



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

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Introduction

Tennessee has some of the highest hydroelectric power potential in the United States. It also has minor coal reserves in the eastern part of the State and is among the leading nuclear power States in the country. Perhaps more critically, Tennessee (as with all other states within the United States) 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 Tennessee 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 Tennessee (based on the 2006 economic accounts for the state) are summarized in the table below, where the dollars are dollars of revenue.

	Tennessee Economic Sectors	
	Energy	All Other
Direct Impact		
Employment (jobs per million \$)	1.7	7.6
Contribution to GSP (per dollar)	0.49	0.50

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. Including renewables as part of the resource mix might expand the potential for greenhouse gas emissions reductions to 40 percent or more. With further research and development that amount of efficiency and renewables potential can grow over time.

Based on Tennessee-specific economic data, the combined energy-related sectors of the Tennessee economy – these include coal mining, electricity production, natural gas services, and other related activities – provide an average of 1.7 direct jobs per million dollars of revenue. All other sectors of the economy – including manufacturing and commercial services – provide an average of about 7.6 jobs. Similarly, the energy-related sectors contribute 49 cents of each revenue dollar to Tennessee’s GSP while all other sectors contribute 50 cents per dollar of revenue (IMPLAN 2008).

This economic context is not unique to Tennessee. 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 Tennessee 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 Tennessee 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 Tennessee 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 Tennessee spent an estimated \$23,186 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 Tennessee 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

$$23,186 * 0.06 * (7.6 - 1.4) = 8,625 \text{ net jobs}$$

In other words, had Tennessee promoted a slightly different mix of productive investments so that the state was just six percent more energy efficient, it could have supported about 8,625 more

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).

jobs than the state now otherwise provides. While this number seems small compared to an overall population of just over 6 million people, it is a significant total in a state looking to increase overall employment and economic development 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:

$$23,186 * 0.06 * (0.50 - 0.49) = \$14 \text{ million (in 2006 dollars)}$$

Here we show a net benefit of about \$14 million for the Tennessee 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 Tennessee 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 Tennessee, a combination of greater energy use and higher energy prices would increase the state's energy bill from \$23,186 million in 2006 to about \$26,850 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 CO₂ 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 CO₂ 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:

$$26,850 * 0.4 * (4.9 - 1.6) = 35,442 \text{ net jobs}$$

In this case, if Tennessee 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

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).

support about 35,442 more jobs than otherwise forecast. In terms of equivalent jobs, this would be the employment directly and indirectly supported by about 284 new manufacturing plants located in the state.

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

$$26,850 * 0.4 * (0.54 - 0.52) = \$284 \text{ million (in 2006 dollars)}$$

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 \$284 million for the Tennessee 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 Tennessee, there does seem to be good news about energy and climate change policies. Such policies do not have to be about ratcheting down the economy; rather, they can be about more productive investments which provide Tennessee 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 Tennessee by 2030 – about 35,000 net jobs and a net GSP benefit of about \$284 million.⁶ This assumes the emissions reductions are led by productivity investments in more energy-efficient and less carbon-intensive energy supply technologies.

Perhaps the even better news is that the analytical findings reported here are entirely consistent with past studies which included an analysis for the State of Tennessee (Center for Electric Power 1999 and Tellus Institute 2001). They are also consistent with a recent meta-review of 48 previous studies that cover state and regional energy policy assessments within the United States (Laitner and McKinney 2008). In short, this analysis suggests the very real possibility for an innovation-led energy policy strategy which emphasizes a cost-effective substitution of energy productivity gains for inefficient energy consumption. To the extent that productivity is actually pursued within the state, it should lead to a small but net positive economic impact for Tennessee as well as the U.S.

⁵ Projections by Economy.Com suggest that Tennessee's economy will have a Gross State Product of just over \$458 billion by 2030 (as expressed in 2006 dollars). A net gain of about \$284 million (or about \$0.284 billion) represents a very small but net positive gain of about 0.06 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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