Why Economists and Energy Efficiency Practitioners Need to Work Together to Improve Energy Efficiency Programs

By Steven Nadel

INTRODUCTION

In the past year, a number of papers from economists have questioned the effectiveness of energy efficiency programs and policies. We have reviewed many of these studies and in general find that some of these studies have useful lessons, but too often they miss the mark because they miss some key issues in the programs they are evaluating, or they seek to overgeneralize their findings to programs very different from the ones they evaluated. These issues are discussed extensively in another paper.[1] But rather than a tit-for-tat debate, it is important to go past some of these details and look more broadly at how economists and energy efficiency practitioners can better avoid these past problems, better understand each other, and better work together.

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See footnotes at end of text.

THERE IS MUCH TO LEARN

First, we admit that not all energy efficiency programs are stellar. It's critical to have good evaluation to help tell what is working well and what needs improving. For example, one of the useful findings from the recent but controversial Fowlie et al. evaluation of the low-income weatherization program in several Michigan communities is that the energy audits in this program were overestimating the energy savings that can be achieved.[2] Fortunately, as Amann recently wrote, other research has found that calibrating audits to actual energy bills can do much to address this problem.[3] This is an example of how identifying a problem can help lead to solutions.

Similarly, Houde and Aldy find that net energy savings are very small when a program promotes efficient products that already have high market share. They found that incentives for ENERGY STAR® refrigerators, clothes washers, and dishwashers did not have much impact, estimating that, depending on the product, free riders were 73–92% of program participants (free riders are customers who take the rebate but would have made the same purchase decision without the rebate). Free riders were high because, as Houde and Aldy note, ENERGY STAR market share was 46–75% of product sales prior to the program.[4] I have noted this issue previously and suggested that qualifying efficiency levels for rebates and other incentives be set at levels with only a modest market share.[5],[6] However this advice was not followed when DOE and states developed their appliance rebate program. When so many products qualify without incentives, the majority of participants will be free riders that contribute to program costs but not energy savings. Houde and Aldy find that the program did not save much energy, so hopefully this lesson will be better recognized in the future.

GETTING BEYOND PARADIGMS TO DISCOVER THE TRUTH

There is a tendency, in both the economics and energy efficiency communities, to work from established paradigms and work with colleagues who share similar views. When the two communities meet they often talk past each other. There is a need for both sides to better understand where the other side is coming from, and to explore opportunities to find a middle ground.

For example, many economists look for rigorous evaluation, preferring what they call the "gold standard": randomized control trials in which a large group of potential participants is randomly assigned to either a study or control group. But randomized control trials can be very difficult to implement, as Angus Deaton, the most recent recipient of the Nobel Prize in Economics has discussed.[7] This is particularly a problem for full-scale programs in which everyone is eligible and random assignment to a control is not possible.

The Fowlie et al. study illustrates this issue. In their various materials they discuss how they "administered a randomized controlled trial (RCT)—considered the gold standard in evidence—on a sample of more than 30,000 WAP-eligible households in the state of Michigan".[8] However a review of the details of their study shows that many of these (more than 20,000) were a control group, 7,549 were encouraged to get weatherization, and 2074 homes were weatherized. Ultimately they were able to obtain data on 436 of their experimental homes, which was too small a sample to get useful statistics from their RCT experiment. To improve the statistics they included an additional 1,473 weatherized homes that were

not part of their RCT sample.[9] Ultimately, their energy savings results come not from an RCT, but from the quasi-experimental approach that is extensively used in energy efficiency evaluation.

On the other hand, the energy efficiency community in recent years has increased use of "deemed savings estimates," since these are easier to use and provide certainty for program implementers. Deemed savings estimates are supposed to be based on prior evaluations, but these evaluations are not always as rigorous or frequent as would be ideal. Perhaps the two sides could agree on more frequent "quasi-experimental" studies that carefully select a control group that is not randomized. And when pilot studies are conducted, randomized control trials should be considered.

Likewise, economists generally believe in the power of markets and have a tendency to believe consumers make rational decisions and to minimize the presence of market barriers that can cause markets to perform sub-optimally. Such beliefs can effect results. For example, Krupnick et al. find that building, lighting, and appliance standards have a cost of $60 per ton of carbon reduced when calculated using a 20% discount rate, a rate determined from studies of consumer decisions assuming there are no market barriers. But this cost declines to $7 per ton with a 5% discount rate (roughly the consumer cost of capital).[10]

On this issue it is also important to point out that the choice of discount rate should not be based on purchaser decision making alone. For example, many utilities operate energy efficiency programs because energy efficiency is less expensive than building a power plant. In this case the appropriate discount rate is probably the cost of capital for building a power plant (currently about 5% real). Use of a 20% discount rate would severely distort the analysis, resulting in very little efficiency investment and hence the need to build more power plants, raising electric rates for all customers.

THE NEED TO BE OBJECTIVE

Both communities need to be fair and objective when they conduct studies, and not seek to bias the results or report valid results in a biased manner. Examples of tilting the field include studies that look at only costs but not benefits (e.g., Batkins[11]), include extra costs unrelated to energy efficiency (e.g., home repair costs, as included by Fowlie et al.[12]), leave out important costs such as changes in the value of products to consumers (a problem with some energy efficiency evaluations, as discussed by Gayer and Viscusci[13]), or are based on a simple cost–benefit framework without considering other goals that the programs might have beyond energy savings, such as in the case of the Weatherization Assistance Program, improving the health and safety of families[14] and in the case of the American Recovery and Reinvestment Act (the 2009 economic stimulus act), "job preservation and creation."[15]

Likewise, each program is different, and one problematic program should not call into question all the others, particularly dissimilar programs. A notable example of this problem is in the policy brief accompanying the Fowlie et al. study which overstates the findings, saying that "residential energy efficiency appears to be a poor investment on average."[16] This statement attempts to apply the results of a study on low-income weatherization in a few communities to all weatherization, regardless of location and home type, as well as to other residential programs such as those intended to reduce energy use of lighting or appliances, despite the fact that these other programs were not studied. Conclusions can only be generalized to similar programs.

GOING BEYOND SURPERFICIAL RESULTS

To be most useful, a study should not only look at what is happening, but also seek to understand why, and then make recommendations on ways the problems identified can be addressed.

A good example of looking beyond the superficial findings is a paper by Withers and Vieira. They compared the energy use of a sample of homes built to the 2009 Florida code with the energy use of a sample of homes built to the code in effect during 1984–1985. Previous building energy simulations by their colleagues had compared the 1984 and 2009 energy codes and predicted energy savings of about 50% for combined heating, hot water, and cooling energy use. But when Withers and Vieira compared actual energy consumption of 1984 and 2009 homes for these end uses, they found only a 7–13% difference (varying depending on what specific data they used).[17] Given such data, less rigorous researchers might have concluded that the Florida building code was not working well. Fortunately, Withers and Vieira were very scrupulous and realized that to fully evaluate this code, they had to look at more than energy consumption data. They decided to dig deeper, collecting and comparing detailed data on the homes. They found a number of factors that helped explain the lower-than-expected energy savings:

- In the old homes, much of the equipment (furnaces, air conditioners, water heaters, and appli-

ances) had been replaced, and the new equipment was much more efficient than the requirements in the 1984 code. The authors attribute the changes to appliance efficiency standards, energy efficiency programs, education efforts, and higher energy prices.
- The older homes had more attic insulation on average than was required by the 1984 code.
- Temperatures in the older homes averaged about 1°F higher during the summer and about 0.6°F colder during the winter. In other words, some of the new code's benefits were being taken in the form of slightly increased comfort.
- A somewhat warmer-than-normal winter affected the data on actual energy use.
- The newer homes had more miscellaneous energy loads (gadgets).

Interestingly, code compliance was not a significant factor. The authors found a 90% compliance rate and estimated that the out-of-compliance items resulted in an annual impact on energy use of 1% or less.

Withers and Vieira then ran the energy use simulations again to compare the homes adjusting for these factors. The first factor (subsequent upgrades to appliances and equipment) was the most important, but, accounting for all the factors, the revised simulated energy use of the new homes was 9% lower than the older homes, near the midpoint of the 7–13% difference they found in actual energy consumption data.

The authors conclude that "[the code] has made a significant difference, but measured savings compared to older homes 25 years after construction are decreased by years of home improvement efforts."

COMBINING SKILLS TO CREATE THE BEST RESEARCH POSSIBLE

So how can we better work together? First, rather than each community conducting separate studies, perhaps economists and energy efficiency practitioners can jointly work together on some studies, as each profession brings useful skills, perspectives and information.

Economists tend to be good at research methods and statistics but they don't always understand the markets they are evaluating. A good example of this problem is a study by Levinson on the California residential building code. Levinson (2014) sought to examine energy savings from California building codes. To do this he examined electricity consumption data. However, building energy codes in the United Sates primarily address energy used for space heating and air conditioning, with some impact on water heating energy use. In California this mostly means that codes would affect natural gas and not electricity use; a study prepared for the California Energy Commission[18] found that 93% of California homes are heated with gas and only 5% are heated with electricity. Likewise it found that 87% of homes have gas water heating and only 7% use electricity for water heating. Thus, Levinson's analysis of electricity use missed most of the energy use that the California code is designed to save. And while codes affect air conditioning energy use, in California, with its mild climate, air conditioning energy use is modest. Nadel estimated that even if the California code worked as well as expected, home electricity use would be reduced by only about 1%, a very small change to find in a statistical analysis.[19] By coupling economists with knowledgeable practitioners, problems such as these can be avoided.

Energy efficiency practitioners generally have a deep understanding of the programs being evaluated but sometimes are not as good at research methods. Also, at times energy efficiency professionals can be too close to the programs they evaluate and seek to minimize problems. For example, as discussed earlier, it took independent researchers to point out problems with audit accuracy in the Michigan Weatherization Assistance Program. Having an objective co-researcher can avoid these problems and make results more credible.

More generally, both groups have their biases (in favor of markets and programs respectively) but by working together they can act as a check on each other's biases.

Likewise, it would be useful to have the other community review studies before they are published, thereby allowing problems to be identified and corrected before publication. Such reviews are particularly important before seeking press coverage. Several recent studies sought press coverage before they were vetted with efficiency experts,[20] giving black eyes to both energy efficiency and the researchers.

Also, generally, good practice in evaluation research is to reference other studies that look at similar programs and to discuss how the findings in a study compare to findings in these other studies. Some of the recent studies that critique energy efficiency programs fail to even note other reputable studies that contradict their findings (e.g., Levinson[21] is particularly notable in this regard as discussed by Nadel[22]).

POTENTIAL RESEARCH AREAS TO EXPLORE TOGETHER

If the economics and energy efficiency communities want to work together, what would be worth studying? Many of the recent critical studies have been of programs that energy efficiency experts have

found to be relatively expensive, such as residential weatherization (particularly low-income weatherization) and residential new construction (see Table 1). It would be useful to have joint studies on some of the less-expensive program types.

Sector and program type	Average cost (cents per kWh saved)
Low-income	14.2
Other residential	3.3
New construction	11.1
Whole-home retrofit	9.4
Multifamily	7.1
Behavior/normative feedback	5.7
Prescriptive	5.4
Consumer product rebates	2.1
Commercial and industrial	5.5
MUSH* and government	8.5
Small commercial	6.3
Custom	5.2
Prescriptive	4.5
New construction	4.2
All sectors	4.6

This table summarizes the results of hundreds of programs; an array of approaches was used to evaluate these different programs.

* MUSH is municipalities, universities, schools, and hospitals.
Source: Hoffman et al.[23]

Table 1. Total Cost of Saved Energy by Sector and Program Type

Another area worth exploring together might be the benefits of programs beyond energy savings. For example, a recent nationwide evaluation of the DOE Weatherization Assistance Program found large benefits beyond energy savings.[24],[25] Greenstone and Wolfram take issue with some of their estimates,[26] indicating an area where further work is needed.

CONCLUSION

Energy efficiency programs can have important benefits, but like any type of program and policy, should be regularly evaluated. Both economists and energy efficiency practitioners have complementary expertise that can contribute to good evaluation – the two groups should work together more. Such studies should look at what is happening and what works and to make recommendations on how programs can be improved to work even better in the future.

Footnotes

1 Nadel, S. 2016. Critiques of Energy Efficiency Policies and Programs: Some Trust But Also Substantial Mistakes and Bias. Washington, DC: ACEEE. aceee.org/critiques-energy-efficiency-policies-and-programs.

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8 See epic.uchicago.edu/news-events/news/do-residential-energy-efficiency-investments-deliver.

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