Verifying Energy Efficiency Job Creation: Current Practices and Recommendations

Casey J. Bell, James Barrett, and Matthew McNerney
September 2015
Report F1501

529 14th Street NW, Suite 600, Washington, DC 20045
Phone: (202) 507-4000 • Twitter: @ACEEEDC
Facebook.com/myACEEE • aceee.org

Contents

About the Authors.....iv

Acknowledgments.....v

Executive Summary.....vi

Introduction.....1

What Are Jobs and How Are They Measured?.....2

Research Methodology.....5

Approaches to Jobs Verification.....5

- Ex Ante, Ex Post, and Midstream Analyses.....5
- Bottom-Up Versus Top-Down Approaches.....6
- Bottom-Up Analyses (Head Counts or Databases).....6
- Top-Down Analyses (Modeling).....6
  - Input-Output Models.....7
  - Computable General Equilibrium Models.....7
  - Econometric Models.....8
  - REMI.....8
  - Multipliers.....8
- Hybrid Top-Down and Bottom-Up Approaches.....9

Current Practices.....9

- Overview.....9
- Bottom-Up Analyses (Head Counts).....10
- Top-Down Analyses (Modeling).....11
- Hybrid Approaches.....12

Barriers To Obtaining Credible Job Creation Estimates.....14

- Costs.....14

Definitions 14

Analytical Approaches 15

Guidelines for Estimating Job Creation 15

Bottom-Up Analysis 15

Ex Post Modeling 16

Input-Output Models 16

Fully Dynamic Models 17

Implementation Phase 18

Savings 19

Challenges 20

Guidelines for Reporting Energy Efficiency Job Creation 21

Bottom-Up Results 21

Modeled Net Impacts 21

Reconciling Bottom-Up and Top-Down Observations 22

Conclusions and Next Steps 22

References 23

Appendix A. Case Studies from Information Request 27

Ontario Power Authority, Industrial Accelerator Program 27

District of Columbia Sustainable Energy Utility 28

Tennessee Valley Authority, Energy Right Solutions for Business 30

Tennessee Valley Authority, Energy Right Solutions for Industry 31

Efficiency Nova Scotia 33

Energy Trust of Oregon, Energy Efficiency and Renewable Energy Programs 34

Clean Energy Works 36

National Grid, 2013 Energy Efficiency Program Plan (Rhode Island) 37

Elevate Energy Multifamily Program 39

Minnesota NGA Policy Academy, Minnesota Clean Energy Economy 40

Appendix B. Instructions for Completing the Information Request 43

Appendix C. Information Request 45

About the Authors

Casey J. Bell joined ACEEE in 2011. Her research focused on exploring opportunities to transform and expand the market for energy efficiency investments. Prior to joining ACEEE, she worked as a consumer behavior researcher in the Division of Consumer and Community Affairs at the Federal Reserve Board of Governors. She also provided project oversight for Reserve Bank Fiscal Agency activities in the Division of Reserve Bank Operations. Casey earned an MA in applied economics from Johns Hopkins University, and she holds BAs in economics and political science from Muhlenberg College. She became mid-Atlantic director for PACE Financial Services in the fall of 2015.

James Barrett concentrates on the nexus of climate change, energy efficiency, and economics and has written extensively on the role of efficiency in achieving environmental and economic goals. Prior to joining ACEEE in 2014, Jim was executive director of Redefining Progress, a public policy think tank promoting a healthy environment, a strong economy, and social justice. Before that he was an economist at the Economic Policy Institute, a senior economist on the Democratic staff of the Joint Economic Committee, and a staff economist at the Institute for Biological Energy Alternatives. Jim earned his BA in economics from Bucknell University and his MA and PhD in economics from the University of Connecticut.

Matthew McNerney assisted with research and analysis for the Economics and Finance Policy program at ACEEE in 2014 and 2015. He holds a BA in economics and business from Colorado College and is currently pursuing a JD at the University of Virginia.

Acknowledgments

This report was made possible through the generous support of utilities, companies, and organizations across the country. Contributors include the ACEEE Ally Program, the District of Columbia Sustainable Energy Utility, the Delaware Sustainable Energy Utility, the Delaware Department of Natural Resources and Conservation, Efficiency Vermont, National Grid, Northeast Utilities, the New York State Energy Research and Development Authority, Southern California Edison, the Tennessee Valley Authority, and the Vermont Energy Investment Corporation. Thank you all for your contribution and participation on the steering committee. The steering committee also includes the Northeast Energy Efficiency Partnership and the Midwest Energy Efficiency Alliance.

The authors gratefully acknowledge external reviewers, internal reviewers, and colleagues who supported this study. External expert reviewers included Eleni Pelican from the US Department of Energy, Heidi Peltier from the University of Massachusetts Amherst, Kelly Haines from Clean Energy Works, Jon Vencil and Bradley Campbell from DNV GL, Karl S. Michael from NYSERDA, David McCulloch from Efficiency Nova Scotia, Adam Shick from Energy Trust of Oregon, Courtney Lane from National Grid, Lara Ettenson, and Lauren Kubiak from NRDC. External review and support does not imply affiliation or endorsement.

Special thanks to Lowell Ungar, our research adviser. Internal reviewers included Maggie Molina, Steve Nadel, and R. Neal Elliott. The authors also gratefully acknowledge the assistance of Brian Stickles. Last, we would like to thank Fred Grossberg for managing the editorial process, Elise Marton for copy editing, Roxanna Usher for proofreading, Eric Schwass for publication design, and Patrick Kiker and Maxine Chikumbo for their help in launching this report.

Executive Summary

Among the many benefits often ascribed to investing in energy efficiency is the fact that it can aid in economic growth and job creation. Past research conducted by ACEEE and others has confirmed this in principle, and job creation is often used as a motivation to spur investments in efficiency. Given these assumptions, a number of researchers have attempted to forecast the potential job creation benefits of proposed efficiency investments as well as policies and programs aimed at inducing such investments, ranging from community-level programs to federal legislative proposals.

Once investments are in place and programs created, utilities, program administrators, other stakeholders, and researchers often attempt to demonstrate or verify job creation claims that have been made. However verifying these job creation benefits is more complicated than it might seem at first. A review of such efforts reveals that they are conducted with a wide variety of terminology and methodologies that produce a variety of results. They examine different and overlapping subsets of impacts, use different standards to account for impacts, and even use different definitions for key terms. This lack of consistency in the employment verification literature prevents easy apples-to-apples comparisons across programs and clouds assessments of individual programs and projects.

In this paper we identify some of the more important issues that we believe contribute to this lack of consistency and propose a framework that is both analytically rigorous and tractable for program evaluators to use in future assessments. Our aim is less to establish a uniform methodology that all assessments should follow than it is to highlight some of the more important issues that often arise, and to provide a framework for evaluators to address them. We hope that our proposed approach will lend credibility to the job creation potential of energy efficiency investments, and that other industries will conduct comparable analyses with similar transparency and rigor.

To begin developing this proposed methodology, ACEEE established a project steering committee consisting of project funders and program leaders for utilities, third parties, and state, regional, and local energy efficiency offices. We collected information on current practices from them and from other programs that have been conducting these types of studies. We supplemented this information with some direct email and telephone conversations with researchers and others.

This paper begins by establishing a common set of terms and definitions and then goes on to describe current practices among stakeholders attempting to quantify the employment impacts of their programs and investments. Of the responses we received, roughly half relied on “bottom-up” approaches to verifying job creation, using surveys, contractor databases, and other methods to directly count the number of people employed in various aspects of efficiency programs. About an equal number of responses indicated that their assessments relied on a variety of “top-down“ estimation methods, primarily economic modeling tools, that do not count observed changes in employment but rather deduce the employment impacts based on changes in spending patterns and the demand for labor they imply. Finally, a number of efforts rely on hybrid approaches using features of both methods.

We found substantial variation in methodologies for both bottom-up and top-down methodologies and also found that key terms were used differently in various assessments. For example, energy efficiency investments create jobs in at least two distinct ways. The first category includes the jobs created in order to implement an efficiency program, e.g., to install new windows on a building. The second category includes jobs created when energy consumers re-spend their energy savings. For example, a homeowner with lower energy bills might use the savings to buy a book. Within each of these channels, we identify three levels at which jobs are created. Direct job creation occurs as a result of the initial change in spending, i.e., window installers and bookstore employees. Indirect job impacts occur along the supply chain of the direct impacts, i.e., window manufacturers and book publishers. Induced jobs are created when direct and indirect workers spend their new incomes on goods and services, i.e., window factory and bookstore employees going out to dinner.

In our review of studies and methodologies, we found that some studies identified "indirect" job impacts as jobs created as a result of energy savings, regardless of the level at which the jobs were created. To the extent that studies report various categories and levels of job creation, the inconsistent use of terms can create significant confusion.

We also found a variety of practices in choosing which jobs to account for and how they were identified. Some studies reported only the jobs created in the implementation phase of an efficiency program, ignoring entirely the economic impacts of the ongoing savings the project was intended to create. Some studies included estimates of all three levels of job creation: direct, indirect, and induced, while others included only direct, and still others included direct and indirect, but did not include induced jobs. In some instances, it was not immediately clear which definitions and methodologies were being used.

Additionally, we found that some studies relied on projections of spending and savings to estimate the job implications of the program in question, so that what initially appeared to be an ex post verification of job creation was actually an ex ante projection conducted after the program was in place. We also found significant variation among studies on whether or how they attempted to account for any negative job implications associated with efficiency, such as might result from reduced energy demand. We found further variation regarding whether or how the assessments accounted for the costs of implementing the programs they were assessing.

In light of this lack of consistency, we propose an overarching analytical framework to use in evaluating the employment impacts of efficiency projects and programs. First, we suggest that practitioners use a headcount or other bottom-up methodology to identify direct jobs created by program implementation. In the event that a similar instrument can identify indirect job creation in the implementation phase, we recommend it be used to identify those jobs as well. However it is most likely that indirect and induced job creation in the implementation phase will not be directly observable, and we recommend creating a jobs-to-jobs multiplier from an input–output modeling framework to estimate those categories of jobs.

Savings-phase job implications are unlikely to be directly observable at any level. These will likely need to be estimated based on the cost savings generated by the efficiency investments in question. We provide some recommendations for creating a simple multiplier framework to estimate direct, indirect, and induced jobs created in the energy savings phase.

In addition to developing an appropriate framework for calculating job implications, we also discuss best practices for dealing with a number of issues that commonly arise during assessments of this type. These include the extent to which energy consumers bear costs of implementing efficiency programs, how the financing of implementation costs may impact job creation, and issues of appropriate accounting for administrative costs. We recommend that practitioners estimate and report job creation outcomes that account for the negative impacts of reduced energy demand on employment in the local energy industry. Practitioners should also account for the costs of implementing programs and any negative impacts those costs may have.

Introduction

Energy efficiency drives economic development and adds value to the economy that extends well beyond helping the environment. Job creation is among the most celebrated of its multiple benefits. One recent study by the American Council for an Energy-Efficient Economy (ACEEE) articulated "small but net positive" results for energy efficiency job creation (Bell 2012). Another 2012 ACEEE study focused on the long-term potential of energy efficiency investments to create jobs. The study used ACEEE's proprietary input–output modeling framework, DEEPER, to apply employment multipliers for jobs in six major US sectors in 2009.[1] The authors estimated that 1.3–1.9 million net jobs were generated through advanced energy efficiency investment and activity. In that year, the energy sector supported on average 9 jobs per $1 million of spending, and the construction and service industries each supported more than 20. (Laitner et al. 2012).

In recent years, job creation metrics used for program evaluation have varied greatly among different fields. The fact that approaches and assumptions used for predicting and measuring job creation within the field of energy efficiency are highly variable is even more troubling. Utilities, third parties, and governments collect information on energy efficiency job creation to meet goals and mandates from diverse stakeholders, including policymakers, investors, and program funders. One of the key reasons is to attract and retain political and financial support for efficiency investments. Unfortunately, in recent years policymakers and other observers have cast doubt on job creation estimates reported by energy- and nonenergy-related sectors (Kessler 2011; *New York Times* 2012; Goad 2013). It does not help that the energy efficiency industry shows very little consistency in tracking, estimating, and reporting job creation. In addition, the jobs created by energy efficiency are often lost in a sea of competing claims from other industries vying for investment (Laitner and McKinney 2008). Thus it is more important than ever to adopt a credible and generally accepted approach to verifying and reporting job impacts.

This report attempts to define and establish a standard approach for verifying and reporting energy efficiency job creation. We highlight best practices that programs across the United States and Canada use to evaluate and verify their job creation impacts for a policymaking audience. Best practices not only provide evidence of direct job creation, but also provide a realistic estimate of the impact of a policy or program on supporting jobs throughout the economy. Our recommendations focus on building credibility with policymakers and facilitating consistency in measurement so that evaluators and administrators can compare impacts across programs. We hope that adoption of our approach will lend credibility to the energy efficiency industry's assertions of job creation, and that other industries will conduct comparable analyses with similar transparency and rigor. The methods we propose may not necessarily answer questions about job quality or predict broader economic development impacts. Future work should explore these and related topics.

---

[1] The tool was developed for ACEEE by economist John A. "Skip" Laitner.

What Are Jobs and How Are They Measured?

As the authors responded to technical assistance requests and interacted with various groups seeking to assess job impacts between 2011 and 2014, it became clear that the job metric might differ conceptually from commonly held beliefs about what constitutes a job.

In economic analysis, jobs are created through shifts in spending patterns between industries in the economy. A "job" in this case is defined in many economic analyses as "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), which can be full or part time" (MIG 2011). This metric is often called a "job-year" when reported year by year in an analysis of a multiyear project or investment.

Various analyses use other definitions for a job, including "full-time equivalency." The US Bureau of Economic Analysis defines this term as follows:

> Full-time equivalent employees equal the number of employees on full-time schedules plus the number of employees on part-time schedules converted to a full-time basis. The number of full-time equivalent employees in each industry is the product of the total number of employees and the ratio of average weekly hours per employee for all employees to average weekly hours per employee on full-time schedules. An industry's full-time equivalent employment will be less than the number of its employees on full- and part-time schedules, unless it has no part-time employees (BEA 2015).

The US Bureau of Labor Statistics defines a full-time worker as an individual who works 35 hours or more per week (BLS 2015).

GREEN JOBS

Energy efficiency is often thought of as a creator of "green jobs" (Bell 2012; Bell 2014a). The US Bureau of Labor Statistics (BLS 2014) defines green jobs in two ways, as

> jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources

and as

> jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

It is important to note that job creation through energy efficiency extends well beyond green jobs, as we will demonstrate below.

ENERGY EFFICIENCY CREATES JOBS IN TWO WAYS

Energy efficiency investments generally create jobs through two different channels. The first channel is the implementation of the efficiency project itself. This implementation or construction phase accounts for the employment and output created by the purchase and installation of energy efficiency or energy conservation measures. This phase generally occurs over a relatively short period, and it is often appropriate to model it as taking place within a single year. The use of this paradigm extends back to 1994 (Laitner 1994).

The second channel is the spending of energy bill savings. This channel is often referred to as the ongoing or savings phase of the project. This channel accounts for the impacts that occur when households and businesses direct their energy bill savings toward other expenditures.

Direct, Indirect, and Induced Jobs

Economic analyses typically measure three types of jobs: direct, indirect, and induced. *Direct jobs* are generated from a change 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 direct and indirect job creation (IMPLAN 2015).

For example, consider a project in which a building owner decides to replace the windows on an office building. Direct job impacts include increased employment at the construction firm hired to install the new windows. The increased level of employment at the window factory are the indirect job impacts, and the increase in employment at restaurants, grocery stores, and other places where construction and factory workers and their families spend their new income represents the induced job impact.

Sometimes, jobs created through energy savings are confused with the indirect or induced impacts of the implementation phase, but that is inaccurate. Like the implementation phase, the ongoing savings phase creates its own set of direct, indirect, and induced impacts.

Using the example above, if the owners of an owner-occupied office building upgrade their windows to more energy-efficient models and use the money they save on energy to make more of their product or service, any increases in employment that result are direct impacts of the savings phase. The jobs created due to increased demand for office supplies, equipment, and other inputs are the indirect impacts, and when the workers in the building and along the supply chain spend their increased income, those are induced impacts.

Table 1 illustrates how each phase of energy efficiency investments create direct, indirect, and induced jobs.

Table 1. Examples of jobs created through energy efficiency investments

	Implementation or construction phase	Ongoing or savings phase
Direct jobs	Window installers	Workers hired as office uses energy savings to increase output
Indirect jobs	Window manufacturers and transporters	Jobs created as office increases purchases of goods and services to support increased output
Induced jobs	Providers of goods and services that are purchased by workers hired as a result of direct and indirect impacts	Providers of goods and services that are purchased by workers hired as a result of direct and indirect impacts

MEASURING NET JOBS AND GROSS JOBS

ACEEE defines *net jobs* as "the number of jobs created in an industry and its supply chain compared to a 'business-as-usual' reference case" (ACEEE 2011). *Gross jobs* are defined as "the total number of jobs produced by an industry and its supply chain" (ACEEE 2011). When policymakers compare programs in an effort to make spending decisions that drive economic development and job creation, comparing net and gross numbers can be highly confusing. This is a contributing factor to growing skepticism over the presentation of job creation claims (Kessler 2011; *New York Times* 2012; Goad 2013).

Accounting for jobs in the tourism industry

Energy efficiency is certainly not the only sector to scrutinize the employment impacts of its investments and activities. Economic and employment impact analyses are a common tool utilized across many sectors of the economy and can offer examples of best practices for energy efficiency job verification studies. The fundamental goal of any economic impact analysis is the quantification and comparison of two scenarios: a base case, or business as usual, and an impacted scenario whereby some change affects the larger economy (Tyrrell and Johnston 2006).

The tourism industry often conducts impact analyses to determine the economic and employment effects of a major event or the construction of a large attraction such as a casino or sports stadium (Dwyer, Forsyth, and Spurr 2005; Chhabra 2007). Impact analyses of casinos may differ from studies of investments in energy efficiency by including a calculation of social costs as well as economic benefits. Still, many authors of such studies utilize input–output models similar to those used in many energy efficiency and clean energy studies. Chhabra (2007), for example, explores an ex ante analysis of the net effects the casino industry will have in Iowa through 10 input–output models using modeling software from the IMPLAN Group. Similarly, Paynter, Jolley, and Nousaine (2014) utilized an IMPLAN-based input–output model to conduct an ex post economic impact evaluation of Supplemental Nutrition Assistance Program spending in states and counties across the United States.

A different approach was applied by Brown et al. (2012) in conducting an ex post analysis of the wind power industry in US counties. The authors utilized an econometric model to analyze county-level changes in per capita income and employment in the Great Plains region due to wind energy. Although the study did not analyze net effects, the authors' findings are consistent with previous input–output-based studies and suggest that the presence of wind power does lead to increases in employment and personal income at the county level.

Research Methodology

To advise the project and assist with data collection, ACEEE created a steering committee made up of project funders and program leaders for utilities; state, regional, and local energy efficiency offices; and third parties.[2] We collected information on current practices via an email information request. We emailed the request to the project steering committee and asked its members to complete the form if applicable. We also asked the committee to disseminate the request to other programs that have been estimating jobs, and we complemented its efforts by disseminating it to some additional program leads. We also emailed the request to programs, initiatives, and companies that expressed interest in the study. The information request can be found in Appendix C.

We sent the steering committee and program managers the following guidance:

> A "program"' is broadly defined as an organized effort or initiative to promote energy efficiency. We are looking at many different types of programs and initiatives, so please feel free to ask for guidance or provide clarification if we have not provided appropriate descriptive options to characterize yours.
>
> If you oversee a portfolio of programs, please fill out a separate form for each individual methodology used within that portfolio. If you only have one program that verifies job creation, or one methodology across all programs, you only need to fill out one form.[3]

In total, the information request reached 34 organizations, and ACEEE received 10 responses. For several of the programs, we supplemented the survey results with information from outside reports. For our discussion of current practices, we derived several examples in the paper from the 10 programs that responded to our information request. Detailed program information and individual approaches to estimating and verifying energy efficiency job creation can be found in the case studies in Appendix A.

In addition, we offer examples from the literature to represent approaches that were not represented in our primary research. A number of studies overview methodologies used to determine the economic and employment effects of an investment or project (Bacon and Kojima 2011; EPA 2011; Anderson et al. 2014). One of these studies, from Collaborative Economics, tracks clean energy jobs beyond those created through energy efficiency (Melville, Steichen, and Kaiser 2014).

Approaches to Jobs Verification

Ex Ante, Ex Post, and Midstream Analyses

Jobs analyses can be conducted at various stages of program implementation. Ex ante analysis occurs prior to a program's start and is predictive of potential impacts. Midstream analyses can occur at various stages during a program's life cycle and may both measure

[2] Members of the project steering committee are listed in the acknowledgments.

[3] Full instructions for filling out the information request can be found in Appendix B.

impacts up to a particular point in time and predict future impacts. Ex post analyses are conducted after program implementation to capture actual results.

BOTTOM-UP VERSUS TOP-DOWN APPROACHES

There are two main approaches to verifying job creation impacts. Bottom-up approaches use head counts and/or database verification to count direct jobs. This approach often underestimates the full range of direct, indirect, and induced employment. Top-down approaches normally use an economic impact analysis tool such as input–output or computable general equilibrium modeling. Economists designed these models to predict job creation impacts rather than to count them, and using predictive tools for retrospective verification may provide inadequate evidence of real-world impacts. Table 2 summarizes the strengths and weaknesses of the bottom-up and top-down approaches.

Table 2. Strengths and limitations of jobs verification approaches

Approach	Strengths	Limitations
Head count or database (bottom-up)	Evidence based	Requires advance planning Can be expensive and challenging Cannot convey full extent of impacts Not always comparable with other results
Modeling (top-down)	Shows big picture Can be relatively inexpensive and quick	Not intended for ex post analysis Vulnerable to skepticism Not always comparable with other results

Source: Bell 2014b

BOTTOM-UP ANALYSES (HEAD COUNTS OR DATABASES)

Bottom-up approaches use surveys or databases of collected information to provide evidence of the number of jobs generated by a given project. This approach is particularly useful for determining gross direct jobs with a high level of specificity. In many cases, these analyses also determine the types of jobs, skills, and wages associated with a project. Thus, bottom-up approaches can closely examine a specific sector or subsector with a high level of detail. However they can be time and cost prohibitive, and they are unable to delve into the full economic impact of a measure because they typically evaluate only direct employment impacts.

TOP-DOWN ANALYSES (MODELING)

Top-down approaches use predictive economic models to estimate the direct, indirect, and induced effects of an investment. Broadly speaking, three types of models may be used: input–output, computable general equilibrium (CGE), and econometric (Weisbrod and Weisbrod 1997). This classification is rough, and some models combine features of more than one of these types.

Input–Output Models

Economists commonly use input–output (IO) models for assessing the impact of energy efficiency programs at national, state, regional, and local levels (SEEA 2013). Their popularity stems from their relative accessibility and low cost, coupled with their ability to provide a reasonably accurate representation of the economic impacts of changes in spending patterns. IO models are based on input–output tables that replicate the flow of goods and services within an economy to show the relationships among producers, their suppliers, and their consumers. At their heart they estimate the amount of inputs, including labor inputs, required to make a dollar's worth of a good or service. Unlike general equilibrium models (discussed below), they make no assumptions about the economic rationality of the relationships being examined, and they do not assume equilibrium in the economy. For example, they generally do not account for the impact of spending changes on prices and how those changes might impact consumption behavior.

The most commonly used IO models in the United States, particularly for energy efficiency and clean energy studies, are based on national input–output tables produced every five years by the US Bureau of Economic Analysis (BEA). An important factor to recognize in reporting IO analyses is the time lag between when the tables are produced and the modeling is conducted (Anderson et al. 2014; EPA 2011; Bacon and Kojima 2011).

Computable General Equilibrium Models

CGE models are descended from IO models and are based on an understanding of how the economy works when it is in equilibrium. These models focus on long-term trends in overall economic behavior and outcomes. They place a strong emphasis on prices and behavior. Because they tend to look at the economy at a highly aggregated level, economists often use them for long-term national and international policy analysis. (The Global Trade Analysis Model [GTAP] is a popular example.) Few general equilibrium models exist for local or state economies, and they are rarely used for projecting impacts of efficiency programs at those levels. They are sometimes used to assess the impacts of efficiency policies or investments at the national level. They typically assume that households and businesses are constantly optimizing their behavior to maximize their well-being and their profits, based on full knowledge of current and future prices for all goods and services.

CGE models represent the economy in an ideal state in which all resources are being used to their highest and most productive potential. This means, among other things, that there is little or no room in the model for economic gains from energy efficiency investments that are not already being captured by the market. In representing how the economy would look in a state of equilibrium, CGE models can be useful for examining what the long-term trajectory of the economy might be under various conditions and how that trajectory changes as prices and technology change. However program evaluators rarely use them for projecting impacts of local efficiency programs for several reasons: economies rarely are in an ideal state of equilibrium, the programs being examined are exactly the type that CGE models assume cannot be cost effective, and these programs are typically built at the national rather than local scale.

Econometric Models

Econometric models lie between input–output and CGE. One example is the IHS-Global Insight model used by the Energy Information Administration in conjunction with its National Energy Modeling System. These models typically contain behavioral elements that allow the model to react to price changes, but they do not impose the requirement that the economy be in equilibrium. These models are often available at the local level, and economists frequently use them for policy analysis. However they are used less frequently for estimating or evaluating the impacts of efficiency investments.

REMI

An economic forecasting model developed by Regional Economic Models, Inc. (REMI) includes elements of all three types of top-down analysis. REMI classifies itself as a hybrid model that utilizes input–output, general equilibrium, econometric models, and economic geography to determine long-term economic and employment impacts (REMI 2015). Focus on Energy, a Wisconsin-based nonprofit that delivers energy efficiency programs for the state's utilities, conducts ex ante analyses utilizing REMI. Its 2013 analysis used the model to project program impacts from 2012 to 2036 (Focus on Energy 2013). REMI has also been used for ex post analyses in the energy efficiency industry. DNV GL used the model to evaluate the impacts of the 2009 American Recovery and Reinvestment Act (ARRA) in California (Gaffney et al. 2015).

In addition, the New York State Energy Research and Development Authority (NYSERDA) and others have made extensive use of REMI over the past decade to analyze the impacts of energy efficiency programs on the economy in the form of employment and gross state product. NYSERDA annually reports the number of net additional jobs created in New York as a co-benefit of energy efficiency projects funded by the System Benefits Charge (SBC). As of year-end 2014, the reported value was 5,791 net jobs (NYSERDA 2015).

According to Karl S. Michael, program manager at NYSERDA:

> The REMI methodology developed by NYSERDA to estimate job impacts emphasizes comprehensiveness in that it shows individually all the components of job impacts. It shows how these components are different from year to year, and it shows how long they last based on the life of the measures. Further, the methodology is transparent in that it shows the relative size of each component to promote understanding of the primary drivers of the results. Analyzing and reporting each component separately also serves as a quality control safeguard for the analysis because it enables issues to be recognized, such as errors in either data or data entry (Pers. comm., August 14, 2015).

Multipliers

According to Anderson et al. (2014), the overarching goal of these three types of top-down models is to determine a simple metric to analyze macroeconomic changes, namely employment, often through the creation of a multiplier that translates investment and savings into an estimate of jobs created. Taylor and Samples (2002) explain the multiplier effect as the "ripple effect expenditures have on the economy." The key to determining this effect is the marginal propensity to consume, which measures increases in consumption for every additional dollar of income.

A note on multipliers and rule of thumb estimates

An oft-cited approach for analyzing economic and employment impacts is derived from IO modeling. This approach utilizes previously established metrics, or multipliers, typically derived from past IO analyses, to yield a rough measure of a project's or investment's effect. Zabin and Scott (2013), for example, estimate employment impacts from California's Proposition 39, which allocates $550 million a year for five years to energy efficiency projects in the state. The authors base their analysis on a conservative estimate from previous IO studies that 6.2 direct and 2.3 indirect and induced jobs are created per $1 million in investment. The authors note that the wide range of previous multiplier estimates necessitates the use of bottom-up approaches to corroborate their findings.

In addition to its rigorous bottom-up tracking, the District of Columbia Sustainable Energy Utility (DCSEU) estimates jobs created by government spending under the American Recovery and Reinvestment Act (ARRA). The utility uses a rule-of-thumb estimate that translates incentives paid to consumers and contractors into green jobs. To determine this number, DCSEU assumes 5 jobs per $1 million of investment, or total direct incentives paid divided by $200,000 (D. Nichols and J. Supp, compliance officer and director, DC Sustainable Energy Utility, pers. comm., February 12, 2015).

Elevate Energy currently uses a simple multiplier to estimate and report direct job creation. Elevate estimates 11 direct jobs per $1 million of investment. In the future, Elevate hopes to pursue a more in-depth analysis (D. Philbrick, senior research analyst, Elevate Energy, pers. comm., December 29, 2014).

HYBRID TOP-DOWN AND BOTTOM-UP APPROACHES

Some authors suggest that the combined use of top-down and bottom-up approaches can reap the benefits of each while overcoming each approach's flaws (Bacon and Kojima, 2011). A weakness of top-down economic modeling is its sensitivity to assumptions. An IO model run before and after program implementation will produce exactly the same results unless the input data are supplemented with real-world observations. A bottom-up analysis can and should (whenever possible) be used to inform the results. In order to adapt IO analysis for midstream and ex post analyses, it is necessary to track actual program spending and investment to provide accurate estimates. It is also important to use actual energy savings rather than predicted energy savings. Particularly in a local economy, a well-conducted survey is able to measure with greater detail the direct employment effects, possibly including qualitative measures as well as worker retention and satisfaction. Used in conjunction with an IO model or other predictive technique, such a study could then also estimate indirect and induced effects generated beyond the initial direct effects.

Current Practices

OVERVIEW

Our survey results were fairly evenly split between programs that indicated using a bottom-up approach such as a head count or database (six programs) and those that indicated using a top-down modeling technique. Several of the programs using a head count or database said that they also used some sort of estimation technique to determine their final numbers. Three of the programs using a modeling technique specified that they employed the IMPLAN input–output model for their analysis. All of the programs reported direct jobs, while only half reported indirect jobs. Only three reported induced jobs, and all of those estimated their job creation numbers. Two programs analyzed jobs created through energy savings in addition to direct investment in energy efficiency. As far as we could determine, only two programs, the Ontario Power Authority Industrial Accelerator Program and Energy Trust of Oregon, were reporting net jobs. Finally, only two programs indicated that they were required to report their job creation to a regulator or government agency.

While we intended the information request to capture ex post verification of jobs created, we believe that some respondents may have provided methodologies for either ex ante or midstream analysis that were not necessarily intended for verifying program results. Nevertheless, we have included these results in our study, as there are overlaps in methodologies and lessons to be learned from all three types of analysis. Our recommendations are intended to be used for ex post analyses or for the verification component of midstream analyses.

BOTTOM-UP ANALYSES (HEAD COUNTS)

Several programs reported using head counts and surveys to estimate job creation impacts.

The Washington, DC, Sustainable Energy Utility (DCSEU) is required to report jobs it creates to the mayor, to the Council of the District of Columbia, and to the District's Department of Energy and Environment (DOEE). In order to meet this requirement, DCSEU conducts a combination bottom-up and rule-of-thumb analysis.[4] For the bottom-up analysis, the utility counts its employees and contractors performing energy efficiency work funded by the District. Only bona fide residents of the District who are paid a living wage for the District (calculated as $13.60 in 2014) are counted in this analysis. In accordance with DOEE's contract with Vermont Energy Investment Corporation (VEIC), 1,950 hours of work constitutes one job-year or one full-time equivalent (FTE). DCSEU keeps detailed records of its employees and those of contractors who perform work on, or deliver services relative to, energy efficiency projects, which they use to determine the number of jobs created (D. Nichols, compliance officer, and J. Supp, director, DC Sustainable Energy Utility, pers. comm., February 12, 2015).

Clean Energy Works (CEW, formerly Clean Energy Works Oregon) built a custom contractor database to track direct jobs from the organization's activities. The database reflects CEW's goals and targets relating to job creation and high-quality jobs by tracking hours worked, wages paid, job class, employee demographics (including gender, race, health insurance status, and apprentice status), and any subcontractors employed. CEW requires contractors to report on all complete projects and to keep up-to-date records. CEW analyzes all of these data to measure economic and community impact (K. Haines, workforce development specialist, Clean Energy Works, pers. comm., November 26, 2014).

A study by Clean Energy Trust (2014) and BW Research provides another example of a bottom-up analysis of clean energy jobs, this time in the state of Illinois. The study was

[4] Rule-of-thumb analyses, discussed below, apply general ratios or multipliers to generate a job metric. Such multipliers are typically applied in a top-down approach.

based on a clean energy jobs survey sent to firms and employers identified by the Bureau of Labor Statistics as potentially "clean." Through participants' responses to a range of questions, Clean Energy Trust was able to compile an estimate of direct clean energy jobs in the state. In addition, BW Research has worked with other partners—including the Natural Resources Defense Council (NRDC), the Massachusetts Clean Energy Center, the state of Vermont, the state of Rhode Island, Advanced Energy Economy, the Southern Alliance for Clean Energy, and the Solar Foundation—to analyze clean energy and transportation jobs in California, Iowa, Massachusetts, Rhode Island, Tennessee, and Vermont (L. Kubiak, energy policy analyst, NRDC, pers. comm., August 13, 2015).

The Minnesota Clean Energy Economy employment database was compiled using a variety of sources. To begin, Collaborative Economics determined which standard industrial classification (SIC) codes and North American Industry Classification System (NAICS) codes would likely include at least some clean energy companies. Collaborative Economics also tracked specific companies known to be active in the clean energy economy. Sources included records of clean energy investments, industry databases, media, and the state of Minnesota's prior research on this topic (J. Burdette, conservation improvement program supervisor, State of Minnesota, pers. comm., February 13, 2015). Through both manual and automated verification, Collaborative Economics determined which companies from their initial listing were clean energy businesses, which it defined as "businesses [that] employ workers and generate revenue directly from products and services that use less energy to provide the same service, or produce heat, power, or fuel from renewable sources of energy." Companies that conduct the majority of their business in the clean energy economy were identified and assigned a segment in the value chain. Using employment data from 2012–2014, Collaborative Economics collected the number of jobs at each of these identified organizations. For multi-establishment companies, Collaborative Economics tracked jobs from only the clean energy segment of the business (Melville, Steichen, and Kaiser 2014).

The Donald Vial Center on Employment in the Green Economy at the University of California, Berkeley (2015) recently released recommended best practices on conducting head count surveys in the state of California. The recommendations call for the state to measure the quantity, quality, type, access, and retention rate of jobs, recognizing that through a standardized set of metrics for recording "green" employment, the state will have better information for investors, businesses, and policymakers on the green economy.

TOP-DOWN ANALYSES (MODELING)

Top-down models are typically used for ex ante analysis but are sometimes observed in midstream or ex post analyses. For example, BC Hydro (2010) conducted an ex ante analysis to determine provincial employment impacts from its demand-side management (DSM) program. The analysis utilized BC Hydro's own IO model based on input–output tables from Statistics Canada. The model, made up of three matrices to form a complete representation of the British Columbia economy, generated economic impacts through spending estimates for each of BC Hydro's DSM programs (BC Hydro 2010).

The Tennessee Valley Authority (TVA) commissioned Deloitte Consulting to conduct an ex ante predictive analysis of economic and job creation impacts from its energy efficiency programs (J. Krupp, senior program manager, TVA, pers. comm. August 4, 2014). The analysis used the IMPLAN model, from which it determined a multiplier of 8 jobs per $1 million of spending.[5] Using the multiplier for project spending and TVA's employee base, analysts were able to project resulting direct, indirect, and induced effects for income, output, and employment from the program.

HYBRID APPROACHES

Some programs use hybrid approaches. Energy Trust of Oregon commissioned Pinnacle Economics to analyze net job creation from its portfolio of programs for 2013. Pinnacle used actual spending data from Energy Trust's 2013 program to conduct a predictive input–output analysis with IMPLAN. It also looked at the number of contractors collaborating with Energy Trust of Oregon. The analysis estimated jobs created from initial investment and redirection of energy bill savings, but it did not differentiate among direct, indirect, and induced jobs. Also, since Energy Trust implements both energy efficiency and renewable energy programs, the study analyzed the effects of both measures but did not differentiate between energy efficiency and renewable energy impacts (A. Shick, Planning Project Manager, Energy Trust of Oregon, December 16, 2014).

Pinnacle Economics calculated total gross impacts for the report and compared its results to a base case scenario to determine net effects. The end result was 1,091 net jobs for $130.3 million in spending and investment in energy efficiency and renewable energy, or approximately 8.4 jobs per $1 million (Pinnacle Economics 2014).

Efficiency Nova Scotia conducted a combination top-down and bottom-up analysis of the energy efficiency sector in the province (Canmac 2013). This was done through a direct survey of organizations reporting that 50% or more of their revenue came from the sale of energy-efficient products and services. Using these data, along with input from industry stakeholders, Efficiency Nova Scotia was able to conduct simulation analyses with the Nova Scotia input–output model to determine total impact on employment, payroll, and GDP of organizations identified as part of the energy efficiency sector. Specific program impacts were captured indirectly in the study.

The modeling portion of the Efficiency Nova Scotia study found that direct employment due to the energy efficiency sector increased by 3,181 person-years and total employment (indirect and induced jobs) increased by 5,629 person-years. The re-spending of energy savings created 898 jobs. The survey of energy efficiency businesses, with a response rate of about 50%, resulted in a count of 1,178.5 full-time equivalents. (Canmac 2013). While the results do not necessarily reconcile, they do supply credible evidence that jobs can be directly attributed to the energy efficiency industry and offer a reasonable idea about the impacts of energy efficiency investment on employment in the broader economy.

The Ontario Power Authority (OPA) utilized an alternative estimation approach to conduct a preliminary midstream analysis of the employment impacts of its Industrial Accelerator Program (IAP). IAP is a financial incentive and resource acquisition program for

---

[5] This multiplier is not generalizable across programs or geographic regions. The figure will vary depending on industry mix, fuel prices, energy demand, and a host of other factors.

transmission-connected companies (L. Urmuzache, senior specialist, Ontario Power Authority, pers. comm., July 31, 2014). OPA indicated that this was an initial analysis and not a verification study, and that it plans to conduct a more rigorous jobs verification study in the future.

The initial analysis included direct jobs, defined in this instance as jobs created through program administration plus labor for projects and studies, and indirect jobs, defined as jobs created through participant bill savings, nonenergy benefits, and product quality improvement. It should be noted that OPA's definition of indirect jobs in this instance differs from the definition provided in an earlier section of this report.

This initial analysis consisted of two rule-of-thumb estimates, each based on several assumptions. The first estimated total participant investment based on project and study incentives. For studies it assumed that 100% of investment was labor costs, and for projects it used historical values to determine jobs per MW multiplied by forecast MW savings. The second methodology estimated that labor represented 100% of investment in studies and 41% of investment in projects. Using up-to-date data on leveraging of program expenditures, they estimated project participant performance of 140% of projected incentives. In both methodologies the labor portion of investment was divided by an hourly rate of $100 (CAD) to estimate person-hours. An additional 24 FTEs were added to the resulting numbers from both methodologies to account for program administration.

OPA determined direct jobs for its analysis as the midpoint of the two methods described above. "Indirect jobs" were estimated using a variety of factors that OPA indicated it felt some uncertainty about.

Peregrine Energy Group undertook an analysis for National Grid's 2013 Energy Efficiency Program Plan in Rhode Island using a full-time equivalency (FTE) analysis. It started with a baseline of National Grid employees working on program planning and development, program administration, regulatory affairs, marketing, evaluation, and market research. Peregrine then interviewed lead vendors who supported National Grid energy efficiency programs, asking them to describe their roles and responsibilities and to provide FTE counts. These FTEs often represented the aggregation of small numbers of hours by many employees.

Peregrine also estimated FTEs from smaller direct service providers by collecting counts of installed energy efficiency measures in 2013 and the average time (in person-hours or -days) required for each installation.

In addition, Peregrine estimated FTEs for National Grid's large commercial retrofit program by collecting National Grid's descriptions and counts of technical assistance and installations performed during 2013 to calculate workforce impacts. It used several assumptions. Peregrine took the total dollars paid out for technical support provided by engineers under contract to National Grid and calculated how many hours of labor it represented at an assumed $120 per hour. Total hours were then converted to FTEs. Installation work performed was treated in a number of ways, depending on how much information was included in the data collected by National Grid. National Grid did not, for instance, include the labor cost component of projects. Peregrine used average installation times provided by installation vendors to estimate workforce requirements and the number of hours or days per installation and converted these to FTEs (C. Lane, senior analyst, National Grid, pers. comm. December 22, 2014).

Barriers to Obtaining Credible Job Creation Estimates

This section discusses some of the inconsistencies observed in survey responses and the barriers to obtaining credible job creation estimates.

COSTS

Programs frequently express frustration with the costs of conducting job creation analyses. Bottom-up analyses, in particular, have the potential to cost an organization a significant amount of money, time, and resources. Costs associated with approaches used by programs that responded to our information request can be found in Appendix A.

DEFINITIONS

When models report a number of jobs created, what they are typically reporting is an increase in labor demand sufficient to employ one person for one year at full time and average wages. However, in the scenario where the office building owner is replacing windows, the construction firm may not actually hire any new employees, but it might employ existing workers for a few more hours per week than it had been, or it might avoid laying off workers or cutting back their hours. Models typically cannot distinguish among these types of effects. They report a "job created" as enough new labor demand to hire someone full time for a year, even if the actual outcome is something like the creation of two half-jobs or the avoidance of a year's worth of hours reductions spread out among a large number of workers.

Moreover, some programs define jobs in highly particular ways. For example, District of Columbia programs report green job creation, but the District counts only those green jobs that both pay a living wage and are held by a District resident (Jerome Paige & Associates 2013). These parameters are likely important in helping local policymakers target resources to specific programs and track success in terms of local economic development goals, but there may be unintended consequences to using highly specific definitions. When local policymakers use broadly accepted terminology to describe narrowly defined goals, this can lead to confusion when comparing program results to the results in other localities using broader (or differently constrained) definitions of job creation. The end result is the absence of a common metric with which to track progress across a range of programs or to compare results among them.

The definitions for direct, indirect, and induced jobs continue to cause confusion. We recommend using the IMPLAN Group definitions. Stated again, *direct jobs* are generated from a change in spending patterns resulting from an expenditure or effort. *Indirect jobs* are generated in the supply chain and supporting industries of an entity that is directly impacted by an expenditure or effort. *Induced jobs* are generated by the re-spending of income resulting from direct and indirect job creation (IMPLAN 2015). Induced jobs are often confused with jobs created through energy savings.

ANALYTICAL APPROACHES

Based on the variation in responses and methodologies, it appears that programs across the United States and Canada are using a wide array of analytic approaches to answer the question, "How many jobs has your program created?" The survey results showed that top-down methods for ex ante, midstream, and ex post verification appear to be reported interchangeably. It can also be challenging to reconcile verification findings with predictive analyses conducted prior to program execution. This is sometimes because of discrepancies between the definition of jobs used in the predictive analysis and the definition used in the verification analysis. Changes in program spending and investment, realized energy savings, prices, and structural changes in the economy can also alter results. There may even be some conflation of predictive analyses and verification in official reporting to various audiences.

Because of the different approaches, it is very challenging to compare the effectiveness of programs in creating jobs, and it can be difficult to provide energy efficiency program funders and policymakers with a reliable and consistent accounting of the employment impacts of investment in energy efficiency. It may be especially difficult to identify a common methodology that provides concrete evidence of jobs created and captures the full impacts of job creation from investments in energy efficiency and from energy savings.

Guidelines for Estimating Job Creation

Given the challenges noted above, ACEEE recommends the following approach for ex post verification of energy efficiency job creation. Like methods used by Clean Energy Trust, Energy Trust of Oregon, Clean Energy Works, and Efficiency Nova Scotia, this approach includes both bottom-up and top-down modeling components. A key strength of using both components is that programs not only will convey the scale of their impacts through the modeling component, but will also provide concrete evidence of actual job creation. Wherever possible, we recommend using a head count or other bottom-up method for the implementation phase and using those results as inputs to a top-down approach for estimating those types of job impacts for which a bottom-up approach is impossible. Since a head count is not practical for the savings phase, we recommend estimating impacts for that phase using energy savings and a top-down framework.

BOTTOM-UP ANALYSIS

We have identified three types of jobs (direct, indirect, and induced) each of which can be created through two different channels (implementation and energy savings). Of these six types of jobs, only direct and indirect jobs created in the implementation phase are directly observable in practice, and counting indirect jobs with a bottom-up approach will be impractical in many cases. Typically, most efforts will be able to track direct employment only in the implementation phase and will need to estimate the rest.

To estimate this direct job creation, we suggest tracking FTE for programmatic support as well as maintaining a database of hiring practices in the contractor network. The CEW contractor database in Oregon represents a best practice. Contractors for CEW are required to keep up-to-date records and report on all completed projects and. CEW tracks hours worked, wages paid, job class, employee demographics (including gender, race, health insurance status, and apprentice status), and any subcontractors employed. It then analyzes all of this data to measure economic and community impact. An advantage of this model is that CEW can also report on job quality if it chooses to do so.

Efficiency Nova Scotia's and Clean Energy Trust's survey methods are a recommended approach for situations in which contractor networks are a degree removed from the researchers conducting the study. It could also be used when it is too late or otherwise impractical to collect real-time data. However the drawback to surveys is that response rates may be low, and thus counts even of direct jobs may be incomplete.

One tracking approach we recommend is to use a payroll-based system in which program administrators and/or contractors identify the labor costs (including taxes and benefits) of workers employed on a particular project along with the number of hours they work on the project. Labor compliance systems developed for the Davis-Bacon Act and other regulations exist explicitly to account for the labor being supported by particular projects.[6] Tracking services are also available from private sector vendors for program administrators and contractors to use in tracking labor on specific projects.[7]

As discussed above, it is important to note that estimated direct impacts may vary from estimates provided in an ex ante analysis for a variety of reasons. The purpose of this bottom-up observation is not to reconcile ex ante estimates with results, but rather to provide concrete evidence of observed changes. It is important to set expectations with stakeholders in advance.

EX POST MODELING

Bottom-up analyses will provide concrete evidence of job creation estimates, but they are just a part of the larger story of how energy efficiency creates jobs. They may be able to capture direct and perhaps indirect job creation in the implementation phase, but they cannot capture induced jobs from investments in energy efficiency, nor can they capture direct, indirect, and induced jobs from the savings phase. Thus we recommend accompanying bottom-up observations and estimates with some ex post modeling results in order to demonstrate the full spectrum of impacts from energy efficiency investment.

Input-Output Models

We believe that input–output models are generally the most appropriate approach for conducting estimates of job impacts of state and local efficiency policies and investments. Although other types of models are able to assess a more comprehensive set of impacts and are typically better at looking at changes over time, the software for CGE and econometric models tends to be both more expensive and more complicated to run, often costing several times more than an input–output model, so the benefits of using general equilibrium or

[6] The 1931 Davis-Bacon Act requires the payment of prevailing wage rates to all laborers and mechanics on federal or federally assisted construction contracts. This type of system is administered by the Department of Labor.

[7] LCPTracker and Elation Systems are two such providers, though their identification here does not constitute an endorsement by ACEEE.

econometric models come at a very high price. In our opinion the relative simplicity, transparency, and cost advantages of input–output modeling make it the most compelling framework. Input–output models tend to be relatively simple and straightforward and not dependent on assumptions or estimations of key behavioral relationships, making them more transparent tools.

Input–output models are far from perfect, and there are caveats that users and potential users should not ignore. As just mentioned, they do not account for changes in prices of goods and services, though this shortcoming is not particularly limiting. However, to the extent that energy efficiency reduces costs of production and increases productivity among firms that invest in it, input–output models also cannot account for changes to the firm or the market it serves that would result from increased productivity. In essence, input–output models assume that households and businesses treat savings from efficiency as serendipitously found money rather than a return on investment. Even when the savings occur year after year, IO models assume that businesses do not change their behavior, by lowering prices and increasing market share, for example (IMPLAN 2015).

Another limitation of input–output models is that they represent a snapshot of input requirements and other key factors at a single point in time. The static nature of most input–output models assumes that industrial structures and spending patterns remain the same over the entire simulation. For an investment that takes place over a relatively short period of time, such as a building upgrade, it is reasonable to assume that the economic structure of the firms undertaking the work will not change significantly in the months it takes to complete the project. However, for investments spread out over a number of years and energy savings that might last a decade or more, these models may fall short. It is possible in some cases to impose some limited dynamic features on an otherwise static model. For example, ACEEE's DEEPER modeling framework accounts for increasing labor productivity over time. However most input–output models do not project a full set of changing interindustry relationships and cost structures. CGE and econometric models do attempt to predict how those relationships change over time, and their results reflect those predicted changes.

Fully Dynamic Models

For agencies with the capacity and wherewithal to use fully dynamic modeling systems like REMI or econometric models, those types of tools are generally more sophisticated and complete and will be able to capture some elements that input–output models will typically miss. When measuring job creation impacts, it is important to account for all identifiable impacts, or at least as many as possible. That includes not only the stimulus effect of spending on efficiency investments and re-spending of savings, but also the fact that every dollar spent on efficiency investments is a dollar not spent somewhere else, and every dollar of energy savings is a dollar less revenue to an energy producer.

A potential benefit of using a CGE model or a model with econometric components as opposed to an input–output model is that these more sophisticated models will be able to take account of the impacts of price changes on different sectors of the economy, as discussed above. In the aggregate, efficiency programs can have a substantial impact on demand, which in turn can have a substantial impact on energy prices (Baatz 2015).

Attempts to model the large-scale impacts of energy efficiency programs should include estimates of the price impacts they produce, and a CGE model may be a useful tool for that sort of analysis. However, taken individually, most efficiency programs and investments will not be large enough to impact either the price of energy or prices elsewhere along the supply chain. So this weakness of input–output models is less relevant for assessing relatively small activities like individual efficiency programs than it is for other types of analysis. The ability to account for those changes is not a critical benefit in these modeling situations.

Implementation Phase

As mentioned above, if there is any place where it is possible to clearly identify job creation, it will be the category of direct jobs in the implementation phase. This should include two general subcategories: workers employed by the project implementers, and workers employed by their contractors. In the context of a utility-based program, this should include, among other things, net new employment in program administration.

However, in doing a jobs assessment, analysts should consider the goal of their work. If it is to determine how many net new jobs were created by a particular program, then to the extent that work on an efficiency program is shifted from another project within the utility, that work is not a net new addition to employment because it is offset by reduced employment elsewhere in the utility, and it should not be reported as part of the analysis. However, if the objective is to allocate the number of jobs attributable to a particular project, then it is not necessary to net out the reductions in work on other projects.

If the costs of an efficiency project are being met by a new, dedicated stream of funding, such as an increase in utility rates, then analysts need to consider whether it is appropriate to account for the cost of reduced disposable income in the residential sector or available cash flow in the business sector, depending on where the funds are coming from. If the program is being funded by an outside entity, such as a federal grant that would not be otherwise available, then it may be appropriate to ignore the costs of the program since they are being drawn from an external source.

Recall the example discussed earlier in which a building owner decides to replace the windows on an office building. If the window replacement project is paid for by public benefits funds collected by a local utility, these are funds that ultimately come from ratepayers. A full accounting should therefore include the fact that utility rates will have to increase to cover the expenditure, or utility spending will have to be cut elsewhere. If the project is funded by the local government, the analysis must account for the fact that taxes will have to increase or other government services will have to be trimmed in order to make the funds available.

This so-called balanced-budget constraint may seem somewhat unrealistic, particularly in an era when the federal government rarely operates under such a model. However ignoring the constraint treats the efficiency investment as though it were created out of thin air. Failing to account for the cost of the investment leads to overly optimistic expectations. A modeling simulation of *any* project funded with such "found money" would produce a positive economic projection. Not accounting for the opportunity costs of other investments also limits our ability to balance the costs and benefits of an efficiency investment both on its own merits and in comparison with other potential uses for the funds. To the extent that some or all of the money comes from sources truly exogenous to the local economy in question (federal grant money spent on a local efficiency project, for example), then that portion of the funding would not need to be subject to a balanced budget constraint, unless that money would otherwise have been made available to spend on something else.

With an estimate of the direct (or direct and indirect) employment impacts, the next step is to create a jobs-to-jobs multiplier for each economic sector that can estimate the number of other types of jobs created. Building a jobs-to-jobs multiplier to account for these job types (either induced jobs alone or both indirect and induced jobs) is conceptually straightforward. It is simply the ratio of the jobs multiplier for the appropriate job category (indirect or induced) to the direct jobs multiplier. For example, if an industry has a direct jobs multiplier of 5 jobs per $1 million, the indirect multiplier is 6, and the induced multiplier is 4 jobs per $1 million, then the appropriate indirect jobs-to-jobs multiplier is 1.2 and the induced jobs-to-jobs multiplier is 0.8. In other words, for every direct job created by implementing the program, two other jobs are created (1.2 indirect plus 0.8 induced).

In practice, this is somewhat more complicated than this simple example because the new employment must be assigned to the appropriate industry in order to create the correct jobs-to-jobs multiplier. For example, the construction and manufacturing industries have direct multipliers that can differ by a factor of 4, and the jobs-to-jobs multipliers can differ by even more. Assigning job gains to the proper sectors and creating the sector-specific jobs-to-jobs multipliers is an important task.

Savings

In estimating job creation from energy savings, analysts do not have the advantage of direct job tracking. It is impossible in practice to track how energy consumers are re-spending their savings; the only option available is to estimate it. The first requirement is an estimate of how much energy is being saved, what the value of those savings are, and who is saving it. In most cases these data will have been projected or measured as a part of program design and monitoring efforts.

An estimate of the lifetime energy savings that result from a particular efficiency investment in kilowatt-hours or therms needs to be converted into dollars using current or projected energy prices for the sector in which energy is being saved. Residential, commercial, and industrial customers typically pay different rates for energy, and it is important to allocate the savings to the correct sectors using the prices specific to that sector. This will produce a total amount of money saved by customers resulting from the efficiency investment. From this it is important to account for two things: how much of the investment would have occurred under business as usual without the program being in place (the net to gross ratio), and any costs that the program participants have to bear.

Once the savings have been adjusted to reflect these two issues, the gross employment impacts can be estimated by allocating these savings to the participating sectors with the assumption that customers spend their savings according to their historical spending patterns for other forms of income. These patterns can be derived from models such as

IMPLAN. Once the savings have been allocated across economic sectors according to these patterns to estimate increased revenues in those sectors, the direct, indirect, and induced employment impacts are estimated by applying those revenue increases to the appropriate jobs multiplier for each sector.

As mentioned above, an accurate accounting of the estimated employment impacts requires that losses to energy supply industries also be accounted for. To do this, apply the total net energy savings (not including participant costs) as revenue losses for the energy supply sector and use the appropriate job multipliers to determine the negative employment impact in the energy supply industry, the supply chain, and the broader economy.

Challenges

This represents a basic guide on how to account for the job implications of efficiency programs. Each program may have particular features or analytical challenges that need to be addressed and are not covered here. However there are at least three challenges that may be more common than others.

FINANCING

The above discussion stresses the importance of accounting for net costs and benefits of a program in order to get the most accurate employment estimate possible. One category of costs that should be considered is the cost of financing. If the up-front costs of implementing the program are covered by some type of financing arrangement, such as a loan program or a utility bond issuance, then the cost of capital must be included and allocated to the appropriate sector. Take, for example, a program that lends money to households to upgrade their homes for efficiency. The costs of the upgrades will eventually be paid for by the consumers as they repay their loans, but the interest they pay on these loans must also be counted as a cost. In practice, it is often most convenient to deduct these costs along with other participant costs from the energy savings calculation before the jobs multipliers are applied.

INCENTIVE PROGRAMS

Incentive programs can be tricky to estimate correctly. For example, if a utility offers a rebate on energy-efficient equipment purchases by residential customers, several things must be accounted for in the jobs estimation. First, the direct job implications should include two main factors: the program administration and the incremental expenditure on the efficient equipment. The issue of program administration is discussed above. For the equipment purchases, the analysis first requires an estimate of how many units of the more efficient equipment will be bought as a result of the incentive. It also requires an estimate of the incremental cost of the efficient equipment as compared with standard equipment. This incremental cost times the number of net units purchased can be allocated as incremental revenue to the industry producing the equipment. Each source of input–output data will have a different level of categorization, and it is a matter of judgment to select the most appropriate sector. Before calculating the direct job implications at the manufacturer level, it is important to allocate a share of the revenues to the retail or wholesale trade sector to account for the fact that the purchase price of the equipment is higher than the production cost to cover sales margins. The direct, indirect, and induced job impacts can then be estimated by applying the revenues for the appropriate sectors to the appropriate jobs multipliers. The other categories of job impacts can be estimated as described above. To calculate the job implications from the energy savings, it is important to subtract the incremental costs of the more expensive equipment from the savings before estimating the employment impacts as described above.

NET IMPACTS

At almost every step in the estimation, it is important to consider whether the analysis is capturing all of the appropriate net new costs and benefits of the investment. This requires determining whether the employment required to manage an efficiency program truly represents new work, or whether it will be covered by shifting work from one program to another. If some or all of an efficiency project is being funded by ratepayers, it is important to ask whether the ratepayer costs should be included. If rates have to be increased to pay for the program, then it seems appropriate to include these as a net new cost (which can be modeled in the same way as other participant costs). If the costs of the program are being covered by shifting resources from one area to another, a true net accounting would generally require the inclusion of the lost benefits from the reduction in spending. This can be difficult to calculate, and in practice it is common to simply model the costs as though they were covered by increased electricity rates and include those in participant costs, as mentioned above. In the case of utility incentive programs, the incentive payment must come from somewhere, and it is important to decide whether the amount of the payment should be accounted for. If it comes from utility customer funds, then it likely should be included, whereas a federal grant or tax credit can be treated as exogenous funding and ignored.

Unfortunately, verifying the employment impacts of an efficiency investment can be difficult. A relatively small proportion of the impacts can actually be observed, and the rest must be estimated. We have outlined here what we believe to be both a responsible and relatively cost-effective approach to developing estimates of the employment impacts of efficiency investments, but as mentioned above, individual investments and efficiency programs have features and challenges that may not be covered here and should be addressed with care.

GUIDELINES FOR REPORTING ENERGY EFFICIENCY JOB CREATION

A comprehensive ex post report on job creation should include bottom-up results, modeled net impacts, and a reconciliation of bottom-up and top-down observations.

Bottom-Up Results

Observed job creation. Report these gross numbers from a bottom-up analysis. The ideal approach is to maintain a contractor database from the point of program implementation. An alternative is to survey relevant energy efficiency employers. If indirect jobs can be observed, they should be included here; otherwise this category will include only direct job creation in the implementation phase.

Modeled Net Impacts

From investment and deployment. Using the methodology described above, report indirect (if not observable) and induced impacts. If the investment takes place over multiple years, provide these impacts by year.

From energy savings. Provide direct, indirect, and induced impacts by year for the life of the investments.

Reconciling Bottom-Up and Top-Down Observations

In theory, it should be possible to compare gross direct jobs observed through a bottom-up approach (such as a contractor database) to gross direct jobs estimated through input–output models. In all likelihood, the numbers will not be an exact match, but they should not be an order of magnitude apart.

If gross direct jobs observed and gross direct jobs modeled are vastly different, it is worth exploring whether the cause is methodological before assuming that the program exceeded expectations or underperformed. Analysts should first ensure that jobs observed conform to the definition of a job used in the IO model. Changes in weather, pricing, or other variations impacting realized energy savings that are not accounted for in the model can also cause distinct differences in results.

It is important to note that to date we have not seen any example of a detailed reconciliation of this kind, and we recommend piloting this approach before it is accepted as a gold standard. The observable world often functions well outside the assumptions used to drive economic models. Their usefulness often lies in our ability to consider why they might be wrong based on real world outcomes, to highlight quirks in human behavior that were taken for granted, and to improve going forward.

Conclusions and Next Steps

The impact of investments in energy efficiency extends well beyond environmental benefits from reduced emissions and energy bill savings. These investments create employment opportunities for American workers, 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.

Ultimately, coordination and standardization are major keys to capturing the nonenergy benefits of energy efficiency and to ensuring their support and funding in the future. For ex post analysis we recommend using a bottom-up approach to capture evidence of energy efficiency job creation, as well as providing a broader context by estimating net impacts of direct, indirect, and induced jobs from investment in energy efficiency and energy savings. The next step might be collaboration among utilities, regional energy efficiency organizations, nonprofits, and economic development offices for feedback on this recommended approach. We hope that these efforts will ensure that program costs yield net benefits to their communities and justify further energy efficiency investments to reduce energy costs, benefit the environment, and build a more robust economy.

References

ACEEE (American Council for an Energy-Efficient Economy). 2011. "How Does Energy Efficiency Create Jobs?" Washington, DC: ACEEE. http://aceee.org/fact-sheet/ee-job-creation.

Anderson, D., D. Belzer, O. Livingston, and M. Scott. 2014. *Assessing National Employment Impacts of Investment in Residential and Commercial Sector Energy Efficiency: Review and Example Analysis*. Richland, WA: Pacific Northwest National Laboratory. http://www.pnnl.gov/main/publications/external/technical_reports/PNNL-23402.pdf.

Baatz, B. 2015. *Everybody Benefits: Practices and Recommendations for Utility System Benefits of Energy Efficiency.* Washington, DC: ACEEE. http://aceee.org/everyone-benefits-practices-and-recommendations.

Bacon, R., and M. Kojima. 2011. *Issues in Estimating the Employment Generated by Energy Sector Activities.* Sustainable Energy Department, World Bank. http://siteresources.worldbank.org/INTOGMC/Resources/Measuring_the_employment_impact_of_energy_sector1.pdf.

BC Hydro. 2010. *Power Smart Employment Impacts: DSM Programs, Rates and Codes and Standards, F2008 to F2037.* Vancouver: BC Hydro. http://www.bchydro.com/content/dam/hydro/medialib/internet/documents/news/press_releases/power_smart_employment_impacts.pdf.

BEA (US Department of Commerce, Bureau of Economic Analysis). 2015. "Frequently Asked Questions." Accessed August 30. http://www.bea.gov/faq/index.cfm?faq_id=368.

Bell, C. 2012. *Energy Efficiency Job Creation: Real World Experiences.* Washington, DC: ACEEE. http://aceee.org/white-paper/energy-efficiency-job-creation.

———. 2014a. "Understanding the True Benefits of Both Energy Efficiency and Job Creation." *Community Development Investment Review* 10 (1): 109–116. http://www.frbsf.org/community-development/files/cdir_vol10issue1-Understanding-the-True-Benefits-of-Energy-Efficiency-and-Job-Creation.pdf.

———. 2014b. "Verifying Energy Efficiency Job Creation." *Proceedings of the 2014 ACEEE Summer Study in Buildings.* Washington, DC: ACEEE. http://aceee.org/files/proceedings/2014/data/papers/10-727.pdf.

BLS (US Department of Labor, Bureau of Labor Statistics). 2014. "Measuring Green Jobs." http://www.bls.gov/green/home.htm.

———. 2015. "BLS Information: Glossary." Accessed August 30. http://www.bls.gov/bls/glossary.htm#F/.

Brown, J., J. Pender, R. Wiser, E. Lantz, and B. Hoen. 2012. "Ex-Post Analysis of Economic Impacts from Wind Power Development in U.S. Counties." *Energy Economics* 34 (6): 1743–1754. http://www.sciencedirect.com/science/article/pii/S0140988312001466.

Canmac Economics Limited. 2013. *Economic Impact Report: Nova Scotia Energy Efficiency Sector.*

Chhabra, D. 2007. "Estimating Benefits and Costs of Casino Gambling in Iowa, United States." *Journal of Travel Research* 46 (2): 173–182. http://jtr.sagepub.com/content/46/2/173.abstract.

Clean Energy Trust. 2014. *Clean Jobs Illinois: An In-Depth Look at Clean Energy Employment in Illinois.* https://www.e2.org/ext/doc/Clean%20Jobs%20Illinois%20-%20Full%20Report.pdf.

Dwyer, L., P. Forsyth, and R. Spurr. 2005. "Estimating the Impacts of Special Events on an Economy." *The Journal of Travel Research* 43 (4): 351–359. http://jtr.sagepub.com/content/43/4/351.short.

Donald Vial Center on Employment in the Green Economy at the University of California, Berkeley. 2015. *Recommended Metrics for Measuring Jobs and Training Opportunities.*

EPA (US Environmental Protection Agency). 2011. *Assessing the Multiple Benefits of Clean Energy: A Resource for States.* "Chapter Five: Assessing the Economic Benefits of Clean Energy Initiatives." http://epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits.pdf.

Focus on Energy. 2013. *Focus on Energy Calendar Year 2012 Economic Impacts Report*. Prepared by Cadmus. https://focusonenergy.com/sites/default/files/FOE_XC_CY12_EconomicImpacts-Final_24JAN2014.pdf.

Gaffney, K., J. Vencil, L. Petraglia, and M. Rudman. 2015. "It's All About the Jobs! Stimulating Employment and Economic Impacts from Investments in Energy Efficiency and Renewable Energy." ECEEE Summer Study Proceedings. http://proceedings.eceee.org/visabstrakt.php?event=5&doc=8-439-15.

Goad, B. 2013. "Chamber Study Claims to Debunk EPA Figures on Job-Creating Regulations." *The Hill,* February 28. http://www.friendsoftheuschamber.com/article/chamber-study-claims-to-debunk-epa-figures-on-job-creating-regulations--#sthash.w3B3H7nd.dpuf.

IMPLAN (IMPLAN Group, LLC). 2015. "The Controlled Vocabulary of IMPLAN-Specific Terms." http://www.implan.com/index.php?option=com_glossary&letter=J&id=231.

Jerome Paige & Associates. 2013. "Independent Review and Update of the District of Columbia SEU's Annual Performance Benchmarks." Report to the District Department of the Environment, Washington DC.

Kessler, G. 2011. "Keystone Pipeline Jobs Claims: A Bipartisan Fumble." *Washington Post,* December 14. http://www.washingtonpost.com/blogs/fact-checker/post/keystone-pipeline-jobs-claims-a-bipartisan-fumble/2011/12/13/gIQAwxFisO_blog.html.

Laitner, J. 1994. *The Climate Change Action Plan as an Economic Development Strategy for the United States.* Washington, DC: ACEEE. http://aceee.org/research-report/ed943.

Laitner, J., S. Nadel, R.N. Elliott, H. Sachs, and A.S. Khan. 2012. *The Long-Term Energy Efficiency Potential: What the Evidence Suggests.* Washington, DC: ACEEE. http://aceee.org/research-report/e121.

Laitner, J., and V. McKinney. 2008. *Positive Returns: State Energy Efficiency Analyses Can Inform U.S. Energy Policy Assessments.* Washington, DC: ACEEE. http://aceee.org/research-report/e084.

Melville, J., R. Steichen, and J. Kaiser. 2014. *Minnesota's Clean Energy Economy Profile: How Industry Sectors Are Advancing Economic Growth*. Burlingame, CA: Collaborative Economics. http://mn.gov/deed/images/MN_CleanEnergyEconomyProfile_FullReport.pdf.

MIG (Minnesota IMPLAN Group). 2011. *Using IMPLAN v.3.* Hudson, WI: MIG. http://www.implan.com/index.php?option=com_content&view=article&id=58&Itemid=1753.

New York Times. 2012. "The Myth of Job Creation." October 22. http://www.nytimes.com/2012/10/22/opinion/the-myth-of-job-creation.html?_r=1.

NYSERDA (New York State Development and Research Authority). 2015. *Operations and Accomplishments and Mission Statement and Performance Measurement Annual Report.* Albany: NYSERDA. http://www.nyserda.ny.gov/About/Publications/NYSERDA-Annual-Reports-and-Financial-Statements.

Paynter, S., G. Jolley, and A. Nousaine. 2014. "Policy Implications of Projecting the Multiplier Effects of Social Safety New Programs Using IMPLAN: Reevaluating the Economic Impact of the Supplemental Nutrition Assistance Program." *State and Local Government Review* 46 (1): 28–45. http://slg.sagepub.com/content/46/1/28.full.pdf+html.

Pinnacle Economics. 2014. *Economic Impacts from Energy Trust of Oregon 2013 Program Activities.* Camas, WA: Pinnacle Economics. http://energytrust.org/library/reports/2013__Economic_Impacts_Report.pdf.

REMI (Regional Economic Models, Inc.). 2015. "The REMI Model." Accessed September 3. http://www.remi.com/the-remi-model.

SEEA (Southeast Energy Efficiency Alliance). 2013. *Progress, Productivity, Prosperity: The Economic Impacts of EE Investments in the Southeast.* Atlanta: SEEA. http://www.seealliance.org/wp-content/uploads/SEEA-EPS-EE-Report.pdf.

Taylor, B., and K. Samples. 2002. "Jobs, Jobs, Jobs: Political Perceptions, Economic Reality, and Capital Bias in U.S. Transit Subsidy Policy." *Public Works Management & Policy* 6 (4): 250–263. http://pwm.sagepub.com/content/6/4/250.short.

Tyrrell, T., and R. Johnston. 2006. "The Economic Impact of Tourism: A Special Issue." *Journal of Tourism Research* 45 (1): 3–7. http://jtr.sagepub.com/content/45/1/3.full.pdf.

Weisbrod, G., and B. Weisbrod. 1997. *Measuring Economic Impacts of Projects and Programs.* Boston: Economic Development Research Group. http://www.edrgroup.com/pdf/econ-impact-primer.pdf.

Zabin, C., and M. Scott. 2013. *Proposition 39: Jobs Training for California's Workforce*. Donald Vial Center on Employment in the Green Economy, University of California, Berkeley. http://www.irle.berkeley.edu/vial/publications/prop39_jobs_training.pdf.

Appendix A. Case Studies from Information Request

This appendix summarizes observations from the information request. The request reached 34 organizations, and ACEEE received 10 responses. One respondent, the Minnesota Clean Energy Economy Profile, did not fill out the information request but provided a report prepared by Collaborative Economics (Melville, Steichen, and Kaiser 2014). For several of the programs, we added supplementary information from outside sources to enhance the reporting provided by respondents.

ONTARIO POWER AUTHORITY, INDUSTRIAL ACCELERATOR PROGRAM

Program Description

The Ontario Power Authority (OPA) Industrial Accelerator Program (IAP) is a financial incentive and resource acquisition program for transmission-connected companies. The program provides financial incentives to encourage investment in innovative, energy-efficient process changes and equipment retrofits. The program seeks to encourage a rate of return that is competitive with other capital projects. In exchange for the financial incentives, participants contractually commit to delivering conservation targets within a set period of time and to maintaining them over the life of the project (L. Urmuzache, senior specialist, Ontario Power Authority, pers. comm., July 31, 2014).

Jobs Analysis Methodology

As of July 2014, OPA had conducted a preliminary midstream analysis on estimated employment impacts of IAP. OPA indicated that this was an initial analysis and not a verification study and said it planned to conduct a more rigorous jobs verification study in the future. The initial analysis includes direct and indirect jobs, defined in this instance as jobs created through program administration plus labor for projects and studies, and jobs created through participant bill savings, nonenergy benefits, and product quality improvement. It should be noted that the definition of indirect jobs OPA used in this instance differs from the definition ACEEE advocates. OPA indicated their analysis attempted to quantify net jobs.

This initial analysis consisted of two rule-of-thumb estimates, each based on a different pair of assumptions. The first estimated total participant investment based on project and study incentives. For studies, 100% of investment was assumed to be labor costs; for projects, historical values were used to determine jobs per MW, and this was multiplied by forecast MW savings.

The second methodology estimated that labor represented 100% of investment in studies and 41% of investment in projects. Using up-to-date data on leveraging of program expenditures, they estimated project participant performance of 140% of projected incentives. In both methodologies the labor portion of investment was divided by an hourly rate of $100 (CAD) to estimate person-hours. An additional 24 FTEs were added to the resulting numbers from both methodologies to account for program administration.

OPA determined direct jobs for its analysis as the midpoint of the two methods described above. “Indirect jobs” were estimated using a variety of factors that OPA indicated it felt some uncertainty about.

Program at a Glance

Feature	Details
General program information	
Program name	Industrial Accelerator Program
Program sponsor and administrator	Ontario Power Authority (now, Independent Electricity System Operator)
Website	http://www.industrialaccelerator.ca/
Contact	Liliana Urzumache
Target market or sector	Transmission-connected companies
Type(s) of projects	Nonfinancing incentives, and resource acquisition
Program start date	Not reported
Program overview	
Program goals	1.7 TWh of electricity savings by end of 2020
Target customers	65 by 2020
Target job creation	1,200 direct jobs, and 800 indirect jobs by 2020
Projects completed to date	65 as of July 2014
Customers served to date	65 as of July 2014
Energy savings (estimated/verified/deemed)	16 GWh as of July 2014
Overview of analysis	
Method (type of analysis)	Ex-ante, rule-of-thumb multiplier analysis
Predictive model	n/a
Study period	2013–2015
Total jobs created or estimated	930 direct and 197 indirect jobs by 2015 From initial investment; did not calculate jobs from energy savings
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	Not reported
Budget for jobs verification	Not reported
Budget for model	Not reported
Estimated level of investment	Not reported

DISTRICT OF COLUMBIA SUSTAINABLE ENERGY UTILITY

Program Description

The District of Columbia Sustainable Energy Utility (DCSEU) helps District residents; small businesses; and commercial, governmental, and nonprofit institutions save energy and money through a portfolio of energy efficiency and renewable energy projects, programs, and services. The organization's stated objective is to "reduce per-capita energy consumption, increase renewable energy generating capacity, reduce the growth of peak electricity demand, improve the energy efficiency of low-income housing, reduce the growth of energy demand of the District of Columbia's largest energy users, and increase the number of green-collar jobs in the District of Columbia" (D. Nichols, compliance officer, and J. Supp, director, DC Sustainable Energy Utility, pers. comm., February 12, 2015).

Jobs Analysis Methodology

DCSEU is required to report jobs it creates to the mayor, the Council of the District of Columbia, and the District's Department of Energy (DDOE). In order to meet this requirement, DCSEU conducts a combination bottom-up and rule-of-thumb analysis. For the bottom-up analysis, DCSEU counts its employees and contractors performing energy efficiency work funded by the District. Only bona fide residents of the District who are paid at least a living wage for the District (estimated at $13.60 in 2014) are counted in this analysis. In accordance with DCSEU's contract with Vermont Energy Investment Corporation (VEIC), 1,950 hours of work constitutes one job-year or one full-time equivalent (FTE). DCSEU keeps detailed records of its employees and those of contractors who perform work on, or deliver services relative to, energy efficiency projects, which they use to determine the number of jobs created.

In addition, DCSEU estimates jobs created by government spending under the American Recovery and Reinvestment Act (ARRA). It uses a rule-of-thumb estimate that translates incentives paid to consumers and contractors into green jobs. To determine this number, DCSEU assumes 5 jobs per $1 million of investment, or total direct incentives paid divided by $200,000.

Program at a Glance

Feature	Details
General program information	
Program name	Green Jobs
Program sponsor and administrator	District of Columbia Sustainable Energy Utility
Website	https://www.dcseu.com/
Contact	Deborah Nichols
Target market or sector	Low-income single and multifamily residential, commercial and institutional businesses, and renewable energy
Type(s) of projects	Weatherization, green retrofit and building improvements, nonfinancing incentives, financing, resource acquisition, and market transformation
Program start date	Not reported
Program overview	
Program goals	51,845 MWh of electricity savings 61,521 Mcf of gas savings 2,000 kW of other energy savings

Feature	Details
Target customers	Not reported
Target job creation	53 direct jobs by September 30, 2014
Projects completed to date	47,000 households 527 commercial and industrial customers 533,272 individual measures as of November 1, 2014
Customers served to date	82,292 as of November 1, 2014
Energy savings (estimated/verified/deemed)	57,432 MWh of electricity savings 135,852 MCf of gas savings 8,525 kW of other energy savings as of November 1, 2014
Overview of analysis	
Method (type of analysis)	Ex post, combination of a bottom-up and rule-of-thumb analysis
Predictive model	n/a
Study period	Not reported
Total jobs created or estimated	82 jobs, gross DCSEU's analysis considers direct jobs from initial investment, based off head count and multiplier analysis.
Employment metrics analyzed	Hours, FTE, residency to specific area, wage requirement
Budget and investment	
Annual administrative costs	$2,115,369
Budget for jobs verification	$110,000
Budget for model	n/a
Estimated level of investment	$8,386,485 in direct incentives $19,335,755 in customer investment

TENNESSEE VALLEY AUTHORITY, ENERGY RIGHT SOLUTIONS FOR BUSINESS

Program Description

The Tennessee Valley Authority (TVA) Energy Solutions for Business provides incentives to commercial end-use customers to adopt energy efficiency. The program offers standard rebates, custom incentives, and tailored contracts for large projects. TVA administers the program through a trade ally network of qualified contractors, whom they consider better able to anticipate market needs.

Jobs Analysis Methodology

TVA commissioned Deloitte Consulting to conduct an ex ante predictive analysis of economic and job creation impacts from its energy efficiency programs. The analysis used the IMPLAN model, from which Deloitte determined a multiplier of 8 jobs per $1 million of spending. Using the multiplier for project spending and TVA's employee base, it was able to determine resulting direct, indirect, and induced effects for income, output, and employment from the program.

Program at a Glance

Feature	Details
General program information	
Program name	Energy Right Solutions for Business
Program sponsor and administrator	Tennessee Valley Authority
Website	http://www.energyright.com/business/
Contact	Jason Krupp
Target market or sector	Commercial
Type(s) of projects	Retrofit and building improvements
Program start date	Not reported
Program overview	
Program goals	147 GWh by September 2014 Goals set annually based on fiscal year budget
Target customers	Not reported
Target job creation	Not reported
Projects completed to date	More than 2,800 as of July 2014
Customers served to date	More than 2,800 as of July 2014
Energy savings (estimated/verified/deemed)	147 GWh as of July 2014
Overview of analysis	
Method (type of analysis)	Ex ante, top-down analysis
Predictive model	IMPLAN
Study period	Not reported
Total jobs created or estimated	Not reported
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	$2.9 million in 2014
Budget for jobs verification	Not reported
Budget for model	Not reported
Estimated level of investment	$11.4 million in direct incentives in 2014

TENNESSEE VALLEY AUTHORITY, ENERGY RIGHT SOLUTIONS FOR INDUSTRY

Program Description

TVA's Energy Solutions for Industry program provides incentives to industrial end-use customers to adopt energy efficiency. The program offers standard rebates, custom incentives, and tailored contracts for large projects. TVA administers the program through a trade ally network of qualified contractors, whom they consider better able to anticipate market needs.

Jobs Analysis Methodology

TVA commissioned Deloitte Consulting to conduct an ex ante predictive analysis of economic and job creation impacts from its energy efficiency programs. The analysis used the IMPLAN model, from which Deloitte determined a multiplier of 8 jobs per $1 million of spending. Using the multiplier for spending and TVA's employee base, it determined resulting direct, indirect, and induced effects for income, output, and employment.

Program at a Glance

Feature	Details
General program information	
Program name	Energy Right Solutions for Industry
Program sponsor and administrator	Tennessee Valley Authority
Website	http://www.energyright.com/industrial/
Contact	Jason Krupp
Target market or sector	Industrial
Type(s) of projects	Retrofit and building improvements
Program start date	Not reported
Program overview	
Program goals	208 GWh by September 2014 Goals set annually based on fiscal year budget
Target customers	Not reported
Target job creation	Not reported
Projects completed to date	207 as of July 2014
Customers served to date	207 as of July 2014
Energy savings (estimated/verified/deemed)	208 GWh as of July 2014
Overview of analysis	
Method (type of analysis)	Ex ante, top-down analysis
Predictive model	IMPLAN
Study period	Not reported
Total jobs created or estimated	Not reported
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	$1.8 million in 2014
Budget for jobs verification	Not reported

Feature	Details
Budget for model	Not reported
Estimated level of investment	$22.8 million in direct incentives More than $200 million in estimated customer investment

EFFICIENCY NOVA SCOTIA

Program Description

Efficiency Nova Scotia conducted a province-wide economic impact analysis on the energy efficiency sector in Nova Scotia. Efficiency Nova Scotia recognizes energy efficiency as an important economic driver for the Nova Scotia economy; thus the study was meant to provide a comprehensive picture of the energy efficiency industry, its definition, and its impact. The study focused in particular on energy savings opportunities for low- and moderate-income homeowners, renters, and a wide variety of businesses.

Jobs Analysis Methodology

The Efficiency Nova Scotia study looked at the economic impact (in employment, payroll, and GDP) of organizations identified as part of the energy efficiency sector. Qualifying organizations were those reporting that 50% or more of their revenue came from the sale of energy-efficient products and services. Specific program impacts were captured indirectly in the study.

The analysis examined direct, indirect, and induced jobs both from energy efficiency industry activity and from the resulting energy savings. The analysis measured gross job creation.

Efficiency Nova Scotia conducted a combination top-down and bottom-up analysis of the energy efficiency sector in the province. This was done through a direct survey of qualifying organizations. Using these data along with input from industry stakeholders, Efficiency Nova Scotia was able to conduct simulation analyses with the Nova Scotia input–output model to determine total impact.

Program at a Glance

Feature	Details
General program information	
Program name	Economic Impact Report: Nova Scotia Energy Efficiency Sector
Program sponsor and administrator	Efficiency Nova Scotia
Website	http://www.efficiencyns.ca/
Contact	Dave McCulloch
Target market or sector	Residential, commercial, nonprofit, institutional, and industrial
Type(s) of projects	Energy efficiency industry in general
Program start date	Not reported

Feature	Details
Program overview	
Program goals	124.2 GWh, 171.5 GJ by 2012
Target customers	Not reported
Target job creation	3,181 direct jobs 2,449 indirect jobs
Projects completed to date	Not reported
Customers served to date	99,400 in 2011 and 2012
Energy savings (estimated/verified/deemed)	158.9 GWh
Overview of analysis	
Method (type of analysis)	Ex ante, combination top-down and bottom-up analysis
Predictive model	Nova Scotia Input–Output Model
Study period	2011
Total jobs created or estimated	5,629 total jobs; includes direct, indirect, and induced jobs both from initial investments in efficiency and redirection of energy bill savings
Employment metrics analyzed	FTE
Budget and investment	
Annual administrative costs	n/a
Budget for jobs verification	$110,000 (CAD)
Budget for model	n/a
Estimated level of investment	$32.67 million (CAD) invested in direct incentive in 2012

Energy Trust of Oregon, Energy Efficiency and Renewable Energy Programs

Program Description

Energy Trust of Oregon is a nonprofit organization dedicated to helping utility customers of Portland General Electric, Pacific Power, and NW Natural and Cascade Natural Gas benefit from saving energy and generating renewable power. Energy Trust sets annual and long-term energy savings goals and renewable energy generation goals as part of its strategic planning. It conducts regular economic assessments of its programs in order to verify achievements and determine economic and employment impacts across the state of Oregon.

Jobs Analysis Methodology

Energy Trust of Oregon commissioned Pinnacle Economics to analyze net job creation from its portfolio of programs for 2013. Pinnacle used actual figures from Energy Trust's 2013 program spending to conduct a predictive input–output analysis with IMPLAN. The analysis estimated jobs created from initial investment and redirection of energy bill savings, but it did not differentiate among direct, indirect, and induced jobs. Since Energy Trust implements both energy efficiency and renewable energy programs, the study analyzed the effects of both measures but did not differentiate between energy efficiency and renewable energy impacts.

Pinnacle Economics calculated gross impacts for the report and compared the results to a base case scenario to determine net effects.

Program at a Glance

Feature	Details
General program information	
Program name	Energy Trust of Oregon: Energy Efficiency and Renewable Energy Program
Program sponsor and administrator	Energy Trust of Oregon and Pinnacle Economics
Website	http://energytrust.org/
Contact	Adam Shick
Target market or sector	Residential, commercial, industrial, and renewable energy generation
Type(s) of projects	Weatherization, financing, retrofit and building improvements, nonfinancing incentives, resource acquisition, behavioral, and multifamily
Program start date	2012
Program overview	
Program goals	53.12 aMWh in 2015 5,586,214 therms in 2015 Note: 1aMW= 8,760 MWh
Target customers	Not reported
Target job creation	Not reported
Projects completed to date	Not reported
Customers served to date	79,016 as of 2014
Energy savings (estimated/verified/deemed)	58.02 aMWh in 2014 5,658,998 therms in 2014
Overview of analysis	
Method (type of analysis)	Ex ante, top-down analysis
Predictive model	IMPLAN
Study period	Not reported
Total jobs created or estimated	1,091 net jobs
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	$4,231,024
Budget for jobs verification	Not reported

Feature	Details
Budget for model	Not reported
Estimated level of investment	$67,243,542 in direct incentives $206,356,925 in customer investments

Clean Energy Works

Program Description

Clean Energy Works (CEW, formerly Clean Energy Works Oregon) is a nonprofit organization that provides services to improve home performance. CEW offers residents of single-family homes with energy efficiency services through a one-stop model, providing energy upgrades and loan products for a variety of upgrades. Its strategic objectives are to build scale with inclusive intention, enable all Oregon communities to access CEW services, expand homeowner diversity and partner with low-moderate income programs, ensure capacity and capability of participating contractors, achieve 20% revenue earned by minority- and women-owned businesses, continue to achieve at least 30% workforce diversity, and demonstrate leadership to magnify the impact of its work (K. Haines, workforce development specialist, Clean Energy Works, pers. comm., November 26, 2014).

Jobs Analysis Methodology

CEW built a custom contractor database to track direct jobs from the organizations' activities. The database reflects CEW's goals and targets relating to job creation and high-quality jobs by tracking hours worked, wages paid, job class, employee demographics (including gender, race, health insurance status, and apprentice status), and any subcontractors employed. Contractors for CEW are required to report on all complete projects and to keep up-to-date records. CEW analyzes all of these data to measure economic and community impact.

Program at a Glance

Feature	Details
General program information	
Program name	Energy Efficiency Services Program
Program sponsor and administrator	Clean Energy Works
Website	https://cewo.org/
Contact	Kelly Haines
Target market or sector	Single-family residential
Type(s) of projects	Weatherization, financing, retrofit and building improvements, and market transformation
Program start date	March 2011
Program overview	
Program goals	Not reported
Target customers	1,100 energy efficiency investment projects by December 2015

Feature	Details
Target job creation	10 per 100 homes completed
Projects completed to date	3,586 as of November 2014
Customers served to date	3,586 as of November 2014
Energy savings (estimated/verified/deemed)	Not reported
Overview of analysis	
Method (type of analysis)	Ex post, bottom-up analysis
Predictive model	n/a
Study period	
Total jobs created or estimated	427 direct jobs from initial investment; 364,966 hours as of November 2014
Employment metrics analyzed	Hours, FTE, race, gender, job class, residency to specific area, wage requirements
Budget and investment	
Annual administrative costs	$1,373,000
Budget for jobs verification	$160,000 to build custom database for job tracking $4,000 annually (staff time)
Budget for model	n/a
Estimated level of investment	$6,608,495 in private loans $43,600,876 in customer investment

NATIONAL GRID, 2013 ENERGY EFFICIENCY PROGRAM PLAN (RHODE ISLAND)

Program Description

The National Grid 2013 Energy Efficiency Program Plan consisted of a portfolio of energy efficiency programs for Rhode Island natural gas and electric customers. The programs included residential retrofits and new construction, lighting and related products, income-eligible services for single and multifamily homes, large commercial new construction and retrofits, small businesses, and pilots (C. Lane, Senior Analyst, National Grid, pers. comm., December 22, 2014). Programs goals were to 1) overcome traditional barriers to homes' and businesses' participation in energy efficiency programs, 2) reach customers where they live and work, 3) develop innovative technologies to continue marketing higher levels of energy efficiency, and 4) drive economic growth for the state of Rhode Island.

Jobs Analysis Methodology

An annual listing of companies working on National Grid's energy efficiency programs and jobs created is required by General Law 39-2-1.2, which was enacted by the Rhode Island General Assembly in 2012 (C. Lane, senior analyst, National Grid, pers. comm., December 22, 2014). In 2014, Peregrine Energy Group undertook the analysis for National Grid's 2013 program. Peregrine started with a baseline of National Grid employees working on program planning and development, program administration, regulatory affairs, marketing, evaluation, and market research. It then interviewed lead vendors who supported National

Grid energy efficiency programs, asking them to describe their roles and responsibilities and to provide FTE counts. These FTEs often represented the aggregation of small numbers of hours by many employees.

Peregrine estimated FTEs from smaller direct service providers by collecting counts of installed energy efficiency measures in 2013 and the average time (in person-hours or -days) required for each installation.

The company also estimated FTEs for National Grid's large commercial retrofit program by collecting National Grid's descriptions and counts of technical assistance and installations performed during 2013 to calculate workforce impacts. It used several assumptions. Peregrine took the total dollars paid out for technical support provided by engineers under contract to National Grid and calculated how many hours of labor it represented at an assumed $120 per hour. Total hours were then converted to FTEs. Installation work was treated in a number of ways, depending on how much information was included in the data collected by National Grid. National Grid did not, for instance, include the labor cost component of projects. Peregrine used average installation times provided by installation vendors to estimate workforce requirements and the number of hours or days per installation and converted these to FTEs.

Program at a Glance

Feature	Details
General program information	
Program name	2013 Energy Efficiency Program Plan (Rhode Island)
Program sponsor and administrator	National Grid and Peregrine Energy Group
Website	https://www1.nationalgridus.com/CorporateHub
Contact	Courtney Lane
Target market or sector	Residential single family, income-eligible single and multifamily, large commercial and industrial, small business, commercial multifamily
Type(s) of projects	Weatherization, financing, retrofit and building improvements, nonfinancing incentives, behavioral, market transformation
Program start date	Not reported
Program overview	
Program goals	158,820 MWh of electricity savings 312,433 MMBtu of gas savings by December 2013
Target customers	621,495 by December 31, 2013
Target job creation	Not reported
Projects completed to date	Not reported
Customers served to date	628,891 as of December 31, 2013

Feature	Details
Energy savings (estimated/verified/deemed)	157,121 MWh 312,433 MMBtu as of December 31, 2013
Overview of analysis	
Method (type of analysis)	Bottom-up database analysis
Predictive model	n/a
Study period	2013
Total jobs created or estimated	544.73 direct jobs in FTE in 2013
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	$4,886,550
Budget for jobs verification	$48,000
Budget for model	n/a
Estimated level of investment	$56,905,741 in direct incentives $6,329,674 in loans $25,993,300 in customer investment

ELEVATE ENERGY MULTIFAMILY PROGRAM

Program Description

Elevate Energy provides a range of energy efficiency services, primarily to multifamily buildings at zero cost to the owner. Its services include energy audits, assistance to locate local incentives, low-interest financing, post-retrofit quality assurance inspections, and utility bill analysis to monitor savings. Elevate offers a diverse range of projects to the multifamily market including insulation, lighting, and HVAC optimization and replacement. Projects range from one-off measures in fully occupied buildings to the incorporation of a long list of energy efficiency measures into a broader-scale rehabilitation project. The building owner hires an independent building contractor to perform the installation. Elevate also coordinates direct-install measures as appropriate (D. Philbrick, senior research analyst, Elevate Energy, pers. comm., December 29, 2014).

Jobs Analysis Methodology

Elevate is currently using a simple multiplier to estimate and report direct job creation, estimating 11 direct jobs per $1 million of investment. Elevate is interested in pursuing a more in-depth analysis in the future.

Program at a Glance

Feature	Details
General program information	
Program name	Elevate Energy Energy Savers
Program sponsor and administrator	Elevate Energy

Feature	Details
Website	http://www.elevateenergy.org/
Contact	Deborah Philbrick
Target market or sector	Multifamily housing throughout the State of Illinois; multifamily building owners
Type(s) of projects	Financing, retrofit and building improvements, nonfinancing incentives, market transformation
Program start date	Not reported
Program overview	
Program goals	5,000–7,500 units retrofitted per year in the State of Illinois
Target customers	Not reported
Target job creation	Not reported
Projects completed to date	484 properties upgraded by December 2014
Customers served to date	20,429 units upgraded
Energy savings (estimated/verified/deemed)	12,920,050 kWh of expected electricity savings 4,770,480 therms of expected gas savings by December 2014
Overview of analysis	
Method (type of analysis)	Rule of thumb, multiplier analysis
Predictive model	n/a
Study period	Not reported
Total jobs created or estimated	489 direct jobs
Employment metrics analyzed	Hours, wage requirements
Budget and investment	
Annual administrative costs	Not reported
Budget for jobs verification	Not reported
Budget for model	Not reported
Estimated level of investment	$28,473,544 in customer investment

MINNESOTA NGA POLICY ACADEMY, MINNESOTA CLEAN ENERGY ECONOMY

Program Description

A Minnesota National Governors Association (NGA) Policy Academy team commissioned a report by Collaborative Economics to quantify the businesses, employment, wages, and investments directly engaged in energy efficiency and clean energy in the state of Minnesota (Melville, Steichen, and Kaiser 2014). The report was part of a broader effort to align economic development and clean energy strategies in the state.

The report looked at direct jobs and indirect jobs within the "clean energy economy," which Collaborative Economics defined as "businesses [that] employ workers and generate revenue directly from the sale of products or services that use less energy to provide the same service, or produce heat, power, or fuel from renewable sources of energy." In addition to energy efficiency, Collaborative Economics looked at businesses and suppliers in the wind, solar, bioenergy, and smart grid sectors (Melville, Steichen, and Kaiser 2014).

Jobs Analysis Methodology

The Minnesota Clean Energy Economy employment database was compiled using a variety of sources. To begin, Collaborative Economics determined which standard industrial classification codes (SICs) and North American Industry Classification System (NACIS) codes would likely include at least some clean energy companies. It also tracked specific companies known to be active in the clean energy economy. Sources included records of clean energy investments, industry databases, media, and the state of Minnesota's prior research on this topic.

Through both manual and automated verification, Collaborative Economics determined which companies from their initial listing conducted the majority of their business in the clean energy economy. These were assigned a segment in the value chain. Using employment data from 2012–2014, Collaborative Economics collected the number of jobs at each of these identified organizations. For multi-establishment companies, only jobs from the clean energy segment of the business were tracked.

Collaborative Economics' study estimated 9,604 energy efficiency jobs in Minnesota, and a total of 15,338 clean energy employees in the state in 2014 (Melville, Steichen, and Kaiser 2014).

Program at a Glance

Feature	Details
General program information	
Program name	Conservation Improvement Program; Minnesota Clean Energy Economy Profile
Program sponsor and administrator	Minnesota National Governors Association team and Collaborative Economics; State of Minnesota
Website	http://mn.gov/deed/data/research/clean-energy.jsp
Contact	Jessica Burdette
Target market or sector	Residential single family, residential multifamily, low-income, commercial, agricultural, industrial
Type(s) of projects	Energy efficiency and renewables
Program start date	

Feature	Details
Program overview	
Program goals	Statutory Requirements (see Minnesota Statutes 216B.241) The NGEA established an energy savings goal of 1.5% of average retail sales for each electric and gas utility beginning in 2010. Utilities may petition the Director of the Division of Energy Resources (DER) to adjust their savings goals to a minimum of 1% based on a conservation potential study, a utility's historic capital improvement plan (CIP) experience, or other factors at the discretion of the director. Legislation passed in 2009 established an interim savings goal of 0.75% over 2010–2012 for qualifying natural gas utilities. Electric utilities, except for Xcel Energy, must spend a minimum of 1.5% of annual gross operating revenues (GOR) on CIP programs. As an owner of nuclear generation facilities, Xcel Energy must spend at least 2% of annual GOR. Natural gas utilities must spend a minimum of 0.5% of annual GOR on CIP programs.
Target customers	Not reported
Target job creation	Not reported
Projects completed to date	Not reported
Customers served to date	Not reported
Energy savings (estimated/verified/deemed)	Total energy efficiency savings of 56 trillion BTUs (electric and natural gas)
Overview of analysis	
Method (type of analysis)	Bottom-up, database approach
Predictive model	IMPLAN
Study period	Not reported
Total jobs created or estimated	9,604 energy efficiency jobs in Minnesota A total of 15,338 clean energy employees in the state in 2014
Employment metrics analyzed	Not reported
Budget and investment	
Annual administrative costs	$77,342,167 (2012, gas and electric utility spending for project delivery and administrative costs)
Budget for jobs verification	$120,000
Budget for model	Part of above
Estimated level of investment	$198,745,288 (2012, gas and electric utility total CIP spending)

Appendix B. Instructions for Completing the Information Request

Dear [Name],

Proponents of energy efficiency believe that it not only saves energy and money, it creates jobs. The stronger the evidence that energy efficiency programs and polices create economic opportunity and jobs, the greater the likelihood that federal, state, and local governments will support them. Managers of existing programs use a variety of methods to monitor and evaluate their job creation impacts in order to justify and extend the investment. The problem is that we do not know the best way to verify how many jobs have been created by a particular energy efficiency policy or program. There is no one sound, generally accepted method for verifying energy efficiency job creation.

The American Council for an Energy-Efficient Economy (ACEEE) is in the process of collecting information from energy efficiency programs and initiatives in the US and Canada on their methods for verifying jobs created. We were hoping that the administrator for your program could take some time to fill out the attached questionnaire to aid in our efforts to document current methodologies. We intend to document current practices in an ACEEE report, and to identify best practices so that we can establish guidelines for a "gold standard" methodology.[8]

GENERAL GUIDANCE

Please fill out the questionnaire to the best of your ability. A "program" is broadly defined as an organized effort or initiative to promote energy efficiency. We are looking at many different types of programs and initiatives, so please feel free to ask for guidance or provide clarification if we have not provided appropriate descriptive options to characterize yours.

If you oversee a portfolio of programs, please fill out a separate form for each individual methodology used within that portfolio. If you only have one program that verifies job creation, or one methodology across all programs, you only need to fill out one form.

Here are some definitions for terms used in the questionnaire.

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

[8] The report will be available in 2015 pending full project funding.

We appreciate your time and cooperation in this important study and hope that you'll be willing to stay in touch for follow-up questions. If you have any questions about the questionnaire or the study, please reach out to Casey Bell, cbell@aceee.org or 202-507-4746.

Thanks again!

Casey Bell
Senior Economist
Finance Policy Lead
ACEEE
202-507-4746

Appendix C. Information Request

ACEEE Jobs Verification Study

ACEEE
American Council for an Energy-Efficient Economy

National Press Building
529 14th Street, N.W., Suite 600
Washington, DC 20045

Where is this program or initiative located?

City ______ **State** ______

Please provide the following information for a key point of contact:

Name ______ **E-mail** ______

Phone ______ **Title** ______

What is the name of your energy efficiency program or initiative that is tracking or planning to track job creation?

______

Is this a portfolio of programs? ◯ Yes ◯ No

(Note: If programs within your portfolio use or plan to use different methods to track job creation it would be helpful for us to have a questionnaire for each individual method. Otherwise, please just fill out one form)

What Type of Program is this?/Defining program characteristics (check all that apply):

- ☐ Weatherization
- ☐ Financing
- ☐ Retrofit/Building Improvement
- ☐ Non-financing Incentive
- ☐ Behavioral
- ☐ Resource Acquisition
- ☐ Market Transformation
- ☐ Demand Response
- ☐ Other (Please Specify) ______

Please briefly describe the program or initiative:

______

Can you provide an estimate of the annual administrative cost to support your program? ______

Can you provide an estimate of the level of investment that goes into energy efficiency as a result of your program by:

Direct subsidy (incentives, rebates, etc)? ______

Individual Investment (the amount that customers or businesses invest)? ______

Loans provided by the program or initiative? ______

How are the loans capitalized? (if applicable) ______

What are/is the target market(s) (e.g. single family, commercial small business, etc.)

What are some of your program's goals, targets, and objectives?

For the following questions, we are looking for any target metrics your program might have. Please provide any relevant information you may have, and indicate "not applicable" (n/a) for the rest.

What is your target number of efficiency investment projects? Is there a target date?

What is your target for number of customers served? Is there a target date?

What is your targeted electricity savings? Is there a target date?

Targeted gas savings? Is there a target date?

Other energy savings? Is there a target date?

Do you have a target for job creation? ◯ Yes ◯ No

If yes, how many:
(please see cover letter for definitions)

Direct Jobs? Indirect Jobs? Induced Jobs? Target date?

<u>Prior to program implementation</u>, did you use a predictive model such as IMPLAN, RIMS, or REMI to estimate job creation?

◯ Yes ◯ No

If yes:

What was your budget for this task? (optional)

What model did you use

Please describe the methodology for the analysis:

What were the results? (please indicate if you are reporting net jobs or gross jobs)

How many?

Direct Jobs? [ ] Indirect Jobs? [ ] Induced Jobs? [ ] Target date? [ ]

Did you include jobs supported through energy savings in your analysis? ◯ Yes ◯ No

Can you provide estimates for those jobs? [ ]

For the following questions, we are looking for any evaluation, measurement and verification metrics your program might have collected. Please provide any relevant information you may have, and indicate "not applicable" (n/a) for the rest.

How many energy efficiency investment projects have you completed? [ ] Date reported? [ ]

How many customers has your program served? [ ] Date reported? [ ]

What are your actual energy savings? [ ] Date reported? [ ]

Actual gas savings? [ ] Date reported? [ ]

Other electricity savings? [ ] Date reported? [ ]

After program implementation, did you make any effort to measure or verify job creation? ◯ Yes ◯ No

Are you planning to make any effort to measure or verify job creation? ◯ Yes ◯ No

What was/is your budget for this task? [ ]

Are there any stakeholders that are requiring this type of analysis? ◯ Yes ◯ No

If yes, please list them: [ ]

Please describe the methodology for the analysis:

[ ]

What were the results? (please indicate if you are reporting net jobs or gross jobs)

How many?

Direct Jobs? [ ] Indirect Jobs? [ ] Induced Jobs? [ ] Target date? [ ]

Have you received any guidance from a funder or supporter on a method for verifying job creation? ◯ Yes ◯ No

Did you have to fulfill any requirements for how you account for jobs? ◯ Yes ◯ No

If yes, please explain:

Please list any information that is collected that can influence the jobs created. Example:

1. Describe the typical type of project or installed measure. {For example for a commercial program, upgrading lighting system would create a different number of direct, indirect and induced jobs than upgrading HVAC system)

2. Other benefits or costs after project implementation. (For example maintenance of a measure can impact job creation of more jobs).

3. Effective useful life of the typical project. (Jobs can be created for the life of the project, or part of it, or change during the life of project).

4. Other factors

Did you verify any of the following employment related metrics as a results of your jobs verification efforts? (check all that apply):

- ☐ Hours
- ☐ FTE
- ☐ Residency to a specific geographic area
- ☐ Wage requirements
- ☐ Other (please specify)

Please describe your results. State how they compared with predictive modelling if applicable:

Is there any additional information that you would like to share? Anything you would like ACEEE to consider when developing a standard method for verifying EE job creation?

May we contact you with follow up questions? ◯ Yes ◯ No

May we connect you with other programs seeking to verify energy efficiency job creation? ◯ Yes ◯ No

Please send completed forms via e-mail to Casey Bell (cbell@aceee.org) along with any reports/memos/materials that present results of your jobs estimation or jobs verification.

Please contact Casey Bell with (cbell@aceee.org) with any questions, comments, or concerns.

Thank you!