Saving Energy, Lowering Bills, and Creating Jobs: An Economic Impact Analysis of Two Statewide Energy Efficiency Program Portfolios

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ABSTRACT

Many states in the American South have large, untapped reserves of a clean, cost-effective energy resource: energy efficiency. Our analysis of two multi-year efficiency program portfolios proposed for Louisiana and Mississippi shows that investments in efficiency foster economic development well beyond the initial expenditures. These proposed programs would, on average, account for a combined $326 million is spent annually by these two states on efficiency upgrades between 2010 and 2030.

Economic and fiscal impacts were measured using an input-output modeling framework based on the IMPLAN software package. Spending from the policies affect the economy directly through purchases of goods and services needed to make efficiency upgrades. These direct effects generate additional purchases in related sectors of the economy. The sum of these direct and indirect impacts makes up the total economic impacts estimated by our model. Total economic impacts are expressed in terms of annual increases in economic output, income, jobs, and tax revenues created by these policies. Additionally, we estimate the sustained economic benefits beyond 2030 that occur due to spending in prior years.

An enhancement of our model allows us to incorporate the effects of a lost revenue adjustment mechanism (LRAM) policy. LRAMs allow for a utility to recover revenue otherwise lost from the implementation of efficiency programs, thereby removing the disincentive to invest in efficiency. Furthermore, our model also considers the multi-year impact of the energy savings resulting from the implementation of efficiency measures. This paper will be of interest to policymakers interested in estimating the economic benefits of energy efficiency initiatives funded using an LRAM provision.

Introduction

In support of ACEEE's efforts to prepare a study of the economic and achievable potential for energy efficiency resources in Louisiana and Mississippi, Evergreen Economics estimated the economic and fiscal impacts of the proposed portfolio of programs over a twenty-year study period (2010-2030) for Louisiana and eleven-year study period (2014-2025) for Mississippi.

We measured the economic and fiscal impacts using an input-output modeling framework and the IMPLAN economic impact modeling software. The IMPLAN model is constructed with historical government data from industries and households in each state. The inputs utilized by the state-level model include program implementation costs, net incremental measure spending, net energy savings to households and businesses, changes in utility revenues, and changes in household spending on non-utility goods and services. Economic impacts are measured as changes in output, wages, business income, and employment. Fiscal impacts include changes in tax and fee revenues for state and local taxing jurisdictions.

For this analysis, gross impacts are calculated and then compared against a base case-spending scenario that assumes the funds that were used to support program activities and incentives are spent by Louisiana and Mississippi ratepayers. The difference in economic impacts attributed to the programs and the base case scenario are referred to as net impacts.

In addition to the economic benefits that occur with the initial equipment expenditures, the energy efficiency programs generate energy bill savings that continue to benefit program participants beyond the first year of measure implementation. Consequently, we also analyzed the economic and fiscal impacts attributed to energy savings that continue in the future over the expected lifespan of the installed energy efficiency equipment.

Economic Impact Analysis Methods

Measuring the economic impacts attributable to efficiency programs is a complex process, as spending by the states of Louisiana and Mississippi and local utilities—and subsequent changes in spending by program participants—unfold over a lengthy period of time. From this perspective, the most appropriate analytical framework for estimating the economic impacts is to classify them into the following categories:

- *Short-term* impacts are associated with changes in business activity as a direct result of changes in spending (or final demand) by program implementers; energy efficiency program participants; and ratepayers who provide funding for energy efficiency programs.
- *Long-term* impacts associated with the potential changes in relative prices, factor costs (e.g., changes in wage rates, cost-of-capital, and fuel prices), and the optimal use of resources among program participants, as well as industries and households linked by competitive, supply-chain, or other factors.

This analysis measures the short-term economic impacts associated with efficiency programs in Louisiana and Mississippi. These impacts are driven by changes (both positive and negative) in final demand, and are 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 state economy. Energy efficiency programs may have longer lasting effects, and this is clearly the case for continued energy savings beyond the end of the programs. However, these long-term, dynamic effects are not measured in this analysis.

The IMPLAN input-output model has several features that make it particularly well suited for estimating these short-term impacts.

- The IMPLAN model is widely used and well respected. The IMPLAN model is constructed with data assembled for national income accounting purposes, thereby providing a tool that has a robust link to widely accepted data development efforts. The United States Department of Agriculture (USDA) recognized the IMPLAN modeling framework as "one of the most credible regional impact models used for regional economic impact analysis" and, following a review by experts from seven USDA agencies, selected IMPLAN as its analysis framework for monitoring job creation associated with the American Recovery and Reinvestment Act (ARRA) of 2009 (Kort 2009).

- The IMPLAN model's input-output framework and descriptive capabilities allow for the construction of economic models with region-specific data for 440 different industry sectors, as well as for households and government institutions. These details permit accurate mapping of program spending and energy savings to industry and household sectors in the IMPLAN model.
- Finally, the IMPLAN model is based on historical economic data for Louisiana and Mississippi and, therefore, reflects the unique nature of each states economy.

Terminology

Input-output analysis employs specific terminology to identify the different types of economic impacts. Energy efficiency programs affect the state directly, through the purchases of goods and services within the region. Specific direct impacts include spending by staff administering the energy efficiency programs and manufacturers and contractors that produce and install the energy efficient equipment. Direct impacts also include changes in spending or output attributed to energy bill savings for households and businesses participating in efficiency programs.

These direct changes in economic activity will indirectly generate purchases of intermediate goods and services from related sectors of the economy. In addition, the direct and indirect increases in employment and income enhance overall economy purchasing power, thereby inducing further economic impacts as households increase spending and businesses increase investment. This cycle continues until the spending eventually leaks out of the local economy as a result of taxes, savings, or purchases of non-locally produced goods and services.

Within this framework, the IMPLAN model reports the following impact measures:

- *Output* is the value of production for a specified period of time. Output is the broadest measure of economic activity, and includes intermediate goods and services and the components of value added (personal income, other income, and indirect business taxes).
- *Wages* includes workers' wages and salaries, as well as other benefits such as health and life insurance, and retirement payments, and non-cash compensation.
- *Business income* is also called proprietary income (or small business income) and represents the payments received by small-business owners or self-employed workers
- *Job* impacts include both full- and part-time employment. Over time, these job impacts are expressed as person-years of employment, as they represent the number of jobs sustained over a single year.

Gross and Net Economic Impacts

For this analysis, gross impacts refer to economic impacts that do not include a counterfactual base case scenario that compares alternative uses of program funding. The gross impacts are calculated based on the annual program spending and energy savings discussed below. These input parameters are then compared against a base case spending scenario that assumes the program funding is returned to ratepayers and spent following historical purchase patterns. The difference between the gross economic impacts attributed to the proposed efficiency programs and the base case scenario is referred to as net impacts.

For the proposed Louisiana and Mississippi energy efficiency programs and policies, specific gross spending impacts include:

- Program administration as program implementers incur administrative costs and purchase labor and materials to carry out energy efficiency programs.
- Incremental measure spending represents additional spending on energy efficiency above what would have been spent on standard efficiency measures in the base case.
- Reductions in energy consumption and the associated increase in household disposable income and lower operating cost for businesses.
- For residential program participants, lower energy costs will increase household disposable income, which is assumed to be spent following historical purchase patterns.
- For businesses, energy savings lowers production costs, which, in the short run, leads to changes in productivity. To estimate the economic impacts associated with these lower energy costs, Evergreen Economics used an elasticity-based approach to measure the direct change in output, and associated changes in direct employment and income.
- Energy savings begin to accrue after energy efficiency measures have been installed. Thus, energy savings in the program year must take into account the timing of these installations. In this analysis, we have assumed that installations occur evenly throughout the year and have used a fifty percent implementation adjustment factor for energy savings in the first program year. Additionally, as efficiency measures reach their respective end of Effective Useful Life, energy savings are zeroed out and no additional economic impacts are observed.
- The efficiency gains result in some loss of utility revenues due to lower power sales. We assume that the utilities are able to recover from ratepayers the costs of implementing the efficiency programs plus some recovery of lost revenues. The mechanisms typically used for revenue recovery are complicated and vary from state to state. To simplify this process for the IMPLAN model, we assume that the utilities are able to recover fifty percent of their lost retail revenues to simulate the revenue recovery process. Our fifty percent estimate assumes that half of utility revenues cover fixed costs, which then need to be recovered from ratepayers, while the other fifty percent represent variable costs that the utility can save as the need for power declines.[1] To reflect the ratepayer perspective, the energy savings of households and businesses are also reduced by fifty percent as part of the revenue recovery mechanism (e.g., half of the energy savings value is transferred from ratepayers to the utility sector through the revenue recovery process). The fifty percent assumption is likely higher than what utilities would actually be able to recover (e.g. fixed costs are likely less than fifty percent of revenues), which results in a conservative estimate of impacts for our model.

[1] A cursory review of the energy cost data provided for our analysis shows that about fifty percent of the retail power costs are avoided costs, indicating that the remaining fifty percent are likely fixed costs, which helps support the assumption used in our model.

Program Activities

Expenditures

For this analysis, spending and energy savings data relating to the proposed efficiency programs was aggregated into several general categories to facilitate economic impact modeling. Table 1 shows the spending for residential, commercial, and industrial programs and policies in select years. Although additional program expenditures occur on an annual basis for most programs, Table 1 omits many of these years for ease of presentation. Note that total program spending on energy efficiency resources increases from 2015 to 2030, and that commercial program spending is greater than spending on residential programs in the early years which in turn is greater than spending on industrial programs.

Table 1. Expected energy efficiency program spending in $ millions in Louisiana and Mississippi (selected years)

Impact Measure	2015		2020		2025		2030		Total Program (2010-2030)
	LA	MS	LA	MS	LA	MS	LA	MS	
Total Residential	$33.6	$9.8	$122.5	$37.8	$179.0	$81.4	$180.1	$0	$2,647.7
Total Commercial	$29.2	$7.8	$106.1	$67.1	$154.4	$99.1	$148.8	$0	$2,566.9
Total Industrial	$9.7	$2.0	$90.7	$8.9	$98.3	$16.0	$74.1	$0	$1,296.6
Total All Programs	$72.5	$17.6	$319.3	$104.9	$431.7	$180.5	$403.0	$0	$6,408.5

Spending on Energy-Efficient Equipment

Next, our analysis considers incremental equipment spending by program. Net incremental spending represents additional spending on energy-efficient equipment in homes and businesses above what would have been spent on standard equipment in the absence of energy efficiency programs. In general, equipment spending and program spending exhibit an increasing trend from 2015 to 2030 even as new codes and standards come into effect and base efficiency levels increase.

The remainder of this report documents the analysis that was completed to develop these economic impact estimates including a summary of key findings and detailed model results.

Economic Impact Results

The economic impacts associated with Louisiana and Mississippi efficiency programs are reported in this section. Results are arranged as follows:

- Summary of key findings.
- Total gross and net economic impacts. This section also reports the distribution of net impacts by residential, commercial, and industrial programs and for combined heat and power.
- Economic impacts attributed to energy savings continuing in future years after the programs have ended in 2030.

Summary of Key Findings

Louisiana and Mississippi's investments in energy efficiency are expected to result in energy savings, increased economic output, business income, jobs, and state and local taxes in the program period and beyond. As shown in Table 2, in the combined program period it is estimated that the portfolio of efficiency programs will result in the following net cumulative impacts:

- Nearly $32.3 billion in economic output, including $10.5 billion in wages, and nearly $6.8 billion in business income to small business owners, and over 273,400 person-years of employment over the twenty-year period;
- Increased state and local tax revenue by $878 million;
- Additional energy savings in future out-years after the programs end in 2031 will sustain a total of $22.6 billion in output, including over $6.7 billion in wages, $4.5 billion in business income, nearly 195,300 person-years of employment, and an increase of $269 million in state and local tax revenue.

Table 2. Summary of energy savings and net economic impacts, by state

Impact Measure	Impacts During Program Years		Impacts in Future Out-Years	
	LA (2010-2030)	MS (2014-2025)	LA (2031-2040)	MS (2026-2040)
Electricity Savings (GWh)	175,370	38,410	159,040	89,860
Natural Gas Savings (MMCF)	168,920	31,290	169,810	62,770
Output ($ millions)	$28,039	$4,256	$16,183	$6,454
Wages ($ millions)	$9,408	$1,103	$5,013	$1,701
Jobs (person-years)	240,600	32,800	143,000	52,300
Business income ($ millions)	$5,973	$825	$3,287	$1,176
State and Local Taxes ($ millions)	$798	$80	$898	$269

Presented another way, these programs would result in the following *annual* impacts in 2031:

- $3.7 billion in economic output, including $1.2 billion in wages, and $775 million in business income to small business owners, and 32,000 person-years of employment in 203;
- Increased state and local tax revenue by $138 million;
- Additional energy savings after the programs end will continue to sustain economic benefits

Total Gross and Net Impacts

Table 3 shows the total cumulative gross and net economic impacts in the two states from residential efficiency programs from 2010 to 2030 for Louisiana and 2014 to 2025 for Mississippi. Over this program period, we expect to see a total increase in state economic output of nearly $13.4 billion relative to the base case scenario. Stated another way, the efficiency programs will increase economic output in Louisiana and Mississippi by $10.1 billion over what would have occurred had the programs not existed, the energy efficiency savings had not been achieved, and the program spending funds were returned to ratepayers and spent following historical purchase patterns. This estimate (and all the ones discussed below) also takes into account the costs of the programs, the higher equipment costs to consumers, and assumes a revenue mechanism where ratepayers compensate utilities for lost revenues. This increase in economic output corresponds to an increase of $2.9 billion in increased wage income and over $2.3 billion in business income. Over this period, the net gains associated with the efficiency scenario are able to sustain 88,800 jobs (measured in person-years of employment). Finally, the net gain in economic activity also results in an increase in tax revenue generated for state and local governments. As shown at the bottom of the table, state and local governments will see an increase of $327 million in tax revenue over the base case scenario.

Table 3. Total gross and net economic impacts for efficiency programs, by sector and state[2]

Sector/Impact Measure	Gross Impacts	Net Impacts	Gross Impacts	Net Impacts
	Louisiana		Mississippi	
Residential				
Output ($ MM)	$11,994	$9,304	$1,441	$809
Wages ($ MM)	$3,595	$2,730	$355	$174
Jobs (person-years)	110,300	83,100	12,000	5,700
Business income ($ MM)	$2,604	$2,095	$357	$223
State and Local Taxes ($ MM)	$469	$317	$47	$10
Commercial				
Output ($ MM)	$11,361	$7,282	$2,951	$2,383
Wages ($ MM)	$3,982	$2,490	$921	$731
Jobs (person-years)	101,600	60,800	27,100	21,500
Business income ($ MM)	$2,399	$1,483	$569	$453
State and Local Taxes ($ MM)	$438	$225	$78	$51
Industrial				
Output ($ MM)	$5,828	$4,331	$1,212	$1,065
Wages ($ MM)	$1,841	$1,497	$218	$198
Jobs (person-years)	43,500	34,900	6,200	5,700
Business income ($ MM)	$1,200	$899	$167	$149
State and Local Taxes ($ MM)	$202	$115	$21	$19
Total				
Output ($ MM)	$29,183	$20,917	$5,604	$4,257
Wages ($ MM)	$9,418	$6,717	$1,494	$1,103
Jobs (person-years)	255,400	178,800	45,300	32,900
Business income ($ MM)	$6,203	$4,477	$1,093	$825
State and Local Taxes ($ MM)	$1,109	$657	$146	$80

[2] Participants of energy efficiency programs may experience non-energy benefits from the installation of efficiency measures (e.g. water savings), however, our analysis did not capture these savings and therefore did not model the economic impact of these additional benefits.

In general, energy savings are expected to be slightly lower for the commercial sector, and as a consequence the resulting economic impacts are also lower relative to the residential programs. The net benefits relative to the base case scenario are still positive, however. All of the same assumptions discussed for the residential sector are also used in the commercial sector, including the assumptions regarding utility revenue recovery. In total, we expect to see an increase in state economic activity equal to $9.7 billion relative to the base scenario where the efficiency programs do not exist. We also find that energy efficiency programs will help sustain over 82,300 person-years of employment over the same time period, in addition to the job gains that occur due to the residential sector efficiency programs. The net increase in economic benefits also increase expected tax revenue, with state and local government estimated to receive an additional $276 million in tax revenue relative to what would occur in the base scenario.

With regard to the industrial sector, our analysis finds that the expected energy savings are lower due to less program and participant spending, and these results are shown in Table 5. Consequently, the sum of the economic impacts of these programs is also lower relative to the residential and commercial programs. In total during the program period, we expect to see an increase in state economic activity equal to $5.4 billion over what would have occurred in the base scenario without the industrial efficiency programs. We also find that the industrial energy efficiency programs will help sustain over 40,600 person-years of employment over the same time period. As before, these impacts are in addition to what is estimated for the commercial and residential efficiency programs.

Overall, the portfolio of residential, commercial, and industrial energy efficiency programs is expected to achieve significant gains in the regional economic activity beyond the base case scenario. The primary driving force behind these net economic gains is the energy bill savings enjoyed by households and businesses that result from the increase in energy efficiency. As discussed below, these energy savings continue beyond the initial installation year, resulting in a substantial amount of economic benefits accruing throughout the study period.

The Effect of the Lost Revenue Mechanisms on Economics Impacts

Utilities across the United States have voiced concern regarding the inherent disincentive they face in investing in energy efficiency, which reduces customer energy usage, results in lower energy bills and can ultimately lead to losses in utility revenues. Reduced revenues without timely adjustments for cost recovery could impede the utilities' ability to provide energy services due to decreased earnings over time. To address this barrier, mechanisms such as lost revenue recovery or decoupling, have been pursued by utilities throughout the country. For any utility program implementing an LRAM, it is important to incorporate the effects of this policy to the inputs of the model. Though the mechanisms typically used for revenue recovery are complicated and vary from state to state, our model used a simplified assumption that Louisiana and Mississippi utilities are able to recover fifty percent of their lost retail revenues to simulate the revenue recovery process. Table 4, below, displays the effect of this lost recovery adjustment mechanism, at various levels, on net economic outputs in the program period.

In general, the economic impacts of energy efficiency programs can vary greatly depending on the proportion of costs that are recoverable by utilities; however, our analysis suggests that a lower LRAM results in higher regional economic impacts in the short-term. These higher impacts can be attributed to a greater proportion of ratepayer spending occurring within the study area, in addition to greater indirect and induced impacts of that spending when compared to an increase in utility revenues on a per-dollar basis.

Table 4. The effect of a LRAM policy on net economic impacts during the program period (2010-2030)

Impact Measure	LRAM=0	LRAM=0.25	LRAM=0.5	LRAM=0.75	LRAM=1
Output ($ millions)	$41,460	$38,031	$32,295	$22,994	$13,405
Wages ($ millions)	$14,239	$12,598	$10,511	$7,689	$4,811
Jobs (person-years)	405,810	343,250	273,440	192,200	110,090
Business income ($ millions)	$6,586	$7,125	$6,798	$4,976	$3,046
State and Local Taxes ($ millions)	$570	$870	$878	$399	-$115

Cumulative Energy Savings and Economic Impacts

The preceding discussion focuses on the economic impacts of both measure spending and energy cost savings that occurs during the policy period 2010-2030. These energy efficiency investments, however, will continue contributing benefits to the economy in future years, as the new energy efficient equipment will continue to deliver energy cost savings beyond 2030. This section presents a separate analysis that examines the economic impacts of just the energy cost savings, both during the policy period and beyond.

Although energy efficiency equipment installations occur in the same year that the equipment and program costs are incurred, energy savings from the new equipment will extend into future years beyond the initial installation. As a consequence, the energy cost savings for homes and businesses also extend into future years (with some degradation as equipment ages). These energy cost savings continue to benefit the economy as households spend less on electricity and more on other consumer products, and businesses are able to produce goods and services more efficiently. As this suggests, the net economic impacts from the first year, when the equipment and program spending occur, only capture a fraction of the overall economic impacts of these programs.

Table 5 shows the annualized net economic impacts due solely to energy cost savings for four select program years. These estimates were calculated using the input-output model to estimate the economic impacts of reduced energy costs while setting all other costs (i.e., equipment purchases and program implementation costs) equal to zero. Note that the assumption that utilities are able to recover 50 percent of the lost power revenues from ratepayers is still maintained in these future years. This forms the basis of energy efficiency benefits in future post-installation years based on the reduced energy costs to the economy, while excluding any additional benefits due to the spending on these programs and measures but including assumptions regarding revenue recovery. As the proposed set of programs ends in 2025 and 2030 and consequently no new equipment will be installed beyond 2030, both cumulative and annual net energy savings will necessarily decrease as equipment from previous installation years fails or becomes obsolete. This effect can be seen in both Table 5 and Figure 1.

Table 5. Total net economic impacts due to annual energy savings alone during program period (Selected Years)

Impact Measure	2015	2020	2025	2030	2035	2040
Electricity Savings (GWh)	555	7,387	22,111	29,726	22,016	9,347
Natural Gas Savings (MMCF)	237	5,928	19,794	28,934	21,362	9,004
Output ($ millions)	$32	$574	$2,806	$3,773	$2,080	$941
Wages ($ millions)	$10	$168	$882	$1,189	$638	$287
Jobs (person-years)	260	4,870	23,290	32,050	18,490	8,280
Business income ($ millions)	$6	$112	$576	$776	$417	$188
State and Local Taxes ($ millions)	$2	$30	$87	$139	$111	$52

Note: For the purposes of this analysis, which examines a concrete combined program period through 2030, the following tables and analysis assume that the energy efficiency programs would end in the year 2030, and therefore examines the post-program period impacts. However, a long-term commitment to energy efficiency could mean continued efficiency resource delivery beyond 2030.

Annualized net energy savings and net economic impacts form the basis of annual energy savings and economic impacts in future post-installation years. Assuming that efficiency programs end in 2030, both net energy savings and net economic impacts would decline in future years at varying rates depending on the equipment life of measures installed. Energy savings do not reduce to zero after program funding ceases in 2030, but continue onward for the duration of the useful life of the equipment installed through the efficiency programs.

Figure 1 illustrates a similar cumulative effect for economic activity that results from energy savings influenced by the efficiency programs. By 2030, economic output in Louisiana and Mississippi is expected to increase by over $3.8 billion based on energy cost savings achieved in that year. Since the output displayed is solely due to electricity savings. By 2040, equipment still in service is expected to result in over $941 million in increased economic output, and by 2050, savings from equipment installed will end, and consequently no further increases to output will occur.

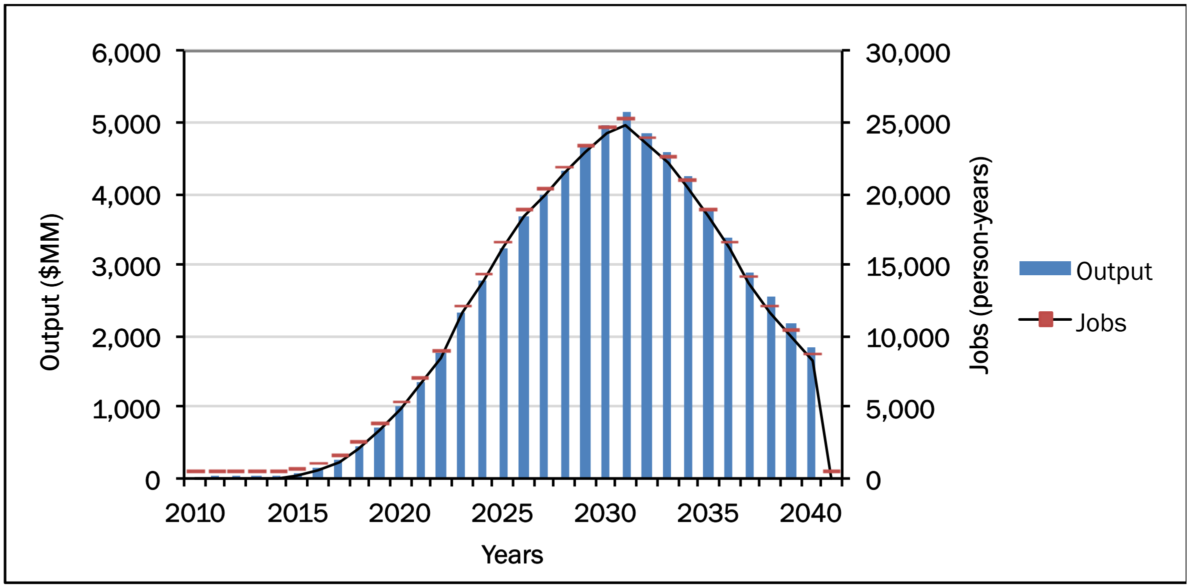

Figure 1. Total cumulative output and jobs due to electricity & natural gas savings. *Source*: Evergreen Economics 2013.

Similarly, energy savings to households and business are estimated to sustain approximately 32,050 jobs by 2030. Figure 1 shows that the total number of cumulative jobs increases substantially over the program period and persists through the post-program period, albeit at a decreasing rate. In total, by 2030 electricity savings from energy efficiency will have sustained over 175,900 person-years of employment.

Conclusion

Overall, the portfolio of residential, commercial, and industrial energy efficiency programs proposed in Louisiana and Mississippi is expected to achieve significant gains in regional economic activity beyond the base case scenario. The primary driving force behind these net economic gains are the energy bill savings enjoyed by households and business resulting from the increase in energy efficiency. These energy savings continue beyond the initial installation year and result in a substantial amount of economic benefits that accrue through the study period and beyond.

Given the static nature of the input-output model used in this analysis, it is important to note that the cumulative impacts presented do not take into account changes in production and business processes that businesses make in anticipation of future increased energy prices and/or competition to increase production efficiency. To the extent that Louisiana and Mississippi businesses are already adjusting in anticipation of these factors, the cumulative impacts presented here may be overstated, as the overall market would become more efficient due to factors outside program influence.

The cumulative numbers also rely on the critical assumption that each dollar saved will translate into a dollar of increased economic output for those businesses adopting conservation measures. This assumption conforms to findings in previous research conducted by Evergreen staff, and is reasonable in the short run (ECONorthwest 2010). In the long run, however, it is likely that a dollar of energy savings will translate to less than a dollar of increased economic output as the businesses adopt more efficient production practices. Despite these caveats, this analysis demonstrates that the ongoing and cumulative effect of conservation due to energy efficiency program activities is nevertheless a significant net benefit to the state economies of Louisiana and Mississippi.

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