Assessing the Economic Impacts of Publicly Funded Investments in Energy Efficiency Programs

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ABSTRACT

The Impact Analysis for Planning (IMPLAN) model characterizes spending patterns and relationships between households and industries, and it allows for the comparative analysis of different spending scenarios. This paper analyzes findings from an IMPLAN modeling study of economic impacts associated with a $26.1 million American Recovery and Reinvestment Act of 2009 (ARRA) investment in a portfolio of energy-efficiency programs, administered in eight Southeast states, relative to impacts from alternative, hypothetical spending scenarios. Specifically, the paper compares the estimated employment, employee compensation, and other economic impacts from energy efficiency investments to impacts from equivalent public investments in supply-side energy infrastructure, solar and wind renewable energy infrastructure, and key regional manufacturing sectors. The study findings suggest the ARRA investment in energy efficiency programs resulted in greater total economic impacts than alternative spending scenarios, and that jobs created as a direct result of 2010–2013 program activities offered higher wages than current regional averages.

Introduction

This paper compares the employment, employee compensation, and other economic impacts from publicly funded investments in energy efficiency to impacts from alternative, equivalent investments in supply-side energy infrastructure, renewable energy infrastructure, and key regional manufacturing sectors. Supported by approximately $26.1 million of American Recovery and Reinvestment Act of 2009 (ARRA) funds,[1] the U.S. Department of Energy (DOE) worked with the Southeast Energy Efficiency Alliance (SEEA)[2] from 2010–2013 to develop and deliver Better Buildings Neighborhood Programs (BBNP), which supported energy-efficient upgrades to homes and other buildings (DOE 2013). For this study, we estimated employment, employee compensation, and other economic impacts resulting from 11 BBNP programs, operating from 2010–2013 in eight states. We conducted the analysis using Impact Analysis for Planning (IMPLAN) v3.1 modeling software,[3] an input/output (IO) tool that characterizes spending patterns and relationships between households and industries. Table 1 summarizes the 11 BBNP programs included in our analysis.

Table 1. BBNP Programs Administered by SEEA, 2010–2013

Program Name	State	City	Year(s)
Huntsville WISE	AL	Huntsville	2011–2013
ShopSmart with JEA	FL	Jacksonville	2011–2012

[1] $26.1 million is approximately 0.9% of Southeast's 2011 gross regional product.
[2] Southeast Energy Efficiency Alliance: http://www.seealliance.org/
[3] IMPLAN Group, LLC. IMPLAN System (data and software). 16740 Birkdale Commons Parkway, Suite 206, Huntersville, NC 28078: http://implan.com

Atlanta SHINE	GA	Atlanta	2010–2013
Decatur WISE	GA	Decatur	2011
NOLA WISE	LA	New Orleans	2011–2013
Carrboro WISE	NC	Carrboro	2011–2013
Chapel Hill WISE	NC	Chapel Hill	2011–2013
Charleston WISE	SC	Charleston	2011–2013
Nashville Energy Works	TN	Nashville	2011–2013
LEAP	VA	Charlottesville	2011–2013
NEXT STEP Program	VA	Hampton Roads	2011

We then compared the economic impacts resulting from 2010–2013 BBNP program activities to the impacts from counterfactual, equivalent investments in the following: supply-side energy infrastructure; renewable energy infrastructure; and the top 10 manufacturing sectors in the Southeast.[4]

This paper summarizes our analytical approach and findings, first reviewing analysis methods used—including an overview of the IMPLAN model, a discussion of cash flows modeled, and details regarding data utilized throughout the analysis. We then present findings in the following order: (1) gross BBNP program and counterfactual baseline scenario impacts; (2) direct BBNP program and counterfactual baseline scenario effects on regional employment and employee compensation; and (3) net BBNP program impacts relative to the supply-side energy infrastructure scenario, the renewable energy infrastructure scenario, and the top 10 manufacturing sector scenario. Finally, we present our conclusions.

Modeling Economic Impacts with IMPLAN

Using static economic multipliers relating regional households and industries, IMPLAN analyzes user-defined inputs to estimate impacts on regional job creation, income, production, and taxes. For this analysis, static model assumptions were based on actual 2011 regional economic data.[5] We used multiple model scenarios to compare the effects of BBNP program-related spending on the Southeast economy to three counterfactual baselines where: BBNP programs would not exist; participant project funds would be diverted to typical spending and saving patterns inherent in the static model assumptions; and ARRA funds would be spent on equivalent $26.1 million investments in supply-side energy infrastructure, renewable energy infrastructure, and the top 10 regional manufacturing sectors. To estimate the relative net impacts associated with BBNP program activities completed from 2010–2013, we subtracted estimated impacts from each counterfactual baseline from impacts estimated from the BBNP program scenario.

We used IMPLAN to generate outputs of estimated economic impact through IO matrices, based on static 2011 regional economic data. These outputs included three types of economic effects:

1. ***Direct effects***, representing regional production changes brought by user-defined changes in final demand. For example, BBNP program marketing expenditures increase final demand for regional advertising services.
2. ***Indirect effects***, predicted by the model and resulting from changes in demand for the intermediate factor inputs necessary for directly affected industries to provide their primary

[4] For analysis purposes, the top 10 Southeast manufacturing sectors were those with the greatest number of employees located in the Southeast region in 2011 (the model base year).

[5] This study utilized static 2011 state-level baseline economic data from IMPLAN Group, LLC. We used 2011 as the model base year because it was the only year during the study period in which all 11 BBNP programs operated.

products. For example, an increase in final demand for advertising services might require a marketing firm to purchase additional office equipment. In this case, the indirect effects predicted by IMPLAN would represent impacts on the portions of the office equipment supply chain operating within the study region.

3. ***Induced effects***, predicted by the model and resulting from the ways households and employees of directly and indirectly affected industries spend money on regional goods and services. These effects describe impacts on regional industries not directly involved with the programs or supplying intermediate factor inputs. For example, a program participant may spend energy bill savings on a concert ticket. Though dollars flow to a completely unrelated industry (the entertainment industry), they remain associated with program effects.

For each model scenario, we used IMPLAN to estimate direct, indirect, induced, and total effects on multiple key economic indicators, including the following:

1. ***Employment*** represents the total number of annual average jobs created, in job-years.[6]
2. ***Labor income*** represents the sum of all forms of employment income, including employee compensation (i.e., wages plus benefits) and proprietor income.
3. ***Employee compensation*** represents the total cost of employees paid by employers, including wages plus benefits; it serves as the best indicator for estimating wage impacts.
4. ***Value added*** represents all profits (i.e., operating surpluses), indirect business taxes, and compensation of employees; it serves as the best indicator for estimating the marginal impact on regional domestic product.
5. ***Output*** equals value added plus intermediate expenditures, and represents the total value of industry production. In IMPLAN, these are annual production estimates for the model base year (i.e., 2011), presented as producer prices.

Modeled Cash Flows

To develop model inputs that accurately account for relevant economic activities, we identified all BBNP program and counterfactual baseline cash flows connecting regional stakeholder groups. As shown in Figure 1, these cash flows affected the Southeast economy in multiple ways:

1. **ARRA Funding.** Through the DOE, the Federal government distributed ARRA funds—assumed to originate outside the study region—for developing BBNP programs.
2. **Program Spending.** Program funds were then spent on in-house program administration activities as well as implementation; marketing; and evaluation, measurement, and verification (EM&V) services provided by program trade allies and partners.
3. **Incentives.** Funds also were spent on incentives that enabled program participants to invest in energy efficiency projects.
4. **Project Payments.** In addition to received incentives, program participants provided their own co-funding to complete payments for project goods and services.
5. **Energy Bill Reductions.** Participants saved energy as long as installed measures remained operational, thus benefitting from energy bill reductions, while utilities forwent those revenues.
6. **Avoided Utility Costs.** As a result of decreased demand for energy resources, regional utilities benefitted from avoided fuel, purchased power, variable O&M, and capacity costs.
7. **Alternative Publicly Funded Investments.** In the supply-side energy infrastructure scenario, ARRA funds provided the electric and natural gas utility sectors with new demand for generation, transmission, and distribution infrastructure development. In the renewable energy

[6] A job-year represents one job lasting one year, two jobs lasting six months each, and so on.

infrastructure scenario, public funds were spent on services and products from industries associated with solar and wind infrastructure development. Finally, in the top 10 manufacturing sector scenario, public funds provided each of the top 10 Southeast manufacturing sectors with a weighted portion of new demand.

8. **Alternative Participant Expenditures.** Figure 1 also illustrates participant expenditures on regional goods and services that would have occurred in the absence of the BBNP programs.

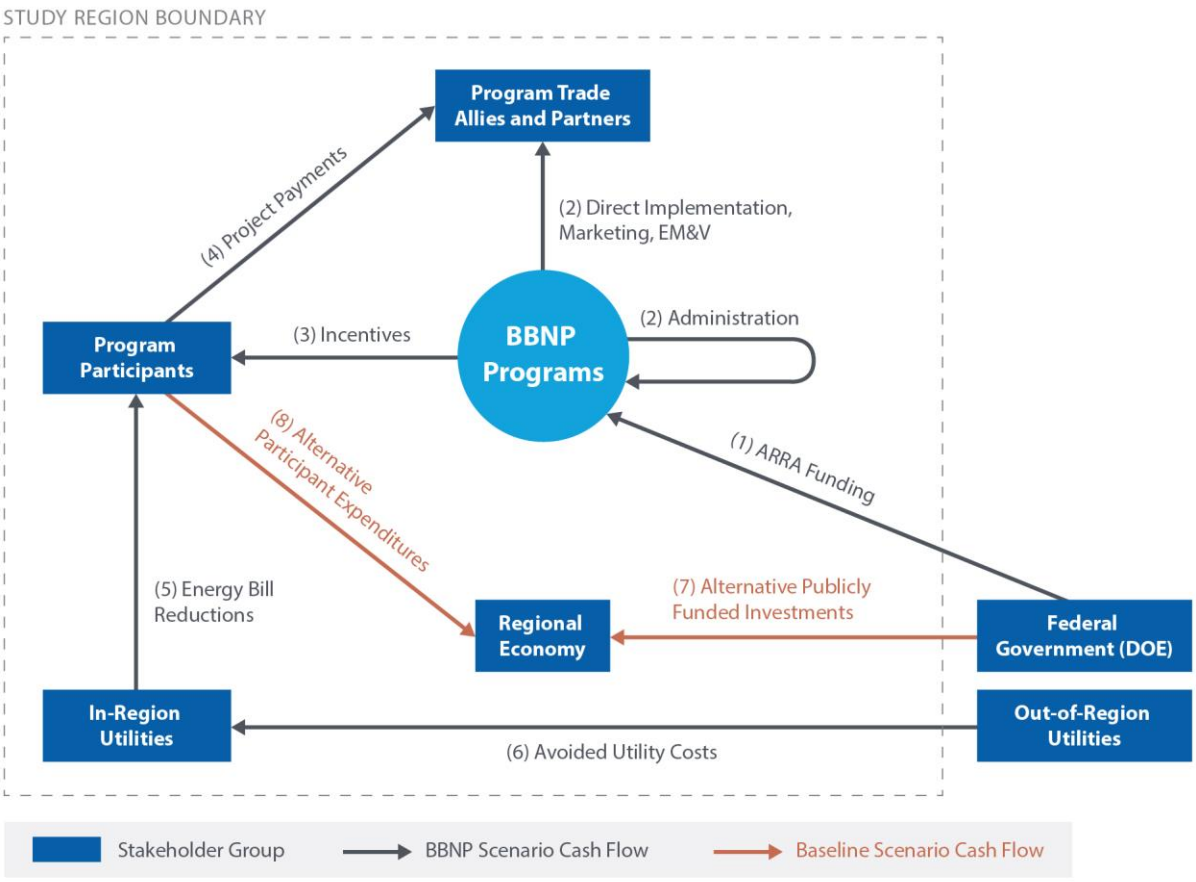

Figure 1. BBNP Program and Counterfactual Baseline Scenario Stakeholder Cash Flows

We adjusted all model inputs to 2011 dollars using the U.S. Department of the Treasury's 3.19% Daily Long Term Rate from July 3, 2013. (U.S. Department of the Treasury 2013) We used income distributions from the static 2011 baseline economic data to construct all model inputs describing changes in regional household income. We based first-year and future-year energy bill reductions and avoided utility costs on verified electricity (kWh), natural gas (therms), and capacity (kW) savings, determined via database reviews, billing analyses, technical desk reviews, building simulation models, and engineering analyses conducted through a separate Cadmus evaluation study (Cadmus 2013). The following sections provide additional details about the data used to develop model inputs.

ARRA Funding, Program Spending, and Incentives. To determine total BBNP program spending, which included payments to program trade allies and partners as well as incentive payments to program

participants, we worked with SEEA representatives to secure individual, ARRA-funded, BBNP program budgets. Table 2 presents total 2010–2013 spending by program.

Table 2. Total 2010–2013 BBNP Program Spending (2011 Dollars)

BBNP Program Name	State	City	Total Spending (2011 Dollars)
Huntsville WISE	AL	Huntsville	$2,182,160.28
ShopSmart with JEA	FL	Jacksonville	$1,740,996.44
Atlanta SHINE	GA	Atlanta	$2,345,348.24
Decatur WISE	GA	Decatur	$514,827.56
NOLA WISE	LA	New Orleans	$1,439,150.27
Carrboro WISE	NC	Carrboro	$443,087.72
Chapel Hill WISE	NC	Chapel Hill	$1,875,681.67
Charleston WISE	SC	Charleston	$689,301.01
Nashville Energy Works	TN	Nashville	$2,933,036.17
LEAP	VA	Charlottesville	$11,246,043.15
NEXT STEP Program	VA	Hampton Roads	$694,472.84
Total			$26,104,105.35

We reviewed annual categorical budgets to determine appropriate ratios for total 2010–2013 program spending on the following:

1. Administration (14.4%)
2. Implementation (49.1%)
3. Evaluation, measurement, and verification (7.7%)
4. Marketing (10.0%)
5. Travel (3.1%)
6. Incentives (15.7%)

Project Payments. Participants paid program trade allies and partners for goods and services necessary to complete projects. These project payments equaled the sum of incentives and participant co-funding. Neither the program budgets nor the program tracking data provided sufficient information about participant co-funding. Therefore, based on a review of BBNP program incentive rules, we assumed total participant co-funding equaled total program incentives received (i.e., 15.7% of $26.1 million, or approximately $4.1 million).

Energy Bill Reductions. Program participants reduced their energy consumption and saved on energy bills as long as energy-efficient measures remained installed and operational, while utilities forwent those revenues. We reviewed verified energy savings and measure life data to determine first-year and future-year energy savings associated with installed program measures. We then applied those savings to historical and projected electricity and natural gas retail prices from the U.S. Energy Information Administration (EIA) to estimate first-year and future-year energy bill reductions through 2032 (EIA 2013).[7]

[7] The study's maximum out-year was 2032, determined by the verified measure lives of installed program measures.

Avoided Utility Costs. Verified first-year and future-year reductions in energy consumption also resulted in avoided utility expenditures on fuel and system capacity. We used annual averages of regional monthly energy prices from the EIA as the basis for estimating avoided electric ($/MWh) and natural gas ($/therm) energy costs through 2032 (EIA 2013). For example, Table 3 shows 2010–2019 annual electric and natural gas avoided energy costs used in the analysis.

Table 3. Avoided Energy Costs, 2010–2019

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
$/MWh	$52.66	$47.49	$38.45	$41.87	$42.61	$43.91	$48.96	$50.99	$53.90	$55.75
$/therm	$0.59	$0.56	$0.43	$0.45	$0.47	$0.49	$0.51	$0.53	$0.55	$0.57

We used PJM Interconnection LLC[8] residual auction capacity prices to estimate first-year and future-year avoided utility capacity costs ($/kW-year) through 2032. For example, Table 4 shows annual avoided capacity costs—which fluctuate based on predicted changes in future regional capacity—for 2010–2019.

Table 4. Avoided Capacity Costs, 2010–2019

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
$/kW-yr	$63.62	$63.62	$40.15	$6.01	$10.12	$45.97	$49.14	$49.80	$50.43	$51.20

Alternative Publicly Funded Investments. For the supply-side energy infrastructure scenario, we modeled $13.05 million of new demand for electricity generation, transmission, and distribution infrastructure as well as $13.05 million of new demand for natural gas distribution infrastructure.

For the renewable energy infrastructure scenario, we modeled a total of $26.1 million of new demand for renewable solar and wind energy infrastructure across the following sectors: semiconductor and related device manufacturing (19.0%); maintenance and repair construction of nonresidential structures (15.0%); maintenance and repair construction of residential structures (15.0%); ferrous metal foundries (9.8%); miscellaneous electrical equipment and component manufacturing (7.6%); fabricated structural product manufacturing (4.6%); mechanical power transmission equipment manufacturing (3.6%); turbine and turbine generator set units manufacturing (3.2%); other plastics product manufacturing (2.9%); motor and generator manufacturing (2.9%); wiring device manufacturing (2.4%); plastics material and resin manufacturing (1.6%); plastics packaging materials and unlaminated film and sheet manufacturing (1.6%); flat glass manufacturing (1.6%); ornamental and architectural metal products manufacturing (1.6%); ball and roller bearing manufacturing (1.6%); speed changer, industrial high-speed drive, and gear manufacturing (1.6%); switchgear and switchboard apparatus manufacturing (1.1%); watch, clock, and other measuring and controlling device manufacturing (0.9%); copper rolling, drawing, extruding, and alloying (0.6%); storage battery manufacturing (0.6%); bare printed circuit board manufacturing (0.5%); and printed circuit assembly manufacturing (0.5%).

Finally, for the top 10 Southeast manufacturing sector scenario, we modeled a total of $26.1 million of new demand across the following sectors: construction of manufacturing structures (21.3%); motor vehicle parts manufacturing (20.2%); other plastics product manufacturing (9.6%); fabricated structural product manufacturing (8.2%); aircraft manufacturing (7.3%); paperboard container manufacturing (7.2%);

[8] A regional transmission organization, PJM serves most of Virginia and parts of North Carolina. Via auction, PJM's capacity market secures the appropriate amount of power supply resources needed to meet demand. http://www.pjm.com/

bread product manufacturing (7.0%); ornamental and architectural metal products manufacturing (7.0%); pharmaceutical preparation manufacturing (6.5%); and surgical supplies manufacturing (5.8%).

Alternative Participant Expenditures. In all three counterfactual baseline scenarios, we modeled increases in regional household income—distributed across nine income brackets according to static 2011 regional economic conditions—equal to participant co-funding payments included in the BBNP program scenario (approximately $4.1 million). Via spending and saving patterns inherent in the model assumptions, we used these changes in household income to estimate the induced economic effects that would have occurred in the absence of the BBNP programs.

Findings

This section presents study findings in the following order: (1) gross BBNP program and counterfactual baseline scenario impacts; (2) direct BBNP program and counterfactual baseline scenario effects on regional employment and employee compensation; and (3) net BBNP program impacts relative to the supply-side energy infrastructure scenario, the renewable energy infrastructure scenario, and the top 10 manufacturing sector scenario. We present all employment impacts in job-years, and we present employee compensation and all other fiscal impacts in 2015 dollars.

Gross BBNP Program and Counterfactual Baseline Scenario Impacts

We modeled BBNP program cash flows in IMPLAN to estimate gross direct, indirect, induced, and total effects associated with program activities conducted from 2010–2013 as well as persistent cost savings accrued through 2032. Although there is no timeframe component to IMPLAN outputs, direct effects mainly result from first-year changes in final demand, while indirect and induced effects mainly represent the present value of predicted impacts accruing over time. Within the study region, the BBNP programs produced a direct employment effect of 207 job-years and a direct employee compensation effect of approximately $11.7 million, or about $56,422 per job-year. Table 5 summarizes these and other gross effects for the BBNP program scenario.

Table 5. Economic Impact Summary, Gross BBNP Program Impacts

Impact Type	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	207	$14,149,760	$11,681,338	$12,658,425	$15,900,361
Indirect Effect	61	$2,914,109	$2,537,915	$3,988,714	$6,779,382
Induced Effect	358	$15,629,839	$13,480,997	$28,762,037	$49,650,370
Total Effect	627	$32,693,709	$27,700,250	$45,409,176	$72,330,114

We also modeled cash flows induced by three counterfactual baseline scenarios. Each counterfactual scenario accounted for alternative participant expenditures of project co-funding and one of three hypothetical public fund expenditures. The first baseline scenario analyzed gross impacts from a $4.1 million increase in regional household income and a $26.1 million ARRA investment in supply-side energy infrastructure. These modeled cash flows had a direct regional effect on employment of 25 job-years and on

employee compensation of approximately $2.8 million, or about $113,127 per job-year. Table 6 summarizes all gross economic impacts associated with this first counterfactual scenario.

Table 6. Economic Impact Summary, Gross Supply-Side Energy Infrastructure Impacts

Impact Type	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	25	$2,933,967	$2,827,276	$12,006,580	$26,104,106
Indirect Effect	38	$2,097,365	$1,694,053	$4,541,245	$8,420,153
Induced Effect	78	$3,419,934	$2,949,973	$6,286,424	$10,854,887
Total Effect	141	$8,451,266	$7,471,302	$22,834,248	$45,379,147

The second baseline scenario analyzed gross impacts from a $4.1 million increase in regional household income and a $26.1 million dollar investment in renewable solar and wind energy infrastructure development. These modeled cash flows had a direct regional effect on employment of 111 job-years and on employee compensation of approximately $5.4 million, or about $48,745 per job-year. Table 7 summarizes all gross economic impacts associated with this second counterfactual baseline scenario.

Table 7. Economic Impact Summary, Gross Renewable Energy Infrastructure Impacts

Impact Type	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	111	$6,701,034	$5,394,672	$11,356,255	$26,104,105
Indirect Effect	73	$4,208,130	$3,702,190	$6,797,260	$13,626,250
Induced Effect	123	$5,391,555	$4,651,208	$9,887,954	$17,082,789
Total Effect	307	$16,300,719	$13,748,069	$28,041,470	$56,813,145

The third and final baseline scenario analyzed gross impacts from a $4.1 million increase in regional household income and a $26.1 million investment in new demand for the top 10 Southeast manufacturing sectors. These modeled cash flows had a direct employment effect of 117 job-years and a direct employee compensation effect of approximately $6 million, or about $51,612 per job-year. Table 8 summarizes all gross economic impacts associated with this third counterfactual scenario.

Table 8. Economic Impact Summary, Gross Top 10 Manufacturing Sector Impacts

Impact Type	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	117	$6,386,664	$6,015,801	$8,817,605	$26,104,105
Indirect Effect	67	$3,939,888	$3,521,830	$6,417,298	$13,797,712
Induced Effect	119	$5,194,546	$4,481,191	$9,532,772	$16,467,015
Total Effect	303	$15,521,097	$14,018,822	$24,767,675	$56,368,832

Gross Direct Effects on Employment and Employee Compensation

Relative to all three counterfactual scenarios, the BBNP program scenario resulted in larger overall direct effects on regional employment and employee compensation. Table 9 summarizes these findings.

Table 9. Direct Effects on Regional Employment and Employee Compensation by Scenario

Scenario	Direct Effects	
	Employment	Employee Comp.
BBNP Programs	207	$11,681,338
Supply-Side Energy Infrastructure	25	$2,827,276
Renewable Energy Infrastructure	111	$5,394,672
Top 10 Manufacturing Sectors	117	$6,015,801

To determine if these direct effects resulted in jobs with competitive wages, we first divided employee compensation by job-years to determine average annual compensation per job by scenario. We then researched 2010 Census data from the United States Department of Labor's Bureau of Labor Statistics (BLS) to determine average annual compensation per job in the study region (BLS 2011). Specifically, we identified the average annual compensation per job in two 2010 Census regions within the study area: (1) East South Central; and (2) South Atlantic.[9]

As shown in Table 10, for all four model scenarios, average annual compensation per job created was higher than actual average annual compensation per job in the East South Central region; for three of the scenarios, average annual compensation per job created also was higher than actual average annual compensation per job in the South Atlantic region. These findings suggest at least three of the four investment scenarios generated jobs in the near term that compensated employees at a higher rate than typical jobs in the Southeast. This primarily resulted from directly affected sectors requiring skilled professionals or labor. For example, in the supply-side energy infrastructure scenario, increased final demand for energy generation, transmission, and distribution required highly skilled, well-paid engineering and construction professionals. In the BBNP program scenario, increased final demand for various specialized services required skilled consulting, marketing, and project implementation professionals. Finally, in both the renewable energy infrastructure and top 10 manufacturing sector scenarios, increased final demand across various sectors required skilled, moderately paid manufacturing labor.

Table 10. Annual Compensation per Job (2015 Dollars) by Scenario Relative to Regional Census Data

Scenario	Average Annual Comp. per Job	Average Annual Comp. per Job	
		East South Central	South Atlantic
BBNP Programs	$56,422	$44,732	$50,523
Supply-Side Energy Infrastructure	$113,127		
Renewable Energy Infrastructure	$48,745		
Top 10 Manufacturing Sectors	$51,612		

[9] The East South Central Census Region includes: Kentucky, Tennessee, Mississippi, and Alabama. The South Atlantic Census Region includes: Delaware, Maryland, West Virginia, Virginia, North Carolina, South Carolina, Georgia, and Florida.

Net BBNP Program Impacts Relative to the Three Counterfactual Baseline Scenarios

By subtracting the gross economic impacts estimated from each counterfactual baseline scenario from the gross economic impacts associated with BBNP program-related cash flows, we estimated net BBNP program impacts relative to all three hypothetical, alternative ARRA investments. As shown in Table 11, in every case, we estimated positive total net effects on regional employment, labor income, employee compensation, value added, and output. Specifically, these net effects suggest the ARRA investment in BBNP programs had a larger positive impact on total regional employment and employee compensation than any of the three alternative public investments investigated.

Table 11. Total Net BBNP Program Impacts Relative to Counterfactual Baseline Impacts

Scenario	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Net Scenario 1	486	$24,242,443	$20,228,948	$22,574,928	$26,950,967
Net Scenario 2	319	$16,392,990	$13,952,181	$17,367,706	$15,516,969
Net Scenario 3	324	$17,172,611	$13,681,428	$20,641,501	$15,961,281

Relative to the supply-side energy infrastructure baseline, the BBNP program scenario had a total net effect on regional employment of 486 job-years and on employee compensation of approximately $20.2 million. As shown in Table 12, these and other total net effects largely were driven by induced effects, caused by first- and future-year consumer spending throughout the regional economy. The direct and indirect net effects on employment, labor income, and employee compensation also were positive as BBNP programs induced greater increases in final demand for labor-intensive industries (such as installation contracting) than an investment in supply-side energy infrastructure development. Still, the hypothetical investment in electricity and natural gas generation, transmission, and distribution infrastructure generated greater indirect effects on regional value added as well as greater direct and indirect effects on regional output.

Table 12. Net Scenario 1, BBNP Program Impacts Relative to Supply-Side Energy Impacts

Impact Type	Key Economic Indicator				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	182	$11,215,793	$8,854,062	$651,845	-$10,203,745
Indirect Effect	24	$816,744	$843,862	-$552,530	-$1,640,771
Induced Effect	280	$12,209,905	$10,531,023	$22,475,613	$38,795,483
Total Effect	486	$24,242,443	$20,228,948	$22,574,928	$26,950,967

Relative to an alternative public investment in renewable solar and wind energy infrastructure, the BBNP programs had a total net effect on regional employment of 319 job-years and on regional employee compensation of approximately $14 million. As shown in Table 13, all total net effects primarily were driven by positive induced effects and, in some cases, by positive direct effects. The induced and direct net effects on employment, labor income, and employee compensation all were positive because the BBNP programs led to greater increases in final demand for local, labor-intensive industries than an investment in renewable

energy infrastructure development, and because BBNP program participants accrued additional income through energy bill savings as long as measures remained installed and operational. Meanwhile, all indirect net effects—caused by changes in demand for factor inputs—were negative. Compared to the ARRA investment in BBNP programs, the hypothetical investment in solar and wind energy infrastructure required more manufactured factor inputs and thus generated greater indirect effects on regional employment, labor income, employee compensation, value added, and output.

Table 13. Net Scenario 2, BBNP Program Impacts Relative to Renewable Energy Impacts

Impact Type	**Key Economic Indicator**				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	96	$7,448,727	$6,286,667	$1,302,170	-$10,203,744
Indirect Effect	-13	-$1,294,021	-$1,164,275	-$2,808,546	-$6,846,868
Induced Effect	235	$10,238,284	$8,829,789	$18,874,083	$32,567,581
Total Effect	319	$16,392,990	$13,952,181	$17,367,706	$15,516,969

Relative to an alternative public investment in new demand for the top 10 Southeast manufacturing sectors, the BBNP programs had a total net effect on employment of 324 job-years and on employee compensation of approximately $13.7 million. As shown in Table 14, all total net effects primarily were driven by positive induced effects and, in most cases, by positive direct effects. The direct and induced net effects on employment, labor income, and employee compensation were positive as the BBNP programs initiated greater increases in final demand for local, labor-intensive industries and because BBNP program participants amassed additional income through energy bill savings as long as installed measures remained operational (i.e., through 2032). Meanwhile, all indirect net effects—caused by final demand for factor inputs—were negative. Compared to the ARRA investment in BBNP programs, the hypothetical investment in key regional manufacturing sectors led to more new demand for factor inputs and thus generated greater indirect effects on all economic indicators.

Table 14. Net Scenario 3, BBNP Program Impacts Relative to Key Manufacturing Sector Impacts

Impact Type	**Key Economic Indicator**				
	Employment	**Labor Income**	**Employee Comp.**	**Value Added**	**Output**
Direct Effect	90	$7,763,096	$5,665,537	$3,840,820	-$10,203,744
Indirect Effect	-6	-$1,025,779	-$983,914	-$2,428,583	-$7,018,330
Induced Effect	239	$10,435,294	$8,999,805	$19,229,264	$33,183,355
Total Effect	324	$17,172,611	$13,681,428	$20,641,501	$15,961,281

Conclusions

We used IMPLAN to compare the effects of BBNP program-related cash flows on the Southeast regional economy to three counterfactual baselines where: BBNP programs would not exist; participant project funds would be diverted to typical spending and saving patterns inherent in the static model assumptions; and ARRA funds would be spent on equivalent $26.1 million investments in supply-side energy infrastructure, renewable solar and wind energy infrastructure, and new demand for the top 10

regional manufacturing sectors. Relative to all three counterfactual scenarios, BBNP programs had positive total net effects on regional employment, labor income, employee compensation, value added, and output. These positive total net effects primarily were driven by induced effects, resulting from program participants and employees of directly and indirectly affected industries spending newfound money on regional goods and services. Furthermore, for three of the four ARRA spending scenarios investigated, annual employee compensation per job created was higher than actual average annual compensation per job in the study region. These findings suggest the ARRA investment in BBNP programs not only created more regional jobs than alternative spending scenarios, but that those jobs compensated employees at a higher annual rate than typical jobs in the Southeast.

We thus conclude the ARRA investment in BBNP programs created more jobs, generated more income, and led to greater economic impacts than any of the three alternative public spending options analyzed. We further conclude that annual compensation per job created was higher than actual average annual compensation per job in the study region, suggesting a positive impact on regional consumer spending power associated with BBNP program activities completed from 2010–2013.

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