Energy Productivity: Efficiency Benefits for Both the Ohio Economy and the Global Climate

John A. "Skip" Laitner
Director, Economic Analysis
American Council for an Energy-Efficient Economy
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Introduction

Ohio is rich in coal and renewable energy potential**.** At the same time, it is also rich in opportunities to improve its economy-wide energy productivity. Cost-effective improvements in overall energy efficiency can save money, provide a small but important net gain in jobs, and reduce carbon dioxide emissions which contribute to global climate change.[1] The E3 Network (or Economics for Equity and the Environment) and the Natural Resources Defense Council (NRDC) asked the American Council for an Energy-Efficient Economy (ACEEE) to examine the reason for this possibility.

While energy is an important part of the Ohio economy, the energy industries are not especially labor intensive compared to the rest of the economy. Nor do they contribute to the state's Gross State Product (GSP) at the same rate as other sectors of the economy. The critical data for Ohio (based on the 2006 economic accounts for the state) are summarized in the table below, where the dollars are dollars of revenue.

	Ohio Economic Sectors	
Direct Impact	**Energy**	**All Other**
Employment (jobs per million dollars)	1.4	7.6
Contribution to GSP (per dollar)	.4	0.5

Based on Ohio-specific economic data, the combined energy-related sectors of the Ohio economy – these include coal mining, electricity production, natural gas services, and other related activities – provide an average of 1.4 direct jobs per million dollars of revenue. All other sectors of the economy – including manufacturing and commercial

[1] There is a broad array of energy-efficient technologies that can be tapped for their productivity benefits. These include the purchase of Energy Star appliances and office equipment to more energy-efficient industrial processes. It also includes greater fuel economy in the fleet of transportation vehicles to more energy-efficient electricity production from combined heat and power plants or waste-to-energy generation systems. Compared to normal energy production and consumption patterns, studies typically find a potential cost-effective savings of 25-30 percent through 2030. With further research and development that amount of efficiency potential can grow over time.

services – provide an average of about 7.6 jobs. Similarly, the energy-related sectors contribute only 40 cents of each revenue dollar to Ohio's GSP while all other sectors contribute close to 50 cents per dollar of revenue (IMPLAN 2008).

This economic context is not unique to Ohio. It turns out that this pattern is repeated throughout all regions of the U.S. economy. That is, all energy-related sectors stimulate less economic activity per dollar of revenue than almost all other business activities. This means that where Ohio can invest in greater energy efficiency – and do so in ways to save money – the resulting energy bill savings allows consumers and businesses to spend money for other goods and services that actually increase the number of jobs compared to the jobs provided directly by the energy industry.

An Economic Thought Experiment

We can adapt the actual Ohio data shown in the table above to determine the potential impact on the state's economy if business and policy leaders were to promote greater energy efficiency as a means to reduce carbon dioxide emissions.

In 2001, for example, the American Council for an Energy-Efficient Economy (ACEEE) recommended a series of energy productivity measures that might have been adopted by the U.S. Congress (Nadel and Geller 2001). Had that series of measures actually been adopted, both the U.S. and the Ohio economies might have improved their respective efficiencies by about six percent compared to their actual performance in 2006.[2] This would have saved money for consumers and businesses. Presumably that energy bill savings would have been spent in other ways, and for this analysis we assume that this spending occurs within the State.

The latest data from the Energy Information Administration shows that Ohio spent an estimated $44,493 million for its total use of energy in 2006.[3] While this amount has undoubtedly grown since then – driven primarily by higher prices we now pay for energy – we can use this information to show the magnitude of impact on the Ohio economy had the state been just 6 percent more energy-efficient.

Using that information we can set up the following calculations to estimate the impact of efficiency gains on both jobs and the state's economy. For net gains in employment, we would show

$$44{,}493 * 0.06 * (7.6 - 1.4) = 16{,}551 \text{ net jobs}$$

In other words, had Ohio promoted a slightly different mix of productive investments so that the state was just six percent more energy efficient, it could have supported about

[2] Author's calculations based on implied impacts of efficiency gains suggested by Nadel and Geller (2001).
[3] The latest data for total energy expenditures available at this point is for the year 2005(EIA 2008a). This information was updated to 2006 using working estimates from the revised *Annual Energy Outlook 2030* (EIA 2008b).

16,551 more jobs than the state now otherwise provides. While this number seems small compared to an overall population of just over 11 million people, it is a significant total in a state looking to increase overall employment opportunities.

We can also examine the impact of efficiency gains on the State's economy by using a similar calculation to determine the impact on GSP, as follows:

$$44{,}493 * 0.06 * (0.5 - 0.4) = \$267 \text{ million (in 2006 dollars)}$$

Here we show a net benefit of about $267 million for the Ohio economy simply by emphasizing greater energy productivity within the state over the last half-dozen years. These numbers are conservative because they assume the energy savings exactly offset the cost of the investments. We know, however, that the energy savings would likely pay for themselves over a 3-5 year period. In regards to the current thought experiment, then, all of the investments made in 2001 would have completely paid themselves off by 2006, and some of them would have *more* than paid for themselves. With buildings and equipment that have investment lives that are 15 years and longer, for example, it is likely the productivity gains would be significantly larger over a longer span of time.

Examining the Impact of Climate Protection in 2030

We can extend this analysis to see whether a more energy-efficient future might positively impact the Ohio economy out to the year 2030. According to the EIA (2008b) the nation's total energy expenditures – in constant dollars to eliminate the expected impact of inflation – might be expected to grow by about 16 percent in 2030 compared to 2006. In the case of Ohio, a combination of greater energy use and higher energy prices would increase the state's energy bill from $44,493 million in 2006 to about $51,612 million in 2030 (with all energy expenditures expressed in constant 2006 dollars). At the same time, normal productivity gains might be expected to change both the number of jobs and the rate of contribution to GSP in 2030 (as suggested in the calculations below).

By 2030, ACEEE and others studies suggest that energy efficiency gains could grow from six percent to 25 percent or better by 2030. Hence, energy efficiency gains would reduce CO_2 emissions by about 25 percent in this analysis. If we expanded our analysis to include a combination of renewable energy and other clean energy supply technologies, the reduction in CO_2 emissions might grow to a 40 percent reduction by 2030.[4]

Substituting the anticipated values for 2030, we can estimate the net impact on jobs as follows:

[4] There is a very large literature and set of reports on the greater energy efficiency potential in the U.S. and around the world. See, for example: McKinsey Global Institute (2007 and 2006), Expert Group on Energy Efficiency (2007), and Laitner et al. (2006). There are also a large number of assessments completed for many of the states that also inform policymakers about cost-effective policy options. See: Eldridge et al. (2008) for Maryland), Elliott et al. (2007 for Texas), and Laitner and Kushler (2007 for Michigan).

$$51{,}612 * 0.4 * (5.0 - 0.8) = 86{,}708 \text{ net jobs}$$

In this case, if Ohio chooses to promote a combination of energy efficiency and clean energy technologies as the critical step in reducing carbon dioxide emissions, such that both energy use and greenhouse gas emissions are productively reduced by 40 percent, the state might support about 86,708 more jobs than otherwise forecast. In terms of equivalent jobs, this would be the employment directly and indirectly supported by about 690 new manufacturing plants located in the state.

As before we can also repeat this same calculation for the state's GSP:

$$51{,}612 * 0.4 * (0.54 - 0.44) = \$2{,}064 \text{ million (in 2006 dollars)}$$

So, instead of a net loss as some might first expect, we find that greater energy productivity gains can generate a net benefit of about $2,064 million for the Ohio economy.[5] As we previously suggested these numbers are conservative because they assume the energy savings exactly offset the investment costs. Even with a longer expected payback as the costs of energy efficiency and clean energy technology grows (with the greater level of emissions reductions), the energy efficiency investments would likely pay back within a 5-9 year period. So with buildings and equipment that still last 15 years and longer, it is still likely the productivity gains would be significantly larger than suggested here.

Conclusions

Based on the available data for the State of Ohio there does seem to be good news about energy and climate change policies. They do not have to be about ratcheting down the economy; rather, they can be about more productive investments that provide Ohio and the U.S. with the needed goods and services while providing them more efficiently.

The data suggest that an appropriate policy analysis would show the very real possibility for small but net positive benefits for Ohio by 2030 – about 87,000 net jobs and a net GSP benefit of about $2.1 billion.[6] This assumes the emissions reductions are led by productivity investments in more energy-efficient and less carbon-intensive energy supply technologies. In short, this analysis suggests there is a very real possibility of an innovation strategy which emphasizes a cost-effective substitution of productivity for energy consumption.

[5] Projections by Economy.Com suggest that Ohio's economy will have a Gross State Product of just over $700 billion by 2030 (as expressed in 2006 dollars). A net gain of about $2,064 million (or about $2.1 billion) represents a very small but net positive gain of about 0.3 percent of GSP.

[6] For further information and the details that underpin this analysis, contact the author either by email at jslaitner@aceee.org, or by phone at (847) 865-5106.

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