

We All Did It: Attribution of Savings in an Environment with Many Helpers

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ABSTRACT

In the Northwest US, many efficiency initiatives are implemented through coordinated efforts of utilities, other Energy Efficiency Service Providers (EESPs), the Northwest Energy Efficiency Alliance, and State Agencies. There has been no unified framework for financial analysis of efficiency investment.

The Energy Trust of Oregon developed an approach and then a quantitative model to explain what benefit Oregon will enjoy from the Energy Trust's combined investments in local and regional initiatives in one market. An example is provided for new homes. The model addresses the total investments with public benefits dollars and benefits to the utility system. Societal costs and benefits are also considered. In a well-designed market intervention the efforts of each implementer are highly interdependent, so allocating savings to each party proved to be meaningless.

The modeling framework pays particular attention to equipment markets- both baseline market conditions and the range of likely results and costs of key interventions. Model development involves first building a framework of demographics and measure cost and savings, then refining assumptions through iterative discussions with program planners, implementers and other sector experts. There is no statistical black box to hide the judgment and context knowledge of the experts because these things validate the market dimensions of the model. The results provide our board with a credible and concise basis for deciding whether to invest in the programs.

The paper also addresses the combined impacts of Energy Trust and state energy office programs.

Introduction

The Energy Trust of Oregon (Energy Trust) is charged with acquiring cost-effective energy efficiency and renewable resources as a means to lower power purchase costs and environmental impacts of power for the Oregon customers of PacifiCorp and Portland General Electric (PGE). Additionally, the Energy Trust acquires cost-effective energy efficiency for the Oregon commercial and residential customers of Northwest Natural Gas. This paper presents an approach taken by the Energy Trust to assess the costs and benefits of efficiency initiatives that involve multiple administrators and initiatives.

First, the paper describes the operating environment, with multiple conservation providers. Then the respective roles of each player in causing savings to happen are detailed. Third, the paper considers the role of the Energy Trust in terms of directly or indirectly funding various activities and the dilemmas that creates for cost/benefit modeling. With this background in place, the paper examines a cross-program integrated modeling framework for looking at Energy Trust-sponsored activities, their prospective results, and their relative merits. Then an example is provided for the new home efficiency programs. The paper shows the results,

including how we deal with the imprecision of forecasts in the modeling process. Finally, we briefly discuss a model built for related but different purposes.

A Superabundance of Helpers

Oregon is an “administrator-saturated” environment for efficiency initiatives, particularly for electric efficiency. The following entities are responsible for helping influence consumer investments in electric and gas efficiency in at least some cases:

1. **Oregon Department of Energy (ODOE)** is one of the most proactive and efficiency-focused State Energy Offices in the country. They administer residential and business tax credits (ODOE, 2006a), a program for passing tax credits through to other taxpayers in exchange for cash (ODOE, 2006b), and an efficiency loan program (ODOE, 2006c). They help upgrade the state energy building code (ODOE, 2006d), and coordinate and oversee efforts to meet efficiency requirements exceeding energy codes for state buildings. They also help Educational Service Districts administer efficiency funds for public schools which come from the electric wires charge (ODOE, 2006e). ODOE also provides technical assistance and bundling of services for consumers. Finally, ODOE administers a provision under the law which created the Energy Trust (Oregon Laws, 1999) whereby large businesses can choose to self-direct investments in efficiency instead of providing funds to the Energy Trust. If tax credits are included, ODOE provides more efficiency funding than the Energy Trust.
2. **Climate Trust.** Under another program financially administered by ODOE, the Climate Trust (Climate Trust, 2006), an Oregon non-profit, receives funds to mitigate carbon emissions from power plants that exceed an ODOE-set threshold. Oregon plant operators pay a fee based on emissions beyond a minimum threshold. While the Climate Trust makes all manner of investments in carbon offsets all over the world, their investments have included in-state investments in energy efficiency, operating initially independently and later in tandem with the Energy Trust.
3. **Northwest Energy Efficiency Alliance (NW Alliance).** (NW Alliance, 2006) This is a regional group funded by public benefits administrators (utilities and entities like the Energy Trust throughout Oregon, Washington, Idaho, and Montana. The NW Alliance is charged with transforming markets to more electric-efficient purchasing, design, and operation practices. Energy Trust funding for the NW Alliance is roughly proportional to the share of northwest electric load that the Energy Trust serves.
4. **Portland Office of Sustainable Development.** (POSD, 2006) In the largest city served by the Energy Trust is one of the more innovative city energy efficiency offices in the United States. They operate programs as a contractor to the Energy Trust¹ and the Climate Trust and as an independent entity.
5. Energy efficiency is also influenced by the initiatives of the **Federal Government**, most prominently (1) the wide array of ENERGY STAR programs for efficient equipment and practices, (2) tax credits, and (3) efficiency standards for the manufacture of equipment.
6. The Energy Trust is a funding member of the **Consortium for Energy Efficiency (CEE, 2006)**, a national coordinating group for energy efficiency program implementers. The

¹ The Energy Trust bids out turnkey operation of most of its efficiency programs, but manages their direction carefully to meet multiple objectives.

Consortium helps members take actions together where it augments the effectiveness of the activities of its members. These include developing common equipment specifications, designing model programs for members to emulate, and acting as a liaison to Federal agencies and manufacturing associations.

7. **The Regional Technical Forum (RTF, 2006)** was set up and staffed by the Northwest Power and Conservation Council as a coordinating entity for agreeing on cost and savings estimates, measure lives and other characteristics for efficiency measures. Recently, the RTF has also taken on a regional role in coordinating high priority research regarding efficiency technologies their cost and savings.
8. While the Energy Trust operates efficiency programs for the Oregon consumers of PacifiCorp, PGE, and Northwest Natural, **the utilities** retain an interest in efficiency and can play an important role in program promotion and implementation. Perhaps the most significant example is Northwest Natural's ongoing program of coordinated promotion for efficient gas furnaces with distributors and contractors. When funding for furnace rebates (originally at Northwest Natural) was turned over to the Energy Trust, Northwest Natural continued to provide leads to contractors through a sophisticated system which is in part funded by the distributors and contractors themselves. While the Energy Trust also promotes efficient furnaces in its other work, this network is the primary market driver for efficient furnace sales. Not to be outdone, PGE has recently offered rebates on heat pumps, which Energy Trust matches with its own rebates on the more efficient models. All three utilities provide bill stuffers to aid in residential marketing and use Energy Trust programs in marketing to large accounts.

The role of the Energy Trust with respect to these entities is described below. Without a well-defined and well-evolved set of respective roles and responsibilities, this superabundance of efficiency “cooks” would provide a redundant, wasteful, confusing, and ineffective “stew” for consumers. Fortunately, the Northwest predilection toward extensive consultation and conjoint planning, while sometimes making the practice of watching paint dry look exciting, has resulted in a reasonably efficient and effective set of coordinated initiatives. There is plenty of work to do, and we've generally built complementary roles around the mission and core strengths of each organization.

So Who Caused What?

This “multiple-cook” approach to implementation, however, makes it difficult to think clearly about investment decision-making and program accountability. While the nature and focus of oversight and accountability differs between groups, to justify program activity, the Energy Trust must demonstrate before and after the fact that its own investments added to the State's efficiency accomplishments. To evaluate this, the Energy Trust first developed several premises, described below.

Some Efficiency Happens in the Market without Further Help

Consumers today do many efficient things on their own and will do even more tomorrow. We are working to broaden and accelerate a massive trend toward energy efficiency, driven by 25 years of progressive public and private sector promotion, investment, market transformation

activity, and legislative and regulatory initiatives. Furthermore, as a consequence of more recent activities and rate increases, consumers are not standing still. Products and services that have recently become available in reliable versions at good prices through mass market channels are expected to grow in market share as familiarity spreads, regardless of additional Energy Trust activities (e.g., many larger commercial buildings now have energy management control systems). We will never have a precise estimate of this “baseline” activity because there is no group of consumers who have been entirely uncontaminated by program activity; spillover occurs through common suppliers, vendors, influence on national programs, and word of mouth. But we try to project the likely future course of markets based on current activity, trends, and market research. The Energy Trust must promote efficiency activities beyond what market trends provide.

ODOE and their Programs were Here First

The Energy Trust invests in a program only when there is a reason to think that it would increase conservation activity over that which ODOE does. The two entities work closely to design programs and marketing approaches that complement each other. For example, for many years ODOE has provided tax credits and loans for retrofit of multifamily buildings with efficient windows, insulation and lighting. The Energy Trust elected to provide rebates for these measures only after a review of program history showed that there was little uptake on these offerings in years when utilities (who had the Energy Trust’s role in earlier years) did not also offer rebates.

The Climate Trust is a “Role Player” to bring in for Special Situations

The Climate Trust needs to demonstrate “additionality” for their investments in carbon reduction through efficiency. In simple terms, this means that without them it would not have happened. So, for example, the Energy Trust brought in the Climate Trust as a co-funder for a very large efficiency investment in Blue Heron Paper (Energy Trust, 2005), after it was ascertained that the combined available resource from the Energy Trust and ODOE were not sufficient to make the deal work.

Local Efficiency Programs Influence State and Federal Building and Equipment Standards

For some efficiency opportunities, building and equipment efficiency standards provide the most effective and comprehensive “exit strategy”. Sometimes ENERGY STAR designation is an intermediate standard which helps build a large enough market share to help justify regulation. To provide one example, the Energy Trust participated in a regional and national initiative to promote residential washing machines with an MEF of 1.8 or better. Energy Trust provided marketing and rebates, ODOE provided a tax credit, the Consortium for Energy Efficiency helped unite program providers nationwide around the 1.8 level, and the NW Alliance provided coordination and promotion with regional retailers (e.g., helped chains develop a floor plan and promotional plan that features ENERGY STAR, knowing that several utilities will support it with rebates). Partially in response to the success of this and similar efforts around the country, the Department of Energy recently decided to upgrade its ENERGY STAR designation to MEF 1.72 as of the beginning of 2007 (ENERGY STAR, 2006). While this did not match the

1.8 level it came close. Historically ENERGY STAR designation brings the Northwest market share of washers meeting its specification up to 30 or 40% of the market within a few years (NW Alliance, 2004). If this happens again, and similar success is seen in other regions, it may create the basis for an eventual Federal minimum efficiency standard for manufacture at 1.72. This would lock in a 100% market share at that level, with massive national and local savings.

Utilities are Essential Marketing Allies

We rely heavily on utilities for their marketing help, but from an attribution point of view we see them as “necessary, but often not sufficient”. We offer rebates and further promotion only in markets where utility promotion by itself would not get as large a market share.

Roles of the Energy Trust

In this system, the Energy Trust funds and plays multiple roles:

- We help fund the Consortium for Energy Efficiency. It is largely a collective instrument of its members. So we can rightly take credit for the impacts of its actions, limited to the local area.
- We help fund the Northwest Alliance, and take credit for its impacts in the same way.
- We help fund RTF research and participate in its activities.
- In some markets we run our own rebate and technical assistance programs.
- Through the NW Alliance, we help fund staffing at ODOE to upgrade energy codes.
- We coordinate and cooperate with everyone else.

Were the Energy Trust not there, many other parties would still be working to help consumers save energy, but there would be far less savings because all these activities would not occur.

Segmented Investment Decision Making Process and Why It Stinks

The Energy Trust management and Board of Directors makes decisions to start, augment, and renew energy efficiency programs based on investment analyses developed by staff. These analyses describe a program, its strategies, and its intended outcome. A cost-benefit analysis is developed, providing two comparisons on a present value basis:

- **Utility System Test.** Energy Trust program costs are compared to the benefits to the utility system- reduced power purchases, power cost risk and T&D construction.
- **Societal Test.** Costs to all parties are compared to the utility system benefits and additional benefits to society. The test considers added benefits from CO2 reduction, and, consumer benefits. For example, water, detergent, and sewage treatment cost reductions from more efficient washing machines are considered.

Customer payback is also examined as part of the cost-effectiveness test to assure that program design is reasonable. The cost-effectiveness tests are performed based on a single year

of cost and savings as part of the annual budget process and for 2 to 3 years in developing turnkey program management contracts.

However, the Energy Trust funds the Northwest Alliance on a five-year basis, considering their overall track record in delivering cost-effective savings from a wide range of initiatives. The Alliance Board of Directors assesses the cost/benefit ratios for individual Alliance initiatives, generally on a three-year basis. In doing this they look at potential market transformation benefits over a much longer time.

Energy Trust staff discovered that they had difficulty clearly articulating program choices to the Board in situations where the Energy Trust funds coordinated NW Alliance and Energy Trust initiatives for a single market. If decisions are made on a basis of normal “programs” the board never sees the whole investment compared to the whole result.

The Efficient New Homes program provides an example. The Northwest Alliance worked with EPA to develop an ENERGY STAR Northwest homes specification, and developed a regional marketing and verification program for efficient single-family homes around that specification. The Alliance funds marketing of ENERGY STAR homes to regional builders, coordinates further development of program specifications, and pays for certification of homes (initially by contracting with the State Energy Offices). This program is designed to stand alone in parts of the region where there are no local energy efficiency implementers engaged in the new homes market. However the Energy Trust and other local implementers in other parts of the region provide further marketing, technical oversight, and rebates. This support is crucial to the speed, and perhaps the success of the Alliance program in transforming the market. The Energy Trust’s direct efforts are funded separately the contract to fund the Alliance.

Even though the Alliance and the Energy Trust use the same basic cost-effectiveness tests in their separate analyses, there are important differences in execution. To provide one example, from the NW Alliance’s perspective (consistent with their charter and funding), the program’s goal is to save electricity. So their utility system test ignores gas benefits while the Energy Trust considers gas benefits.² These Alliance and Energy Trust approaches prove compatible in operation in spite of the different goals because the all-fuels approach is required to transform the market; the Alliance’s means and the Energy Trust’s ends are the same.

Another important difference is what costs are included in cost/benefit tests. The focus of the utility system test for the Alliance is Alliance cost/benefit, ignoring the direct and parallel investment by utilities and the Energy Trust in the program. This analysis reflects an agreement amongst the NW Alliance and funders that addressed an accounting dilemma. Local conservation program administrators claim savings from the homes that they rebate, while the Alliance claims additional savings from additional market change that the program causes, beyond the rebated homes. This avoids “double-counting” of savings, and gives everybody something to claim. But it is an accounting convention of convenience, not a meaningful division. It is clear that the Energy Trust’s resource acquisition program could not save energy without the services funded by the NW Alliance, and the NW Alliance’s market transformation efforts would at best have lesser and slower impact without the support of the Energy Trust and its peers around the region.

The shortcomings of this approach became apparent when the investment analysis for the Energy Trust’s Efficient New Homes Program, the complementary Energy Trust program to the NW Alliance’s ENERGY STAR Homes program, was presented to the Energy Trust board. It

² Their societal test includes gas benefits in addition to electric.

showed a societal cost/benefit ratio between .8 and 1.1, and a utility system cost/benefit ratio between 1.2 and 1.6. In fact, the initial analysis showed that the gas portion of the program, considering the proportionate share of rebates and administrative costs for gas versus electric saving activities, was not cost-effective at all! Subsequent improvements to the engineering analysis resulted in even lower cost/benefit ratios. This illustrated the fallacies of segmented analysis:

- The electric portion of the program was highly cost-effective, but depended on the gas program for its success.
- The Alliance portion of the program (viewed in isolation) was far more cost-effective than the Energy Trust part of the program, but depended on Energy Trust activities for its level of success.

The models were showing discrete choices when program activities were truly interdependent.

Solution: A Cross-“Program” Integrated Analysis by Market

The Energy Trust solved this problem in two steps. First, we reallocated costs to the gas vs. electric portions of the Energy Trust program based on the percent of utility system benefits (value of avoided power and gas purchase and delivery costs) that come from saving each fuel. Thus, the electric and gas utility system benefit/cost ratios became the same ratio. While the program was now shown to be cost-effective for both fuels, it was not competitive with other program choices for the Energy Trust’s limited budget. Our initial response was to state to the Board that the Energy Trust’s and the Alliance’s new homes effort (which showed high benefit/cost ratios) were interdependent, and were collectively very attractive. But we lacked the analysis to demonstrate this, because of the differences in the program time frame, engineering assumptions³ and accounting basis of Alliance and Energy Trust analyses. The board took this argument on faith, and approved the program, albeit with some members opposed. The opposition was justifiable, in that staff had not numerically shown how the sum of investments was justified by the benefits.

Energy Trust staff resolved to find a way to show benefits and costs from collective Energy Trust/Alliance efforts to the board in a more transparent way. We decided to build a new modeling structure.

Developing the Framework

The model framework used many of the engineering estimates of savings being developed for the regional program. We reconfigured the baseline analysis to reflect Oregon market conditions and codes. We conducted informal market research (sometimes referred to as “calling a bunch of people”) and reviewed recent market studies to establish the current penetration of each efficiency measure in the “ENERGY STAR NW Home” bundle. This

³ The four states in the Northwest differ in their building codes. The NW Alliance, to forecast regional savings, needs to model a baseline that is somewhere between the four. Furthermore the Alliance engineering analyses were older and did not include improved simulations of duct sealing and heat pump measures.

analysis was performed separately for homes with gas, heat pump, and resistance heat. Some of the more interesting findings follow.

- Efficient gas furnaces in Oregon had a low penetration prior to the programs (12%) and a very high price (about \$1200 incremental cost). (Haybart and Hewitt, 2005)
- Penetration of ENERGY STAR windows is, without the new program, near 100% due to a previous and very successful NW Alliance initiative. (NW Alliance, 2002)
- There was negligible penetration of efficient duct sealing and heat pump installation protocols prior to the new programs.
- Federal standards would require that new heat pumps be manufactured at a minimum of SEER 13 in 2006, so the program could only claim savings above that level after that standard takes hold.

We then held a series of meetings with program, market and technology experts at the Energy Trust, NW Alliance, ODOE, and with program contractors to estimate the following:

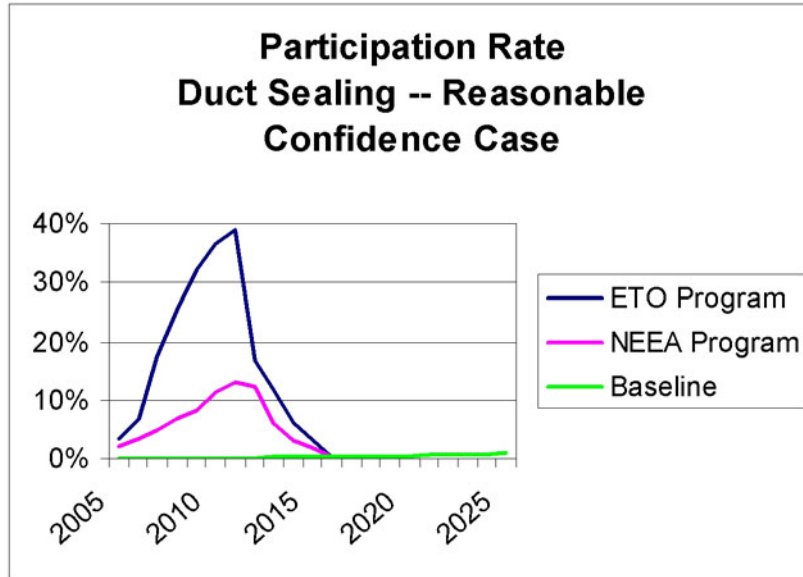
1. How would measure penetration likely change without Energy Trust funded efforts (its own and through the Alliance)?
2. What would the likely penetration of ENERGY STAR homes (with the entire bundle of measures) be?
3. How might the program influence market share after the program is through?
4. How might that influence building codes for specific measures?

To provide an example, Figure A provides baseline and assumed program penetration curves for duct sealing with and without the program. For this measure, prior to the program, there was a long history of negligible interest among developers and their contractors, and no indication that this would change. The plan was for the ENERGY STAR designation to attract developers, who would then direct their contractors to change practices, using training from the program and with program quality assurance.

The analysis covered nine program years and an additional twelve years where savings might occur through the sustained market effects of the program. We could forecast these effects because the NW Alliance program was based on a well developed, defensible “market theory” of how the program could save energy. Among the key planks of this theory:

- Past utility efforts of this sort (Super-Good Cents in the 1980s and 1990’s) had significantly improved building practices and eventually led to code changes (with Alliance funding to support energy code development at the States).
- The ENERGY STAR brand is having significant influence on many commodity appliance markets (NW Alliance, 2004). Furthermore, the ENERGY STAR new homes program (albeit with less stringent standards than the Northwest program) was seeing significant success in several markets around the country.

Figure A. Penetration Forecast for Duct Sealing



Results

Table 1 shows the results of the new homes program analysis. Separate estimates of penetration were developed, and B/C ratios calculated, for the NW Alliance program only and the Alliance program with support from the Energy Trust program. However, the analysts concluded that the distinction was one of the least precise things in a model that was not all that precise to begin with. The graph shows a “peak” in impact toward the latter years of the program, then a dramatic, but not instantaneous, falloff in duct sealing after incentives are curtailed. Our basic conclusions were that the Energy Trust rebates, marketing, and quality oversight are very important to the overall effort, and that trying to distinguish between the programs, given their common funder and interdependence, is a silly thing to try to do.

Table 1. New Home Market Transformation Combined Program Analysis

Cost Metric	Energy Trust/NW Alliance Combined Program
<u>Societal Benefit/Cost Ratio*</u> Reasonable Confidence Case: Best Case:	1.6 2.5
<u>Utility System Benefit/Cost Ratio</u> Reasonable Confidence Case: Best Case	4.4 23**
<u>Cost to Energy Trust***</u> Electric Gas	\$6.0-12 million \$9.4-13 million
<u>Levelized Cost to Energy Trust</u> Electric Gas	\$.003-.007/kWh \$.027-.13/therm

*Excludes comfort benefits, which we could not quantify

**Assumes that duct sealing is included in code

Dealing With Imprecision

Forecasts of baseline and program savings over twenty years cannot be precise, but they can be useful in informing decisions if the uncertainty is analyzed. In setting up our assumptions, we identified and tested the impact of “swing” variables where the outcome is not known, and which have a big influence on long-term cost/benefit ratios.

For example, it is uncertain whether Oregon energy building code will eventually pick up the enhancements to duct sealing that are popularized through the ENERGY STAR program. We ran one scenario with only market-based duct sealing after the program concluded (shown in Figure A) and another where in the year 2014 duct sealing practices are included in the code. Since code-required savings would come virtually “free” to the utility system, this variable had a huge impact on the utility system benefit/cost ratio. As shown in Table 1, the utility system benefit-cost ratio for the combined Energy Trust/Alliance program is 4.4 if the code does not include duct sealing and 23 if the code includes duct sealing by the year 2014.

There was also considerable uncertainty in the savings from duct sealing and heat pump installation protocols. These two measures are a large portion of the savings. Northwest experts know there is a great deal of savings from proper duct installation, and that inefficient practices are commonplace. However, estimates of baseline duct sealing practices and consequent air leakage were based on limited field data. Likewise, a regional study of heat pump loads and savings was just getting underway when the model was built. Staff concluded that the savings estimates were “good enough” to assure that the technical success (adequate savings) of the program was likely, but there was still a wide confidence interval around the savings estimates.

Since we knew that these issues would be resolved after the first 2-3 years of the program, before there were huge sunk costs, these were not dealt with in sensitivity tests of the model. Rather, they were reasons to proceed only if there was a benefit/cost ratio of considerably greater than one (which it is). In 2005 the heat pump study was completed, and a baseline study of duct losses is currently underway.

Role of Other Parties

To attribute savings to the Energy Trust, staff needed to make a case that other parties would not be able to achieve the same results without the Energy Trust-funded activities. Critical elements of this case included the following:

1. The (Energy Trust co-funded) NW Alliance worked with EPA for two years to establish the ENERGY STAR Northwest homes specification that exceeded the national specification. The regional role and the ENERGY STAR designation were essential to recruiting volume builders, who are critical to the program’s success.
2. There are sufficient market barriers to duct sealing and proper installation of heat pumps that the incentives are important.
3. While ODOE can offer tax credits, their limited latitude to market them, their limited scope with respect to ENERGY STAR homes, and the absence of cash incentives reduce their leverage in the market.
4. Single fuel utilities like programs that promote a single fuel, and their primary concern tends to be heating equipment choices. It takes a package of efficient heating systems and building features, plus lighting to produce significant savings above Oregon code.

All these parties play important roles in achieving the savings, and we will credit each with playing a role if the program succeeds. However, without the Energy Trust-funded activities, savings would be modest.

The Climate Trust and Portland Office of Sustainable Development, had minor or nonexistent roles in this particular initiative, but are important to other initiatives.

Analysis for Other Purposes

An analysis of savings or cost/benefit must be crafted around a particular audience. The analysis described above is intended to help the Energy Trust board and management prioritize investments in various programs. Another audience is the Oregon Governor's task force on climate change. They are interested in carbon mitigation at a state level. The State is in the process of setting a series of policies and targets for carbon reduction. From their perspective, it is the combined effects of ODOE's efforts and those funded by the Energy Trust that is most important; attribution between the two entities is a secondary issue.

For this audience ODOE and the Energy Trust are crafting an analysis of the overlap between Energy Trust program participants and State tax credit and loan recipients, using both evaluation interviews and cross-mapping of participant lists. This is an equally important question, but one from a different direction based on the purpose of the answer; to help chart the sum of statewide achievements accurately.

Conclusions

1. When an efficiency program implementer funds coordinated initiatives in a single market, it is sometimes appropriate to consider the costs and benefits from all those initiatives in combination when assessing costs and benefits.
2. This sometimes requires analysis of costs and effects that cross program boundaries, budget line items, and organizations. However, if it draws the most meaningful picture of costs and benefits, it is the most useful analysis for decision makers.
3. This is particularly true when rebate-based resource acquisition programs are tied closely to more long-term market transformation initiatives.
4. It is useful for such complex models to test sensitivity to the most uncertain variables. Those programs that show good cost-benefit analysis across a range of assumptions are the most attractive.

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