Reaping the Wind: The Economic Impacts of Spending on Renewable Energy and Energy Efficiency Programs

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ABSTRACT

As part of Oregon's electricity market deregulation, a public benefits fund was established to fund energy efficiency and renewable energy programs within the state through the Energy Trust of Oregon (Energy Trust). To help demonstrate the benefits of these programs, an input-output model was used to estimate their economic impacts in terms of jobs and economic output. All economic impacts of Energy Trust spending are reported as net impacts relative to what would have occurred had the money been returned and spent by Oregon residents. With over $60 million spent on these programs in 2002 and 2003, approximately 530 jobs were created in Oregon and economic output increased by $60 million. In addition, energy efficiency gains for Oregon industries are estimated to create 616 jobs and increase output by $62 million annually if 2003 spending levels are maintained.

This analysis emphasizes benefits that are not often considered with conservation and renewable energy programs. While employment and economic output benefits should not be the primary justification for these programs, these are the benefits that tend to resonate most clearly with lawmakers. This is particularly true for states like Oregon that face budget deficits and high unemployment. In several states lawmakers have looked to public benefit funds to finance other programs and have siphoned off money that was originally mandated for energy efficiency and renewable energy. This paper will be of interest to anyone interested in defending public benefit funds against these types of raids.

Introduction

ECONorthwest was asked by the Energy Trust of Oregon (Energy Trust) to estimate the effects of its energy efficiency and renewable energy programs on the Oregon economy. This includes impacts on employment, output, and wages as well as tax revenue for Oregon for 2002 spending and budgeted spending for 2003. We have also isolated the economic impacts of efficiency gains to estimate the benefits to the economy in the future due to efficiency measures installed in prior years.[1]

For this analysis, all impacts were compared against a Base Case scenario, where funds that were paid to the Energy Trust are assumed returned and spent by Oregon residents. The difference in economic impacts between the Energy Trust spending and the Base Case scenario is referred to as the *net impact* of the spending by the Energy Trust. For example, if an impact of 5 new jobs is reported, this means that spending on Energy Trust programs resulted in 5 more

[1] A copy of the full report showing additional detail on the analysis methods and results is available on the ECONorthwest website www.econw.com.

jobs in that particular sector than would have occurred had the money been returned and spent by Oregon residents. (An alternative scenario for the Base Case is also discussed in footnote 2.)

Spending by the Energy Trust during 2002 occurred between March and December and totaled $19.5 million and spending in 2003 was estimated to be over $41 million. The combined spending by the Energy Trust for these years had the following net impacts on the Oregon economy:

- Economic output increased by $60 million
- 530 new jobs were created in Oregon
- Wages increased by $20 million

In general, the construction, manufacturing, and service sectors of Oregon's economy all experienced net gains in these areas due to the Energy Trust program spending.

The remainder of this paper documents the analysis methods used to estimate these impacts for 2002 and 2003 and concludes with a short section that isolates the economic impacts associated with the improvements in energy efficiency in Oregon's economy.

Analysis Method

Expenditures through the 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 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 economic modeling framework that best captures these direct, indirect, and induced effects 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 out the effects (economic impacts) of a change in the demand for commodities (goods and services). We use the IMPLAN input-output modeling software for this analysis, which utilizes Oregon-specific multipliers to estimate spending impacts at the 4-digit SIC code level.

For this analysis, economic impacts are reported as different types of income effects. In the following tables, the impact on Wages reflects the increase in wage income for all workers as a result of activities funded by the Energy Trust. Similarly, Business Income is the increase in income to local businesses as a result of spending associated with Energy Trust spending. Finally, Jobs reflects the number of full and part time jobs that result directly from Energy Trust activities and from the increase in spending in other sectors of the economy.

Commercial and residential customers that invest in energy efficient have an additional impact on the economy due to lower production costs resulting from lower energy costs. This is particularly true for the commercial and industrial sector, as costs of production decrease and overall output will increase due to more efficient production processes relative to the Base Case where these investments in efficiency do not occur.

Economic Impact Results

2002 Expenditures (March 1 – December 31)

Table 1 shows the general areas of spending for the Energy Trust and reflects actual expenditures from March to December of 2002 (the first period of operation for the Energy Trust). For this analysis, budget information for the Energy Trust has been aggregated into several general categories to facilitate economic impact modeling along similar areas of spending. As shown at the bottom of Table 1, total spending by the Energy Trust in 2002 was $19.6 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, and high efficiency industrial motors, and variable speed fan drives for commercial applications. In 2002, incentives for residential energy efficient measures totaled $1.66 million and the estimated impacts are based on the full cost of each measure (incentive plus the remaining equipment cost paid by the participant). Over twice as much was devoted to the commercial and industrial sector, with $3.53 million going to incentives in 2002. Along with incentives are costs for contracted program management, which is the money the Energy Trust spends for outside agencies to run energy efficiency programs. In 2002, this includes money for both PGE and PacifiCorp to implement the transition programs and funding provided to the Northwest Energy Efficiency Alliance (NEEA).

The final category shown at the bottom of Table 1 includes the costs for the Energy Trust to run its pilot programs and the general overhead and administration costs for all the energy efficiency programs. For 2002, this category also includes spending on the Renewable Energy Program, which amounted to just under $500,000 during this period. As spending for renewable energy was relatively low and did not result in any new generation coming online during 2002, it was included in the Program Management and Implementation category for this analysis as spending effects are likely similar to other expenditures in this category. The combined total for all these costs was $3.18 million for 2002.

Table 1. 2002 Energy Trust Program Spending ($ millions)

Spending Category	Transition Programs	Pilot Programs	Renewables	NEEA	Total
Residential Incentives	1.66	0.3			1.96
Commercial / Industrial Incentives	3.53	0.1			3.63
Contracted Program Management	8.0	0.03		2.8	10.83
Energy Trust Program Management, G&A, Overhead	2.58	0.1	0.5		3.18
Total	**15.77**	**0.53**	**0.5**	**2.8**	**$19.60**

Table 2 provides a summary of the estimated economic impacts for Energy Trust spending for 2002. Again, all of the economic results reported here are *net impacts* and reflect economic benefits over and above what would have occurred had the Energy Trust funds been returned to and spent by Oregon residents.[2] For reporting purposes, spending on residential and commercial incentives is combined into a single category labeled Residential and Commercial Efficiency in Table 2. Similarly, spending on Energy Trust program management, contracted program management, and overhead will all have similar economic impacts and has been combined into the Program Implementation and Renewable Energy category shown at the bottom of Table 2.

As shown in the first column of Table 2, economic output within Oregon increased by $23.9 million from the Energy Trust program spending in 2002 and resulted in a net increase of 203 full and part time jobs within the state. For both residential and non-residential customers, energy cost savings is treated as income each year and assumed to follow normal spending patterns within that sector or individual SIC code. Most of this impact results from the C&I Efficiency segment, as spending on energy efficiency allows Oregon business to operate using less energy, which reduces energy costs, increases business income, and ultimately increases production. This overall increase in economic activity results in an increase in wages for Oregon workers of $7.9 million and an increase in Oregon business income of $1.5 million.

[2] An alternative counterfactual scenario would be to assume that the utilities would have continued to provide energy efficiency programs at their historical levels in absence of the Energy Trust. Based on utility filings with the Oregon PUC, annual spending on energy efficiency programs for both utilities combined has averaged $13.3 million annually over 1999-2001, with average annual electricity savings of 13.4 aMW. Spending on utility programs has varied significantly over this period, ranging from $8.9 million in 1999 to $23.7 million in 2001. Regardless of the variations in spending, the historical funding and savings levels are lower than those projected for the Energy Trust in 2003, where over $30 million will be spent on efficiency programs that are projected to save 28 aMW. If this utility program scenario is used as the counterfactual instead of assuming that the Energy Trust funds are returned and spent by Oregon residents, the benefit estimates for the Energy Trust efficiency programs are reduced by approximately 40 percent relative to 2003 funding and impact levels.

Table 2. 2002 Economic Impacts

Program Sector	Output ($ Millions)	Wages ($ Millions)	Business Income ($ Millions)	Jobs
Residential and Commercial Efficiency	21.2	6.4	1.3	188
Program Implementation and Renewable Energy	2.7	1.5	0.2	15
Total Net Impacts	**$23.9**	**$7.9**	**$1.5**	**203**

Table 3 shows the total impact of the Energy Trust programs in terms of electricity saved, both in terms of energy (annual kWh) and demand (aMW). For these estimates, we reviewed claimed savings for the transition programs being implemented by Portland General Electric and PacifiCorp, the pilot programs started by the Energy Trust, and the energy savings for the NEEA programs that have been attributed to the Energy Trust funding.[3]

A total of 12.61 average megawatts have been saved as a result of Energy Trust program activities in 2002.[4] Of this, approximately 72 percent (9.05 aMW) comes from efficiency gains in the commercial and industrial sectors.

Table 3. 2002 Net Energy and Demand Savings from Energy Trust Programs

Program Sector	Annual kWh Saved	Average MW Saved (aMW)
Residential Sector Programs	31,159,000	3.56
Commercial/Industrial Sector Programs	79,279,000	9.05
Total Energy Saved	**110,438,000**	**12.61**

The efficiency gains shown in Table 3 result in a loss of revenue to Oregon utilities due to lost power sales, and this loss of revenue has been accounted for in our analysis.[5] If the utility sector had similar spending impacts as other sectors in Oregon's economy, then the energy cost savings from 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 both PacifiCorp and PGE are owned by companies headquartered outside the state. Consequently, some of the revenue loss (and the resulting losses in employment and economic activity) is incurred elsewhere. The net result of the efficiency gains, then, is a benefit to the Oregon

[3] A free ridership estimate of 10 percent was applied to the programs to adjust for those participants that would have likely installed the energy efficiency measure even if the program had not existed. The savings estimates provided by NEEA for their programs already account for free riders so no additional adjustment was needed. Savings due to NEEA's promotion of Energy Star high efficiency clothes washers and windows are not included in this analysis.

[4] Due primarily to the large amount hydroelectric resources in the Pacific Northwest, demand impacts are traditionally reported in terms of average megawatts. From an economic cost standpoint, however, it is primarily the kWh impact that will affect operating costs. For these reasons we report both types of impacts.

[5] For this analysis, it was assumed that utilities did not sell saved power on the spot market, as estimates of the amount power sold that can be attributed 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.

economy, as Oregon residents and business enjoy all the benefits of lower spending on electricity while the costs of lost power sales are absorbed in part by entities outside the region.

There is an additional long-term benefit to 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 resources due to increased costs of capital and issues associated with siting new power plants relative to existing resources. 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 but it is an important issue and is one of the primary tenants underlying conservation and demand-side management programs.

2003 Expenditures

Table 4 shows budgeted expenditures for 2003 (the first full year of operation for the Energy Trust) across the same general sectors for 2002.[6] In 2003, spending for the Renewable Energy program is expected to increase substantially and is now separated from the program management category in the economic impact analysis. In 2003, the majority of energy efficiency spending will go to incentives for high efficiency equipment in the residential and commercial sectors, with combined spending of over $25 million planned in 2003. For both the Energy Efficiency and Renewable Energy Programs, total spending for 2003 is $41.76 million.

Table 4. Budgeted 2003 Energy Trust Program Spending ($ million)

Spending Category	Energy Trust Efficiency Programs	Renewables	Total
Residential Incentives	7.6		7.6
Commercial / Industrial Incentives	17.78	5.74	23.52
Contracted Program Management (including NEEA)	6.35	1.28	7.63
Energy Trust Program Management, G&A, Overhead	1.96	1.05	3.01
Total	**33.69**	**8.07**	**$41.76**

Table 5 shows the estimated economic impacts of the planned expenditures in 2003. As before, these impacts are net impacts relative to a Base Case scenario where Energy Trust funds are returned and spent by the Oregon taxpayers. Since the spending for contracted and Energy Trust program management and overhead expenses shown in Table 4 will all have similar

[6] Economic impacts were modeled for the calendar year 2003, but the budget used in this analysis was for the fiscal year ending September 2003. As the Energy Trust was still revising the updated calendar year 2003 budget at the time of this analysis, the FY 2003 budget was used as a close approximation of calendar year spending.

economic impacts, they have been combined in this analysis into the Program Management and Implementation category shown in the Table 5.

For the residential and commercial efficiency programs, the effect of program incentives will increase economic output in Oregon by $23.67 million over the Base Case. Stated another way, planned Energy Trust spending on residential and commercial sector incentives will increase Oregon's economic output $23.67 million over what would have occurred had the same money been spent by Oregon residents based on traditional spending patterns. Spending on residential and commercial incentives will also increase wages by $7.3 million and business income by $1.7 million. This spending will also add 178 new jobs to the Oregon economy relative to the Base Case.

Spending on Program Management and Implementation has a positive effect on Oregon's economy, although this effect is smaller than the other sectors relative to the Base Case. As shown in the second row of Table 5, spending on this area will increase Oregon's economic output by $1.89 million, which includes an increase in wages of $1.4 million and business income of $450,000. There will also be an increase of 47 jobs as a result of spending in these areas.

Renewable energy expenditures increase substantially over 2002 and have been separated into a separate category for the 2003 benefits estimation. Planned projects include several large wind farms, small hydro and solar projects, and the start of a biomass power project. Spending on these projects is estimated to increase Oregon's economic output by $10.75 million in 2003, including an increase of $3.59 million in wages and $690,000 in business income. Renewable projects will also create 102 new jobs in Oregon over what would have occurred in the Base Case.

Table 5. 2003 Economic Impacts

Program Sector	Output ($ Millions)	Wages ($ Millions)	Business Income ($ Millions)	Jobs
Residential and Commercial Efficiency	23.67	7.30	1.7	178
Program Management and Implementation	1.89	1.40	0.45	47
Renewable Energy	10.75	3.59	0.69	102
Total Net Impacts	**$36.31**	**$12.29**	**$2.84**	**327**

The greater program activity in 2003 also results in larger anticipated energy savings for the year. As shown in Table 6, the residential programs are estimated to save 6.0 aMW or 52,560,000 kWh over the entire year. For the commercial sector, Energy Trust programs are anticipated to save 22.0 aMW or 192,720,000 annual kWh. As before, the cost savings for residential and commercial customers resulting from reduced electricity use has been incorporated into the economic benefit analysis, as business have lower costs of doing business and residents spend less money on electricity and therefore can spend more money on other goods and services.

Table 6. 2003 Net Energy and Demand Savings

Program Sector	Annual kWh Saved (Estimate)	Average MW Saved (Estimate)
Residential Sector Programs	52,560,000	6.0
Commercial/Industrial Sector Programs	192,720,000	22.0
Total Energy Saved	**245,280,000**	**28**

Combined 2002 and 2003 Net Economic Benefits

Table 7 shows the combined economic benefits of Energy Trust for both 2002 and 2003. At the end of 2003, Energy Trust programs are predicted to save Oregonians 40.6 aMW of electricity. The combined effect of this energy savings is an increase of $60.21 million of economic output over the Base Case, and includes an increase of $20.19 million in wage income and $4.74 in business income. Investments in energy efficiency will also create an additional 530 jobs in Oregon over this period.

Table 7. Combined 2002 and 2003 Economic and Energy Impacts

Program Sector	AMW	Output ($ Millions)	Wages ($ Millions)	Business Income ($ Millions)	Jobs
Residential and Commercial Efficiency	40.6	44.87	13.7	3	366
Program Management and Implementation		4.59	2.9	1.05	62
Renewable Energy		10.75	3.59	0.69	102
Total Net Impacts	**40.6**	**$60.21**	**$20.19**	**$4.74**	**530**

As the benefits shown in Table 7 suggest, the impact of energy programs have a cumulative impact that will help sustain an economy after the initial spending on these equipment is completed. The next section details the benefits to Oregon's economy from gains in energy efficiency over time.

Cumulative Economic Impacts of Energy Conservation

For most energy efficiency measures, installation occurs during the same year that 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 anywhere from eight to sixteen years (or more). As a consequence, 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 program costs have ended. These cost savings continue to benefit the economy, as households spend less on electricity and businesses are able to produce goods and services more efficiently as energy costs are lower.

Table 8 shows the economic benefits resulting from efficiency improvements based on the average megawatts saved in 2002. 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. 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. It is these reduced energy costs that are relevant when estimating the continued benefits of efficiency improvements after the initial investment has been made.

Table 8 shows the estimated benefits for different economic factors from a one average megawatt improvement in energy efficiency. These numbers show the effect of money that normally would have been spent on electricity becoming available as income and spent within the sector. As shown in the first row of Table 8, one average megawatt saved increases annual economic output in Oregon by $2,230,572. Wage income in Oregon also increases by $684,536 and business income by $125,882 with each average megawatt saved through improved energy efficiency. Each average megawatt improvement also results in an increase of 22 new jobs in Oregon.

Table 8. Economic Impacts per Average Megawatt Savings

Economic Impact Measure	Impact per aMW Saved
Output	$2,230,572
Wages	$684,536
Business Income	$125,882
Jobs	22

Source: Calculated by ECONorthwest using 2002 Energy Trust spending and energy savings impacts.

The following figures show the cumulative effects of continued improvements in efficiency and assume that annual efficiency improvements in future years will continue at the level predicted for 2003. These figures highlight the fact that the incremental benefit of any single year is quickly dwarfed by the cumulative effect of efficiency gains achieved in prior years.

Figure 1 shows the extrapolation of average megawatt savings if improvements were to continue at the level anticipated for 2003.[7] By 2006, total energy saved through energy efficiency investments is 125 average megawatts. The continued gains in efficiency help guard against the cyclical tendency for promoting energy efficiency – where conservation is emphasized only as a response to a current or past energy crisis. Continuous investment in energy efficiency allows the economy to consistently improve and be better positioned to deal with the future energy crisis as less electricity will be needed and households and business are operating more efficiently.

Figure 2 shows the cumulative effect of energy efficiency gains if conservation rates were to continue at 2003 levels. In 2003, economic output in Oregon is increased an additional $28 million based on the energy efficiency gains made in 2002. This trend continues each year that the programs exist and consequently the cumulative benefit expands over time. By 2006

[7] This is consistent with the Energy Trust's stated goal of conserving 300 aMW by 2012.

(assuming annual incremental energy savings continue at 2003 rates), economic output increases by $215 million in that year due solely to efficiency gains made in prior program years.

Figure 1. Cumulative aMW Savings

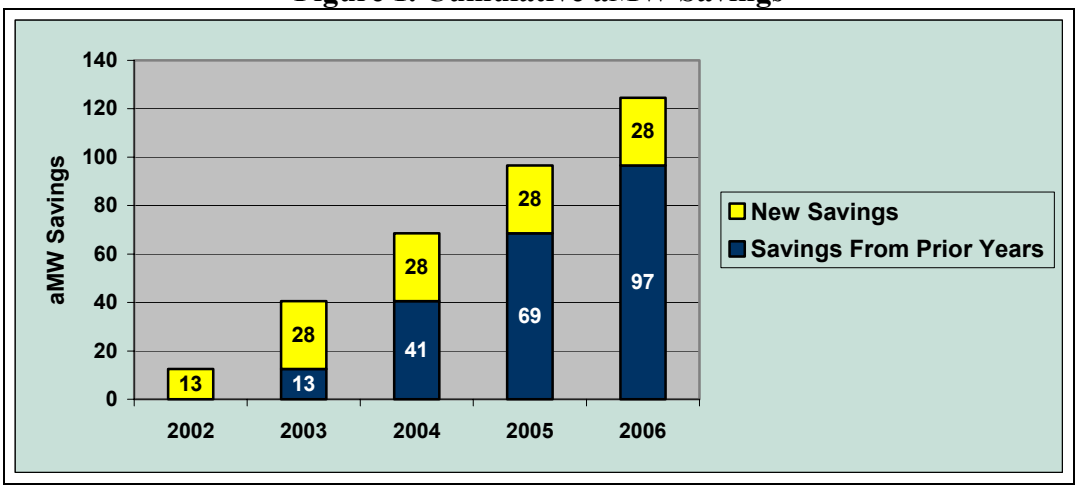


Figure 2. Cumulative Economic Output Effect from Energy Savings

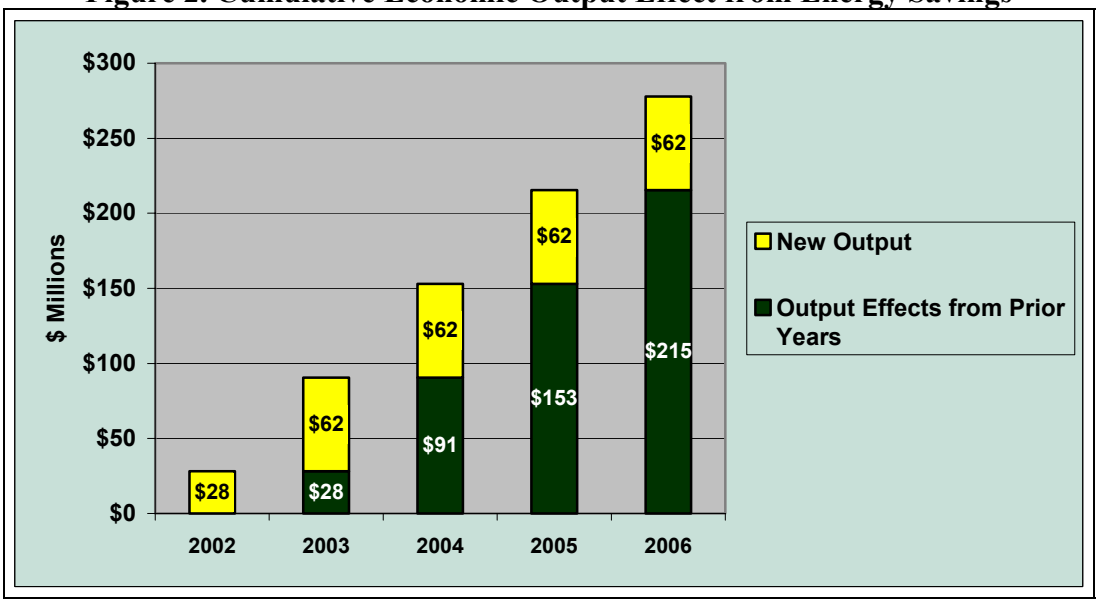
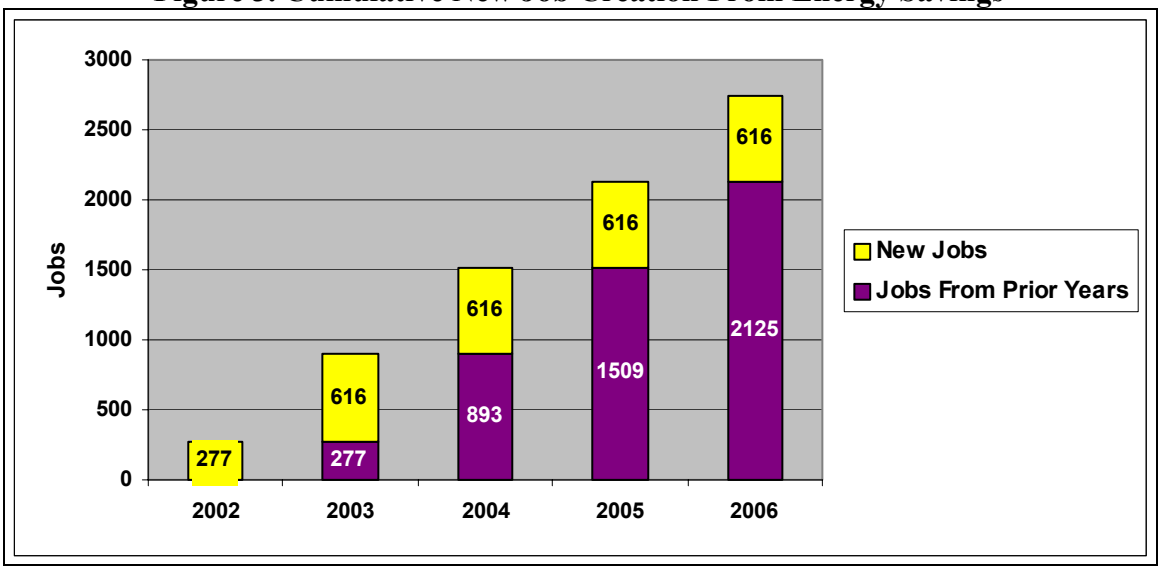


Figure 3 shows the cumulative impact of improved energy efficiency on employment in Oregon. When efficiency gains persist, businesses are able to direct spending away from energy costs to other factors of production and by lowering their costs are able to increase output. Similarly, residents spending less on energy also contribute to increased employment as spending shifts to other goods and services that have a greater impact on the Oregon economy. The analysis presented earlier shows that the combined shift in spending translates to about 22 jobs for each average megawatt gained through efficiency. If these efficiency gains persist over time, then the employment impacts should persist as well, at least in the short term.[8] The

[8] Over the long term, shifts in the Oregon economy and changes in efficiency in other regions will alter these employment impacts. Without a much more detailed modeling exercise that takes into account changes in regions

combined effect of energy savings for 2002 and 2003 is an increase of 893 new jobs, with an additional 616 new jobs added each subsequent year.[9] If present trends continue, the cumulative effect on employment by 2007 will be 2,741 new jobs for Oregon relative to the case where these energy efficiency investments are not made.

Figure 3. Cumulative New Job Creation From Energy Savings



Conclusions

As part of Oregon's electricity market deregulation, a public benefits fund was established to fund energy efficiency and renewable energy programs within the state. To help demonstrate the benefits of these programs, an input-output model was used to estimate their economic impacts in terms of jobs and economic output. With over $60 million spent on these programs in 2002 and 2003, approximately 530 jobs were created in Oregon and economic output increased by $60 million. This is relative to the case where these funds are returned and spent by Oregon residents following historical spending patterns. In addition to the spending effect, energy efficiency gains for Oregon industries are estimated to create 616 jobs and increase output by $62 million annually in future years if 2003 spending levels are maintained. In particular, the construction, manufacturing, and service sectors all experience net gains in employment and output due to the Energy Trust program spending.

This analysis emphasizes benefits that are not often considered with conservation and renewable energy programs. While employment and economic output benefits should not be the primary justification for these programs, these are the benefits that are often most important to lawmakers. This is particularly true for those states like Oregon that face budget deficits and high unemployment.

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outside of Oregon, long term employment impacts are impossible to predict with accuracy. The extrapolation from 2002 impacts is presented here only as an approximation of employment impacts in the short term.

[9] Note that these estimates are higher than the net effects reported earlier for 2002 as they reflect the continued benefit of spending from prior years. In essence, for energy savings from prior years is a free benefit in future years, as the cost of achieving this benefit has already been incurred in earlier years.