

# **Federal Funds Spur Local Action: The Findings and Lessons Learned From the Preliminary Impact Evaluation of the National Better Buildings Neighborhood Program**

*Lynn Roy and Kevin Afflerbaugh, Nexant  
Stephen Grover and Matthew Koson, Evergreen Economics  
Edward Vine, Lawrence Berkeley National Laboratory*

## **ABSTRACT**

The U.S. Department of Energy's Better Buildings Neighborhood Program (BBNP) provided \$508 million for residential, commercial, multifamily, and agriculture energy efficiency upgrades and improvement programs across the U.S. beginning in 2010, utilizing funding from the American Recovery and Reinvestment Act. BBNP awarded grants ranging from \$1.4 million to \$40 million to 41 state and local governmental entities. These grantees worked with nonprofits, energy efficiency experts, financial institutions, utilities, and other organizations to develop community-based incentive and financial programs for achieving building energy upgrades. Each grantee proposed, and implemented, its own program design to deliver energy efficiency within its designated jurisdiction.

Nexant, Inc. and Evergreen Economics completed a preliminary impact evaluation of BBNP in October, 2013 that detailed quantitative estimates of BBNP's energy savings for projects completed from the onset of programmatic activities through the second quarter of 2012. A final impact evaluation is currently underway which will evaluate the impacts of BBNP from second quarter 2012 through the end of the grant period. The impact evaluation consists of both measurement and verification activities as well as a billing regression analysis.

The evaluation utilized unique methods and approaches due to the program's unprecedented scale of funding and the varied scope of program offerings. This paper will detail the overall findings of the preliminary impact evaluation and will discuss how these findings and lessons learned influenced the approach and methodology utilized in the final evaluation.

## **Introduction**

Nexant and Evergreen Economics (evaluation team) are part of a team of consultants retained by the Lawrence Berkeley National Laboratory (LBNL) and the U.S. Department of Energy (DOE) to conduct a comprehensive evaluation of DOE's Better Buildings Neighborhood Program (BBNP). The evaluation team is tasked with verifying the energy and economic impacts of BBNP, which included the following components:

- A preliminary impact evaluation focusing on the early grantee projects and including a limited market effects analysis.
- A final impact evaluation focusing on all grantee projects, including a limited market effects analysis.

This document presents the study methodology used and findings from the preliminary impact evaluation of the BBNP for the preliminary impact evaluation period (fourth quarter 2010 through second quarter 2012). The methods used for the evaluation include the use of utility

billing regression analysis and measurement & verification in order to quantify energy savings and associated metrics such as cost savings and GHG emission reduction for the single family residential and commercial sectors. While many grantees also provided services to the multifamily and agricultural sectors, these were not analyzed as part of the evaluation due to a lack of available data.

## Better Buildings Neighborhood Program

BBNP is one of many programs funded through the American Recovery and Reinvestment Act of 2009. Total funding under BBNP was approximately \$508 million for energy efficiency upgrades and improvement programs for the residential, commercial, multifamily, and agriculture sectors. The state and local governmental entities that were awarded the grants worked with nonprofits, energy efficiency experts, financial institutions, utilities, and other organizations to develop community-based programs and incentives for building energy upgrades. Each grantee proposed, and implemented, its own program design to deliver energy efficiency within its designated jurisdiction. The three BBNP objectives are:

1. Initiate building energy upgrade programs that promote projects estimated to achieve energy savings in more than 40 communities.
2. Demonstrate more than one sustainable business model for providing energy upgrades to a large percentage of the residential and/or commercial buildings in a community.
3. Identify and spread the most effective approaches to completing building energy upgrades that support the development of a robust retrofit industry in the United States.

BBNP seeks to increase the overall energy efficiency of residential and nonresidential facilities through home and building assessments, a trained workforce, and through financing and incentives that lead to energy efficiency upgrade projects. The DOE provided the evaluation team access to databases detailing the performance of the grantees from the time the grants were awarded in August 2010 through Q2 2012. Table 1 outlines the reported achievement through Q2 2012. The reported energy savings resulted from programs spanning four different sectors served by the grantees: residential, commercial, multifamily, and agriculture. The DOE reports total energy savings as *source* energy savings in million British thermal units (MMBtus). Source energy savings represent the sum of the savings at the facility (often referred to as *site* savings) and the savings from the energy not having to be extracted, converted, and transmitted to the facility due to the energy efficiency or renewable energy project.

Table 1. BBNP reported progress through Q2 2012

Metric	Through Q2 2012 Result	Overall Program Budget/Goal	Percent Total Achieved
Spending	\$245.7 million	\$508 million	48%
Projects	32,254	172,792	19%
Grantees with Projects	40	41	98%
Total Reported Energy Savings (Source)	1,876,327 MMBtu	—	—
\$/MMBtu Saved (Source)	\$130.9/MMBtu	—	—

Table 2 provides the energy savings breakdown between sectors. As the table shows, the residential sector accounted for 86% of the projects, but only 60% of the savings. The commercial sector accounted for only 4% of the projects, but nearly 36% of the savings.

Table 2. Reported BBNP projects and energy savings through Q2 2012

Sector	Number of Projects Implemented	Percent of Total Projects	Total Source Energy Savings (MMBtu)	Percent of Portfolio Savings
Residential	27,742	86%	1,116,160	59.5%
Multifamily	3,119	9.7%	83,839	4.5%
Commercial	1,334	4.1%	667,108	35.6%
Agriculture	59	0.2%	9,220	0.5%
BBNP Total	32,254	100%	1,876,327	100%

## Evaluation Objectives

The overall objective of the preliminary impact evaluation was to develop independent, quantitative estimates of BBNP’s economic impacts and energy savings for projects completed from the onset of programmatic activities through Q2 2012. Additionally, the evaluation team sought to provide lessons learned and recommendations to DOE and the grantees that wish to continue their programs after the grant funding has ended. We used the preliminary evaluation findings to inform the final impact evaluation activities, which are currently underway.

In order to determine the estimated energy and cost savings, the team collected data from a sample of projects across a sample of grantees in addition to utility billing data where available. These data, along with other information gathered as part of the activities, were utilized to determine gross and net impacts. These activities were not intended to be an evaluation of the individual grantees, which would require a much greater level of sampling, data collection, and overall effort. As a result, the evaluation report does not document or present specific findings and impacts attributable to individual grantee programs. Table 3 presents the key metrics measured as part of this evaluation in an effort to gauge results through Q2 2012.

Table 3. Key Metrics

Key Metric	Description
No. of Energy Units Saved—by Project, by Program	These units include annual and lifetime kWh, kW, therms, gallons of oil, and MMBtus, and is weather-normalized.
Costs Saved – by Project, by Program	This includes the value of annual and lifetime energy savings, at current customer costs.
No. of Households/ Businesses Retrofitted	These totals are based on the tracking data provided from grantees and verified for a sample of projects.
No. of Jobs Created/ Retained	This is measured in person-years of employment and is based on surveys and modeling the impacts against a base case scenario.
Economic Output	This is based on modeling the impacts against a base case scenario.
Personal and Business Income	This is based on modeling the impacts against a base case scenario.

Tax Revenue	This is based on modeling the impacts against a base case scenario.
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## Energy Impact Evaluation Methodology

The evaluation of BBNP was challenging due to the program’s significant scope, size, and reporting methodology. Grantees collected and reported a wide range of information, and the team needed to implement a flexible methodology that handled the variety of information that was available. The impact evaluation consisted of three high-level activities to determine verified energy savings of the programs offered by the grantees:

- Measurement and verification (M&V) of a sample of grantees and projects. M&V activities were conducted to determine gross verified energy savings through a combination of file reviews, telephone surveys, on-site inspections, and engineering analysis of projects. Because it was not cost-effective to complete analysis and site inspections on a census of the programs and the program projects, we verified savings for a representative sample of projects.
- Billing analysis on projects from grantees with sufficient utility bill data. The evaluation team also conducted a billing analysis to estimate realized energy savings at the project level. The scale of this billing analysis depended on the availability of sufficient pre and post-installation utility billing data for a large enough sample of end-use customers to support a regression model.
- Net-to-Gross (NTG) analysis on the M&V sample population. We conducted attribution surveys on the same sample population that received M&V activities. Surveys were conducted via telephone with the goal of understanding participant behavior and actions due to the program influence.

The preliminary impact evaluation utilized data from multiple sources: grantee databases, DOE databases and utility billing data. For the M&V activities and NTG analysis, surveys were conducted with over 300 residential and commercial project participants across a sample of 36 grantee locations. We completed billing analysis for four grantees and over 2,200 participants<sup>1</sup>. Ultimately, the evaluation team combined the results from all activities and extrapolated to the population in order to determine the overall verified energy savings estimated for BBNP.

## Economic Impact Methodology

The goal of an economic impact analysis of energy efficiency programs is to provide useful, action-oriented information to policymakers and program managers, and to inform interested stakeholders and the public. At the national level, an economic impact analysis can be used to examine the effect of changes made to various public programs and policies, as well as the adoption of new technologies on the local economy. To that end, the economic impact analysis should: 1) rely on program-specific data whenever possible; 2) be based on a reliable and transparent modeling framework; 3) fully document the modeling approach, and the assumptions and limitations of that approach; and 4) report the full range of economic impact

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<sup>1</sup> The evaluation team worked with DOE and NREL to obtain billing data. The DOE periodically requests billing data from the grantees, however, due to the challenges associated with obtaining utility bills from the local utilities, many grantees were unable to collect these data

results and produce economic impact metrics that policy makers can use to improve program performance or affect program outcomes.

Measuring the economic impacts estimated for BBNP was a complex process, as spending by grantees and program participants unfolded over time. From this perspective, the most appropriate analytical framework for estimating the economic impacts was to classify them into short-term and long-term.

- Short-term impacts are associated with changes in business activity as a direct result of changes in spending (or final demand) by program administrators, program participants, and institutions that provide funding for energy efficiency programs.
- Long-term impacts are associated with the potential changes in relative prices, factor costs, and the optimal use of resources among program participants, as well as industries and households linked by competitive, supply-chain, or other factors.

The analysis conducted for the preliminary evaluation measured the short-term economic impacts approximated for BBNP. These impacts are driven by changes (both positive and negative) in final demand, and were measured within a static input-output modeling framework that relies on data for an economy at a point in time and assumes that program spending does not affect the evolution of the economy<sup>2</sup>. Input-output models involve mathematical representations of the economy that describe how different parts (or sectors) are linked to one another. To conduct this modeling, the team relied on an economic impact model of the US economy constructed using the IMPLAN (IMPACT Analysis for PLANning) modeling software<sup>3</sup>.

Energy efficiency programs may have longer lasting effects, and this is clearly the case for continued post-installation energy savings. However, the team did not measure long-term, dynamic effects in this analysis, as it is unlikely that BBNP is causing significant structural changes to the economy given the small magnitude of energy savings achieved relative to the overall size of the national economy.

## Evaluation Challenges

The preliminary impact evaluation attempted to verify the savings of a \$500 million program that allocated resources to varied programs across the country. The challenges associated with this task were significant and affected the team's ability to conduct this evaluation. Throughout the implementation activities, the team developed strategies based on cost, availability of data, and feasibility of the timelines. While these challenges presented risks to the validity of the study, the team worked to mitigate these risks through planning and the implementation of a sound evaluation methodology. The main challenges included:

- Difficulty interpreting grantee data
- Inaccuracies of DOE reported metrics
- Lack of or delayed grantee responsiveness
- Limited value of participant phone verification surveys

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<sup>2</sup> This last event is what economists call a change in the "production possibilities frontier" of the economy.

<sup>3</sup> MIG, Inc. 2011. IMPLAN System (data and software). Hudson, WI.: MIG, Inc. ([www.implan.com](http://www.implan.com)).

- Large scope and broad scale of the grantee programs

### **Difficulty Interpreting Grantee Data**

The grantees were responsible for submitting metrics associated with project impacts and program operation on a quarterly basis to DOE. However, the grantees were allowed to utilize varying methods for tracking and quantifying savings, which created a number of challenges associated with understanding and interpreting their data. As a result, the evaluation team was challenged with understanding and verifying how the Grantees estimated energy savings. In order to calculate the estimated energy savings reported to DOE, grantees used a deemed approach, modeled approach or a combination of both. However, the inputs that were used in these calculations were often not available to the evaluation team. The evaluation team often had no insight into the methodology for the original calculation of savings and, therefore, could not easily identify potential reasons for discrepancies between verified savings and reported savings.

Other challenges resulted from the fact that grantees had two options for reporting savings to DOE. These two reporting options resulted in DOE receiving very different levels of information and, therefore, a separate methodology was implemented by DOE to capture the required information. In addition, all of the grantees tracked project information differently and maintained varying levels of information regarding project implementation activities. Some maintained only tracking databases with a limited level of information, while others kept detailed project records complete with rebate applications or invoices. This variety of information created challenges in verifying measure specific details at all of the project sites for some grantees.

### **Inaccuracies of DOE Reported Metrics**

DOE depends on quarterly reporting from the grantees in order to determine the energy savings, cost savings and number of implemented projects across all the grantees. However, during the course of this evaluation, the team uncovered reporting issues that resulted in inaccuracies in the reported savings and project totals. There appeared to be a number of reasons for the inaccuracies:

1. Grantee reporting errors. There were cases of grantees reporting project details in the wrong fields, projects with missing data, double counting, or projects listed in the wrong sector.
2. DOE database upload inconsistencies. DOE uploaded the grantee project data into the overall program database. However, inconsistencies occurred during the upload process that created differences between what was reported and what was uploaded.
3. Fuel conversion calculation errors. Grantees occasionally did not report fuel savings in the units requested by DOE, which led to conversion and reporting errors in the database.

### **Delayed or Lack of Grantee Responsiveness**

The evaluation team worked closely with each sampled grantee in attempts to obtain the project-level data needed to conduct the evaluation. During the data request process, grantees were often found to be delayed in their responsiveness, and some grantees simply did not respond to our inquiries. The team learned quickly that the main reason for the hesitation of the grantees to provide the requested information was due to privacy concerns. Grantees were

concerned with sharing participant contact information and project-level data to the evaluation team for purposes of the evaluation. After the evaluation team outlined the numerous procedures employed to ensure the confidentiality of the data received, including secure FTP sites and confidentiality agreements, most of the grantees did provide the team with the requested information, but a few grantees did refuse to share any participant or project-level information outside of what they report directly to DOE.

The delay in and/or lack of responsiveness impacted the evaluation team's ability to achieve the goals established in the preliminary impact evaluation plan for both the M&V activities and the billing analysis. While the team selected a significant number of alternate samples, the elimination of those grantees that did not provide the requested information impacted the team's ability to recruit sufficient numbers of projects in the timeframe of the preliminary evaluation. This was especially significant in the commercial sector where unresponsive grantees made it extremely difficult to re-allocate the necessary amount of samples to the remaining grantees due to the much smaller sample frame. Additionally, in the multifamily sector, unresponsive grantees prevented the team from being able to evaluate this sector for the preliminary evaluation.

### **Limited Value of Participant Phone Verification Surveys**

The use of phone surveys of program participants in order to verify the installation of single measures is a common evaluation practice. As part of the approach for the M&V activities, the evaluation team implemented phone surveys at approximately 300 residences and businesses. While the phone surveys were useful in verifying overall project participation and obtaining attribution information, the evaluation team encountered challenges verifying several aspects of the participant's project. First, there was often uncertainty in regards to which program funded the measures that a participant implemented, as many participants may have participated in multiple funding programs or implemented measures at different points over the two-year time period. We also found that specific measure details installed as part of the project often could not be obtained through the phone surveys. For example, in many cases, there had been a significant time lapse from project implementation to the phone survey (often ~2 years), which impacted the ability of the participants to remember the details of the measures that they implemented, and especially the baseline condition that existed prior to implementation. Additionally, many of the participants had multiple measures installed, some of which included air sealing or insulation, which have specifications that are difficult to remember (i.e., R-values for insulation).

### **Large Scope and Broad Scale of Grantee Programs**

Often, evaluations of efficiency programs involve analyzing a specified set of measures across the territory of one utility and developing verified savings based on these known conditions. However, BBNP's large scope and broad scale of the programmatic offerings created challenges in establishing a consistent methodology for verifying energy savings. There was a wide variety of measures offered across the various grantees' programs and the scope of implementation of these measures within each grantee's region was unknown before the analysis. Additionally, grantees utilized different methodologies to calculate the savings associated with the measures in a wide range of climatic conditions in the grantee regions.

## Addressing Evaluation Challenges

The evaluation team took steps to mitigate the inaccuracies and bias that the challenges listed above can have on the evaluation findings, these steps are outlined below:

- **Data quality and inaccuracies.** The evaluation team often used a triangulation approach to determine sources of inconsistency, areas of concern, and overall quality of the data received from DOE and the grantees. We worked with representatives from DOE and NREL to correct errors, understand underlying issues, and interact with the grantees to correct issues. While many data quality issues could be resolved through these discussions, there were still some reporting inaccuracies that could not be resolved and in these instances, the evaluation worked with the values provided by DOE.
- **Non-response bias.** The evaluation team encountered instances of non-response from both grantees and participants. However, we did take careful steps to minimize the non-response risk. Grantees were contacted numerous times for data, and most grantees eventually provided the team with the necessary data. For those grantees that did not provide data, the samples from their location were reallocated to grantees within the same stratum. During the phone verification surveys, potential participants were called at least three times at varying times during the day/evening to obtain participation. In addition, incentives were offered for participants who agreed to participate in the on-site surveys.
- **Large scale and scope of BBNP.** After discussions with grantees and DOE, the evaluation team determined that there was a strong likelihood for a larger deviation in reported savings. In order to address this issue, when setting the sample size for the evaluation, we set the coefficient of variance (CV<sup>4</sup>) at 1.2 for the overall BBNP. Utility evaluations generally use a CV of .5 for the majority of evaluations, as their programs are generally focused on specific measures and have established standardized reporting and measurement procedures. By establishing a higher CV, we acknowledged the challenges listed above and selected a larger sample size to account for the perceived higher variability in the reported results.
- **Measurement error.** In order to reduce the possibility of measurement error, the evaluation team utilized a triangulation approach to the review of project data. We used grantee-provided project data, DOE reports, phone surveys and in the applicable cases, on-site surveys to capture project implementation activities. While the inputs and assumptions were not provided to the team to determine issues with grantee calculation of ex ante savings, the team developed an approach to the calculation of savings that strived for consistency and clearly factored in regional/state specific data for the calculation of verified savings.

## Energy Impact Findings

The evaluation team estimated gross verified savings and realization rates for the residential and commercial sectors using results from the M&V activities and the billing analysis regression as well as the energy savings reported by DOE. We calculated the net verified savings

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<sup>4</sup> In probability theory and statistics, the coefficient of variation (CV) is a normalized measure of dispersion of a probability distribution or frequency distribution, also defined as the ratio of the measure of variability to the average about which the variation occurs.



using customer attribution surveys. Savings are presented as source energy savings in million British thermal units (MMBtu) as this is how DOE reports savings. Table 4 outlines the overall energy savings reported by BBNP and those verified by the evaluation team through Q2 2012.

Table 4. BBNP reported and verified gross and net energy savings through Q2 2012

Sector	Reported Projects	Reported Source Savings (MMBtu)	Realization Rate (%)	Gross Verified Source Savings (MMBtu)	NTG Ratio	Net Verified Source Savings (MMBtu)	Confidence / Precision <sup>5</sup>
Residential	27,743	1,116,160	79%	883,999	83%	733,816	90/7
Commercial	1,333	667,108	106%	706,545	92%	646,888	90/12
Multifamily <sup>6</sup>	3,119	83,839	—	—	—	—	—
Agricultural	59	9,220	—	—	—	—	—
Total	32,254	1,876,327	—	1,590,544	—	1,380,704	90/7

One of the goals of this evaluation was to achieve 90% confidence and 10% precision of the results at the overall BBNP level. As shown in Table 4, the evaluation activities achieved 90% confidence and 7% precision for BBNP.

Due to challenges and inconsistencies in determining the verified program level cost savings, the team applied the sector-level realization rates and NTG ratios to the reported cost savings in order to calculate the net BBNP cost savings, as outlined in Table 5.

Table 5. Annual Reported vs. Verified Net Cost Savings

Sector	Reported Annual Cost Savings (\$)	Realization Rate (Percent)	Net-to-Gross Ratio	Net Annual Cost Savings (\$)
Residential	\$ 17,415,485	79%	83%	\$ 11,449,760
Commercial	\$ 7,140,893	106%	92%	\$ 6,924,457
Multifamily	\$ 512,412	—	—	—
Total	\$ 25,068,790	—	—	\$18,374,217

### Issues that Impacted the Energy Impact Findings

Over the course of the M&V and billing analysis activities, the team uncovered issues impacting the gross verified findings. The following describes our understanding of the main reasons for some of the largest discrepancies:

<sup>5</sup> Confidence and precision statistics were calculated for the sampling error of the M&V and billing analysis studies, and are therefore applicable to the gross savings. Confidence and precision were calculated in accordance with the California Evaluation Framework and take into account the variability in the realization rates.

<sup>6</sup> The multifamily and agricultural sectors were not included in the evaluation activities due to a small amount of activity and a lack of data provided by grantees to the evaluation team. Therefore, verified savings totals do not include savings from these two sectors.

1. *No reported savings.* Approximately 7% of the projects in the M&V sample achieved savings, but were reported by the respective grantee to have zero savings.
2. *Measures installed and not reported.* The team encountered many grantee projects with incomplete measure reporting. This reduced the amount of savings that the grantee should have credited for these projects.
3. *More measures reported than verified.* Conversely, there were also cases of measures reported as installed, where the M&V activities verified that they were not installed. This often occurred where recommended measures from an audit were counted as installed.
4. *Overstatement of savings.* In a few cases, the team identified issues where the energy savings being reported by the grantee were more energy than was actually consumed by a typical customer. This likely was due to energy modeling issues, but because the models could not be calibrated or the inputs verified, it was difficult to know the exact reasons.
5. *Fuel type reporting issues.* There were cases where grantees reported fuel type savings incorrectly, either by listing the wrong fuel type or listing the wrong units (i.e., MMBtu instead of gallons).
6. *Lack of billing data.* As part of the grant specifications, grantees were supposed to provide DOE with utility billing data from all participants. However, due to difficulty in obtaining these bills from the local utilities, many grantees were not able to provide the utility bill data or the data were insufficient to conduct a statistically significant analysis. Additionally, it was difficult to obtain any billing information for fuel types other than electricity and natural gas (e.g. propane and fuel oil).

## Economic Impact Findings

Table 6 reports the gross economic and fiscal impacts, by type, associated BBNP spending and energy savings between Q4 2010 and Q2 2012. To be consistent with the secondary job impacts, the table reports direct job impacts for the period in person-years of employment<sup>7</sup>.

Table 6. BBNP gross direct economic and fiscal impacts, by type, Q4 2010–Q2 2012

Impact Measure	Direct	Secondary	Total
Output (\$ millions)	\$408.0	\$662.7	\$1,070.7
Personal Income (\$ millions)	\$171.4	\$205.5	\$376.9
Jobs (person-years)	2,582	4,099	6,681
State and Local Taxes (\$ millions)	\$11.2	\$31.1	\$42.2
Federal Taxes (\$ millions)	\$25.9	\$42.5	\$68.4

<sup>7</sup> The IMPLAN modeling software reports jobs in “person-years” of employment where one person-year of employment is equivalent to one person being employed for the duration of one year, two people being employed for half a year each, etc. Furthermore, each “person-year” of employment can represent a new job being created or an existing job from a previous year being sustained for an additional year. It is necessary to employ the use of person-years of employment when measuring jobs to emphasize the temporary nature of program-related employment. In the case of these BBNP programs, the initial employment will last as long as program funding is available to encourage the installation of energy efficient equipment, however, longer-term employment gains also occur due to energy cost savings enjoyed by customers over the life of the equipment.

On a total gross basis, BBNP is linked to almost \$1.1 billion in economic activity, including \$376.9 million in personal income, 6,681 person-years of employment, \$42.2 million in state and local tax revenues, and \$68.4 million in federal tax revenues between Q4 2010 and Q2 2012. These impacts include:

- Direct impacts of \$408.0 million in economic activity, including \$171.4 million in personal income and 2,582 person-years of employment (full-time equivalent). In addition, this economic activity directly generated \$11.2 million in state and local tax and fee revenues, and \$25.9 million in federal tax and fee revenues.
- Secondary impacts associated with supply-chain and consumption-driven spending linked to BBNP consisting of \$662.7 million in output, including \$205.5 million in personal income and 4,099 person-years of employment. This secondary spending and activity is associated with \$31.1 million and \$42.5 million in tax and fee revenues for state and local, and federal governments, respectively.

BBNP is supported by funds through ARRA. These funds could have been re-directed and used to support other federal government programs. To account for this, the gross economic impacts were adjusted for foregone federal government spending on non-defense programs based on the total outlays incurred between Q4 2010 and Q2 2012. These *net impacts* reflect economic benefits over and above what would have occurred had BBNP not existed. The total gross and net impacts estimated for BBNP are reported in Table 7.

Table 7. BBNP total economic and fiscal impacts, gross and net, Q4 2010–Q2 2012

Impact Measure	Total Gross Impacts	Total Net Impacts
Output (\$ millions)	\$1,070.7	\$655.6
Personal Income (\$ millions)	\$376.9	\$155.4
Jobs (person-years)	6,681	4,266
State and Local Taxes (\$ millions)	\$42.2	\$24.3
Federal Taxes (\$ millions)	\$68.4	\$30.1

Together, spending and energy savings associated with BBNP supported, on a net basis, \$655.6 million in output, including \$155.4 million in personal income, 4,266 person-years of employment, \$24.3 million in state and local tax revenue, and \$30.1 million in federal tax revenues between Q4 2010 and Q2 2012. To these one-time impacts, the team included the economic benefits attributed to energy cost savings that persist over the short term. Over a five-year, post-installation time period, those impacts amounted to \$309.0 million in output, including \$97.0 million in personal income, 2,100 person-years of employment, \$15.9 million in state and local tax revenues, and \$21.4 million in federal tax revenues. Table 8 shows these future year net impacts.

Table 8. BBNP total economic and fiscal impacts, program and future year

Impact Measure	Program Year Net Impacts (Q4 2010 – Q2 2012)	Future Year Net Impacts (Q3 2012 – Q3 2015)
Output (\$ millions)	\$655.6	\$309.0
Personal Income (\$ millions)	\$155.4	\$97.0
Jobs (person-years)	4,266	2,100
State and Local Taxes (\$ millions)	\$24.3	\$15.9
Federal Taxes (\$ millions)	\$30.1	\$21.4

## Key Lessons Learned

The goal of the preliminary impact evaluation was to verify the savings of a \$500 million program that allocated resources to varied energy efficiency programs across the country. While navigating the challenges presented earlier, we learned many lessons that will help shape future programs that may be offered through a comparable grant process. In addition, these lessons aided in the planning and development of the final impact evaluation activities currently underway. The following is a summary of the key lessons learned.

- *Evaluators need to be flexible.* Actual evaluation activities diverged from the evaluation plan based on additional and revised information obtained from the grantees. Many grantees provided periodic project updates that adjusted savings and project counts throughout the evaluation activities. The team had to be flexible in our sampling strategy (for both the M&V and billing analysis) and carefully make adjustments based on these updates and revisions in order to maintain a valid data set and evaluation analysis.
- *Allow sufficient time to request and gather data from the grantees.* Grantees are busy, and unlike most utility-funded efficiency program managers, they are not equipped with the tools and databases to easily extract participant and project level information. In addition, grantees are frequently understaffed, so making clear and concise data requests is necessary to help speed up the response time and alleviate any concerns or questions that they may have regarding data needs.
- *Phone verifications had limited value.* Phone verifications are standard practice in many utility-funded impact evaluations. While the phone surveys were useful in verifying overall project participation and obtaining attribution information, the evaluation team determined that the phone verifications utilized for the M&V activities for nationwide program such as BBNP proved to have limited value due to factors such as: difficulty for participants to gather key data on measures implemented, confusion regarding the measure funding source (BBNP or local utility program), and uncertainty surrounding baseline and new equipment.
- *On-site verifications were valuable.* While on-site surveys encounter some of the same issues with reliability as the phone surveys, the on-site surveys were valuable in obtaining a greater level of detail regarding project implementation than could be obtained during phone verifications and file review.
- *The importance of the design and enforcement of proper reporting processes.* The design of proper reporting processes and concise yet all-inclusive data capturing procedures is crucial to the success of any program of this scale and magnitude. In addition, this lesson can be carried into energy efficiency program design, both for utility-funded structures

and for non-utility structures, such as those that exist in BBNP. Designing a reporting structure that captures the basic data effectively and accurately is essential to a successful program both in the near term and the long term. Clear reporting procedures lead to a better understanding of the program effects both in the context of energy savings and the proper use of resources. This, in turn, helps lead to better program design in the future and greater program success.

## **Recommendations**

The lessons learned by the evaluation team led to several recommendations that were utilized for the planning and design of the final impact evaluation. In addition, these lessons informed the recommendations for DOE and the grantees when/if programs of a similar nature are offered in the future.

### **Recommendations for the Final Evaluation**

- Reduce participant telephone surveys, and conduct more participant on-site visits. The team doubled the number of site visits while reducing the phone surveys by half.
- Ensure the sampling strategy accounts for the end of each grantee's funding cycle by appropriately scheduling necessary data collection activities. The team worked with grantees to obtain the needed data before the grantee date closeouts.
- Overlap billing analysis and M&V sample frames. In the preliminary evaluation, these two efforts were applied separately to different populations of grantees in an effort to reach a larger number of grantees, however, this separation of populations made the combination of results difficult. For the final evaluation, these efforts will overlap which will help the team understand potential differences that might arise between the evaluation methodologies.
- Develop cost effectiveness tests that will provide useful comparisons to similar type programs.

### **Recommendations for DOE**

- Conduct more investigation into the savings of unresponsive grantees.
- Investigate opportunities for increasing reported measure accuracy by continuing to provide support to grantees where there appears to be insufficient QA/QC.
- Work with grantees to reduce or eliminate the reporting of zero savings values for projects that indeed achieved energy savings.
- Compile a final dataset to be used for all reporting and analysis in the final evaluation.
- Plan and develop a comprehensive and easy to use data tracking and reporting system. Efforts could be tied in with other ARRA programs to create consistency in reporting across all similar federally-funded programs.
- Assess requiring grantees provide timely and accurate progress reports in order to receive funding.
- Require consistent documentation procedures across all grantees and programs.