of electricity and fuel savings are expected to exceed NYSERDA's investment in the demonstrations under the 10-year and 20-year scenarios ("low," "medium," and "high"). It should 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 may be higher than the figures suggest. It is also important to note that energy cost savings are only a subset of the total cost savings presented in Table ES-8; as shown in that table, total cost savings and revenues exceed NYSERDA's investment in the demonstration projects.

Table ES-11. Cost Effectiveness of Electricity/Fuel Savings from Demonstrations and Replications

	Energy Prices				
Lifespan (Years)	Low	Medium	High		
1	\$0.14	\$0.18	\$0.18		
5	\$0.70	\$0.84	\$0.86		
10	\$1.41	\$1.69	\$1.74		
20	\$2.81	\$3.39	\$3.54		

The study also assessed cost-effectiveness from the firm's perspective. Key findings include the following:

- Out of 61 respondents, 27 (44%) had considered alternative investments to the demonstration project. All but one of these respondents indicated that the demonstration was the best choice relative to the alternatives.
- A very strong majority (89%) indicated that the demonstration project was a good investment.
- A strong majority (79%) indicated that their return on investment was positive, 15% breakeven, and only 6% indicated that their return was negative.

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

Data limitations pose challenges for evaluating NYSERDA's R&D demonstration projects. Several projects were missing contact information or had either outdated or incorrect information. In other cases, the company contact was correct, but the Principal Investigator had moved on and could not be located. In addition, many respondents had difficulty recalling the benefits of projects that ended two or more years ago. The NYSERDA R&D Metrics Database does not currently include comprehensive benefits data, although this is expected to change over time. Final project reports are another potential source of benefits data, but they do not appear to be archived in a central location, and are difficult to retrieve.

ES.7 RECOMMENDATIONS

NYSERDA has committed to repeating the R&D demonstration survey at regular intervals to ensure the existence of a regularly updated, comparable set of information about NYSERDA's demonstration projects and associated replications. This survey and the previous round provided valuable information that can guide future survey efforts. Recommendations include the following:

Fully leverage information in the R&D Metrics Database and Final Project Reports. The R&D Metrics Database was created in 2009. It did not exist when the first survey was conducted, and it was not fully populated for the second (current) survey. Assuming these issues are addressed for future rounds, NYSERDA may be able to obtain benefits data for most or all projects before conducting the survey. The survey would then focus on validating the benefits data and obtaining information about replication projects. NYSERDA is currently planning for an evaluability assessment that would leverage and build on NYSERDA's previous database-building efforts, explore and categorize data from prior evaluations, and offer constructive input on issues that NYSERDA is still considering.

Interview all three types of participants for each demonstration project. Each NYSERDA demonstration project typically involves three categories of participants: 1) integrators who bring together market actors and "package" the project; 2) vendors who supply the technology, product, or process; and 3) site owners. The first two surveys interviewed a single type of respondent for each demonstration site – e.g., integrator, vendor, or site owner. Depending on available time and resources, NYSERDA may be able to survey all three types of participants for every site in future rounds. This would provide more comprehensive information about the benefits of NYSERDA's demonstrations.

Re-survey demonstration projects from prior rounds. The first two surveys focused on two distinct populations: projects completed in 2004-2007, and projects completed in 2008-2010. NYSERDA could consider re-surveying projects from 2004-2010, to learn whether demonstration benefits persisted and whether there have been any additional installations or sales of the demonstrated technology.

Clarify the definition of replication and track NYSERDA's replication costs. The first two R&D surveys defined replication projects broadly, and included replications with and without NYSERDA funding. However, NYSERDA is considering whether NYSERDA-funded replication projects should be "counted" as market replications. Going forward, NYSERDA should make a determination as to whether NYSERDA-funded replications will or will not be "counted" for the survey. If NYSERDA continues to include these projects, it should track the costs of each NYSERDA-funded replication in a way that can be traced back to the original demonstration. It would also be desirable to know whether these replications received funding from NYSERDA's R&D Program or NYSERDA's deployment programs. This information would provide a more comprehensive understanding of the demonstration-replication process and would allow for a more comprehensive assessment of NYSERDA's cost effectiveness.

Survey the replication sites. The first two rounds only surveyed demonstration participants, and asked if they were aware of any replication projects. Some respondents were unsure about the number of replications; others were unsure what specific benefits the replications had produced. Using a "snowball" survey technique, NYSERDA could ask demonstration respondents for "leads" at replication sites and follow up directly with the replicators. This would help verify the number of replications, quantify the

replication benefits, and understand the causal link between NYSERDA's demonstration projects and subsequent replications. In addition, the survey data could potentially be used to track changes in performance (such as installation costs, operating costs, sales volume, and return on investment) from the first replication to the fifth (or higher) replication.

Explore the impacts of knowledge creation. Sixty-two percent (62%) of respondents in the current survey identified knowledge creation as a direct benefit of their project – more than any other benefit category. NYSERDA could further explore the tangible and intangible benefits of knowledge creation in future rounds of the survey. For example, future surveys could ask respondents whether they have applied the knowledge they gained from the demonstration project in future projects or in their ongoing business practices. The survey could also inquire how the knowledge gained from the demonstration projects has affected their operations, productivity, and sales. In addition, if replicators are included in future rounds, the survey could ask whether they applied the knowledge, methods, or lessons from the demonstration projects – thereby tracing the transfer of knowledge from demonstration sites to replication sites – and their resulting changes in performance.

INTRODUCTION

This section begins with the background and purpose of the study. Next, it provides a brief overview of NYSERDA's Research and Development (R&D) Program, and offers definitions for demonstration and replication projects. The section concludes with the outline for the report.

1.1 BACKGROUND

NYSERDA's R&D Program employs a variety of approaches that aim to advance the development of innovative, reliable, efficient, and clean energy technologies, and increase their market acceptance and adoption. R&D demonstration projects 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, including advanced materials, air and waste remediation, building systems, electric power delivery, energy storage, industrial products, heating and cooling, transportation, waste management, wastewater treatment, and others. While demonstration projects often generate benefits in their own right, these projects are designed to achieve additional impacts through successful replications.

In 2012, NYSERDA finalized the first study of its R&D demonstration projects.¹¹ The study was based on a survey and review of project records for projects that were completed between 2004 and 2007. The survey assessed: demonstration impacts, NYSERDA's influence on the demonstrations, replications and sales, demonstration influence on the replications, replication impacts, and participant satisfaction.

The current study updates the R&D demonstration survey with projects that were completed between 2008 and 2010. The survey was conducted on a census of all demonstration projects completed during the study period.

1.2 PURPOSE OF THE STUDY

The study 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.

Audiences for the report's findings include: NYSERDA R&D directors, managers, and program staff, NYSERDA's Board of Directors and Officers, the New York State Department of Public Service, and other stakeholders with an interest in NYSERDA's R&D Program.

¹¹ R&D Demonstration Survey Report, prepared by Megdal & Associates, September 2012.

1.3 OVERVIEW OF NYSERDA R&D PROGRAM

The R&D demonstration projects covered in this report are an important part of NYSERDA's R&D Program and are aligned with the program's overarching goals. As articulated during the Systems Benefits Charge round three (SBC III) – which was in effect when the projects in this evaluation were completed ¹² – overarching goals include the following:

- Improve New York's energy system reliability.
- Reduce the energy cost burden of New Yorkers.
- Mitigate the environmental and health impacts of energy use.
- Create economic opportunity and promote economic well-being. 13

In pursuit of these goals, NYSERDA undertakes demonstration projects in a variety of program areas, organized under two departments. The R&D departments and program areas include the following:

End Use Application & Innovation

- Buildings Research
- Innovation & Business Development
- Manufacturing Technology & On-Site Power

Clean Energy Research & Market Development

- Energy Markets & Power Delivery
- Environment & Energy Resources
- Transportation & Power Systems

Under SBCIII, NYSERDA R&D also supported the Transmission and Distribution program. This is now part of the Energy Markets and Power Delivery program.

1.4 DEFINITION OF DEMONSTRATIONS AND REPLICATIONS

Demonstration projects are designed to test a new technology or a new application of an existing technology in order to accelerate commercialization, scale up production, or increase market adoption of successful technologies. Replication projects are a primary means by which demonstration projects achieve broader market impacts. This report characterizes demonstration and replication projects as follows:

• **Demonstrations** are defined as the demonstration of a new technology or process, or application of an existing technology in a commercial setting. Demonstration projects are designed to showcase the value and effectiveness of the technology or process being demonstrated. Given the breadth of projects across program areas, NYSERDA classifies demonstrations in three crosscutting categories: (1) on-site power production, (2) on-site process improvement, and (3) product demonstration. Demonstration projects can be designed and proposed by three different types of market actors: (1) integrators, (2) site owners, and (3) vendors. 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.

¹² SBCIII covered the period from July 2006 through the end of 2011. In October 2011, the New York Public Service Commission extended the SBC program through the end of 2016. The SBC program is administered by NYSERDA.

¹³ NYSERDA. 2007. *SBC-Funded Research and Development (R&D) Program: Sector-level Program Logic*. Final Report. Prepared by GDS Associates, Inc. September 2007.

• Replications are defined somewhat differently depending on whether the market actor is an integrator, site owner, or vendor. For integrators and site owners, replication projects involve an additional installation or scaling up of the technology or process demonstrated under the NYSERDA-funded project. The replication could be at the same site as the NYSERDA demonstration project or at another site. Replications may be carried out by the same firm or a different firm than the original demonstration project. For vendors, replications are defined as additional sales of the same technology or services that were used in the NYSERDA-funded demonstration project. These additional sales could be to the same buyer that participated in the demonstration project or a different buyer. These definitions were provided to survey respondents to ensure consistency in responses.

1.5 OUTLINE OF REPORT

The remainder of this report presents the methods, findings, and conclusions for the R&D demonstration survey. The report is organized as follows:

- Methods and Analysis (Section 2) describes the survey implementation methodology, response rates, and methods for estimating NYSERDA's contribution to demonstration and replication impacts.
- Overview of NYSERDA Demonstration Projects (Section 3) provides an overview of the types of
 projects covered in the survey, prior experience with demonstration projects, whether the project
 objectives were achieved, and the benefits and challenges of planning and executing the project.
- Demonstration Impacts and NYSERDA's Contribution (Section 4) describes the quantity and distribution of impacts across demonstration projects, and estimates NYSERDA's contribution.
- Replications, Impacts, and Demonstration Influence (Section 5) describes the number and type of replications, their scale relative to the original demonstration projects, their estimated impacts, and the influence of the original demonstrations on the replications.
- Process Evaluation Results (Section 6) discusses participant satisfaction with NYSERDA's R&D Program as collected through process-related survey questions.
- Cost Effectiveness (Section 7) assesses the cost effectiveness of NYSERDA's R&D demonstration portfolio and summarizes participant feedback on the value of their investment.
- Conclusions and Recommendations (Section 8) presents overall conclusions and recommendations for future R&D demonstration surveys.

METHODS AND ANALYSIS

This section discusses the survey design process, sampling method, and framework for assessing NYSERDA's contribution to demonstration and replication projects.

2.1 SURVEY DESIGN AND IMPLEMENTATION

The R&D demonstration survey instrument, developed by IEc with input from NYSERDA evaluation and R&D staff, was designed to collect information about the benefits of demonstration projects, replications, NYSERDA's role, and satisfaction with NYSERDA's R&D program. The current instrument builds on the previous survey, but incorporates several refinements based on guidance from NYSERDA. Differences between the previous and current survey include the following:

- Simplified language and sentence structure and "unpacked" compound questions into separate questions.
- Changed questions that asked for estimates of "lower bound," "upper bound," and "best estimate" percentages, to a simpler Likert Scale.
- Clarified the definition of replication, as described in Section 1.
- Added questions for qualitative measures of cost effectiveness.
- Replaced questions about "success" (which can unintentionally "lead" respondents to provide a favorable answer), to ask about the value of the project relative to the firm's other investment options.

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. The database sometimes indicated the PI's role, but in many cases did not. As part of the scheduling process, APPRISE (IEc's survey subcontractor) determined whether the respondent was an integrator, vendor, or site owner to ensure that the appropriate survey instrument was used.

Although there were three separate survey instruments for integrators, vendors, and site owners, most of the questions in the three surveys were identical or extremely similar. The main difference between the surveys was the replication section. Specifically, the integrator and site owner surveys defined replication as *new installations or scaling up* of the demonstrated technology, while the vendor survey defined replication as additional *sales*. Other differences between the survey instruments were minor, and reflected differences in who was taking the survey (for example, the integrator survey asked about the respondent's interactions with vendors and site owners, while the site owner survey asked about interactions with integrators and vendors).

APPRISE pre-tested the survey with five respondents and IEc incorporated suggested revisions into the revised survey instruments. The most substantive change was in the benefits section. Although the previous survey classified benefits as "primary" or "secondary," respondents for the five pre-tests typically responded in terms of "direct" or "indirect" benefits. Therefore, the benefits section was modified to employ the "direct/indirect" distinction.

On November 7, 2013, NYSERDA issued an advance notification to PIs selected to participate in the survey. The letter introduced the evaluation team, specified the project that the survey would focus on, and provided NYSERDA and IEc contact information for the PI to call if he or she had any questions.

Responses to this communication were shared by NYSERDA with the IEc project team to inform the screening and scheduling task.

The screening and scheduling calls began the week of November 11, 2013. Scheduling calls were attempted at least three times per week, at different times of day and on different days of the week. During scheduling, if a contact's voicemail was reached, a message was left. Every effort was made to connect with the original PI when possible, but if the listed PI was no longer available, referrals were followed. Up to 14 scheduling call attempts were made, with an average of five calls made per record during the screening period, which ended on December 23, 2013. While all surveys were scheduled by APPRISE, both IEc and APPRISE staff conducted them. Given the unique circumstances surrounding each demonstration project, the policy analysts who conducted the surveys were given the flexibility to tailor questions as necessary. The length of the surveys ranged from 25 to 90 minutes; the length varied based on the number of distinct benefits that the respondent could knowledgeably discuss, and whether or not the project resulted in replications. Respondents were not incentivized for their participation.

APPRISE developed an Access database to capture and quantify the in-depth survey data. The survey analysts entered their survey data into the database after completing the surveys. Analysts at IEc and APPRISE reviewed the data to ensure their accuracy and consistency. An IEc Associate conducted a thorough secondary review of the data, and an IEc Senior Associate conducted a final data quality check.

2.2 POPULATION AND SURVEY COMPLETIONS

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. Because a primary goal of the evaluation was to identify replications, projects were subjected to two screening criteria: (1) The project demonstrated a technology or process that could conceivably be replicated (i.e., it was not basic research, and the project was not terminated prior to implementation); and (2) the project was completed at least two years ago, giving sufficient lead time for replications. Given the budget and timeline for this study, the survey was limited to projects that were not already surveyed in the previous round.

Based on these screening criteria, ¹⁴ NYSERDA provided IEc with a sample frame containing 88 demonstration projects that were completed between 2008 and 2010. ¹⁵ Two projects had incorrect contact information (and no new contact information was found), another six companies went bankrupt, and another project was later determined not to be a demonstration project; these projects had to be dropped from the sample frame. Therefore, the final sample frame for this study consisted of 79 demonstration projects. The evaluation team attempted to conduct a full census rather than drawing a sample from the 79 eligible projects. The sample was not stratified in any way.

The team made an extensive effort to minimize non-response bias and obtain as many completed surveys as possible, resulting in 61 completed surveys, as shown in Table 2-1. Of the 18 non-completions, five PIs refused, four were unresponsive, and nine were no longer with the same firm and could not be reached. Therefore, the response rate was 77% – the same response rate as for the previous R&D demonstration survey. ¹⁶

¹⁴ Thirty-six projects did not meet the screening criteria and were therefore excluded, leaving 88 projects.

¹⁵ The R&D Metrics Database does not include the project completion date; therefore, the contract closed date was used as a proxy. This is consistent with the methodology from the previous survey. In some cases, project activities ended well before the contract was closed.

¹⁶ Excluding the nine PIs who had left their former firms and could not be reached from the sample frame would increase the response rate to 87%.

Table 2-1. Final Survey Disposition

Status	Count
Starting Number of Projects	88
Out of Sample Frame	9
Company Went Bankrupt, No PI Contact Information	6
Contact Information Was Incorrect, No New PI Contact Information	2
Not a Demonstration Project	1
In Sample Frame	79
Completions	61
Refusals	5
PI Not Responsive	4
PI No Longer with Firm, No Productive Referrals	9
Response Rate (61 completions out of 79 projects in sample frame)	77%
Adjusted Response Rate (61 completions out of 70 projects, excluding the 9 PI no longer with firm/no productive referrals)	87%

2.3 METHOD FOR ESTIMATING DEMONSTRATION PROJECT IMPACTS

While the survey was the primary method for estimating demonstration benefits, the evaluators also consulted NYSERDA's R&D Metrics Database, Research Project Updates (RPUs), and final project reports for the following information:

- Survey. Respondents were asked to report their benefits, or to confirm benefits data from the Metrics Database, RPUs, or project reports. Respondents were asked the year(s) when benefits accrued to determine if benefits persisted after the project ended. While almost all respondents were able to describe their benefits in qualitative terns (e.g., power production, demand reduction, etc.), fewer were able to quantify the benefits. Many respondents stated that the quantifiable benefits were included in their final project reports to NYSERDA (see below), but could not recall the figures given the time that had elapsed since the project ended. Therefore, this evaluation presents the benefits data in two ways, qualitatively and quantitatively. Although the qualitative and quantitative results cannot be aggregated, the qualitative data suggests that total benefits likely exceed what the respondents were able to quantify.
- **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. Since 2009, NYSERDA is 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 87 projects in the survey sample, eight

¹⁷ Qualitative results include respondents who were able to quantify their benefits *and* respondents who were not able to quantify their benefits.

¹⁸ The post-implementation reporting period varies by type of project.

had resource savings (energy, non-energy, or air emissions) captured in the database. ¹⁹ Seven of these eight projects also reported net dollars (revenue generation or cost savings). Nine projects reported jobs created or retained, including five projects that reported resource savings and four projects that did not report resource savings. The evaluators used this information as a starting point, and attempted to verify the figures with survey respondents. Most of these respondents confirmed the accuracy of the figures; however, several of these same respondents reported additional benefits that were not in the R&D Metrics Database.

- Reports. NYSERDA requires most demonstration participants to submit final reports that describe the demonstration project and the benefits realized by the end of the project. However, these reports do not seem to be archived in a central location. NYSERDA indicated that it was not possible to compile all of the reports within the short timeframe allotted for the survey. Therefore, APPRISE searched the Internet for published reports of the demonstration findings. In total, this search found 21 reports online, including 10 for which a survey was completed and 11 for projects where no survey was completed. In addition, the evaluators managed to obtain a limited number of reports prior to conducting the surveys, 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; in addition, 10 of the 11 reports for non-surveyed projects contained useable benefits data. IEc incorporated these data in the analysis of demonstration benefits. This report presents the findings in aggregate and separately for projects with and without a survey.
- **RPUs.** The RPUs describe the status of NYSERDA's R&D demonstration projects, and in some cases, information about actual or expected benefits. The evaluators reviewed the RPUs prior to conducting each survey and drew on relevant information.

2.4 METHOD FOR ESTIMATING REPLICATION PROJECT IMPACTS

A primary goal of the survey was to estimate the number of replication projects and their impacts. Integrators and site owners were asked to provide the number of replication projects; vendors were asked to provide the number and volume of sales. All respondents who reported at least one replication for a similar application in New York were asked how their replication impacts compared to the original demonstration impacts. Because replication projects are often implemented by a different firm than the original demonstration project, quantifying the impacts of replication projects can be quite challenging. Therefore, respondents were asked to consider the size of the replication impacts relative to the original demonstration impacts, which provides an indication of the scale of replication benefits without requiring a precise numeric estimate. Specifically, respondents were asked whether the replication impacts were lower, the same, or higher compared to the original demonstration project.

As shown in Table 2-2, a strong majority of respondents (79% excluding those who answered "Don't Know") stated that the replication benefits were *the same or higher* compared to the benefits of the original demonstration project. Similarly, 74% of respondents (excluding "Don't Know") stated that revenues generated or costs saved from the replications were *the same or higher* compared to the demonstration project. However, almost none of the respondents who reported "higher" replication impacts were not able to estimate *how much* higher the impacts were. Therefore, as a basis for deriving a quantitative estimate of the replication impacts, the evaluators assume that replication benefits are *equal*

¹⁹ An additional four projects had benefits information in the "notes" field.

²⁰ On-site power production projects are not typically required to submit a final report.

to the original demonstration benefits. ²¹ Although this assumption will not hold for every project (and is, overall, a conservative assumption), it provides a lower-bound estimate of replication benefits that can be compared to the cost of NYSERDA's investment. If the benefits estimated under this conservative approach compare favorably with NYSERDA's costs, it increases confidence in the overall cost-effectiveness of the portfolio. Also, this conservative approach for estimating replication impacts is consistent with the method used in the previous survey.

Table 2-2. Comparison of Replication and Demonstration Impacts for Five Most Recent Replication Projects

	Comparison of Resource Savings (kW, MWh, Therms, Etc.) to Original Demonstration					Generation and I Demonstration
	Number	Number Percentage Excluding "Don't Know"		Number	Percentage	Percentage Excluding "Don't Know"
Lower than Original Demo	5	5%	7%	6	7%	9%
The Same Size	18	19%	25%	17	18%	26%
Higher than Original Demo	39	42%	54%	31	34%	48%
Not Comparable	10	11%	14%	11	12%	17%
Don't Know	21	23%		27	29%	
Total	93 100% 100%			92*	100%	100%

Notes: Respondents who reported at least one replication in New York were asked the questions in Table 3.2 for their *five most recent* replications. Because some respondents had more than five replications, the number of responses shown in Table 3-2 (n=93) is less than the total number of replications. (*) One respondent did not answer O54.

2.5 METHOD FOR ESTIMATING NYSERDA'S CONTRIBUTION

An important element in impact assessment is separating impacts to which the program contributed from impacts that would have occurred without the program. The current survey uses a different methodology to accomplish this task than the previous survey. The previous survey calculated a "net-to-gross" ratio for the full set of surveyed projects, subtracting naturally occurring impacts ("free ridership") from the measured impacts. While this method is well-suited for traditional deployment programs, it is less conducive to measuring the impacts of R&D innovation projects. Therefore, NYSERDA requested IEc to develop an alternative methodology for estimating NYSERDA's contribution. This section summarizes the method developed by IEc, as presented in the approved Methods Document.²²

The analysis estimates NYSERDA's contribution based on a composite of five factors, which are in turn based on the respondent's answers to a number of survey questions:

- Novelty: Was this the first time that participants had demonstrated the technology?
 - o Q3. Is this the first time your firm used this technology? If no:
 - Q4. How many times had your firm used this technology prior to the demonstration project?

²¹ For example, if a hypothetical demonstration project installed a 10-kW power production system, and the project was replicated 10 times, replication impacts are estimated as 100 kW.

²² IEc, *R&D Demonstration Project Survey Method*, November 9, 2013.

- Q5. How did the demonstration project differ from previous uses of the technology?
- **Importance:** How important was NYSERDA's assistance in developing the demonstration projects?
 - Q40: On a scale of 0 to 5, where 0 = "not at all important" and 5 = "very important," how important or unimportant was NYSERDA's financial assistance in your decision to do this project?
 - Q41: On a scale of 0 to 5, where 0 = "not at all important" and 5 = "very important," how important or unimportant was NYSERDA's technical assistance in your decision to do this project?²³
- **Likelihood:** What is the likelihood that participants would have carried out the demonstration projects without NYSERDA?
 - O Q42: What is the likelihood that your firm would have completed this project in New York without NYSERDA's financial assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.
 - Q43: What is the likelihood that your firm would have completed this project in New York without NYSERDA's technical assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.²⁴
- **Magnitude:** How did NYSERDA affect the magnitude of the impacts of the demonstration projects?
 - O Q44. Overall, without NYSERDA's involvement, would the magnitude of the impacts for this project have been of the same size, smaller, or larger?
- **Timing:** How did NYSERDA affect the timing of the demonstration projects?
 - Q45. Without NYSERDA's support, would you have carried out this project earlier, at about the same time, or later?

Based on the respondent's answers to the previous questions, the policy analysts who administered the survey calculated NYSERDA's contribution score using the algorithm shown in Table 2-3.

The composite contribution score (Calculation #5 in Table 3-3) 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%). ²⁵

IEc multiplied NYSERDA's contribution score for each project (expressed as a percentage) by the project's reported benefits. ²⁶ This calculation represents the best estimate of NYSERDA's contribution to

²³ This question was only asked for respondents who indicated that NYSERDA provided technical assistance for the demonstration project (Q37).

²⁴ Again, this question was only asked for respondents who indicated that NYSERDA provided technical assistance for the demonstration project.

 $^{^{25}}$ 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%).

²⁶ For example, if a project installed a 100-kW system and had a composite contribution score of 3 (i.e., 50%), NYSERDA's estimated contribution would be 50 kW (equals 50% of 100 kW).

each project. Summing these figures across all projects provides an estimate of NYSERDA's overall contribution. Given the uncertainties inherent in this type of analysis, the results are best interpreted as indicative of the general level and scale of NYSERDA's contribution, rather than a precise quantification of the benefits can be attributed directly to NYSERDA.

Table 2-3. Method for Calculating NYSERDA's Demonstration Contribution Score

Component	Survey Questions	Calculations
Novelty	Q3: Is this the first time your firm used this technology? If no: Q4: How many times had your firm used this technology prior to the demonstration project? Q5: How did the demonstration project differ from previous uses of the technology?	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.
Importance	Q40: 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? Q41: 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?	Calculation #2: Take the <i>higher</i> of the respondent's ratings for the importance of NYSERDA's financial assistance (Q40) and NYSERDA's technical assistance (Q41).
Likelihood	Q42: What is the likelihood that your firm would have completed this project in New York without NYSERDA's financial assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely. Q43: What is the likelihood that your firm would have completed this project in New York without NYSERDA's technical assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.	Calculation #3A: Take the <i>lower</i> of the respondent's ratings for financial assistance (Q42) and technical assistance (Q43). <i>If the firm did not receive technical assistance from NYSERDA, use Q42 only.</i> Calculation #3B: Now, take the inverse (e.g., 0 becomes 5, 1 becomes 4, etc.).
Magnitude	Q44: Overall, without NYSERDA's involvement, would the magnitude of the impacts for this project have been of the same size, smaller, or larger?	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.
Timing	Q45. Without NYSERDA's support, would you have carried out this project earlier, at about the same time, or later?	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.
Demonstration Contribution Score	This is a composite score based on the previous questions. This calculation <i>averages</i> 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).	Calculation #5: Take the <i>average</i> of calculations #2 and #3B, then add Calculations #1, #4A, and #4B to the total.

A similar method was used to estimate NYSERDA's contribution to replication benefits:

• **Importance:** How important was the demonstration project for developing the replication projects?

- O Q58. On a scale of 0 to 5, where 0 = "strongly disagree" and 5 = "strongly agree," to what extent do you agree or disagree with the following statement: "Overall, the NYSERDA-funded demonstration project was critical for getting the replication project(s) developed."
- **Likelihood:** What is the likelihood that the replication projects would have been developed in New York without the demonstration project?
 - O Q60. What is the likelihood that these replication projects would have been developed in New York without the NYSERDA-funded demonstration project? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.
- **Magnitude:** Would the impacts of the replication projects have been smaller without the demonstration projects?
 - O Q61. Without the NYSERDA-funded demonstration project, would the magnitude of the impacts for these replication projects have been of the same size, smaller or larger?
- **Timing:** How did the demonstration project affect the timing of the replication projects?
 - Q62. Without the NYSERDA-funded demonstration project, would the replication projects have occurred sooner, at about the same time, or later?

Table 2-4 shows how the survey analysts calculated NYSERDA's contribution to the replication projects, based on the respondent's answers to the questions above.

Table 2-4. Method for Calculating NYSERDA's Replication Contribution Score

Component	Survey Questions	Calculations
Magnitude	Q61: Without the NYSERDA-funded demonstration project, would the magnitude of the impacts for these replication projects have been of the same size, smaller or larger?	Calculation #6A: If the impacts of the replication project(s) would have been <i>the same or larger</i> without the demonstration project, adjust downward by -1. Otherwise, the adjustment factor is 0.
Timing	Q62. Without the NYSERDA-funded demonstration project, would the replication projects have occurred sooner, at about the same time, or later?	Calculation #6B: If the project would have occurred earlier without NYSERDA, adjust downward by -1. If the project would have occurred at the same time, the adjustment factor is 0. If the project would have occurred later, the adjustment factor is +1.
Likelihood	Q60. What is the likelihood that these replication projects would have been developed in New York without the NYSERDA-funded demonstration project? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely.	Calculation #6C: Take the <i>inverse</i> of Q60.
Importance	Q58. On a scale of 0 to 5, where 0 = "strongly disagree" and 5 = "strongly agree," to what extent do you agree or disagree with the following statement: "Overall, the NYSERDA-funded demonstration project was critical for getting the replication project(s) developed."	Calculation #6D: Take the <i>average</i> of Q58 and Calculation #6C.
Replication Contribution Score	This is a composite score based on the previous questions.	Calculation #7: Add the results of Calculations #6A, #6B, #6D, and #1.

As with the demonstration score, the replication contribution score can range from -3 to +6. IEc converted the score to a percentage using the same method described above for the demonstration projects. For each replication project, IEc multiplied NYSERDA's contribution (in percentage terms) by the estimated benefits of the replication.

2.6 METHOD FOR ESTIMATING COST EFFECTIVENESS

NYSERDA is interested in assessing the cost effectiveness of its R&D demonstration projects. This evaluation assesses cost effectiveness in two ways: quantitatively (from NYSERDA's perspective) and qualitatively (from the firm's perspective). These methods are explained below:

- Quantitative (NYSERDA's perspective): The previous survey was not able to calculate cost effectiveness because the cost data included only a subset of the demonstration projects. For the current round, NYSERDA asked IEc to consider methods for assessing cost effectiveness. To assess cost effectiveness quantitatively, the evaluators worked with NYSERDA to obtain comprehensive cost data for all R&D demonstration projects that were completed in 2008-2010. In total, NYSERDA spent \$22,683,039 on 124 R&D demonstrations that closed in 2008-2010. This figure includes the cost of the projects in the survey sample *and* demonstration projects that were not in the survey sample (e.g., terminated projects²⁷). IEc calculated the following metrics using the cost data and the benefits data described in the previous section:
 - NYSERDA cost per demonstration project revenues, adjusted for NYSERDA's estimated contribution.
 - NYSERDA cost per demonstration project cost savings, adjusted for NYSERDA's estimated contribution.
 - o NYSERDA's cost per demonstration project net dollars; this is the sum of the two previous calculations.
 - All of the above including demonstration benefits and replication benefits. The cost-effectiveness calculation was not able to account for the costs that NYSERDA incurred for NYSERDA replication projects. Therefore, cost effectiveness was calculated separately for replications with and without NYSERDA funding.

In addition, IEc estimated the monetary value of electricity savings and fuel savings from the demonstration and replication projects, and the cost effectiveness of NYSERDA's investment relative to the estimated savings. To reflect different potential scenarios for future energy prices and technology lifespans, the analysis was carried out under a "low," "medium," and "high" scenario. The results of the scenario analysis are presented in Section 7.

- Qualitative (firm's perspective): Ideally, the evaluators would be able to calculate the "fully loaded" cost of the demonstration projects, including NYSERDA's costs and costs incurred by private firms. However, while the survey asked respondents for cost data, these data were not provided in a comprehensive or consistent way. Therefore, it was not possible to quantify firms' contributions to the demonstration projects. This was predictable given firms' general reluctance to share specific cost data with external parties. Therefore, the survey also included qualitative questions designed to assess the respondent's perceptions about cost effectiveness. Four questions were relevant for this analysis:
 - O Q12: At the time the project began, were you considering alternatives to the ["product," "process," "technology," or "type of generation"] that you used in the NYSERDA project?
 - o Q13 (if "yes" to Q12): Looking back, do you think the ["product," "process," "technology," or "type of generation"] that you used in the NYSERDA project was the best alternative?

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²⁷ The cost reflects the money spent on the project (versus the original contracted amount). There are many projects that were terminated and the remaining funds were disencumbered.

- o Q14: Do you feel the [NYSERDA project description] project was a good investment?
- \circ Q15: In general terms, how would you describe your return on this project positive, negative, or breakeven/neutral?

OVERVIEW OF NYSERDA DEMONSTRATION PROJECTS

This section provides an overview of demonstration projects with completed surveys in terms of program area, project type and market actor, prior experience with demonstration projects, and the benefits and challenges associated with planning and executing the projects.

3.1 NYSERDA PROJECT TYPES AND PARTICIPANTS

Figure 3-1 shows the distribution of survey respondents across NYSERDA's R&D program areas. Overall, 72% of respondents had projects in the End Use Application & Innovation Department and the other 28% had projects in the Clean Energy Research & Market Development Department. In terms of specific program areas, Manufacturing Technology & On-site Power was the most common among survey respondents, followed by Buildings Research, Environment & Energy Resources, and Transportation & Power Systems. ²⁸

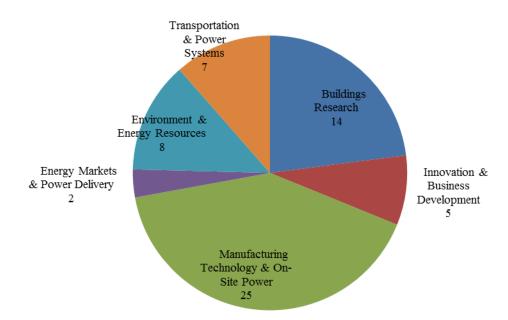


Figure 3-1. Survey Respondents by NYSERDA Program Component (n=61)

Given the breadth of projects across programs, NYSERDA classifies demonstration projects into three distinct categories: on-site power production, on-site process improvement, and product demonstration. NYSERDA defines these categories in the following ways:²⁹

• On-site Power Production: These projects provide incentives for the on-site generation of power. They are intended to buy down the risk of installing clean energy equipment to increase

²⁸ Three of the seven Transportation & Power Systems projects were formerly classified under the now-closed Transmission & Distribution program.

²⁹ Definitions provided by NYSERDA in *Project Types and Groups* (undated file).

- market penetration. Power systems funded in this category include: advanced distributed generation, biomass, combined heat and power, fuel cell, hydropower, photovoltaic, wind, and others.
- On-site Process Improvement: These projects are intended to demonstrate process efficiency at a particular site, typically (but not always) a manufacturing facility. Expected benefits include savings of energy, water, and other resources. There is a subset of process improvement projects where NYSERDA has worked with industry partners to develop new processes for their industries. Examples of process improvement projects include: paper drying by hot pressing, water recycling at a paperboard recycling plant, and improved plastic injection mold base.
- **Product Demonstration:** These projects involve the demonstration of a commercially available product in its intended environment (this does not include on-site power generation projects). The goal is to increase sales and usage of the demonstrated product in the market. Results are used for product commercialization or to generate objective performance information for policymakers or end-users. Products funded in this category encompass a wide range of technologies.

Table 3-1 shows the number and percent of survey respondents associated with each project type. All three project types are well-represented in the survey responses. Of the 61 respondents, 28 projects were product demonstrations, 18 were power production, and 15 were process improvement projects.

Table 3-1. Demonstration Survey Respondents by NYSERDA Project Type

Project Type	Number of Surveyed Projects	Percent of Surveyed Projects	
On-site Power Production	18	29%	
On-site Process Improvement	15	25%	
Product Demonstration	28	46%	
Total	61	100%	

Demonstration projects can be designed and proposed by integrators, vendors, or site owners. For each project, only one of the three actors was solicited for the survey. As shown in Table 3-2, 70% of respondents were integrators, followed by vendors and site owners (15% each).

Table 3-2. Demonstration Survey Respondents by Participant Type

Project Type	Number of Surveyed Projects	Percent of Surveyed Projects	
Integrator	43	70%	
Vendor	9	15%	
Site Owner	9	15%	
Total	61	100%	

3.2 EXPERIENCE WITH DEMONSTRATION PROJECTS PRIOR TO NYSERDA PROJECT

Initial survey questions covered prior experience with demonstrating the technology and a comparison of the prior demonstrations (if any) to the NYSERDA-funded demonstration. As shown in Table 3-3, a solid majority of respondents (44 projects, or 73%) stated that the NYSERDA project was their first time demonstrating the technology. Out of the 16 projects that had demonstrated the same technology before,

most were demonstrated once or twice prior to the NYSERDA project, while two projects had demonstrated the same technology more than a dozen times before.

Table 3-3. Number of Times the Technology was Demonstrated Prior to NYSERDA-Funded Project

Number of Times the Technology was Demonstrated Prior to the NYSERDA-Funded Project	Number of Projects (n=60)*	Percent of Projects
Not At All	44	73%
Technology Was Previously Demonstrated	16	27%
1 or 2 times	6	
3 to 4	1	
5 to 6	3	
7 to 12	0	
More than 12	2	
Don't Know/Did Not Specify How Many Times Previously Demonstrated	4	

Notes (*): One respondent did not answer the questions about prior demonstrations.

Respondents who had previously demonstrated the same technology were asked to provide additional information regarding the differences (if any) between the NYSERDA project and their previous demonstrations. As shown in Table 3-4, only two respondents indicated that their prior demonstrations were basically the same as the NYSERDA demonstration. Half of the respondents who had conducted prior demonstrations stated that the NYSERDA project involved a different application of the technology. Four respondents indicated that the NYSERDA demonstration project was larger in scale or used different inputs than their previous projects. The three "other" responses were as follows:

- One NYSERDA project involved a different method of generating electricity.
- Another NYSERDA project involved testing/quality assurance for an existing product.
- The third project involved new equipment that increased productivity and energy efficiency.

Table 3-4. Scope of NYSERDA Demonstration Project in Comparison to Previous Demonstrations

Response	Number of Projects* (n=16)	Percent
No Difference	2	13%
Smaller in Scale Than Previous Demonstrations	0	0%
Larger in Scale Than Previous Demonstrations	2	13%
Different Inputs	2	13%
Different Application of the Technology	8	50%
Other	3	19%

Notes (*): Multiple responses were allowed. The responses reflect the 16 projects with prior demonstration projects and percentages are calculated based on these 16 projects.

3.3 BENEFITS AND CHALLENGES

R&D efforts involve new and previously untested technologies where success is not assured. Therefore, the survey included a question to ascertain whether the demonstration projects accomplished their objectives. As shown in Table 3-5, 90% of respondents stated that their projects met "all" or "most" of their objectives, with over half of all projects meeting all of their objectives. Only one respondent reported meeting none of the project objectives.

Table 3-5. Extent to Which Demonstration Projects Achieved their Objectives

	Number of Projects (n=61)	Percent
All	33	54%
Most	22	36%
Some	4	7%
None	1	2%
No answer	1	2%
Total	61	100%

Respondents whose projects did *not* meet *all* of their objectives were asked to explain why. Typical answers included variations on the following themes:

- Operating and maintenance costs were higher than expected.
- Expected energy savings or productivity gains were lower than expected.
- Acceptance by the target market was lower than expected.
- The project is still evolving and not all objectives have been accomplished yet.

The survey also investigated the benefits and challenges encountered by respondents in the process of planning and executing their projects. The benefits questions, which were added to the current survey, allowed for open-ended responses. Many respondents cited the new knowledge or experience gained with different technologies, market actors, or regulators as benefits. The range of benefits from planning and executing the projects is broad and includes the following:

- Gained knowledge about a different technology, process, method, or approach.
- Gained valuable experience working with manufacturers, regulators, and market actors.
- Gained technical knowledge from working with experts in the field.
- Research conducted during the planning phase set the stage for a commercial project.
- Established contacts with the community and potential business partners.
- Gained knowledge about the business and the market.
- Enhanced the company's credibility or reputation.
- Learned more about NYSERDA and developed a stronger relationship.

The questions about challenges were close-ended and used similar answer choices as the previous survey. Technological and regulatory barriers were the most common responses at 26% and 20%, respectively, as shown in Table 3-6. Several respondents identified cost (7%), lack of interest among potential end users

(5%), and difficulty finding an appropriate site (5%). Only two respondents identified lack of qualified personnel or expertise, and only one respondent identified lack of funding or timing.

Table 3-6. Challenges in Implementing the NYSERDA Demonstration Project

Challenge	Number of Projects* (n=61)	Percent
Technological barriers	16	26%
Regulatory barriers	12	20%
Cost prohibitive	4	7%
Lack of interest among potential end users	3	5%
Could not find an appropriate site	3	5%
Lack of qualified personnel or expertise	2	3%
Lack of funding	1	2%
Timing was not right	1	2%
Other	15	25%

Notes (*): Multiple responses were allowed. The percentages are calculated based on the 61 projects.

As shown in the previous table, one-fourth of all respondents cited "other" barriers, reflecting the diverse suite of projects in NYSERDA's R&D portfolio. "Other" challenges included the following:

- Lack of coordination or cooperation from various market actors or end users.
- Construction-related challenges.
- Challenges procuring necessary equipment.
- Administrative difficulties.
- Difficulty writing the NYSERDA funding proposal (one respondent).

DEMONSTRATION IMPACTS AND NYSERDA CONTRIBUTION

This section describes the types of impacts reported by demonstration participants, and quantifies these impacts where possible using the survey responses and R&D metrics data. It also describes NYSERDA's influence on the development of the projects and estimates NYSERDA's contribution to reported impacts.

4.1 TYPES OF IMPACTS

The survey was designed to make the fullest possible use of the information in NYSERDA's R&D Metrics Database. Survey respondents whose projects had data in the Metrics Database were asked to confirm the types of benefits reported. Most of these respondents validated the accuracy of the data; however, several mentioned additional benefits that were not captured in the R&D Metrics Database. This is not unexpected given the broad variety of potential benefits generated by the projects.

Table 4-1 shows the distribution of direct benefits among the surveyed demonstration projects. The single most commonly identified benefit was knowledge creation (62%), which is consistent with the technical expertise, market intelligence, and valuable experience reported in other questions about demonstration projects. Notably, even respondents whose projects did not accomplish their financial objectives found the projects worthwhile due to the knowledge generated. In terms of resource savings, over half of respondents (56%) identified energy efficiency as a direct benefit.

Table 4-1. Direct Benefits by Project Type

	Number of Projects (n = 61)* Percent		By Project Type		
Benefit Type		Percent	On-site Power Production	On-site Process Improvement	Product Demonstration
Knowledge Creation	38	62%	12	11	15
Energy Efficiency	34	56%	8	10	16
Demand Reduction	30	49%	14	5	11
Environmental Quality Improvement	28	46%	10	6	12
Power Production	23	38%	15	1	7
Marketability	23	38%	6	6	11
Product Quality/Reliability Improvement	21	34%	5	8	8
Productivity	20	33%	3	10	7
Air Emissions	19	31%	9	4	6
Operations & Maintenance	18	30%	3	6	9
Waste Management	15	25%	6	6	3
Reduced Material Costs	11	18%	3	5	3
Reduced Labor Costs	10	16%	1	5	4
Water Quality	9	15%	1	1	7
Water Reductions	7	11%	2	2	3
Other	18	30%	3	2	13

Notes: (*) Multiple responses were allowed. Percentages were calculated out of the 61 projects.

As shown in the previous table, 18 projects (30%) identified "other" benefits. The other benefits were very wide-ranging and included the following:

- Capital avoidance; cost savings; and lower bills. 30
- Improved safety.
- Increased the town's tax base.
- Reduced processing time.
- End-user behavioral changes.
- Temperature control.
- Public health.
- Customer education.
- Media visibility.
- Favorable regulatory ruling.
- Learned about the advantages and disadvantages of a new technology.
- Implemented a sound new technology.
- Downstream effects of the demonstration project.
- Established a new program that supports an emerging technology.
- Permanent avoidance of greenhouse gas associated with building heating.
- Peace of mind to farmers.

Respondents were also asked to describe the indirect benefits of their projects. Indirect benefits include secondary or downstream benefits resulting from the direct project benefits. For example, as shown in Table 4-2, 25% of respondents cited environmental quality improvement and reduced air emissions, which are indirect benefits resulting from energy efficiency and demand reduction.

Table 4-2. Indirect Benefits by Project Type

	Total	Percent	By Project Type			
Benefit Type			On-site Power Production	On-site Process Improvement	Product Demonstration	
Environmental Quality Improvement	15	25%	4	4	7	
Reduced Air Emissions	15	25%	2	4	9	
Marketability	11	18%	7	3	1	
Product Quality/Reliability Improvement	6	10%	2	1	3	
Operations & Maintenance	6	10%	2	1	3	
Reduced Material Costs	5	8%	1	1	3	
Energy Efficiency	5	8%	2	2	1	
Waste Management	4	7%	1	0	3	
Reduced Labor Costs	3	5%	1	1	1	
Water Reductions	2	3%	1	0	1	
Power Production	1	2%	0	0	1	
Demand Reduction	1	2%	0	1	0	
Knowledge Creation	1	2%	0	0	1	
Productivity	1	2%	1	0	0	
Water Quality	1	2%	1	0	0	

Notes: (*) Multiple responses were allowed. Percentages were calculated out of the 61 projects.

³⁰ As discussed in Section 4.3, many other respondents identified "cost savings" when asked about this in a subsequent question.

4.2 QUANTIFIABLE IMPACTS OF DEMONSTRATION PROJECTS

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 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. In addition, the limited number of project reports found online was used to supplement the survey data.

Based on the responses, benefits were quantified using three metrics: installed capacity (kW), energy savings (MWh/year), and fuel savings (therms/year). Tables 4.3 - 4.5 present the results of this analysis.

The columns on the left side of the tables show the number of survey responses by project type, the number of surveyed projects that were able to quantify each impact, and the quantity of impacts reported. It is possible that additional projects beyond those shown in the tables had impacts, but there were no data to quantify their benefits.

The columns on the right side of the tables show the number of non-surveyed projects that estimated each impact and the quantity of impact; the last column sums the impacts from surveyed and non-surveyed projects. For example, of the 28 product demonstration projects that completed the survey, four projects estimated energy savings totaling 400 MWh/year. In addition, one non-surveyed product demonstration project reported energy savings of 5,800 MWh/year. Summing the benefits of the surveyed and non-surveyed projects yields 6,200 MWh/year, as shown in the last column. On-site power production accounted for half of the projects that quantified their energy savings and 75% of the total energy savings.

Table 4-3. Summary of Energy Savings from Demonstration Projects

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Energy Savings*	Energy Savings of Surveyed Projects (MWh/Year)	Number of Non-Surveyed Projects with Estimated Energy Savings	Energy Savings of Non- Surveyed Projects (MWh/Year)	Total Energy Savings (MWh/Year)
On-site Power Production	18	7	21,098	0	0	21,098
On-site Process Improvement	15	1	685	1	3	688
Product Demonstration	28	4	400	1	5,800	6,200
Total	61	12	22,183	2	5,803	27,986

Note: (*) This table shows the projects that reported quantitative impact data (MWh/year).

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³¹ The data source for non-surveyed projects is a limited number of project reports found online. The data could not be confirmed with respondents. The data do not include benefits that may have accrued since projects were completed or replication benefits. This also includes one project with benefits data in the R&D Metrics Database that did not take the survey.

Another eight projects reported energy savings as efficiency improvements in percentage terms. The percent savings varied from 3% to 49%. However, in the absence of data about their baseline and current energy use, it is not possible to quantify the absolute impacts.

Table 4-4. Summary of Installed Capacity Impacts from Demonstration Projects

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Installed Capacity*	Installed Capacity of Surveyed Projects (kW)	Number of Non-Surveyed Projects with Estimated Installed Capacity	Installed Capacity of Non-Surveyed Projects (kW)	Total Installed Capacity (kW)
On-site Power Production	18	6	4,568	0	0	4,568
On-site Process Improvement	15	1	100	0	0	100
Product Demonstration	28	1	2	1	715	717
Total	61	8	4,670	1	715	5,385

Note: (*) This table shows the projects that reported quantitative impact data (installed kW).

Table 4-5. Summary of Fuel Savings from Demonstration Projects

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Fuel Savings*	Fuel Savings of Surveyed Projects (Therms/Year)	Number of Non-Surveyed Projects with Estimated Fuel Savings	Fuel Savings of Non-Surveyed Projects (Therms/Year)	Total Fuel Savings (Therms/Year)
On-site Power Production	18	0	0	0	0	0
On-site Process Improvement	15	2	41,600	2	30,582	72,182
Product Demonstration	28	3	17,204	0	0	17,204
Total	61	5	58,804	2	30,582	89,386

Note: (*) This table shows the projects that reported quantitative impact data (therms/year).

In addition to the standardized impacts shown above, 19 projects reported alternative impact metrics. Some of these alternative impacts include the following:

- Two projects reported combined annual reductions of 4,720 tons carbon dioxide and one project reported annual reductions of 4,060 English tons carbon dioxide.
- One project reported reductions of 0.72 English tons carbon monoxide, reductions of 5.32 English tons nitrogen oxides, and reductions of 0.04 English tons sulfur dioxide.³²
- One project reported annual reductions of 55.2 million cubic feet biogas.
- One project reported annual revenues of \$367 per cow.
- One project reported an increase of 900 degrees Fahrenheit in its manufacturing process.

³² This is one of the two projects that reported carbon dioxide reductions in the previous bullet point.

- One project reported average annual water savings of 753,287 gallons.
- One project reported a 30% improvement in productivity.

4.3 REVENUES AND COST SAVINGS OF DEMONSTRATION PROJECTS

This study also evaluated revenues and cost savings that the demonstration projects achieved through 2013. NYSERDA's R&D Metrics Database includes some revenue and cost savings data, and the survey included questions to confirm the metrics data or collect new information. This approach was similar to the method used for estimating impacts.

As shown in Table 4-6, 10 surveyed projects and one non-surveyed project quantified the revenues associated with the demonstration project, with total revenues exceeding \$1.2 billion. This impressive figure is mostly due to a single project that reported \$1.2 billion in sales that the respondent attributed to the demonstration project. This type of revenue distribution is typical for R&D portfolios, where one or two very successful projects often account for the majority of the portfolio's benefits.

Table 4-6. Summary of Revenue Generated from Demonstration Projects

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Revenue	Total Revenue of Surveyed Projects	Number of Non-Surveyed Projects with Estimated Revenue	Total Revenue of Non- Surveyed Projects	Total Revenue
On-site Power Production	18	5	\$5,742,841	0	\$0	\$5,742,841
On-site Process Improvement	15	2	\$1,200,090,000	1	\$120,000	\$1,200,210,000
Product Demonstration	28	3	\$15,260,000	0	\$0	\$15,260,000
Total	61	10	\$1,221,092,841	1	\$120,000	\$1,221,212,841

As shown in Table 4-7, 25 surveyed projects and seven non-surveyed projects quantified the cost savings associated with the demonstrations. Total cost savings were estimated at \$38.2 million. This figure includes energy cost savings as well as cost savings resulting from enhanced productivity and efficiency.

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³³ Given the magnitude of the reported revenue for this one firm, the evaluators validated the figure by: (1) following up directly with the respondent after the initial survey to ensure that the respondent had understood the question and answered it correctly; and (2) cross-checking the survey data with the information contained in the final project report.

Table 4-1. Summary of Cost Savings from NYSERDA Demonstration Projects

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Surveyed Projects	Number of Non-Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Non- Surveyed Projects	Total Cost Savings
On-site Power Production	18	9	\$14,680,938	1	\$2,000,000	\$16,680,938
On-site Process Improvement	15	6	\$13,857,392	4	\$2,046,229	\$15,903,621
Product Demonstration	28	10	\$5,332,558	2	\$325,700	\$5,658,258
Total	61	25	\$33,870,888	7	\$4,371,929	\$38,242,817

It is important to note that the tables above only capture revenues and cost savings achieved at the time the survey was conducted or (in the case of non-surveyed projects) when the final report was submitted. Several respondents indicated that revenues and cost savings are expected to continue. Therefore, total revenues and cost savings should continue to grow over time.

4.4 NYSERDA INFLUENCE ON THE DEMONSTRATIONS

The survey included a number of questions to assess NYSERDA's influence on the demonstration projects. An initial question aimed to establish the chronology of events by documenting when respondents first learned about NYSERDA's R&D Program. The earlier in the project respondents learned about the program, the more likely it is that NYSERDA influenced the design of the project. As shown in Table 4-8, 77% of respondents learned about the program prior to planning their demonstration projects, and 13% learned about it during the planning phase. Only two projects (3%) learned about the program after starting implementation. While these figures do not by themselves establish NYSERDA's influence, the timing is consistent with NYSERDA contributing to the development of the projects.

Table 4-8. When Firms Learned About NYSERDA R&D Program

Response	Number of Projects (n=61)	Percent of Projects	Adjusted Percent of Projects
Prior to Planning	47	77%	82%
During Planning	8	13%	14%
After Finalizing Plans	0	0%	0%
After Starting Implementation	2	3%	4%
Don't Know	4	7%	
Total	61	100%	100%

Respondents were asked to rate the importance of NYSERDA's financial and technical assistance in their decision to undertake the demonstration project. As shown in Table 4-9, 94% of respondents rated NYSERDA's financial assistance as a 4 or 5 out of 5.0. The average rating for this question was 4.8 out of 5.0. The responses indicate that NYSERDA's financial assistance was influential in the firms' decision to develop the demonstration projects.

Table 4-9. Importance of NYSERDA's Financial Assistance in Decision to Undertake the Project

_	Not At All Important					Very Important
	0	1	2	3	4	5
Number of Projects (n=61)	0	0	0	4	6	51
Percent of Projects	0%	0%	0%	6%	10%	84%

Out of 61 projects, 17 respondents indicated that they received NYSERDA's technical assistance. As shown in Table 4-10, the perceived importance of NYSERDA's technical assistance was more varied than financial assistance, with 42% of respondents rating technical assistance a 4 or 5. The average score for respondents who answered the question was 3.2.

Table 4-10. Importance of NYSERDA's Technical Assistance in Decision to Undertake the Project

	Not At All Important					Very Important
	0	1	2	3	4	5
Number of Projects (n=17)	1	1	2	6	3	4
Percent of Projects (out of 17)	6%	6%	12%	35%	18%	24%

To provide a broader context for assessing NYSERDA's influence on the demonstration projects, respondents were asked to consider other organizations that provided funding and technical assistance. As shown in Table 4-11, 36 projects (59%) received funding from other sources, in combination with technical assistance or alone. Respondents received nearly \$18.6 million in funding from a variety of sources, including non-profits, federal agencies, state agencies, institutions, and corporations. An even higher percentage of respondents (69%) received technical assistance from other organizations, either alone or in combination with financial assistance. Technical assistance providers included engineering firms, utilities, building and design firms, universities, manufacturers, and other entities. While these findings indicate that NYSERDA was not the only contributor, they do not indicate the extent to which NYSERDA's contribution mattered. By design, NYSERDA's R&D Program aims to be a catalyst rather than the sole actor; therefore, the program's overall influence may not be directly proportional to the share of funding or other assistance provided by NYSERDA.

Table 4-2. Non-NYSERDA Funding and Technical Assistance

Assistance Type	Number of Projects (n=61)	Percent of Projects	Adjusted Percent of Projects
Funding Only	8	13%	14%
Technical Assistance Only	14	23%	24%
Both Funding and Technical Assistance	28	46%	48%
No Additional Funding or Technical Assistance	8	13%	14%
Don't Know*	3	5%	
Total	61	100%	100%

Notes: (*) "Don't Know" includes one respondent who received technical assistance but did not know if other sources provided funding, plus two respondents who did not receive funding and were unsure if they received technical assistance.

To better understand NYSERDA's influence on the demonstrations, respondents answered questions about the likelihood of completing the project in New York State without NYSERDA. As shown in Table 4-12, 64% of respondents rated the likelihood of completing the project in New York without NYSERDA's assistance a 0 or 1 out of 5.0. The average rating was 1.2. This suggests that NYSERDA's financial assistance was an important factor in developing the demonstrations in New York. As shown in Table 4-13, the likelihood of completing the project without NYSERDA's technical assistance was more varied with 24% of respondents out of the 17 that received technical assistance giving a 0 or 1 rating. The average rating was 3.

Table 4-12. Likelihood of Completing the Project in NYS without NYSERDA's Financial Assistance

	Not At All Likely					Very Likely
	0	1	2	3	4	5
Number of Projects (n=61)	29	10	9	8	2	3
Percent of Projects	48%	16%	15%	13%	3%	5%

Table 4-13. Likelihood of Completing the Project in NYS without NYSERDA's Technical Assistance

	Not At All Likely					Very Likely
	0	1	2	3	4	5
Number of Projects (n=17)	3	1	0	6	3	4
Percent of Projects (out of 17)	18%	6%	0%	35%	18%	24%

Next, respondents answered questions about how NYSERDA affected the magnitude of project impacts and project timing. As shown in Table 4-14, 75% of respondents stated that projects would have happened on a smaller scale (34%) or not at all (41%) without NYSERDA. As shown in Table 4-15, a similar percentage of respondents (78%) indicated that their projects would have happened later (34%) or not at all (44%) without NYSERDA. Respondents who stated that the project would have happened later were asked to estimate how much later; the average response was 2.6 years. These responses suggest that NYSERDA played an important role in accelerating the projects and enhancing their impacts.

Table 4-14. Estimated Project Impacts Without NYSERDA

Response	Number of Projects (n=61)	Percent of Projects	Adjusted Percent of Projects
Same without NYSERDA	13	21%	22%
Smaller without NYSERDA	21	34%	36%
Larger without NYSERDA	0	0%	0%
Project Would Not Have Happened without NYSERDA	25	41%	42%
Don't Know	2	3%	
Total	61	100%	100%

Table 4-15. NYSERDA's Effect on Project Timing

Response	Number of Projects (n=61)	Percent of Projects	Adjusted Percent of Projects
Earlier without NYSERDA	1	2%	2%
About the Same Time	11	18%	18%
Later (Average: 2.6 years Later)	21	34%	35%
Project Would Not Have Happened without NYSERDA	27	44%	45%
Don't Know	1	2%	
Total	61	100%	100%

These findings are validated by a subsequent survey question that asked about NYSERDA's role as a catalyst for demonstration projects. As shown in Table 4-16, 95% of survey respondents indicated their agreement (4 or 5 out of 5.0) with the statement: "NYSERDA's credibility is an important catalyst for demonstration projects in New York." The average rating was 4.7. These findings indicate that NYSERDA played an important role in the development of the R&D demonstration projects.

Table 4-16. Importance of NYSERDA's Credibility as a Catalyst for Demonstrations in New York

	Strongly Disagree					Strongly Agree
	0	1	2	3	4	5
Number of Projects (n=61)	0	0	1	2	13	45
Percent of Projects	0%	0%	2%	3%	21%	74%

4.5 NYSERDA CONTRIBUTION TO R&D DEMONSTRATION IMPACTS

Using the influence questions shown above and experience with prior demonstrations, a contribution score was derived for each demonstration project. The score is a composite of five factors that reflect NYSERDA's influence.³⁴ The average contribution score across demonstration projects was 5.0 out of 6.0.³⁵ The contribution score for each project was converted to a percentage and applied to the impacts reported for each project.³⁶ For example, a contribution score of 5.0 translates to 75%.

Table 4-17 through Table 4-19 show that NYSERDA contributed to 21,838 MWh/year in energy savings, 4,601 kW installed capacity, and 57,866 therms in fuel savings. Given the uncertainties inherent in this type of analysis, the results are best interpreted as indicating the general scale of NYSERDA's contribution rather than a precise quantification of impacts that can be directly attributed to NYSERDA.

Table 4-3. Summary of NYSERDA Contribution to Energy Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Energy Savings	Energy Savings of Surveyed Projects (MWh/ Year)	Number of Non-Surveyed Projects with Estimated Energy Savings	Energy Savings of Non-Surveyed Projects (MWh/ Year)	Total Energy Savings (MWh/ Year)	NYSERDA Contribution (MWh/ Year)
On-site Power Production	18	7	21,098	0	0	21,098	17,062
On-site Process Improvement	15	1	685	1	3	688	88
Product Demonstration	28	4	400	1	5,800	6,200	4,688
Total	61	12	22,183	2	5,803	27,986	21,838

³⁴ The method used to calculate the contribution score is described in Section 2.5.

³⁵ This is the simple average across projects and is shown for illustrative purposes only. It does not account for the relative size of benefits reported by each project, and therefore cannot be applied to total reported benefits. Instead, the analysis calculates the contribution separately for each project based on the project's reported benefits and the project's individual contribution score.

³⁶ The contribution score for non-surveyed projects was estimated as the average contribution score for the project type.

Table 4-4. Summary of NYSERDA Contribution to Installed Capacity

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Installed Capacity	Installed Capacity of Surveyed Projects (kW)	Number of Non-Surveyed Projects with Estimated Installed Capacity	Installed Capacity of Non- Surveyed Projects (kW)	Total Installed Capacity (kW)	NYSERDA Contribution (kW)
On-site Power Production	18	6	4,568	0	0	4,568	3,988
On-site Process Improvement	15	1	100	0	0	100	75
Product Demonstration	28	1	2	1	715	717	538
Total	61	8	4,670	1	715	5,385	4,601

Table 4-5. Summary of NYSERDA Contribution to Fuel Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Fuel Savings	Fuel Savings of Surveyed Projects (Therms/ Year)	Number of Non- Surveyed Projects with Estimated Fuel Savings	Fuel Savings of Non- Surveyed Projects (Therms/ Year)	Total Annual Fuel Savings (Therms/ Year)	NYSERDA Contribution (Therms/ Year)
On-site Power Production	18	0	0	0	0	0	0
On-site Process Improvement	15	2	41,600	2	30,582	72,182	44,137
Product Demonstration	28	3	17,204	0	0	17,204	13,729
Total	61	5	58,804	2	30,582	89,386	57,866

Using the same project contribution scores and percentages derived above, the study estimated NYSERDA's contribution to demonstration revenues and cost savings. Tables 4-20 and 4-21 show that NYSERDA contributed to \$1.1 billion in revenues and \$23.8 million in cost savings. As discussed in Section 4.3, the revenues are mostly attributable to one project.

Table 4-20. Summary of NYSERDA Contribution to Demonstration Revenues

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Revenue	Total Revenue of Surveyed Projects	Number of Non- Surveyed Projects with Estimated Revenue	Total Revenue of Non- Surveyed Projects	Total Revenue	NYSERDA Contribution
On-site Power Production	18	5	\$5,742,841	0	\$0	\$5,742,841	\$3,194,233
On-site Process Improvement	15	2	\$1,200,090,000	1	\$120,000	\$1,200,210,000	\$1,050,180,000
Product Demonstration	28	3	\$15,260,000	0	\$0	\$15,260,000	\$9,590,000
Total	61	10	\$1,221,092,841	1	\$120,000	\$1,221,212,841	\$1,062,964,233

Table 4-21. Summary of NYSERDA Contribution to Demonstration Cost Savings

Project Type	Number of Surveyed Projects	Number of Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Surveyed Projects	Number of Non-Surveyed Projects with Estimated Cost Savings	Total Cost Savings of Non- Surveyed Projects	Total Cost Savings	NYSERDA Contribution
On-site Power Production	18	9	\$14,680,938	1	\$2,000,000	\$16,680,938	\$11,748,933
On-site Process Improvement	15	6	\$13,857,392	4	\$2,046,229	\$15,903,621	\$8,514,463
Product Demonstration	28	10	\$5,332,558	2	\$325,700	\$5,658,258	\$3,545,264
Total	61	25	\$33,870,888	7	\$4,371,929	\$38,242,817	\$23,808,660

REPLICATIONS, IMPACTS, AND DEMONSTRATION INFLUENCE

Replications are a primary goal of NYSERDA's R&D demonstration projects. This section covers the survey questions regarding the number and type of demonstration projects that were replicated, number of replications, impacts associated with the replications, and the contribution of the demonstration projects to developing the replications. This section also assesses the factors that can help or hinder replications.

5.1 NUMBER AND TYPES OF REPLICATIONS

The definition of replication varies by market actor. As discussed in Section 1.4, the survey defined replications for integrators and site owners as additional installations or scaling up of the technology or process demonstrated under the NYSERDA-funded project. Replications could be at the same site as the NYSERDA demonstration project or at another site, and may be carried out by the same firm or a different firm than the original demonstration. For vendors, replications are defined as additional sales of the same technology or services that were used in the demonstration project. The sales could be to the same buyer that participated in the demonstration project or to a different buyer.

Respondents were asked whether their firm or another firm replicated the NYSERDA demonstration project in a similar application or different application. As shown in Table 5-1, 33 projects (54%) reported replications for similar applications alone or in combination with different applications. Another seven projects (11%) reported replications for different applications only. Seventeen projects (28%) reported no replications, and the other four (7%) did not know.

Table 5-1. Comparison of NYSERDA-Funded Demonstrations to Replications by Application

Replication Market and Application	Number of Projects (n=61)	Percent of All Projects (n=61)	Percent of Replicated Projects (n=40)
Similar Application Only ¹	25	41%	63%
Different Application Only ²	7	11%	18%
Both Similar and Different Applications	8	13%	20%
No Replications	17	28%	
Don't Know ³	4	7%	
Total	61	100%	100%

Notes: (1) Six respondents answered "Yes" for similar applications and "Don't Know" for different applications; two answered "Yes" for similar and did not answer for different. (2) Two answered "Yes" for different and "Don't Know" for similar. (3) Two answered "No" for similar and "Don't Know" for different, and two answered "Don't Know" for both.

Respondents who reported different applications were asked to describe how the applications differed from the original demonstration project. Answers were varied and included the following:

- Different markets or technologies.
- Different uses.
- Modified the design for particular sites.
- Different companies and products.
- Applied some parts of the model but not others.

- Developed as part of a new (rather than existing) building.
- Different material, same general concept.
- No educational component.
- Different regulatory jurisdictions.

Respondents who reported at least one similar replication were asked about replications in New York State. As shown in Table 5-2, 28 projects reported at least one replication in New York. Thirteen of the 28 reported that NYSERDA provided funding for one or more replications, while the other 15 projects indicated that NYSERDA did not provide funding.³⁷ Overall, integrators and site owners reported 116 replication projects in New York and vendors reported \$2.4 million in replication sales.

Table 5-2. Replications in New York State by Project Type

	Number		Demonstration Replications in N	U	Percent of	Number of Replications	Volume of
Project Type	of Projects Surveyed	Total	Without NYSERDA Funding	With NYSERDA Funding	Projects Replicated (Out of 61)	(Integrators and Site Owners) ^{1,2}	Sales (Vendors) ³
On-site Power Production	18	12	5	7	67%	56	\$1,849,302
On-site Process Improvement	15	5	4	1	33%	14	
Product Demonstration	28	11	6	5	39%	46	\$570,000
Total	61	28	15	13	46%	116	\$2,419,302

Notes: (1) Because only one type of respondent (integrator or site owner) was surveyed for each site, the numbers in this column are additive. (2) One respondent reported that their demonstration was replicated "innumerable times." It is included in the number of demonstration projects with replications, but not in the total number of replications. (3) Vendors reported a total of 115 sales associated with the \$2,419,302 in sales revenue.

Table 5-3 shows replications across program areas. All of the major program areas had at least one demonstration project with replications in New York. Integrators and site owners reported 29 replications for Manufacturing Technology & On-Site Power and 20 replications each for Buildings Research and other End Use Application & Innovation projects. The majority of vendor replication sales (\$1.8 million out of \$2.4 million) were for Innovation & Business Development.

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³⁷ This question was asked for up to five most recent replications.

Table 5-3. Replications in New York State by Program Area

Program Area	Number of Projects	Projects with Replications in NYS	Percent of Projects Replicated in NYS	Number of Replications (Integrators and Site Owners)	Volume of Sales (Vendors)
End Use Application & Innovation					
Buildings Research	12	4	33%	20	
Innovation & Business Development	5	3	60%	12	\$1,849,302
Manufacturing Technology & On-Site Power	22	10	45%	29	
Other	2	1	50%	20	
Clean Energy Research & Market Development					
Energy Markets & Power Delivery	2	1	50%	11	
Environment & Energy Resources	8	6	75%	19	\$270,000
Transportation & Power Systems	4	2	50%	4	\$300,000
Transmission & Distribution	3	1	33%	1	
Other	3	0	0%	0	
Total	61	28	46%	116	\$2,419,302

Respondents who had not replicated their demonstration project in New York were asked whether they expected their projects to be replicated in the future. As shown in Table 5-4, 50% of respondents who answered the question expected that their projects will be replicated in New York (65% if adjusted for those who answered "Don't Know"). This includes projects that have already started actively planning for replications.

Table 5-4. Expectation that Projects will be Replicated in New York State in the Future

	Number of Projects (n=30)*	Percent of Projects (Out of 30)	Adjusted Percent of Projects
Yes	15	50%	65%
No	8	27%	35%
Don't Know	7	23%	
Total	30	100%	100%

Notes: (*) Three respondents without replications in New York did not answer this question.

5.2 SUPPORTING FACTORS AND BARRIERS TO REPLICATIONS IN NEW YORK

Respondents provided a range of reasons for being able to replicate the NYSERDA project in New York State. As shown in Table 5-5, technical expertise and demonstrable savings achieved from the demonstrations were the most frequently mentioned factors. Less than one-third of respondents cited financing as a factor. Six respondents mentioned other factors, including: the demonstration proved the technical functionality of the product or service; market demand for the product or service was strong; and the demonstration enhanced the reputation of the demonstrated technology or firm.

Table 5-5. Reasons for Replications

Reasons for Replications	Number of Projects (n=28)*	Percent of Projects (Out of 28)
Technical Expertise Gained	21	75%
Demonstrable Savings were Achieved	14	50%
Operating Conditions were Right	12	43%
Location Available	11	39%
Requested by Building Owner	10	36%
Financing Available	9	32%
Other	6	21%

Notes: (*) Respondents were allowed to select more than one answer.

Respondents who have not replicated their projects in New York were asked to identify the barriers to replications in the state. As shown in Table 5-6, four respondents cited the absence of other companies, institutions, or sites in New York to take advantage of the demonstrated technology. Cost and unproven technology were each cited by three respondents.

Table 5-6. Barriers to Project Replication

Reason	Number of Projects* (n=29)	Percent of Projects	Adjusted Percent of Projects
Absence of Suitable Companies/Institutions/Locations	4	14%	15%
Cost	3	10%	12%
Technology is Still Being Proven	3	10%	12%
Permitting/Regulatory Barriers	2	7%	8%
Propietary Technology	2	7%	8%
Lack of Proximity to Potential Users	2	7%	8%
No Other Similar Company in New York State	2	7%	8%
Lack of Effective Marketing/Publicity	2	7%	8%
Complex Operating Environment/Too Many Competing Actors	2	7%	8%
New Markets/New Technologies	1	3%	4%
Company No Longer Makes the Product	1	3%	4%
Never Saw the Project Through to Completion	1	3%	4%
Project Answered all Questions it Set Out to Answer	1	3%	4%
Denied Commercialization	1	3%	4%
Don't Know	3	10%	12%

Notes: (*) Respondents could select more than one answer. Four projects without out replications did not answer the question.

5.3 REPLICATION IMPACTS

One of the study objectives was to estimate the impact of the replication projects. Because replication projects are often implemented by a different firm than the original demonstration project, quantifying the impacts of replication projects can be challenging. Therefore, as a first step, respondents were asked to consider the size of the replication impacts relative to the original demonstrations.

As shown in Table 5-7, a majority of respondents (79% excluding "Don't Know") characterized the replication impacts as the same or higher compared to the original demonstration. Similarly, more than half of respondents (74% excluding "Don't Know") stated that revenues or cost savings from the replications were the same or higher compared to the demonstrations. On this basis, the study conservatively estimates replication impacts assuming they are the same size as the original demonstration impacts.³⁸

Table 5-7. Scope of Replications in Comparison to NYSERDA Demonstration Project

	Comparison of Resource Savings (MWh, kW, Therms, Etc.) to Original Demonstration			Comparison of Revenue Generation and Cost Savings to Original Demonstration		
	Number Percentage Percentage Excluding "Don't Know"		Number	Percentage	Percentage Excluding "Don't Know"	
Lower than Original Demo	5	5%	7%	6	7%	9%
The Same Size	18	19%	25%	17	18%	26%
Higher than Original Demo	39	42%	54%	31	34%	48%
Not Comparable	10	11%	14%	11	12%	17%
Don't Know	21	23%		27	29%	
Total	93	100%	100%	92*	100%	100%

Notes: Respondents who reported at least one replication in New York were asked the questions for their *five most recent* replications. Because some respondents had more than five replications, the number of responses shown in the table (n=93) is less than the total number of replications. (*) One respondent did not answer the question.

Tables 5-8 – 5-10 show the estimated impacts of the replication projects. Estimated impacts include 21,388 MWh/year in energy savings, 5,632 kW installed capacity, and 40,690 therms/year of fuel savings. The tables group benefits by project type. For example, of the 12 on-site power production projects that reported replications in New York, six had estimated energy savings. The replications from these six demonstration projects have estimated energy savings of 21,217 MWh/year.

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³⁸ The method for estimating replication impacts is described in Section 2.4.

Table 5-8. Energy Savings from Replications in New York

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Energy Savings (MWh/Year)	Replication Energy Savings (MWh/Year)
On-site Power Production	18	12	6	21,217
On-site Process Improvement	15	5	-	-
Product Demonstration	28	11	2	171
Total	61	28	8	21,388

Table 5-9. Installed Capacity from Replications in New York

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Demonstration Projects with Projects with Projects with Projects with Replications and Estimated Installed	
On-site Power Production	18	12	4	5,532
On-site Process Improvement	15	5	1	100
Product Demonstration	28	11	-	-
Total	61	28	5	5,632

Table 5-10. Fuel Savings from Replications in New York

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Fuel Savings (Therms/Year)	Replication Fuel Savings (Therms/Year)
On-site Power Production	18	12	-	-
On-site Process Improvement	15	5	1	1,600
Product Demonstration	28	11	2	39,090
Total	61	28	3	40,690

Tables 5-11 and 5-12 estimate the revenues and cost savings for replication projects in New York. The estimated revenue for the replications totals \$81.1 million, of which on-site power production accounts for \$20.2 million. Estimated cost savings totals \$63.3 million; power production accounts for \$55.7 million and process improvement accounts for \$7.3 million.

Table 5-11. Revenue from Replications in New York

Project Type	Number of Demonstration Projects Surveyed	Projects with		Replication Revenue
On-site Power Production	18	12	5	\$20,217,387
On-site Process Improvement	15	5	1	\$270,000
Product Demonstration	28	11	2	\$60,640,000
Total	61	28	8	\$81,127,387

Table 5-12. Cost Savings from Replications in New York

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in NYS	Number of Demonstration Projects with Replications <u>and</u> Estimated Cost Savings	Replication Cost Savings
On-site Power Production	18	12	8	\$55,724,852
On-site Process Improvement	15	5	2	\$7,256,000
Product Demonstration	28	11	4	\$356,992
Total	61	28	14	\$63,337,844

5.4 DEMONSTRATION INFLUENCE ON REPLICATIONS

The survey included a series of questions to assess the influence of the NYSERDA-funded demonstrations on the replication projects. Respondents who reported replications in New York were asked to express the extent of their agreement or disagreement with the statement: "Overall, the NYSERDA-funded demonstration project was critical for developing the replication project(s)." As shown in Table 5-13, 89% of respondents gave a rating of 4 or 5 out of 5.0. The average rating was 4.3 out of 5.0 indicating strong agreement about the influence of the demonstration projects.

Table 5-13. Influence of NYSERDA Demonstration Projects on Replications in New York State

	Strongly Disagree					Strongly Agree
	0	1	2	3	4	5
Number of Projects (n=28)	0	0	1	2	12	13
Percent of Projects (out of 28)	0%	0%	4%	7%	43%	46%

Respondents who gave a rating of 3 or higher were asked to describe how NYSERDA's assistance with the demonstration project influenced the ability to develop the replication projects. Responses included the following:

- The demonstration proved that it is possible to do this type of project.
- The demonstration dispelled false impressions about this type of project.

- The NYSERDA demonstration brought added credibility.
- The knowledge and expertise gained from the demonstration project helped with the replications.
- The demonstration resulted in improved marketing which led to increased sales of the technology.
- The demonstration provided the technical underpinnings for future projects.

Respondents were asked how the NYSERDA demonstration project affected the likelihood that the replications occurred. As shown in Table 5-14, 36% of respondents rated the likelihood as a 0 or 1 out of 5.0. Only one project (4%) gave a rating of 4 and none gave a rating of 5. The other 60% of respondents were in the middle.

Table 5-14. Likelihood that Replications Would Have Occurred in NYS without NYSERDA's Demonstration

	Not At All Likely					Very Likely
	0	1	2	3	4	5
Number of Projects (n=28)	5	5	5	12	1	0
Percent of Projects (out of 28)	18%	18%	18%	42%	4%	0%

To further assess how the demonstration projects influenced the replications, respondents were asked how the demonstrations affected the magnitude of the replication impacts and the timing of the replications. As shown in Table 5-15, 46% of respondents indicated that the impacts would have been smaller (32%) or not happened at all (14%) without the NYSERDA demonstration project, while 32% indicated the impacts would have been the same. The findings also suggest that the demonstration projects accelerated the development of the replication projects. As shown in Table 5-16, 75% of respondents stated the replications would have happened later (64%) or not at all (11%) without the NYSERDA demonstration project. Respondents who reported that replications would have occurred later estimated that the demonstrations accelerated the replications by an average of 2.6 years.

Table 5-15. Estimated Magnitude of Replication Impacts Without the NYSERDA Demonstration Project

Magnitude of Replication(s) without NYSERDA Demonstration Project	Number of Projects	Percent of Projects	Adjusted Percent of Projects
Same	9	32%	41%
Smaller	9	32%	41%
Larger	0	0%	0%
Replication(s) Would Not Have Happened without NYSERDA	4	14%	18%
Don't Know	6	21%	
Total	28	100%	100%

Table 5-16. Estimated Timing of Replications without the NYSERDA Demonstration Project

Timing without NYSERDA Demonstration Project	Number of Projects	Percent of Projects	Adjusted Percent of Projects
Earlier	0	0%	0%
About the Same Time	4	14%	16%
Later (Average: 2.6 years later)	18	64%	72%
Replication(s) Would Not Have Occurred without NYSERDA	3	11%	12%
Don't Know	3	11%	0%
Total	28	100%	100%

Based on the answers to the previous questions, replication contribution scores were derived using a similar method as the demonstration contribution scores in Section 4. The average replication contribution score was 4.1 out of 6.0.³⁹ The contribution scores were converted to percentages and applied to the estimated replication impacts to estimate NYSERDA's contribution. For example, a contribution score of 4.1 translates to 75%.

Tables 5-17 – 5-19 summarize NYSERDA's contribution to replication project impacts. The tables show that NYSERDA demonstration projects contributed to 16,704 MWh/year in energy savings, 4,138 kW installed capacity, and 30,318 therms of fuel savings.

Table 5-17. Demonstration Contribution to Energy Savings from Replications

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Energy Savings (MWh/Year)	Replication Energy Savings (MWh/Year)	NYSERDA Demonstration Contribution (MWh/Year)
On-site Power Production	18	12	6	21,217	16,558
On-site Process Improvement	15	5	-	-	-
Product Demonstration	28	11	2	171	146
Total	61	28	8	21,388	16,704

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³⁹ This is the simple average across projects and is shown for illustrative purposes only. It does not account for the relative size of benefits reported by each project, and therefore cannot be applied to total reported benefits. Instead, the analysis calculates the contribution separately for each project based on the project's reported benefits and the project's individual contribution score.

Table 5-18. Demonstration Contribution to Installed Capacity from Replications

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Installed Capacity (kW)	Replication Installed Capacity (kW)	NYSERDA Demonstration Contribution (kW)
On-site Power Production	18	12	4	5,532	4,075
On-site Process Improvement	15	5	1	100	63
Product Demonstration	28	11	-	-	-
Total	61	28	5	5,632	4,138

Table 5-19. Demonstration Contribution to Fuel Savings from Replications

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Fuel Savings (Therms/Year)	Replication Fuel Savings (Therms/Year)	NYSERDA Demonstration Contribution (Therms/Year)
On-site Power Production	18	12	-	-	-
On-site Process Improvement	15	5	1	1,600	1,000
Product Demonstration	28	11	2	39,090	29,318
Total	61	28	3	40,690	30,318

Tables 5-20 and 5-21 show NYSERDA's estimated contribution to replication revenues and cost savings. The tables show that NYSERDA demonstration projects contributed to \$73.2 million in replication revenues and \$41.9 million in cost savings. Cost savings include energy cost savings as well as cost savings resulting from improved productivity and efficiency.

Table 5-20. Demonstration Contribution to Revenue from Replications

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Revenue	Replication Revenue	NYSERDA Demonstration Contribution
On-site Power Production	18	12	5	\$20,217,387	\$12,515,540
On-site Process Improvement	15	5	1	\$270,000	\$202,500
Product Demonstration	28	11	2	\$60,640,000	\$60,480,000
Total	61	28	8	\$81,127,387	\$73,198,040

Table 5-21. Demonstration Contribution to Cost Savings from Replications

Project Type	Number of Demonstration Projects Surveyed	Number of Demonstration Projects with Replications in New York State	Number of Demonstration Projects with Replications <u>and</u> Estimated Cost Savings	Replication Cost Savings	NYSERDA Demonstration Contribution
On-site Power Production	18	12	8	\$55,724,852	\$36,160,752
On-site Process Improvement	15	5	2	\$7,256,000	\$5,435,000
Product Demonstration	28	11	4	\$356,992	\$274,719
Total	61	28	14	\$63,337,844	\$41,870,471

PROCESS ANALYSIS

While impact assessment was the study's primary purpose, the survey also included some questions about NYSERDA's processes. This section covers survey questions about overall satisfaction and satisfaction with specific aspects of NYSERDA's R&D Program.

6.1 PROGRAM AWARENESS AND COMMUNICATION

Respondents were asked how they first learned about the potential for NYSERDA assistance. As shown in Table 6-1, one-third of respondents cited prior participation in NYSERDA's R&D Program. More than one-fifth of respondents (21%) learned about NYSERDA by word of mouth from business colleagues or clients. Advertising and contact from a NYSERDA representative were each cited by 11% of respondents.

Table 6-1. Sources of NYSERDA Program Awareness

Source of Program Awareness	Number of Projects (n=61)*	Percent of Projects
Prior Participation in NYSERDA R&D Program	20	33%
Word of Mouth – Business Colleague/Client	13	21%
Advertising	7	11%
Contacted by a NYSERDA Program Representative	7	11%
Another NYSERDA Program	3	5%
Word of Mouth – Friend/Relative	1	2%
Visited a Demonstration Site	0	0%
Other	12	20%
Don't Know	1	2%

Notes: (*) Multiple responses were allowed.

6.2 SATISFACTION WITH PROGRAM ASSISTANCE

The survey included a set of questions designed to assess satisfaction with NYSERDA's assistance. Respondents were asked to indicate their agreement or disagreement with a series of statements relating to program participation, including communication, timeliness of assistance, qualifications of program staff, and other aspects of NYSERDA's assistance as shown in Table 6-2.

Overall satisfaction with NYSERDA's R&D Program was quite high, with 92% of respondents agreeing or strongly agreeing (a 4 or 5 rating out of 5) that they are satisfied overall with their participation in the program. Respondents also gave very high ratings (greater than 80% gave a rating of 4 or 5) for NYSERDA's communications with project participants and qualifications of program staff. The lowest scores were providing marketing information (36%) and market intelligence (23%) that supports the demonstration process. However, several respondents commented that they do not view it as

NYSERDA's role to provide this type of information; therefore, disagreements with the statements do not necessarily represent dissatisfaction with the R&D Program.

Table 6-2. Respondent Feedback on NYSERDA's R&D Program Characteristics (n=61)

-			Strongly	Disagree ((1) to Strong	gly Agree (5)
Statement	Calculation	1	2	3	4	5	Don't Know/ Refused
Overall, I am satisfied with my	Raw	7%	-	-	33%	59%	2%
participation in NYSERDA's R&D program.	Adjusted ¹	7%	-	-	33%	60%	
NYSERDA communicates well with	Raw	ı	7%	8%	38%	43%	5%
demonstration project participants.	Adjusted ¹	ı	7%	9%	40%	45%	
NYSERDA staff members working with	Raw	5%	3%	3%	28%	56%	5%
this program are well qualified.	Adjusted ¹	5%	3%	3%	29%	59%	
NYSERDA provides assistance in a timely	Raw	7%	7%	11%	34%	39%	2%
manner.	Adjusted ¹	7%	7%	12%	35%	40%	
NYSERDA provides technical information	Raw	7%	16%	26%	25%	20%	7%
that supports the demonstration process.	Adjusted ¹	7%	18%	28%	26%	21%	
NYSERDA provides technical information	Raw	10%	13%	28%	23%	16%	10%
that supports the replication process.	Adjusted ¹	11%	15%	31%	25%	18%	
NYSERDA provides marketing	Raw	10%	20%	23%	21%	15%	11%
information that supports the demonstration process.	Adjusted ¹	11%	22%	26%	24%	17%	
NYSERDA provides market intelligence	Raw	15%	21%	26%	15%	8%	15%
that supports the demonstration process.	Adjusted ¹	17%	25%	31%	17%	10%	

Notes: (1) Adjusted percentages exclude "Don't Know/Refused." Percentages may not sum exactly to 100% due to rounding.

6.3 POTENTIAL IMPROVEMENTS RECOMMENDED BY SURVEY RESPONDENTS

Respondents were asked a series of open-ended questions about potential improvements that NYSERDA could undertake to encourage more demonstrations and replications.

Suggestions for how NYSERDA could encourage more demonstration projects included the following:

- Simplify the solicitation process.
- Improve outreach and communicate more with potential customers.
- Increase communication between NYSERDA and funding recipients.
- Disseminate information and communicate results more effectively.
- Talk to more people in industry to stay apprised of current trends and innovations.
- Understand the specific technologies better.
- Align projects with policy.
- Demonstrate best practices for proven technologies; do not focus solely on developing new products.

- Fund verification efforts to monitor projects.
- Give due attention to smaller projects.

Suggestions for how NYSERDA could encourage more replication projects included the following:

- Facilitate more knowledge sharing with peers about the benefits and costs of technologies.
- Post project reports online and offer an online database of project results.
- Attend local meetings and increase outreach to potential customers and partners.
- Attend more technical conferences and webinars.
- Align R&D with policy decisions and implications.
- Enhance communication with end users, not only with engineers.
- Market through other organizations.
- Hold open houses at demonstration sites.
- Publish a regular or quarterly report.
- Help bring market actors together to develop projects.
- Improve coordination with federal agencies.

Section 7:

COST EFFECTIVENESS

This section assesses the cost effectiveness of NYSERDA's R&D demonstration portfolio. The first part of the section calculates cost-effectiveness in terms of revenues and cost savings achieved per NYSERDA dollars spent. The second part calculates electricity and fuel savings per NYSERDA dollars spent. Calculations are presented separately for demonstration projects, replication projects, and the combined effects of demonstration and replication projects. The last part of this section is a qualitative assessment of whether participants consider the demonstrations to be worthwhile investments.

The benefit figures in this section are taken from Sections 4 and 5.⁴⁰ It should be noted that the revenue and cost savings figures represent the totals achieved through 2013; in some cases, these benefits will continue into the future. In those cases, the benefits per NYSERDA dollar will grow over time.

The cost includes NYSERDA's total investment in all R&D demonstration projects that closed in 2008-2010, including surveyed projects and non-surveyed projects (e.g., terminated projects⁴¹). In total, NYSERDA spent \$22.7 million on 124 R&D demonstration projects that closed during the study period. Dividing the benefits of the projects by NYSERDA's investment indicates the cost effectiveness of NYSERDA's R&D demonstration portfolio.

7.1 NYSERDA'S COST EFFECTIVENESS: REVENUES AND COST SAVINGS

The following metrics were calculated by dividing reported benefits by NYSERDA's investment:

- Demonstration project revenues per NYSERDA cost.
- Demonstration project cost savings per NYSERDA cost.
- Demonstration project total dollars (revenues and cost savings) per NYSERDA cost.
- All of the previous calculations for replication projects.
- All of the previous calculations combining demonstration and replication projects.

Table 7-1 shows the dollars saved and generated by the demonstration projects for every dollar of NYSERDA investment. For example, the demonstrations saved \$1.05 in costs and generated almost \$47 in revenues for every dollar that NYSERDA spent. The revenue figure includes a single project that reported \$1.2 billion in sales. Excluding this one project reduces the revenues to \$0.57 per dollar spent. The last row in the table combines cost savings and revenues. Overall, each dollar of NYSERDA investment yielded almost \$48 in revenues or cost savings. Excluding the one project that generated \$1.2 billion, the figure is much lower but still positive: \$1.62 in revenues or cost savings for every dollar spent.

⁴⁰ All of the benefits figures in this section reflect the benefits to which NYSERDA contributed. Section 2 .5 describes the method for estimating NYSERDA's contribution.

⁴¹ The cost reflects the money spent on the project (versus the original contracted amount). There are many projects that were terminated and the remaining funds were disencumbered.

⁴² Information provided by NYSERDA staff on February 11, 2014.

⁴³ Some portion of the revenues and cost savings may include the benefits of electricity and fuel savings presented below.

⁴⁴ This analysis is not meant to imply that the \$1.2 billion *should* be excluded; its purpose is to show how a single project affects the overall cost-effectiveness of the portfolio.

Table 7-1. Cost Effectiveness for Demonstration Benefits

Benefit Type	Cost Effectiveness	Cost- Effectiveness Adjusted (Outlier Removed)
Demonstration Cost Savings per NYSERDA \$	\$1.05	\$1.05
Demonstration Project Revenues per NYSERDA \$	\$46.86	\$0.57
Total Demonstration Dollars (Revenues Plus Cost Savings) per NYSERDA \$	\$47.91	\$1.62

Table 7-2 presents similar calculations for the replication projects. Overall, the replications saved or generated roughly \$5.07 for each dollar that NYSERDA invested in the original demonstration projects. The last two table columns differentiate between replications that were funded in whole or in part by NYSERDA and those that were funded without NYSERDA. Respondents were asked to describe the sources of funding for up to five of the most recent replications associated with their demonstration project. However, some respondents did not know if NYSERDA provided funding (many replications were carried out by different firms than the original demonstration), and others did not know the amounts. Moreover, given the limited time available for telephone surveys, the survey did not collect information on funding sources for replications beyond the most recent five. Therefore, the analysis uses a conservative approach for assigning replication projects to the "NYSERDA Funding" category; if one or more of the five most recent replications received NYSERDA funding, all of the replications associated with that demonstration project are assigned to that category. However, the figures do not reflect the costs incurred by NYSERDA for the replication projects, because these data were not available in a comprehensive or consistent way. As such, the cost-effectiveness calculations in Table 7-2 only account for the \$22.7 million that NYSERDA invested in its demonstration portfolio. If NYSERDA's replication costs were included in the calculations, the cost-effectiveness figures for "All replications" and "Replications Receiving NYSERDA Funding" would be lower. This would not affect replications that were funded independent of NYSERDA.

Table 7-2. Cost Effectiveness for Replication Benefits

Benefit Type	Cost Effectiveness (All Replications)	Cost Effectiveness (Replications Receiving NYSERDA Funding)	Cost Effectiveness (Replications Not Receiving NYSERDA Funding)
Replication Cost Savings per NYSERDA \$	\$1.85	\$1.41	\$0.43
Replication Project Revenues per NYSERDA \$	\$3.23	\$2.92	\$0.31
Total Replication Dollars (Revenues and Cost Savings) per NYSERDA \$	\$5.07	\$4.33	\$0.74

Table 7-3 presents the cost-effectiveness figures for combined demonstration and replication benefits. Overall, the demonstration and replication projects saved or generated more than \$52 for every dollar invested in NYSERDA's R&D demonstration portfolio. Removing the single demonstration project with \$1.2 billion in revenue, cost-effectiveness is still positive at \$6.69 per NYSERDA dollar of investment in the demonstration projects.

Table 7-3. Cost Effectiveness for Combined Demonstration and Replication Benefits

Benefit Type	Cost Effectiveness	Cost Effectiveness Adjusted (Outlier Removed)
Demonstration and Replication Cost Savings per NYSERDA \$	\$2.90	\$2.90
Demonstration and Replication Project Revenues per NYSERDA \$	\$50.09	\$3.80
Demonstration and Replication Total Dollars (Revenues and Cost Savings) per NYSERDA \$	\$52.98	\$6.69

7.2 NYSERDA'S COST EFFECTIVENESS: ELECTRICITY AND FUEL SAVINGS

As discussed in Section 1.3, NYSERDA's R&D Program supports projects that are designed to deliver public benefits. These benefits range 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 main 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.

This section analyzes NYSERDA's cost-effectiveness in terms of electricity savings (MWh) and fuel savings (therms). As described in Sections 4 and 5, respondents reported electricity and fuel savings on an annual basis (MWh/year and therms/year, respectively). Many respondents indicated that savings will continue in years to come – i.e., only a fraction of the expected benefits have been realized to date. However, all of NYSERDA's demonstration project costs were incurred upfront. Therefore, to compare the benefits and costs on equal terms, the analysis estimates the value of future energy savings.

This type of analysis is complicated by the uncertainties inherent in predicting future energy prices and energy savings. It is also uncertain how far the technologies or processes resulting in the energy savings will continue into the future. To reflect the uncertainties, the analysis calculates NYSERDA's cost-effectiveness under a variety of scenarios. 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 U.S. Energy Information Administration (EIA) *Annual Energy Outlook 2013* for the U.S. Middle Atlantic region, which includes New York State. 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. ⁴⁶ The benefits also reflect whether the systems or processes operate for one year, five years, 10 years, or 20 years. The survey did not ask about years of operation; however, NYSERDA's experience has shown that many projects stay online longer than one year, while a 20-year lifetime might be longer than average.

⁴⁵ The study was not able to conduct a similar analysis for installed capacity (kW) given the available information. Installed capacity does not represent actual energy generated, but rather the ability to generate energy. Estimating the quantity of energy generated would require detailed information about each industry and each firm beyond the data collected in the survey,

⁴⁶ Annual Energy Outlook 2013 expresses all energy prices in 2011 dollars, unless otherwise noted. Expressing all savings in current dollars adjusts for the effects of inflation on energy prices in later years, and therefore represents a reasonably accurate assessment of the world from NYSERDA's point of view. It does not, however, account for the firm's opportunity cost of capital – i.e., other investments the firm could have made instead of investing in the project. If a private firm were considering the investments described in this section, it would further discount the future energy savings by its weighted average cost of capital – i.e., the cost required to finance the firm's mix of debt and equity – thereby reducing the present value of the savings.

The first step in this analysis is estimating the benefits of future energy savings. Tables 7-4 – 7-6 estimate the electricity savings for demonstration projects, replication projects, and the combined benefits of demonstrations and replications. For example, as shown in Table 7-4, if demonstration projects operate for five years under the medium scenario, they will save an estimated \$10.6 million in electricity costs. If they operate for a shorter time, the benefits will be smaller (holding all else equal); if they operate longer than five years, the benefits will be larger. Similarly, the benefits depend on electricity prices, which vary across the "low," "medium," and "high" scenario. For example, if the projects operate for one year, they would have an estimated savings of \$1.7 million in the low scenario and \$2.3 million in the high scenario. Overall, the demonstration savings vary from \$1.7 million to \$44.2 million depending on electricity prices and lifespan.⁴⁷

Table 7-4. Estimated Electricity Savings from Demonstration Projects

	Energy Prices			
Lifespan (Years)	Low	Medium	High	
1	\$1,748,030	\$2,253,523	\$2,249,432	
5	\$8,692,358	\$10,561,874	\$10,759,566	
10	\$17,562,966	\$21,086,454	\$21,755,010	
20	\$34,989,165	\$42,319,108	\$44,183,758	

Table 7-5. Estimated Electricity Savings from Replication Projects

	Energy Prices				
Lifespan (Years)	Low	Medium	High		
1	\$1,337,049	\$1,723,695	\$1,720,565		
5	\$6,648,687	\$8,078,658	\$8,229,871		
10	\$13,433,715	\$16,128,792	\$16,640,163		
20	\$26,762,819	\$32,369,410	\$33,795,660		

Table 7-6. Combined Estimated Electricity Savings

	Energy Prices				
Lifespan (Years)	Low	Medium	High		
1	\$3,085,079	\$3,977,218	\$3,969,997		
5	\$15,341,045	\$18,640,532	\$18,989,436		
10	\$30,996,681	\$37,215,246	\$38,395,173		
20	\$61,751,985	\$74,688,518	\$77,979,418		

Tables 7-7 – 7-9 show the same type of analysis for fuel savings. However, fuel savings also depend on the type of fuel used, because different fuel sources have different prices. The analysis identified the fuel source for five of the seven demonstration sites that reported quantifiable fuel savings; however, the fuel source for two sites was unknown. For these two sites, the analysis was based on the typical fuel mix for each project's sector (commercial/industrial or residential) in New York State. ⁴⁸ As shown in Table 7-9,

⁴⁷ Please refer to Appendix C for further details about the methodology for this analysis.

⁴⁸ Appendix C describes the data sources and methodology used for calculating the fuel mix.

the value of expected fuel savings ranges from \$91,911 to \$2.3 million depending on assumptions about lifespan and energy prices. ⁴⁹

Table 7-7. Estimated Fuel Savings from Demonstration Projects

	Energy Prices				
Lifespan (Years)	Low	Medium	High		
1	\$45,829	\$51,562	\$51,562		
5	\$227,213	\$253,089	\$256,016		
10	\$471,956	\$522,665	\$534,685		
20	\$1,021,606	\$1,123,863	\$1,166,257		

Table 7-8. Estimated Fuel Savings from Replication Projects

	Energy Prices		
Lifespan (Years)	Low	Medium	High
1	\$46,082	\$49,613	\$49,613
5	\$223,322	\$243,042	\$244,778
10	\$458,621	\$500,518	\$507,680
20	\$979,267	\$1,071,216	\$1,098,140

Table 7-9. Combined Estimated Fuel Savings

	Energy Prices			
Lifespan (Years)	Low Medium High			
1	\$91,911	\$101,175	\$101,175	
5	\$450,535	\$496,131	\$500,795	
10	\$930,576	\$1,023,183	\$1,042,365	
20	\$2,000,873	\$2,195,079	\$2,264,397	

The estimated electricity and fuel savings were summed to derive aggregate savings, ⁵⁰ and the aggregate savings were divided by NYSERDA's costs to calculate cost effectiveness. Tables 7-10 – 7-12 present the results of the analysis. As shown in Table 7-12, the demonstration and replication projects could together save between \$0.14 and \$3.54 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 may be higher than the figures suggest. It is also important to note that the energy cost savings shown in Tables 7-10 and 7-11 represent a subset of the total cost savings presented in Sections 4.3, 5.3, and 7.1. In other words, energy cost savings are only a fraction of total cost savings, with total cost savings and revenues exceeding NYSERDA's investment in the demonstration projects.

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⁴⁹ The analysis assumes that the replication sites use the same fuel source as the demonstration sites.

⁵⁰ To save space, the report does not show this intermediate step.

Table 7-10. Cost Effectiveness of Electricity and Fuel Savings from Demonstrations

	Energy Prices		
Lifespan (Years)	Low	Medium	High
1	\$0.08	\$0.10	\$0.10
5	\$0.39	\$0.48	\$0.49
10	\$0.80	\$0.95	\$0.98
20	\$1.59	\$1.92	\$2.00

Table 7-11. Cost Effectiveness of Electricity and Fuel Savings from Replications

	Energy Prices		
Lifespan (Years)	Low	Medium	High
1	\$0.06	\$0.08	\$0.08
5	\$0.30	\$0.37	\$0.37
10	\$0.61	\$0.73	\$0.76
20	\$1.22	\$1.47	\$1.54

Table 7-12. Cost Effectiveness of Combined Electricity and Fuel Savings

	Energy Prices		
Lifespan (Years)	Low	Medium	High
1	\$0.14	\$0.18	\$0.18
5	\$0.70	\$0.84	\$0.86
10	\$1.41	\$1.69	\$1.74
20	\$2.81	\$3.39	\$3.54

7.3 PARTICIPANT PERSPECTIVES OF COST EFFECTIVENESS

The study also sought to assess cost-effectiveness from the firm's perspective. The survey included questions about resources committed by participants and their perceptions of whether the investment was worthwhile.

Out of 61 respondents, 18 contributed staff time to the project and 43 contributed project expenses ranging from \$1,020 to \$20 million, with an average contribution of \$1,514,340. These figures include cash and in-kind contributions. Moreover, the figures are partial and cannot be aggregated. Therefore, while the numbers give some indication of the level of the firm's investment, they cannot be used to quantitatively assess cost effectiveness.

Therefore, the study used a qualitative approach to assess the value of the investment from the firm's perspective. A series of questions asked respondents about other investments the firm was considering when it began the demonstration project and how those alternatives compared. As shown in Table 7-13, 27 out of 61 projects (44%) stated that they had considered alternatives to the demonstration project. As shown in Table 7-14, all but one of these respondents indicated that the demonstration was the best choice relative to the alternatives.

Table 7-13. Alternatives Considered at the Time of the Demonstration Project

	Number of Projects	Percent of Projects	Adjusted Percent of Projects
Yes	27	44%	47%
No	31	51%	53%
Don't Know	3	5%	
Total	61	100%	100%

Table 7-14. Value of Demonstration Relative to Alternatives

	Number of Projects	Percent of Projects
Yes	26	96%
No	1	4%
Total	27	100%

The survey asked respondents if they considered the demonstration project to be a good investment, and whether their return on investment was positive, negative, or neutral. As shown in Table 7-15, 54 respondents out of 61 (89%) indicated that the demonstration was a good investment.

Table 7-15. Assessment of Whether the Demonstration was a Good Investment

	Number of Projects	Percent of Projects	Adjusted Percent of Projects
Yes	54	89%	93%
No	4	7%	7%
Don't Know/Refused	3	5%	
Total	61	100%	100%

Note: Due to rounding, percentages do not sum to exactly 100%.

As shown in Table 7-16, 79% indicated that their return on investment was positive, 15% breakeven, and only 6% indicated that their return was negative. The findings indicate that a strong majority of respondents considered the demonstration projects to be worthwhile investments.

Table 7-16. Firm's Return on Investment

	Number of Projects	Percent of Projects
Positive	48	79%
Negative	4	6%
Breakeven/Neutral	9	15%
Total	61	100%

CONCLUSIONS AND RECOMMENDATIONS

This evaluation explored the impacts of NYSERDA's R&D demonstration projects and replication projects. The findings also highlight the factors that support and hinder replications in New York. While the survey gathered valuable information, it also helped identify data gaps and limitations that could be addressed in the future. This section presents the overall conclusions of this study and recommendations for future R&D demonstration surveys.

8.1 CONCLUSIONS

The evaluation has the following major conclusions:

NYSERDA's R&D demonstrations have mostly achieved their objectives while generating substantial impacts. Nine out of 10 survey respondents reported meeting "all" or "most" of their objectives, with over half of all projects meeting all of their objectives. Respondents cited a wide range of project impacts, including energy efficiency, demand reduction, power production, environmental quality improvement, marketability, knowledge creation, and many others. Given the broad range of projects and benefits, and the challenges of recalling savings from two or more years ago, many benefits could not be quantified. However, the benefits that could be quantified are impressive, as shown in Table 8-1. In addition, almost two-thirds of the surveyed demonstration projects (65%) reported replications, with 46% of projects reporting one or more replications in New York. These replications had their own significant impacts. Table 8-1 summarizes the demonstration and replication impacts to which NYSERDA contributed.

Table 8-1. Summary of NYSERDA Contribution to Demonstration and Replication Impacts

	Estima	ted Benefits by Pro		
Benefits Type	Power Production	Process Improvement	Product Demonstration	Total Benefits
Demonstration Installed Capacity (kW)	3,988	75	538	4,601
Replication Installed Capacity (kW)	4,075	63	-	4,138
Total Installed Capacity (kW)	8,063	138	538	8,739
Demonstration Electricity Savings (MWh/year)	17,062	88	4,688	21,838
Replication Electricity Savings (MWh/year)	16,558	-	146	16,704
Total Electricity Savings (MWh/Year)	33,620	88	4,834	38,542
Demonstration Fuel Savings (Therms/Year)	0	44,137	13,729	57,866
Replication Fuel Savings (Therms/Year)	-	1,000	29,318	30,318
Total Fuel Savings (Therms/Year)	0	45,137	43,047	88,184
Demonstration Cost Savings	\$11,748,933	\$8,514,463	\$3,545,264	\$23,808,660
Replication Cost Savings	\$36,160,752	\$5,435,000	\$274,719	\$41,870,471
Total Cost Savings	\$47,909,685	\$13,949,463	\$3,819,983	\$65,679,131
Demonstration Revenue	\$3,194,233	\$1,050,180,000	\$9,590,000	\$1,062,964,233
Replication Revenue	\$12,515,540	\$202,500	\$60,480,000	\$73,198,040
Total Revenue	\$15,709,773	\$1,050,382,500	\$70,070,000	\$1,136,162,273

Demonstrable savings and technical expertise are important factors for developing replication projects in New York. Technical expertise and demonstrable savings achieved from demonstrations were the most frequently mentioned factors that support the development of replication projects in New York. This finding is consistent with NYSERDA's rationale for conducting demonstration projects, which is to showcase the value and effectiveness of a new technology or process in a commercial setting. It also reflects the technical assistance provided by NYSERDA, as well as the contacts facilitated by NYSERDA between demonstration participants and industry experts. The barriers to replication that respondents identified most often include: absence of other companies, institutions, or sites in New York to take advantage of the demonstrated technology; cost; and uncertainties about unproven technologies. The barriers and success factors appear closely linked; for example, technical functionality and financial considerations play a key role in supporting and hindering replication. The absence of opportunities to replicate projects in New York is more difficult to explain, and suggests a need to consider broader market forces that help determine the success of new or less-proven technologies.

NYSERDA's R&D demonstration portfolio performs well across several measures of costeffectiveness. Tables 8-2 and 8-3 summarize NYSERDA's cost effectiveness in terms of demonstration
and replication benefits achieved per dollar spent on demonstration projects. The revenue benefits are
quite high, particularly with one demonstration project that reported \$1.2 billion in sales. This result
exemplifies the nature of R&D investment, where a small number of very successful projects typically
justify the cost of the whole portfolio. It is notable that even without this one project, the benefits still
exceed NYSERDA's investment. Moreover, some of these projects are expecting additional revenues
and cost savings in future years, which will further drive down the cost of NYSERDA's investment
relative to the benefits. The benefits of electricity and fuel savings – which are a subset of total cost
savings – exceed NYSERDA's investment in the demonstration projects in the 10-year and 20-year
scenarios ("low," "medium," and "high"), but not in the one-year or five-year scenarios. However, this
may reflect incomplete benefits data rather than any inefficiency on the part of NYSERDA. Also, it is
important to note that NYSERDA funds R&D demonstrations to achieve public policy goals that are not
uniformly centered on cost-effective energy savings. Survey responses suggest that participants generally
found the demonstration projects to be worthwhile investments.

Table 8-2. Cost Effectiveness for Combined Demonstration and Replication Benefits

Benefit Type	Cost Effectiveness	Cost Effectiveness Adjusted (Outlier Removed)
Demonstration and Replication Cost Savings per NYSERDA \$	\$2.90	\$2.90
Demonstration and Replication Revenues per NYSERDA \$	\$50.09	\$3.80
Demonstration and Replication Dollars (Revenues and Cost Savings) per NYSERDA \$	\$52.98	\$6.69

Tubic o 5. Cost Effect	Dicties of Electricity	E B:	cinonisti utions and ite	
		Energy Prices		
Lifespan (Years)	Low	Medium	High	
1	\$0.14	\$0.18	\$0.18	
5	\$0.70	\$0.84	\$0.86	
10	\$1.41	\$1.69	\$1.74	
20	\$2.81	\$3.39	\$3.54	

Table 8-3. Cost Effectiveness of Electricity/Fuel Savings from Demonstrations and Replications

Participant satisfaction with NYSERDA's R&D Program appears very high. Ninety-two percent (92%) of survey respondents agreed or strongly agreed with the statement: "Overall, I am satisfied with my participation in NYSERDA's R&D Program." Respondents also gave very high ratings (greater than 80%) for communications with project participants and qualifications of program staff. Though generally satisfied, respondents offered several suggestions for ways in which NYSERDA could further promote demonstration and replication projects in New York. These suggestions include, among others: simplify the application process; post project reports online and offer an online database of project results; align projects with relevant policies; facilitate more knowledge sharing activities with peers; and enhance communications with end users.

Data limitations pose challenges for evaluating NYSERDA's R&D demonstration projects. Several projects were missing contact information or had outdated or incorrect information. In other cases, the company contact was correct, but the Principal Investigator had moved on and could not be located. In addition, many respondents had difficulty recalling the benefits of projects that ended two or more years ago. The NYSERDA R&D Metrics Database does not currently include comprehensive benefits data, although this is expected to change over time. Final project reports are another potential source of benefits data, but they do not appear to be archived in a central location, and are difficult to retrieve.

8.2 **RECOMMENDATIONS**

NYSERDA has committed to repeating the R&D demonstration survey at regular intervals to ensure the existence of a regularly updated, comparable set of information about NYSERDA's demonstration projects and associated replications. This survey and the previous round provided valuable information that can guide future survey efforts. Recommendations include the following:

Fully leverage information in the R&D Metrics Database and Final Project Reports. The R&D Metrics Database was created in 2009. It did not exist when the first survey was conducted, and it was not fully populated for the second (current) survey. Assuming these issues are addressed for future rounds, NYSERDA may be able to obtain benefits data for most or all projects before conducting the survey. The survey would then focus on validating the benefits data and obtaining information about replication projects. NYSERDA is currently planning for an evaluability assessment that would leverage and build on NYSERDA's previous database-building efforts, explore and categorize data from prior evaluations, and offer constructive input on issues that NYSERDA is still considering.

Interview all three types of participants for each demonstration project. Each NYSERDA demonstration project typically involves three categories of participants: 1) integrators who bring together market actors and "package" the project; 2) vendors who supply the technology, product, or process; and 3) site owners. The first two surveys interviewed a single type of respondent for each demonstration site – e.g., integrator, vendor, or site owner. Depending on available time and resources, NYSERDA may be able to survey all three types of participants for every site in future rounds. This would provide more comprehensive information about the benefits of NYSERDA's demonstrations.

Re-survey demonstration projects from prior rounds. The first two surveys focused on two distinct populations: projects completed in 2004-2007, and projects completed in 2008-2010. NYSERDA could

consider re-surveying projects from 2004-2010, to learn whether demonstration benefits persisted and whether there have been any additional installations or sales of the demonstrated technology.

Clarify the definition of replication and track NYSERDA's replication costs. The first two R&D surveys defined replication projects broadly, and included replications with and without NYSERDA funding. However, NYSERDA is considering whether NYSERDA-funded replication projects should be "counted" as market replications. Going forward, NYSERDA should make a determination as to whether NYSERDA-funded replications will or will not be "counted" for the survey. If NYSERDA continues to include these projects, it should track the costs of each NYSERDA-funded replication in a way that can be traced back to the original demonstration. It would also be desirable to know whether these replications received funding from NYSERDA's R&D Program or NYSERDA's deployment programs. This information would provide a more comprehensive understanding of the demonstration-replication process and would allow for a more comprehensive assessment of NYSERDA's cost effectiveness.

Survey the replication sites. The first two rounds only surveyed demonstration participants, and asked if they were aware of any replication projects. Some respondents were unsure about the number of replications; others were unsure what specific benefits the replications had produced. Using a "snowball" survey technique, NYSERDA could ask demonstration respondents for "leads" at replication sites and follow up directly with the replicators. This would help verify the number of replications, quantify the replication benefits, and understand the causal link between NYSERDA's demonstration projects and subsequent replications. In addition, the survey data could potentially be used to track changes in performance (such as installation costs, operating costs, sales volume, and return on investment) from the first replication to the fifth (or higher) replication.

Explore the impacts of knowledge creation. Sixty-two percent (62%) of respondents in the current survey identified knowledge creation as a direct benefit of their project – more than any other benefit category. NYSERDA could further explore the tangible and intangible benefits of knowledge creation in future rounds of the survey. For example, future surveys could ask respondents whether they have applied the knowledge they gained from the demonstration project in future projects or in their ongoing business practices. The survey could also inquire how the knowledge gained from the demonstration projects has affected their operations, productivity, and sales. In addition, if replicators are included in future rounds, the survey could ask whether they applied the knowledge, methods, or lessons from the demonstration projects – thereby tracing the transfer of knowledge from demonstration sites to replication sites – and their resulting changes in performance.

R&D Demonstration Survey MethodAppendices

Appendix A

ADVANCE LETTER AND TELEPHONE SURVEY INSTRUMENTS

PRINTED ON NYSERDA LETTERHEAD

[DATE]

[NAME & FIRM ADDRESS]

Dear [NAME]:

The New York State Energy Research and Development Authority (NYSERDA) has retained Industrial Economics, Inc. (IEc) and APPRISE to conduct an evaluation of projects NYSERDA has funded for the purpose of demonstrating specific technologies or processes. This important study will enable NYSERDA to better assess program accomplishments and improve programs that serve New York.

We wish to collect data about the [NAME OF THE PROJECT]. Our records indicate this project received NYSERDA funding from NYSERDA's R&D Program for the project that was completed in [MONTH/YEAR]. We are interested to learn about the results of NYSERDA's assistance on your ability to demonstrate the effectiveness of this project as well as potential applications beyond this particular site.

We would like to schedule an interview with you. The interview will take up to one hour to complete, and someone from APPRISE will call you to schedule a time that is most convenient for you. Policy analysts from IEc and APPRISE will conduct the interview.

IEc and APPRISE are independent researchers. The information you provide will be kept confidential to the extent permitted by law. We will report all responses in aggregate and will not attribute any comments to you.

Someone will be calling you within the next week to conduct this interview. Your participation is important to our evaluation effort. We know your time is valuable, and we sincerely appreciate your efforts to help us. If you have questions about the survey, please call Brian Peter at NYSERDA at (518) 862-1090, extension 3615, or Daniel Kaufman of IEc at (617) 354-0074. If you would like more information about IEc or APPRISE, please visit their websites: http://www.indecon.com/ and http://www.appriseinc.org/.

Thank you for your assistance.

Sincerely,

Signed originals mailed

Brian Peter Assistant Project Manager, Evaluation NYSERDA 17 Columbia Circle Albany, NY 12203

bwp@nyserda.ny.gov

NYSERDA

Demonstration Project Survey

INTEGRATORS

Interview Date:

[mm/dd/yyyy]

	Interviewer name:
	Interviewer phone:
CNTRCT_ID:	
Project Description:	
Best Contact:	
NYSERDA Project Manager	
PI First Name and PI Last Name	
Title:	
Phone:	
Email:	
Project Role:	
Company Name:	
Program Area:	[Buildings, Transportation, Energy Resources, etc.]
Project Type:	[PRODUCT, PROCESS OR POWER PRODUCTION]
NYSERDA \$	(Encumbered \$ for this project.)
Earliest contract signed date	
Latest contract closed date	
Location	

THE POLICY ANALYST CONDUCTING THE INTERVIEW WILL WORK THROUGH THE INSTRUMENT USING THE SPECIFIC DATASET INPUT AND PROJECT DESCRIPTION TO REFINE QUESTION WORDING AS NECESSARY TO PROVIDE CLEAR LANGUAGE AND TO OBTAIN THE INFORMATION DESIRED FROM EACH QUESTION. GIVEN THE INFORMATION IN THE DATASET, THE SURVEY INSTRUMENT FOR EACH INTERVIEW WILL BE MARKED FOR THE APPROPRIATE HANDLING OF QUESTIONS AND SKIP PATTERNS REGARDING THE IMPACTS FROM THE DEMONSTRATION PROJECT (QUESTIONS 17 THROUGH 32).

Identify the Appropriate Contact

Hello, my name is [interviewer name], and I am calling from [company name] on behalf of the New York State Energy Research and Development Authority, also known as NYSERDA. NYSERDA is conducting a study to assess the impact of its funding on New York State companies and on the State's economy. This study will also assess the impact of its funding and technological support on [use "product", "process", or "generation" depending on participant] demonstration projects conducted in New York State.

NYSERDA has contracted with Industrial Economics, Incorporated and APPRISE to perform this study. IEc and APPRISE are independent research and consulting firms. I would like to ask some questions about your involvement in a completed NYSERDA demonstration project – the [SUMMARIZE FROM CONTRACT DESCRIPTION]. The information you provide will be kept confidential to the extent permitted by law. We will report all responses in aggregate and will not attribute any comments to you. The information you provide will be used to improve NYSERDA's research and development programs. NYSERDA is contacting all participants who completed demonstration projects within the last five years.

SCREENING

Our records show that NYSERDA provided \$_____ in funding to [COMPANY NAME] for the demonstration project [CONTRACT DESCRIPTION].

- SCR-1. This survey will take about one hour to complete. We would like to talk to the person who is most knowledgeable about the project. If not you, could you please direct me to, or provide me with the name of the person who is the most qualified to discuss this project?
 - a. Caller [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Most qualified contact [CONTACT THIS PERSON, REPEAT INITIAL INTRODUCTION AND THE INTRODUCTION TO THE SCREENING SECTION, AND CONTINUE WITH THE FOLLOWING QUESTION]
- SCR-2 Mr./Ms. [name] referred me to you to answer specific about this project [DESCRIBE PROJECT BRIEFLY as this is another person]. This survey will take about one hour to complete. Can we discuss the project now, or can we schedule a time when I can call you back?
 - a. Can discuss now [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Call back on at time:
 - c. [IF THIS PERSON IS NOT THE MOST QUALIFIED PERSON, LOOP BACK TO SCR-1]
- SCR-3 Which of the following <u>best</u> describes your role in the [PROJECT]? [READ ALL CHOICES TO RESPONDENT AND SELECT THE MOST APPROPRIATE CHOICE.]
 - a. I provided the [PRODUCT/PROCESS/TECHNOLOGY/TYPE OF GENERATION... tailor to the project based on project type] for this project. [USE VENDOR SURVEY INSTRUMENT]
 - b. I am the site owner. [USE SITE OWNER SURVEY INSTRUMENT]
 - c. I developed the project and brought together the vendor, site owner, and other market actors. [USE INTEGRATOR SURVEY INSTRUMENT]
- SCR-4 Do you have any reports or presentations that describe the results of the [PROJECT]?
 - a. Yes [ASK THE RESPONDENT TO SEND THE REPORTS IN ADVANCE OF THE CALL]
 - b. No
 - c. Don't Know [ASK THE RESPONDENTTO CHECK AND SEND WHAT THEY HAVE IN ADVANCE OF THE CALL]

SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW

[NOTE: PRIOR TO BEGINNING THE DISCUSSION, ASK THE RESPONDENT WHETHER OR NOT IT IS OKAY TO RECORD THE CALL.]

1.	Our records show that NYSERDA provided funding to [COMPANY NAME] for a project involving [CONTRACT DESCRIPTION]. Is this an accurate description of the project? a) (1) Yes b) (2) No
[IF	Q1 = YES, SKIP TO Q3. IF Q1 = NO, ASK Q2.]
2.	How would you describe the project?
	Record open-ended response:
3.	Is this the first time your firm used this ["product", "process", "technology" or "type of generation"tailor to project based on PROJECT TYPE]? a) (1) Yes b) (2) No c) (3) Don't know
[IF	Q3 = NO, PROCEED TO Q4. OTHERWISE, SKIP TO Q6]
4.	How many times had your firm used this ["product", "process", "technology" or "type of generation"tailor to project] prior to the [reference NYSERDA demo project]? a) [RECORD THE NUMBER OF TIMES] b) Don't know
5.	How did [reference NYSERDA demo project] differ from previous uses of this ["product", "process", "technology or "type of generation"tailor to project]?
	RECORD VERBATIM RESPONSE:
	a) b) c)
RE	ECORD VERBATIM COMMENTS FIRST; DO NOT READ LIST. THEN, LOOK AT THE LIST AND VERIFY THE ELEVANT SELECTION(S) WITH RESPONDENT.] d) No difference e) Smaller in scale than previous projects of this type f) Larger in scale than previous projects of this type g) Different inputs h) Different application of the technology i) Different type of facility

[POLICY ANALYST CALCULATION #1: DO NOT READ TO SURVEY RESPONDENT.

STEP ONE: IF Q3 = "YES" OR "DON'T KNOW", RECORD 0 ON THE LINE BELOW. SKIP STEP TWO.

RECORD 0.
CALCULATION #1:]
6. Now I would like to discuss the [SUMMARIZE CONTRACT DESCRIPTION] Project. How would you describe the objectives of this project? [OPEN-ENDED QUESTION TO PRIME THE RESPONDENT'S THINKING]
7A. Can you identify specific challenges you faced when planning this project? [ASK UNPROMPTED FIRST.] a b c
[RECORD VERBATIM COMMENTS FIRST; DO NOT READ LIST. THEN, LOOK AT THE LIST AND VERIFY THE RELEVANT SELECTION(S) WITH RESPONDENT.] d.
7B. Can you identify specific challenges you faced when executing this project? [ASK UNPROMPTED FIRST.] a b c
[RECORD VERBATIM COMMENTS FIRST; DO NOT READ LIST. THEN, LOOK AT THE LIST AND VERIFY THE RELEVANT SELECTION(S) WITH RESPONDENT.] d.
8A. Can you identify any benefits that you received from planning this project? 8B. Can you identify any benefits that you received from executing this project?
9. Overall, do you feel this project accomplished all, most, some, or none of its objectives?

a. All b. Most c. Some d. None e. Don't know / refused [DO NOT READ THIS OPTION] [IF RESPONDENT SELECTS "ALL" OR "DON'T KNOW," SKIP TO Q11. OTHERWISE, ASK Q10.] 10. Please explain why this project did not accomplish all of its objectives:
SECTION 2: COST EFFECTIVENESS
Now I would like to ask about the cost-effectiveness of the project.
11. NYSERDA furnished a grant for [NYSERDA \$]. In addition to that amount, how much did your firm invest in this project in terms of staff time and project expenses? \$, staff
[IDEALLY, COLLECT DATA ON \$ AND STAFF TIME. HOWEVER, IT IS OKAY IF THE RESPONDENT CAN ONLY PROVIDE ONE OR THE OTHER (OR NEITHER).]
12. At the time the project began, were you considering alternatives to the ["product", "process", "technology" or "type of generation"] that you used in the NYSERDA project? a Yes, explain: b No c Don't know
[IF Q12 = YES, PROCEED TO Q13. OTHERWISE, SKIP TO Q14.]
13. Looking back, do you think the ["product", "process", "technology" or "type of generation"] that you used in the NYSERDA project was the best alternative? a Yes, explain: b No, explain: c Don't know
14. Do you feel the [PROJECT DESCRIPTION] project was a good investment? a.
 15. In general terms, how would you describe your return on this project? [READ LIST TO RESPONDENT] a. Positive b. Negative
c. Breakeven or neutral
16. Have you advertised or communicated the results of this project to any potential buyers, suppliers, or business partners?

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a. Yes, explain:
b. No, explain:
c. Don't know
SECTION 3: DEMONSTRATION PROJECT IMPACTS
Now I would like to talk with you more about the project's benefits.
[NOTE: WHEN ASKING FOR BENEFITS DATA, TRY TO GET NUMERICAL UNITS AS OPPOSED TO PERCENTAGES. IF RESPONDENT REPORTS A PERCENTAGE OR PERCENTAGE CHANGE, ASK IF HE/SHE CAN NUMERICALLY QUANTIFY THE CHANGE, OR IF HE/SHE CAN PROVIDE THE BASELINE THAT THE PERCENTAGE CHANGE IS BASED ON.]
IF PROGRAM DATA INCLUDES RESOURCE TYPE, ASK Q17-Q21. OTHERWISE, ASK Q17D, THEN SKIP TO Q22.]
17A.NYSERDA program records indicate that this project resulted in [RESOURCE TYPE 1] benefits involving [RESOURCE TYPE 2]. [NOTE: IF A PROJECT HAS MORE THAN ONE ENTRY FOR "RESOURCE TYPE 1," ASK THE QUESTION SEPARATELY FOR EACH ENTRY.]
Is that correct?
☐ Yes [SKIP TO Q18]
☐ No [ASK Q17B]
☐ Don't know [ASK Q17B]
17B. Did you previously report these benefits to NYSERDA?
Yes [ASK 17C]
□ No [SKIP TO 17D]
☐ Don't know [SKIP TO 17D]
17C. Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED: FILL IN RESPONDENT'S ANSWER]
17D. Which of the following describe the specific types of benefits this project produced? For each benefit that your project produced, please state if it was a direct benefit, indirect benefit, or uncertain benefit. [READ THE LIST. CHECK ALL THAT APPLY. FOR EACH BENEFIT TYPE IDENTIFIED BY RESPONDENT, ASK RESPONDENT IF THIS IS A DIRECT BENEFIT, INDIRECT BENEFIT, OR UNCERTAIN BENEFIT. MAKE SURE TO ASK ABOUT ANY OTHER BENEFITS THAT WE MAY NOT HAVE MENTIONED.]
☐ Power production ☐ Direct ☐ Indirect ☐ Uncertain
☐ Energy efficiency ☐ Direct ☐ Indirect ☐ Uncertain

	Air emissions	☐ Direct		Indirect		Uncertair	1
	Productivity	Direct		Indirect		Uncertair	1
	Waste management	Direct		Indirect		Uncertair	1
	Product quality/reliabili	ty improveme	nt	☐ Direct] Indirect	Uncertain
	Water reductions	Direct		Indirect		Uncertair	1
	Water quality	Direct		Indirect		Uncertair	1
	Operations & Maintena	ance \square	Direct	Indire	ct [Uncerta	ain
	Marketability	Direct		Indirect		Uncertair	1
	Demand reduction	Direct		Indirect		Uncertair	1
	Reduced labor costs	☐ Direct		Indirect		Uncertair	1
	Reduced material costs	s 🗌	Direct		Indirect		Uncertain
	Environmental quality i	mprovement		Direct		Indirect	☐ Uncertain
	Knowledge creation		Direct		Indirect		Uncertain
	Other Specify:			Direct		ndirect	☐ Uncertain
18.	NYSERDA's records in	ndicate that th	is projec	t <u>produce</u>	<u>d</u> [IF BEN	NEFIT IS F	G. OTHERWISE, SKIP TO Q22.] POWER PRODUCTION] saved [IF
	QUESTION AND REC						
	[Net Units]	[Unit Typ	e]	[Metric	Year]		
	Are these numbers cor (1) Yes [SKIP TO C (2) No [ASK Q19]						
19.	Did you previously report [1] (1) Yes [ASK Q20] [2) No [SKIP TO Q [3] Don't know [SK	21]	bers to I	NYSERDA	λ?		
20.	Do you know why there have? [ASK OPEN-EN						the information that you currently
	Performance of the	e equipment o	changed	over time			
	☐ We decommission	ed the projec	t				
	☐ Benefits were real	ized prior to th	ne first re	eporting ye	ear		

Additional benefits accrued over time
Other, please specify:
21. Please estimate the actual benefits.
Specify unit: [kWh, kW, MMBtu, pounds of pollutant, etc.]. Year(s):
[ASK Q22 IF THE PROGRAM DATA DOES NOT INCLUDE NET UNITS. IF MORE THAN ONE BENEFIT, ASK THE QUESTION AND RECORD RESPONSES SEPARATELY FOR EACH BENEFIT. ASK ABOUT ALL DIRECT AND INDIRECT BENEFITS; DO NOT ASK ABOUT UNCERTAIN BENEFITS.]
22. Please provide an estimate of the [REDUCTION IN / PRODUCTION OF] in [ENERGY, kW, EMISSIONS, ETC. – TAILOR TO SPECIFICS]. IF MORE THAN ONE BENEFIT IS REPORTED, ASK THE QUESTION AND RECORD RESPONSES SEPARATELY FOR EACH REPORTED BENEFIT.]
Specify unit: [kWh, kW, MMBtu, pounds of pollutant, etc.] Year(s):
[ASK Q23 IF RESPONDENT DID <u>NOT</u> ANSWER Q21 OR Q22. IF RESPONDENT ANSWERED Q21 OR Q22 SKIP TO Q24.]
23. Besides [METRIC YEAR(S) REPORTED IN THE DATABASE], has the project produced any other [UNIT TYPE] benefits?
(1) Yes, explain: [Net Units] [Unit Type] [Metric Year(s)]
(2) No (3) Don't know
23-AA. Besides [UNIT TYPE], has the project produced any other types of benefits?
(1) Yes [IF YES, LOOP BACK TO Q17D]
☐ (2) No
(3) Don't know
[IF PROGRAM DATA INCLUDES NET DOLLARS, ASK Q24-27. OTHERWISE, SKIP TO Q28.]
24. NYSERDA's records indicate that this project [GENERATED/SAVED]:
[Net Dollars] [Metric Year(s)]
Are these numbers correct? (1) Yes [SKIP TO Q32] (2) No [ASK Q25]

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25.	Did you previously report these numbers to NYSERDA? (1) Yes [ASK Q26] (2) No [SKIP TO Q27] (3) Don't know [SKIP TO Q27]
26.	Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED]
27.	Please estimate the actual net dollars in [REVENUE/COST SAVINGS] from this project: \$, year(s):
[AS	K Q28 IF THE PROGRAM DATA DOES NOT INCLUDE NET DOLLARS. OTHERWISE, SKIP TO Q32]
28.	Did this project generate any revenue?
	☐ (1) Yes [ASK Q29] ☐ (2) No [SKIP TO Q30] ☐ (3) Don't know [SKIP TO Q30]
29.	Please provide an estimate of the revenue generated from this project.
	\$, year(s):
30.	Did this project generate any cost savings?
	☐ (1) Yes [ASK Q31] ☐ (2) No [SKIP TO Q33] ☐ (3) Don't know [SKIP TO Q33]
31.	Please provide an estimate of the cost savings generated from this project.
	\$, year(s):
	[ASK Q32 IF RESPONDENT DID <u>NOT</u> ANSWER Q27. Q29, OR Q31. IF RESPONDENT ANSWERED Q27, Q29, OR Q31, SKIP TO Q33.]
32.	Besides [METRIC YEAR(S) REPORTED IN THE DATABASE], has the project generated any other [REVENUE/COST SAVINGS]?
	(1) Yes, amount: \$
	(2) No (3) Don't know
33.	Who were the primary end users for this project?

A-11

	G.	(3)	DOIT KNOW			
39.	Did sou	rces othe	r than NYSERDA provide fu	unding for this proj	ect?	
	a.	(1)	Yes, explain	\$	Identify source:	
	b.	(2)	No			
	C.	(3)	Don't know			

40.	was NYSERDA's financial assistance in your decision to do this project?							
	(Not at all import	ant)					(Very important)	
	0 1	2	3	4	5			
	[ASK Q41 ONLY	' IF Q37	= "YES". I	F Q37 =	"NO" OR	"DON'T	KNOW", RECORD 0.]	
41.	On a scale of 0 t						very important," how important or unimportant this project?	
	(Not at all import	ant)					(Very important)	
	0 1	2	3	4	5			
							RD THE <u>HIGHER</u> SCORE OF Q40 OR Q41.	
	DO <u>NOT</u> READ	TO THE	RESPON	DENT: _		_]		
			_					
42.							s project in New York without NYSERDA's where 0 is not at all likely and 5 is very likely.	
							,	
	(Not at all likely)						(Very likely)	
	, ,,,	0	1	2	3	4	5	
[AS	K Q43 ONLY IF (237 = "YI	ES". IF Q3	37 = "NO'	OR "DO	N'T KNO	W", RECORD 0.]	
43.							s project in New York without NYSERDA's	
	technical assist	ance? P	lease ans	wer on a	scale fro	m 0 to 5,	where 0 is not at all likely and 5 is very likely.	
	/NI=4 =4 =11 1211. A						(Mary West)	
	(Not at all likely)	0	1	2	2	1	(Very likely)	
		0	1	2	3	4	5	
ſDΩ	TZV INIA VST	DEDE∩E	OM CALC	ι ΙΙΙ ΑΤΙΩΙ	\I#2∧· E	DECODD.	THE <u>LOWER</u> SCORE OF Q42 OR Q43:	
							PLE, 0 BECOMES 5, 1 BECOMES 4, ETC.	
	NOT READ TO		<u></u>			K LAAWII	EL, O DECOMES 3, 1 DECOMES 4, E16.	
טט	NEAD TO	TIL IXLO	A CHULI					
	O 11			_				
44.	Overall, without the same size, s			ement w	ould the I	magnitud	de of the impacts for this project have been of	

a. Same b. Smaller c. Larger d. Project would not have happened v e. Don't know [DO NOT READ]	without NYSERDA						
45. I would now like to ask you about how, if at all, NYSERDA's support affected the timing of the project. Without NYSERDA's support, would you have carried out this project earlier, at about the same time, or later?							
a Earlier: years earlier [ASK RE b About the same time c Later: years later [ASK RESPO d Project would not have happened ve Don't know [DO NOT READ]							
[POLICY ANALYST CALCULATION #4A: IF Q44 = A C DO <u>NOT</u> READ TO THE RESPONDENT:							
[POLICY ANALYST CALCULATION #4B: IF Q45 = A, RECORD -1. IF Q45 = B OR E, RECORD 0. IF Q45 = C OR D, RECORD +1.] [CALCULATION #5: TAKE THE AVERAGE OF CALCULATION #2 AND #3B. THEN, ADD THE RESULTS OF CALCULATIONS #1, #4A, AND #4B. RECORD YOUR ANSWER HERE: DO NOT READ TO THE SURVEY RESPONDENT.]							
SECTION 5: REPLICATIONS							
I have some questions now concerning your experience with classifies the project we have been discussing as a demonstra							
We define a demonstration project as the demonstration of a existing technology in a commercial setting. Demonstration profession process being demonstrated	ojects are designed to showcase the value and						
We define replication as an additional installation or scaling up of the technology or process demonstrated under the NYSERDA-funded project. The replication could be at the same site as the NYSERDA demonstration project or at another site. The replication could be conducted by your firm or another firm.							
46. NYSERDA funded the [SUMMARY OF DEMO PROJ that time, has your firm or another firm replicated the demonstration project for similar applications?	technology or process from the NYSERDA						
a. (1)☐ Yes How Many?: b. (2)☐ No	Month, Year: , , , , , , , , , , , , , , , , , , ,						
c. (3) Don't know							

47.		ur firm or for a diff e			chnology or process from the NYSERDA demonstration
	a.	(1) (2) (2)	Yes No	How Many?:	Month, Year: [IF MORE THAN 5, GET DATES FOR THE MOST RECENT 5]
	C.	(3)	Don't kı	now	NEOLIVI OJ
-	In what		the repli		49.] the original NYSERDA demonstration project? [RECORD
[CONTII	NUE WIT	TH Q49 IF	- Q46 = \	YES; SKIP TO Q63 I	F Q46 = NO OR DON'T KNOW.
49.					replicated this demonstration project in New York? [DO NO
	[IF Q49	= 0, SKII	P TO Q6	3]	
50.	the 1st r replicati MONTH	eplicatior ion in Nev	in New York? blication blication	York? From the NYS	ion project was operational, how long did it take to complete SERDA demonstration project to the completion of the 2 nd of the 3 rd replication? [GET NUMBER OF YEARS AND/OR
51.			TIONS, E Technic Financi Locatio Reques Operati	EXCEPT "OTHER"] cal expertise gained ng available navailable sted by building owne on conditions were restrable savings were	ight
[IF 5 OR	R FEWER	R REPLIC	ATIONS	SKIP TO Q53.]	
52.	replicati		oare to th	ne original demonstra	eted in New York State, how did the [Unit Type] of the ation? [IF MORE THAN ONE TYPE OF BENEFIT, ASK FOR

a. (1) Lower b. (2) Same c. (3) Higher d. (4) Not Compare e. (5) Don't know	able, specil	fy					
[IF Q52 = 4]							
53b. Why are the impacts not	comparabl	e to the ori	ginal demo	nstration p	roject?		
[IF MORE THAN 5 REPLICATIONS REPLICATIONS, ASK FOR ALL.]							
53. How did the [Net Units ar	nd Unit Typ	e] of the re	plications	compare to	the origina	ıl demonstration?	
		T	Replication	1	Г		
	1	2	3	4	5		
Lower than Original Demo							
The same size							
Higher than Original Demo							
Not Comparable, specify							
Don't Know							
54. How did the [net dollars S demonstration?	AVED/GEN	NERATED]	of the repl	ications co	mpare to th	ne original	
			Replication				
	1	2	3	4	5		
Lower than Original Demo							
The same size							
Higher than Original Demo							
Not Comparable, specify							
Don't Know							
55. Did NYSERDA provide funding replications?	j assistance	e, technical	l assistance	e, both of th	nese or oth	er assistance for the	
	Replication						
	1	2	3	4	5		
Yes, Funding							

	Ye	es, Techn	ology As	sistance								
		es, Both F echnology										
	Υe	es, Other:										
	No)										
	Do	on't Know	I									
IF "	YES	a. b. c. s", PROC	(1)	Yes, am No Don't kn Q57. OTH ther fundin	ount \$ ow HERWISI ng source	E, SKI es?	P TO Q58] ally finance	ed, investm	replications	ed through v	venture capital or	
		b. c.	(3) N	ederal Go YS agenc	y Grant c	r Sub	nt or Subsid	lized Finar			total funding nding	
		d. e. f. g.	(4) \(\bigcirc \) (5) \(\bigcirc \) (6) \(\bigcirc \) O	pecify NY Other priva Utility prog ther, spec on't know	ite grant (ram			Estimated ' Estimated '	Estim % of total fu % of total fu % of total fu	unding unding	otal funding	
	58.	disagree	e with the		stateme	nt: "O					extent do you agre n project was critic	
		(Strongl	y disagre	ee)					(Strongly ag	ree)	
		0	1	2	3	4	5					
		[IF Q58	=>3, AS	K Q59. O	THERWIS	SE, Sk	(IP TO Q60).]				
	59.			scribe hov n projects.		RDA's	assistance	with the de	emonstratio	on project in	offluenced the ability	y to
	60.	NYSERI		ed demons							ew York without th ere 0 is not at all li	
			(Not at	all likely)					(Very likely)		
			0	1	2	3	Δ	5				

replication projects have been of the same size, smaller or larger? a. Same b. Smaller c. Larger d. Replication project(s) would not have happened without NYSERDA e. Don't know [DO NOT READ]
 62. Without the NYSERDA-funded demonstration project, would the replication projects have occurred sooner, at about the same time, or later? a Earlier: years earlier [ASK RESPONDENT TO ESTIMATE YEARS] b About the same time c Later: years later [ASK RESPONDENT TO ESTIMATE YEARS] d Project(s) would not have occurred without NYSERDA e Don't know [DO NOT READ]
[POLICY ANALYST CALCULATION #6A: IF Q61 = A OR C, RECORD -1. IF Q61 = B, D, OR E RECORD 0.
POLICY ANALYST CALCULATION #6B: IF Q62 = A, RECORD -1. IF Q62 = B OR E, RECORD 0. IF Q62 = C OR D, RECORD +1.
POLICY ANALYST CALCULATION #6C: TAKE THE INVERSE OF Q60. E.G., 0 BECOMES 5, 1 BECOMES 4, ETC.
POLICY ANALYST CALCULATION #6D: TAKE THE AVERAGE OF #6C AND Q58.
POLICY ANALYST CALCULATION #7: ADD THE RESULTS OF CALCULATION #6A, CALCULATION #6B, CALCULATION #1:
DO <u>NOT</u> READ TO RESPONDENT]
-[SKIP SECTION 6 IF Q46 =YES and Q49>0]
SECTION 6: NON-REPLICATIONS
63. What do you think are the reasons why the NYSERDA project was not replicated in New York?
64. Do you expect the NYSERDA project will be replicated in New York at some point in the future? a. (1) Yes [REASONS] b. (2) No [REASONS]
SECTION 7: PROCESS EVALUATION
65. How did you become aware of NYSERDA and the potential for NYSERDA assistance?
[DO NOT READ, MARK ALL STATED IN REPLY]
a. (1) Prior participation in a NYSERDA R&D program b. (2) Another NYSERDA program c. (3) Advertising d. (4) Word-of-mouth (PROBE FOR FOLLOWING):
a) Business colleague/client b) Friend/relative
·,

e.	(5)	Contacted by a NYSERDA program representative
f.	(6)	Visit to another NYSERDA demonstration project
q.	(7)	Other

Please rate your agreement or disagreement with the following statements. Please use a 1 to 5 scale where 5 indicates strongly agree, 4 indicates agree, 3 indicates neither agree not disagree, 2 indicates disagree, and 1 is strongly disagree.

66.	NYSERDA provides technical information that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
67.	NYSERDA provides marketing information that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
68.	NYSERDA provides market intelligence that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
69.	NYSERDA communicates well with demonstration project participants.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
70.	NYSERDA provides assistance in a timely manner.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
71.	NYSERDA staff members working with this program are well qualified.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
72.	NYSERDA's credibility is an important catalyst for demonstration projects in New York.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
73.	NYSERDA provides technical information that supports the replication process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
74.	Overall, I am satisfied with my participation in NYSERDA's R&D program.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A

- 75. Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more demonstration projects such as this? [LIST]
- 76. Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more replications of its demonstration projects? [LIST]

SECTION 8: INTEGRATOR FIRMOGRAPHICS

I want to complete our interview with a few final questions about your firm.

77. What is the firm's principal business activity?

	78.	How many employees does the firm have overall? [APPROXIMATE NUMBER IS ADEQUATE.]
	79.	How many employees does the firm have in New York? [APPROXIMATE NUMBER IS ADEQUATE.]
IF	ГНЕ	PROGRAM DATA INCLUDES JOBS CREATED/RETAINED, ASK Q80. OTHERWISE, SKIP TO Q83.]
	80.	Our records indicate that [COMPANY NAME] [CREATED/RETAINED] [NUMBER] jobs due to the NYSERDA demonstration project. Is this correct? a. Yes [SKIP TO Q86] b. No [ASK Q81] c. Don't Know [DO NOT READ. IF RESPONDENT DOES NOT KNOW, SKIP TO Q84.]
	81.	Did you report these numbers to NYSERDA? a. Yes [ASK Q82] b. No [SKIP TO Q83] c. Don't Know [SKIP TO Q83.]
	82.	Do you know why there is a difference between NYSERDA's records and the information you currently have? [ASK OPEN-ENDED FIRST, READ PROMPTS IF NEEDED] a The company [ADDED/LOST] jobs after reporting the numbers to NYSERDA due to factors related to the demonstration project. b The company [ADDED/LOST] jobs after reporting the numbers to NYSERDA due to factors unrelated to the demonstration project. c Other, please specify:
	83.	Has the NYSERDA-funded demonstration project affected the firm's number of employees in New York? a. Yes b. No [SKIP Q84 and Q85]
	84.	How has the NYSERDA-funded demonstration project affected the firm's number of employees in New York? a. Created/retained jobs b. Lost jobs
	85.	How many jobs were [created/retained FOR Q84=A] [eliminated for Q84=B]? a. b. Don't know (DO NOT READ.)
	86.	Can NYSERDA call you back at a later time to obtain more information about the NYSERDA R&D Program? a. Yes b. No

ON BEHALF ON NYSERDA, THANK YOU FOR YOUR TIME IN HELPING US CONDUCT THIS RESEARCH. HAVE A GREAT DAY.

NYSERDA

Demonstration Project Survey

VENDORS

[mm/dd/yyyy]

Interview Date:

	Interviewer name:
	Interviewer phone:
CNTRCT_ID:	
Project Description:	
Best Contact:	
NYSERDA Project Manager	
PI First Name and PI Last Name	
Title:	
Phone:	
Email:	
Project Role:	
Company Name:	
Program Area:	[Buildings, Transportation, Energy Resources, etc.]
Project Type:	[PRODUCT, PROCESS OR POWER PRODUCTION]
NYSERDA \$	(Encumbered \$ for this project.)
Earliest contract signed date	
Latest contract closed date	
Location	

THE POLICY ANALYST CONDUCTING THE INTERVIEW WILL WORK THROUGH THE INSTRUMENT USING THE SPECIFIC DATASET INPUT AND PROJECT DESCRIPTION TO REFINE QUESTION WORDING AS NECESSARY TO PROVIDE CLEAR LANGUAGE AND TO OBTAIN THE INFORMATION DESIRED FROM EACH QUESTION. GIVEN THE INFORMATION IN THE DATASET, THE SURVEY INSTRUMENT FOR EACH INTERVIEW WILL BE MARKED FOR THE APPROPRIATE HANDLING OF QUESTIONS AND SKIP PATTERNS REGARDING THE IMPACTS FROM THE DEMONSTRATION PROJECT (QUESTIONS 17 THROUGH 32).

Identify the Appropriate Contact

Hello, my name is [interviewer name], and I am calling from [company name] on behalf of the New York State Energy Research and Development Authority, also known as NYSERDA. NYSERDA is conducting a study to assess the impact of its funding on New York State companies and on the State's economy. This study will also assess the impact of its funding and technological support on [use "product", "process", or "generation" depending on participant] demonstration projects conducted in New York State.

NYSERDA has contracted with Industrial Economics, Incorporated and APPRISE to perform this study. IEc and APPRISE are independent research and consulting firms. I would like to ask some questions about your involvement in a completed NYSERDA demonstration project – the [SUMMARIZE FROM CONTRACT DESCRIPTION]. The information you provide will be kept confidential to the extent permitted by law. We will report all responses in aggregate and will not attribute any comments to you. The information you provide will be used to improve NYSERDA's research and development programs. NYSERDA is contacting all participants who completed demonstration projects within the last five years.

SCREENING

Our records show that NYSERDA provided \$_____ in funding to [COMPANY NAME] for the demonstration project [CONTRACT DESCRIPTION], and that your company provided the [PRODUCT / PROCESS / TECHNOLOGY / GENERATOR] for the project.

- SCR-1. This survey will take about one hour to complete. We would like to talk to the person who is most knowledgeable about the project. If not you, could you please direct me to, or provide me with the name of the person who is the most qualified to discuss this project?
 - a. Caller [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Most qualified contact [CONTACT THIS PERSON, REPEAT INITIAL INTRODUCTION AND THE INTRODUCTION TO THE SCREENING SECTION, AND CONTINUE WITH THE FOLLOWING QUESTION]
- SCR-2 Mr./Ms. [name] referred me to you to answer specific about this project [DESCRIBE PROJECT BRIEFLY as this is another person]. This survey will take about one hour to complete. Can we discuss the project now, or can we schedule a time when I can call you back?
 - a. Can discuss now [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Call back on at time:
 - c. [IF THIS PERSON IS NOT THE MOST QUALIFIED PERSON, LOOP BACK TO SCR-1]
- SCR-3 Which of the following <u>best</u> describes your role in the [PROJECT]? **[READ ALL CHOICES TO RESPONDENT AND SELECT THE MOST APPROPRIATE CHOICE.]**
 - a. I provided the [PRODUCT/PROCESS/TECHNOLOGY/TYPE OF GENERATION... tailor to the project based on project type] for this project. [USE VENDOR SURVEY INSTRUMENT]
 - b. I am the site owner. [USE SITE OWNER SURVEY INSTRUMENT]
 - c. I developed the project and brought together the vendor, site owner, and other market actors. [USE INTEGRATOR SURVEY INSTRUMENT]
- SCR-4 Do you have any reports or presentations that describe the results of the [PROJECT]?
 - a. Yes [ASK THE RESPONDENT TO SEND THE REPORTS IN ADVANCE OF THE CALL]
 - b. No
 - c. Don't Know [ASK THE RESPONDENT TO CHECK AND SEND WHAT THEY HAVE IN ADVANCE OF THE CALL]

SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW

INOTE: PRIOR TO BEGINNING THE DISCUSSION, ASK THE RESPONDENT WHETHER OR NOT IT IS OKAY TO RECORD THE CALL.] 1. Our records show that NYSERDA provided funding to [COMPANY NAME] for a project involving [CONTRACT DESCRIPTION]. Is this an accurate description of the project? a) (1) Yes b) (2) No [IF Q1 = YES, SKIP TO Q3. IF Q1 = NO, ASK Q2.] 2. How would you describe the project? Record open-ended response: 3. Is this the first time your firm provided the ["product", "process", "technology" or "type of generation"tailor to project based on PROJECT TYPE] for this particular type of project? a) (1) Yes b) (2) No c) (3) Don't know [IF Q3 = NO, PROCEED TO Q4. OTHERWISE, SKIP TO Q6] 4. How many times had your firm sold the ["product", "process", "technology" or "type of generation"tailor to <u>project</u>] for this particular type of project prior to the [reference NYSERDA demo project]? [RECORD THE NUMBER OF TIMES] Don't know b) 5. How did [reference NYSERDA demo project] differ from previous uses of this ["product", "process", "technology" or "type of generation"tailor to project]? RECORD VERBATIM RESPONSE: ______ b) IRECORD VERBATIM COMMENTS FIRST; DO NOT READ LIST. THEN, LOOK AT THE LIST AND VERIFY THE RELEVANT SELECTION(S) WITH RESPONDENT.] d) \ No difference e) Smaller in scale than previous projects of this type f) Larger in scale than previous projects of this type g) 🔲 Different inputs h) Different application of the technology

[POLICY ANALYST CALCULATION #1: DO NOT READ TO SURVEY RESPONDENT.

Different type of facility

STEP ONE: IF Q3 = "YES" OR "DON'T KNOW", RECORD 0 ON THE LINE BELOW. SKIP STEP TWO. STEP TWO: IF Q3 = "NO", LOOK AT ANSWER TO Q5. IF Q5 = D ONLY OR E ONLY, RECORD -1. ELSE RECORD 0.
CALCULATION #1:]
6. Now I would like to discuss the [SUMMARIZE CONTRACT DESCRIPTION] Project. How would you describe the objectives of this project? [OPEN-ENDED QUESTION TO PRIME THE RESPONDENT'S THINKING]
7a. Were you involved with planning or executing this project? a. Yes [ASK Q7B] b. No [SKIP TO Q9]
7b-1. Can you identify specific challenges you faced when planning this project? [ASK UNPROMPTED FIRST.] a b c
[PROMPT - BE CAREFUL NOT TO BIAS OR INFLUENCE RESPONSE, SUGGEST CODE FOR ANSWERS PROVIDED ABOVE IF APPROPRIATE] d.
7b-2. Can you identify specific challenges you faced when executing this project? [ASK UNPROMPTED FIRST.] a b c
[PROMPT - BE CAREFUL NOT TO BIAS OR INFLUENCE RESPONSE, SUGGEST CODE FOR ANSWERS PROVIDED ABOVE IF APPROPRIATE] d.

8a. Can you identify any benefits that you received from planning this project?

8b. Can you identify any benefits that you received from executing this project?
9. Overall, do you feel this project accomplished all, most, some, or none of its objectives? a.
[IF RESPONDENT SELECTS "ALL" OR "DON'T KNOW," SKIP TO Q11. OTHERWISE, ASK Q10.]
10. Please explain why this project did not accomplish all of its objectives:
SECTION 2: COST EFFECTIVENESS
Now I would like to ask about the cost-effectiveness of the project.
11. NYSERDA furnished a grant for [NYSERDA \$]. In addition to that amount, how much did your firm invest in this project in terms of staff time and project expenses? \$, staff
[IDEALLY, COLLECT DATA ON \$ AND STAFF TIME. HOWEVER, IT IS OKAY IF THE RESPONDENT CAN ONLY PROVIDE ONE OR THE OTHER (OR NEITHER)].
12. At the time the project began, were you considering alternative customers or applications for the ["product", "process", "technology" or "type of generation"] that you used in the NYSERDA project? a Yes, explain: b No c Don't know
[IF Q12 = YES, PROCEED TO Q13. OTHERWISE, SKIP TO Q14.]
13. Looking back, do you think that providing the ["product", "process", "technology" or "type of generation"] for the demonstration project was the best alternative for your firm? a Yes, explain: b No, explain: C Don't know
14. Do you feel that the [PROJECT DESCRIPTION] project was a good investment? a Yes, explain: b No, explain: c Don't know
 15. In general terms, how would you describe your return on this project? [READ LIST TO RESPONDENT] a. Positive b. Negative c. Breakeven or neutral
c Breakeven or neutral

16. Have you advertised or communicated the results of this project to any potential buyers, suppliers, or business partners?
a. Yes, explain:
b. No, explain:
c. Don't know
SECTION 3: DEMONSTRATION PROJECT IMPACTS
Now I would like to talk with you more about the project's benefits.
[NOTE: WHEN ASKING FOR BENEFITS DATA, TRY TO GET NUMERICAL UNITS AS OPPOSED TO PERCENTAGES. IF RESPONDENT REPORTS A PERCENTAGE OR PERCENTAGE CHANGE, ASK IF HE/SHE CAN NUMERICALLY QUANTIFY THE CHANGE, OR IF HE/SHE CAN PROVIDE THE BASELINE THAT THE PERCENTAGE CHANGE IS BASED ON.]
[IF PROGRAM DATA INCLUDES RESOURCE TYPE, ASK Q17-Q21. OTHERWISE, ASK Q17D, THEN SKIP TO Q22.]
17A.NYSERDA program records indicate that this project resulted in [RESOURCE TYPE 1] benefits involving [RESOURCE TYPE 2]. [NOTE: IF A PROJECT HAS MORE THAN ONE ENTRY FOR "RESOURCE TYPE 1," ASK THE QUESTION SEPARATELY FOR EACH ENTRY.]
Is that correct?
Yes [SKIP TO Q18]
☐ No [ASK Q17B]
☐ Don't know [ASK Q17B]
17B. Did you previously report these benefits to NYSERDA?
Yes [ASK 17C]
☐ No [SKIP TO 17D]
☐ Don't know [SKIP TO 17D]
17C. Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED: FILL IN RESPONDENT'S ANSWER]
17D. Which of the following describe the specific types of benefits this project produced? For each benefit that your project produced, please state if it was a direct benefit, indirect benefit, or uncertain benefit. [READ THE LIST. CHECK ALL THAT APPLY. FOR EACH BENEFIT TYPE IDENTIFIED BY RESPONDENT, ASK RESPONDENT IF THIS IS A DIRECT BENEFIT, INDIRECT BENEFIT, OR UNCERTAIN BENEFIT. MAKE SURE TO ASK ABOUT ANY OTHER BENEFITS THAT WE MAY NOT HAVE MENTIONED.]
☐ Power production ☐ Direct ☐ Indirect ☐ Uncertain

	Energy efficiency
	Air emissions
	Productivity Direct Indirect Uncertain
	Waste management
	Product quality/reliability improvement
	Water reductions
	Water quality Direct Indirect Uncertain
	Operations & Maintenance
	Marketability
	Demand reduction
	Reduced labor costs
	Reduced material costs
	Environmental quality improvement
	Knowledge creation Direct Indirect Uncertain
	Other Specify: Direct Indirect Uncertain
18.	[ASK Q18 – Q21 IF Q17A = 1/YES AND NET UNITS ARE NOT MISSING. OTHERWISE, SKIP TO Q22.] NYSERDA'S records indicate that this project <u>produced</u> [IF BENEFIT IS POWER PRODUCTION] <u>saved</u> [IF BENEFIT IS NOT POWER PRODUCTION]. IF MORE THAN ONE BENEFIT IS REPORTED, ASK THE QUESTION AND RECORD RESPONSES SEPARATELY FOR EACH REPORTED BENEFIT.]
	[Net Units] [Unit Type] [Metric Year]
	Are these numbers correct? (1) Yes [SKIP TO Q23] (2) No [ASK Q19]
19.	Did you previously report these numbers to NYSERDA? (1) Yes [ASK Q20] (2) No [SKIP TO Q21] (3) Don't know [SKIP TO Q21]
20.	Do you know why there is a difference between NYSERDA's records and the information that you currently have? [ASK OPEN-ENDED FIRST, READ PROMPTS IF NEEDED.]
	☐ Performance of the equipment changed over time
	☐ We decommissioned the project

	☐ Benefits were realized prior to the first reporting year
	Additional benefits accrued over time
	Other, please specify:
21.	Please estimate the actual benefits.
	Specify unit: [kWh, kW, MMBtu, pounds of pollutant, etc.]. Year(s):
TH	SK Q22 IF THE PROGRAM DATA DOES NOT INCLUDE NET UNITS. IF MORE THAN ONE BENEFIT, AS E QUESTION AND RECORD RESPONSES SEPARATELY FOR EACH BENEFIT. ASK ABOUT ALL RECT AND INDIRECT BENEFITS; DO NOT ASK ABOUT UNCERTAIN BENEFITS.]]
22.	Please provide an estimate of the [REDUCTION IN / PRODUCTION OF] in [ENERGY, kW, EMISSIONS, ETC. – TAILOR TO SPECIFICS]. IF MORE THAN ONE BENEFIT IS REPORTED, ASK THE QUESTION AND RECORD RESPONSES SEPARATELY FOR EACH REPORTED BENEFIT.]
	Specify unit: [kWh, kW, MMBtu, pounds of pollutant, etc.] Year(s):
	SK Q23 IF RESPONDENT DID <u>NOT</u> ANSWER Q21 OR Q22. IF RESPONDENT ANSWERED Q21 OR Q22 IP TO Q24.]
23.	Besides [METRIC YEAR(S) REPORTED IN THE DATABASE], has the project produced any other [UNIT TYPE] benefits?
	(1) Yes, explain: [Net Units] [Unit Type] [Metric Year(s)]
	(2) No (3) Don't know
23-	AA. Besides [UNIT TYPE], has the project produced any other types of benefits?
	(1) Yes [IF YES, LOOP BACK TO Q17D]
	☐ (2) No
	(3) Don't know
ΊF	PROGRAM DATA INCLUDES NET DOLLARS, ASK Q24-27. OTHERWISE, SKIP TO Q28.]
-	NYSERDA's records indicate that this project [GENERATED/SAVED]:
	[Net Dollars] [Metric Year(s)]
	Are these numbers correct? (1) Yes [SKIP TO Q32] (2) No [ASK Q25]

25.	Did you previously report these numbers to NYSERDA? (1) Yes [ASK Q26] (2) No [SKIP TO Q27] (3) Don't know [SKIP TO Q27]
26.	Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED]
27.	Please estimate the actual net dollars in [REVENUE/COST SAVINGS] from this project: \$, year(s):
[AS	K Q28 IF THE PROGRAM DATA DOES NOT INCLUDE NET DOLLARS. OTHERWISE, SKIP TO Q32]
28.	Did this project generate any revenue? (1) Yes [ASK Q29] (2) No [SKIP TO Q30] (3) Don't know [SKIP TO Q30]
29.	Please provide an estimate of the revenue generated from this project. \$, year(s):
30.	Did this project generate any cost savings? (1) Yes [ASK Q31] (2) No [SKIP TO Q33] (3) Don't know [SKIP TO Q33]
31.	Please provide an estimate of the cost savings generated from this project. \$, year(s):
	[ASK Q32 IF RESPONDENT DID <u>NOT</u> ANSWER Q27, Q29, OR Q31. IF RESPONDENT ANSWERED Q27, Q29, OR Q31, SKIP TO Q33.]
32.	Besides [METRIC YEAR(S) REPORTED IN THE DATABASE], has the project generated any other [REVENUE/COST SAVINGS]?
	(1) Yes, amount: \$
	(2) No (3) Don't know
33.	Who were the primary end users for this project?

	[RECOI	RD OPEN-ENDED RESPONSE]
34. Did you a. b. c.	(1) (2) (3) (3) (3) (3) (3) (3)	any feedback from end-users from this project site? Yes No Don't know
[IF YES, PR	OCEED	TO Q35. IF NO OR DON'T KNOW, SKIP TO Q36]
35. Was the a. b. c.	e feedbac (1) (2) (3)	ck useful for understanding whether or how the technology worked? Yes No Don't know
SECTION 4: NY	/SERDA	INFLUENCE ON THE DEMONSTRATION PROJECT
I would now like PROJECT] Proje		s your interactions with NYSERDA concerning the [SUMMARY OF DEMONSTRATION
		arn about NYSERDA's R&D program? [READ THE LIST OF RESPONSE OPTIONS, 「KNOW"]
a.	(1)	I have not heard of NYSERDA's R&D program
b.	(2)	Before you began planning this project
C.	(3)	During the planning process but before the plans were finalized
d.	(4)	After the plans were finalized
e.	(5)	After project implementation started
f.	(6)	Don't know
37. Did NY	SERDA p	rovide technical assistance for this project?
a.	(1)	Yes, explain: Type of assistance: Identify source:
b.	(2)	No
C.	(3)	Don't know
38. Did sou	ırces othe	er than NYSERDA provide technical assistance for this project?
a.	(1)	Yes, explain: Type of assistance: Identify source:
b.	(2)	No
C.	(3)	Don't know
39. Did sou	ırces othe	er than NYSERDA provide funding for this project?
a.	(1)	Yes, explain \$ Identify source:

	b.	(2)	No					
	C.	(3)	Don't kr	NOW				
40.								
	(Not at a	all import	ant)					(Very important)
	0	1	2	3	4	5		
	[ASK Q	41 ONLY	' IF Q37 =	= "YES". I	IF Q37 =	"NO" OR	"DON'T	KNOW", RECORD 0.]
41.								
	(Not at a	all import	ant)					(Very important)
	0	1	2	3	4	5		
								RD THE <u>HIGHER</u> SCORE OF Q40 OR Q41.
42.	NYSER	DA's fina						
	(Not at a	all likely)						(Very likely)
	`	37	0	1	2	3	4	5
[AS	K Q43 O	NLY IF (237 = "YE	S". IF Q	37 = "NO	" OR "DO	N'T KNO	W", RECORD 0.]
43.	NYSER	DA's tec						
	(Not at a	all likely)						(Very likely)
	•	37	0	1	2	3	4	
			-			-		
ſΡΩ	I ICY AN	IAI YST	PFRFOR	M CALC	UI ATIO	N #3A· F	RECORD	THE LOWER SCORE OF 042 OR 043.
_								
		On a scale of 0 to 5, where 0 = "not at all important" and 5 = "very important," how important or unimportant was NYSERDA's financial assistance in the decision to do this project? Not at all important) (Very important) 1 2 3 4 5 ASK Q41 ONLY IF Q37 = "YES". IF Q37 = "NO" OR "DON'T KNOW", RECORD 0.] On a scale of 0 to 5, where 0 = "not at all important" and 5 = "very important," how important or unimportant was NYSERDA's technical assistance in the decision to do this project? Not at all important) (Very important) 1 2 3 4 5 POLICY ANALYST PERFORM CALCULATION #2: RECORD THE <u>HIGHER</u> SCORE OF Q40 OR Q41. ONOT READ TO THE RESPONDENT:] What is the likelihood that this demonstration project would have been completed in New York without laySERDA's financial assistance? Please answer on a scale from 0 to 5, where 0 is not at all likely and 5 is very likely. Not at all likely) (Very likely)						

 44. Overall, without NYSERDA's involvement would the magnitude of the impacts for this project have been of the same size, smaller, or larger? a. Same b. Smaller c. Larger d. Project would not have happened without NYSERDA e. Don't know [DO NOT READ]
45. I would now like to ask you about how, if at all, NYSERDA's support affected the timing of the project. Without NYSERDA's support, would this project have occurred earlier, at about the same time, or later?
a years earlier [ASK RESPONDENT TO ESTIMATE YEARS] b About the same time c years later [ASK RESPONDENT TO ESTIMATE YEARS] d Project would not have happened without NYSERDA e Don't know [DO NOT READ]
[POLICY ANALYST CALCULATION #4A: IF Q44 = A OR C, RECORD -1. IF Q44 = B, D OR E, RECORD 0.
DO <u>NOT</u> READ TO THE RESPONDENT:]
[POLICY ANALYST CALCULATION #4B: IF Q45 = A, RECORD -1. IF Q45 = B OR E, RECORD 0. IF Q45 = C OR D, RECORD +1.]
[CALCULATION #5: TAKE THE AVERAGE OF CALCULATION #2 AND #3B. THEN, ADD THE
RESULTS OF CALCULATIONS #1, #4A, AND #4B.
RECORD YOUR ANSWER HERE: DO <u>NOT</u> READ TO THE SURVEY RESPONDENT.]
SECTION 5: REPLICATIONS
I have some questions now concerning your experience with demonstration projects and replications. NYSERDA classifies the project we have been discussing as a demonstration project.
We define a demonstration project as the demonstration of a new technology or process or application of an existing technology in a commercial setting. Demonstration projects are designed to showcase the value and effectiveness of the technology or process being demonstrated.
We define replication as additional sales of the same technology or services that were used in the NYSERDA-funded demonstration project. These additional sales could be to the same buyer that participated in the demonstration project or a different buyer.
46. NYSERDA funded the [SUMMARY OF DEMO PROJECT] demonstration project in [MONTH/YEAR]. Since that time, has your firm or another firm sold the technology used in the NYSERDA demonstration project for similar applications? Total sales revenue? \$ Month, Year.

	b.	(2)	No		[IF MORE THAN 5, GET DATES FOR THE MOST RECENT 5]
	C.	(3)	Don't kr	now	NEGENT 3]
47.		ur firm or a		irm sold the technology	used in the NYSERDA demonstration project for a
		(1) (2) (2)	Yes No	Number of sales?:	Total sales revenue? \$Month, Year [IF MORE THAN 5, GET DATES FOR THE MOST RECENT 5]
	C.	(3)	Don't kr	now	
	In what	way was	the appli	RWISE, SKIP TO Q49.] ication of the technolog N-ENDED RESPONSE:	y different from the original NYSERDA demonstration
[CONTII	NUE WIT	⁻ H Q49 IF	7 Q46 = \	YES; SKIP TO Q63 IF C	246 = NO OR DON'T KNOW.
49.	NYSER				imilar applications in New York since the completion of the FER "DON'T KNOW". QUESTION RESPONDENT TO GET
	No. of s	ales:	_ \$	_	
	[IF Q49	= (0,\$0),	SKIP TO) Q63]	
50.	next cus NYSER	stomer in	New Yor Instration (1S] Ilication Olication	k that wanted to use the	project was operational, how long did it take to find the e technology for a similar application? From the project? To the third project? [GET NUMBER OF YEARS
51.			THE LIST Technic Financion Location Reques Operati	T OF OPTIONS, EXCE cal expertise gained ng available n available sted by building owner ng conditions were rightstrable savings were ac	

[IF 5 OR FEWER REPLICATIONS SKIP TO Q53.]

replications compare to the ori	ginal demo	ompleted in nstration?	New York [IF MORE ⁻	State, how THAN ONE	did the TYPE OF	_ [Unit Type] of the BENEFIT, ASK FOR
a. (1) Lower b. (2) Same c. (3) Higher d. (4) Not Compare e. (5) Don't know	able, speci	fy				
[IF Q52 = 4]						
53b. Why are the impacts not	comparabl	e to the ori	ginal demo	nstration p	roject?	
[IF MORE THAN 5 REPLICATIONS REPLICATIONS, ASK FOR ALL.]	S, ASK Q53	3 AND Q54	FOR THE	MOST RE	CENT 5 OI	NLY. IF 5 OR FEWER
53. How did the [Net Units ar	nd Unit Typ	e] of the re	plications o	compare to	the origina	I demonstration?
			Replication			
b. (2) Same c. (3) Higher d. (4) Not Comparable, specify e. (5) Don't know F Q52 = 4] 53b. Why are the impacts not comparable to the original demonstration project? — F MORE THAN 5 REPLICATIONS, ASK Q53 AND Q54 FOR THE MOST RECENT 5 ONLY. IF 5 OR FEWER REPLICATIONS, ASK FOR ALL.] 3. How did the [Net Units and Unit Type] of the replications compare to the original demonstration? Replication 1						
Lower than Original Demo						
The same size						
Higher than Original Demo						
Not Comparable, specify						
Don't Know						
	AVED/GEI	NERATED]	of the repl	ications co	mpare to th	ne original
			Replication			
	1	2	3	4	5	
Lower than Original Demo						
The same size						
Higher than Original Demo						
Not Comparable, specify						
Don't Know						

55. Did NYSERDA provide funding assistance, technical assistance, both of these or other assistance for the replications?

14

	1	2	3	4	5						
Yes, Funding											
Yes, Technology Assistance											
Yes, Both Funding & Technology Assistance											
Yes, Other:											
No											
Don't Know											
56. Did any sources other than NY a. (1) Yes, amount b. (2) No c. (3) Don't know [IF "YES", PROCEED TO Q57. OTHER 57. What were the other funding so a. (1) Investment Cap stocks, loan) b. (2) Federal Gover c. (3) NYS agency Control Specify NYS a d. (5) Utility program e. Other private grant or f. (6) Other, specify g. (7) Don't know 58. [On a scale of 0 to 5, where 0 disagree with the following state getting the replication project(so (Strongly disagree) 0 1 2 3	wise, ski wise, ski ources? oital (interna onment Gra Grant or Sul gency philanthropy e "strongly tement: "O	P TO Q58] ally finance nt or Subsi bsidized Finance pic contribution disagree and a serverall, the	d, investme Estimated G dized Finan nancing ution Estin Estimated G Estimated G	ent financeo % of total funcing Est Estimate Mated % of % of total functions ongly agreed	d through vunding imated % od % of total fundingunding e," to what	of total funding I funding ng extent do you agree or n project was critical for					
	0 1 2 3 4 5 [IF Q58 =>3, ASK Q59. OTHERWISE, SKIP TO Q60.]										

59. Please briefly describe how NYSERDA's assistance with the demonstration project influenced the ability to get the replication projects developed.

60.	NYSER		ed demon					ve been developed in New York without the n a scale from 0 to 5, where 0 is not at all likely
		(Not at a	all likely)					(Very likely)
		0	1	2 3	3	4	5	
61.			ts have b Same Smaller Larger Replicat	een of the	same siz	ze, sm d not h	aller or laı	the magnitude of the impacts for these rger? ened without NYSERDA
62.			e time, or Earlier: About th Later: _ Project(later? years ne same tin years la	earlier [/ ne ter [ASK ot have c	ASK R RESF	ESPOND PONDENT	the replication projects have occurred sooner, ENT TO ESTIMATE YEARS] TO ESTIMATE YEARS] NYSERDA
[POLICY	Y ANALY	ST CAL	CULATIO	ON #6A: IF	Q61 = A	A OR	C, RECOF	RD -1. IF Q61 = B, D OR E, RECORD 0.
	' analy: ORD +1.	ST CALC	CULATIO	N #6B: IF	Q62 = A	A, REC	ORD -1. I	F Q62 = B OR E, RECORD 0. IF Q62 = C OR
POLICY ETC.	'ANALY	ST CALC	CULATIO	N #6C: T <i>A</i>	AKE THE	E INVE	RSE OF	Q60. E.G., 0 BECOMES 5, 1 BECOMES 4,
POLICY	'ANALY	ST CALC	CULATIO	N #6D: T <i>A</i>	AKE THE	E AVE	RAGE OF	#6C AND Q58.
				N #7: ADI JLATION #		ESUL	TS OF CA	ALCULATION #6A, CALCULATION #6B,
DO <u>NO</u>	[READ]	TO RESF	ONDEN ⁻	Γ]				
-				nd Q49>0]]			
SECTIO	N 6: NO	N-REPL	ICATION	S				
63.	What do	you thin	k are the	reasons w	hy the N	YSER	DA projec	t was not replicated in New York?
64.	Do you the futur a. b.	•	e NYSEF Yes No	RDA-funded REASON REASON	IS]	stratio	n project v	will be replicated in New York at some point in

SECTION 7: PROCESS EVALUATION

65. How did you become aware of NYSERDA and the potential for NYSERDA assistance?
[DO NOT READ, MARK ALL STATED IN REPLY]
a. (1)☐ Prior participation in a NYSERDA R&D program b. (2)☐ Another NYSERDA program
c. (3) Advertising
d. (4) Word-of-mouth (PROBE FOR FOLLOWING):
a) Business colleague/client b) Friend/relative
e. (5) Contacted by a NYSERDA program representative
f. (6) Visit to another NYSERDA demonstration project
g. (7) From the site owner or integrator
h. (8) I was not aware of the potential for NYSERDA assistance.
i. (9) Other

Please rate your agreement or disagreement with the following statements. Please use a 1 to 5 scale where 5 indicates strongly agree, 4 indicates agree, 3 indicates neither agree not disagree, 2 indicates disagree, and 1 is strongly disagree.

66. NYSERDA provides technical information that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
67. NYSERDA provides marketing information that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
68. NYSERDA provides market intelligence that supports the demonstration process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
69. NYSERDA communicates well with demonstration project participants.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
70. NYSERDA provides assistance in a timely manner.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
71. NYSERDA staff members working with this program are well qualified.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
72. NYSERDA's credibility is an important catalyst for demonstration projects in New York.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
73. NYSERDA provides technical information that supports the replication process.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A
74. Overall, I am satisfied with my participation in NYSERDA's R&D program.	(Strongly disagree)	1	2	3	4	5	(Strongly agree)	N/A

^{75.} Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more demonstration projects such as this? [LIST]

76. Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more replications of its demonstration projects? [LIST]

SECTI	ON 8: VENDOR FIRMOGRAPHICS					
want t	want to complete our interview with a few final questions about your firm.					
77	. What is the firm's principal business activity?					
78	. How many employees does the firm have overall? [APPROXIMATE NUMBER IS ADEQUATE.]					
79	. How many employees does the firm have in New York? [APPROXIMATE NUMBER IS ADEQUATE.]					
IF THE	E PROGRAM DATA INCLUDES JOBS CREATED/RETAINED, ASK Q80. OTHERWISE, SKIP TO Q83.]					
80	Our records indicate that [COMPANY NAME] [CREATED/RETAINED] [NUMBER] jobs due to the NYSERDA demonstration project. Is this correct? a. Yes [SKIP TO Q86] b. No [ASK Q81] c. Don't Know [DO NOT READ. IF RESPONDENT DOES NOT KNOW, SKIP TO Q84.]					
81	Did you report these numbers to NYSERDA? a. Yes [ASK Q82] b. No [SKIP TO Q83] c. Don't Know [SKIP TO Q83.]					
82	 Do you know why there is a difference between NYSERDA's records and the information you currently have? [ASK OPEN-ENDED FIRST, READ PROMPTS IF NEEDED] a.					
83	. Has the NYSERDA-funded demonstration project affected the firm's number of employees in New York? a. Yes b. No [SKIP Q84 and Q85]					
84	 How has the NYSERDA-funded demonstration project affected the firm's number of employees in New York? a.					

- 85. How many jobs were [created/retained FOR Q84=A] [eliminated for Q84=B]?
 - a. _____ b. Don't know (DO NOT READ.)
- 86. Can NYSERDA call you back at a later time to obtain more information about the NYSERDA R&D Program?
 - a. Yes
 - b. No

ON BEHALF ON NYSERDA, THANK YOU FOR YOUR TIME IN HELPING US CONDUCT THIS RESEARCH. HAVE A GREAT DAY.

NYSERDA

Demonstration Project Survey

SITE OWNERS

[mm/dd/yyyy]

Interview Date:

	Interviewer name:
	Interviewer phone
CNTRCT_ID:	
Project Description:	
Best Contact:	
NYSERDA Project Manager	
PI First Name and PI Last Name	
Title:	
Phone:	
Email:	
Project Role:	
Company Name:	
Program Area:	[Buildings, Transportation, Energy Resources, etc.]
Project Type:	[PRODUCT, PROCESS OR POWER PRODUCTION]
NYSERDA \$	(Encumbered \$ for this project.)
Earliest contract signed date	
Latest contract closed date	
Location	

THE POLICY ANALYST CONDUCTING THE INTERVIEW WILL WORK THROUGH THE INSTRUMENT USING THE SPECIFIC DATASET INPUT AND PROJECT DESCRIPTION TO REFINE QUESTION WORDING AS NECESSARY TO PROVIDE CLEAR LANGUAGE AND TO OBTAIN THE INFORMATION DESIRED FROM EACH QUESTION. GIVEN THE INFORMATION IN THE DATASET, THE SURVEY INSTRUMENT FOR EACH INTERVIEW WILL BE MARKED FOR THE APPROPRIATE HANDLING OF QUESTIONS AND SKIP PATTERNS REGARDING THE IMPACTS FROM THE DEMONSTRATION PROJECT (QUESTIONS 17 THROUGH 32).

Identify the Appropriate Contact

Hello, my name is [interviewer name], and I am calling from [company name] on behalf of the New York State Energy Research and Development Authority, also known as NYSERDA. NYSERDA is conducting a study to assess the impact of its funding on New York State companies and on the State's economy. This study will also assess the impact of its funding and technological support on [use "product", "process", or "generation" depending on participant] demonstration projects conducted in New York State.

NYSERDA has contracted with Industrial Economics, Incorporated and APPRISE to perform this study. IEc and APPRISE are independent research and consulting firms. I would like to ask some questions about your involvement in a completed NYSERDA demonstration project – the [SUMMARIZE FROM CONTRACT DESCRIPTION]. The information you provide will be kept confidential to the extent permitted by law. We will report all responses in aggregate and will not attribute any comments to you. The information you provide will be used to improve NYSERDA's research and development programs. NYSERDA is contacting all participants who completed demonstration projects within the last five years.

SCREENING

Our records show that NYSERDA provided \$_____ in funding to [COMPANY NAME] for the demonstration project [CONTRACT DESCRIPTION].

- SCR-1. This survey will take about one hour to complete. We would like to talk to the person who is most knowledgeable about the project. If not you, could you please direct me to, or provide me with the name of the person who is the most qualified to discuss this project?
 - a. Caller [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Most qualified contact [CONTACT THIS PERSON, REPEAT INITIAL INTRODUCTION AND THE INTRODUCTION TO THE SCREENING SECTION, AND CONTINUE WITH THE FOLLOWING QUESTION]
- SCR-2 Mr./Ms. [name] referred me to you to answer specific about this project [DESCRIBE PROJECT BRIEFLY as this is another person]. This survey will take about one hour to complete. Can we discuss the project now, or can we schedule a time when I can call you back?
 - a. Can discuss now [PROCEED TO SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW]
 - b. Call back on at time:
 - c. [IF THIS PERSON IS NOT THE MOST QUALIFIED PERSON, LOOP BACK TO SCR-1]
- SCR-3 Which of the following <u>best</u> describes your role in the [PROJECT]? **[READ ALL CHOICES TO RESPONDENT AND SELECT THE MOST APPROPRIATE CHOICE.]**
 - a. I provided the [PRODUCT/PROCESS/TECHNOLOGY/TYPE OF GENERATION... tailor to the project based on project type] for this project. [USE VENDOR SURVEY INSTRUMENT]
 - b. I am the site owner. [USE SITE OWNER SURVEY INSTRUMENT]
 - c. I developed the project and brought together the vendor, site owner, and other market actors. [USE INTEGRATOR SURVEY INSTRUMENT]
- SCR-4 Do you have any reports or presentations that describe the results of the [PROJECT]?
 - a. Yes [ASK THE RESPONDENT TO SEND THE REPORTS IN ADVANCE OF THE CALL]
 - b. No
 - c. Don't Know [ASK THE RESPONDENTTO CHECK AND SEND WHAT THEY HAVE IN ADVANCE OF THE CALL]

SECTION 1: NYSERDA DEMONSTRATION PROJECT OVERVIEW

[NOTE: PRIOR TO BEGINNING THE DISCUSSION, ASK THE RESPONDENT WHETHER OR NOT IT IS OKAY TO RECORD THE CALL.]

1.	Our records show that NYSERDA provided funding to [COMPANY NAME] for a project involving [CONTRACT DESCRIPTION]. Is this an accurate description of the project? a) (1) Yes b) (2) No
[IF	Q1 = YES, SKIP TO Q3. IF Q1 = NO, ASK Q2.]
2.	How would you describe the project?
	Record open-ended response:
3.	Is this the first time this ["product", "process", "technology" or "type of generation"tailor to project based on PROJECT TYPE] was used at your site? a) (1) Yes b) (2) No c) (3) Don't know
[IF	Q3 = NO, PROCEED TO Q4. OTHERWISE, SKIP TO Q6]
4.	How many times had this ["product", "process", "technology" or "type of generation"tailor to project] been used at your site prior to the [reference NYSERDA demo project]? a) [RECORD THE NUMBER OF TIMES] b) Don't know
5.	How did [reference NYSERDA demo project] differ from previous uses of this ["product", "process", "technology or "type of generation"tailor to project]?
	RECORD VERBATIM RESPONSE:
	a) b) c)
	ECORD VERBATIM COMMENTS FIRST; DO NOT READ LIST. THEN, LOOK AT THE LIST AND VERIFY THE ELEVANT SELECTION(S) WITH RESPONDENT.] d)

[POLICY ANALYST CALCULATION #1: DO NOT READ TO SURVEY RESPONDENT.

STEP ONE: IF Q3 = "YES" OR "DON'T KNOW", RECORD 0 ON THE LINE BELOW. SKIP STEP TWO.

STEP TWO: IF Q3 = "NO", LOOK AT ANSWER TO Q5. IF Q5 = D <u>ONLY</u> OR E <u>ONLY</u> , RECORD -1. ELSE RECORD 0.
CALCULATION #1:]
6. Now I would like to discuss the [SUMMARIZE CONTRACT DESCRIPTION] Project. How would you describe the objectives of this project? [OPEN-ENDED QUESTION TO PRIME THE RESPONDENT'S THINKING]
7a. Were you involved with planning or executing this project? a. Yes [ASK Q7B] b. No [SKIP TO Q9]
7b-1. Can you identify specific challenges you faced when planning this project? [ASK UNPROMPTED FIRST.] a b c
[PROMPT - BE CAREFUL NOT TO BIAS OR INFLUENCE RESPONSE, SUGGEST CODE FOR ANSWERS PROVIDED ABOVE IF APPROPRIATE] d.
7b-2. Can you identify specific challenges you faced when executing this project? [ASK UNPROMPTED FIRST.] a b c
[PROMPT - BE CAREFUL NOT TO BIAS OR INFLUENCE RESPONSE, SUGGEST CODE FOR ANSWERS PROVIDED ABOVE IF APPROPRIATE] d.

8a. Can you identify any benefits that you received from planning this project?

8b. Can you identify any benefits that you received from executing this project?
9. Overall, do you feel this project accomplished all, most, some, or none of its objectives? a.
[IF RESPONDENT SELECTS "ALL" OR "DON'T KNOW," SKIP TO Q11. OTHERWISE, ASK Q10.] 10. Please explain why this project did not accomplish all of its objectives:
To. Please explain why this project did not accomplish all of its objectives
SECTION 2: COST EFFECTIVENESS
Now I would like to ask about the cost-effectiveness of the project.
11. NYSERDA furnished a grant for [NYSERDA \$]. In addition to that amount, how much did you invest in this project in terms of staff time and project expenses? \$, staff
[IDEALLY, COLLECT DATA ON \$ AND STAFF TIME. HOWEVER, IT IS OKAY IF THE RESPONDENT CAN ONLY PROVIDE ONE OR THE OTHER (OR NEITHER).]
12. At the time the project began, were you considering alternatives to the ["product", "process", "technology" or "type of generation"] that you used in the NYSERDA project? a Yes, explain: b No c Don't know
[IF Q12 = YES, PROCEED TO Q13. OTHERWISE, SKIP TO Q14.]
13. Looking back, do you think the ["product", "process", "technology" or "type of generation"] that you used in the NYSERDA project was the best alternative? a.
 14. Do you feel the [PROJECT DESCRIPTION] project was a good investment? a. Yes, explain: b. No, explain: c. Don't know
 15. In general terms, how would you describe your return on this project? [READ LIST TO RESPONDENT] a. Positive b. Negative c. Breakeven or neutral

16. Have you advertised or communicated the results of this project to any potential buyers, suppliers, or business partners?
a. Yes, explain:
b. No, explain:
c. Don't know
SECTION 3: DEMONSTRATION PROJECT IMPACTS
Now I would like to talk with you more about the project's benefits.
[NOTE: WHEN ASKING FOR BENEFITS DATA, TRY TO GET NUMERICAL UNITS AS OPPOSED TO PERCENTAGES. IF RESPONDENT REPORTS A PERCENTAGE OR PERCENTAGE CHANGE, ASK IF HE/SHE CAN NUMERICALLY QUANTIFY THE CHANGE, OR IF HE/SHE CAN PROVIDE THE BASELINE THAT THE PERCENTAGE CHANGE IS BASED ON.]
IF PROGRAM DATA INCLUDES RESOURCE TYPE, ASK Q17-Q21. OTHERWISE, ASK Q17D, THEN SKIP TO Q22.]
17A.NYSERDA program records indicate that this project resulted in [RESOURCE TYPE 1] benefits involving [RESOURCE TYPE 2]. [NOTE: IF A PROJECT HAS MORE THAN ONE ENTRY FOR "RESOURCE TYPE 1," ASK THE QUESTION SEPARATELY FOR EACH ENTRY.]
Is that correct?
☐ Yes [SKIP TO Q18]
☐ No [ASK Q17B]
☐ Don't know [ASK Q17B]
17B. Did you previously report these benefits to NYSERDA?
☐ Yes [ASK 17C]
☐ No [SKIP TO 17D]
☐ Don't know [SKIP TO 17D]
17C. Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED: FILL IN RESPONDENT'S ANSWER]
17D. Which of the following describe the specific types of benefits this project produced? For each benefit that your project produced, please state if it was a direct benefit, indirect benefit, or uncertain benefit. [READ THE LIST. CHECK ALL THAT APPLY. FOR EACH BENEFIT TYPE IDENTIFIED BY RESPONDENT, ASK RESPONDENT IF

THIS IS A DIRECT BENEFIT, INDIRECT BENEFIT, OR UNCERTAIN BENEFIT. MAKE SURE TO ASK ABOUT ANY

OTHER BENEFITS THAT WE MAY NOT HAVE MENTIONED.]

	Power production	Direct		Indirect	Uncertain	
	Energy efficiency	Direct		Indirect	Uncertain	
	Air emissions	Direct		Indirect	Uncertain	
	Productivity	Direct		Indirect	Uncertain	
	Waste management	Direct		Indirect	Uncertain	
	Product quality/reliability i	improvemen	ıt [Direct	☐ Indirect	Uncertain
	Water reductions	Direct [Indirect	Uncertain	
	Water quality	Direct [Indirect	Uncertain	
	Operations & Maintenanc	се 🔲 п	Direct [Indirect	☐ Uncertain	
	Marketability	Direct		Indirect	Uncertain	
	Demand reduction	Direct		Indirect	Uncertain	
	Reduced labor costs	Direct		Indirect	Uncertain	
	Reduced material costs		Direct	☐ Indi	rect 🗌 Un	certain
	Environmental quality imp	orovement		Direct	Indirect	☐ Uncertain
	Knowledge creation			Direct	Indirect	☐ Uncertain
	Other Specify:			Direct \square	Indirect	Uncertain
	_					OTHERWISE, SKIP TO Q22.]
18.						WER PRODUCTION] saved [IF T IS REPORTED, ASK THE
	QUESTION AND RECOR					
	[Net Units]	_ [Unit Type]	[Metric Yea	ar]	
	A	-10				
	Are these numbers correct [1] (1) Yes [SKIP TO Q23					
	(2) No [ASK Q19]					
10	B.1			V(0555 40		
19.	Did you previously report (1) Yes [ASK Q20]	these numb	ers to N	YSERDA?		
	(2) No [SKIP TO Q21]					
		10 (221)				
20.	Do you know why there is	s a differenc	e betwee	en NYSERDA	a's records and th	e information that you currently
	have? [ASK OPEN-ENDE					,
	Performance of the e	equipment ch	nanged (over time		

	□ V	Ve decommissioned	the project		
		Benefits were realize	d prior to the first repo	rting year	
		Additional benefits a	ccrued over time		
		Other, please specify	<i>/</i> :		
21.	Pleas	se estimate the actua	al benefits.		
		Specify unit:	[kWh, kW, MMBtu	, pounds of pollutant,	etc.]. Year(s):
THE	E QUE	STION AND RECO		PARATELY FOR EAC	IF MORE THAN ONE BENEFIT, ASK CH BENEFIT. ASK ABOUT ALL N BENEFITS.]
22.	ETC.	- TAILOR TO SPE		AN ONE BENEFIT IS	OF] in [ENERGY, kW, EMISSIONS, REPORTED, ASK THE QUESTION ED BENEFIT.]
		_ Specify unit:	[kWh, kW, MMBtu	, pounds of pollutant,	etc.] Year(s):
_	K Q23 P TO (DID <u>NOT</u> ANSWER Q	21 or Q22. If Resp	ONDENT ANSWERED Q21 OR Q22,
23.		les [METRIC YEAR) [] benefits?	(S) REPORTED IN TH	E DATABASE], has t	he project produced any other [UNIT
		-	[Net Units]	[Unit Type]	[Metric Year(s)]
		(2) No (3) Don't know			
23-	AA. Be	esides [UNIT TYPE],	has the project produc	ced any other types c	of benefits?
		(1) Yes [IF YES,	LOOP BACK TO Q17	[D]	
		(2) No			
		(3) Don't know			
[IF I	PROG	RAM DATA INCLUI	DES NET DOLLARS, A	ASK Q24-27. OTHER	WISE, SKIP TO Q28.]
24.	NYSE	ERDA's records indi	cate that this project [G	GENERATED/SAVED]:
		[Net Dollars]	[Metric Year(s)]		
	Are th	nese numbers corre	ct?		

	☐ (1) Yes [SKIP TO Q32] ☐ (2) No [ASK Q25]
25.	Did you previously report these numbers to NYSERDA? (1) Yes [ASK Q26] (2) No [SKIP TO Q27] (3) Don't know [SKIP TO Q27]
26.	Do you know why there is a difference between NYSERDA's records and the information that you currently have? [OPEN-ENDED]
27.	Please estimate the actual net dollars in [REVENUE/COST SAVINGS] from this project: \$, year(s):
[AS	K Q28 IF THE PROGRAM DATA DOES NOT INCLUDE NET DOLLARS. OTHERWISE, SKIP TO Q32]
28.	Did this project generate any revenue? (1) Yes [ASK Q29] (2) No [SKIP TO Q30] (3) Don't know [SKIP TO Q30]
29.	Please provide an estimate of the revenue generated from this project. \$, year(s):
30.	Did this project generate any cost savings? (1) Yes [ASK Q31] (2) No [SKIP TO Q33] (3) Don't know [SKIP TO Q33]
31.	Please provide an estimate of the cost savings generated from this project. \$, year(s):
	[ASK Q32 IF RESPONDENT DID <u>NOT</u> ANSWER Q27. Q29, OR Q31. IF RESPONDENT ANSWERED Q27, Q29, OR Q31, SKIP TO Q33.]
32.	Besides [METRIC YEAR(S) REPORTED IN THE DATABASE], has the project generated any other [REVENUE/COST SAVINGS]?
	(1) Yes, amount: \$

		(3) Don'	n'i know					
33.	Who we	ho were the primary end users for this project?						
			_ [RECORD OPEN-ENDED RESPONSE]					
34.	Did you a. b. c.	receive a (1)	any feedback from end-users from this project site? Yes No Don't know					
[IF	YES, PR	OCEED	TO Q35. IF NO OR DON'T KNOW, SKIP TO Q36]					
	a. b. c.	(1)	k useful for understanding whether or how the technology worked? Yes No Don't know					
			NFLUENCE ON THE DEMONSTRATION PROJECT					
	now like CT] Proj∈		s your interactions with NYSERDA concerning the [SUMMARY OF DEMONSTRATION					
36.			arn about NYSERDA's R&D program? [READ THE LIST OF RESPONSE OPTIONS, KNOW." CHECK ALL THAT APPLY.]					
	a.	(1)	Before you began planning this project					
	b.	(2)	During the planning process but before the plans were finalized					
	C.	(3)	After the plans were finalized					
	d.	(4)	After project implementation started					
	e.	(5)	From the integrator or vendor					
	f.	(6)	I have not heard about NYSERDA's R&D Program					
	g.	(7)	Don't know					
37.	Did NY:	SFRDA n	rovide technical assistance for this project?					
	а.	(1)	Yes, explain: Type of assistance: Identify source:					
	b.	(2)	No					
	C.	(3)	Don't know					
38.	Did sou	rces othe	r than NYSERDA provide technical assistance for this project?					
	a.	(1)	Yes, explain: Type of assistance: Identify source:					
	b.	(2)	No					
	C.	(3)	Don't know					

39.	Did sou	irces othe	er than N	YSERDA	provide f	funding fo	r this proj	oject?
	a.	(1)	Yes, e	xplain		\$	_	Identify source:
	b.	(2)	No					
	C.	(3)	Don't k	now				
40.								very important," how important or unimportant is project?
	(Not at	all import	ant)					(Very important)
	0	1	2	3	4	5		
	[ASK Q	41 ONLY	' IF Q37	= "YES".	IF Q37 =	"NO" OR	"DON'T I	KNOW", RECORD 0.]
41.								very important," how important or unimportant nis project?
	(Not at	all import	ant)					(Very important)
	0	1	2	3	4	5		
	[DOLIC	' ΙΔΙΛ Α '	VST DFI	PEODM C	· ΔΙ (-ΙΙΙ Δ	ATI∩N #2:	· PECOE	RD THE HIGHER SCORE OF Q40 OR Q41.
	-			RESPON				ND THE HIGHER SOOKE OF Q40 OK Q41.
42.								leted in New York without NYSERDA's where 0 is not at all likely and 5 is very likely.
	(Not at	all likely)						(Very likely)
			0	1	2	3	4	5
[AS	K Q43 C	ONLY IF (237 = "Y	ES". IF Q	37 = "NO	" OR "DO	N'T KNO	DW", RECORD 0.]
43.								leted in New York without NYSERDA's where 0 is not at all likely and 5 is very likely.
	(Not at	ما اللحايا						(Vong likoh)
	(เพบเ ฮโ	all likely)	0	1	2	3	1	(Very likely)
			U	I	۷	J	4	5
[PO	LICY A	NALYST	PERFO	RM CALC	ULATIO	N #3A: R	ECORD	THE <u>LOWER</u> SCORE OF Q42 OR Q43:

CALCULATION #3B: TAKE THE <u>INVERSE</u> OF 3A. FOR EXAMPLE, 0 BECOMES 5, 1 BECOMES 4, ETC.
DO NOT READ TO THE RESPONDENT:]
44. Overall, without NYSERDA's involvement would the magnitude of the impacts for this project have been of the same size, smaller, or larger? a. Same b. Smaller c. Larger d. Project would not have happened without NYSERDA e. Don't know [DO NOT READ]
45. I would now like to ask you about how, if at all, NYSERDA's support affected the timing of the project. Without NYSERDA's support, would this project have occurred earlier, at about the same time, or later?
a. Earlier: years earlier [ASK RESPONDENT TO ESTIMATE YEARS]
 b. About the same time c. Later: years later [ASK RESPONDENT TO ESTIMATE YEARS] d. Project would not have happened without NYSERDA e. Don't know [DO NOT READ]
[POLICY ANALYST CALCULATION #4A: IF Q44 = A OR C, RECORD -1. IF Q44 = B, D OR E, RECORD 0. DO NOT READ TO THE RESPONDENT:]
[POLICY ANALYST CALCULATION #4B: IF Q45 = A, RECORD -1. IF Q45 = B OR E, RECORD 0. IF Q45 =
C OR D, RECORD +1.]
[CALCULATION #5: TAKE THE AVERAGE OF CALCULATION #2 AND #3B. THEN, ADD THE RESULTS OF CALCULATIONS #1, #4A, AND #4B. RECORD YOUR ANSWER HERE: DO NOT READ TO THE SURVEY RESPONDENT.]
CTION 5: REPLICATIONS

SEC

I have some questions now concerning your experience with demonstration projects and replications. NYSERDA classifies the project we have been discussing as a demonstration project.

We define a **demonstration** project as the demonstration of a new technology or process or application of an existing technology in a commercial setting. Demonstration projects are designed to showcase the value and effectiveness of the technology or process being demonstrated.

We define **replication** as an additional installation or scaling up of the technology or process demonstrated under the NYSERDA-funded project. The replication could be at the same site as the NYSERDA demonstration project or at another site. The replication could be conducted by your firm or another firm.

46.	that time		technolo			CT] demonstration project in [MONTH/YEAR]. Since ERDA demonstration project been replicated for
	a.	(1) (2) (2)		How Many?:	[]	Month, Year: , , , , , , , , , , , , , , , , , , ,
	C.	(3)	Don't kn	IOW		
47.	Has the		gy or pro	cess from the NYSEF	RDA den	monstration project been replicated for a different
	a.	(1) <u> </u>	Yes No	How Many?:	[1	Month, Year : IF MORE THAN 5, GET DATES FOR THE MOST RECENT 5]
	C.	(3)	Don't kn	OOW		•
	In what		the replic			nal NYSERDA demonstration project? [RECORD
[CONTII	NUE WIT	TH Q49 IF	Q46 = Y	'ES; SKIP TO Q63 IF	Q46 = N	NO OR DON'T KNOW.
49.				demonstration project PONDENT TO GET		eplicated in New York? [DO NOT ENTER "DON'T IMATE.]
	[IF Q49	= 0, SKIF	P TO Q63]		
50.	the 1st r	eplication ion in Nev	in New York? V York? Dication	ork? From the NYS	ERDA de	ct was operational, how long did it take to complete emonstration project to the completion of the 2 nd replication? [GET NUMBER OF YEARS AND/OR
51.			TIONS, E Technic Financir Locatior Reques	cons the demonstration XCEPT "OTHER"] all expertise gained and available available ted by building ownering conditions were rig	r	ct was able to be replicated? [READ LIST OF

	Demonstrable savings were achieved Other [LIST]							
F 5 OR FEWER REPLICATION	5 OR FEWER REPLICATIONS SKIP TO Q53.]							
replications compare to	52. On average over all similar replications completed in New York State, how did the [Unit Type] of the replications compare to the original demonstration? [IF MORE THAN ONE TYPE OF BENEFIT, ASK FOR EACH DIRECT BENEFIT TYPE.]							
b. (2)☐ Sam c. (3)☐ High d. (4)☐ Not (Lower Same Higher Not Comparable, specify Don't know							
[IF Q52 = 4]								
53b. Why are the impa	acts not comparabl	e to the ori	ginal demo	nstration p	roject?			
[IF MORE THAN 5 REPLIC		3 AND Q54	FOR THE	MOST RE	CENT 5 OI	NLY. IF 5 OR FEWER		
REPLICATIONS, ASK FOR	? ALL.]							
53. How did the [Net	Units and Unit Typ	e] of the re	plications o	compare to	the origina	d demonstration?		
		Г	Replication	1				
	1	2	3	4	5			
Lower than Original Demo								
The same size								
Higher than Original Demo								
Not Comparable, specify								
Don't Know								
54. How did the [net of demonstration?	54. How did the [net dollars SAVED/GENERATED] of the replications compare to the original demonstration?							
	Replication							
	1	2	3	4	5			
Lower than Original Demo								
The same size								
Higher than Original Demo								
Not Comparable, specify								
Don't Know								

ng nology A			1						
			<u> </u>	2	3	4	5		
ology A									
	ssistanc	е							
unding Assista									
I									
(1)	nvestme loan) Federal IYS age Specify N Other pri Utility pro Other, sp Oon't kno	ent Capi Governr ncy Gra NYS age ivate gra ogram ecify	tal (interr nent Gra nt or Sub ncy ant or phi	nt or Subsidisidized Fin	Estimated Glized Finant ancing Econtribution Estimated Gestimated	% of total for cing Estimated 9 Estimated 9 Estim Estim 6 % of total for 6 % of	unding mated % of % of total funated % of total funding unding unding	total funding unding total funding	10
e with th ing the r	e followi eplicatio	ng state	ment: "C			-funded de	monstratio	n project was critical f	
		_				(Strongly ag	gree)	
					O.]				
	(1)	sources other the (1) Yes, a (2) No (3) Don't (2) Pere the other function (1) Investment (2) Federal (3) NYS age Specify No (4) Other pro (5) Utility pro (6) Other, spo (7) Don't known (2) Specify No (3) NYS age Specify No (4) Other pro (5) Utility pro (6) Other, spo (7) Don't known (2) Specify No (3) NYS age Specify No (4) Other pro (5) Utility pro (6) Other, spo (7) Don't known (2) Specify No (3) Utility pro (4) Other, spo (5) Utility pro (5) Utility pro (6) Utility pr	sources other than NYS (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERW Pere the other funding sou (1) Investment Capit stocks, loan) (2) Federal Governr (3) NYS agency Gran Specify NYS age (4) Other private gran (5) Utility program (6) Other, specify (7) Don't know cale of 0 to 5, where 0 = e with the following state bing the replication project ly disagree) 1 2 3	r sources other than NYSERDA pr (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERWISE, SK Pere the other funding sources? (1) Investment Capital (interr stocks, loan) (2) Federal Government Gra (3) NYS agency Grant or Sub Specify NYS agency (4) Other private grant or phi (5) Utility program (6) Other, specify (7) Don't know cale of 0 to 5, where 0 = "strongly e with the following statement: "Coing the replication project(s)." ly disagree) 1 2 3 4	r sources other than NYSERDA provide funding (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERWISE, SKIP TO Q58] For the other funding sources? (1) Investment Capital (internally finance stocks, loan) (2) Federal Government Grant or Subsidiced Fin Specify NYS agency (4) Other private grant or philanthropic of (5) Utility program (6) Other, specify (7) Don't know Cale of 0 to 5, where 0 = "strongly disagree" are with the following statement: "Overall, the bing the replication project(s)." ly disagree) 1 2 3 4 5	r sources other than NYSERDA provide funding for the r (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERWISE, SKIP TO Q58] Pere the other funding sources? (1) Investment Capital (internally financed, investment stocks, loan) (2) Federal Government Grant or Subsidized Financing (3) NYS agency Grant or Subsidized Financing Specify NYS agency (4) Other private grant or philanthropic contribution (5) Utility program (6) Other, specify (7) Don't know Cale of 0 to 5, where 0 = "strongly disagree" and 5 = "stree with the following statement: "Overall, the NYSERDA ping the replication project(s)." ly disagree)	r sources other than NYSERDA provide funding for the replications (1)	r sources other than NYSERDA provide funding for the replications? (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERWISE, SKIP TO Q58] Pere the other funding sources? (1) Investment Capital (internally financed, investment financed through stocks, loan) Estimated % of total funding (2) Federal Government Grant or Subsidized Financing Estimated % of (3) NYS agency Grant or Subsidized Financing Estimated % of total funding Specify NYS agency (4) Other private grant or philanthropic contribution Estimated % of (5) Utility program Estimated % of total funding (6) Other, specify Estimated % of total funding (7) Don't know Estimated % of total funding cale of 0 to 5, where 0 = "strongly disagree" and 5 = "strongly agree," to what e with the following statement: "Overall, the NYSERDA-funded demonstrationing the replication project(s)." ly disagree) (Strongly agree) 1 2 3 4 5	r sources other than NYSERDA provide funding for the replications? (1) Yes, amount \$ (2) No (3) Don't know CEED TO Q57. OTHERWISE, SKIP TO Q58] ere the other funding sources? (1) Investment Capital (internally financed, investment financed through venture capital or stocks, loan) Estimated % of total funding (2) Federal Government Grant or Subsidized Financing Estimated % of total funding (3) NYS agency Grant or Subsidized Financing Estimated % of total funding Specify NYS agency (4) Other private grant or philanthropic contribution Estimated % of total funding (5) Utility program Estimated % of total funding (6) Other, specify Estimated % of total funding (7) Don't know Estimated % of total funding cale of 0 to 5, where 0 = "strongly disagree" and 5 = "strongly agree," to what extent do you agree of the with the following statement: "Overall, the NYSERDA-funded demonstration project was critical for bing the replication project(s)." (Strongly agree) (Strongly agree)

60.	NYSER		ed demor					ave been developed in New York without the n a scale from 0 to 5, where 0 is not at all likely
		(Not at a	all likely)					(Very likely)
		0	1	2	3	4	5	
61.			ts have t Same Smaller Larger Replica	oeen of the	he same	size, sma	aller or la	the magnitude of the impacts for these arger?
62.		the NYS t the sam	e time, o Earlier: About t Later: _ Projecti	r later? yea he same years (s) would	irs earliei time later [AS	r [ASK RESP SK RESP	ESPOND ONDEN	the replication projects have occurred sooner, DENT TO ESTIMATE YEARS] T TO ESTIMATE YEARS] t NYSERDA
POLICY								RD -1. IF Q61 = B, D, OR E RECORD 0. IF Q62 = B OR E, RECORD 0. IF Q62 = C OR
POLICY ETC.	ANALY	ST CALC	CULATIC	N #6C:	TAKE T	HE INVE	RSE OF	Q60. E.G., 0 BECOMES 5, 1 BECOMES 4,
POLICY	ANALY	ST CALC	CULATIC	N #6D:	TAKE T	HE AVER	RAGE OI	F #6C AND Q58.
		ST CALC #6D, AN				RESULT	S OF C	ALCULATION #6A, CALCULATION #6B,
00 <u>NO</u> 1	READ	TO RESP	PONDEN	T]				
[SKIP S	SECTION	I 6 IF Q4	6 =YES a	and Q49:	>01			
_		N-REPL			•			
63.	What do	you thin	k are the	reasons	why the	NYSERI	DA projed	ct was not replicated in New York?
64.	Do you a. b.	expect th (1) (2)	e NYSEI Yes No	RDA proj [REAS [REAS	ONS]	e replicat	ed in Ne	w York at some point in the future?
SECTIO	N 7· DD	OCESS!	EV/ALIIA	TION				

65. How did you become aware of NYSERDA and the potential for NYSERDA assistance?

[DO NOT READ, MARK ALL STATED IN REPLY]

a. b. c. d.	(1)	Prior participation in a NYSERDA R&D program Another NYSERDA program Advertising Word-of-mouth (PROBE FOR FOLLOWING):
e. f. g.	a)	Business colleague/client b) Friend/relative Contacted by a NYSERDA program representative Visit to another NYSERDA demonstration project I was not aware of the potential for NYSERDA assistance Other

Please rate your agreement or disagreement with the following statements. Please use a 1 to 5 scale where 5 indicates strongly agree, 4 indicates agree, 3 indicates neither agree not disagree, 2 indicates disagree, and 1 is strongly disagree.

	<u> </u>		
66.	NYSERDA provides technical information that supports the demonstration process.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
67.	NYSERDA provides marketing information that supports the demonstration process.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
68.	NYSERDA provides market intelligence that supports the demonstration process.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
69.	NYSERDA communicates well with demonstration project participants.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
70.	NYSERDA provides assistance in a timely manner.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
71.	NYSERDA staff members working with this program are well qualified.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
72.	NYSERDA's credibility is an important catalyst for demonstration projects in New York.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	
73.	NYSERDA provides technical information that supports the replication process.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A
74.	Overall, I am satisfied with NYSERDA's R&D program.	(Strongly disagree) 1 2 3 4 5 (Strongly agree) Don't Know	N/A

^{75.} Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more demonstration projects such as this? [LIST]

76.	Besides increasing financial incentives, how could NYSERDA improve its R&D program to encourage more replications of its demonstration projects? [LIST]
SECTIO	N 8: SITE OWNER FIRMOGRAPHICS
I want to	complete our interview with a few final questions about your firm.
77.	What is the firm's principal business activity?
78.	How many employees does the firm have overall? [APPROXIMATE NUMBER IS ADEQUATE.]
79.	How many employees does the firm have in New York? [APPROXIMATE NUMBER IS ADEQUATE.]
THE DE	ONLY ASK Q80-85 IF THE SITE OWNER WAS ACTIVELY INVOLVED IN PLANNING AND EXECUTING MONSTRATION PROJECT (Q7A). IF THE SITE OWNER WAS NOT DIRECTLY INVOLVED IN PROJECT ING OR EXECUTION, SKIP TO Q86.]
[IF THE	PROGRAM DATA INCLUDES JOBS CREATED/RETAINED, ASK Q80. OTHERWISE, SKIP TO Q83.]
80.	Our records indicate that [COMPANY NAME] [CREATED/RETAINED] [NUMBER] jobs due to the NYSERDA demonstration project. Is this correct? a. Yes [SKIP TO Q86] b. No [ASK Q81] c. Don't Know [DO NOT READ. IF RESPONDENT DOES NOT KNOW, SKIP TO Q84.]
81.	Did you report these numbers to NYSERDA? a. Yes [ASK Q82] b. No [SKIP TO Q83] c. Don't Know [SKIP TO Q83.]
82.	Do you know why there is a difference between NYSERDA's records and the information you currently have? [ASK OPEN-ENDED FIRST, READ PROMPTS IF NEEDED] a. The company [ADDED/LOST] jobs after reporting the numbers to NYSERDA due to factors related to the demonstration project. b. The company [ADDED/LOST] jobs after reporting the numbers to NYSERDA due to factors unrelated to the demonstration project. c. Other, please specify:

83. Has the I a. b.	NYSERDA-funded demonstration project affected the firm's number of employees in New York? Yes No [SKIP Q84 and Q85]
84. How has York? a. b.	the NYSERDA-funded demonstration project affected the firm's number of employees in New Created/retained jobs Lost jobs
85. How mar a. b.	ny jobs were [created/retained FOR Q84=A] [eliminated for Q84=B]? Don't know (DO NOT READ.)
a.	SERDA call you back at a later time to obtain more information about the NYSERDA R&D Program´Yes No
ON BEHALF ON I	NYSERDA, THANK YOU FOR YOUR TIME IN HELPING US CONDUCT THIS RESEARCH.

HAVE A GREAT DAY.

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R&D Demonstration Survey

Appendices

Appendix B

COMPARISON OF SURVEY RESULTS FROM ROUNDS 1 AND 2

Appendix B presents a comparison of major conclusions from the first two rounds of the R&D demonstration survey. It should be noted that the surveys covered two distinct populations: projects completed in 2004 – 2007 (Round 1), and projects completed in 2008 – 2010 (Round 2). Moreover, the methodology was revised for the second round, especially the method for estimating NYSERDA's contribution to project impacts. Therefore, caution should be exercised when attempting to draw comparisons between the results of the two surveys. Nonetheless, a high-level comparison across selected metrics can provide insight about the performance of NYSERDA's R&D demonstration portfolio over time. The remainder of this appendix describes the results of this high-level comparison.

B.1 COMPARISON OF IMPACTS

Tables B-1 and B-2 compare the impacts in Rounds 1 and 2, respectively. There are similarities and differences in the types of benefits that were quantified in each round. While both rounds estimated MWh and kW, the first round did not provide aggregated benefits for revenues and cost savings. On the other hand, Round 2 did not provide aggregated benefits for wastewater savings. One project in Round 2 reported water savings of 753,287 gallons, but this project was an outlier; the most commonly reported quantities benefits were expressed as MWh, kW, therms, or dollars saved or generated.

Table B-1. Summary of "Net Savings" in Round 1

	Estimated	Total Estimated		
Savings Type	Power	Process	Product	Net Savings
	Production	Improvement	Demonstration	rect bavings
Program Net Savings (kW)	94	0	1,263	1,357
Replication Net Savings (kW)	7,967	0	3,032	10,999
Total Net kW Savings	8,061	0	4,295	12,356
Program Net Savings (MWh/year)	9,711	142,744	200	152,655
Replication Net Savings (MWh/year)	46,314	46,107	4,106	96,527
Total Net MWh/year Savings	56,025	188,851	4,306	249,182
Total Net Waste Water Savings ¹ (x1000 Gallons)	509	35,522	0	36,031

¹ No replications were conducted for projects with estimated waste water treatment impacts. Source: Megdal & Associates, *R&D Demonstration Survey Report*. September 2012.

Table B-2. Summary of Savings to Which NYSERDA Contributed in Round 2

•	Estima	Estimated Benefits by Project Type				
Benefits Type	Power Production	Process Improvement	Product Demonstration	Total Benefits		
Demonstration Installed Capacity (kW)	3,988	75	538	4,601		
Replication Installed Capacity (kW)	4,075	63	-	4,138		
Total Installed Capacity (kW)	8,063	138	538	8,739		
Demonstration Electricity Savings (MWh/year)	17,062	88	4,688	21,838		
Replication Electricity Savings (MWh/year)	16,558	-	146	16,704		
Total Electricity Savings (MWh/Year)	33,620	88	4,834	38,542		
Demonstration Fuel Savings (Therms/Year)	0	44,137	13,729	57,866		
Replication Fuel Savings (Therms/Year)	-	1,000	29,318	30,318		
Total Fuel Savings (Therms/Year)	0	45,137	43,047	88,184		
Demonstration Cost Savings	\$11,748,933	\$8,514,463	\$3,545,264	\$23,808,660		
Replication Cost Savings	\$36,160,752	\$5,435,000	\$274,719	\$41,870,471		
Total Cost Savings	\$47,909,685	\$13,949,463	\$3,819,983	\$65,679,131		
Demonstration Revenue	\$3,194,233	\$1,050,180,000	\$9,590,000	\$1,062,964,233		
Replication Revenue	\$12,515,540	\$202,500	\$60,480,000	\$73,198,040		
Total Revenue	\$15,709,773	\$1,050,382,500	\$70,070,000	\$1,136,162,273		

Comparing across the two metrics that were common to both surveys, it appears that Round 1 projects outperformed Round 2 projects, especially on MWh. However, NYSERDA funds a wide variety of

demonstration projects with different goals and activities. It is possible that projects in Round 1 were generally more focused on power production as a primary goal. Moreover, it should be noted that the method used for estimating NYSERDA's contribution differed across the two surveys. Specifically, Round 1 calculated a "net-to-gross" ratio, whereas Round 2 estimated NYSERDA's contribution to R&D demonstration impacts. While the two concepts are not entirely dissimilar, the methodological distinction could explain some of the variance in results across the surveys.

It is not possible to compare cost effectiveness; this was a new analysis added in Round 2. Going forward, NYSERDA can continue to track measures of cost effectiveness and compare future results to Round 2.

B.2 COMPARISON OF FACTORS SUPPORTING AND HINDERING REPLICATION

Tables B-3 and B-4 show the reasons that respondents identified for replications in Rounds 1 and 2, respectively. In both rounds, technical expertise/experience and success/demonstrable savings were cited as key factors for successful replications. More than one in five respondents cited financing in both rounds; interestingly, the percentage increased in Round 2 (from 22% to 32%) even as financing declined in relative importance compared to other factors. This finding may reflect the broader financial climate, or the relative ease or difficulty of obtaining financing relative to technical support. The data are not sufficiently detailed to draw a definitive conclusion.

Table B-3. Reasons for Replications in Round 1

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	18		

Table B-4. Reasons for Replications in Round 2

Reasons for Replications	Number of Projects (n=28)*	Percent of Projects (Out of 28)
Technical Expertise Gained	21	75%
Demonstrable Savings were Achieved	14	50%
Operating Conditions were Right	12	43%
Location Available	11	39%
Requested by Building Owner	10	36%
Financing Available	9	32%
Other	6	21%

Notes: (*) Respondents were allowed to select multiple answers.

Tables B-5 and B-6 show the factors that respondents identified as barriers to project replication. The lack of customer interest, location issues, and replication not requested/needed in Round 1 correspond to the lack of suitable companies, institutions, or locations identified in Round 2. Cost and administrative (or permitting) issues were also identified in both surveys. It appears these barriers have continued. On the other hand, insufficient/unavailable equipment and specialization incompatibilities were identified in Round 1, but were not identified as being major issues in Round 2.

Table B-5. Barriers to Replication Identified in Round 1

Reason	Number of Projects ¹ (n=22)	Percent of Projects	Adjusted Percent of Projects
Lack of Resources	5	23%	31%
Lack of Consumer Interest	3	14%	19%
Production Costs	2	9%	13%
Insufficient/ Unavailable Equipment	2	9%	13%
Replication not requested/needed	2	9%	13%
Administrative Issues	1	5%	6%
Location Issues	1	5%	6%
Unsuccessful Product	1	5%	6%
Replicated by others instead	1	5%	6%
Specialization incompatibilities	1	5%	6%
Not meant for commercialization	1	5%	6%
Don't Know/No Answer/Refused	6	27%	

¹ Multiple responses were allowed. Percents are based on the 22 projects without replications.

Table B-6. Barriers to Replication Identified in Round 2

Reason	Number of Projects* (n=29)	Percent of Projects	Adjusted Percent of Projects
Absence of Suitable Companies/Institutions/Locations	4	14%	15%
Cost	3	10%	12%
Technology is Still Being Proven	3	10%	12%
Permitting/Regulatory Barriers	2	7%	8%
Propietary Technology	2	7%	8%
Lack of Proximity to Potential Users	2	7%	8%
No Other Similar Company in New York State	2	7%	8%
Lack of Effective Marketing/Publicity	2	7%	8%
Complex Operating Environment/Too Many Competing Actors	2	7%	8%
New Markets/New Technologies	1	3%	4%
Company No Longer Makes the Product	1	3%	4%
Never Saw the Project Through to Completion	1	3%	4%
Project Answered all Questions it Set Out to Answer	1	3%	4%
Denied Commercialization	1	3%	4%
Don't Know	3	10%	12%

Notes: (*) Respondents could select more than one answer. Four projects without out replications did not answer the question.

B.3 COMPARISON OF PROCESS EVALUATION RESULTS

Both rounds included similar questions about participant satisfaction with NYSERDA's R&D Program. As shown in Tables B-7 and B-8, overall program satisfaction was quite high in both rounds. Opinions about the qualifications of staff working with this program were also consistently high. The responses suggest that the program made improvements in responding in a timely manner; 73% of respondents agreed with this statement in Round 2 (rating of 4 or 5, out of 5), up from 64% in Round 1. Ratings for providing market knowledge/market intelligence still rank near the bottom of the list; however, several respondents in Round 2 stated they do not see this as function as part of NYSERDA's role. Overall, the findings suggest that the program is maintaining or improving its performance in most categories.

Table B-7. Round 1 Respondent Feedback on NYSERDA's R&D Program Characteristics

Program Characteristic	Agree or Strongly Agree	Disagree or Strongly Disagree
Overall Program Satisfication	98%	2%
NYSERDA staff working with this program are well qualified	95%	0%
NYSERDA provides information that is highly supportive of the demonstration process	79%	5%
Turn-around time for assistance from NYSERDA does not significantly hamper demonstration efforts	64%	21%
The process of obtaining funding from NYSERDA is adequate	64%	24%
The assistance that NYSERDA provides to encourage knowledge gained from the demonstration is adequate	62%	14%
NYSERDA's effort to increase market knowledge greatly assists in obtaining replications	46%	22%

Table B-8. Round 2 Respondent Feedback on NYSERDA's R&D Program Characteristics (n=61)

_		Str	ongly D	isagree (1) to Str	ongly Ag	gree (5)
Statement	Calculation	1	2	3	4	5	Don't Know/ Refused
Overall, I am satisfied with my participation in	Raw	7%	-	-	33%	59%	2%
NYSERDA's R&D program.	Adjusted ¹	7%	-	-	33%	60%	
NYSERDA communicates well with demonstration	Raw	-	7%	8%	38%	43%	5%
project participants.	Adjusted ¹	-	7%	9%	40%	45%	
NYSERDA staff members working with this program	Raw	5%	3%	3%	28%	56%	5%
are well qualified.	Adjusted ¹	5%	3%	3%	29%	59%	
NVCEDDA mayidas assistanas in a timaly mannar	Raw	7%	7%	11%	34%	39%	2%
NYSERDA provides assistance in a timely manner.	Adjusted ¹	7%	7%	12%	35%	40%	
NYSERDA provides technical information that supports	Raw	7%	16%	26%	25%	20%	7%
the demonstration process.	Adjusted ¹	7%	18%	28%	26%	21%	
NYSERDA provides technical information that supports	Raw	10%	13%	28%	23%	16%	10%
the replication process.	Adjusted ¹	11%	15%	31%	25%	18%	
NYSERDA provides marketing information that	Raw	10%	20%	23%	21%	15%	11%
supports the demonstration process.	Adjusted ¹	11%	22%	26%	24%	17%	
NYSERDA provides market intelligence that supports	Raw	15%	21%	26%	15%	8%	15%
the demonstration process.	Adjusted ¹	17%	25%	31%	17%	10%	

Notes: (1) Adjusted percentages exclude "Don't Know/Refused." Percentages may not sum exactly to 100% due to rounding.

¹ Although the questions were worded somewhat differently, they address the same theme.

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R&D Demonstration Survey

Appendices

Appendix C

ENERGY SAVINGS AND PRICE FORECAST

- Methodology for Estimating Future Energy Savings
- AEO 2013 Energy Prices by Sector and Source, Middle Atlantic, Reference Case
- AEO 2013 Energy Prices by Sector and Source, Middle Atlantic, High Economic Growth
- AEO 2013 Energy Prices by Sector and Source, Middle Atlantic, Low Economic Growth
- EIA State Energy Data 2011: Commercial Sector Energy Consumption Estimates
- EIA State Energy Data 2011: Industrial Sector Energy Consumption Estimates
- EIA 2009 Residential Energy Consumption Survey: Space Heating in U.S. Homes in Northeast Region, Divisions, and States

Appendix C describes the methodology used for estimating future energy savings in the cost-effectiveness analysis. As described in Sections 4 and 5 of the main report, most respondents reported electricity and fuel savings on an annual basis (MWh/year and therms/year, respectively); many of these respondents indicated that savings will continue into the future. However, all of NYSERDA's demonstration project costs were incurred upfront. Therefore, to compare the benefits and costs on equal terms, the analysis estimates the monetary value of future energy savings.

Given the uncertainties inherent in predicting future energy savings, the report conducts a scenario analysis. The scenario analysis estimates how projected energy savings are expected to vary with different lifespans (one year, five years, 10 years, and 20 years) and future energy prices ("high," "medium," and "low"). The survey did not ask about years of operation; however, NYSERDA's experience has shown that many projects stay online longer than one year, while a 20-year lifetime might be longer than average.

Forecasted energy prices were taken from the U.S. Energy Information Administration (EIA) *Annual Energy Outlook 2013* for the U.S. Middle Atlantic region, which includes New York State. 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 analysis was conducted separately for electricity (MWh) and fuel (therms). For electricity, annual savings (MWh/year) were converted to MMBTU, which is the unit that EIA uses in its energy price forecasts. The analysis used the standard conversion factor of 3.412 MMBTU/MWh. For example, demonstration projects reported 21,838 MWh/year in electricity savings; multiplying 21,838 MWh by 3.412 yielded 74,511 MMBTU. This value was then multiplied by EIA's forecasted electricity prices (under the reference case, low case, and high case, respectively) to calculate the monetary savings.

As shown in Table C-1, the EIA price forecast shows residential, commercial, and industrial energy prices separately. In the absence of detailed data about which sector each site belongs to, the analysis took the simple average of the commercial and industrial prices. The top part of the table shows data excerpted from EIA's energy price forecast; the shaded section at the bottom shows IEc's calculations.

Table C-1. EIA Energy Price Forecast by Sector (Reference Case, Middle Atlantic Region)

Sector and Source	2012	2013	2014	2015	2016
Commercial ¹					
Distillate Fuel Oil	25.697847	24.682537	22.63097	22.693171	23.075819
Residual Fuel	20.043619	18.818247	12.897819	12.887959	13.182909
Natural Gas	8.485619	8.919311	8.669165	8.524491	8.900762
Electricity	39.249451	36.473335	36.450665	35.80909	36.188709
Industrial ¹					
Distillate Fuel Oil	26.608124	25.557804	23.023254	23.137028	23.528515
Residual Fuel Oil	19.71102	18.520655	12.897819	12.887959	13.182909
Natural Gas	5.653099	5.984531	5.834828	5.850177	6.195745
Metallurgical Coal	6.943663	7.206048	7.385982	7.787265	7.994534
Other Industrial Coal	3.59021	3.649058	3.596577	3.712585	3.762938
Electricity	21.238831	19.794004	19.665545	19.186272	19.442217
Commercial/Industrial Average ²					
Distillate Fuel Oil	26.1529855	25.1201705	22.827112	22.9150995	23.302167
Residual Fuel	19.8773195	18.669451	12.897819	12.887959	13.182909
Natural Gas	7.069359	7.451921	7.2519965	7.187334	7.5482535
Electricity	30.244141	28.1336695	28.058105	27.497681	27.815463

Notes: (1) Excerpt from EIA "Energy Prices by Sector and Source, Middle Atlantic, Reference case," 2013. (2) IEc calculations.

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¹ All values used in this analysis are adjusted for NYSERDA's contribution.

The analysis was repeated for the one-year, five-year, 10-year, and 20-year scenario. For example, the five-year scenario sums the energy prices in years 2012-2016. The analysis uses 2012 as Year 1 across projects. Some projects began to accrue benefits prior to 2012, but the survey did not capture this in a systematic way across all projects. In addition, the study assumes a lag time of two years from the end of the demonstration projects to the associated replication projects. Assuming the last demonstration project was completed in 2010, the associated replications would have been implemented in 2012. In the absence of detailed data about when each demonstration and replication project began to generate benefits, the analysis uses 2012 as the common starting point. Using the same starting point (2012) across projects facilitates comparisons by adjusting for differences in energy prices in the year when projects came online.² This has the advantage of smoothing over idiosyncratic fluctuations in energy prices when attempting to compare benefits over time. However, this approach has the disadvantage of not reflecting the actual energy prices at the time when the projects began to generate benefits.

Annual Energy Outlook 2013 expresses all energy prices in 2011 dollars unless otherwise noted; therefore, it was not necessary for this analysis to discount future prices back to current dollars. Expressing all savings in current dollars adjusts for the effects of inflation on energy prices in later years, and therefore represents a reasonably accurate assessment of the world from NYSERDA's point of view. It does not, however, account for the firm's opportunity cost of capital – i.e., other investments the firm could have made instead of investing in the project. If a private firm were considering the investments described in this section, it would further discount the future energy savings by its weighted average cost of capital – i.e., the cost required to finance the firm's mix of debt and equity – thereby reducing the present value of the savings.

The analysis used a similar process for fuel savings (therms/year). Therms were converted to MMBTU by dividing by 10. This value was then multiplied by EIA's forecasted prices (under the reference case, low case, and high case, respectively) to calculate the monetary savings. However, a complicating factor in the fuel analysis is that different sites use different types of fuel. A key question in projecting the fuel savings is which fuel source was displaced at each site. For example, if a site reduced its use of natural gas by 1,200 therms per year, the annual monetary savings would be calculated as 1,200 therms times the price of natural gas. If a firm switched to using natural gas in lieu of coal, the savings would be the quantity of the displaced coal times the price of coal. The evaluators were able to identify the fuel source for five of the seven demonstration sites; however, the fuel source for the other two demonstration sites could not be identified.³ For the two sites whose fuel source was unknown, the analysis calculated a "typical" fuel mix for the sector and state using the following data sources:

- EIA State Energy Data 2011: Commercial Sector Energy Consumption Estimates. This table shows the estimated energy consumption by the commercial sector in trillion Btu. The data are further broken out by state. The table includes a variety of fuel sources; based on knowledge about the demonstration projects, the evaluators selected the applicable fuel sources coal, natural gas, distillate fuel oil, and residual fuel oil and excluded non-applicable fuel sources (e.g., motor gasoline and kerosene). The analysis uses data for New York State.
- **EIA State Energy Data 2011: Industrial Sector Energy Consumption Estimates.** This table is analogous to the previous table, but shows estimated energy consumption for the industrial

² For example, prices may have been atypically high or atypically low in the year when a particular project came online. In addition, the demonstration projects as a group may have come online during a period when energy prices were different from when the replication projects came online.

³ The analysis assumes that the replication sites use the same fuel source as the demonstration sites.

sector instead of the commercial sector. The evaluators used the relevant data (same categories as above) for New York State.

• EIA 2009 Residential Energy Consumption Survey: Space Heating in U.S. Homes in Northeast Region, Divisions, and States. This table provides residential data for 2009, broken out for selected states. An advantage of this table is that it is specific to heating as opposed to general energy consumption. A disadvantage is that the figures are expressed in millions of housing units, rather than Btu. The analysis used the figures for natural gas and fuel oil for New York State to calculate the relative percentage of homes that use each fuel source.

Of the two demonstration sites with unknown fuel sources, one was a commercial/industrial site and the other was residential. For the commercial/industrial site, the analysis first summed the commercial and industrial consumption for each fuel source, and then calculated commercial/industrial consumption of each fuel source as a percentage of total consumption. This is shown in Table C-2.

Table C-2. EIA Commercial and Industrial Sector Energy Consumption Estimates, 2011 (trillion Btu)

	Coal	Natural Gas	Distillate Fuel Oil	Residual Fuel Oil	Total
Commercial ¹	0.1	298.9	59.9	44.6	403.5
Industrial ¹	25.9	78.7	16.3	49.7	170.6
C/I Sub-total ²	26	377.6	76.2	94.3	574.1
Percent of Total ²	5%	66%	13%	16%	100%

Notes: (1) Excerpt from EIA data. (2) IEc calculations.

For the residential site, the analysis estimated the fuel mix by calculating the number of homes that use natural gas or fuel oil, respectively, as a percent of the total. The figures are shown in Table C-3.

Table C-3. Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

	Number of Housing Units (millions)	Percent of Housing Units
Natural Gas ¹	4.1	66%
Fuel Oil ¹	2.1	34%
Total ²	6.2	100%

Notes: (1) Excerpt from EIA data. (2) IEc calculations.

The final step in the analysis calculated a "typical" fuel price for each sector (commercial/industrial and residential, respectively) based on the percentages derived in Tables C-2 and C-3. To do this, the percentages in the tables were applied to the energy prices from the *Annual Energy Outlook 2013*. For example, the "typical" energy price for the commercial/industrial site was calculated as follows: 5% of the coal price plus 66% of the natural gas price plus 13% of the distillate fuel oil price plus 16% of the residual fuel oil price. A similar method was used for the residential site using the percentages in Table C-3 and the EIA energy price forecast. The rest of the analysis for these two sites was carried out in the same way as for the sites with known fuel sources.

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⁴ For each fuel source, the EIA "price" was the simple average of the commercial and industrial prices, as described above in the main text. The exception was coal, which only had an industrial (but not commercial) price.

Energy Prices by Sector and Source, Middle Atlantic, Reference case (2011 dollars per million Btu, unless otherwise noted)

Sector and Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Growth Rate (2011-2040)
Residential																																
Propane Distillate Fuel Oil	31.579645 21.96921	29.061356	27.479818	26.007195	25.463589	24.730688	24.836483	25.651047	26.167799	26.653893	27.114859	27.443455	27.805685	28.121868	28.402895	28.666199	28.936497	29.160994	29.377439	29.572397	29.772116 31.901106	29.957613	30.144238	30.353468	30.61174	30.888811	31.197189	31.512808	31.831276	36 593067	32.375019	0.40% 1.20%
Natural Gas	13.396526	12.581223	12.153114	12.101941	11.936802	11.756869	12.191467	12.421128	12.764744	12.938112	13.086956	13.202745	13.432504	13.626386	13.782135	13.89576	14.181978	14.257023	14.409037	14.552016	14.687663	14.879704	15.024144	15.213665	15.481662	15.763497	16.146065	16.413403	16.817993	16.999004	17.306328	1.10%
Electricity	47.491482	46.560055	45.426205	43.561356	44.171864	43.9673	44.343662	44.110321	44.194214	43.826042	43.759045	43.163033	43.110168	43.338985	44.154526	44.713207	45.274685	45.618023	46.375027	46.179539	46.427475	46.785538	46.97168	47.608028	47.780216	48.176792	48.82336	49.1082	49.486397	50.545013	50.90514	0.30%
Commercial																																0.50%
Propane Distillate Fuel Oil	25.207697	23.783081 25.522793	22.013229	20.328802	19.722401	18.916889 22.693171	19.034151	19.934116	20.512598	21.061497	21.587227	25.229933	22.383533	26.143127	23.079552	23.388838	23.7075	23.973457	24.23031	24.462431	24.700647 29.011099	24.92234	25.145924	25.397005	25.707706	26.042299	26.416134	26.80044 32.650211	27.19001	27.527449	27.859978	0.50% 1.00%
Residual Fuel	11.360969	19.080826	20.043619	18.818247	12.897819	12.887959	13.182909	13.356054	13.819541	14.041525	14.435704	14.776312	15.132013	15.497165	15.892485	16.2096	16.638054	17.067251	17.520895	17.866409	18.376308	18.423994	19.049009	19.479988	19.775129	20.490061	20.950607	21.51346	21.797049	22.508562	23.010811	0.60%
Natural Gas Electricity	10.538739 41.874641	9.439743		8.919311 36.473335			8.900762 36.188709	9.060043	9.33553 36.897671		9.547451	9.606102 36.511124	9.781948 36.35387	9.922104	10.030037	10.090686	10.321918	10.341401	10.437936	10.524714	10.60498 36.045277	10.740586	10.824242	10.952262	11.156499	11.374598	11.696773	11.901158	12.249475	12.376627	12.624857	1.00%
Electricity	41.874641	40.25901	39.249451	30.473335	30.450005	35.80909	30.188709	30.200109	30.89/0/1	37.0/1365	37.068962	30.311124	30.35387	30.384537	30.812108	30.202431	35.330914	35.051514	30.044315	33.913779	36.045277	30.174023	30.193882	36.900368	37.000733	30.224070	38.318401	38.094183	39.538525	40./31861	41.544342	0.10%
Industrial 1/	26 702470	22 540225	20.774050		40 455330	47 (57(24	47 774 404		40.330536	40 334336	20 204554	20.00040		24 452050	24 700277			22.574552	22 024 702	22.45.4200	23.40317	22 525525	22.040024	24.402042	24 44 44 60	24.750520			25 005077	20.240404	20 504505	0.60%
Propane Distillate Fuel Oil						23.137028										27.616898	28.00082	28.379541	28.775282	29.149	29.485853	29.845083	30.259037	30.760107	31.292053	31.89583	32.520199	33.123764				
Residual Fuel Oil		18.783236				12.887959														17.866409	18.376308				19.775129	20.490061	20.950607	21.51346	21.797049	22.508562	23.010811	0.70%
Natural Gas 2/ Metallurgical Coal	7.659351 5.60948	7.710135 6.627745	5.653099 6.943663	5.984531 7.206048	5.834828 7.385982	5.850177 7.787265	6.195745 7.994534	6.316631 8.156348	6.560854 8.312846	6.655949 8.440476	6.737161 8.608109	6.773579 8.749131	6.935381 8.871216	7.063557 9.008785	7.166739 9.134497	7.21825 9.263708	7.44706 9.405762	7.45897 9.55145	7.546703 9.706802	7.626187 9.866014		7.827239	7.897803 10.264899	8.01193 10.386187			8.701222 10.780517			9.334716		0.70% 1.80%
Other Industrial Coal		3.823964	3.59021		3.596577		3.762938		3.884256					4.037128	4.056824				4.138881	4.140819	4.17612	4.189102		4.222359					4.393969		4.460303	0.50%
Coal to Liquids Electricity	0 25 202552	24 207251	21 220021	0	10.665545	10.196272	10.442217	10.303635	10.745640	10 722704	10.046608	0	20.090101	20 403553	20 622274	0	20.000000	21.004904	21 204025		0 21.519899	21 71 4905	21 00706	22 202207	22 62015	22.026064	0	24.120626	24 640072	0	0 25 23 5 0 7	
Electricity	23.332333	24.307231	21.230031	19.794004	19.003343	19.100272	19.442217	19.393023	15.743045	15.722704	15.540000	19.873293	20.069191	20.405333	20.023274	20.098532	20.500550	21.004654	21.204033	21.291344	21.313033	21./14093	21.09700	22.392307	22.02013	25.020004	23.740500	24.120030	24.045075	23.300704	23./336/	0.20%
Transportation			24 202044				22.005054				24 024742									25 420022	26.300657			25 702554	27.042042	27.240254						
Propane E85 3/						33.163055															38.958096						42.498013					0.40% 1.90%
Motor Gasoline 4/	23.457163	29.041368	29.496508	27.343349	26.903473	26.530447	26.48761	26,73679	27.113493	27.615351	28.277746	28.758785	29.167973	29.375443	29.602039	29.723625	29.969938	30.209087	30.46558	30.817499	31.166479	31.514971	31.874374	32.410118	32.847652							0.80%
Jet Fuel 5/ Diesel Fuel (distillate fuel oil) 6/		22.651917 26.975737		20.708824		19.794664 25.668396	26.063787	26.584818	20.791767	21.236059	21.665833	22.08913			23.359903	23.859093	24.309395				26.139381 32.032516	26.528225		27.409388 33.293465			29.227638 35.070446			30.702711 36.719654		1.10% 1.10%
Residual Fuel Oil	9.908025	16.630077	17.470333	16.402508	11.13359	11.095444	11.34795	11.670079	11.986842	12.27089	12.591885	12.90391	13.219269	13.556937	13.891834	14.21929	14.566759	14.915557	15.289264	15.629498	15.999357	16.28359	16.633673	17.020994	17.441847	17.923323	18.391115	18.810659	19.220121	19.663599	20.130081	0.70%
Natural Gas 7/ Electricity	16.179142	16.888252	13.46614	15.069566	14.998329	15.010325 32.414417	15.380541	15.560556	15.856809	16.019506	16.159349	16.263178	16.602005	16.881914	17.176558	17.487263	17.920198	18.126057	18.402737	18.615335	18.80711	19.01774	19.140366 35.609283	19.27578 36.034859								0.70%
Electricity	30.0121/1	33.500132	34.032923	33.070098	32.048285	32.414417	32.073033	32.348492	32.880814	32.020090	32.093933	32.334839	32.412483	32.779858	33.442337	33.843174	34.224003	34.510632	33.100100	33.090977	35.321002	35.487804	33.009263	30.034633	30.370302	30.817109	37.331978	37.034083	38.173416	35.005301	39.390107	0.30/6
Electric Power 8/	10.30335	22.25****	22.42245	22.4042-	10.0000-	19.988697	20.25025	20.902007	21.14040-	34 55044	24 024247	22 2442	22 74020	22.1044	33 61000-	24.00400-	24 52554-	24.060247	25 44420	25 05 575	26.264385	36 605305	37 11000-	27 60205-	39 110000	28 60044	29 270849	20.00544-	20 22054-	20.05527	21 524000	1.10%
Distillate Fuel Oil Residual Fuel Oil																					26.264385 17.501041											
Natural Gas	5.56554	5.124975	3.569553	3.969969	3.962628	4.108188	4.482864	4.590744	4.834589	4.92675	5.007025	5.017257	5.170186	5.303686	5.435214	5.497812	5.734733	5.7604	5.870306	5.964934	6.059683	6.20558	6.290487	6.415879	6.613558	6.852565	7.170555	7.363694	7.698226	7.839789	8.103902	1.60%
Steam Coal	2.656512	2.960406	2.898772	2.807209	2.839045	2.863869	2.889351	2.917521	2.959133	2.989127	3.028921	3.053141	3.08762	3.110904	3.133158	3.158476	3.182636	3.204307	3.231213	3.260548	3.295009	3.315305	3.332741	3.354829	3.377424	3.409602	3.441581	3.476548	3.507461	3.542595	3.56966	0.60%
Average Price to All Users 9/ Propane	24 707224	22 971006	20 022206	10.155702	10 410100	17 353479	17 202001	10 22571	10 741020	10 200993	10 735630	20.120052	20 551550	20.056770	21 224026	21 711065	22 1206	22.49469	22 901556	22 102266	23 410765	22 70215	24 001970	24.240979	24 759252	25 211105	25 717651	26 241016	26 770125	27.250012	27 710202	0.70%
E85 3/	26.135481	26.135481	34.030392	31.56214	33.629341	33.163055	33.109512	33.420986	33.891865	34.519188	35.347183	35.948483	36.459961	36.719303	37.002552	37.154533	37.462425	37.76136	38.081974	38.52187	38.958096	39.393711	39.842968	40.512646	41.059566	41.74469	42.498013	43.251728	44.006573	44.864071	45.756275	1.90%
Motor Gasoline 4/						26.530447															31.166475											0.80%
Jet Fuel 5/ Distillate Fuel Oil	16.682594 22.450382	26.66404	26.928782	20.708824	19.782154 25.110319	19.794664 25.187088	25.575495	26.077671		26.970802			22.482166 28.385185			23.859093 29.628357		30.407364			26.139381 31.540997	26.528225	26.902552 32.33009	27.409388 32.829319	33.358223	33.959488	29.227638	29.768082 35.183079	30.157282	36.234699	31.156252	1.10%
Residual Fuel Oil		17.565975	18.506735	17.317741	11.970988	11.952766	12.22637	12.475811		13.119118	13.476008	13.80267	14.13833	14.489591	14.852904	15.175537	15.561713	15.947616	16.35848	16.70154	17.136854	17.311058	17.78978	18.197344	18.559164	19.149427	19.614832	20.103722	20.455339	21.023533	21.506752	0.70%
Natural Gas Metallurgical Coal	9.476547 5.60948	8.730988 6.627745	7.414679 6.943663		7.898974 7.385982	7.795592 7.787265	8.141676 7.994534	8.31662 8.156348	8.574672 8.312846	8.693071 8.440476	8.796894 8.608109	8.895449 8.749131	9.092158 8.871216	9.234781 9.008785	9.330811	9.401753 9.263708	9.654186 9.405762	9.668777 9.55145	9.75932	9.849008 9.866014		10.067824	10.160252	10.294719 10.386187	10.499976	10.739202	11.001119	11.229736	11.550456	11.698627	11.990549	1.10% 1.80%
Other Coal	2.679923	3.009031	2.937408		2.878174	2.91241	2.939317	2.966946	3.012217	3.04174		3.105662	3.138154	3.161632	3.183491	3.207998	3.232687	3.253853	3.279703		3.342191	3.36208	3.379192	3.401283	3.423662	3.455921	3.488329	3.523314	3.554723	3.590082	3.617895	
Coal to Liquids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	
Electricity	40.501880	35.00725	36.100208	35.821815	33.990124	33.30///3	35.000782	33.33357	33.870302	33.700030	33.700736	35.282913	35.221931	33.401431	33.932390	35.92054	35./8352/	33.043023	30.042434	30.302780	36.79697	37.001463	37.210313	37.506112	30.330213	30.91392	39.37532	39.741627	40.373413	41.405421	42.001226	0.20%
Non-																																
Renewable Energy Expenditures by Sector																																
(billion 2011 dollars) Residential	40 521 201	40.766760	20 410202	20.072200	27 400022	26.021.004	27 200520	27.264204	27 622902	27 612060	27 500251	27 200055	27 405252	27 622417	20.022661	20.204202	20 000000	20 054726	20 220017	20 252240	39.437866	20 72112	20 007726	40 202511	40 565100	40.056345	44 5 43343	44 007030	42.250002	42.000624	42 201454	0.20%
Commercial						28.54854	29.11072	29.364727	29.967918	30.239607	30.364336	30.233385	30.405264	30.64579	31.057068	30.957005	30.803146	30.889034	31.625301	31.777332	32.01173	32.279869	32.49762	33.119858	33.79557	34.369621	34.834625	35.381447	36.251148	37.153305	37.901871	0.60%
Industrial Transportation	12.977623	15.703782	14.889511	12.813774	13.47655	14.113684	14.72817	15.176981	15.711201	16.04714	16.362995	16.558702	16.936934	18.406454	17.417477	17.547434	17.709673	17.718954	17.803989	17.852594	17.989571 70.596634			18.900337	18.751143	19.11207	19.585287	20.006119	20.537531	21.017157	21.480282	1.10% 0.20%
Transportation Total Non-Renewable Expenditures																					160.035797											0.20%
		0.018352																														-1.50%
Transportation Renewable Expenditures Total Expenditures	0.008442 149.705963			0.0111	0.009239 148.174805	147.416962	0.00986 148,968704	0.010252 150.210861	0.010613 152.16124	0.010957 153.483047	0.011287 154.486282	0.011475 154.782227	0.011591 155.838318	0.011583 157.601364	0.011552 157.283401	0.011441 157.30072	0.011374 157.550049	0.011316 157.716949	0.01126 158.91748	0.011229 159.269714	0.011192 160.046982	0.011155 161.036087	161.89241	164.304947	0.011132 165.861206		0.011264 171.000336					-1.50% 0.40%
Prices in Nominal Dollars																																
Residential Propane	20.02222	20.00425	27.00202	200/	20 20	36 35533	20 00	20.45	20.24===	30 32002	21 265245	22.40	22.24	24.105247	35 15024-	20.45:22	27.45	39 005500	20.03003-	40.0	41.083809	43 113400	43 15503-	44.34000	45 43500-	46 67407	47.05	40.2/	E0 72555	E2 07757	E2 4224CT	2 10%
Propane Distillate Fuel Oil																					41.083809											2.10%
Natural Gas																					20.268131											2.90%
Electricity	46.499714	46.560055	46.23267	45.088909	46.363743	46.856354	47.996807	48.468822	49.344082	49.707142	50.457214	50.633362	51.489433	52.700447	54.657806	56.346996	58.09272	59.594852	ь1.691227	62.568607	64.067245	b5.767647	67.246742	69.404053	70.920006	72.798073	75.104652	76.901054	78.875893	81.987328	84.016121	2.10%
Commercial	1																															
Propane Distillate Fuel Oil				21.041666 25.548073			20.602234 24.976864										30.419498 35.181572				34.085472 40.033646											2.30% 2.80%
Residual Fuel		19.080826	20.399458	19.47814	13.537829	13.734816	14.268951	14.675756	15.429907	15.925784	16.645369	17.333683	18.073202	18.844639	19.672916	20.427126	21.348572	22.296457	23.307489	24.20718	25.35825	25.89909	27.271406	28.398365	29.352154	30.961731	32.22818	33.689034	34.742104	36.510365	37.978073	2.40%
Natural Gas Electricity	10.318658	9.439743																			14.634263 49.74041											2.80% 1.90%
Electricity	41.000172	40.23501	33.540233	37.732333	30.235411	36.102073	35.170025	35.045333	41.157205	42.040043	42.743004	42.030133	43.415520	44.243737	43.300076	43.03740	43.341370	43.75065	47.546006	40.002247	45.74041	30.630709	31.610/09	33.734101	33.033727	37.70012	30.344342	00.353212	03.020077	00.003730	08.300043	1.50%
Industrial 1/	26 22205*	22 540225	24.46250	10 72500	10 271171	19 917000	10.325.45	20 502505	21 47026*	22 42400	22 207577	24.245205	25 19252-	26.095925	26 961271	37 93003	20 75240-	20 624777	20 505424	34 305 45	32.295029	22 211022	24 144600	25 12650*	26 2270cr	27 200550	30 65300-	30.05222	41 201205	42 573000	42 97444	2.30%
Propane Distillate Fuel Oil	21.373304	26.433073	27.080505	19.725891	24.165707	18.817888 24.657341	19.235458 25.466856	26.4133	27.317581	28.301794	29.144798	24.245283	25.183537 31.529371	32.558735	33.639267	27.836939 34.802448	28.752489 35.928329	29.621773 37.074703	38.278847	39,49395	32.295029 40.688782	41.95401	43.320179	44.842773	46.446682	48.196545	50.02560R	39.952888 51.870205	53.499836	55.434284	43.8/1441 57.386501	2.30%
Residual Fuel Oil	10.952318	18.783236	20.060955	19.170115	13.537829	13.734816	14.268951	14.675756	15.429907	15.925784	16.645369	17.333683	18.073202	18.844639	19.672916	20.427126	21.348572	22.296457	23.307489	24.20718	25.35825	25.89909	27.271406	28.398365	29.352154	30.961731	32.22818	33.689034	34.742104	36.510365	37.978073	2.50%
Natural Gas 2/ Metallurgical Coal	7.499401 5.492337	7.710135 6.627745	5.75346 7.066936	6.194389 7.45874	6.124362 7.752486	6.234588 8.29896	6.706167 8.653145	6.940773 8.96227	7.325378 9.281527	7.549124 9.57312	7.768413 9.925747	7.945899	8.283401 10.595502	8.589324 10.954734	8.871531 11 30737	9.096343	9.555449		10.039139		10.624115 13.844351	11.002954	11.306845	11.679973 15.141216	12.169673	12.688115	13.385032	13.908295	14.691962	15.141523 17.913408	15.794868	2.50% 3.60%
Other Industrial Coal	3.014621	3.823964	3.653948	3.777019	3.775045	3.956536	4.072938	4.164205	4.336881	4.426864	4.553417	4.642728	4.772135	4.90917	5.021843	5.129838		5.385224	5.505822	5.610392		5.88873	6.014839	6.15545	6.299997	6.478878	6.654647	6.826982		7.180199	7.361485	2.30%
Coal to Liquids Electricity	24.862270	24 207251	0	0	20 64129	0 20.446983	0	21 200902	22.046574	22 269224	22 000824	0	22 9920	24.910922	25 529047	0	26.929602	27.440548	28 212475	0 04753	0 29.696224	20 525104	21 249947	32.644000	22 575000	34 793789	36 510055	27 771740	20 297010	41 363915	42 475626	
cieculary	24.002278	24.30/251	21.015889	20.488115	20.04138	20.440983	21.043917	*1.303233	£2.0405/4	22.309331	£2.339821	23.512811	43.9939	24.010833	23.329047	20.084017	20.028093	£7.44U348	20.3154/5	28.84762	25.030224	JU.323194	31.349947	32.044009	J3.375UUS	J-1.73763	30.519955	37.7/1/48	39.26/918	41.303815	42.4/303b	1.90%
*	1																															
Transportation Propane	30.097452	25.591074	24.724117	23.878633	23.732746	23.436369	23.904474	25.031294	25.929256	26.811222	27.713688	28.523174	29.409304	30.270344	31.11179	31.956221	32.833633	33.679348	34.540279	35.404636	36.293396	37.192696	38.10519	39.060402	40.095169	41.173927	42.318798	43.499836	44.707687	45.876671	47.057728	2.10%
E85 3/	25.589691	26.135481	34.634544	32.668919	35.298088	35.342171	35.837158	36.723286	37.841221	39.151386	40.757751	42.170174	43.546635	44.650875	45.804554	46.821651	48.06868	49.331001	50.659241	52.193241	53.75993	55.376766	57.040958	59.060246	60.944565	63.078773	65.374405	67.73011	70.141655	72.772476	75.518204	3.70%
Motor Gasoline 4/				28.302191 21.435015		28.273741		29.37863	30.272978	31.321108 24.085768	32.606201 24.982209	33.736137	34.837311	35.720703	36.643639						43.00795 36.070843			47.248196 39.958019								2.60% 2.90%
Diesel Fuel (distillate fuel oil) 6/	22.590229	26.975737	27.757521	26.182245	26.800062	27.355043	28.210989	29.211641	30.177559	31.222082	32.102875	33.306	34.658165	35.732487	36.860767	38.075371	39.250557	40.443722	41.696705	42.958672	44.203033	45.500816	46.944305	48.535961	50.210293	52.034489	53.948635	55.857807	57.559593	59.561691	61.590698	2.90%
Residual Fuel Oil	9.701115	16.630077	17.780489	16.97769	11.686057	11.824515	12.282823	12.82319	13.383647	13.917544	14.519316	15.13722	15.788681	16.485312	17.196362	17.918962	18.690857	19.48551	20.338823	21.17639	22.078194	22.890268	23.813503	24.813587	25.88887	27.083235	28.29093	29.456579	30.634768	31.895649	33.223587	2.40%

Natural Gas 7/ Electricity						15.996641 34.544342		17.098082	17.704573	18.169195	18.632851 37.698376	19.077887	19.828915 38.712456	20.528502 39.860489						25.221899	25.95273 48.741779	26.733734		28.100664	28.960131 53.993305	29.82905		31.752737	32.88736	33.63908 63.275745	34.580711	2.50% 2.10%
Electricity	33.04/333	33.500132	34.037119	34.230391	34.200349	34.344342	33.300303	33.704304	30.713031	37.231034	37.050370	37.931107	30.712430	33.000463	41.350200	42.040724	43.713403	43.004200	40.700335	47.344727	40.741773	45.000131	30.373632	32.332423	33.553303	33.032300	37.427320	36.304400	00.044242	03.273743	03.011292	2.10%
Electric Power 8/																																
Distillate Fuel Oil	18.802338	23.264605	23.837973	23.283173	20.989275	21.302137	22.03651	22.85841	23.612553	24.452204	25.291788	26.211996	27.171146	28.188761	29.238485	30.364061	31.469147	32.607731	33.803799	35.033318	36.243343	37.526844	38.824772	40.241524	41.724556	43.366604	45.027153	46.830013	48.341923	50.213226	52.029678	2.80%
Residual Fuel Oil	11.62077	16.052402	17.121294	15.65499	12.619129	12.802035	13.321576	13.714004	14.452646	14.933064	15.636125	16.306931	17.027811	17.780308	18.589445	19.324123	20.225502	21.153019	22.14315	23.02128	24.150431	24.668703	26.018335	27.122379	28.052998	29.639147	30.88176	32.318409	33.347023	35.090622	36.533493	2.90%
Natural Gas	5.449315	5.124975	3.632924	4.109183	4.159261	4.378133	4.852174	5.044351	5.397954	5.58788	5.773447	5.885605	6.175108	6.449312	6.728117	6.92827	7.358334	7.525319	7.809081	8.081883	8.362015	8.723346	9.00574	9.353213	9.81648	10.354644	11.030416	11.531187	12.270128	12.716654	13.375042	3.40%
Steam Coal	2.601036	2.960406	2.950235	2.905649	2.979923	3.052052	3.127384	3.205798	3.303955	3.390244	3.492556	3.581555	3.687756	3.782877	3.87846	3.98027	4.083694	4.186069	4.29838	4.417713	4.546923	4.660411	4.771299	4.890745	5.013099	5.152116	5.294161	5.444106	5.590508	5.746322	5.891526	2.40%
Average Price to All Users 9/																																
Propane			21.191969				18.815145		20.925789				24.546137					29.373724	30.332186		32.305511	33.320133	34.362152		36.748589	38.09552	39.561291		42.683006		45.74918	2.40%
E85 3/						35.342171				39.151386		42.170174		44.650875		46.821651	48.06868	49.331001	50.659241	52.193241		55.376766			60.944565		65.374405			72.772476		3.70%
Motor Gasoline 4/	22.895582					28.273741						33.736137	34.837311	35.720699		37.457321	38.454937		40.527393	41.754597	43.007942											2.60%
Jet Fuel 5/	16.334209							22.472431			24.982208					30.066916	31.191799	32.355446	33.591656	34.829777	36.070843		38.514885							49.801815		2.90%
Distillate Fuel Oil		26.66404		26.259138					29.581329			32.633759				37.337265	38.519276	39.723824	40.986961	42.26543	43.524761	44.86414					53.189777	55.094997		58.775066		2.90%
Residual Fuel Oil	10.423209		18.835291	17.925018	12.565008			13.708535	14.362894	14.879598	15.538773	16.191532	16.886379		18.386045	19.124012	19.967501		21.761168		23.647875		25.468637	26.528496		28.935955				34.101551		2.50%
Natural Gas		8.730988	7.546314	8.324794	8.290935	8.307834	8.812408	9.138378	9.573862	9.859612	10.143429	10.435006	10.859389	11.229545	11.550382	11.847966	12.387451	12.631178	12.982513	13.34441	13.701573	14.152602	14.545867	15.007872	15.585076		16.922947	17.585222	18.41016		19.78974	2.90%
Metallurgical Coal	5.492337	6.627745	7.066936	7.45874	7.752486	8.29896	8.653145	8.96227	9.281527	9.57312	9.925747	10.263364	10.595502	10.954734	11.30737	11.674003	12.068693	12.477902	12.912651	13.367453	13.844351	14.268346	14.695684	15.141216	15.601855	16.090136	16.583597	17.085535	17.601257			3.60%
Other Coal	2.623958	3.009031	2.989557	2.95089	3.020994	3.103781	3.181465	3.260108	3.363225	3.449917	3.554068	3.643166	3.748112	3.844563	3.940766	4.042677	4.147915	4.250795	4.362885	4.481199	4.612031	4.726163	4.837802	4.958467	5.081729	5.222107	5.366073	5.517339	5.665839	5.823349		2.40%
Coal to Liquids											0											0			0						0	
Electricity	40.047729	39.66729	38.776615	37.077969	37.776016	37.713078	38.605106	39.044388	40.056969	40.59148	41.24155	41.389412	42.06797	43.048359	44.479832	45.26659	45.914455	46.824913	48.744347	49.538879	50.777706	52.098293	53.283676	55.263294	56.982456	58.804333	60.570793	62.233459	64.350792	67.266129	69.320709	1.90%
Non-																																
Renewable Energy Expenditures by Sector																																
(billion nominal dollars)																																
Residential	39.675091	40.766769	39.10033	39.408394	39.359589	39.357792	40.382099	41.052933	42.00692	42.661346	43.250767	43.733261	44.676975	45.750286	47.079697	48.27055	49.642384	50.759373	52.198421	53.182926	54,421986	55.837032	57.105038	58.739326	60.210648	61.887535	63.90411	65.594482	67.50267	69.731995	71.598701	2.00%
Commercial	32.628082	31.968939	30.416698	30.023529	30.149593	30.42444	31.508936	32.266232	33,460022	34.297516	35.012184	35.46595	36.315094	37.26545	38.444782	39.011608	39.52404	40.353073	42.070133	43.055073	44.174347	45.376652	46.525032	48.282871	50.162643	51.934597	53,585869	55.405628	57.780357	60.265106	62.554943	2.30%
Industrial	12.706611	15.703783	15.15385	13.263111	14.14528	15.041081	15.941515	16.676605	17.541996	18.200537	18.867666	19.424557	20.228941	22.382351	21.560667	22.113045	22.723583	23.147835	23.684082	24.188459	24.824574	25.493565	26.122494	27.553337	27.832254	28.879503	30.127916	31.328613	32.734573	34.091209	35.452019	2.80%
Transportation	61.561592	77.202377	78.185982	72.726074	71.863312	72.270157	73.397903	75.046036	76.871506	78.907402	80.989746	82.93354	84.893547	86.231964	87.597816	88.818665	90.250557	91.764496	93.435257	95.352684	97.419304	99.649696	102.00386	104.935669	107.965111	111.433327	115.413437	119.70002	124.102318	129.100525	134.328873	1.90%
Total Non-Renewable Expenditures	146.571365	165.641861	162.856857	155.421112	155.517792	157.09346	161.230469	165.041809	169.880447	174.066818	178.120377	181.557297	186.114548	191.630051	194.682968	198.213882	202.140564	206.02478	211.387894	215.779144	220.84021	226.356949	231.756439	239.5112	246.17067	254.134964	263.031342	272.028717	282.119904	293.188843	303.93454	2.10%
Transportation Renewable Expenditures		0.018352		0.01149	0.009698		0.010672	0.011265	0.01185	0.012427	0.013015	0.013461	0.013843		0.0143	0.014418		0.014783	0.014979							0.016863	0.017327	0.017863				0.30%
Total Expenditures	146.579636	165.660217	162.868515	155.432587	155.527481	157.103607	161.241135	165.053085	169.892303	174.079239	178.133408	181.570755	186.128403	191.644135	194.697266	198.228302	202.155151	206.039581	211.402878	215.794357	220.855637	226.372635	231.772339	239.527435	246.187195	254.15181	263.048676	272.0466	282.138336	293.207886	303.954285	2.10%

I Includes combined beat and power plants that have a non-regulatory status, and small on-site generating systems.

I Includes use for lease and plant fuel.

I Site Sirefes to a Below of 85 percent enthanol (renewable) and 15 percent motor gazoline (nonrenewable). To address codd starting issues, the percentage of ethanol varies essensially. The annual average ethanol content of 74 percent is used for the forecast.

I Size reverse to average price for all gazes. Includes Federal 28.8st, and folcal taxes.

I Size reverse average price for all gazes. Includes Federal 28.8st, and folcal taxes.

I Reverse to reverse the fuel includes Federal and States texts within excluding county and local taxes.

I Reverse to reverse the fuel includes Federal and States taxes while excluding county and local taxes.

I have a support of the size of the

9) Weighted averages of end use fuel prices are derined from the prices shown in sexu-sector and the coll exposurone genus and an exposure of the section of the prices are derived from the prices shown in sexu-sector and the coll exposure of the prices and the prices are derived from the coll and prices the braden opinion. Solidar from gooding, distillating from official field fast prices (and prices are braden opinion). Solidar from gooding, distillating from the prices (and prices are braden opinion). December 2011; 2010 residential, commercial, and industrial natural gas delevered prices: EIA, Natural Gas Annual 2010, DOF/IA-013(2010) (Washington, DC, December 2011). 2011 residential, commercial, and industrial natural gas delevered prices are based on: EIA, Natural Gas Annual 2010, DOF/IA-013(2010) (Washington, DC, December 2011). 2011 residential, commercial, and industrial natural gas delevered prices are based on: EIA, Natural Gas Annual 2010, DOF/IA-013(2010) (Washington, DC, December 2011). 3 and estimated state users, feeded taxes, and dispensing costs or charges. 2011 transportation sector natural gas delevered prices are based on: EIA, Natural Gas Annual 2010, DOF/IA-013(2010) (Washington, DC, December 2011). 3 and estimated state users, feeded taxes, and dispensing costs or charges. 2011 transportation sector natural gas prices: EIA, Electric Power Monthly, April 2011 and April 2011. 4 and April 2011 and April 2011. 4 and EIA, State Energy Data System. 2010, DOF/IA-014(2010) (Washington, DC, Darenter) Coll 2010 and 2011 deceptively prices: EIA, Activity Coll 2011, 2014 (2011) (Washington, DC, September 2011). 2010 and 2011 opticity prices taxed. Electric Power Scott Power Monthly, 2011 and 2011 opticity prices taxed. Electric Power Monthly, 2011 and 2011 opticity prices taxed. Electric Power Monthly, 2011 and 2011 opticity prices taxed. Electric Power Monthly, 2011 and 2011 opticity prices taxed. Electric Power Monthly, 2011 and 2011 opticity based on prices based on EIA, State Energy Boud System.

Energy Prices by Sector and Source, Middle Atlantic, High economic growth (2011 dollars per million Btu, unless otherwise noted)

Sector and Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Growth Rate (2011-2040)
Residential																																
Propane Distillate Fuel Oil																					30.381748 32.697083											0.40% 1.30%
Natural Gas Electricity																					15.437697 47.661686											1.30% 0.40%
	47.431402	40.300033	43.390114	43.773109	43.390370	45.03019	44.536046	44.010742	43.002009	44.770775	44.037421	44.030370	44.073323	44.804083	43.32533	40.223636	40.272018	40.547233	40.764601	47.343367	47.001000	47.050733	46.400303	40.333412	49.310034	45.055708	30.329307	30.004022	31.044633	31.20/0/3	31.633640	0.40%
Commercial Propane	25.207697	23.772453	21.988014	20.439817	19.945555	19.246153	19.485846	20.456709	21.081171	21.679266	22.243174	22.705757	23.13904	23.510103	23.855993	24.181349	24.470032	24.73867	24.975122	25.217178	25.452597	25.68712	25.880878	26.147518	26.436672	26.811804	27.139622	27.477667	27.830877	28.430447	28.723881	0.70%
Distillate Fuel Oil Residual Fuel						22.859606							26.077415	26.567389	27.112989	27.598698	28.008974	28.451548	28.814268	29.268438	29.74485 18.618624	30.273769	30.744356	31.276728	31.970404	32.66135	33.299824	33.801247	34.506413	35.246384	35.921494	1.20% 0.70%
Natural Gas	10.538739	9.439743	8.485888	9.066078	8.808095	8.640168	9.056722	9.282841	9.612879	9.796559	9.938517	10.086449	10.258754	10.430365	10.538714	10.654002	10.943322	10.979226	11.036841	11.167177	11.222931	11.347673	11.440398	11.717249	11.855279	12.195644	12.48692	12.652861	12.88753	13.203053	13.477425	1.20%
Electricity	41.874641	40.25901	39.181999	36.629452	37.609306	36.872856	36.938068	37.175213	37.957394	38.124825	38.250713	38.489101	38.537411	38.288147	38.611626	38.389702	36.924782	36.968796	36.618511	36.988174	37.360439	37.635799	38.398037	38.573616	39.471786	39.976662	40.748791	41.217396	41.761242	42.100204	42.798241	0.20%
Industrial 1/	26 702170	22 520507	20 740805	40.457545	10 676001	17.002627	10 217520	40 475224	10 703649	20.285645	20.044357	24 405004	21 02005	22 200005	22 555245	22 00212	22 171407	22 440020	22 679206	22 024452	24.157532	24 202191	24 588005	24.055404	25 147102	25 524962	25 955262	26 106122	20 5525	26.010224	27.206755	0.70%
Distillate Fuel Oil	21.829166	26.433073	26.608124	25.557804	23.186132	23.30212	23.767139	24.302719	24.714952	25.176718	25.593348	26.132763	26.635546	27.140844	27.681585	28.152412	28.540497	28.953009	29.292219	29.719732	30.174084	30.705349	31.172255	31.702579	32.4072	33.095844	33.733517	34.229954	34.936218	35.686779	36.36808	1.10%
Residual Fuel Oil Natural Gas 2/	11.185915 7.659351	18.783236 7.710141	19.71102 5.652989	18.520655 6.1337	12.884114 5.966049	12.989532 5.955527	13.238774 6.340863	13.577886 6.525077	13.955468 6.818648	14.363375 6.979072	14.633945 7.097888	15.05379 7.223362	15.439988 7.3748		16.176153 7.625322		17.015532 8.01055	17.378361 8.042939	17.76615 8.088866	18.158815 8.211256	18.618624 8.256041	18.919821 8.372983			20.384169 8.816249		21.330343 9.393684	21.760071 9.537999		23.124012 10.057586		0.80%
Metallurgical Coal Other Industrial Coal	5.60948 3.078899	6.627745 3.82299	6.931417 3.589277	7.285545 3.679657	7.518696 3.649385	7.862817 3.708696	7.964508 3.723624	8.130988 3.787558	8.324732 3.903304	8.473179 3.933453	8.627535 3.979978	8.761654 3.995	8.910166 4.035165	9.042784 4.059575	9.179214 4.067405	9.314908 4.081771	9.462386 4.121887	9.6265 4.137936	9.776866 4.150429		10.132705 4.206353	10.24346		10.493213 4.259399	10.637142 4.290539		10.916636 4.356693		11.168541 4.44236		11.419091 4.498911	1.90% 0.60%
Coal to Liquids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Electricity	25.392555	24.307201	21.19647	19.711073	20.380955	20.035501	20.248812	20.355715	20.90881	21.029306	21.186417	21.65839	21.930199	22.016474	22.31241	22.519802	22.412222	22.786711	22.570314	22.837223	23.059963	23.255892	23.678459	23.841169	24.49671	24.9223	25.606119	26.036663	26.50976	26.830988	27.291399	0.40%
Transportation Propage	20 720206	35 503303	24 27417	22 152000	22 701407	22.246202	22.422459	22 179109	22 651906	24 101119	24 521501	24 961924	25 179217	25 447066	25 607917	25 021002	26 120474	26 220042	26 409162	36 660451	26 835535	27 000404	27 126242	27 222002	27 524056	27 706224	29 01 27/19	28 248011	29 401407	20.121025	20.220205	0.50%
E85 3/	26.135481	26.135481	34.030392	31.56214	33.60675	33.190708	33.282528	33.584496	34.168255	34.890198	35.816498	36.419224	36.949139	37.24424	37.496105	37.78722	38.159302	38.609898	38.898991	39.251362	39.675747	40.24725	40.757492	41.384117	42.173038	43.056522	43.857079	44.517349	45.570091	46.481251	47.406448	2.10%
Motor Gasoline 4/ Jet Fuel 5/	16.682594	22.651917	22.686928	20.708824	19.947081	26.552567 19.988424	20.369148	20.773695	20.978142	21.497578	21.952103	22.388103	22.910738	23.352161	23.92926	24.471384	24.916649	25.380827	25.73418	31.401089 26.220158	26.816038	27.3783	32.605991 27.811512	28.36838	29.016888		30.367571	35.61388 30.981215		32.310005	32.871681	0.90% 1.30%
Diesel Fuel (distillate fuel oil) 6/ Residual Fuel Oil						25.836508								29.729809				31.516029	31.844484	32.25967	32.70686 16.396671	33.240936	33.705452	34.236488				36.7663		38.231937	38.91468	1.30% 0.80%
Natural Gas 7/	16.179142	16.888254	13.466355	15.231313	15.155113	15.14564	15.59311	15.860149	16.230343	16.457611	16.649866	16.867819	17.135046	17.470388	17.708162	18.053614	18.609671	18.867622	19.069376	19.359716	19.537296	19.77812	19.937334	20.270508	20.425844	20.79472	21.085772	21.242777	21.467615	21.784611	22.044428	0.90%
Electricity	36.618317	35.965927	34.009903	33.258308	33.522831	33.212086	33.337437	33.339493	33.856461	33.901066	33.846554	34.073654	34.24897	34.43568	35.053028	35.590145	35.678253	36.130962	36.23917	36.627361	36.867188	37.049175	37.460579	37.650513	38.22282	38.674625	39.32851	39.738358	40.201191	40.466869	40.866417	0.40%
Electric Power 8/ Distillate Fuel Oil	19 203363	23 264605	23 422152	22 49437	20 157097	20 156963	20 604763	21 081398	21 425547	21 902174	22 200781	22 74968	23 216736	23 68576	24 238008	24 744057	25 184662	25 668343	26.063192	26 553802	27.060362	27 586077	28 061701	28 59687	29 275583	29 969677	30 609245	21 117/01	31 821152	32 546638	33 213291	1.20%
Residual Fuel Oil	11.868625	16.052402	16.822636	15.124619	12.008846		12.363506	12.702619	13.080201	13.488107	13.758677	14.178522	14.56472	14.93629	15.300885	15.666214	16.140265	16.503094	16.890882	17.283548	17.743357 6.689519	18.044554	18.608461	19.081703	19.508902	20.002235	20.455074	20.884804	21.585367	22.248745	22.777277	1.20%
Natural Gas Steam Coal	5.565541 2.656446	5.124975 2.958686	3.569698 2.898624	4.145937 2.809296	4.120509 2.89612	4.209256 2.884276	4.632316 2.873138		5.103964 2.993897		5.374287 3.08047	5.488127 3.107982	5.635886 3.13202		5.913872 3.179802						6.689519 3.325711						7.888818 3.48804	8.068715 3.526177			8.78353 3.613539	1.90% 0.70%
Average Price to All Users 9/																																
Propane E85 3/	26.135481	26.135481	34.030392	31.56214	33.60675	33.190708	33.282528	33.584496	34.168255	34.890198	35.816498	36.419224	36.949139	37.24424	37.496105	37.78722	38.159302	38.609898	38.898991	39.251362	24.301611 39.675747	40.24725	40.757492	41.384117	42.173038	43.056522	43.857079	44.517349	45.570091	46.481251	47.406448	0.80% 2.10%
Motor Gasoline 4/ Jet Fuel 5/						26.552567 19.988424											30.527443 24.916649			31.401085 26.220158	31.740599 26.816038			33.107296 28.36838				35.613884				0.90% 1.30%
Distillate Fuel Oil	22.450382	26.664042	26.928766	25.370079	25.266945	25.349426	25.812614	26.342192	26.745312	27.212755	27.628267	28.158859	28.660673	29.163797		30.185616	30.58209	31.004562	31.351465	31.787195	32.248295 17.465788	32.786541	33.255154	33.786785	34.490227	35.179241	35.817429	36.315403	37.022591	37.773129	38.455902	1.30%
Residual Fuel Oil Natural Gas	9.476547	8.730949	7.414571	8.123419	7.975854		8.272743	8.52437	8.820187	9.007262	9.163264	9.327601	9.5058	9.663222	9.779839	9.903	10.183423	10.196751	10.259019	10.370828	10.426752		10.68502	18.720959 10.929348	11.113951	11.451718	11.74456	11.94813	12.198544	12.512432	12.794841	1.30%
Metallurgical Coal Other Coal	5.60948 2.67986	6.627745 3.007366	6.931417 2.937187	7.285545 2.855125	7.518696		7.964508 2.92312	8.130988 2.976987	8.324732		8.627535 3.132462	8.761654 3.157981	8.910166 3.182121				9.462386	9.6265 3.298223	9.776866 3.315165		10.132705 3.373832	10.24346 3.393821	10.372531 3.415195	10.493213 3.434097	10.637142 3.46673	10.787624 3.50085	10.916636 3.536284	11.042762	11.168541 3.613893		11.419091 3.664433	1.90%
Coal to Liquids	0	0	0	0	0	0 36.375885	0	0	0	0	0	0	0	0	0 37.393177	0	0	0	0	0	0 38.001751	0	0	0	0	0	0	0 41.631981	0	0	0	0.30%
Electricity	40.901947	39.00/118	38.049553	35.934227	37.044548	30.375885	30.31/038	36.2/163/	30.760838	36.702492	36.697575	36.945415	37.021595	36.931358	37.393177	37.017908	37.016136	37.402145	37.186871	37.64238	38.001751	38.283344	38.949158	39.13525	39.987583	40.48//1/	41.220154	41.631981	42.12/388	42.416042	43.005905	0.30%
Non-																																
Renewable Energy Expenditures by Sector (billion 2011 dollars)																																
Residential																					41.953117											0.50%
Commercial Industrial	12.977623	17.166759	14.866837	13.01972	14.224786	14.880859	15.784662	16.65921	17.510435	18.208815	18.741339	19.270954	21.184629	21.383232	20.378847	20.650221	20.853798	22.03875	21.012053	21.244394	33.237873 21.497517	22.511209	22.781013	23.11311	23.51914	24.071913	24.22014	24.823729	25.58256	26.284698	27.305408	0.70% 1.60%
Transportation Total Non-Renewable Expenditures	62.874683	77.178802 167.080643	76.82225 159.939545	70.381943	68.931435 150.731873	68.425476 150.015854	68.879929 152 114349	69.745514 154.498688	70.722534	71.982224	73.231262	74.080399	74.728386 166.975342	74.913704	75.13842 167.765167	75.250244 168.735565	75.362389 168 984314			76.037674 171.806	76.64286 173.33136			79.430092 180.289398								0.70%
Transportation Renewable Expenditures	0.008443	0.018353	0.011444	0.044445	0.000044	0.000538	0.000018	0.040333	0.040707	0.01121	0.044535	0.044073	0.012020	0.013083	0.043050	0.043000	0.011097	0.011073	0.044003	0.044040	0.011824	0.011856	0.04407	0.044040	0.012012	0.013134	0.013307	0.04247	0.042757	0.013074	0.013455	-1.10%
Transportation Renewable Expenditures Total Expenditures	149.706039	167.098999	159.950989	0.011115 150.863617	0.009244 150.741119	150.025375	152.124268	0.010337 154.509018	0.010787 157.515121	159.977859	0.011626 161.991089	0.011873 163.955078	166.987381	167.65271	167.777222	168.747574	168.996307	171.124557	0.011903 170.303711	0.011848 171.817841	173.343185	175.956512	0.01187 178.073944	0.011918 180.301315	183.604065	187.083725	190.509644	193.889465	0.012757 198.513214	202.881042	207.913055	0.80%
Prices in Nominal Dollars Residential																																
Propane	30.920164	29.052179	27.945297	27.015596	26.915056	26.584122	27.117355	28.364414	29.303762	30.218685	31.142164	31.991041	32.849499	33.679268	34.508827	35.339123	36.154694	36.965588	37.744423	38.554066	39.35569 42.354912	40.174973	40.949986	41.806927	42.694519	43.690769	44.641689	45.616428	46.619549	47.87439	48.836483	1.80% 2.70%
Distillate Fuel Oil Natural Gas	13.116766	12.581223	12.368978	12.672266	12.673368	27.395235 12.62729	13.286627	13.765051	14.371977	14.812843	15.224526	15.657652	16.141628	16.640577	17.080173	17.537447	18.22888	18.615406	19.038715	19.563412	19.997574	20.529272	21.035303	21.790974	22.378078	23.253635	24.071209	24.7197	25.476025	26.364231	27.195431	2.70%
Electricity	46.499714	46.560055	46.195934	45.299381	47.609047	47.853767	48.335236	48.673691	49.513561	49.751823	50.239601	51.108501	51.81414	52.461071	54.07542	55.700924	56.579155	58.252655	58.887016	60.473164	61.739651	62.927486	64.576538	65.554405	67.506783	68.940361	70.734276	72.051949	73.621346	74.918907	76.755348	1.70%
Commercial		22 772452	22 270274			20.441162				24 004222				27 527052			20.020755	20 50502			22.0705	22 752257		35 316174	25 407554	27 404 524	20 4 4252					2.00%
Propane Distillate Fuel Oil	20.636293	25.522793	26.154068	25.54196	23.903513	24.278978	25.046186	25.878672	26.603243	27.425299	28.224628	29.15476	30.110956	31.107735	32.202225	33.255711	34.248001	35.303001	36.267895	37.380264	38.53067	39.779121	40.963799	42.243946	43.762478	45.305752	46.800304	48.126942	49.768116	51.507141	53.169834	2.60%
Residual Fuel Natural Gas	11.123716 10.318658		20.399458 8.63654			13.796062 9.176643															24.118057 14.53788											2.10%
Electricity	41.000172	40.25901	39.877609	37.904854	39.442253	39.162323	39.676796	40.374527	41.707043	42.366463	43.032055	43.851208	44.498211	44.831562	45.859207	46.258583	45.149811	45.8713	46.090927	47.239548	48.395699	49.452679	51.161568	52.099495	54.030701	55.453087	57.269241	58.686214	60.231651	61.522942	63.348576	1.60%
Industrial 1/	20 20	22 52	24.44***		40.55	40.05			24 7 :	22.00			25.24	20.0		22 5	20 22	20.05			24 20000	22.055			24 45555	25 462	20 20 20 20 20 20 20 20 20 20 20 20 20 2			20 2	40.0====	
Propane Distillate Fuel Oil	21.373304	26.433073	27.080505	26.447702	24.316143	24.748968	25.529324	26.39422	27.156441	27.977795	28.792517	29.773447	30.755415	31.779194	32.877548	33.92292	34.897923	35.925217	36.86948	37.956635	31.293011 39.086685	40.34621	41.533928	42.819122	44.360382	45.908451	47.409824	48.737347	50.388016	52.150715	53.830856	2.00% 2.50%
Residual Fuel Oil Natural Gas 2/		18.783236		19.165527	13.512041	13.796062		14.746404 7.086628	15.334071	15.961394	16.46319	17.151007 8.229685	17.828178	18.513741	19.212492	19.932051			22.361868		24.118057	24.860262	25.960131		27.902737	28.959946	29.978132	30.982458	32.394661	33.792171	35.009731	2.20%
Metallurgical Coal	5.492337	6.627745	7.054472	7.539221	7.885131	8.351026	8.555026	8.830745	9.147098	9.415876	9.705976	9.982284	10.288352	10.588188	10.902196	11.22422	11.570142	11.94467	12.305928	12.713821	13.12563	13.4597	13.820366	14.172669	14.560583	14.963907	15.342481	15.722922	16.108231	16.511999	16.90217	3.30%
Other Industrial Coal Coal to Liquids	3.014602 0	0	0	3.807779 0	0	3.938972 0	0	0	0	0	4.477475 0	0	0	0	4.830876 0	0	0	0	0	5.326294	0	0	0	5.752961 0	0	0	0	0	0	0	0	1.90%
Electricity	24.86228	24.307201	21.572777	20.397394	21.374252	21.279522	21.750134	22.107536	22.974302	23.368956	23.834719	24.675728	25.322268	25.779072	26.500553	27.135771	27.404566	28.274006	28.408764	29.16662	29.87125	30.557772	31.549192	32.201099	33.532162	34.570633	35.9874	37.071564	38.234653	39.209343	40.395847	1.80%
*																																
Transportation Propane																					34.762024											1.80%
E85 3/ Motor Gasoline 4/	25.589691 22.967304	26.135481 29.041368	34.634544 30.020168	32.661102 28.295418	35.244629 28.195704	35.251545 28.201239	35.750217 28.600176	36.474789	37.543594 30.034874	38.771961 31.017567	40.293564 32.234844	41.492966 33.194374	42.664268 34.131413	43.609253 34.887405	44.534298 35.627441	45.532612 36.42609	46.659325 37.327461	47.907593 38.32608	48.961315 39.1690#	50.129982 40.103985	51.394882 41.11591	52.884075 42.307259	54.305305 43.444744	55.8955 44.716404				63.384762 50.707809				3.50% 2.30%
Jet Fuel 5/ Diesel Fuel (distillate fuel oil) 6/	16.334209	22.651917	23.089695	21.429886	20.919233	21.229523	21.879393	22.561487	23.050486	23.889324	24.696115	25.507101	26.454472	27.343027	28.420893	29.487377	30.466856	31.492815	32.391056	33.487144	34.736767 42.367577	35.974533	37.056072	38.315781	39.719578	41.246201	42.679253	44.111721	45.844143	47.21608	48.655602	2.70%
Diesel Fuel (distillate fuel oil) 6/ Residual Fuel Oil						27.440718 11.885948															42.367577 21.239803											2.70% 2.20%

Natural Gas 7/ Electricity						16.086046 35.274254	16.749243 35.8092	17.22508 36.208702	17.83367 37.200996	18.28863 37.672787		19.217758 38.820625			21.032066 41.632645			23.411158 44.831703			25.308081 47.756752	25.988052	26.564514				29.634405	30.245924 56.58033		31.834843 59.136078		2.30% 1.80%
Electricity	33.633013	33.303327	34.013065	34.410332	33.13002	33.274234	33.0032	30.208702	37.200330	37.072767	30.077374	30.020023	35.340432	40.320703	41.032043	42.003137	43.023022	44.031/03	43.013401	40.776730	47.730732	40.0010/3	43.312430	30.632703	32.321030	33.040304	33.273131	30.30033	37.561013	35.130076	00.469131	1.80%
Electric Power 8/																																
Distillate Fuel Oil	18.802338	23.264605	23.837973	23.277601	21.139484	21.408525	22.132477	22.89567	23.542088	24.338936	25.088379	25.91905	26.8078	27.733639	28.787596	29.815941	30.794571	31.849567	32.805176	33.913261	35.053257	36.247551	37.389427	38.624393	40.073692	41.572033	43.018906	44.305752	45.895203	47.561882	49.161243	2.60%
Residual Fuel Oil	11.62077	16.052402	17.121294	15.651244	12.594116	12.866449	13.280184	13.795811	14.372339	14.988748	15.478512	16.153803	16.817528	17.48889	18.172932	18.877377	19.735525	20.477224	21.260187	22.07373	22.984262	23.71018	24.793924	25.772722	26.704634	27.745829	28.748009	29.736235	31.132275	32.513103	33.714191	2.60%
Natural Gas	5.449315	5.124975	3.633072	4.290295	4.321328	4.470612	4.975774	5.20644	5.608163	5.83982	6.046073	6.252706	6.50762	6.80672	7.023933	7.280635	7.750792	7.964858	8.146389	8.463642	8.665421	8.973939	9.220607	9.690015	9.970945	10.557492	11.087117	11.48841	11.967162	12.51005	13.001099	3.30%
Steam Coal	2.600971	2.958686	2.950084	2.907113	3.037266	3.063363	3.086164	3.179789	3.289652	3.379472	3.465529	3.540971	3.616467	3.697912	3.776666	3.858629	3.943838	4.032273	4.112725	4.199292	4.308036	4.395417	4.485894	4.573112	4.679277	4.789493	4.902168	5.020648	5.1409	5.253784	5.348643	2.10%
Average Price to All Users 9/																																
Propane	24.269598	22.862368	21.16326	19.933319	19.580236	18.798876	19.150831	20.333261	21.191586	22.01825	22.937519	23.795418	24.672295	25.540281	26.380966	27.258898	28.148161	29.013895	29.805004	30.644543	31,479647	32.328445	33.127403	34.066223	35.056732	36.235252	37.344532	38.49321	39.691097	41.111576	42.252544	2.10%
E85 3/	25.589691	26.135481	34.634544	32.661102	35.244629	35.251545	35.750217	36.474789	37.543594	38.771961	40.293564	41.492966	42.664268	43.609253	44.534298	45.532612	46.659325	47.907593	48.961315	50.129982	51.394882	52.884075	54.305305	55.8955	57.728291	59.725273	61.637703	63.384762	65.725105	67.925171	70.169495	3.50%
Motor Gasoline 4/	22.895582	28.907553	29.918657	28.241138	28.195704	28.201239	28.600176	29.179834	30.034874	31.017567	32.23484	33.194374	34.131413	34.887405	35.627441	36.42609	37.327461	38.326077	39.169052	40.103981	41.11591	42.307255	43.444244	44.716404	46.182632	47.780212	49.310158	50.707813	52.58009	54.340137	56.135597	2.30%
Jet Fuel 5/	16.334209	22.651917	23.089695	21.429886	20.919233	21.229523	21.879393	22.561487	23.050486	23.889324	24.696115	25.507101	26.454472	27.343027	28.420893	29.487377	30.466856	31.492815	32.391056	33.487144	34.736767	35.974533	37.056072	38.315781	39.719578	41.246201	42.679253	44.111721	45.844143	47.21608	48.655602	2.70%
Distillate Fuel Oil	21.98155	26.664042	27.406839	26.253441	26.498369	26.923395	27.72646	28.609211	29.387369	30.240355	31.081802	32.08181	33.093781	34.147869	35.285542	36.372875	37.394283	38.47081	39.461411	40.597103	41.773563	43.080853	44.309185	45.634155	47.211723	48.798409	50.3386	51.70665	53.397163	55.199593	56.921188	2.60%
Residual Fuel Oil	10.423209	17.565975	18.835281	17.921284	12.602622	12.797966	13.235538	13.744211	14.269347	14.856552	15.386954	16.026493	16.671738	17.328625	18.013945	18.707951	19.499468	20.2176	20.919424	21.704044	22.624706	23.425133	24.350874	25.28548	26.208223	27.162762	28.137293	29.088333	30.431271	31.707069	32.886242	2.20%
Natural Gas	9.278647	8.730949	7.546204	8.406269	8.36457	8.38577	8.886115	9.25798	9.691496	10.009379	10.308672	10.627075	10.976116	11.31466	11.615561	11.932856	12.451791	12.652243	12.912805	13.24513	13.506531	13.860126	14.236727	14.761735	15.21326	15.885097	16.506062	17.012005	17.593788	18.284986	18.938511	2.70%
Metallurgical Coal	5.492337	6.627745	7.054472	7.539221	7.885131	8.351026	8.555026	8.830745	9.147098	9.415876	9.705976	9.982284	10.288352	10.588188	10.902196	11.22422	11.570142	11.94467	12.305928	12.713821	13.12563	13.4597	13.820366	14.172669	14.560583	14.963907	15.342481	15.722922	16.108231	16.511999	16.90217	3.30%
Other Coal	2.623896	3.007366	2.989332	2.954538	3.079836	3.113468	3.139852	3.233188	3.347138	3.436656	3.52402	3.597935	3.674318	3.755662	3.834668	3.916431	4.003514	4.092472	4.172726	4.260542	4.37037	4.459412	4.550408	4.638267	4.74541	4.856157	4.969972	5.089884	5.212267	5.327099	5.423976	2.10%
Coal to Liquids	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Electricity	40.047787	39.667118	38.725056	37.185425	38.849972	38.634495	39.010365	39.393188	40.392288	40.785885	41.284775	42.092464	42.747932	43.242897	44.412052	45.328594	45.261517	46.409004	46.806305	48.075066	49.226437	50.303543	51.895878	52.858063	54.736744	56.161987	57.940144	59.276508	60.759743	61.984493	63.655952	1.60%
Non-																																
Renewable Energy Expenditures by Sector																																
(billion nominal dollars)																																
Residential	39.675091	40.766396	39.082996	39.608463	40.050098	39.917618	40.696594	41.412224	42.40955	43.089321	43.62635	44.473442	45.332394	46.181293	47.440956	48.69421	49.789246	51.030048	51.857365	53.207638	54.344925	55.544754	56.913567	58.193554	59.829815	61.459961	63.197353	64.587196	66.251251	67.927406	69.782738	1.90%
Commercial	32.628082	31.968683	30.379126	30.190964	30.818953	30.933947	31.754154	32.541924	33.704842	34.449276	35.131378	35.952915	36.721554	37.354977	38.368198	39.070168	39.188046	40.096722	40.755386	41.970814	43.055435	44.154076	45.590397	46.814438	48.474533	50.062607	51.849411	53.328148	55.037636	56.75452	58.688686	2.10%
Industrial	12.706611	17.166759	15.130771	13.473054	14.918053	15.804824	16.954996	18.092909	19.240217	20.234665	21.084007	21.955687	24.461374	25.037609	24.204052	24.882977	25.499002	27.345928	26.447414	27.132336	27.847298	29.579275	30.353436	31.217745	32.194023	33.391029	34.039516	35.344559	36.897366	38.411026	40.416584	3.00%
Transportation	61.561665	77.178802	78.186096	72.832573	72.290916	72.674072	73.986946	75.747841	77.708916	79.990723	82.38517	84.400902	86.287048	87.716393	89.242256	90.674576	92.149437	93.845726	95.282455	97.111725	99.281075	101.909637	104.392601	107.282333	110.810417	114.580238	118.642876	122.786331	128.108185	133.367249	138.838272	2.00%
Total Non-Renewable Expenditures	146.571457	167.080643	162.779007	156.105042	158.078033	159.33046	163.392685	167.794907	173.063522	177.763992	182.226898	186.782944	192.802368	196.290268	199.255478	203.32193	206.625748	212.318405	214.342606	219.422501	224.528732	231.187729	237.250015	243.508072	251.308777	259.493835	267.729156	276.046265	286.294434	296.460175	307.726288	2.10%
Transportation Renewable Expenditures	0.008266	0.018352	0.011647	0.011502	0.009694	0.010119	0.010654	0.011227	0.011853	0.012457	0.01308	0.013527	0.013901	0.014148	0.014321	0.014469	0.014657	0.014855	0.014982	0.015132	0.015317	0.015578	0.015815	0.016097	0.016444	0.016831	0.017283	0.017755	0.018399	0.019105	0.019916	0.30%
Total Expenditures	146.579712	167.098999	162.790649	156.116547	158.087723	159.340576	163.403336	167.806122	173.075378	177.776459	182.239975	186.796478	192.816254	196.304428	199.269791	203.336411	206.640411	212.333267	214.35759	219.437622	224.544052	231.203308	237.265808	243.524155	251.325241	259.510651	267.746429	276.063995	286.312836	296.479279	307.746185	2.10%

I Includes combined beat and power plants that have a non-regulatory status, and small on-site generating systems.

I Includes use for lease and plant fuel.

I Est feets to a bear of 85 percent ethanol (enewable) and 15 percent motor gazoline (nonrenewable). To address codd starting issues, the percentage of ethanol owners essenoilly. The annual average ethanol content of 74 percent is used for the forecast.

I Seles weighted average price for all gazes. Encludes Feedral, Sate, and folcal taxes.

I Seles weighted average price for all gazes. Encludes Feedral, Sate, and folcal taxes.

I Recomestype jet fuel. Includes Feedral and States taxes while excluding county and local taxes.

I Recommended to the selection of the selection

9/ Weighted averages of end-use feel prices are derived from the prices shown in each sector and the corresponding sectoral consumption. Blue a British thermal unit.

— a field applicable.

Another Dale for 2011 are model results and may differ slightly from official EA data sports.

Note: Dale for 2011 are price for model results and may differ slightly from official EA data sports.

Note: Dale for 2011 applicable from gaspline, distillate unit and set place the bashed on prices in the LLS Energy information Administration (EAA) pertoneum Marketing Monthly, DOE/EIA-0380(2012/08) (Washington, DC, August 2012).

2010 residential, commercial, and industrial natural gas delethered prices: EIA.

Natural Gas Annual 2010, DOE/EIA-031(2010) (Washington, DC, December 2011). 2011 to residential, commercial, and industrial natural gas delethered prices: EIA. Natural Gas Montal 2010, DOE/EIA-031(2010) (Washington, DC, December 2011). 2010 to rangotation sector natural gas delivered prices: EIA. Natural Gas Annual 2010, DOE/EIA-031(2010) (Washington, DC, December 2011). 310 and 2011-decrip oper sector distillate and residual there of prices:

EIA, Monthly Energy Review, DOE/EIA-031(2012) (Washington, DC, September 2010). 2010 and 2011-decrip oper sector natural gas of sector sector natural gas of sector sector for the process EIA, Electric Perus Monthly,

2010 DOE/EIA-0214(2010) (Washington, DC, June 2011).

2010 and 2011 capter gene sector natural gas of sector EIA, Electric Perus Monthly,

2010 and 2011 capter gene prices beaded on: EIA, Capterfey Coal Report Monthly,

2010 and 2011 capter (pay prices beaded on: EIA, Capterfey Coal Report Monthly,

2010 and 2011 capter (pay prices beaded on: EIA, Capterfey Coal Report Perus (pay prices and EIA, AEO2013 National Energy Modeling System.

2010 and 2011 capter (pay prices beaded on: EIA, AEO2013 National Energy Modeling System.

2011 and 2011 capter (pay prices beaded on: EIA, AEO2013 National Energy Modeling System.

2011 and 2011 capter (pay prices beaded on: EIA, AEO2013

(2011 dollars per million Btu, unless	otherwise n	oted)																														
Sector and Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Growth Rate (2011-2040)
Residential Propane	27.612459	25.025761	23.718796	22.425512	21.904715	21 201027	21.170216	21 775092	22.10087	22.47085	22 026221	23.071224	22.262015	23.624901	23.860012	24.084627	24 214457	24.51852	24.752798	24.99704	25.246155	25.475168	25.65098	25.836899	26.036095	26.258572	26.472963	26.761148	27.073526	27.35454	27.576094	0.30%
Distillate Fuel Oil		26.377192	26.551687	25.497665	24.802435	24.709562		25.380589	25.723713	26.058947	26.372515			27.477932			28.710169				30.412325		31.118856	31.56319	31.990417	32.485718	32.902184	33.525806				1.00%
Natural Gas Electricity	11.359373 34.522823	10.802343	10.46613	10.460558	10.195184 33.590237	10.072795	10.46888 34.564217	10.719712 34.79248	11.055447 34.727726	11.252128 34.442749	11.366106 34.223221	11.515205 34.136726	11.700644 33.969261	11.866777 33.955807	11.967444 34.005329	12.045289 34.161144	12.188901 34.128181	12.287466 34.20953	12.504576 34.216984	12.700806 34.357117	12.882002 34.424736	13.065743 34.526558	13.189687 34.593342	13.342455 34.602146	13.563623	13.890039	14.214123	14.65321	15.078327	15.3921	15.561028	1.30% 0.20%
•	34.522823	34.335876	33.27586	32.727371	33.590237	33.742073	34.564217	34.79248	34.727726	34.442749	34.223221	34.136726	33.969261	33.955807	34.005329	34.161144	34.128181	34.20953	34.216984	34.357117	34.424736	34.526558	34.593342	34.602146	34.632786	34.852875	35.12291	35.458149	35.815353	36.08244	7 36.306263	0.20%
Commercial Propage	24 100212	22 055248	20 411705	18.828791	18 201582	17 36541	17 328459	18 049036	18 43952	18.887243	19.320431	19.620653	19.981037	20.304365	20 506045	20 977694	21.166152	21 422265	21 710755	22.030088	22 247004	22 641502	22.067722	22 107690	22.265566	22 654595	23 934101	24 311275	24.722115	25 0935	25 387627	0.50%
Distillate Fuel Oil	21.353447	25.86795	26.048241	24.996838		21.948441	22.202873	22.681578	23.070255	23.465408	23.829372	24.24494	24.673965	25.045378	25.475155	25.856121	26.220787	26.587294	26.980659	27.34313	27.755465	28.11879	28.409405	28.80518	29.240967	29.739431	30.185345	30.810303	31.510593	32.15453	32.622158	0.80%
Residual Fuel Natural Gas	11.386296 9.396975	19.165131 8.836861	20.135052 8.073982	18.831163 8.446106	13.202799 8.180921	13.048066 8.028308	13.330789 8.381491	13.510124 8.573873	13.823326 8.851769	14.180005 9.004212	14.529487 9.087084	14.822131 9.201472	15.13909 9.358736	15.570087 9.494752	15.885678 9.570773	16.159584 9.623552	16.430298 9.743041	16.815306 9.808812	17.233145 9.986407	17.668892 10.141735	18.082991	18.422106 10.424339	18.842987 10.505122	19.251888	19.741585	20.306648	20.751627	21.372019	21.94898 12.129746	22.46799 12.40554		0.60% 1.20%
Natural Gas Electricity	30.492579	29.980652	28.475626	27.867262	28.258715	28.176624	28.899446	29.114199	29.124062	28.949659	28.706797	9.201472 28.638306	9.358736 28.4161			28.120918							28.086102	10.615216 28.170853	10.795315 28.219463	28.531662	28.896574	29.303894	29.746626			0.00%
Industrial 1/																																
Propane	23.727947	22.495939	20.748369	19.145542	18.491774	17.623985	17.589609	18.356459	18.779568	19.269945		20.061344		20.790808			21.705902			22.620129			23.50535	23.760263	24.034031	24.340359	24.636744	25.03615	25.470064	25.86279	26.161337	0.50%
Distillate Fuel Oil Residual Fuel Oil	21.872606 11.297433	26.501867 18.860607	26.678123 19.815308	25.619671		22.245071 15.462597	22.526766 15.687399	23.044138 15.876047	23.469213 16.191607	23.906929	24.311844	24.788172		25.631674 17.929489	26.057356 18.241468	26.429165 18.532591			27.503469 19.670578			28.554016		29.215738		30.165321 22.730572	30.631994	31.265242 23.801039				0.80%
Natural Gas 2/	5.483961	4.89107	3.760916	18.608541 4.315305	15.662995 4.32121	4.347113	4.699115	4.832056	5.025158	16.546968 5.134593	16.892164 5.18777	17.183552 5.277763	17.500154 5.423512	5.555255	5.620189	5.655619	18.856159 5.739235	19.255043 5.806301	5.977774	6.134212	6.264583	20.864616 6.399954	21.283716 6.458157	6.55393	6.719296	6.986644	7.253288	7.632829	24.381718 8.00705	24.90040 8.26798		1.00% 1.90%
Metallurgical Coal	5.96456	7.01	7.229744	7.504471	7.701272	8.082412	8.276903	8.406076	8.556293	8.666833	8.811481	8.934104	9.03644	9.155892	9.269857	9.399324	9.510137	9.649312	9.796195	9.953378	10.119079	10.237353	10.348742	10.464723	10.580317	10.723673	10.844096	10.880786		11.04599	3 11.025928	1.60%
Other Industrial Coal Coal to Liquids	2.767579	3.429703	3.242764	3.288817	3.273858	3.345382	3.373764	3.376302	3.396048	3.411215	3.435217	3.452057	3.461447	3.479132	3.504148	3.533062	3.557487	3.578734	3.599618	3.62987	3.661383	3.694754	3.727137	3.762237	3.785293	3.822845	3.857036 2.740708	3.894248 2.780362	3.928566	3.96137		0.50%
Electricity	20.260443	19.975758	18.444393	18.195911	18.252407	18.083138	18.663712	18.839308	18.847397	18.722275	18.572275	18.587465	18.546101	18.636398	18.655716	18.665657	18.566589	18.632029	18.687759	18.864912	18.993999	19.115896	19.231974	19.327618	19.428339	19.711145	20.042309	20.449858		21.184	7 21.450882	0.20%
Transportation																																
Propane		26.025311							23.157251		23.889071	24.134502	24.427494	24.689238	24.925117	25.150488	25.381033				26.315306	26.545004	26.721394	26.907831	27.107536	27.330462	27.545254	27.833689		28.42755		0.30%
E85 3/ Motor Gasoline 4/	25.561684 23.179705	25.191607 28.699213	33.602161 29.140028	31.06316 27.018265	25.269239		24.154396 25.954109		26.108969 26.516466	26.46936 26.868998	28.534971		27.420317 28.236706	26.695816 28.453352	27.269478			27.717485		27.449879 29.809788	27.319672 30.157686		27.417074	27.797876	28.220905	28.749256 31.982073	29.206068 32.422638	29.806465	30.496782 33.692955	31.1135		0.80%
Jet Fuel 5/	16.566288	22.494694	22.527222	20.554899	19.264303	19.247263	19.447115	19.913559	20.310108	20.715816	21.100183	21.490427	21.880957	22.299858	22.781336	23.219795	23.657171	24.10248	24.565977	24.981335	25.476053	25.923079		26.734289	27.221451	27.73657	28.221849	28.885141	29.578894	30.23116		1.10%
Diesel Fuel (distillate fuel oil) 6/ Residual Fuel Oil	22.375546	26.146343	26.444435	24.526279	24.073875	24.141907 13.255686	24.431202	24.960033	25.396931	25.848608	26.27194	26.773235	27.283779 15.205535		28.044899	28.410788	28.758495	29.099428	29.456631		30.143776		30.738695	31.11344	31.549372 19.276419	32.060013	32.530262	33.165745				1.00%
Residual Fuel Oil Natural Gas 7/	10.623604 16.510302	17.831915 16.137417	18.723665 14.588269	17.577642 15.82964	13.35183 15.649047	13.255686 15.621594		13.748596 15.954275	14.03295 16.136372	14.359035 16.224272	14.636056 16.269676	14.9095 16.405003	15.205535 16.592697	15.541133 16.757195	15.869343 16.968889	16.179874 17.12582	16.504589 17.325432	16.848139 17.461693	17.205654 17.662827	17.554541 17.838654	17.91836 17.960161	18.24304 18.075018	18.553858 18.117846		19.276419 18.313286	19.695045 18.56909	20.065351 18.814333	20.56867 19.145597				0.70% 0.70%
Electricity	33.91317	32.774685	31.137701	30.606037	30.344206	30.034882	30.360079		30.030481	29.713812	29.279825		28.88776	28.950184	29.165081	29.541559	29.702787		29.939754		30.496632			30.909164	31.092815	31.378607	31.800098	32.176456	32.6469			0.10%
Electric Power 8/																																
Distillate Fuel Oil		23.300116						20.878113		21.58317	21.90099	22.241007	22.605856		23.451689	23.852036	24.229961	24.628317		25.465199									29.770372			1.00%
Residual Fuel Oil Natural Gas	12.113503 5.258165	15.974203	19.02774	17.017555	21.70343	21.576262 3.784661	21.905298	23.227791	23.548044	24.356428 4.498363	24.65303 4.542804	24.994827 4.630498	25.374302 4.779434	25.867462 4.910525	26.269728	26.869135	27.289585 5.16144	27.672953 5.239667	28.058027		29.032293	29.378124	29.84564	30.263275	30.766531 6.170179	31.337732 6.445385	31.742655 6.722803	32.361664 7.104914	32.949017 7.481032			2.60%
Steam Coal	2.297989	2.38	2.413564	2.335511	2.399993	2.389891	2.456065	2.45454	2.441869	2.439654	2.465257	2.50488	2.537858	2.572214	2.609577	2.641022	2.669622	2.700965	2.734324	2.767869	2.80566	2.839442	2.866588	2.895892	2.924186	2.962768	2.998459	3.033358	3.068746	3.10218	3.132249	1.00%
Average Price to All Users 9/																																
Propane E85 3/		17.071365 25.191607	14.65686 33.602161	12.768081	11.901892	10.785862 24.144695			11.858901 26.108969	12.325585 26.46936	12.838146		13.667205 27.420317	14.110085			15.375292 27.464186			16.744894 27.449879	17.266722 27.319672		18.143208 27.417074		19.002609		20.016384					1.00%
Motor Gasoline 4/	23.060801	28.471485	28.96701	26.929667	26.379793	25.98608	25.950964	26.122787	26.513056	26.865454	27.569593	27.838554	28.232788	28.449282	28.632366	28.863951	29.054741	29.28912	29.518724	29.805134	30.152868	30.40041	30.701029	31.06312	31.467134	31.976595	32.416981	33.001614	33.687046	34.29482	7 35.098068	0.70%
Jet Fuel 5/	16.566288 22.174622	22.494694	22.527222	20.554899	19.264303 23.75865	19.247263 23.803625	19.447115 24.091339	19.913559 24.616676	20.310108	20.715816	21.100183		21.880957 26.887264			23.219795 28.032024	23.657171 28.385315	24.10248 28.731033	24.565977				26.303738 30.409801	26.734289	27.221451 31.227179	27.73657	28.221849	28.885141				1.10%
Distillate Fuel Oil Residual Fuel Oil	11.056978	26.179953 17.653021	26.440582 18.967886	17.703102	14.43802	14.328343	14.505248	14.72277	25.04587 15.021783	25.48834 15.368367	25.901899 15.661737	26.389393 15.947121	16.258274	27.238449 16.623991	16.958237	17.2747	17.602362	17.960873	29.096394 18.334105					30.789108 20.131233	20.547533	31.736992 21.009293	32.204281 21.400978	32.838623 21.939323				1.00%
Natural Gas	7.269652	6.684091	5.406232	5.989887	5.888806	5.861121 8.082412	6.150236	6.322693	6.550133	6.674445	6.742742	6.847034	7.003098 9.03644	7.145373	7.223951	7.27828	7.391208	7.471019	7.669233	7.840321	7.992743	8.154078	8.237076	8.349446	8.540927	8.834519	9.123452 10.844096	9.525039	9.925157			1.50%
Metallurgical Coal Other Coal	5.96456 2.330101	7.01 2.44546	7.229744 2.468191	7.504471 2.395423	7.701272 2.455953	2.45287	8.276903 2.520524	8.406076 2.51765	8.556293 2.506249	8.666833 2.504253	8.811481 2.529084	8.934104 2.56717	2.597815	9.155892 2.630293	9.269857 2.66659	9.399324 2.697524	9.510137 2.725485	9.649312 2.756105	9.796195 2.787408		10.119079 2.857715	10.237353 2.891197		10.464723 2.948411	10.580317 2.97611	10.723673 3.014462	3.050066	10.880786	10.997857 3.120517			1.60% 0.90%
Coal to Liquids	0 29.404024	29.029833	0 27.589231	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2.641094	2.694112 28.706558	2.740708 29.049328	2.780362 29.451887	2.821024 29.881264			
Electricity	29.404024	29.029833	27.589231	27.085615	27.535965	27.42063	28.116966	28.296385	28.269724	28.070358	27.850733	27.801102	27.64822	27.672117	27.682224	27.72142	27.605137	27.677536	27.705116	27.894848	28.032015	28.169851	28.249502	28.332937	28.41198	28.706558	29.049328	29.451887	29.881264	30.19820	30.485971	0.20%
Non-																																
Renewable Energy Expenditures by Sector																																
(billion 2011 dollars) Residential	252 564007	249 064201	221 057402	221 472120	220 746252	220 512152	224 415405	226 622462	220 114075	228 510727	227 552520	238 000351	220 541226	220 794222	241 100616	242 057777	244 02652	245 647279	247 251969	249 427765	251 112046	252.006826	254 40255	255 004406	257 972602	261 249922	265.052216	260 751242	274 F05005	270 442	281 739746	0.40%
Commercial	182.473419	179.96019	168.12558	166.312073	167.381989	167.587341	172.858276	175.540924	177.733932	179.061615	179.722595	181.347214	182.395828	184.126221	185.494263	186.777237	187.55307	189.384583	191.305542	194.186539	196.597305	198.951111	200.763977	203.309067	206.047928	210.526276	215.257019	220.677933	226.200806	230.75822	234.843292	0.90%
Industrial Transportation	210.379257 584.309143	227.34404 719.27655	213.674393	198.372879	201.527145	207.216217	214.89949	221.185394	226.517639	230.852509	233.963593	236.871552	240.886566	243.388351	245.220413	246.401337	247.225967	247.858154	249.162186	250.990997	253.137863	255.275513	257.058197	259.404449	262.579742	267.482056	272.660187	279.680298	286.316101	291.82092	3 296.170654	0.90%
Total Non-Renewable Expenditures												1318.799805																				0.50%
Transportation Renewable Expenditures	0.156247	1 722059	0.200971	0.897522	2 906255	3.175053	2 2000	2 125054	2 065505	2 125960	2 602179	3.236496	3 405914	2 059727	5 229610	6 247769	7 027947	7.014516	6 999799	7.366969	7 562615	7 605671	7 695201	7 712029	7.744104	7 802602	7 960756	7 964944	9 002424	8 20661	8 394979	5.60%
Total Expenditures							1256.734497	1273.156738	1289.473267	1301.678101	1314.151978	1322.036255	1332.719849	1338.44165	1343.353149	1347.984863	1350.268921	1354.913574 1	360.949097	1369.527466 1	379.922485	1389.445435	1398.89917 1	411.972168								0.50%
Prices in Nominal Dollars																																
Residential Propane	27 035826	25.025761	24.139881	23.229189	23.095053	22.833872	23 38224	24.696478	25.809921	27.044085	28.349419	29.613276	31 040585	32.505291	33 960712	35.457569	37 069324	38.696339	40.486267	42.376389	44.348358	46.347878	48.331593	50.442696	52.678059	55.091511	57.590012	60.367462	63.30999	66.29509	7 69.239532	3.60%
Distillate Fuel Oil	21.313227	26.377192	27.023067	26.411442	26.15024	26.611496	27.553299	28.784519	30.040762	31.362427	32.753784	34.288494	35.961037	37.806644	39.739666	41.700043	43.770935	45.929855	48.306381	50.759941	53.42345	56.077538	58.634167	61.622425	64.725258	68.156303	71.576317	75.62709	80.075104	84.56355	88.799316	4.30%
Natural Gas Electricity	11.122153 33.80188	10.802343 34.335876	10.651938	10.83544	10.749207 35.415585	10.848113 36.339252	11.562747 38.175747	12.157391 39.458691	12.910812 40.555866	13.542145 41.452488	14.116326 42.504101	14.780445 43.816498	15.545186 45.130718	16.327394 46.719498	17.033644 48.400867	17.733164 50.29229	18.582949 52.031128	19.392685 53.991169	20.452784 55.966114		22.629015 60.471806	23.770971 62.815392	24.852015 65.180794	26.049156 67.555534	27.442877 70.071487	29.141848 73.122696	30.921795 76.407349	33.054523 79.986038	35.259861 83.752281			4.50% 3.40%
Commercial Propane	23.597025	22.055248	20.77408	19 503571	19.190685	18.702051	19.139067	20.469692	21.534109	22.731148	23.995331	25 184263	26.54631	27.936596	29.316286	30.736282	32 269485	33.811413	35.525349	37.346645	39.257339	41 19249	43 087376	45 114319	47.274857	49.628246	52.066902	54.841068	57 81134	60.81545	63 74461	3.70%
Distillate Fuel Oil	20.90752	25.86795	26.510683		23.149391			25.723528		28.241055	29.595287	31.119806	32.781216	34.459713	36.259598	38.065575	39.975677	41.961376	44.130215	46.353615	48.756306	51.157513	53.529018	56.23782	59.16238	62.394489	65.666031	69.501495				4.10%
Residual Fuel Natural Gas	11.148516 9.200737	19.165131 8.836861	20.492516 8.217321	19.506027 8.748795	13.92026 8.625484	14.052396 8.646258	14.72369 9.257253	15.322042 9.723762	16.143209 10.337307	17.065899 10.836737	18.045139 11.285856	19.025078 11.810632	20.113419	21.422745 13.063745	22.61059	23.790262	25.049297		28.186943 16.334005			33.515991 18.965372	35.503967	37.586445	39.942562	42.604141	45.143658 24.716209	48.210728 26.511126	51.326511 28.364761			3.90% 4.50%
Electricity	29.855799	29.980652	28.981161	28.865959	29.794338	30.345423	31.919079		34.011772	34.841454	35.652885	36.758949	37.752926		40.212074		42.423191			47.218475			52.919849	54.99939	57.0956	59.860542	62.862404	66.103355				
Industrial 1/																																
Propane	23.232433	22.495939	21.11672	19.831673	19.496647	18.980532	19.427504					25.749916					33.092373		36.461422		40.326328		44.288795		48.627338	51.067024	53.595448	56.476231		62.67974		3.80%
Distillate Fuel Oil Residual Fuel Oil		26.501867	27.151749 20.167095	26.537821 19.275429	23.389381 16.514147	23.95731 16.652777	24.880533 17.326538	26.134712 18.00527	27.407906 18.908943	28.772432 19.914583	30.1945 20.979506	31.817078 22.056101	33.584148 23.250271	35.266396 24.669027	37.088264 25.963661	38.909218 27.283819			44.985332 32.173668	47.193348 34.08371	49.571114 36.052273		54.336437 40.102791	57.039375 42.350624	60.002357 44.843327	63.288025 47.689629	66.63768 50.424068	70.52774 53.690083				4.00% 4.30%
	21.415838					4.681717	5.190114	5.480109	5.868499	6.179578	6.443038	6.77432	7.205544	7.643427	7.999394	8.326244	8.74992	9.16379	9.77739	10.399061	11.004605	11.643664	12.168464	12.795571	13.594952	14.658253	15.779002	17.21804	18.724056	20.03787	21.025259	5.20%
Natural Gas 2/	11.061507 5.369439	18.860607 4.89107	3.827685	4.469956	4.556032			9.533461	9.992243	10.430694	10.943566	11.467448	12.005589		13.194083 4.987565	13.837756 5.2014	14.49896 5.423673	15.22902 5.648135	16.022892 5.887621	16.873526 6.15356	17.775558 6.431725	18.625181 6.721998	19.499105 7.022675	20.430811 7.345206	21.406839 7.658671	22.498684 8.020478	23.590546 8.390702	24.544741	25.717899			
Metallurgical Coal	11.061507 5.369439 5.840001	18.860607 4.89107 7.01	3.827685 7.358096	7.773414	8.119772	8.704527	9.141737				4.200420						5.4236/3	3.040135	5.88/621 0	6.15356	0.431/25	0.721998	1.0226/5									4.90%
Metallurgical Coal Other Industrial Coal Coal to Liquids	11.061507 5.369439 5.840001 2.709783 0	18.860607 4.89107 7.01 3.429703 0	3.827685 7.358096 3.300334 0	7.773414 3.40668 0	8.119772 3.451765 0	8.704527 3.602881 0	3.72628 0	3.829116 0	3.965986 0	4.105461 0	4.266426 0	4.430919 0	4.598792 0	4.786908 0	0	0	0				U	0	0	0	5.343647	5.652353	5.962212	8.784595 6.271906	9.186741 6.596813	9.60058 6.93390	10.028016	3.80%
Metallurgical Coal Other Industrial Coal	11.061507 5.369439 5.840001 2.709783 0	18.860607 4.89107 7.01 3.429703 0	3.827685 7.358096	7.773414 3.40668 0	8.119772 3.451765 0	8.704527	3.72628 0	3.829116 0	3.965986 0 22.010437	0	0	4.430919 0 23.858105	0	0	0	0	28.306244	29.405987	30.566147	31.98086	33.365582	34.778229	0 36.236897	0	5.343647 39.308784				9.186741 6.596813	9.60058 6.93390	10.028016	3.80%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity	11.061507 5.369439 5.840001 2.709783 0	18.860607 4.89107 7.01 3.429703 0	3.827685 7.358096 3.300334 0	7.773414 3.40668 0	8.119772 3.451765 0	8.704527 3.602881 0	3.72628 0	3.829116 0	0	0	0	0	0	0	0	0	28.306244	29.405987	30.566147	31.98086	33.365582	34.778229	0 36.236897	0		5.652353	5.962212	6.271906	9.186741 6.596813	9.60058 6.93390	10.028016	3.80%
Metallurgical Coal Other Industrial Coal Coal to Uquids Electricity	11.061507 5.369439 5.840001 2.709783 0 19.837341	18.860607 4.89107 7.01 3.429703 0 19.975758	3.827685 7.358096 3.300334 0 18.771843	7.773414 3.40668 0 18.848009	8.119772 3.451765 0 19.244272	8.704527 3.602881 0 19.475023	3.72628 0 20.613838	3.829116 0 21.36595	0 22.010437	0 22.532606	0 23.066149	0 23.858105	0 24.639889	0 25.641655	0 26.553274	0 27.479721								0 37.734295	39.308784	5.652353 41.354755	5.962212 43.600594	6.271906 46.130531	9.186741 6.596813 48.823944	9.60058 6.93390 51.34216	1 10.028016 5 7.279897 3 53.860023	3.80%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propane ESS 3/	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711	7.773414 3.40668 0 18.848009 24.308355 32.176392	8.119772 3.451765 0 19.244272 24.196833 26.64241	8.704527 3.602881 0 19.475023 23.961262 26.003149	3.72628 0 20.613838 24.541716 26.67823	3.829116 0 21.36595 25.891031 28.578083	0 22.010437 27.043587 30.490673	0 22.532606 28.319523 31.856367	0 23.066149 29.669432 35.439484	0 23.858105 30.978054	0 24.639889 32.453762 36.429955	0 25.641655 33.969704 36.730537	0 26.553274 35.476711 38.813515	0 27.479721 37.026737 41.925117	38.695404 41.871334	40.380669 43.745102	42.232983 45.717518	44.187748 46.53458	46.226471 47.990776	48.294266 49.29752	50.348469 51.659267	0 37.734295 52.533531 54.27121	39.308784 54.845871 57.098518	5.652353 41.354755 57.340378 60.317062	5.962212 43.600594 59.922703 63.535686	6.271906 46.130531 62.786884 67.237053	9.186741 6.596813 48.823944 65.81852 71.315094	9.60058 6.93390 51.34216 68.89558 75.40512	1 10.028016 5 7.279897 3 53.860023 4 71.933746 1 79.961517	3.80% 3.50% 3.60% 4.10%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propane E85 3/ Motor Gasoline 4/	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504	3.72628 0 20.613838 24.541716 26.67823 28.665993	3.829116 0 21.36595 25.891031 28.578083 29.630028	0 22.010437 27.043587 30.490673 30.966558	0 22.532606 28.319523 31.856367 32.337337	0 23.066149 29.669432 35.439484 34.245148	0 23.858105 30.978054 35.208366 35.737339	0 24.639889 32.453762 36.429955 37.514584	0 25.641655 33.969704 36.730537 39.148716	0 26.553274 35.476711 38.813515 40.759258	0 27.479721 37.026737 41.925117 42.499966	38.695404 41.871334 44.302933	40.380669 43.745102 46.232685	42.232983 45.717518 48.289154	44.187748 46.53458 50.535229	46.226471 47.990776 52.976139	48.294266 49.29752 55.317535	50.348469 51.659267 57.856533	0 37.734295 52.533531 54.27121 60.656326	39.308784 54.845871 57.098518 63.677368	5.652353 41.354755 57.340378 60.317062 67.09964	5,962212 43.600594 59.922703 63.535686 70.533096	6.271906 46.130531 62.786884 67.237053 74.457649	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980	1 10.028016 7.279897 3 53.860023 4 71.933746 1 79.961517 7 88.140556	3.80% 3.50% 3.60% 4.10% 3.90%
Metallurgical Coal Other industrial Coal Coal to Liquids Electricity Transportation Propane ESS 3/ Motor Gasoline 4/ Jer Fuel 5/ Dissel Fuel (distillate fuel oil) 6/	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.22033 21.908274	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536 21.291538 25.405245	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574 20.311157 25.382088	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959	3.829116 0 21.36595 25.891031 28.578083 29.630028 22.584276 28.30756	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025	0 24.639889 32.453762 36.42995 37.514584 29.070498 36.24855	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576	38.695404 41.871334 44.302933 36.067242 43.844616	40.380669 43.745102 46.232685 38.039722 45.926151	42.232983 45.717518 48.289154 40.180698 48.17997	44.187748 46.53458 50.535229 42.349762 50.480347	46.226471 47.990776 52.976139 44.752205 52.951706	48.294266 49.29752 55.317535 47.162777 55.426373	50.348469 51.659267 57.856533 49.561516 57.917866	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227	6.271906 46.130531 62.786884 67.237053	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672	1 10.028016 7.279897 8 53.860023 1 71.933746 1 79.961517 7 88.140556 1 76.968399	3.50% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Tempsortation Propane Motor Gasoline 4/ Motor Gasoline 4/ Electricity Diesel Fuel (distillate fuel oil) 6/ Residual Fuel Oil	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.220333 21.908274 10.40175	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213 22.494694 26.146343 17.831915	3.827685 7.358096 3.300334 0.18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536 21.291538 25.405245 18.207584	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574 20.311157 25.382088 14.077391	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145 14.275996	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959 14.818512	3.829116 0 21.36595 25.891031 28.578083 29.630028 22.584276 28.30756 15.592496	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281366	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876 18.177494	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722	0 24.639889 32.453762 36.42955 37.514584 29.070498 36.24855 20.201696	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198 22.587339	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563	42.232983 45.717518 48.289154 40.180698 48.17997 28.141979	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 36.881367	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227 43.650719	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 46.398548	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 52.28530	1 10.028016 5 7.279897 3 53.860023 4 71.933746 1 79.961517 7 88.140556 6 87.795715 9 55.179813	3.80% 3.50% 4.10% 4.30% 4.30% 4.30%
Metallurgical Coal Other Industrial Coal Coal to Luguids Electricity Transportation Propane 185 3/ Montor Gasoline 4/ Let Fuel 5/ Residual Fuel Coil (dutillate fuel oil) 6/ Residual Fuel Coil Natural Gas 7/ Natural Gas 7/	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.22033 21.908274	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213 22.494694 26.146343	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536 21.291538 25.405245 18.207584 16.396938	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574 20.311157 25.382088 14.077391 16.499441	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145 14.275996 16.824013	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959	3.829116 0 21.36595 25.891031 28.578083 29.630028 22.584276 28.30756 15.592496 18.09399	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439	28.319523 31.856367 32.337337 24.93187 31.10928 17.281366 19.526213	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876 18.177494 20.206396	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24855 20.201696 22.044647	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256 26.414	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905	42.232983 45.717518 48.289154 40.180698 48.17997 28.141979	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212 32.884521	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 60.744354 73.6479153	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 38.958679	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191 45.552128	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 52.28530 47.73994	1 10.028016 5 7.279897 3 53.860023 4 71.933746 1 79.961517 7 88.140556 4 76.96839 5 87.795715 9 55.179813 4 49.6203	3.80% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30% 4.00% 3.90%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propone ESS 3/ Motor Gassine 4/ Jet Ford 5/ Dessel Ford (destillate fivel oil) 6/ Network (Asserting for the Coal) Network (Asserting for the Coal	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.220333 21.908274 10.40175 16.165514	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213 22.494694 26.146343 17.831915 16.137417	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536 21.291538 25.405245 18.207584 16.396938	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574 20.311157 25.382088 14.077391	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145 14.275996 16.824013	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959 14.818512 17.548779	3.829116 0 21.36595 25.891031 28.578083 29.630028 22.584276 28.30756 15.592496 18.09399	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281366	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876 18.177494 20.206396	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24855 20.201696 22.044647	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198 22.587339 24.152359	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905	42.232983 45.717518 48.289154 40.180698 48.17997 28.141979 28.889742	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 60.744354 73.6479153	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 38.958679	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227 43.650719 40.929218	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 46.398548 43.188396	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191 45.552128	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 52.28530 47.73994	1 10.028016 5 7.279897 3 53.860023 4 71.933746 1 79.961517 7 88.140556 4 76.96839 5 87.795715 9 55.179813 4 49.6203	3.80% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30% 4.00% 3.90%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propane Electricity Set 3G Coalene 6/ Journal of Coalene 6/ Journal o	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.22033 21.908274 10.40175 16.165514 33.20496	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213 22.494694 26.146343 17.831915 16.137417 32.774685	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726 31.690496	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986536 21.291538 25.405245 18.207584 16.396938 31.702887	8.119772 3.451765 0 19.244272 24.196833 26.64241 27.816574 20.311157 25.382088 14.077391 16.499441 31.993158	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145 14.275996 16.824013 32.346714	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959 14.818512 17.548779 33.53233	25.891031 28.578083 29.630028 22.584276 28.30756 18.09399 34.215172	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439 35.070309	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281366 19.526213 35.761124	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876 18.177494 20.206396 36.364567	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787 37.3913	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24855 20.201696 22.044647 38.379562	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076 39.832302	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198 22.587339 24.152359 41.511585	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761 43.491306	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256 26.414 45.284264	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905 47.145428	42.232983 45.717518 48.289154 40.180698 48.17997 28.141979 28.889742 48.970177	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091 51.17754	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501 53.571545	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212 32.884521 55.831623	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657 57.933174	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 36.881367 35.479153 60.345539	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727 62.909172	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 38.958679 65.833542	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227 43.650719 40.929218 69.17881	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 44.3188396 72.583244	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191 45.552128 76.343025	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 52.28530 47.73994 80.0617	1 10.028016 5 7.279897 5 3.860023 4 71.933746 1 79.961517 7 88.140556 4 76.968399 87.795715 9 55.179813 4 49.6203 9 83.643875	3.80% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30% 3.90% 3.90% 3.30%
Metallurgical Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propane ESS 3/ Motor Cassion 4/ Discellar of (distillate fuel oil) 6/ Residual (1940) Electricity Electricity Electricity Electricity Distillate fuel oil 0 Natural Gas 7) Distillate fuel oil 0 Distillate fuel oil 0 Residual (1940)	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.20333 21.908274 10.40175 16.165514 33.20496	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 26.699213 22.494694 26.146343 17.831915 16.137417 32.774685 23.300116 15.974203	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726 31.690496	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986336 21.291538 25.405245 18.207584 16.396938 31.702887 23.392672 17.627424	8.119772 3.451765 019.244272 24.196833 26.64241 27.816574 20.311157 25.382088 41.077391 16.499441 31.993158 21.369888 22.88283	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000134 14.275996 16.824013 32.346714 21.756023 23.237019	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959 14.818512 17.548779 33.53233 22.582685 24.19413	25.891031 28.578083 29.630028 22.584276 28.30756 18.09399 34.215172 23.67819 26.342997	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439 35.070309 24.789539 27.499966	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281366 19.526213 35.761124 25.975744 29.313412	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.622876 18.177494 20.206396 36.364567 27.2003 30.618244	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787 37.3913 28.547642 32.082333	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24855 20.201696 22.044647 38.379562	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076 39.832302 31.652735 35.590813	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198 22.587339 24.152359 41.511585 33.379532 37.390537	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761 43.491306 35.115147 39.556942	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256 26.414 45.284264 36.940502 41.605145	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905 47.145428	42 232983 45.717518 48 289154 40.180698 48.17997 28.141979 28.889742 48.970177 40.982918 45.892384	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091 51.17754 43.170036 48.391285	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501 53.571545 45.541206 50.999229	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212 32.884521 55.831623 47.92205 53.448666	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657 57.933174	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 36.881367 35.479153 60.345539 52.852455 59.084534	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727 62.909172 55.681129 62.249008	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 38.958679 65.833542 58.777737 65.747787	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227 43.650719 40.929218 69.17881 61.902206 69.053848	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 46.398548 43.188396 72.583244 65.59362 73.00103	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191 45.552128 76.343025	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.66329 52.28530 47.73994 80.0617	1 10.028016 7.279897 3 53.860023 1 71.933746 1 79.961517 7 88.140556 1 76.968399 8 76.968399 8 49.6203 8 49.6203 8 3.643875 1 77.50528 8 5467209	3.80% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30% 3.90% 3.30% 4.20% 6.00%
Metallurgial Coal Other Industrial Coal Coal to Liquids Electricity Transportation Propose ESS 3/ Motor Gasoline 4/ Jet Fuel S/ Disect Fuel Gardine fuel oil 6/ Reschaaf Ived Di Natural Goa 5/ Electricity Electricity Electricity Electricity Coal Electricity Electricity Coal Electricity Electricity Coal Electricity Electricity Electricity Electricity Distillate Fuel Oil	11.061507 5.369439 5.840001 2.709783 0 19.837341 26.948795 25.027876 22.695641 16.22033 21.908274 10.40175 16.165514 33.20496	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 28.699213 22.494694 26.146343 17.831915 16.137417 32.774685 23.300116 15.974203 4.774714	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726 31.690496	7.773414 3.40668 018.848009 24.308355 32.176392 27.986536 21.29153 31.702887 31.702887 23.392672 21.527424 3.837509	8.119772 3.451765 019.244272 24.196833 26.64241 27.816574 20.311157 25.382088 14.077391 16.499441 31.993158 21.369888 22.88283 3.914439	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.989504 20.728754 26.000145 14.275996 16.824013 32.346714 21.756023	3.72628 0 20.613838 24.541716 26.67823 28.665993 21.479095 26.983959 14.818512 17.54877 33.53233	3.829116 0 21.36595 25.891031 28.578083 29.630028 22.584276 28.30756 15.592499 34.215172 23.67819 26.342997 4.78197	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439 35.070309 24.789539 27.499966 5.142513	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281363 35.761124 25.975744 29.313412 5.413864	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.628876 18.177494 20.206396 36.364567 27.2003 30.618244 5.642012	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787 37.3913 28.547642 32.082333 5.943517	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24855 20.201696 22.044647 38.379562	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076 39.832302 31.652735	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.17198 22.587339 24.152359 41.511585 33.379532 37.390537 7.106012	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761 43.491306 35.115147 39.556942 7.432456	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256 26.414 45.284264 36.940502 41.605145 7.869026	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905 47.145428 38.869625 43.67482 8.269501	42 232983 45.717518 48 289154 40.180698 48.17997 28.141979 28.889742 48.970177	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091 51.17754 43.170036 48.391285 9.420053	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501 53.571545 45.541206 50.999229 9.989655	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212 32.884521 55.831623 47.92205 53.448666 10.593984	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657 57.933174 50.245537 56.235172 11.110809	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 36.881367 35.479153 60.345539 52.852455 59.084534 11.706017	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727 62.909172	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 38.958679 65.833542	5,962212 43,600594 59,922703 63,535686 70,533096 61,394588 70,767227 40,929218 69,17881 61,902206 69,053848 14,624969	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 46.398548 43.188396 72.583244 65.59362 73.00103 16.027176	9.186741 6.596813 48.823944 65.81852 71.315094 79.20417 45.552128 76.343025 69.616417 77.04507 17.493992	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 54.7.73944 80.0617 73.68903 81.197 18.77376	1 10.028016 7.279897 3 53.860023 1 71.933746 1 79.961517 7 88.140556 3 76.968399 5 87.795715 9 83.643875 4 77.50528 4 77.50528 8 85.467209 7 19.729126	3.80% 3.50% 4.10% 4.30% 4.30% 4.30% 4.30% 4.30%
Metallurgical Goal Other Industrial Goal Coat to Ligado Externity Transportation Propose Motor Garoline 4/ Jet Fuel 5/ Her Long 1/ Her Lon	11.061507 5.369439 5.840001 2.709783 00 19.837341 26.948795 25.027876 22.695641 16.22033 21.908274 10.40175 16.165514 33.20496	18.860607 4.89107 7.01 3.429703 0 19.975758 26.025311 25.191607 26.699213 22.494694 26.146343 17.831915 16.137417 32.774685 23.300116 15.974203	3.827685 7.358096 3.300334 0 18.771843 25.157187 34.198711 29.65736 22.927155 26.91391 19.056072 14.84726 31.690496	7.773414 3.40668 0 18.848009 24.308355 32.176392 27.986336 21.291538 25.405245 18.207584 16.396938 31.702887 23.392672 17.627424	8.119772 3.451765 019.244272 24.196833 26.64241 27.816574 20.311157 25.382088 41.077391 16.499441 31.993158 21.369888 22.88283	8.704527 3.602881 0 19.475023 23.961262 26.003149 27.999504 20.728754 26.000145 14.275996 16.824013 32.346714 21.756023 23.237019 4.075972	3.72628 0 20.613838 24.541716 26.67823 22.665593 21.479095 26.983959 14.8185179 33.53233 22.582685 24.19413 4.544771	25.891031 28.578083 29.630028 22.584276 28.30756 18.09399 34.215172 23.67819 26.342997	0 22.010437 27.043587 30.490673 30.966558 23.718626 29.65914 16.388014 18.844439 35.070309 24.789539 27.499966	0 22.532606 28.319523 31.856367 32.337337 24.93187 31.10928 17.281366 19.526213 35.761124 25.975744 29.313412	0 23.066149 29.669432 35.439484 34.245148 26.205727 32.622876 18.177494 20.206396 36.364567 27.2003 30.618244	0 23.858105 30.978054 35.208366 35.737339 27.584229 34.365025 19.13722 21.056787 37.3913 28.547642 32.082333	0 24.639889 32.453762 36.429955 37.514584 29.070498 36.24955 20.201696 22.044647 38.379562 30.033579 33.711666 6.349838	0 25.641655 33.969704 36.730537 39.148716 30.682178 38.011459 21.382908 23.056076 39.832302 31.652735 35.590813 6.756348	0 26.553274 35.476711 38.813515 40.759258 32.4254 39.917198 22.587339 24.152359 41.511585 33.379532 37.390537	0 27.479721 37.026737 41.925117 42.499966 34.184357 41.826576 23.820133 25.212761 43.491306 35.115147 39.556942	38.695404 41.871334 44.302933 36.067242 43.844616 25.16256 26.414 45.284264 36.940502 41.605145	40.380669 43.745102 46.232685 38.039722 45.926151 26.590563 27.558905 47.145428	42.232983 45.717518 48.289154 40.180698 48.17997 28.141979 28.889742 48.970177 40.982918 45.892384 8.844022	44.187748 46.53458 50.535229 42.349762 50.480347 29.759445 30.241091 51.17754 43.170036 48.391285	46.226471 47.990776 52.976139 44.752205 52.951706 31.476072 31.549501 53.571545 45.541206 50.999229	48.294266 49.29752 55.317535 47.162777 55.426373 33.190212 32.884521 55.831623 47.92205 53.448666	50.348469 51.659267 57.856533 49.561516 57.917866 34.959187 34.137657 57.933174	0 37.734295 52.533531 54.27121 60.656326 52.194717 60.744354 36.881367 35.479153 60.345539 52.852455 59.084534	39.308784 54.845871 57.098518 63.677368 55.076351 63.832905 39.001408 37.052727 62.909172 55.681129 62.249008 12.483941	5.652353 41.354755 57.340378 60.317062 67.09964 58.19241 67.263161 41.320976 58.858679 65.833542 58.777737 65.747787 13.52267	5.962212 43.600594 59.922703 63.535686 70.533096 61.394588 70.767227 43.650719 40.929218 69.17881 61.902206 69.053848	6.271906 46.130531 62.786884 67.237053 74.457649 65.158737 74.814873 46.398548 43.188396 72.583244 65.59362 73.00103	9.186741 6.596813 48.823944 65.81852 71.315094 78.789169 69.168655 79.20417 49.30191 45.552128 76.343025	9.60058 6.93390 51.34216 68.89558 75.40512 83.12980 73.26672 83.63399 54.7.73944 80.0617 73.68903 81.197 18.77376	1 10.028016 7.279897 3 53.860023 1 71.933746 1 79.961517 7 88.140556 3 76.968399 5 87.795715 9 83.643875 4 77.50528 4 77.50528 8 85.467209 7 19.729126	3.80% 3.50% 3.60% 4.10% 3.90% 4.30% 4.30% 3.90% 3.30% 4.20% 6.00%

Table C6. Commercial Sector Energy Consumption Estimates, 2011

					Petrol	eum				Biomass				Electrical	
State	Coal	Natural Gas ^a	Distillate Fuel Oil	Kerosene	LPG b	Motor Gasoline ^c	Residual Fuel Oil	Total d	Hydro- electric Power ^e	Wood and Waste ^f	Geothermal	Retail Electricity Sales	Net Energy ^g	System Energy Losses ^h	Total ⁹
(Trillion Btu)		,	l												
Alabama	0.0	25.5	7.0	(s)	2.7	0.2	0.0	10.0	0.0	0.9	0.0	75.9	112.4	144.8	257.2
Alaska	9.4	16.9	10.1	(s) 0.1	0.6	0.7	0.0	11.5	0.0	0.3	0.1	9.7	48.0	20.2	68.2
Arizona	0.0	33.1	6.8	(s)	1.5	0.7	0.0	8.9	0.0	0.5	(s)	100.7	143.2	202.3	345.5
Arkansas	0.0	40.6	3.6	(s)	1.2	0.4	0.0	5.2	0.0	1.3	0.0	41.4	88.6	86.1	174.7
California	0.0	250.9	47.9	0.1	8.7	1.4	0.0	58.1	(s)	17.4	0.7	418.9	746.2	809.9	1,556.1
Colorado	3.2	57.6	5.9	(s) 0.1	2.9 3.5	0.2	0.0	9.1	0.0	1.2	0.2	67.9	138.6	148.6	287.2
Connecticut	0.0 0.0	46.1 10.8	12.4			0.2	(s) 0.0	16.2 2.2	0.0 0.0	0.8 0.2	0.0 0.0	44.7	107.7 27.7	76.6	184.4 58.9
Delaware Dist. of Col	(s)	17.2	1.1 0.7	(s) (s)	1.1	(s) 1.4	0.0	2.2	0.0	(s)	0.0	14.5 30.6	49.9	31.2 69.7	119.6
Florida	0.0	55.5	14.6	(5)	(s) 7.1	4.9	0.0	26.8	0.0	2.5	2.4	313.1	400.3	571.3	971.6
Georgia	0.0	57.6	6.3	0.1	3.3	0.4	0.0	10.1	0.0	1.9	(s)	160.1	229.9	334.5	564.4
Hawaii	0.0	1.9	1.7	(s)	2.5	0.1	0.0	4.3	0.0	2.8	(s)	11.5	18.7	22.0	40.7
Idaho	0.2	17.2	2.4	(s)	1.0	0.1	(s)	3.6	0.0	0.5	0.6	20.4	42.4	42.9	85.3
Illinois	3.4	217.9	5.4	(s)	2.9	1.0	0.1	9.4	0.0	1.9	0.0	172.2	402.2	386.9	789.1
Indiana	6.9	76.9	3.2	0.1	3.1	3.4	0.0	9.7	0.0	5.6	0.9	82.3	181.9	194.9	376.9
lowa	5.7	52.3	3.9	(s)	3.1	11.2	0.0	18.4	0.0	1.4	0.7	41.2	114.2	93.7	207.9
Kansas	0.0	32.8	1.6	(s)	1.2	0.3	(s)	3.2	0.0	0.6	0.4	53.3	90.2	126.2	216.4
Kentucky	1.2	35.4	2.3	(s)	2.0	0.2	0.0	4.5	0.0	1.9	1.0	63.9	107.9	145.3	253.3
Louisiana	0.0	26.4	5.7	(s)	1.0	0.2	0.0	7.0	0.0	0.3	1.0	82.8	117.5	163.9	281.4
Maine	0.0	6.9	13.9 8.4	0.2	5.7 3.3	0.1	1.3	21.2 12.0	0.0	3.8	0.0	13.7 104.9	45.6	18.1 237.6	63.7 428.0
Maryland Massachusetts	0.6 0.0	69.4 83.4	20.9	0.1 (s)	2.5	0.2 0.8	(s) 2.1	26.4	0.0 0.1	3.6 1.4	0.0 0.9	60.6	190.4 172.8	105.0	428.0 277.8
Michigan	4.1	165.8	7.2	0.1	2.6	0.8	0.6	10.9	0.0	7.5	1.1	131.7	321.1	289.4	610.5
Minnesota	0.6	95.3	6.1	(s)	3.1	3.3	0.8	13.3	0.0	2.5	0.0	76.3	188.3	153.4	341.7
Mississippi	0.0	20.6	3.8	(s)	2.2	0.2	0.0	6.2	0.0	0.7	0.6	46.9	74.9	89.2	164.2
Missouri	2.8	62.8	2.6	(s)	3.4	0.3	0.0	6.4	0.0	3.5	0.0	105.6	181.1	232.5	413.6
Montana	0.2	22.7	0.7	(s)	1.2	0.1	(s)	2.0	0.0	0.4	0.1	16.7	42.2	36.0	78.3
Nebraska	0.0	32.5	1.1	(s)	0.6	0.4	0.0	2.1	0.0	0.5	0.4	31.2	66.6	69.2	135.8
Nevada	0.0	31.5	2.1	(s)	0.7	0.1	0.1	2.9	0.0	0.2	0.8	30.7	66.5	53.1	119.6
New Hampshire	0.0	9.2	6.3	0.1	4.3	0.3	1.6	12.5	0.0	1.1	0.0	15.3	38.1	28.5	66.6
New Jersey	0.0	196.8	14.3	0.1	1.7	0.3	0.8	17.3	0.0	5.3	0.0	133.5	352.8	278.7	631.5
New Mexico	0.0	25.6 298.9	1.4	(s) 1.0	1.3 7.1	0.1	0.0	2.8	0.0	0.9	0.1	31.6	61.0	65.7 504.2	126.7
New York North Carolina	0.1 4.3	298.9 50.6	59.9 8.8	0.2	7.1	1.0 2.0	44.6	113.5 18.2	0.1 0.1	4.7 2.3	0.6 0.0	260.7 158.5	678.5 234.1	504.2 344.7	1,182.7 578.8
North Dakota	1.5	11.8	6.1	(s)	1.6	0.1	(s) 0.1	7.9	0.1	0.1	0.0	16.6	37.2	36.0	73.2
Ohio	5.1	166.5	13.3	0.1	4.0	0.5	(s)	17.9	0.0	2.9	0.9	160.7	354.0	357.5	711.5
Oklahoma	0.0	41.6	3.1		1.6	0.8	0.0	5.5	0.0	0.7	0.0	66.9	114.7	132.8	247.6
Oregon	0.0	31.0	3.0	(s) 0.1	1.4	0.2	0.2	4.8	0.0	2.4	0.7	53.8	92.8	102.6	195.4
Pennsylvania	4.3	147.0	21.2	0.2	8.2	0.5	0.3	30.3	0.0	5.3	0.9	148.5	336.4	301.8	638.2
Rhode Island	0.0	11.1	3.1	(s)	0.4	0.1	0.3	3.8	0.0	0.2	0.0	12.5	27.6	16.3	43.9
South Carolina	0.0	22.6	3.2	(s)	2.5	0.2	(s) (s)	6.0	(s)	0.5	0.0	73.7	102.8	159.1	261.9
South Dakota	0.0	11.2	1.4	(s)	1.0	0.1	(s)	2.4	0.0	0.2	0.7	15.2	29.7	32.7	62.4
Tennessee	1.8	52.9	6.0	(s)	2.7	0.3	0.0	9.0	0.0	1.0	0.0	99.0	163.8	223.3	387.0
Texas	0.3	189.6	26.7	0.1	7.1	1.6	0.3	35.8	0.0	2.1	1.0	437.5	666.3	889.3	1,555.5
Utah	0.0	42.0	3.1	(s)	2.2	0.1	0.0	5.4	0.0	0.1	0.3	36.0	83.8	74.0	157.8
Vermont Virginia	0.0 2.4	2.5 66.0	3.8 6.7	(s) 0.1	3.3 6.2	(s) 0.6	0.3 0.1	7.4 13.7	0.0 0.0	1.3 6.6	0.0 1.0	6.9 160.5	18.1 250.2	11.1 357.5	29.2 607.7
Washington	0.0	58.1	6.8	(s)	2.7	0.6	(s)	10.1	0.0	2.4	0.4	100.3	171.3	215.3	386.6
West Virginia	0.0	26.1	2.4	(s)	0.8	0.5	(5)	3.4	0.0	2.4	(s)	26.5	58.4	53.2	111.6
Wisconsin	2.7	88.3	4.8	(s)	3.2	0.3	0.0	8.3	0.0	2.9	0.0	78.7	180.9	176.0	356.9
Wyoming	0.5	12.1	2.2	(s)	1.5	3.2	0.0	6.9	0.0	0.2	0.5	14.9	35.1	32.6	67.6
United States	61.7	3,224.7	417.2	3.2	146.5	45.3	53.7	666.1	0.2		19.7	4,531.3	8,604.3	9,347.6	17,951.9

a Natural gas as it is consumed; includes supplemental gaseous fuels that are commingled with natural gas. b Liquefied petroleum gases.

included in both natural gas and the other fossil fuels from which they are mostly derived, but should be counted only once in net energy and total.

Incurred in the generation, transmission, and distribution of electricity plus plant use and unaccounted for

^c Motor gasoline as it is consumed; includes fuel ethanol blended into motor gasoline.

d includes small amounts of petroleum coke not shown separately.
Conventional hydroelectric power. Does not include pumped-storage hydroelectricity.

f Wood, wood-derived fuels, and biomass waste.

⁹ Distributed solar thermal and photovoltaic energy consumed in the commercial sector is included in residential consumption. Includes small amount of solar and wind energy consumed by commercial plants with capacity of 1 megawatt or greater. Adjusted for the double-counting of supplemental gaseous fuels, which are

electrical system energy losses.

electrical system energy losses.

Where shown, (s) = Value less than 0.05 trillion Btu.

Notes: Totals may not equal sum of components due to independent rounding. • The commercial sector includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.

Web Page: All data are available at http://www.eia.gov/state/seds/seds-data-complete.cfm.

Sources: Data sources, estimation procedures, and assumptions are described in the Technical Notes.

Table C7. Industrial Sector Energy Consumption Estimates, 2011

23.9 3.19.2 0.33.2 1.77.2 23.22.8 7.7 0.01 (s.636.7 4.27.6 5.2.0 0.0	1 1.0 4 4.6 6 4.0 9 29.6 6 4.9 7 2.5	6.7 46 0.0 27 (s) 18 0.1 17 (s) 312	.3 83.9 .1 47.4 .4 57.6	Hydro- electric power ^e	Wood and Waste f	Losses and Co- products ^g	Geo- thermal	Retail Electricity Sales	Net Energy ^{h,i}	System Energy Losses	Total ^{h,i}
19.2 0. 33.2 1. 31.1 2. 77.2 23. 22.8 7. 3.8 2. 1.7 0. 0.1 (s 36.7 4.27.6 5.	1 1.0 4 4.6 6 4.0 9 29.6 6 4.9 7 2.5	0.0 27 (s) 18 0.1 17 (s) 312	.1 47.4 .4 57.6	0.0		0.0	/->				
33.2 1. 31.1 2. 77.2 23. 22.8 7. 3.8 2. 1.7 0. 0.1 (s 36.7 4. 27.6 5.	4 4.6 6 4.0 9 29.6 6 4.9 7 2.5	(s) 18 0.1 17 (s) 312	.4 57.6				(s)	115.1	590.4	219.5	810.0
31.1 2. 77.2 23. 22.8 7. 3.8 2. 1.7 0. 0.1 (s 36.7 4. 27.6 5.	6 4.0 9 29.6 6 4.9 7 2.5	(s) 312			0.1	0.0	0.0	4.5	306.0	9.4	315.4
77.2 23. 22.8 7. 3.8 2. 1.7 0. 0.1 (\$\frac{3}{6}.7 4. 27.6 5.	9 29.6 6 4.9 7 2.5	(s) 312			1.4	3.1	0.2		136.5	84.7	221.2
22.8 7. 3.8 2. 1.7 0. 0.1 (\$ 36.7 4. 27.6 5.	6 4.9 7 2.5			0.0 0.0	72.7 28.4	0.0 10.0	(s) 1.2	58.0 170.4	284.5 1,456.2	120.5 329.4	405.0 1,785.7
3.8 2. 1.7 0. 0.1 (§ 36.7 4. 27.6 5.	7 2.5	0.0 25	.9 61.2		0.4	7.1	0.3	52.0	309.8	113.9	423.6
0.1 (s 36.7 4. 27.6 5.		0.1 7	.2 16.3	0.0	3.5	0.0	0.0	12.5	58.9	21.5	80.4
27.6 5.		1.6 29			(s)	0.0	0.0		63.7	19.0	82.7
27.6 5.	0.2		.2 0.5	0.0	0.0	0.0	0.0	0.7	1.2	1.7	2.9
		5.8 30 2.9 41		0.0 0.2	123.4 149.2	0.0 5.7	0.0 (s)	57.6 107.5	371.9 523.1	105.1 224.7	477.0 747.7
		2.9 16		0.5	4.3	0.0	(s)	12.5	40.4	23.9	64.3
16.2 0.	7 3.2			0.0	21.9	3.1	0.8	30.4	119.7	64.1	183.8
36.0 43.		(s) 10 0.1 165		0.0	12.9	69.7	0.0		885.7	343.8	1,229.5
29.0 5.		0.2 97			10.4	52.3	0.0		927.8	386.2	1,314.0
34.6		0.2 13			18.4	202.4	0.0		596.8	149.1	745.9
26.5 55. 39.1 21.		1.7 52 0.0 72			0.6 17.1	24.8 2.0	0.0	36.9 148.8	333.6 465.6	87.4 338.7	421.0 804.3
59.5 206.	7 5.9	27.9 886		0.0	93.7	0.1	(s)	102.6	2,476.8	202.9	2.679.7
5.5 0.			.0 16.5		63.5	0.0	0.0	10.3	126.0	13.6	139.6
7.4 1.		1.6 22			9.2	0.0	0.0	17.1	107.4	38.7	146.1
7.3 1.			.2 24.5	0.1	4.2	0.0	0.0	57.9	134.5	100.3	234.8
18.6 3.		1.4 55 1.6 74		0.3 1.1	35.6 33.7	15.2 63.8	0.0	107.9	471.1	237.0	708.1 655.0
39.4 7. 13.5 2.		0.3 56		0.0	33.7 48.6	3.1	(s)	80.6 55.5	493.0 305.1	162.0 105.7	410.8
21.9 10.		0.1 39			4.6	14.5	0.0	59.1	230.1	130.1	360.2
13.8 0.	9 1.5	0.0 28	.3 44.4	0.0	1.8	0.0	0.1	13.6	84.0	29.3	113.4
24.0 2.			.7 35.8	0.0	4.2	109.3	0.0	36.1	291.7	80.2	371.9
10.4 0.			.8 19.6		0.5	0.0	0.4	45.8	80.2	79.3	159.5
2.5 0. 12.2 1.		0.7 3 1.9 113	.2 8.1 .6 134.7	(s) 0.0	1.6 3.9	0.0 0.0	0.0	6.6 27.4	23.0 217.0	12.3 57.2	35.3 274.3
9.4 17.		0.0 24			0.6	1.7	0.0		189.0	49.0	238.0
16.3 2.		7.8 49		0.7	14.0	9.3	0.0	45.8	258.4	88.6	346.9
17.4 10.		5.8 32		(s) 0.0	72.5	0.0	0.0	90.6	358.1	197.0	555.1
50.3 1.		0.2 13		0.0	2.0	21.4	0.0	14.7	234.3	32.0	266.3
30.2 6.		3.0 151			23.7	25.1	0.0		820.9	409.1	1,230.0
14.8 1. 14.8 1.		3.7 75 1.0 16		0.0 0.0	20.8 24.4	0.0 2.3	0.0 0.2		452.7 167.4	107.1 77.9	559.8 245.3
10.9 30.		4.4 141		0.0	31.0	6.2	0.0		867.8	343.8	1,211.6
0.7 0.	3 0.6	0.6 1	.7 3.9	0.0	0.1	0.0	0.0	3.1	14.7	4.1	18.8
8.2 2.		3.3 28	.6 44.8	0.0	79.4	0.0	0.0	95.9	321.8	207.0	528.9
13.2 0.			.3 22.4	0.0	0.2	57.6	0.3	8.8	133.9	19.0	152.9
11.1 1. 76.6 1,708.		0.2 65 28.6 1,200		0.0 0.0	45.7 61.9	12.5 17.7	0.0 0.0	97.7 348.5	404.4 5,379.2	220.3 708.3	624.6 6,087.6
.חויון ס.סי		(s) 1,200			0.4	0.0	0.0		152.9	65.5	218.4
12 2		0.6	.9 6.4	0.0	1.6	0.0	0.0	4.8	15.9	7.8	23.7
12.2 0. 3.9 0.	2 5.0	6.4 22	.4 50.5	0.1	50.7	0.0	0.0	58.7	305.6	130.8	436.5
12.2 0. 3.9 0. 14.6 2.				(s)		0.0	0.0	95.3	381.4	204.5	585.9
12.2 0. 3.9 0. 14.6 2. 17.0 4.				5.4							275.6
12.2 0. 3.9 0. 14.6 2. 17.0 4. 28.3 0.											581.8 322.4
12.2 0. 3.9 0. 14.6 2. 17.0 4. 28.3 0. 22.2 4.		` ,									30,923.8
1	7.0 4 8.3 0 2.2 4 3.8 0	7.0 4.2 5.9 8.3 0.5 1.0 2.2 4.7 5.6 3.8 0.5 1.1	7.0 4.2 5.9 1.6 107 8.3 0.5 1.0 0.3 9 2.2 4.7 5.6 0.8 40 3.8 0.5 1.1 (s) 24	7.0 4.2 5.9 1.6 107.2 135.9 8.3 0.5 1.0 0.3 9.5 39.6 2.2 4.7 5.6 0.8 40.7 73.9 3.8 0.5 1.1 (s) 24.9 60.3	7.0 4.2 5.9 1.6 107.2 135.9 (s) 8.3 0.5 1.0 0.3 9.5 39.6 5.4 2.2 4.7 5.6 0.8 40.7 73.9 1.5 3.8 0.5 1.1 (s) 24.9 60.3 0.0	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 0.0 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 0.0 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 28.5 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1 0.6	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 0.0 0.0 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 0.0 0.0 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 28.5 0.0 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1 0.6 0.1	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 0.0 0.0 95.3 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 0.0 0.0 40.0 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 28.5 0.0 79.9 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1 0.6 0.1 35.0	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 0.0 0.0 95.3 381.4 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 0.0 0.0 40.0 195.3 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 28.5 0.0 79.9 403.2 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1 0.6 0.1 35.0 245.6	7.0 4.2 5.9 1.6 107.2 135.9 (s) 69.9 0.0 0.0 95.3 381.4 204.5 8.3 0.5 1.0 0.3 9.5 39.6 5.4 1.3 0.0 0.0 40.0 195.3 80.3 2.2 4.7 5.6 0.8 40.7 73.9 1.5 56.6 28.5 0.0 79.9 403.2 178.7 3.8 0.5 1.1 (s) 24.9 60.3 0.0 0.1 0.6 0.1 35.0 245.6 76.8

^a Natural gas as it is consumed; includes supplemental gaseous fuels that are commingled with natural gas.

residential consumption. Includes small amount of solar and wind energy consumed by industrial plants with capacity of 1 megawatt or greater. Adjusted for the double-counting of supplemental gaseous fuels, which are included in both natural gas and the other fossil fuels from which they are mostly derived, but should be counted only once in net energy and total.

I Incurred in the generation, transmission, and distribution of electricity plus plant use and

natural gas.

b Liquefied petroleum gases.
c Motor gasoline as it is consumed; includes fuel ethanol blended into motor gasoline.
d Includes asphalt and road oil, kerosene, lubricants, and the 16 other petroleum products as described in the Technical Notes, Section 4, "Other Petroleum Products."
e Conventional hydroelectric power. Does not include pumped-storage hydroelectricity.

f Wood, wood-derived fuels, and biomass waste.
g Losses and co-products from the production of fuel ethanol.
h U.S. total includes 11.1 trillion Btu of net imports of coal coke that are not allocated to the states.

Distributed solar thermal and photovoltaic energy consumed in the industrial sector is included in

unaccounted for electrical system energy losses.

Where shown, (s) = Value less than 0.05 trillion Btu.

Notes: Totals may not equal sum of components due to independent rounding. • The industrial sector includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.

Web Page: All data are available at http://www.eia.gov/state/seds/seds-data-complete.cfm.

Sources: Data sources, estimation procedures, and assumptions are described in the Technical Notes.

Table HC6.8 Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

Million Housing Units, Final

		Northeast Census Region									
	Total U.S. ¹ (millions)			New England ensus Divisi			Middle A				
Space Heating		Total Northeast	Total New England	MA	CT, ME, NH, RI, VT	Total Middle Atlantic	NY	PA	NJ		
Total Homes	113.6	20.8	5.5	2.5	3.0	15.3	7.2	4.9	3.2		
Space Heating Equipment											
Use Space Heating Equipment	110.1	20.8	5.5	2.5	3.0	15.3	7.2	4.9	3.2		
Have Space Heating Equipment But Do											
Not Use It	2.4	Q	Q	Q	N	N	N	N	N		
Do Not Have Space Heating Equipment	1.2	N	N	N	N	N	N	N	N		
Main Heating Fuel and Equipment ²											
Natural Gas	55.6	10.8	2.2	1.3	0.9	8.6	4.1	1.9	2.6		
Central Warm-Air Furnace	44.3	6.1	1.0	0.6	0.4	5.2	2.0	1.5	1.6		
For One Housing Unit	42.5	5.5	0.8	0.5	0.3	4.7	1.8	1.4	1.5		
For Two or More Housing Units	1.8	0.6	0.1	0.0	Q	0.5	0.3	Q	Q		
Steam or Hot Water System	6.9	4.3	1.2	0.7	0.5	3.1	1.9	0.3	0.9		
For One Housing Unit	3.7	2.3	0.7	0.4	0.3	1.6	0.8	0.2	0.6		
For Two or More Housing Units	3.2	2.0	0.5	0.4	0.2	1.6	1.1	Q	0.4		
Built-In Room Heater	2.3	0.2	0.1	0.1	Q	Q	Q	Q	Q		
Floor or Wall Pipeless Furnace	1.2	0.1	Q	Q	Ñ	0.1	0.1	N	N		
Other Equipment	0.9	Q	Q	Q	N	Q	Q	Q	Q		
Electricity	38.1	2.4	0.4	0.3	0.2	2.0	0.5	1.3	0.1		
Central Warm-Air Furnace	19.1	0.3	0.0	0.0	Q	0.2	0.3	Q Q	Q		
Heat Pump	9.8	0.4	Q.0	0.0 Q	N N	0.4	Q	0.4	N		
Built-In Electric Units	5.7	1.4	0.3	0.2	0.1	1.1	0.3	0.7	Q		
Portable Electric Heater	2.7	0.1	0.5 Q	0.2 Q	Q	Q	0.5 Q	Q.7	N		
Other Equipment	0.9	0.1	Q	Q	Q	0.1	0.1	Q	Q		
Fuel Oil	6.9	5.7	2.3	0.8	1.5	3.4	2.1	1.0	0.3		
Steam or Hot Water System	3.9	3.6	1.4	0.5	1.0	2.2	1.3	0.6	0.3		
•	2.6	2.4	1.4	0.3	0.8	1.2	0.4	0.6	0.3		
For Two or More Housing Units	1.3	1.3	0.2	0.4	0.8	1.0	0.4	0.0 Q	0.2 Q		
For Two or More Housing Units					0.2				Q		
Central Warm-Air Furnace	2.7 0.3	1.8 0.3	0.8 Q	0.3 Q	0.5 Q	1.0	0.6	0.3 Q	Q N		
Other Equipment			0.2			0.2	0.2				
Propane/LPG	5.6	0.7	-	0.1	0.1	0.6	Q	0.5	Q		
Central Warm-Air Furnace	3.9 1.7	0.5 0.2	Q 0.1	Q Q	Q 0.1	0.5 Q	Q Q	0.4 Q	Q N		
Other Equipment			_	Q	0.1						
Wood	2.8	0.6	0.3		0.2	0.4	0.1	Q	Q		
Heating Stove	2.2	0.5	0.2	Q	0.1	0.3	0.1	Q	Q		
Other Equipment	0.6	0.1	0.1	Q	0.1	Q	Q	Q	N		
Kerosene	0.5	0.3	0.1	Q	0.1	0.2	0.1	Q	N		
Other Fuel	0.5	0.2	Q	Q	Q	0.1	0.1	Q	N		
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N		

U.S. Energy Information Administration

Table HC6.8 Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

Million Housing Units, Final

		Northeast Census Region									
		.1 Total		New England ensus Divisi		Middle Atlantic Census Division					
Space Heating	Total U.S. ¹ (millions)		Total New England	MA	CT, ME, NH, RI, VT	Total Middle Atlantic	NY	PA	NJ		
Total Homes	113.6	20.8	5.5	2.5	3.0	15.3	7.2	4.9	3.2		
Housing Units Served by											
Main Heating Equipment ²											
One Housing Unit	101.2	15.8	4.4	2.0	2.4	11.4	4.2	4.6	2.6		
Two or More Housing Units	8.9	4.9	1.1	0.4	0.6	3.9	3.0	0.3	0.6		
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N		
Age of Main Heating Equipment											
Less Than 2 Years	10.6	1.9	0.5	0.2	0.2	1.4	0.7	0.4	0.3		
2 to 4 Years	15.9	2.8	0.7	0.3	0.4	2.1	0.9	0.6	0.6		
5 to 9 Years	26.3	4.1	1.2	0.5	0.7	3.0	1.3	1.1	0.5		
10 to 14 Years	20.4	3.4	0.9	0.4	0.5	2.5	1.3	8.0	0.5		
15 to 19 Years	11.2	2.2	0.5	0.3	0.2	1.7	8.0	0.6	0.3		
20 Years or More	25.7	6.4	1.7	0.8	0.9	4.7	2.2	1.5	1.0		
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N		
Routine Service or Maintenance											
Performed on Main Heating Equipment ³											
Yes	44.0	9.5	3.1	1.3	1.8	6.4	2.8	2.3	1.4		
No	66.0	11.2	2.4	1.2	1.2	8.8	4.4	2.7	1.8		
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N		
Proportion of Heat Provided by											
Main Heating Equipment											
All or Almost All	98.4	19.1	4.9	2.3	2.6	14.3	6.7	4.6	3.0		
About Three-Fourths	6.8	1.0	0.3	0.1	0.2	0.7	0.4	Q	Q		
Closer to One-Half	4.9	0.6	0.3	0.1	0.2	0.3	0.1	Q	Q		
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N		

Table HC6.8 Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

79.0

16.9

6.0

3.5

11.9

4.9

0.7

Q

1.....

2 or More.....

Not Applicable.....

Do Not Have or Use Heating Equipment.....

Million Housing Units, Final **Northeast Census Region New England** Middle Atlantic **Census Division Census Division** Total Total Total U.S.¹ New Middle Total CT, ME, **England** Atlantic **Space Heating** (millions) Northeast MA NH, RI, VT NY PA NJ 113.6 2.5 7.2 3.2 Total Homes..... 20.8 5.5 3.0 15.3 4.9 **Secondary Heating Fuel and Equipment** (more than one may apply) Secondary Heating Equipment Used..... 42.7 7.0 2.3 0.9 1.4 4.7 1.6 2.2 8.0 Natural Gas..... 7.2 0.9 0.1 0.1 Q 8.0 0.3 0.2 0.2 Q Q Q Q Fireplace..... 4.8 0.5 0.4 0.1 0.2 Central Warm-Air Furnace..... Q 0.2 Q Q Q 0.2 Q Q 1.1 0.1 Q Q Q Q Q Other Equipment..... 1.4 0.3 0.2 26.8 2.9 0.4 Electricity..... 4.3 1.3 0.6 0.7 1.0 1.5 22.7 3.6 0.5 0.5 2.6 0.9 0.4 Portable Electric Heater..... 1.1 1.3 Q Built-In Electric Units..... 2.3 0.6 0.3 0.1 0.2 0.3 0.1 0.2 Heat Pump..... 1.3 Q Q Q Q Q Ν Q Ν Q Q Q Q Q Q Q Other Equipment..... 1.2 Ν Q Q Ν Fuel Oil..... 0.4 0.3 0.2 0.2 0.1 Q Propane/LPG..... 2.8 0.5 0.2 Q 0.1 0.3 Q 0.2 Q Q Q Q Q Fireplace..... 1.5 0.3 0.1 0.2 0.2 Other Equipment..... 0.2 0.1 Q 0.1 Q Q Q Ν 1.4 Wood..... 8.8 1.7 0.7 0.2 0.5 1.0 0.2 0.5 0.2 Fireplace..... 6.4 1.0 0.3 0.1 0.2 0.7 0.1 0.4 0.2 Q Heating Stove..... 2.6 8.0 0.5 0.1 0.3 0.3 0.1 Q Other Equipment..... Q Q Q Q Q Ν Ν Ν Ν 0.1 Q Q Q Q Q Ν Kerosene..... 0.9 Q Q Q Q Q Q Q Q Other Fuel..... 0.7 0.1 No Secondary Heating Equipment Used...... 67.4 13.8 3.2 1.6 10.6 5.6 2.7 2.3 1.6 Do Not Have or Use Heating Equipment...... 3.5 Q Q Q Ν Ν Ν **Thermostats Number of Thermostats Used for** Heating⁴ 0..... 8.2 3.2 0.3 0.2 0.1 2.9 2.2 0.4 Q

1.6

1.2

0.2

Ν

8.9

3.0

0.5

Ν

3.8

1.0

0.2

Ν

3.2

1.1

0.3

Ν

1.9

0.9

Q

Ν

1.4

0.7

0.0

Q

3.0

1.9

0.2

Q

Table HC6.8 Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

Million Housing Units, Final	
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willion rousing office	,	Northeast Census Region										
				New Englandensus Divisi			Middle A					
Space Heating	Total U.S. ¹ (millions)	Total Northeast	Total New England	MA	CT, ME, NH, RI, VT	Total Middle Atlantic	NY	PA	NJ			
Total Homes	113.6	20.8	5.5	2.5	3.0	15.3	7.2	4.9	3.2			
Have a Programmable Thermostat												
Yes	41.7	7.1	1.7	0.8	0.9	5.4	2.3	1.6	1.6			
No	54.2	9.7	3.3	1.4	1.9	6.5	2.6	2.7	1.2			
No Thermostat or Do Not Have or Use Heating Equipment	17.7	3.9	0.6	0.3	0.3	3.4	2.4	0.7	0.3			
Use of Programmable Thermostat Reduces Temperature During Day												
Yes	22.1	3.7	1.0	0.5	0.5	2.7	1.3	0.6	8.0			
No	19.6	3.3	0.6	0.3	0.3	2.7	1.0	1.0	8.0			
Reduces Temperature During Sleeping Hours												
Yes	25.6	4.7	1.2	0.6	0.6	3.5	1.7	0.8	1.0			
No	16.0	2.4	0.4	0.2	0.2	2.0	0.6	0.7	0.6			
No Programmable Thermostat or Do Not												
Have or Use Heating Equipment	72.0	13.7	3.9	1.7	2.2	9.8	4.9	3.4	1.5			
Winter Indoor Temperatures												
Daytime Temperature When Someone is Home												
63 Degrees or Less	6.1	1.6	0.6	0.2	0.3	1.0	0.5	0.4	Q			
64 to 66 Degrees	11.8	2.7	1.0	0.4	0.5	1.7	0.7	0.6	0.4			
67 to 69 Degrees	29.6	7.4	1.8	0.8	1.0	5.5	2.4	1.8	1.3			
70 Degrees	26.2	5.3	1.3	0.6	0.7	4.0	2.3	1.0	0.7			
71 to 73 Degrees	17.8	2.1	0.4	0.2	0.2	1.6	0.6	0.6	0.4			
74 Degrees or More	18.5	1.7	0.4	0.2	0.2	1.4	0.6	0.5	0.2			
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N			
Daytime Temperature When												
No One is Home	00.7	0.0	0.0	4.0	4.0	4.4	4.0	4.0	0.7			
63 Degrees or Less	26.7	6.3	2.2 1.2	1.0 0.5	1.2 0.7	4.1 3.1	1.8 1.3	1.6 0.8	0.7 1.0			
64 to 66 Degrees	21.8 23.2	4.3 4.6		0.5 0.4	0.7 0.5	3.1 3.7	1.3 1.6	0.8 1.3	1.0 0.7			
67 to 69 Degrees	23.2 17.2	4.6 3.3	0.9 0.8	0.4	0.5 0.4	3.7 2.5	1.6 1.6	1.3 0.5	0.7			
70 Degrees	17.2 10.4	3.3 1.4	0.8 0.2	0.3 0.1	0.4 0.1	2.5 1.1	1.6 0.4	0.5 0.4	0.4			
71 to 73 Degrees	10.4	1.4	0.2	0.1	0.1	0.7	0.4	0.4	0.3 Q			
74 Degrees or More Do Not Have or Use Heating Equipment	3.5	1.0 Q	0.2 Q	0.1 Q	0.1 N	0.7 N	0.4 N	0.2 N	Q N			
Do Not have of use heating Equipment	ა.5	Q	Q	Q	IN	IN	IN	IN	IN			

U.S. Energy Information Administration

Table HC6.8 Space Heating in U.S. Homes in Northeast Region, Divisions, and States, 2009

Million Housing Units, Final

		Northeast Census Region										
				New England ensus Divisi								
Space Heating	Total U.S. ¹ (millions)	Total Northeast	Total New England	MA	CT, ME, NH, RI, VT	Total Middle Atlantic	NY	PA	NJ			
Total Homes	113.6	20.8	5.5	2.5	3.0	15.3	7.2	4.9	3.2			
Temperature at Night												
63 Degrees or Less	19.0	4.8	1.7	0.7	1.0	3.1	1.5	1.0	0.6			
64 to 66 Degrees	20.0	4.7	1.3	0.6	0.7	3.4	1.6	0.9	1.0			
67 to 69 Degrees	25.3	5.0	1.1	0.5	0.6	4.0	1.8	1.5	0.7			
70 Degrees	19.5	3.4	0.9	0.4	0.5	2.6	1.5	0.6	0.5			
71 to 73 Degrees	12.0	1.4	0.3	0.1	0.2	1.2	0.4	0.4	0.3			
74 Degrees or More	14.3	1.3	0.3	0.1	0.1	1.1	0.5	0.4	0.2			
Do Not Have or Use Heating Equipment	3.5	Q	Q	Q	N	N	N	N	N			
Humidifier Use During 2009												
Use a Humidifier	17.2	3.2	1.1	0.4	0.7	2.1	0.6	0.8	0.6			
1 to 3 Months	9.2	1.6	0.7	0.2	0.5	0.9	0.3	0.3	0.3			
4 to 6 Months	5.7	1.3	0.4	0.2	0.2	0.9	0.3	0.4	0.3			
7 to 9 Months	0.9	0.1	Q	Q	Q	Q	Q	Q	Q			
10 to 11 Months	0.2	Q	N	N	N	Q	N	Q	N			
Turned on All Year	1.2	0.2	Q	Q	Q	0.2	Q	Q	Q			
Do Not Use a Humidifier	96.5	17.5	4.4	2.0	2.3	13.2	6.5	4.1	2.5			

¹Total U.S. includes all primary occupied housing units in the 50 States and the District of Columbia. Vacant housing units, seasonal units, second homes, military housing, and group quarters are excluded.

²Use of heating equipment for another housing unit also includes the use of the heating equipment for a business or farm building as well as another housing unit.

³Only includes routine service or maintenance performed in the last year.

⁴Housing units with heating stoves, portable electric heaters, fireplaces, and cooking stoves as the main heating equipment were not asked if they had a thermostat.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

N = No cases in reporting sample.

Notes: • Because of rounding, data may not sum to totals. • See Glossary for definition of terms used in these tables.

Source: U.S. Energy Information Administration, Office of Energy Consumption and Efficiency Statistics, Forms EIA-457 A and C of the 2009 Residential Energy Consumption Survey.