# Economic Impacts From Energy Trust of Oregon 2006 Program Activities

## Final Report

October 1, 2007

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## Acknowledgements

This report was prepared by ECONorthwest's Portland office for Energy Trust of Oregon. Dr. Stephen Grover was the ECONorthwest project manager for the analysis and was the primary author of this report. Questions regarding the report should be directed to him at grover@portland.econw.com or by phoning the Portland office at (503) 222-6060. Dr. Grover was assisted in this project by Alec Josephson, Jonny Holz, John Boroski, and Jessica Brown.

# 1. INTRODUCTION AND SUMMARY

ECONorthwest was asked by Energy Trust of Oregon (Energy Trust) to estimate the effects of its energy efficiency and renewable energy programs in 2006 on the Oregon economy. These effects include impacts on employment, output, and wages in Oregon that resulted from 2006 program spending and activities. ECONorthwest also analyzed the economic impacts of the energy efficiency gains (i.e., energy savings) that were realized in 2006 to estimate the benefits to the economy that accumulate in future years.

For this analysis, all impacts were compared against a Base Case spending scenario, which assumes that the funds that were paid to Energy Trust are returned and spent by the Oregon ratepayers in the Oregon service territories of Portland General Electric (PGE), PacifiCorp, Northwest Natural, Cascade Natural Gas and Avista. The difference in economic impacts between Energy Trust spending and the Base Case scenario is referred to as the *net impact* of the spending by Energy Trust. Unless otherwise stated, the results in this report reflect net impacts. For example, if an impact of 5 new jobs is reported, this means that spending on Energy Trust programs resulted in 5 more jobs in a particular sector relative to what would have occurred had the money been returned and spent by Oregon ratepayers in the utility service territories.

Energy Trust spending on its programs during 2006 totaled $47.9 million and the programs funded by these dollars had the following net impacts on the Oregon economy:

- Output in Oregon's economy increased by $37.8 million
- 404 new full and part time jobs were created in Oregon
- Wages increased by $11.9 million
- Energy efficient equipment and renewable energy installations saved Oregonians 33.1 average megawatts (aMW) of electricity (289,414 MWh annually) and 2.3 million therms. This includes 48,653 MWh of annual renewable generation for which funding has been committed but which will not be completed until 2007 (the majority of the work was done during 2006).[1]

The remainder of this report documents the analysis that was completed to develop these impact estimates.

[1] For purposes of this impact assessment it was deemed appropriate to include these projects in 2006 as the majority of the staff time, analysis, and engagement of industry partners associated with these projects was incurred during that year. Similarly, projects that were substantially initiated in 2005 but completed in 2006 were not included in this analysis. The 2006 renewable energy generation and total programs expenditures ($47.9 million) reported in this analysis do not match figures reported in Energy Trust's 2006 Annual Report, which only included projects completed (i.e., installed) in 2006.

# 2. ENERGY TRUST 2006 PROGRAM ACTIVITIES

## 2006 EXPENDITURES

For this analysis, budget information provided by Energy Trust was aggregated into several general categories to facilitate economic impact modeling for similar areas of spending. Table 1 shows the general areas of spending for Energy Trust and reflects actual expenditures for 2006. As shown at the bottom of the table, total spending by Energy Trust in 2006 was $47.9 million across all categories.

As a general rule, spending on program incentives goes directly to equipment purchases and labor for installation. Common measures that receive incentives include high efficiency lighting (compact fluorescents and T-8's), high efficiency HVAC systems, home weatherization, high efficiency industrial motors and variable speed fan drives for commercial applications. In 2006, program expenditures (i.e., incentives and allocated support costs) for energy efficiency measures totaled $43.2 million while program expenditures for renewable resources totaled $2.4 million.

**Table 1: 2006 Energy Trust Program Spending ($ millions)**

| Spending Category | Total Program Expenses | Total Support Costs | Total |
|---|---|---|---|
| Energy Efficiency Programs | $43.2 | | $43.2 |
| Renewable Programs | $2.4 | | $2.4 |
| Other Admin & Program Support | | $2.3 | $2.3 |
| **Total** | **$45.6** | **$2.3** | **$47.9** |

**Source:** Energy Trust of Oregon

## ENERGY SAVINGS AND GENERATION

Table 2 shows the total electricity saved by Energy Trust programs, in terms of both energy (annual kWh) and demand (aMW). A total of 33 average megawatts were saved or generated as a direct result of Energy Trust program activities in 2006. This includes savings for both residential and commercial programs as well as energy generated by renewable energy installations that were completed or substantially initiated in 2006. Of this, approximately 70 percent (23 aMW) was from efficiency gains in the commercial and industrial sectors. Since energy savings and renewable generation are essentially identical from a customer standpoint in terms of economic effects (both reduce energy bills), the savings and generation kWh values have been combined for this analysis.

**Table 2: 2006 Net Energy Savings**

| Program Sector | Annual kWh Saved | Average MW Saved (aMW) | Annual Therms Saved |
|---|---|---|---|
| Residential Sector Programs | 88,241,177 | 10.1 | 1,029,959 |
| Commercial/Industrial Sector Programs | 201,172,753 | 23.0 | 1,264,636 |
| **Total Energy Saved** | **289,413,930** | **33.1** | **2,294,595** |

**Source:** Energy Trust of Oregon

The efficiency gains shown in Table 2 result in a loss of revenue to Oregon utilities due to lost power sales, and this loss of revenue has been accounted for in this analysis.[2] If the utility sector had similar spending impacts as other sectors in Oregon's economy, then the energy cost savings in other sectors would roughly cancel out the loss of revenue in the utility sector. For Oregon utilities, however, much of the spending impact flows outside the state, as PacifiCorp is owned by an out-of-state company and both PacifiCorp and PGE have shareholders that are widely distributed throughout the country. Consequently, some of the revenue loss (and the resulting losses in employment and economic activity) is incurred outside of Oregon.

There is an additional long-term benefit from the efficiency gains, as they delay the need for building new power generation. Power generated from new sources will almost certainly be more expensive than existing power resources due to increased costs of capital and issues associated with siting new power plants. In this sense, efficiency gains can be viewed as a means for prolonging the use of lower-cost resources and delaying the need for switching to higher cost power supplied by new generation. By enabling the efficient use of lower cost resources, these programs help the entire Oregon economy run more efficiently. This benefit was not explicitly modeled for this analysis because it is directly addressed in the Energy Trust's benefit/cost analysis. It is nevertheless an important issue and is one of the primary tenets underlying conservation and demand-side management programs.

## 3. ANALYSIS METHODS

Estimating the economic impacts attributable to Energy Trust of Oregon's programs is a complex process, as spending by Energy Trust—and subsequent changes in spending by program participants—unfold over a lengthy period of time. From this perspective, therefore, the most appropriate analytical framework for estimating the economic impacts is to classify them into the following categories:

- *Short-term* economic impacts associated with changes in business activity as a direct result of changes in spending by Energy Trust programs and participants.

[2] For this analysis, it was assumed that utilities did not sell saved power on the spot market, as estimates of the amount of power sold due to energy efficiency are generally unavailable. If utilities can sell conserved power on the market due to the efficiency programs, then there is an additional benefit in the form of increased revenues to the utility sector. As this was not included in this analysis, the results discussed here represent a lower bound for potential utility sector benefits.

- *Long-term* economic impacts associated with the subsequent changes in factor costs and optimal use of resources.

This analysis estimates the short-term economic impacts of Energy Trust program activities during the 2006 program year. The short-term economic impacts are those attributed to additional dollars accruing to Oregon households and businesses as a result of these programs. The economic modeling framework that best measures these short-term economic impacts is called input-output modeling. Input-output models provide an empirical representation of the economy and its inter-sectoral relationships, enabling the user to trace the effects (economic impacts) of a change in the demand for commodities (goods and services). Because input-output models generally are not available for state and regional economies, special data techniques have been developed to estimate the necessary empirical relationships from a combination of national technological relationships and county-level measures of economic activity. This modeling framework, called IMPLAN (for IMpact Analysis for PLANning), is the technique that ECONorthwest has applied to the estimation of impacts.[3]

Input-output analysis employs specific terminology to identify the different types of economic impacts that result from economic activities. Expenditures made through Energy Trust programs affect the Oregon economy *directly*, through the purchases of goods and services in this state, and *indirectly*, as those purchases, in turn, generate purchases of intermediate goods and services from other, related sectors of the economy. In addition, the direct and indirect increases in employment and income enhance overall economy purchasing power, thereby *inducing* further consumption- and investment- driven stimulus. 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 or "imports."

The IMPLAN model reports the following economic impacts:

- *Total Industrial Output (Output)* is the value of production by industries for a specified period of time. Output can be also thought of as the value of sales including reductions or increases in business inventories.
- *Employee Compensation (Wages)* includes workers' wages and salaries, as well as other benefits such as health and life insurance, and retirement payments, and non-cash compensation.
- *Proprietary Income (Business Income)* represents the payments received by small-business owners or self-employed workers. Business income would include, for example, income received by private business owners, doctors, accountants, lawyers, etc.
- *Job* impacts include both full and part time employment.

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[3] IMPLAN was developed by the Forest Service of the US Department of Agriculture in cooperation with the Federal Emergency Management Agency and the Bureau of Land Management of the US Department of the Interior to assist federal agencies in their land and resource management planning. Applications of IMPLAN by the US Government, public agencies and private firms span a wide range of projects, from broad, resource management strategies to individual projects, such as proposals for developing ski areas, coal mines, and transportation facilities, and harvesting timber or other resources.

- *Tax revenues* for various state and local taxing jurisdictions.

Within this modeling framework, the following terms are used to classify impacts:

- *Gross Impacts* reflect the economic impacts with no adjustment made for impacts that might have occurred in the Base Case scenario.

- *Net Impacts* are the effects of Energy Trust program expenditures that have been adjusted to reflect the Base Case scenario. That is, net impacts are those impacts over and above what would have occurred in the Base Case scenario.

The following types of impacts form the basis of this analysis:

- *Program operations spending* as Energy Trust purchases labor and materials to carry out its energy efficiency programs.
- *Measure spending* by participants in Energy Trust programs.
- *Reductions in energy consumption* and the associated lower operating costs to businesses and increase in household disposable income.
- *Reductions in utility revenues* as households and businesses consume less electricity.

## 4. GROSS ECONOMIC IMPACTS

The gross economic impacts attributed to the 2006 Energy Trust programs are based on the program costs, including administration costs and incentives issued by Energy Trust, and the measure spending and energy savings of program participants. Measure spending by program participants consists of expenditures on energy efficiency equipment such as appliances and furnaces/boilers, heating, ventilation and air conditioning (HVAC) systems, lighting modifications, and also industrial processing equipment.

ECONorthwest received detailed measure spending data from Energy Trust, and this spending data for the various energy measures were then mapped to over 20 different IMPLAN sectors. Energy Trust also supplied detailed energy savings estimates, broken out by fuel type (electricity, natural gas) for program participants. For residences, lower energy costs will increase Oregon households' disposable income. As such, the estimated energy cost savings were input into a consumption function representing the spending pattern of a middle-income household in Oregon, which mapped the spending to over 500 IMPLAN sectors.[4]

Energy savings for commercial/industrial participants were identified by Standard Industrial Classification (SIC) code and ECONorthwest used this detailed energy savings information to allocate energy savings to approximately 100 different business sectors in the IMPLAN model. From an input-output perspective, energy savings will *indirectly* affect Oregon businesses by lowering their production costs. To estimate the economic impacts associated with these lower energy costs, ECONorthwest used an elasticity-based approach to measure the likely change in

[4] This consumption function was modified to exclude spending on electricity.

output. That is, this approach assumes that lower energy costs increase the competitiveness of Oregon businesses, allowing them to decrease price, and increase output.[5]

Finally, the energy savings for households and businesses translate into lower revenues to utilities, refiners, and other providers of energy services. ECONorthwest used estimated energy savings, by fuel type, to reduce revenues to utilities, refiners and other providers of energy services.

### ENERGY TRUST SPENDING IMPACTS

The gross economic impacts of Energy Trust programs for 2006 are shown in Table 3. Spending related to Energy Trust programs increased economic output by $99 million in 2006, which includes an increase of $31.1 million in wage income and $5.6 million in business income within Oregon. This activity also created 932 jobs in Oregon. It is important to reiterate that these are gross impacts and therefore do not take into consideration alternative uses of Energy Trust and participant spending related to these programs. These net impacts are addressed in the next section.

**Table 3: 2006 Energy Trust Gross Impacts**

| Impact Type | 2006 |
|---|---|
| Output | $99,032,300 |
| Wages | $31,100,300 |
| Business Income | $5,594,700 |
| Jobs | 932 |

**Source:** ECONorthwest.

## 5. NET ECONOMIC IMPACTS

All of the economic impacts reported in this section of the report are *net impacts* and reflect economic benefits over and above what would have occurred had Energy Trust programs not existed. To calculate net impacts, the economic impacts of the Base Case scenario are estimated first, which assumes that the money that is currently spent on Energy Trust programs is instead allocated to ratepayers of the utilities. The economic impacts resulting from the Base Case scenario are then subtracted from the gross impacts discussed in the previous section to determine net impacts.

Table 4 shows the net economic impacts attributed to Energy Trust programs in 2006. The net economic impacts are positive and (by design) are significantly less than the gross economic impacts reported previously. The gross economic impacts included the assumption that revenues

[5] Because we do not have price elasticity of demand coefficients for each of the 100 business sectors (and their commodities) that benefited from reduced energy costs, ECONorthwest assumed that the price elasticity of demand for each industry's output was -1.0, i.e., unitary elastic. A 1 percent decrease in costs would, therefore, translate into a 1 percent decrease in price and a 1 percent increase in output.

to utilities, refiners and other providers of energy services decline as a result of the energy savings by households and businesses. To this, we have now included the Base Case spending scenario that assumes that all Energy Trust funds are instead spent by ratepayers of the utilities according to the spending patterns of a typical Oregon household.

For 2006, Energy Trust programs had a net effect of increasing Oregon's economic output by $37.8 million relative to the Base Case scenario. This includes an increase of $2.9 million in business income and $11.9 million in wage income within Oregon. Energy Trust programs also had a positive net impact on employment in Oregon, with 404 jobs created in 2006. Again, this reflects jobs over and above what would have been created in the Base Case scenario.

**Table 4: 2006 Net Economic Impacts**

| Impact Type | 2006 Impacts |
|---|---|
| Output | $37,820,800 |
| Wages | $11,866,600 |
| Business Income | $2,915,400 |
| Jobs | 404 |

**Source:** ECONorthwest.

## 6. Energy Savings-Related Economic Impacts Over Time

For many projects, the installations occur in the same year that the equipment and program costs are incurred. The energy savings from these measures, however, extend into future years as most measures have expected useful lives of eight to 16 years (or more). The cost savings from these measures for homes and businesses also extend into future years (with some degradation as equipment ages) after the initial purchase costs and tax credit costs have ended. These 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 a consequence, the net effects from the first year when the equipment and program spending occur only capture a fraction of the overall benefit of these programs.

Table 5 shows the gross economic benefits due to the total 2006 energy cost savings from energy efficiency projects alone (i.e., they do not account for new generation from renewable sources). 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 purchase and program implementation costs) equal to zero. To truly isolate the impact of the energy cost savings, we also assumed that there were no lost utility revenues resulting from the measures installed and that utilities would be able to sell the unused power to other customers. This provides an estimate of energy efficiency benefits based solely on the reduced energy costs to the economy and excludes any additional benefits due to the spending on these programs and measures.

As shown in Table 5, 26 aMW of energy savings from energy efficiency in 2006 increased economic output by $19.6 million, which includes an increase of $7 million in Oregon wages. This increased output also led to the creation of 193 jobs.

**Table 5: Economic Impacts Due to 2006 Energy Savings Alone**

| Economic Impact Measure | Impact Due to 2006 Savings Only |
|---|---|
| Output | $19,554,136 |
| Wages | $7,025,316 |
| Business Income | $775,639 |
| Jobs | 193 |

**Source:** Calculated by ECONorthwest using 2006 Energy Trust spending and energy savings impacts.

The following figures illustrate how the effects of continued improvements in efficiency would accumulate in the future, assuming that annual efficiency improvements in future years continue at the level observed in 2006 for Energy Trust programs. These figures highlight the fact that the incremental benefit of any single year is only a fraction of the cumulative effect of efficiency gains achieved in prior years. It should also be noted that 2006 includes few impacts from renewable energy projects, as the larger scale wind projects are developed across multiple years. When the effects of the larger renewable energy projects are included, the cumulative impacts will be significantly greater than what is shown here using only the savings and generation created in 2006.

Figure 1 shows the cumulative energy savings resulting from Energy Trust energy efficiency program activities in 2006. This exhibit assumes that the 26 aMW in savings observed for 2006 is achieved in future years. Given that the average measure life for equipment covered by Energy Trust programs is over 10 years, the potential for sustained cumulative savings benefits is quite large.

**Figure 1: Cumulative Savings Over Time**

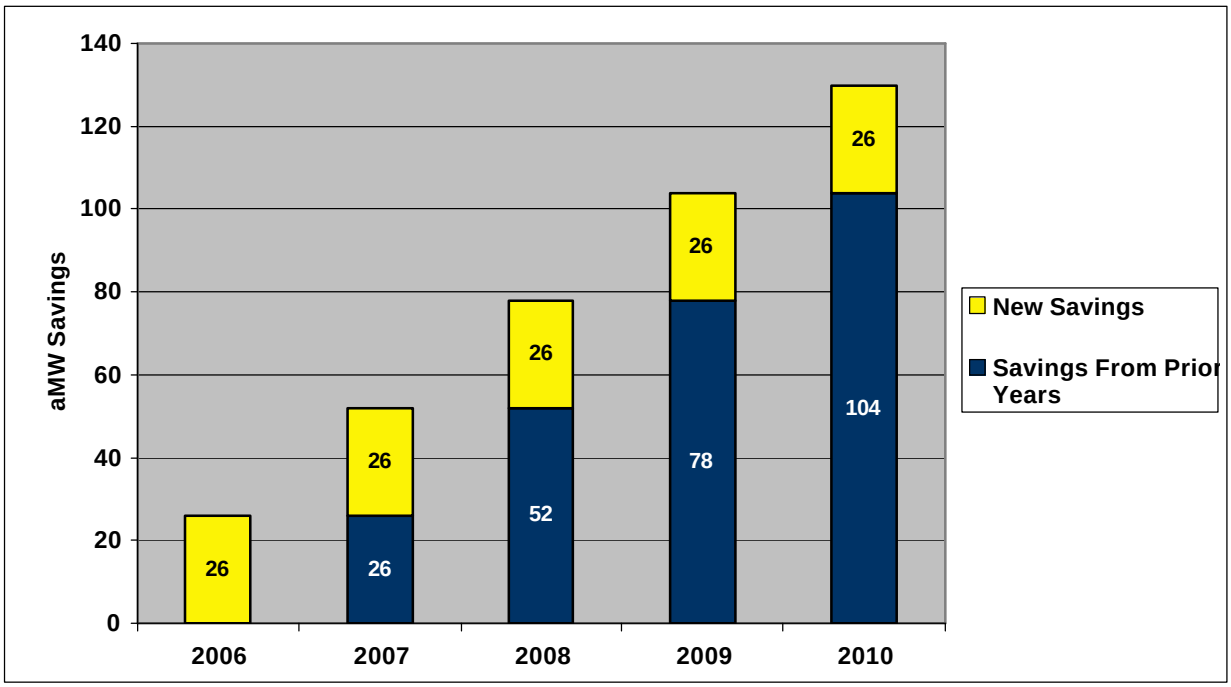


Figure 2 illustrates a similar cumulative effect over time for the economic output impacts that result from energy cost savings. As before, energy savings are assumed to continue at the 2006 levels observed for Energy Trust programs. In 2006, net economic output in Oregon increased an additional $19.6 million based on the energy cost savings achieved in 2006. This trend continues each year that the programs exist and consequently the cumulative benefits expand over time. By the end of 2010, Oregon's economic output increases by $100 million in that year due solely to efficiency gains made over the past five years.

**Figure 2: Cumulative Output Effects Based on 2006 Savings**

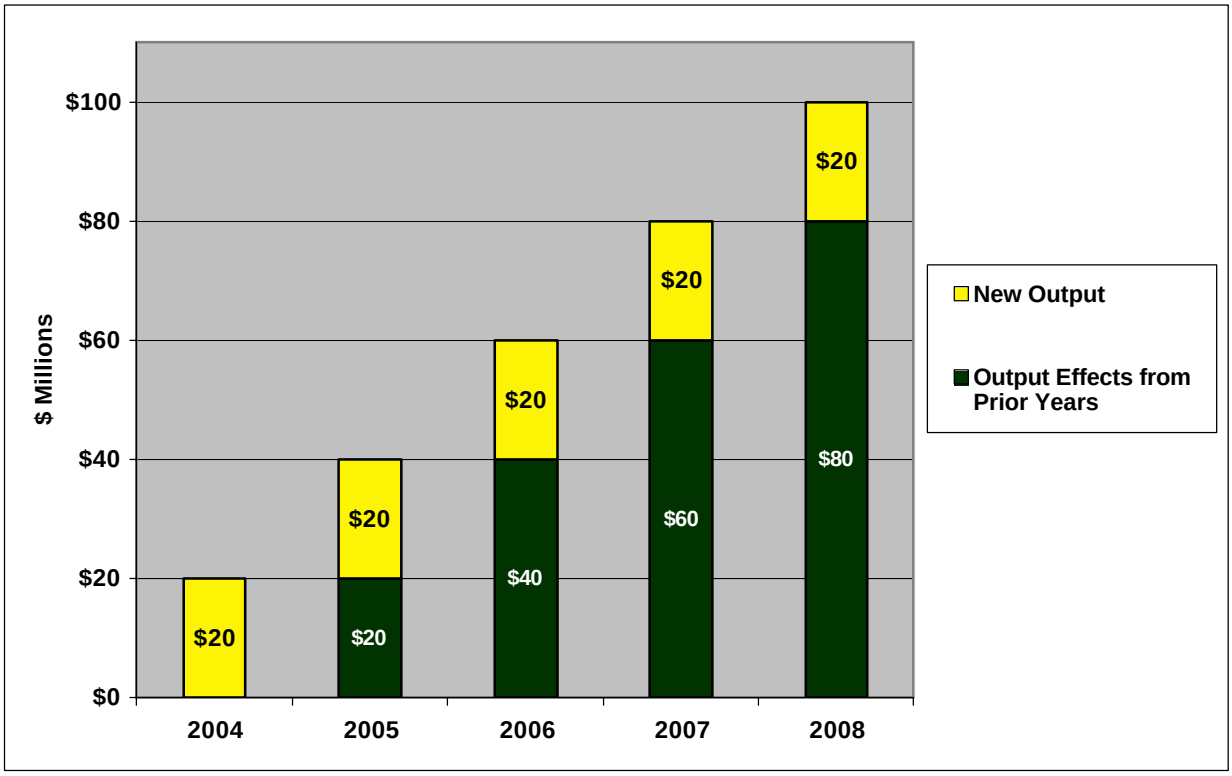


Figure 3 illustrates the potential cumulative impact of energy cost savings on employment in Oregon. When energy cost savings persist over time, businesses are able to direct spending away from energy costs to other factors of production. By lowering their costs, businesses are able to increase output. Similarly, less residential spending on energy also contributes to increased employment as spending shifts to other goods and services in sectors that have a greater impact on the Oregon economy.

As shown in Table 5 and Figure 3, the savings that resulted from Energy Trust's 2006 program activities results in the creation of 193 jobs in subsequent years based solely on the benefit of energy cost reductions. If these savings can be sustained over time, then the employment impacts should persist as well, at least in the short term.[6] The combined effect of energy savings out to 2010 is an increase of 965 new jobs for Oregon, with an additional 193 new jobs added each subsequent year if the savings trends are maintained. After the first year, there would be essentially no cost associated with achieving these energy savings, either in terms of equipment costs or program costs, as all the equipment and program costs have been included in the first year.

[6] The extrapolation from 2006 impacts is presented here as an approximation of the potential employment impacts in the short term. Over the long term, shifts in the Oregon economy and changes in efficiency in other regions will alter the employment impacts. Estimating the long-term impacts taking into account *regional* changes in energy efficiency and the subsequent impact on economic output requires a much more extensive dynamic modeling exercise that is beyond the scope of this project.
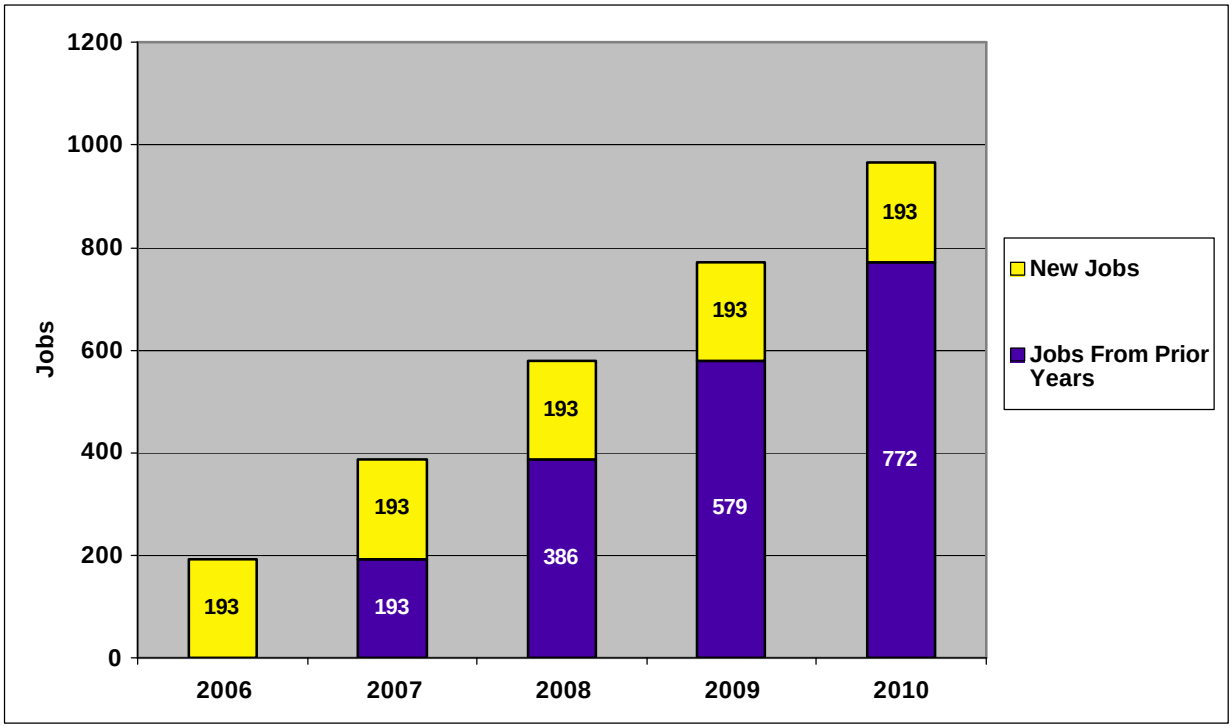
**Figure 3: Cumulative Employment Impacts Based on 2006 Savings**