Energy Efficiency Job Creation: Real World Experiences

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Introduction and Background

For the last several years, the United States' economy has faced sluggish growth, loss of jobs, and sustained unemployment. Despite the technical end of the "Great Recession" in 2009, recovery has been slow and unemployment remains high. In the face of sustained high unemployment, policymakers continue to seek lasting solutions that will reenergize the American workforce and create permanent job opportunities. Energy efficiency catalyzes employment opportunities that draw upon the broad range of Americans' skills. Moreover, as companies' investments in energy efficiency improve their bottom line they experience increased competitiveness, which is a potential contributing factor to bringing jobs back to American soil (Sirkin, Zinser & Honer 2011).

This report illustrates concrete ways in which energy efficiency has, in recent years, stimulated the creation of direct, indirect, and induced jobs. These vignettes illustrate examples of job creation resulting from energy efficiency by profiling programs, policies, investments, partnerships, and business models that have catalyzed regional increases in employment. Whereas previous ACEEE work has provided an analytic framework for *how* jobs are created through efficiency, this paper focuses on the jobs themselves. (For a description of ACEEE's analytical framework for studying job creation through energy efficiency, please see Appendix A.) In this characterization we capture just a portion of the jobs creation equation. We have profiled jobs created as the efficiency measures are put in place; yet the true power of energy efficiency to stimulate job growth is manifested even more strongly through the re-spending of resulting energy bill savings, which may account for the majority of the net gains in jobs.

The Efficiency/Jobs Connection

The concept of stimulating job growth through investment in the "green economy" is a familiar one. The notion of "green job" creation is often promoted in the policy arena, and has at times been controversial. The United States Bureau of Labor Statistics provides two definitions for "green jobs." Definition A includes jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources, and Definition B includes jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources (BLS 2012). These definitions capture the intuitive idea that there are industries that create jobs through technologies or strategies to improve the health of the environment, but they fall short of capturing the power of investments in energy efficiency to empower a healthier economy that supports higher levels of employment.

Pollin and Wicks-Lim (2008) find that job opportunities in the green economy (including renewable energy) leverage skill sets that are already abundant in the United States. Examples of energy efficiency job opportunities include work for electricians, heating/air conditioning installers, carpenters, construction equipment operators, roofers, insulation workers, industrial truck drivers, building inspectors, civil engineers, rail track layers, metal fabricators, engine assemblers, production helpers, bus drivers, and computer software engineers.

Laitner (2012a) suggests that lagging improvement in the conversion of total energy into useful work over the past 32 years has been steadily weakening the economy. Thus, it is essential to deploy and implement technologies that can free up economic resources to boost productivity and facilitate macroeconomic growth. The aggressive pursuit of comprehensive energy efficiency policies and initiatives could potentially save $1.2 trillion by 2020. Such substantial savings would stimulate the sluggish economy by freeing resources to bolster productivity and thus provide opportunities for job creation. Looking at the long term, it is estimated that by investing in and deploying existing and more advanced technologies, the United States' economy could support a net increase of 1.3 to 1.9 million jobs by the year 2050 (Laitner et al. 2012b).

The notion of energy efficiency as a driver for widespread, sustained employment may not be immediately intuitive. Increasing energy efficiency means higher levels of productivity and output achieved through lower levels of energy use. At first glance, it may seem like producing less energy to accomplish the same amount of work would have a negative impact on employment. This view, however, falls short of recognizing the complete economic impact of redistributing saved resources. First, it takes a significant amount of labor input to implement (i.e., plan, manage, install, or construct) efficiency measures. When compared to the economy as a whole, the energy production and distribution sectors do not require a significant amount of labor (though they do require a significant amount of capital). However, a company that spends less money on its energy bills likely has more cash on hand to expand and hire, and expansion with increased employment can also stimulate job growth in a local economy. In sum, energy efficiency stimulates economic activity and is a key to driving a more robust and abundant economy.[1]

TWO MECHANISMS FOR ENERGY EFFICIENCY JOB CREATION

The effects of energy efficiency on job growth are powerful and multi-faceted, and they reverberate through the economy over an extended period of time. Investments in energy efficiency shift existing spending patterns in two ways, both of which stimulate a net increase in employment. First, an expenditure or effort such as a retrofit project or infrastructure investment stimulates the creation of jobs as the project is carried out, and, second, the dollars saved from lower energy bills are respent in the broader economy. Each of these mechanisms produces direct, indirect and induced jobs. **Direct jobs** are defined as 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 impacted by an expenditure or effort. **Induced jobs** are generated by the re-spending of income resulting from newly created direct and indirect jobs (MIG 2011).

In models of job creation and retention, jobs are measured in terms of job-years or 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 metric of a job can be composed of full- or part-time employment (IMPLAN 2011).

[1] For more information on how energy efficiency creates jobs, see Appendix A.

The initial expenditure or effort promoting energy efficiency drives direct, indirect, and induced jobs in the near term 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. 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 (supporting the relatively capital-intensive energy sectors) are put back into the general economy (which is, on average, more labor intensive), 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.

Forces behind Energy Efficiency Job Creation

Investment in energy efficiency promotes a healthier and more robust economy that supports higher levels of employment. Job creation stimulated by energy efficiency is driven by several forces, illustrated in the case studies that follow. New technologies, such as smart grid solutions, pave the way for innovative companies like Opower that drive home energy savings and catalyze broader employment in the economy. Policies, such as the New York City Greater Greener Buildings Plan, drive energy efficiency job creation by requiring buildings to meet specific standards and catalyzing market competition for distinction among efficient buildings. Investment in improving efficiency at its manufacturing plant has helped Nissan North America become more competitive, retain jobs, and create new ones. Federal stimulus programs, most notably the *American Recovery and Reinvestment Act of 2009* (ARRA), assisted non-profits such as the Corporation for Ohio Appalachian Developments in offering weatherization improvements to low- and moderate-income households while offering training courses for local contractors. Public/private partnerships, such as the one formed by Johnson Controls and the Wisconsin Energy Initiative, leverage private-sector networks to catalyze energy efficiency improvements while also maximizing operational efficiency. And market forces, such as the rising demand for energy-efficient appliances that follows, in part, from the widespread presence of this equipment in the marketplace, creates employment opportunities in U.S. manufacturing, as seen in the opportunities created at General Electric's Appliance Park and consequently in the surrounding area. In the case of General Electric, these market forces have been

contributing factors to the feasibility for the company to relocate some production from Mexico back to the United States.

Case Studies in Energy Efficiency Job Creation

Below, we offer several case studies that illustrate the job creation that follows closely on the heels of businesses' initial investments in energy efficiency. These profiles primarily illustrate jobs arising from the implementation of efficiency measures, from the supply chain supporting this direct implementation, and from additional dollars circulating in the broader economy that are spent by workers in these categories.

What we have not emphasized here are the multitude of jobs that are supported when individuals and businesses redirect the money they save by paying lower utility bills. While ACEEE's methodology allows us to quantify the impact of this re-spending in the U.S. economy as a whole, illustrating this type of job creation is problematic in the context of case studies as the choices for where to redirect dollars is as varied as the people and businesses making those choices.

Our description of these case studies is distilled from information collected from program representatives at the organizations profiled. Many of the estimates of number of jobs created were provided by the program representatives and do not stem from one single methodology.[2] Each study serves as an independent portrait of the various driving forces behind energy efficiency job creation, illustrates the diversity of energy efficiency jobs, and demonstrates the extent to which they draw upon Americans' existing skills and competencies.

OPOWER

Opower is a privately held software company founded in 2007 by Alex Laskey and Dan Yates that partners with 70 utilities to develop feedback reports on home energy performance. These reports highlight energy usage patterns, provide feedback to customers on how they are performing relative to their neighbors, and offer the customer information on how to use less energy. The program is structured like a drug trial – with a "treatment group" of homes that receives the report and a randomly selected "control group" of homes does not, and their energy use is compared. This design allows the impact of the reports to be measured and has demonstrated average savings ranging from 1.5 to 3.5%, which have been validated in more than ten independent evaluations (Allcott 2010 and Gerney 2012). The Environmental Defense Fund has verified an average of 2% savings (Davis 2011). Opower estimates that for every dollar a utility invests in Opower programs, the average residential consumer saves three (Gerney 2012). Opower is headquartered in Arlington, Virginia, with additional offices in San Francisco, California, and the United Kingdom (Gerney 2012).

Since the launch of the company, Opower has grown to employ more than 240 software engineers, programmers, and sales and marketing experts. This is up from less than 150 at the start of 2011 and

[2] These estimates were individually reviewed for plausibility, but may slightly differ from the estimates ACEEE would provide if analysis was undertaken internally.

less than 100 at the start of 2010. As a complement to its product, the company also advertises a highly progressive and modernized approach to work/life balance. Employee compensation is highly competitive. In addition to medical, dental, vision, long-term disability, 401K and add-on benefits, employees are given a $100 commuting stipend, generous vacation and sick days, and paid office closure during the last week of the year. Furthermore, the Opower offices are dog-friendly.

In 2010, President Obama visited the Opower offices to give an address on employment. He called for other companies to replicate Opower's success, calling for investments "in the jobs of the future and the industries of the future" (The White House 2010).

In addition to employing 240 workers of its own, Opower has driven job creation in the economy in a number of ways. Its feedback reports have likely catalyzed opportunities for local contractors and suppliers of energy efficiency products and appliances. Opower also estimates that its efforts have saved customers over $150 million in energy savings, which has potentially stimulated household spending and induced additional employment in communities across the United States (Opower 2012).

NEW YORK CITY GREENER, GREATER BUILDINGS PLAN

The New York Greener, Greater Buildings Plan was conceived as a component of PlaNYC, the city's overarching sustainability plan, to address energy waste in the large existing building stock. Buildings with over 50,000 square feet account for nearly 45% of the city's total greenhouse gas emissions. The Greener, Greater Buildings Plan was enacted in 2009 with the passage of four local laws and the subsequent establishment of the New York City Energy Efficiency Corporation (NYCEEC) for financing. At its core, the program seeks to empower decision-makers with information that encourages the pursuit of cost-effective energy efficiency measures (PlaNYC 2011).

The four laws require that managers of large buildings (greater than 50,000 square feet) benchmark[3] their energy performance annually (LL84), conduct an energy audit and retro-commissioning[4] study every ten years (LL87), and the upgraded lighting in commercial space to meet code, and install submetering[5] (LL88). Local Law 85 (LL85) requires the adoption of a local energy code. The city estimates that the laws will generate $700 million in savings and create roughly 17,800 construction jobs over ten years (Burr 2012).

The four laws are coming into effect one by one, and with them have appeared new jobs dedicated to planning and carrying out the efficiency measures. Local Law 84, requiring benchmarking, was enacted in 2009, applying to nearly 3,000 public buildings such as libraries, police and fire stations, and schools, with more than 10,000 square feet by May 2010. In May 2011, 16,000 private commercial

[3] Benchmarking compares a building's energy use with other similar structures and looks at how it varies from a baseline.
[4] Retro-commissioning is a systematic, documented process that identifies low-cost operational and maintenance improvements in existing buildings and brings the buildings up to the design intentions of its current usage.
[5] Sub-metering refers to the individual metering of utilities in a multi-use building.

and multifamily buildings with more than 50,000 square feet were required to submit a benchmarking report, and subsequently given a three month grace period for compliance. After the grace period, two-thirds of buildings had complied. The city has found that the service provider community was very proactive in building small business ventures to aid building owners with compliance. Firms specializing in energy issues and sustainability have been founded or expanded as building owners work to comply with the law and seek assistance in designing and implementing the most energy-efficient and cost-effective measures (PlaNYC 2011).

Regional firms have seen a surge in activity and employment as a result of Greener, Greater Buildings Plan. Steven Winters Associates, Inc., a Connecticut-based consulting firm, hired over ten new employees to meet the need for assistance with compliance for benchmarking, and the subsequent demand for assistance in interpreting benchmarking metrics, and applying the information to investment decisions. The New York office consisted of just six employees in 2008, but has grown to over 50 as they experience an uptick in interest from new clients. The firm emphasizes the value of efficiency improvements beyond compliance and anticipates additional growth when Local Law 87—requiring energy audits and retro-commissioning—goes into effect in late 2012 (Brabon 2012). Steven Winters is just one of a dozen or more similar firms that have seen job and business growth as a result of the Greener, Greater Buildings Plan

New York City considers its Greener, Greater Buildings Plan to be successful to date, and cities such as Philadelphia, Seattle, Chicago, and the District of Columbia are currently working to enact similar initiatives aimed at energy savings for businesses and higher employment for those businesses and the economy of the region overall.

NISSAN NORTH AMERICA

Nissan North America employs 13,000 American workers, primarily in its Smyrna and Decherd plants in Tennessee, and a third location in Canton, Mississippi. Over the past several years, Nissan has demonstrated a commitment to developing fuel-efficient vehicles such as its electric vehicle, the Nissan Leaf. Moreover, beyond Nissan's commitment to manufacturing an efficient product, the company has taken bold steps to promote an energy-smart culture company-wide.

In 2006, in the aftermath of Hurricane Katrina and amidst rising natural gas prices, Nissan made the decision to prioritize investments in energy efficiency and establish a rigorous energy-management program to control manufacturing costs and become more competitive. Its U.S. locations partnered with the U.S. Department of Energy's Industrial Technology Program *Save Energy Now* initiative and received a total of nine energy audits. Targeted measures for energy savings included the installation of variable-frequency drives, a reduction in the number of air compressors, submetering and monitoring, upgrades to and replacement of chillers, and upgrades to lighting and controls. Implementation of these measures reduced the plants' overall energy consumption by more than 30% and saves Nissan more than $11.5 million per year in U.S. manufacturing plants (DOE 2012).

Given the new levels of efficiency Nissan was able to increase the size of its power train plant in Decherd, Tennessee. An additional result of efficiency improvements is increased global competitiveness. By improving the cost-effectiveness of the production process, Nissan is now more competitive, creating and retaining jobs on U.S. soil. Nissan also received a $1.4 billion loan from the Department of Energy's Loan Guarantee program to retrofit the Smyrna plant, which will also enable increases in production. The Smyrna plant is the location for production of the zero-emission, electric Nissan Leaf. The production of the Leaf is estimated to support 1,300 gross direct jobs[6] (DOE 2012).

Higher levels of production at Nissan also support indirect jobs in its supply chain which require additional labor resources to supply Nissan's plants in the United States. Nissan is also a strong proponent of the "Energy Value Chain" and actively fosters supplier plants to become more efficient (potentially directly creating jobs through their own energy efficiency investments). Suppliers for Nissan, including 3M, Alcoa, and ArcelorMittal, are among the most efficient in the United States (DOE 2012).

In an effort to engage employees, Nissan's Energy Management Team endeavors to educate employees about the company's specific energy goals and the relationship between energy efficiency and job security. The Energy Management Team utilizes e-mail, company intranet, displays in break areas, and formal presentations to convey its message. It further rewards smart energy use by recognizing and rewarding high-performing employees at each plant (DOE 2012).

Since Nissan is among the fastest growing car companies in the world, its efficiency investments have great potential to induce job creation in surrounding local economies. As its U.S. plants grow and as productivity increases, it is likely that the wages of the new workers are creating a ripple effect, inducing additional job creation in service industries in the region.

OHIO LOW-INCOME WEATHERIZATION

The Corporation for Ohio Appalachian Development (COAD) is a 40-year-old non-profit community organization dedicated to improving the quality of life for Ohio's low-income residents in a 30-county area in southeastern Ohio. Its weatherization program not only provides affordable energy efficiency improvements that enhance the comfort and livability of homes and commercial buildings, but also draws labor and materials from the local economy wherever possible, and provides training opportunities for local contractors.

Since 1975, COAD has leveraged local resources to weatherize over 87,000 homes. It operated at its greatest capacity after receiving funds from the American Recovery and Reinvestment Act (ARRA) in 2009. For two years, COAD received approximately $62 million a year in ARRA funding and $18 million from utilities. During that period, COAD weatherized 9,000 homes and expanded its workforce by 400 people (Calhoun 2012 and Pitts & Kupcak 2012).

[6] This is a gross estimate of jobs supported by the production of the Leaf and does not attempt a comparison with jobs supported by non-electric vehicles.

Weatherization requires labor for installation as well as performance measurement and verification. In the residential market, consumers generally rely on local contractors to provide these services. These improvements also require a vast array of materials, which, according to COAD program managers, often are sourced from local suppliers. During the ARRA period, COAD, using Pollin's methodology, estimates that they catalyzed a total of 188 indirect and induced jobs in Ohio (Calhoun 2012 and Pollin et al. 2009).

One example of regional indirect employment resulting from ARRA stimulus is the Kredl Machine Company in Delphos, Ohio. This family-owned manufacturer of insulation equipment added an additional eight-hour shift of workers to support ARRA-level activity. Additionally local vendors such as hardware companies saw a surge in sales. COAD purchased over 6.4 million pounds of cellulose insulation through a competitive bid process from Advanced Fiber Technology in Bucarys, Ohio, a purchase that offset the reduction in sales that the company had seen from the slowdown in new housing construction.

In addition to promoting weatherization projects in the region, COAD also operates a training center for local contractors and endeavors to enhance the skill sets of the regional workforce. As new workers are hired, they are trained at the center and then placed in the field with the skilled workforce. During the ARRA funding period, many of the approximately 400 workers that received the training were identified as young, formerly unskilled, potentially "at-risk" individuals (Calhoun 2012).

Unfortunately, ARRA funding was a one-time stimulus, and after it was depleted, COAD was forced to lay-off some workers. While programs like ARRA are not designed to be single-handed, long-term solutions, ARRA demonstrated the scale needed to effectively approach weatherization as well as the job creation potential of such efforts. Currently, 250,000 homes in southeastern Ohio remain to be weatherized. At full funding (estimated around $100 million per year over 20 years), these energy efficiency measures would support approximately 1,600 jobs over the next 20 years (Calhoun 2012).

Other approaches to weatherization and retrofits, such as the Maryland MHelp program, provide loans to consumers to invest in energy efficiency retrofits. While direct federal stimulus may not be a sustainable means for supporting the program in the future, utility funding and innovative financing schemes could provide a partial solution to catalyze the effort and stimulate local economic growth and increased employment.

JOHNSON CONTROLS: WISCONSIN ENERGY INITIATIVE

Johnson Controls, Inc. (JCI) is a global company with over 162,000 employees that offers products and services to optimize energy and operational efficiency in buildings. Over the years, Johnson Controls has led numerous efforts to leverage its products, services, and solutions to optimize energy efficiency in buildings. These projects have stimulated economic activity and job creation in a number of states including Tennessee, Pennsylvania, Maryland, Louisiana, Missouri, Wisconsin, and others.

Johnson Controls' work with the Wisconsin Energy Initiative highlights how energy efficiency investments in public buildings can stimulate local economic activity. In 1992, Johnson Controls worked with the State of Wisconsin to implement more than $35 million of energy conservation lighting projects, which generated more than $3.7 million in annual energy savings. The state of Wisconsin established a public/private partnership utilizing Johnson Controls as the lead contractor to improve lighting fixtures and ballasts in public buildings. Measure life estimates for these types of projects vary, but Skumatz et al. (2005) suggest 11-15 years, enabling positive cash flow after the 9.5 year payback period.

In 1998, the program was expanded to include additional efficiency measures such as HVAC optimization, steam trap improvements, advanced lighting systems, demand control ventilation, utilization of variable frequency drives on electric motors, and replacement of low efficiency equipment as well as reductions in water consumption. This $60 million of additional energy projects supported employment opportunities in providing energy audits, performing energy savings calculations, overseeing project management, and carrying out measurement and verification. Payback periods for these measures vary, but the project was funded on a 15 year amortization schedule, and it is expected that the investments will pay for themselves after 12.5 years (Anderson 2012).

The combined $95 million dollars of energy improvements across 35 million square feet of space generated more than $10 million annually in energy savings for a presumed handful of years past the initial payback period. The total effort created 1,500 annual jobs for more than 50 private-sector companies employing architects, engineers, electricians, and maintenance workers (JCI 2008).

In 2008, the State of Wisconsin continued this successful program with the initiation of the Conserve Wisconsin program. Johnson Controls continues to participate as an Energy Services Company (ESCO) in this effort with the State and has implemented over $50 million of energy savings projects at higher education facilities and correctional facilities. The annual savings from these projects is in excess of $9 million dollars per year. These Conserve Wisconsin projects have supported an additional 800 jobs throughout the implementation period.

GENERAL ELECTRIC: APPLIANCE PARK

Appliance Park in Louisville, Kentucky is the headquarters for General Electric Appliances, one of the largest suppliers of appliances in the world. General Electric (GE) broke ground on the complex now known as Appliance Park in 1951, and today the complex employs more than 5,000 full time employees.

Appliance Park has grown in the wake of consumer demand for more efficient products. Over the past several years, the company has found that in addition to parameters like capacity and high-functioning features, energy efficiency is a priority for consumers. As of 2011, GE offered more than 750 ENERGY STAR®-qualified lighting and appliance products, which account for more than 70% of GE's total dollar sales (GE 2012a).

GE has discovered that through process improvement that reduces waste and saves energy, it is increasingly possible and more cost-effective to bring manufacturing jobs into the United States. Appliance Park made headlines in October 2010 when the company announced that it would be investing $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. GE is also planning to move production of its new GeoSpring Hybrid Water Heater to Louisville from China.

A 2010 Tripp Umbach study commissioned by GE shows that the company directly and indirectly generates $1.6 billion in the state from local purchasing and other mechanisms. Its presence also supports over 12,000 jobs in the state. For every job at Appliance Park, an additional 1.5 jobs are indirectly supported through vendor purchases or are induced through the re-spending of a GE employee's wages (GE 2012b).

Conclusions

The impact of investments in energy efficiency extends well beyond reducing energy costs or addressing the environmental impacts of energy extraction and use. These investments provide jobs for American workers and are helping them to support their families and communities. As evidenced by our profiles, the direct, indirect, and induced jobs supported by energy efficiency are diverse and require an array of skill sets, many of which are abundant in the existing American workforce. Energy efficiency jobs span a multitude of industries and reverberate over time throughout economies locally, regionally, and nationally.

The myriad of ways in which smarter energy use is supported and promoted, including policies, partnerships, investments, federal stimulus programs, new technologies, and market opportunities, all contribute to a healthier economy that supports higher levels of overall employment. Ultimately, the shifting of spending patterns away from capital-intensive energy production and into more labor-intensive sectors—including the majority of sectors where Americans find jobs—is the key to sustaining enduring employment that utilizes the entire range of Americans' skills and expertise.

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Appendix A: How Energy Efficiency Creates Jobs

JOBS ANALYSIS 101

In an era of sustained, high unemployment, job creation has become an immense priority for policymakers. Often, job creation is used as a justification for public sector investment in a program, policy, institution, or project. You may also see numbers from the energy industry as different sectors claim their particular resource creates jobs. These claims, however, rarely or clearly explain how job creation assessments are carried out and what those numbers actually mean. The American Council for an Energy-Efficient Economy (ACEEE) regularly prepares comprehensive analyses and reports regarding the impacts of energy efficiency on the economy, including employment. Below, we clarify how net job impacts should be estimated, and we demonstrate how investments in cost-effective energy efficiency improvements can yield a net positive benefit for the nation's overall employment.

HOW ARE JOBS DEFINED IN ECONOMIC ANALYSIS?

In almost all of ACEEE's assessments, jobs are defined as shown in Table A-1.[7] ACEEE evaluates energy policies for their contribution to net job creation against a baseline employment scenario. This means that *net* jobs (see Table A-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.

Job creation is sometimes reported in terms of *gross* jobs (see Table A-1), in which case the impact of an investment is not compared to the "business as usual" case. This approach ultimately inflates the estimates by neglecting to provide context. For example, a power plant may support 100 jobs, but the economy might be able to support 170 jobs if funds were not required to keep the plant running. In this scenario, saying that the power plant creates 100 jobs is misleading.

[7] This definition of jobs is also used by the U.S. Bureau of Labor Statistics, U.S. Bureau of Economic Analysis, and MIG, Inc.

Table A-1. Common Terms Used in Jobs Analysis

Job	A metric that is equivalent to the resources required to employ a person for 12 months (or 2 people working 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 created in 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 income resulting from direct and indirect job creation.
Labor Intensity	The proportion of labor to capital required to produce goods and services.

HOW DOES ENERGY EFFICIENCY IMPACT EMPLOYMENT AND CREATE JOBS?

To understand how a cost-effective energy efficiency investment can create jobs, it is important to consider how efficiency redirects funds away from less labor-intensive sectors of the economy in order to support greater overall employment. On average, $1 million spent in the U.S. economy supports approximately 17 total jobs[8] (including direct, indirect, and induced jobs—defined in the example below).[9] Investments directed towards a specific industry may support greater or fewer jobs depending on the industry (you can see in Figure A-1 that manufacturing supports approximately 14 jobs per $1 million investment, while the trade-services sector supports just under 19 jobs).

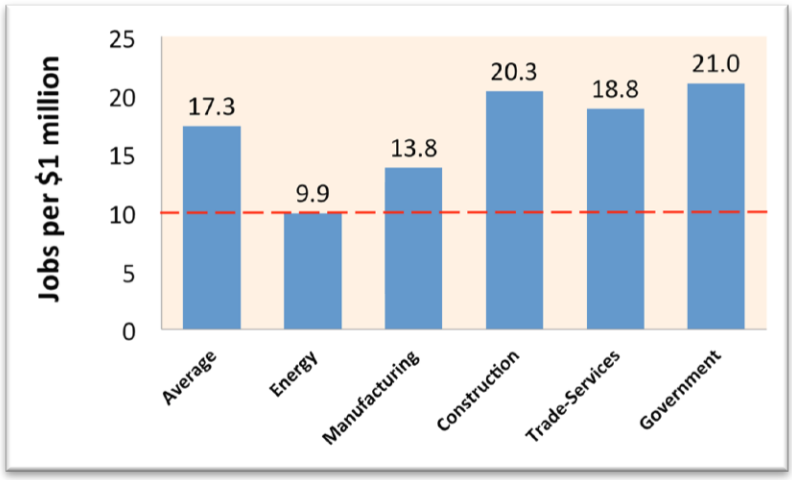
So, an investment in energy efficiency will first create opportunities for workers in industries that are more labor intensive than average (as you'll see in our example, a retrofit project will create jobs in the construction sector, which supports approximately 20 jobs per $1 million, compared to the all-sector average of 17). Then, it will continue to support jobs year after year by saving energy. The energy savings generated by the investment redirects spending away from the energy industry,[10] which supports just under 10 total jobs per $1 million (see Figure A-1), back into the overall economy (which supports 17 jobs per $1 million).

[8] These job multipliers are derived from IMPLAN. MIG, Inc. 2009. "IMPLAN US Model 2009 All Sectors." Hudson, WI: MIG, Inc.

[9] It is important to note that the $1 million expenditure does not divide neatly into workers' salaries (17 people are not making $59,000 a year as a result of this investment).

[10] The energy industry, in Figure A-1, includes power generation and distribution from a variety of fuels. The fuel mix can be adjusted depending on the analysis, which could slightly alter the number of jobs supported per $1 million.

Figure A-1. Jobs per Million Dollars of Revenue by Key Sectors of the U.S. Economy



Source: These job multipliers are derived from MIG (2009).

Thus, a net increase in jobs from energy efficiency, for the most part, is the result of two major changes: 1) an initial expenditure or effort that drives energy bill savings; and 2) the resulting adjustment in the existing spending patterns brought about by that initial expenditure or effort.

AN EXAMPLE

A city decides to use $15 million of its revenue to improve energy efficiency in public buildings. These improvements will save the city $3 million a year for the next 20 years.

Three types of jobs are created from this investment. First, a construction contractor will have to hire workers to install the desired energy efficiency measures. These contractor jobs are the *direct* jobs resulting from the investment. In addition, the workers will require materials that they have to purchase from other companies (e.g., insulation, tools). These purchases create jobs throughout the economy for manufacturers and service providers that supply the building industry. These supply-chain jobs are the *indirect* jobs resulting from the investment. Finally, workers in these direct and indirect industries may choose to spend their earnings on goods and services in the local economy, creating *induced* jobs.[11]

Assuming that the city's funds would otherwise have been spent in a "business as usual" spending pattern and channeled into the construction industry, which is more labor intensive than the average sector of the economy. This will support approximately 20 (direct, indirect, and induced) jobs per $1 million investment. In this case, the tradeoff (from spending that supports 17 jobs per $1 million to

[11] The IMPLAN social accounting matrices used by ACEEE to perform input-output analyses accounts for leakages, or money that will be spent outside the analyzed region's economy. MIG, Inc. 2009. "IMPLAN US Model 2009 All Sectors." Hudson, WI: MIG, Inc.

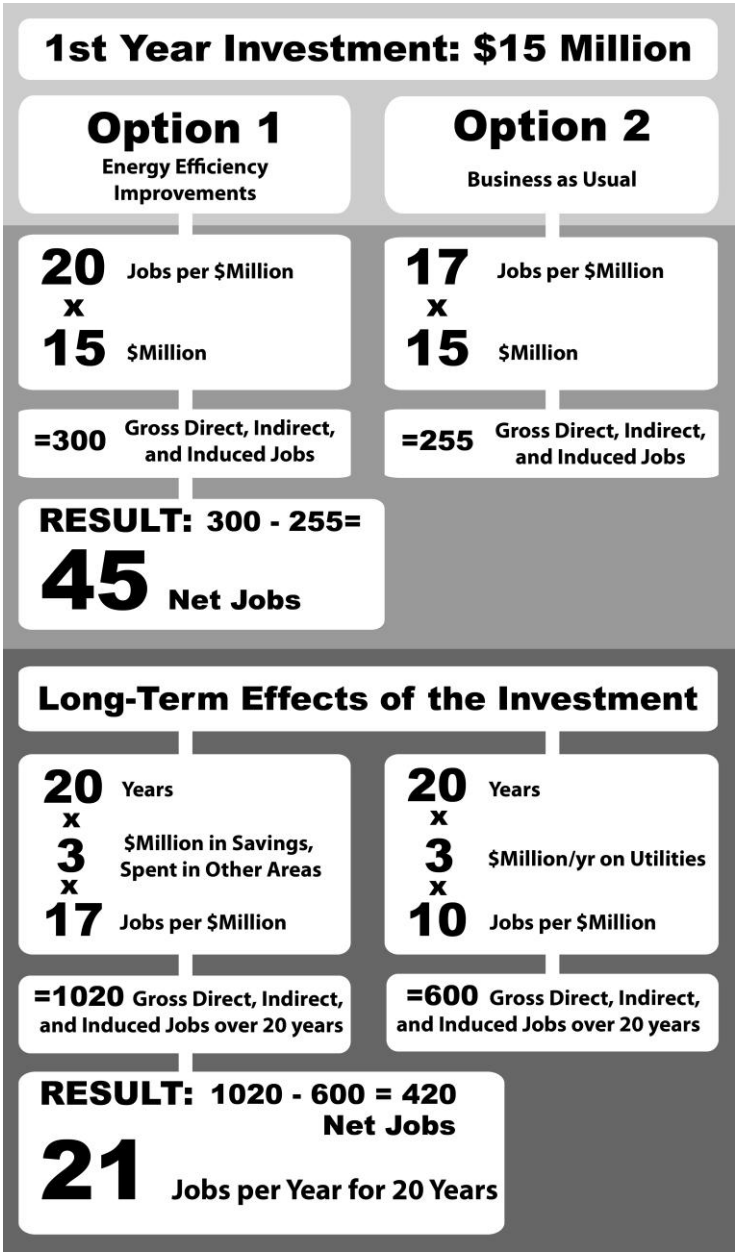
spending that supports 20 jobs per $1 million) results in an additional 45 jobs in the year the upgrade occurs (see Figure A-2).

Additionally, energy efficiency generates energy bill savings over the life of the investment, which frees up funds to support more jobs in the economy by shifting jobs in the energy generation and distribution industries (lower labor intensity: 10 jobs per $1 million) to jobs in all other industries (higher labor intensity: 17 jobs per $1 million on average). We assume that our investment will save $3 million a year for 20 years,[12] and thus achieve a net gain of 21 jobs per year (see Figure A-2).

Again, ACEEE reports *net* jobs numbers. As you can see in Figure A-2, you could say that the "business as usual" (pre-efficiency) scenario supports 855 *gross* jobs in the first year, which sounds like a lot of jobs (and 600 gross jobs year after year for the next 20 years). However, you can also see that the efficiency scenario supports 1,320 *gross* jobs in the first year (and 1,020 gross jobs year after year for the next 20 years), which is a greater than the number of jobs supported by the "business as usual." **Therefore, energy efficiency creates 66 *net* jobs in the first year, and continues to support an additional 21 *net* jobs year after year for the 20-year life of the investment.**

[12] Please note that to simplify our calculations in this demonstrative example we assumed that energy savings would be recognized immediately in the first year of the investment, which is often not the case. For many of our analyses, we assume that energy savings are recognized at least six months to one year after the efficiency measures are implemented.

Figure A-2. $15 Million for Energy Efficiency Improvements



How Does ACEEE Determine the Number of Jobs Created by a Given Policy, Program, Institution, or Project?

ACEEE uses its in-house Dynamic Energy Efficiency Policy Evaluation Routine (DEEPER) modeling system to evaluate the economy-wide impacts of a variety of energy efficiency, renewable energy, and climate policies at the local, state, and national level. For more information on the DEEPER modeling system, see http://aceee.org/fact-sheet/deeper-methodology.