Understanding the True Benefits of Both Energy Efficiency and Job Creation*

Casey J. Bell

The American Council for an Energy-Efficient Economy (ACEEE)

In recent years, the U.S. economy has struggled to create and sustain job growth. Despite the technical end of the "Great Recession" in 2009, recovery has been slow and unemployment remains high. In the face of continued high unemployment, policymakers continue to seek lasting solutions that will reenergize the American workforce and create permanent job opportunities.

Investments in energy efficiency spark opportunities for employment that draw on skill-sets that are prevalent in the United States. Moreover, evidence suggests that as companies' investments in energy efficiency improve their bottom line, their competitiveness increases, which can help bring jobs back to American soil.[1] Furthermore, cost savings from energy efficiency can eventually translate into additional productive spending, creating economic development opportunities and increasing job creation.

However, the means through which investment in energy efficiency stimulates net job creation are complex and often misunderstood. Discrepancies between approaches to modeling job creation and measuring it after implementation can lead to conflicting ideas about the effectiveness and value of energy efficiency programs. Thus, in order to increase and maintain support for energy efficiency policies and programs, it is important to flesh out the underlying economic argument and assumptions that drive preliminary analyses. Such efforts can also help us to set appropriate goals and realistic expectations for program implementation and job creation measures.

Net Jobs or Gross Jobs?

Models that explore the potential impact of policies and programs on job creation (e.g. input-output and computable general equilibrium models) are often based on shared accounting matrices that represent how industries within the economy trade goods and services with one another. These matrices are typically based on data from the Bureau of Labor Statistics, the Bureau of Economic Analysis, and other sources.[2]

---

* Portions of this article are excerpted from Energy Efficiency Job Creation: Real World experiences, an ACEEE white paper, and related blogs and fact sheets. The article, as a whole is original and has not been previously published and is not in the public domain. For more information on this topic, visit the website at www.aceee.org.

1 H. Sirkin, M. Zinser, and D. Honer, Made in America, Again: Why Manufacturing Will Return to the U.S. (Chicago: Boston Consulting Group, 2011).

2 Minnesota Implan Group, Using IMPLAN V3. (Hudson, WI: MIG, 2011).

Analysts apply a series of manipulations to these matrices to derive multipliers that represent how many jobs (or how much economic activity) are created per $1 million invested in each sector of the economy. In other words, any investment in any industry in the economy will result in some level of job creation. However, one should be wary of those who choose to report on gross job creation (see Table 1) without assessing impacts relative to the "business as usual" case. This approach ultimately inflates the estimates by neglecting to provide context. For example, a coal-fired power plant may support 100 jobs. However, if those expenditures into energy production and distribution were redirected to more labor-intensive energy efficiency investments, the economy might be able to support 170 jobs. In this scenario, it is misleading to claim that the power plant creates 100 jobs.[3]

Table 1. Common Terms Used in Jobs Analysis

Job	A metric that is equivalent to the resources required to employ 1 person for 12 months (or 2 people for 6 months each, or 3 people for 4 months each. Can be full- or part-time.
Gross Jobs	The total number of jobs supported by an industry and its supply chain.
Net Jobs	The number of jobs supported by an industry and its supply chain beyond a "business as usual" reference case.
Direct Jobs	Jobs generated directly from a change in spending patterns resulting from an expenditure or effort.
Indirect Jobs	Jobs generated in the supply chain and supporting industries of an industry that is directly impacted by an expenditure or effort.
Induced Jobs	Jobs generated by the re-spending of received income resulting from direct and indirect job creation.
Labor Intensity	The proportion of labor capital required to produce goods and services.

Source: MIG 2011 and ACEEE 2011

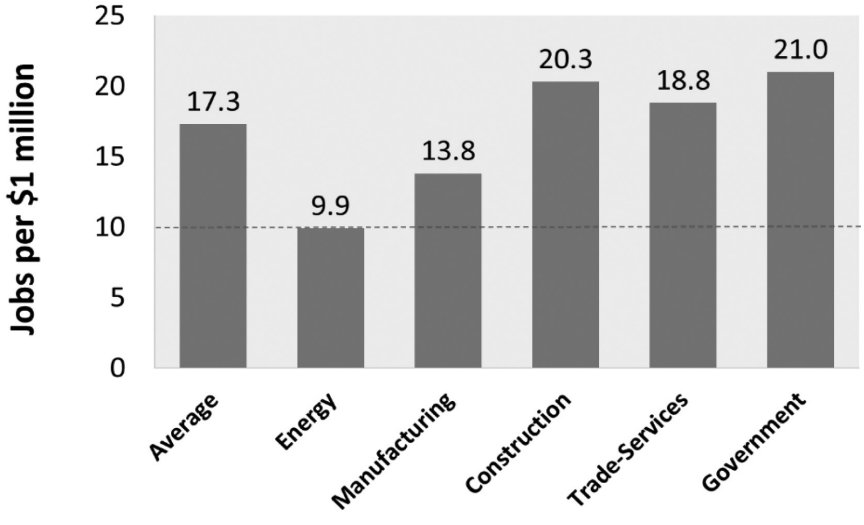
Instead, a more accurate analysis would report on net job creation (or loss). Net jobs (see Table 1) are created only when the employment created by an investment extends beyond the "business as usual" scenario–in other words, the number of jobs that would have been supported on average across all sectors of the economy by that same investment amount.[4]

Figure 1 extracts multipliers for labor intensities (see Table 1) across various industries from the IMPLAN shared accounting matrix. We can compare these labor intensities to form a compelling narrative about how investments in energy efficiency, and the energy savings resulting from these investments, create and sustain jobs.

3 ACEEE, "How Does Energy Efficiency Create Jobs?" (Washington, DC: American Council for an Energy-Efficient Economy, 2011).

4 Ibid.

Figure 1. Jobs per Million Dollars of Revenue by Key Sectors of the US Economy



Source: MIG 2011 and ACEEE 2011

Two Links between Energy Efficiency and Job Creation

Investments in energy efficiency shift spending patterns within an economy in two ways, both of which stimulate a net increase in employment. First, an expenditure or effort such as a building owner's investment in energy efficiency upgrades or an infrastructure investment stimulates the creation of jobs as the project is carried out, and, second, the dollars saved from lower energy bills are re-spent in the broader economy.[5]

> I described this phenomenon in an earlier ACEEE white paper:
>
> Both the initial investment and the re-spending of energy savings produce direct, indirect, and induced jobs. Direct jobs are jobs that are supported directly through a shift in spending patterns resulting from an expenditure or effort. Indirect jobs are generated in the supply chain and supporting industries of an industry that is directly affected by an expenditure or effort. Induced jobs are generated by the re-spending of income resulting from newly created direct and indirect jobs.
>
> Generally, an initial investment in energy efficiency drives direct, indirect, and induced jobs in labor-intensive industries such as construction, engineering, maintenance, and contracting. Direct jobs are created as workers are deployed to develop and install the efficiency measures. Indirect jobs are subsequently created in the supply chain in facilities such as lumber yards and with manufacturers such as plumbing suppliers.

5 C. Bell, Energy Efficiency Job Creation: Real World Experiences. (Washington, DC: American Council for an Energy-Efficient Economy, 2012).

> Then, as newly employed workers spend their earnings, induced jobs are created in a wide variety of service and retail industries throughout the economy.
>
> The second round of job creation occurs as individuals and businesses re-spend the money that they saved through lower energy bills, and this wave of job creation reverberates throughout the economy over the long-term. In fact, this is where the bulk of energy efficiency job creation resides. Dollars once spent on energy bills are put back into the general economy (which is, on average, more labor intensive than energy production and distribution), and ongoing job creation is stimulated. The recognition of energy savings, in the form of lower energy bills, causes consumers and businesses to redirect their prior spending into other activities to support higher levels of employment in the form of direct, indirect, and induced jobs.
>
> For example, a factory that recognizes significant energy savings from a retrofit of its facilities may be able to support (or maintain) direct jobs as a result of increased competitiveness. Depending on the demand for goods and services from the beneficiary, factory suppliers may also see a small but net positive increase in employment. And, as with the first mechanism, induced jobs are generated as new workers spend their earnings in the surrounding economy.[6]

As a simplified numerical example of the two ways in which energy efficiency stimulates job creation, we will consider an energy efficiency upgrade where the initial expenditures for an energy efficiency project will rely heavily on the labor-intensive construction industry. According to Figure 1, "construction" supports approximately 20.3 jobs per $1 million dollar investment. This industry is more labor intensive than the economy on average, which is labeled "average" above. The economy on average supports 17.3 jobs per $1 million. So the initial investment shifts spending from the economy on average (17.3) into the construction industry (20.3) to create approximately 3 jobs per $1 million.[7]

In addition, energy savings will shift spending away from energy production and distribution, which is labeled "energy" in Figure 1. Energy production and distribution, in this example supports 9.9 jobs per $1 million. Energy savings shift spending back into the economy on average, or "average" (17.3) to create approximately 7 jobs. Let's say the initial investment produces energy savings for 20 years. These 7 jobs are supported each year for 20 years.[8]

Real World Examples of Energy Efficiency Job Creation

In an earlier article and ACEEE blog post, I profiled six examples of real world experiences in energy efficiency job creation.[9] These "vignettes" illustrate examples of job

6 Ibid.

7 ACEEE, "How Does Energy Efficiency Create Jobs?" (Washington, DC: American Council for an Energy-Efficient Economy, 2011).

8 Ibid.

9 C. Bell, Energy Efficiency Job Creation: Real World Experiences. (Washington, DC: American Council for an Energy-Efficient Economy, 2012).

creation resulting from energy efficiency by profiling programs, policies, investments, partnerships, and business models that have spurred regional increases in employment. These examples serve as valuable examples of the types of jobs created through energy efficiency, however it should be noted that all numbers are self-reported by the subjects. Highlights from the report include the following:

OPower: Opower is a software provider that partners with utilities to develop feedback reports on home energy performance. Opower today employs more than 400 software engineers, programmers, and sales and marketing experts.[10]

New York City Greener, Greater Buildings Plan: The New York Greener, Greater Buildings Plan was enacted in 2009. Four local laws require, among other actions, annual benchmarking of building energy performance and retro-commissioning. A number of firms have employed energy analysts to help meet compliance and the subsequent demand for interpreting benchmarking metrics and applying the information to investment decisions.[11] New York City estimates that the laws will generate $700 million in savings and support roughly 17,800 construction jobs over 10 years.[12] These reported numbers are likely gross effects, but the employment returns to efficiency should be sufficient to promote net job creation.

Nissan North America: In 2006, in the aftermath of Hurricane Katrina and amid rising natural gas prices, Nissan decided to prioritize investments in energy efficiency and establish a rigorous energy-management program to control manufacturing costs and become more competitive. By improving the cost-effectiveness of the production process, Nissan is now more competitive, creating and retaining jobs on U.S. soil.[13]

Ohio Low-Income Weatherization: With support from the American Recovery and Reinvestment Act (ARRA), the Corporation for Ohio Appalachian Development (COAD) weatherized 9,000 homes and expanded its workforce by 400 people and catalyzed a total of 188 indirect and induced jobs in Ohio. They are now working to sustain program funding without ARRA. COAD estimates that at full funding, given current demand, the program could support approximately 1,600 jobs during the next 20 years.[14]

Johnson Controls, Wisconsin Energy Initiative: In 1992, Johnson Controls worked with the State of Wisconsin to implement energy conservation lighting projects, and expanded their efforts in 1998 to include additional efficiency measures. The total

10 (Opower 2014), available at http://opower.com/company.

11 Personal communication with E. Brabon, Steven Winters & Associates, June 26, 2012.

12 A. Burr, Energy Disclosure and the New Frontier for American Jobs. (Washington, DC: Institute for Market Transformation, 2012).

13 U.S. Department of Energy, Nissan Showcases the Results of an Energy-wise Corporate Culture. (Washington, DC: DOE, 2012).

14 Personal communication with T. Calhoun, Corporation for Ohio Appalachian Development, Sept. 14, 2012.

effort created 1,500 annual jobs for more than 50 private-sector companies employing architects, engineers, electricians, and maintenance workers.[15]

General Electric, Appliance Park: Appliance Park in Louisville, Kentucky, is the headquarters for General Electric Appliances, which manufactures more than 750 ENERGY STAR-qualified lighting and appliance products. Appliance Park made headlines in October 2010 when it announced that it would invest $800 million to upgrade the facilities in order to begin manufacturing new products at the Louisville campus, including a dishwasher production line being moved to Louisville from Mexico. A 2010 Tripp Umbach study commissioned by GE shows that the Appliance Park directly and indirectly generates $1.6 billion in the state from local purchasing and other mechanisms, and supports over 12,000 jobs in the state. For every job at Appliance Park, which employs more than 5,000 full-time employees, an additional 1.5 jobs are indirectly supported through vendor purchases or are induced through the re-spending of a GE employee's wages.[16]

Discrepancies between Modeling Predictions and Verifying Real World Experiences

Fiscal responsibility is an important priority, and energy efficiency is a cost-effective policy intervention that can provide economic development benefits in addition to energy savings and environmental impacts. However, verification of job creation, can pose a challenge. While ACEEE is in the process of establishing a generally accepted method for verifying job creation from energy efficiency investments, to date there is no standard approach.

Programs typically use either a modelling tool such as input-output model to estimate the job impacts or a headcount to show evidence of job creation. Both approaches have shortcomings. Input-output models were not developed for ex-post analyses, but are appropriately used as predictive tools. They also do not provide concrete evidence of job creation, and given their reliance on assumptions, they are vulnerable to skepticism.

Headcounts do provide verification of jobs created, but it is challenging for them to convey the full range of direct, indirect and induced job creation. In addition, program managers may struggle to gather accurate employment information from contractors. It is also challenging to assess how many of the new jobs that they report are directly attributable to the energy efficiency program.

Additional challenges arise when programs try to compare predictive modeling results with results from headcounts. As Table 1 specifies, jobs in these models are measured in terms of job-years or, in some cases, full time equivalency. Therefore, a job is a metric that represents the amount of resources required to employ one person for forty hours per week for a full year (or two people for six months each, or three people for four months each). The

15 Johnson Controls, Inc., Case Study: Wisconsin Energy Initiative. (Madison, WI: Johnson Controls, 2008).

16 General Electric, "GE Unveils French Door Refrigerator Factory in Louisville's Appliance Park." Press Release. Louisville, KY: GE, 2012).

metric of a job can be composed of full- or part-time employment.[17] Programs often include additional parameters around the metric such as only counting full-time employees, positions that pay a living wage, or individuals that have been on the job for a full year. These additional parameters cause discrepancies. For example, if a program measures an individual with 2,080 hours at the time of analysis as one job and a particular position has been occupied by two different individuals over the course of the year because of turnover, the results of the model and the headcount will not match.

When verifying indirect and induced jobs there is even more gray area. Degrees of separation from initial program spending make it more difficult to account for the job creation activity that is directly attributable to the energy efficiency program or investment. Furthermore, it may be particularly challenging to provide concrete evidence of net job creation, as it could be challenging to measure and verify jobs that were not created and maintained in other industries.

These observations are not assertions that we should avoid evaluating the performance of these programs and investments as job creators, but merely that it is important to set realistic standards and expectations for verifying for the job creation impacts.

Clean Energy Works Oregon (CEWO) is an example of a potentially acceptable approach. Clean Energy Works Oregon (CEWO) is a nonprofit program that provides turnkey solutions for residential retrofits. They connect customers with contractors to provide energy audits and perform upgrades and also offer a utility on-bill financing product.[18] CEWO hired a workforce specialist to construct and maintain a detailed database of contractor employment data. Contractors associated with CEWO report information about their employees for every project, and the workforce specialist uses the information (including hours worked, project costs, and job classifications) to determine the job creation that is attributable to the program. The workforce development specialist can use this information to provide additional estimation of other job impacts in the local economy.[19]

Conclusion

The impact of investments in energy efficiency extends well beyond environmental benefits and energy bill savings. These investments create employment opportunities for American workers and are helping them to support their families and communities. The underlying argument that lays out the job creation potential of energy efficiency is structurally effective and sound, but it can be difficult to verify in the real world.

17 Minnesota Implan Group, Using IMPlAN.

18 A recent ACEEE report describes on-bill financing in these terms: Property Assessed Clean Energy (PACE) enables municipal governments to offer a bond to investors, and subsequently to loan the money to consumers and businesses for energy efficiency improvements. The loans are repaid through an annual assessment on the borrower's property tax bill. The concept originated in Berkeley, California in 2008 and has since been adopted by 31 states and the District of Columbia (PACENow 2014), PACE legislation overcomes several recognized barriers to the adoption of energy efficiency: high first costs, high transaction costs involved in identifying and financing projects, and payback times that often exceed expected occupancy. S. Vaidyanathan, et al. Overcoming Market Barriers and Using Market. Forces to Advance Energy Efficiency. Washington, DC: ACEEE, 2013)

19 Green for All, Job Projection and Tracking Guide. (Oakland, CA: Green for All, 2013).

In an effort to ensure that energy-saving, cost-saving, and job-creating energy efficiency programs are supported in the future, we are working to establish generally accepted practices for verifying program results. We hope that these efforts will further ensure that the costs of program administration yield net benefits to their respective communities and further justify energy efficiency investments that help reduce energy costs, environmental benefits, and build a more robust economy.

Casey J. Bell joined the American Council for an Energy-Efficient Economy in 2011. She performs macroeconomic modeling of the impacts of energy efficiency policy and programs, and has worked to document and articulate the underlying economic mechanics behind how energy efficiency supports job creation. She also leads the organization's finance policy research identifying best practice polices and market mechanisms that can be used to finance energy efficiency in the residential, commercial, manufacturing, and nonprofit sectors. Prior to joining ACEEE, Casey worked as a consumer behavior researcher in the Division of Consumer and Community Affairs at the Federal Reserve Board of Governors. She also previously worked as an analyst in the Division of Reserve Bank Operations providing project oversight for Reserve Bank Fiscal Agency activities.