ACEEE Topic Brief
American Council for an Energy-Efficient Economy

ACEEE State Policy Toolkit: Guidance on Measuring the Economic Development Benefits of Energy Efficiency

Introduction

While the primary benefit of energy efficiency investments is their ability to deliver energy services at a lower cost than that of energy itself, investing in energy efficiency often produces a range of additional benefits. Among those benefits is local economic development, including job creation, increased local income, and the growth of local industries. Increased efficiency reduces household energy bills, which increases disposable income that may be spent locally; this, in turn, contributes to the local economy, creating new jobs or supporting existing ones. Similarly, for businesses, efficiency reduces the cost of producing goods and services, which results in increased overall productivity and profitability, leading to increased output and employment. Finally, investing in energy efficiency itself increases demand for local businesses that implement the investments; it can thus create a cluster of economic activity in efficiency and related industries that further contribute to local economic development and job creation.

State regulators have recognized the value of energy efficiency investments as a low-cost way to meet the energy demands of utility customers, reduce emissions, and provide multiple other benefits.[1] As a result, regulators often require utilities to invest in energy efficiency as part of their energy resource plans. For example, regulators in 27 states require utilities or other program administrators to meet energy efficiency targets by running efficiency programs for their customers. These programs are subject to benefit–cost criteria that require efficiency investments to produce more benefits than costs. The range of benefits and costs can include both utility and nonutility system impacts. Depending on the type of cost test used by a jurisdiction and how it is applied, the latter can include both societal and participant impacts.

The primary benefit included in cost-effectiveness analyses is the ability of energy efficiency investments to save money for utility customers by avoiding the need for new energy supply. Analyses can also include other efficiency benefits such as reduced pollution due to reduced demand for fossil fuels, increased comfort in homes and buildings, and improved health outcomes for occupants of buildings with higher energy efficiency levels. Table A1 in Appendix A presents a range of impacts including societal and participant benefits.

Many jurisdictions are increasingly interested in accounting for the broader economic development and job-creation benefits from energy efficiency (and other clean energy) investments that use ratepayer funds. This toolkit provides guidance on methods that jurisdictions can use to estimate these economic impacts. It includes

- A description of the methodological approaches
- Critical issues and potential pitfalls of each approach
- Examples of real-world applications of various approaches

[1] For example, a large body of evidence demonstrates that energy efficiency is often the least-cost source of energy services (Molina 2014; Billingsley et al. 2014). See Russell et al. (2015) for a review of multiple benefits of efficiency.

- An examination of two economic studies as examples of the methodological issues to consider when determining how to value local economic development and/or job creation as part of efficiency cost tests[2]

Approaches to Estimating Economic Development Impacts

Definitions

To start, we provide common terms and definitions related to these economic analyses—particularly in the context of job creation, which is often a major focus of economic development efforts. While the idea of creating a job seems intuitive, it can be a complex topic, and some basic definitions are important for quantifying and counting job-creation results.

Full-time job-year equivalent (FTE). This is generally what people mean when they refer to a *job*. This term can refer to a single person working full time for a year or two people working half time for a year. The time element of this definition is important. Commonly used language can be confusing, as in a program that "creates 100 jobs over 10 years." Such a statement might mean that employment levels after 10 years are 100 jobs higher than they used to be, or that the program created 10 jobs that lasted 10 years each. In calculating and reporting job creation, the best practice is to calculate the number of FTEs, define the term clearly, and indicate when and if the analysis varies from this metric.

Implementation or construction phase. Energy efficiency investments create jobs in at least two ways. The first occurs in this phase, when the project is implemented and workers are hired to produce and install equipment. This is often referred to as the *implementation phase* or the *construction phase*. This phase may be relatively brief, such as a few months for an upgrade to a single house, or it may be several years, such as an ongoing program of efficiency investments on multiple homes.

Savings phase. This second phase occurs once efficiency measures are in place and begin to return savings over time. When businesses and households re-spend these savings, that spending creates additional jobs.

Direct jobs. These are the jobs created during the first round of any spending. In the implementation phase, these jobs are often related to the building receiving the upgrades, with the company or organization performing those upgrades hiring people to install equipment, handle administrative operations, and so on. In the savings phase, the direct jobs are those created when households spend their savings, often at retail or other service-sector establishments.

Indirect jobs. These are the jobs created in the supply chains that deliver goods and services to establishments in the direct job category. During the implementation phase, these might be jobs in the manufacturing sector to make new appliances for installation in upgraded buildings. For the savings phase, these jobs might be in wholesale industries that supply food to restaurants or in manufacturing to build cars and other products that people use their savings to help pay for.

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[2] See NESP 2017 for a discussion of various approaches to cost–benefit analysis and principles for how to choose an approach.

Induced jobs. These are jobs that are created when the newly hired workers in the direct or indirect categories re-spend their new earnings on goods and services.

It is important to note that the terms *direct* and *indirect jobs* are sometimes used to refer to the jobs created in the implementation and savings phases, respectively. Although intuitive, this usage does not conform to the terminology used in economic studies of job creation.

Methods and Tools for Assessing Economic Development Impacts

The range of approaches for estimating economic impacts include

- Adders
- Multipliers
- Input–output models
- Econometric models
- Computable general equilibrium (CGE) and hybrid models

To develop estimates of the economic impacts of efficiency programs and investments, some type of economic tool is required to translate expenditures and savings into changes in employment and other measures of economic development. There are several categories of tools, with various tools in each category. Key elements to consider when choosing between tools are their ease of use, their ability to reflect impacts on a specific local economy, and whether their results are clear and reliable.

In its report, *Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy*, the Environmental Protection Agency (EPA) discusses various options in detail and summarizes case studies using various approaches and tools (EPA 2018). The following section summarizes and extends parts of that discussion; we encourage interested readers to explore the EPA report for more details.

As we now describe, the methods and approaches for estimating economic development impacts range from simple (and typically less costly) to more comprehensive, sophisticated, and expensive. For each option, we describe advantages and disadvantages. We begin with two similar—and simple—approaches for estimating economic development benefits: adders and multipliers.

Adders

Adders are typically a percentage of quantified energy benefits that are added to those benefits to estimate a broader range of benefits. For example, using an adder of 10% would mean that, for every dollar of quantifiable energy benefits, the program administrator would add an additional 10 cents to the overall benefit. Adders are based on any of a range of factors, including a review of other states' practices and uses, studies of the nonenergy benefits of specific investments, and simple rules of thumb. Typically, adders are used to cover a wide range of nonenergy benefits under a single umbrella.

Pros

The principal benefit of using an adder is its simplicity and low cost. Further, regulators can adjust the value of the adder up or down to include or exclude specific categories of benefits.

Cons

Adders are generally rough estimates; their obvious drawback is that they typically lack rigorous analysis underpinning their precise value. As we note below, Colorado uses an adder to encompass a broad range of nonenergy benefits from efficiency programs.

Multipliers

Multipliers are similar to adders, but they are generally based on more rigorous economic analysis. Typically, developing a multiplier involves estimating the average amount of revenue required to support a single worker for one year at full time, or the amount of efficiency investments required to add a dollar to the state's GDP. Multipliers can be used to estimate direct job creation or GDP benefits in both the implementation and savings phases by multiplying efficiency expenditures or net energy savings by the relevant multiplier. For example, in its guidance for estimating job creation from the Energy Efficiency and Conservation Block Grant Program of the American Recovery and Reinvestment Act of 2009 (ARRA), the Department of Energy (DOE) initially instructed grantees to estimate direct job creation using a multiplier of one job created or retained for every $92,000 of expenditure (Garland 2009).

Pros

The principal advantage of using multipliers is their straightforward application and simplicity. Once a multiplier is determined, there is essentially no additional cost to apply them. However creating a multiplier and using it appropriately can be complicated; it typically either requires a study of proposed efficiency measures or (more likely) relies on an existing economic analysis of similar approaches.

For example, Rhode Island's cost-effectiveness test relies on a study that identified an electricity efficiency job-creation multiplier of 36.5 jobs created per million dollars of expenditure, or one job for every $27,397 (National Grid 2014). Using this factor as a multiplier is relatively straightforward and essentially zero cost, but the study that generated it was an analysis conducted by consultants using an economic model. Further, using the Rhode Island multiplier appropriately can be tricky. It is based on a comparison of total employment in a baseline economic projection compared with a projection of the impacts of an alternative scenario with efficiency investments. The multiplier thus includes direct, indirect, and induced job impacts from both the implementation and savings phases, along with any job impacts in operations and maintenance activities, and is net of the costs of implementation and any negative impacts on the electricity generating industry. This explains why it is different in scale from the multiplier used by DOE (which includes only direct jobs). It also highlights how, when using multipliers, it is important to be clear about exactly which kinds of expenditures the multiplier should be used for and which types of job calculations it is likely to require.

Cons

Although easy to apply, multipliers typically require a somewhat complex underlying analysis to estimate their value. Obtaining a multiplier specific to particular efficiency programs in a particular state (or smaller geographical area) requires a separate modeling exercise for each proposed program, which entails significant time and expense. A less resource-intensive approach is to conduct one analysis for an existing or proposed program in a specific area, derive multipliers from that study, and use them for subsequent programs even though they may differ significantly. This has the advantage of being location-specific and less expensive than analyzing each proposed program individually, with the obvious drawback being that the greater the difference between the previously analyzed program and the prospective programs, the less accurate the multiplier will be. Similarly, the suitability of multipliers derived from a modeling analysis declines as the time between the analysis and the proposed program increases.

Input–Output Models

Input–output models are more detailed than multipliers and are based on answering a similar economic question: *How much revenue does a firm need to receive in order to support a single worker full-time for a single year or create a single dollar of GDP?* By offering a more detailed representation of the economy than simple multipliers, input–output models can be more accurate in estimating the economic impacts of actual and proposed efficiency programs. Input–output models are based on data that relate the output of each economic sector to the inputs required from other sectors to create it. As such, they also clearly calculate direct, indirect, and induced jobs separately.

Input–output models have the advantage of being relatively straightforward and transparent—and relatively inexpensive—compared to other types of economic models. However using them correctly still generally requires significant expertise. As we describe below, the IMPLAN model is an example of an input–output model commonly used for estimating impacts of efficiency investments. ACEEE's DEEPER modeling framework is based on IMPLAN data and extends that model's capabilities in a number of ways.[3] As we also note below, Rhode Island used an input–output model to generate the multipliers it uses in its cost test.

Pros

In addition to the benefits mentioned above, input–output models are typically less expensive and easier to use than other economic models. They also tend to be less complex, which often translates into greater transparency. Finally, they are typically available at a wide range of geographic specificity, ranging from national to county levels.

Cons

Input–output models typically have at least two drawbacks that they share with multipliers. The first is that they are static and do not reflect how the economy might change over time. This is less of a problem for estimating implementation-phase jobs since those expenditures tend to occur over a short time period. However, for programs that last multiple years, the implementation expenditures will be spread out over time, and the further into the future the investments take place, the more the economy in question is likely to change and the less accurate the results will be.

Additionally, input–output models typically do not model how an economy reacts to changes in prices (i.e., price elasticity). If an efficiency program is sufficiently large that it would reduce

[3] See Appendix B for IMPLAN and DEEPER URLs as well as other useful resources.

demand for electricity enough to lower electricity prices, for example, input–output models will not be able to determine the impact of lower electricity prices on the economy and job creation.

Econometric Models

Econometric models use statistical methods to predict how an overall economy and individual sectors within it react to changes in economic conditions, such as an increase in energy efficiency expenditures. These models typically start with a baseline forecast of what the future will look like under a set of assumptions about key economic parameters. Modelers next specify how those parameters might change in reaction to certain policies or other initiatives. They then run a second forecast, and the difference in the two forecasts represents the projected impacts on the economy.

Unlike input–output models, econometric models are forward looking and contain some prediction of how the economy will change over time; they also allow the economy to react to changes in prices induced by policy changes. As such, they are dynamic rather than static. An econometric model might predict the impacts of an efficiency program by first examining how program funding might impact the cost of electricity, how the expenditures might increase the demand for specific types of equipment and labor, and what the reduction in electricity demand might be as a result of the program. The model might then calculate the change in electricity demand as a result of adding a charge to fund the program, how increased demand for equipment and workers might impact prices and wages, and how customers might spend their savings. Next, it might estimate the combined effect of all these factors, as well as changes in parts of the economy that these factors might create, until it arrives at a set of economic outcomes that is consistent with all of the factors and the model's basic understanding of how the economy works. REMI Policy Insight+ is an example of an econometric model; it is often used to assess the impacts of energy efficiency policies and investments.

Pros

A primary strength of econometric models is that they can dynamically represent economic relationships that forecast how the economy and its individual sectors respond to various changes. For example, they can forecast how one economic sector would respond to changes in prices of related sectors, such as how electricity production would change in response to a change in natural gas prices, and how natural gas prices and production would respond to a change in coal prices. Econometric models can also forecast changes in economic relationships over time, allowing them to reflect trends in technology that might impact the economy's structure down the road, such as how the increasing adoption of electric cars might impact demand for both gasoline and electricity.

Some econometric model benefits are less important to efficiency analyses—especially when efficiency investments are small. An example here is the ability to forecast economic changes in reaction to changes in prices. For modest efficiency programs, the impact on retail energy prices is minimal, especially since they are regulated for a large share of customers and thus tend to react less to changes in demand and other conditions. Econometric models can identify other effects of reduced energy prices, including increased economic growth and sectoral shifts in the state economy. The native ability of econometric models to forecast into the future is a strong benefit, and potential users must weigh this and other benefits against the cost, which is often significantly higher than other models.

Cons

The principal drawbacks of econometric models are their expense and complexity. The complex representations this model provides typically come at a high price for both obtaining and operating the model—and the latter requires highly specialized expertise. Further, adding layers of sophistication and complexity typically make models less transparent. As a result, users must rely largely on the model's internal mechanics and the assumptions they embody. An econometric model may cost much more to access than an input–output model, and the model's complexity often necessitates a consultant with model-specific expertise, which can add significant cost.

Computable General Equilibrium and Hybrid Models

CGE models are based largely on well-developed economic theories of how economies work and relate to changes in various key factors. As the name suggests, CGE models examine what the economy looks like when all markets are in a state of equilibrium, which represents somewhat of a best-case scenario; this makes the models best suited for long-term projections and less capable of examining shorter-term issues and predicting economic trends (such as the business cycle).

CGE models are grounded in economic theory and use econometric methods to estimate key parameters. However these models require a degree of internal consistency dictated by theory—a requirement that is absent from input–output models and less prevalent in econometric ones. This theoretical complexity also means that CGE models are almost exclusively built to represent national economies, and few exist at the state or local level.

Pros

The principal strength of CGE models for many applications is their focus on equilibrium, which is also their main drawback for modeling efficiency policies. By representing a state of full economic equilibrium both for the economy as a whole and in individual sectors, CGE models represent a state in which all resources are being put to their best and highest use. As such, they do not contemplate a state in which energy resources are being used inefficiently. As a result, policy efforts to increase energy efficiency are by definition more economically costly than any technical inefficiencies they may eliminate. This is at odds with real-world experience, which, along with their relative unavailability at the sub-national level, makes traditional CGE models an inappropriate choice for efficiency analysis.

Hybrid models attempt to capture the theoretical aspects of CGE models and marry them with the near-term and localized capabilities of econometric models. The resulting models are more detailed than traditional CGE models, but they tend to be less detailed than pure econometric or input–output models. The REMI Policy Insight+ model is an econometric model with some CGE characteristics and may best be characterized as a hybrid model.

Cons

As mentioned above, CGE models are typically unavailable at the sub-national scale, making them unsuitable for state or local economic analyses. Additionally, their tendency to represent economies in a state at or near optimum efficiency and equilibrium may translate into an incorrect valuation of the benefits of additional efficiency investments.

Table 1. Approaches for estimating economic impacts of efficiency programs

Tool	Description	Application	Cost	Pros and cons
Adders and multipliers	A simple factor to scale up resource benefits to include or estimate economic development benefits from a given resource benefit amount	Once adder is determined or multiplier is estimated, can be applied to resource benefits estimates using simple arithmetic	Adders: relatively low Multipliers: require some resources to estimate	Pros: simplicity, transparency, and ease of use; relatively low cost Cons: limited accuracy; adders are sometimes set somewhat arbitrarily
Input–output models	A relatively simple model that calculates benefits based on the number of jobs required to sustain a given economic activity or the GDP created by economic activity	Practitioners must input the level of resources being invested and the savings they generate as well as the investment costs and other key parameters	Relatively low	Pros: less expensive and easier to use than other types of models; transparent Cons: limited ability to assess impacts of price changes; often do not assess changes over time
Econometric models	A more complicated model that relates changes in individual sectors and prices to one another and the economy as a whole	Typically requires an experienced modeler to program the efficiency investments and other key parameters	High	Pros: thoroughly represent interactions between sectors and changes over time Cons: expensive; results are heavily influenced by opaque parameters estimated by the modeler
CGE and hybrid models	A typically less-detailed model of the economy with relationships governed by economic theory and estimated parameters	Typically requires an experienced modeler to program efficiency investments and other key parameters	High	Pros: theoretically consistent results; can project long-term impacts; available at state and local levels; hybrid models allow for unexploited efficiency opportunities Cons: results heavily influenced by opaque parameters and assumptions; unavailable at subnational levels; traditional CGE models assume a state of economic equilibrium

Examples of Efficiency Modeling Exercises

Of the model types mentioned above, IMPLAN and REMI are the most commonly used tools for assessing the economic impacts of efficiency policies and investments. In this section, we discuss two different studies—one using IMPLAN and one using REMI—to show how evaluators can use these approaches to estimate employment impacts from efficiency programs. Many other examples of this type of modeling exist; these two are representative of the larger body of research.

IMPLAN

A 2013 study prepared for the Southeast Energy Efficiency Alliance, *The Economic Impact of EE Investments in the Southeast* (SEEA 2013), looks at the overall economic impact of energy efficiency investments in eight southeastern states resulting from participation in the DOE's Better Buildings Neighborhood Program, funded by federal grants under ARRA.

The study used the IMPLAN model to produce assessments at the state and regional level. It found that $20 million of regional spending on energy efficiency programs would create a total of 350 FTEs and add almost $38 million to the states' GDPs. To generate these results, Cadmus tracked the following changes in cash flow as inputs to the model:

- *ARRA funding.* Money that the federal government gave to states in the region to implement efficiency programs. This funding is modeled as increased revenues to efficiency program administrators and represents a pure stimulus to the region, as the modelers treated this as an influx of funding without any offsetting payments to the federal government.
- *Incentive payments to participants.* Payments from ARRA program administrators to program participants to offset costs of participating in efficiency programs. This input represents income to households and businesses.
- *Payments to implementers.* Payments from program administrators and program participants to contractors to undertake assessments and install efficiency upgrades. This input was modeled as increased revenue to implementers, who in turn spend it on providing services and purchasing efficiency-related equipment.
- *Reduced energy bill payments.* Payments from program participants to utilities. The payments are lower than they otherwise would have been, representing increased disposable income for businesses and households.
- *Revenue recovery payments.* Payments to utilities from utility customers, regardless of whether or not they participated in efficiency programs. These payments cover fixed utility costs, which are now spread across lower volume of sales.
- *Avoided fuel and capacity costs.* Reduced payments from utilities to cover fuel costs and to maintain electricity capacity as a result of lower demand.

These changes in cash flow are attributed to industries such as construction, manufacturing of various types, and consulting and other services. IMPLAN tracks how the increases in demand caused by these changes in cash flow increase demand in these sectors and the sectors that supply them, including labor. IMPLAN calculates the labor required to supply all of these goods and services, and reports that labor as job creation in terms of FTEs. Unlike REMI, however, it does not predict or calculate the impacts of price changes, and (as mentioned above) it assumes that the economy's structure, including labor and input requirements, is static over time.

REMI

In 2011, under contract to the Vermont Department of Public Service, Optimal Energy Inc. and Synapse Energy prepared a report, *Economic Impacts of Energy Investments in Vermont* (Optimal Energy and Synapse Energy Economics 2011). The report found that an investment of $67.1 million in program costs, customer incentives, and participant expenditures would save $272 million in energy costs and create 1,894 jobs (FTEs) over the lifetime of the efficiency measures. It also found that the total program budget of $44.4 million (which excludes participant costs) would create 43 jobs per million dollars of investment.

Generating these estimates required tracking the following changes in cash flows throughout the state economy and inputting those changes into the REMI PI+ model to generate economic impact estimates:

- *Efficiency charges.* Charges that utilities place on their consumers' bills to pay for the efficiency programs. These are modeled as a cost to households and businesses.
- *Overhead.* Payment to utilities for program administration and other costs of administering efficiency programs. These are modeled as revenues to the utilities that are spent on administrative activities.
- *Efficiency premium.* Payments by program implementers for energy-efficient equipment, but only to the extent that the equipment costs more than equivalent baseline equipment. These are modeled as costs to ratepayers and come both from a combination of the efficiency charges above and from program participants.[4]
- *Incentive payments for contractors and equipment.* Payments to contractors for technical assistance on efficiency investment provided by the program, and incentives for the incremental costs of more-efficient equipment. These are modeled as revenues for contractors and equipment manufacturers.
- *Reduced utility bills.* Reduced energy costs for program participants resulting from more-efficient equipment. These are modeled as increased disposable income for participating households and businesses.
- *Changes in utility rates.* Because the energy efficiency investments are predicted to reduce energy demand enough to reduce energy prices, these lower prices are modeled to reflect further decreases in utility bills and reduced revenues to utilities. Utilities also will pay less to the regional grid operator, which will also lower utility rates. These reductions are at least partially offset by an increase in rates to ensure that utilities can continue to recover the fixed costs of electricity delivery. Because demand will fall as a

[4] Note that we include only the incremental cost of the efficiency equipment here, as the basic costs of equipment are considered part of the baseline. For example, if a program incentivizes residents to purchase more-energy-efficient refrigerators, the analysis assumes that the difference in price between an average refrigerator and an otherwise equivalent, more-efficient refrigerator represents the cost of the latter's efficiency characteristics.

result of the program, these fixed costs must be spread out over a lower volume of sales, representing an increase in rates.

All of these changes in cash flow are used as inputs to the REMI model to calculate changes in overall economic growth and employment. The REMI model is complex, and a detailed description of how it works is beyond the scope of this toolkit; in short, it tracks the changes in demand created by the changes in cash flow described here and determines the changes in output required by each economic sector to satisfy that demand. It also simultaneously tracks how those changes influence the prices of goods and services throughout the economy, how those changes in prices in turn influence demand, and so on.

The initial changes in cash flow are modeled as changes in revenue to construction, equipment and appliance manufacturers, professional and administrative services, and other sectors of the economy. In both examples, the modeling exercises do not differentiate between implementation- and savings-phase job creation. As we discuss below, however, practitioners are likely to need this distinction to avoid double-counting.

Estimating Economic Development Impacts: Challenges and Recommendations

Other than adders, all the methodologies discussed here require some economic analysis as a basis for calculating economic development and job impacts. Whether a jurisdiction relies on an existing study of past programs or commissions a new study of proposed activities, it should consider and manage several general issues, which we now describe. When using an existing analysis to create a job-creation metric, it is especially important for evaluators to understand how the following issues impact the results of the analysis they are working from and, in some cases, be able to disentangle specific categories of outcomes from the analysis results.

Avoid Double-Counting Benefits

Estimates of an efficiency program's economic impacts tend to examine that program's overall impact on the economy as a whole. This overall impact often includes direct, indirect, and induced impacts in both the implementation and savings phases. If economic development impacts are used in conjunction with a pre-existing cost–benefit test, evaluators must be sure not to include any benefits twice. Perhaps the easiest mistake would be to include the savings-phase benefits in a test that already values customer savings. If a cost test includes the value of customer savings, it has identified the dollar value of the savings to the economy. If we consider the savings as essentially an increase in disposable income for energy customers, the fact that they spend it on activities that create jobs and increase GDP is simply another way of describing that benefit. In most instances, the only new impacts that should be included are the impacts from the implementation phase.

Similarly, there are at least two ways to measure implementation-phase benefits: job creation and GDP growth. Although conceptually distinct, these factors measure the same benefit, but use different metrics. From an economic standpoint, GDP is equivalent to the value of final products produced in a given year. Employment is a means of creating final products, much like other parts of the supply chain that are consumed to make a good or service, but that are not themselves considered final products. Increased employment in the implementation phase is thus an aspect of increased GDP and not distinct from it.

Just as savings-phase employment should not be included in a cost–benefit test that already values savings, job creation, and GDP growth should not be included as additive benefits of a program. However it can be appropriate to include job-creation benefits as an additional descriptor to tests that include energy savings or GDP impacts. When either of these two metrics are already part of a cost test, the job impacts should be included only as another way to express the same outcomes, not as additional to them.

Avoid Undercounting Costs

Double-counting costs is less of an issue, since the primary costs of efficiency programs tend to be easily identified as the cost to the utilities and/or program participants. These typically belong to the implementation phase. The savings phase can also include costs that may not be counted in terms of reduced employment in electricity generation. If efficiency programs are likely to result in reduced electricity generation in the state, then evaluators should generally subtract those lost jobs from the job-creation benefits of the savings phase. In other words, calculating net jobs (job gains minus job losses) will generally be a fuller measure of employment impacts than simply looking at gross jobs (job gains only).

Analyses based on economic models generally include these negative impacts in their assessments, but it is important to ensure that they are accounted for appropriately. For example, to the extent that a state imports electricity, any employment impacts that result from reductions in electricity consumption should account for the fact that some of the reduced consumption will come from reduced electricity imports, which will have little to no negative impact on in-state employment. Similarly, for states that export electricity, reductions in electricity consumption may not reduce generation employment if electricity demand from nearby states is sufficient to support current generation levels.

These questions can be difficult to resolve analytically because they involve tracking gross interstate electricity flows. Using a dispatch model to inform the economic analysis is one way to help assess these impacts. However adding a dispatch model to an economic analysis is difficult and may be prohibitively expensive. As an alternative, it may be sufficient to adjust impacts on employment in electricity generation using net interstate flows. For example, in a state that generates only enough electricity to supply 75% of in-state consumption, it may be sufficient to assume that 25% of the reduction in electricity demand impacts out-of-state generators and should thus be excluded from the analysis.

This question is easier to address for natural gas programs because gas is produced in fewer states and net interstate flows are a reasonable proxy for gross flows. A state that produces no gas and reduces gas consumption through efficiency programs can discount any negative job impacts on the gas-producing industry because it all occurs out of state. The opposite is true for a gas-producing state.

Regardless of a particular state's situation, it is important to understand how the economic analysis that forms the basis of job-creation estimates addresses these issues, as well as to ensure that they are handled in a reasonable way for that state.

Assign Expenditures to Appropriate Sectors

When designing an economic model to assess the employment benefits of an efficiency program, it is important to assess a program's costs and benefits to the correct economic sectors and agents. For example, household spending patterns are significantly different than spending patterns of industrial or commercial businesses. Assessing savings-phase employment benefits accurately requires that the economic model assign savings to the appropriate sectors, so that residential savings are reflected in increased household expenditures, for example.

For implementation-phase expenditures, it is important to allocate spending in the appropriate economic sectors to the extent possible. Different types of efficiency programs focus on different types of activities, e.g., upgrading lighting, installing efficient appliances, or adding insulation. To the extent possible, evaluators should assign the appropriate share of program spending to various activities and implement this allocation in the economic model as closely as possible.

One trade-off of using more complex models, such as CGE models, is that they tend to have less sectoral detail, trading off finer levels of economic aggregation for computational complexity. Input–output models, on the other hand, are computationally much simpler, and generally have a greater level of sectoral detail. Because different types of efficiency expenditures have different economic impacts, it is important to start the modeling process with a clear understanding of the types of activities that will occur and the types of goods and services that the project will require. Converting this information into inputs to an economic model requires good judgment in assigning different spending types to different economic sectors.

State Efforts to Include Economic Development Benefits

To date, few states have included these broader economic benefits of energy efficiency investments in their cost–benefit tests. A few states explicitly include a value to account for an increased local economic growth impact, while others are working to include it. Rhode Island, for example, has explicitly included a specific valuation for increased local economic growth in its Rhode Island Test for evaluating utility plans (Rhode Island PUC 2017). Other states—including Illinois through its Future Energy Jobs Act (Illinois General Assembly 2017) and Minnesota (Minnesota Department of Commerce 2018)—are working to include the value of efficiency's economic benefits in their cost–benefit tests for utility efficiency investments going forward.

The National Standard Practice Manual (NSPM) for assessing the cost effectiveness of energy resources gives regulators a comprehensive framework for valuing energy efficiency's costs and benefits (NESP 2017). The NSPM explicitly references the value of economic development and job creation as an additional energy efficiency benefit that states may want to include in their cost tests to the extent that it aligns with applicable state policy goals and objectives.

RHODE ISLAND

In July 2017, the Rhode Island Public Utility Commission published its *Least Cost Procurement Standards* (Rhode Island PUC 2017) to guide utilities in meeting the state's energy efficiency goals. It requires utilities to assess the cost effectiveness of efficiency measures using a cost test that builds on the Total Resource Cost Test (TRC)—the previous standard method—but that also "more fully reflects the policy objectives of the State with regard to energy, its costs, benefits, and environmental and societal impacts… These benefits should include resource impacts, nonenergy impacts, distribution system impacts, economic development impacts, and the value of greenhouse gas reductions…" (Page 2). To this end, Rhode Island adopted the Rhode Island Test, which aligns with the state's policy objectives and includes a specific valuation for increased local economic growth (Rhode Island PUC 2017).

To implement this requirement, National Grid, the state's largest utility, relied on a study that projected the macroeconomic impacts of its *Energy Efficiency Program Plan for 2014* (National Grid 2013). That study, conducted by REMI, developed multipliers to quantify the lifetime economic development benefits to the state per million dollars spent on efficiency programs. It found that, for every million dollars spent by the utility and its customers on electricity efficiency, the state would realize an increase in GDP of $3.4 million and the creation of 36.5 job-years. For natural gas efficiency, the results were lower: a $1.6 million increase in GDP and 18.5 job-years for every million dollars of investment.

To use these values in the Rhode Island Test, National Grid created multipliers to calculate the present value of lifetime benefits to state GDP from efficiency investments. However, because the Rhode Island Test is designed as an expansion of the TRC, multipliers must include benefits and costs not already included in their evaluation to avoid double-counting. Further, because the TRC already accounts for the value of energy savings to customers, these benefits and their contributions to GDP must be removed from the economic benefit estimates to develop multipliers that are net additions to the TRC. The same is true for the costs incurred both by the utility and program participants, since these were also already accounted for in the TRC and other tests. Ultimately, the only new economic costs or benefits included in the Rhode Island Test are the economic benefits generated in the state as a result of construction and other activities associated with implementing efficiency programs.

After accounting for these factors, National Grid developed multipliers to calculate implementation-phase GDP benefits per dollar spent for five categories of efficiency investments: combined heat and power, residential sector electric and gas efficiency, and commercial sector electric and gas efficiency. The multiplier values were the same for gas and electric efficiency in each customer class. The residential and commercial sector multipliers were further broken down to identify the benefits per dollar spent based on whether the utility or program participant made the investment. The multiplier values range from $0.56 per utility dollar spent on commercial gas and electric efficiency to $0.75 per participant dollar spent on residential electric and gas efficiency. They estimate that every dollar spent on combined heat and power contributes $0.80 to state GDP (National Grid 2017).

OTHER STATE INITIATIVES

Although Rhode Island has made the most progress toward including job creation and other economic benefits in its efficiency cost test framework, other states are also making efforts in this direction.

Colorado

To regulate electric and natural gas demand-side management programs, Colorado state law defines the benefits of such programs to include their nonenergy benefits. These benefits are determined by the state's Public Utility Commission (PUC), giving it broad leeway in deciding which types of benefits to include and how to value them (Colorado General Assembly 2017). In

2008, the PUC approved a demand-side management plan for Xcel Energy (filing under the name *Public Service Corporation of Colorado*) directing the utility to include nonenergy benefits in its cost test.

In its order, the PUC did not clearly define nonenergy benefits or specifically identify macroeconomic benefits (such as job creation) as something that should be included in the calculation of net benefits. However it did agree broadly with submitted testimony that nonenergy benefits were an important component of benefit calculations. The PUC also broadly agreed with testimony on how to include nonenergy benefits, which included reference to macroeconomic benefits as well as more commonly considered benefits such as pollution reduction. The commission subsequently ordered Xcel to use an adder of 10% of the value of other quantifiable benefits to represent the value of all nonenergy benefits together (Colorado PUC 2008).

Minnesota

In 2018, Synapse Energy Economics released a report under contract with the Minnesota Department of Commerce's Division of Energy Resources that provides recommendations for modifying the cost test that utilities use to evaluate their energy efficiency programs (Malone et al. 2018). The recommendations were intended as a straw proposal to help the state develop an alternative framework that is consistent with state policy goals.

The state currently relies primarily on the Societal Cost Test (SCT). The Synapse report recommends that it develop a Minnesota Cost Test, expanding on the SCT to include a broader range of benefits and costs, including economic development and job creation. The report falls short of recommending a methodology for calculating the economic benefits, preferring instead to previous work that used the IMPLAN model to quantify the economic impacts of past state activities as a starting point for developing a methodology. Ultimately, the report recommends that, at a minimum, the state include job-creation estimates and present them with the results of cost–benefit analyses so that they can be included in decision-making processes.

Illinois

In 2017, Illinois enacted the Future Energy Jobs Act, establishing a number of requirements for utilities, including expanding energy efficiency and renewable energy deployment, funding job development programs, and providing support for nuclear generators in the state (Illinois General Assembly 2017). Among its other provisions, the Act requires that utilities issue semi-annual reports on their implementation of the Illinois Solar for All program; these reports must include how many jobs and job opportunities and other economic benefits were created through the program. The law does not require similar reporting on energy efficiency programs, and it is not clear how this requirement will play into future cost–benefit testing frameworks in the state, but it is a clear indication of increased focus on the broader economic benefits of clean energy investments.

Conclusion

States are increasingly considering economic development as a key benefit of investing in energy efficiency and other clean energy resources. As we have discussed here, this benefit can be substantial. We created this toolkit to help guide regulators, practitioners, and others who wish to incorporate economic development into their assessment of energy efficiency costs and benefits as they plan and evaluate programs. Developing a methodology for including this benefit in cost tests is complicated, and a state may wish to develop its own. Each of the tools states can use in these tests has its pros and cons; together, they reveal energy efficiency's considerable job-creation and economic development potential.

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Appendix A. Summary of Efficiency Resource Impacts

Table A1. Efficiency resource impacts

Type of impact	Description
	Utility system
Costs incurred or saved by the utility that funds the efficiency resource	Includes costs to utility of acquiring efficiency resources, while savings can include reductions in costs to the utility system associated with both avoided capital investments (e.g., for new generating facilities, environmental compliance, and T&D) and avoided variable operating costs (e.g., energy/fuel costs)
	Beyond utility system
Participant measure costs	These accrue when the financial incentives provided by efficiency programs cover only a portion of an efficiency measure's cost and participants bear the balance
Participant nonresource impacts	Impacts on program participants that are not related to resource (fuel or water) savings; these include asset value, productivity, economic well-being, comfort, health and safety, and customer satisfaction
Incremental low-income participant impacts	Impacts on low-income program participants that are different from or incremental to non-low-income participant impacts; these include reduced foreclosures, reduced transiency, and poverty alleviation
Other fuel impacts	Impacts on end-use fuels that are not provided by the funding utility; these include electricity (for a gas utility), gas (for an electric utility), oil, propane, and wood
Water impacts	Impacts on participant water consumption and related wastewater treatment
Environment	Impacts associated with CO_2 emissions, criteria pollutant emissions, land use, etc.; these include only those impacts that are not included in the utility cost of compliance with environmental regulations
Public health	Impacts on public health; these include health impacts that do not overlap with participant impacts or environmental impacts, as well as benefits (in terms of reduced health care costs)
Economic development and jobs	Impacts on economic development and jobs
Energy security	Reduced reliance on fuel imports from outside the state, region, or country

Source: NESP 2017

Appendix B. Additional Resources and Tools

IMPLAN: www.implan.com

REMI PI+: www.remi.com

DEEPER: aceee.org/files/pdf/fact-sheet/DEEPER_Methodology.pdf

National Efficiency Screening Project: nationalefficiencyscreening.org

Department of Energy Better Buildings Cost Effectiveness Tool: www.energy.gov/sites/prod/files/2017/03/f34/bbrp_ee_ce_tool-faqs_2017.pdf

State and Local Energy Efficiency Action Network Evaluation, Measurement, and Verification Resource Portal: www4.eere.energy.gov/seeaction/evaluation-measurement-and-verification-resource-portal