Effectiveness and Balance: a Canadian Regulator's Approach to Review of Energy Efficiency Funding Proposals

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INTRODUCTION

Energy efficiency programs encourage customers to be more efficient in their use of energy. However, they also require a source of funding, and it can be difficult to explain why utilities should fund programs that encourage customers to use less (rather than more) of their product. In addition, customers may complain that these programs are unfair as they typically increase rates and not all customers (in particular low-income customers) benefit from them.

To obtain funding for energy efficiency programs it is therefore critical to be able to explain in 'plain English' why it is in the public interest for these programs to be funded, and to address equity concerns around who pays and who benefits.

This article puts forward an 'Effectiveness and Balance' response to this issue based on the approach used in British Columbia (BC), Canada which may assist organizations secure funding for their own cost-effective and balanced energy efficiency programs.

The model described here has its origins in the cost-effectiveness tests described in the 2001 California Public Utilities Commission Standard Practice Manual. In 2008, the BC government enacted the Demand-Side Measures Regulation (Regulation) which outlined the cost-effectiveness tests to use in British Columbia and programs that must be included to ensure a balanced portfolio (such as low-income and educational programs).

In 2014, the British Columbia government updated the Regulation to recognize emissions reduction and non-energy benefits and allow utilities to claim a portion of savings from any code or standard towards which market transformation activities were targeted. In the same year, the British Columbia Utilities Commission published a decision which applied the Regulation to a utility's funding request, and it is this decision which forms the foundation for the model described in this paper. Additional refinements have been made since that date, including minimum levels of funding required for programs that provide direct support to governments crafting new codes and standards promoting efficiency, and the appropriate test to use for utility electrification programs that increase load. Undoubtably this model will continue to be refined in the future.

CORE ASSUMPTIONS

Before getting into the details of developing and evaluating energy efficiency programs, it is important to start with a definition of 'success' that is shared by all parties involved.

Defining 'Success'

Should 'success' be defined as only focusing on efficient supply of electricity, or do we also care about whether the customer is efficient in their use of electricity once it is delivered?

In British Columbia, 'success' is when customers receive their heat, light, power (and now with the advent of electric cars, even transportation) at the lowest total cost. This means that we focus on the whole market - promoting both the efficient supply and efficient use of electricity.

Customers in jurisdictions with this 'whole market' definition of success will therefore receive the services they need (heat, light etc.) at a lower overall cost than jurisdictions who only focus on the supply side of the market.

This broader definition of 'success' (promoting both the efficient supply and efficient use of electricity) is the one adopted in this article.

Aligning Incentives

Steps to improve the efficiency of the demand side of the market require a source of funding and an entity to deliver the programs. It is important that all parties involved share the same definition of success.

As mentioned previously, companies operating in a competitive environment are generally not in the business of helping their customers use less of their product. This is because the lower sales would typically result in lower profits.

However, regulated companies are different. In their case the regulator determines how much profit the utility is allowed to earn, adds on allowed costs, and then uses an estimate of future sales volumes to set the rates to be charged. The regulator can therefore assure the utility that it will be able to recover the cost of energy efficiency programs in its rates, and can even provide the utility with a financial incentive to run these programs effectively.

For example, where it is cheaper for the utility to meet customers need for energy through energy efficiency programs rather than new supply options, the regulator can require and incent a regulated utility to take on this additional role.

Where it is not possible to fully mitigate a utility's incentive to sell more (rather than less) of its product, or where there is a desire to offer programs that targets more than one fuel source (such as electricity

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and heating oil) an alternative option is for the utility to provide the funding for energy efficiency programs (and recover those costs in its rates), but for an independent third party to design and deliver the energy efficiency programs. This approach is used in Nova Scotia.

EFFECTIVENESS

Once we have established a definition of 'success' as promoting both the efficient supply and use of electricity, we need to identify where customers are wasting electricity and design cost-effective programs to reduce waste. The following two step approach can be used:

Step One: Is There a Problem?

How do we know when a customer is wasting electricity, for example by continuing to use inefficient equipment or by not using the equipment that they have in an efficient way?

The analysis that identifies where waste is occurring is referred to in British Columbia as a 'Conservation Potential Review'. This starts with a list of alternative investment decisions available to the customer that could improve efficiency (such as investing in efficient motors, lightbulbs, insulation etc.) or customer behaviours (such as turning off lights when not in use).

The Conservation Potential Review then estimates if the cost to the customer of becoming more energy efficient is lower than the cost to the utility of the energy that is being wasted. If the answer is yes, it is then in the public interest to 'nudge' the customer into making that investment decision/behaviour change.

For example, let's say we wanted to find out whether it is in the public interest to 'nudge' a customer into replacing their incandescent lightbulbs with LED bulbs. To do this, we would compare the cost of the LED lightbulb with the value of electricity saved over the expected life of the LED lightbulb. If the value of electricity saved exceeds the cost of the LED lightbulb, it would pass this test.

There are some nuances in this calculation:

- Cost of the investment: this represents the incremental cost to the customer of making the energy efficiency investment (including the cost of their own time) before any incentives are received from energy efficiency programs. If this test is done on the proposed energy efficiency program, it will also include the costs of administering the program.
- Value of energy saved: the value of energy saved is not the reduction in the customer's bill, but the utility's avoided costs. If the energy saved is over the long term, a long-run avoided cost should be used. As the energy saved is at the customer's meter, the value should also include avoided: incremental network losses; network upgrade costs; and generation reserves. Adjustments may also be appropriate to reflect the beneficial seasonal and within-day shape of energy saved.
- Emission reduction: The energy saved is equivalent to 'clean' electricity, and so the value of emission reductions should also be included as a benefit in the calculation. This could be undertaken by pricing the CO_2 saved at an appropriate value, or (as used in British Columbia) valuing the energy saved at the avoided cost of clean electricity.
- Non-energy benefits/drawbacks: Some energy efficiency investments have other non-energy benefits (for example, double glazed windows can offer noise reduction, an insulated house can offer health and comfort benefits). As a result, 'nudging' the customer to make these types of investments can still be in the public interest even if not all the costs are recovered through energy savings. In British Columbia, these non-energy benefits may be estimated and included in the calculation.
  To the extent that there are non-energy drawbacks (for example, where the more efficient product is less aesthetically pleasing to the customer), this can also be considered.

This first test (which can be referred to as a total resource cost test or societal test depending on the inputs used) can be considered an initial screening test. It ensures that the energy efficiency program is 'nudging' the customer into making a decision that makes sense from a societal perspective. There may be some investments that do not pass this initial screening test but which may be still in the public interest – for example, a new technology where costs are expected to decrease in the future. Some level of judgment in interpreting the test result is therefore required.

In undertaking this analysis, it is important that the list of potential new investment opportunities reviewed is kept current. Otherwise there is a 'picking winners' risk where the energy efficiency programs 'nudge' customers to invest in a particular product when there is a better product available on the market.

This test can also be used to determine if it is in the public interest to 'nudge' a customer to switch from a fossil fuel for their energy needs (cooking, heating, power, transportation, etc.) to cleaner electricity. In this case, the test would be to see if the total cost of electricity as defined above (energy, emissions, non-energy benefits/drawbacks) is lower than the total cost of the fossil fuel currently being used.

It is important to note that this screening test does not include the size of any incentive provided to the customer to 'nudge' them into making an energy efficient investment – it therefore only identifies if there is a problem and not whether the energy efficiency program is effective in addressing the problem.

For example, an energy efficiency program to encourage customers to invest in LED lights could include proposals to give away $1, $10 or even $100 with every $5 lightbulb purchased, and these different incentive levels would not affect the results of this first

screening test. As a result, even if a program passes this step, it is important to continue to step two below.

Step Two – Can the Utility Fix the Problem?

Once you have identified the investments or behaviours customers should be making to reduce waste (Step One), the next step is to determine if it is cheaper for the utility to 'nudge' the customer to be more efficient in their use of electricity, or to continue to supply the electricity that is being wasted.

This step is typically undertaken in a utility's Integrated Resource Plan (a longer-term outlook of how the utility intends to meet forecast demand), where several energy efficiency portfolio options can be evaluated against supply side options. However, this test can also be performed on an individual energy efficiency program by program basis.

Developing and evaluating energy efficiency programs involves (i) identifying the market barriers preventing a customer from making efficient decisions regarding their energy use and designing programs to mitigate those market barriers (and so 'nudge' the customer into making efficient decisions), and (ii) estimating whether the cost of these energy efficiency programs is lower than the utility's cost of supplying the electricity that is being wasted.

Design programs to mitigate market barriers.

This step requires a very good understanding of the customer in order to identify why they are being inefficient in their use of electricity, together with marketing expertise to determine how best to 'nudge' the customer into changing their behaviour. If the utility does not already have this expertise they will need to acquire it.

Market barriers preventing customers from being efficient in their energy use could include a requirement for a short payback period (for example, a customer desire for a 2-year payback period when the investment's payback period is 4 years). In this case, a program to 'nudge' a customer to make the energy efficient investment might include a utility incentive to shorten the payback period.

Market barriers could also include a lack of information or time, for example where energy efficiency is not a key priority for the customer. In this case, a program to reduce the 'hassle factor' for the customer (such as providing subsidised energy audits and/or energy efficiency managers to commercial and industrial customers) may be appropriate. Other market barriers could include a lack of available product and/or product awareness, in which case working with suppliers and trade organizations can be an effective option. For example, in BC one utility runs a Trade Ally Network program that develops and maintains a contractor network to promote energy efficiency programs and customer messaging.

Low cost ways to encourage increased energy efficiency can also include the utility providing resources to various levels of governments to assist in the development of new codes and standards (such as improved building codes), or the development of rate designs (such as inclining block rates) which can reduce payback periods for customers. In British Columbia, utilities are required to devote a minimum level of their energy efficiency portfolio spending to support the development and enforcement of energy efficiency related codes and standards.

Partnerships with other trusted service providers (such as low-income and affordable housing associations, community groups) can also be an effective way of delivering energy efficiency programs to target market segments.

In addition, while it can be useful to review energy efficiency program offerings of other jurisdictions, programs that work well in one jurisdiction may not always work well in others. There may also be a benefit from developing targeted programs for different customer sub-groups, for example programs offered in rural areas may be more effective if designed differently from those offered in cities.

Customer end-use surveys can also be a useful tool in developing energy efficiency programs for segmented markets. In BC, residential and commercial end-use surveys capture a range of building characteristics, fuel choices and installed appliances, energy-use behaviours, customer economic background and attitudes towards energy issues. This dataset can then be 'sliced and diced' to help design programs targeted at different customer segments.

Evaluate cost-effectiveness of programs.

Once energy efficiency programs are designed, the last part of the effectiveness step is to estimate whether it is cheaper for the utility to 'nudge' the customer into making these energy efficiency investments (or behavioural changes) or supply the energy that would otherwise be wasted. It can be useful to show this test result as a $/MWh or ¢/kWh of energy saved from the energy efficiency program.

Unlike Step One, where we determine if there is a 'problem', the test in Step Two (also called the utility cost test) includes the cost of any incentive provided by the utility. If an energy efficiency program does not pass this test, it could be an indicator that the program is not effective in targeting the market barrier (for example, the market barrier could be around lack of time/information while the program is focused on offering incentives). It could also be that a significant level of the benefits to the customer relate to non-energy benefits (such as improved health or comfort), and so it might be more appropriate for another funding agency (such as the government) to fund this program rather than utility ratepayers.

There are some nuances with this test:

- **Value of energy saved**: the $/MWh value should be the same as that used in Step One.
- **Free-rider adjustment:** There may be some customers who participate in the energy ef-

ficiency program (for example, by receiving a rebate for installing an efficient motor or receiving a subsidized energy efficiency audit), when they would have done this anyway without an incentive. These customers are referred to as 'free-riders', and the energy associated with estimated free-riders should be deducted from the total energy savings estimated to result from the program.

- **Spillover adjustment:** In this case, a customer undertakes an energy efficiency investment or behaviour change because of an energy efficiency program but does not directly participate in that program. An example could be where an energy efficiency program encourages market transformation such that the more efficient product becomes 'business as usual'. The estimated savings from the energy efficiency program can therefore be grossed up for any spillover effect. For example, in British Columbia utilities are allowed to claim a portion of savings from any code or standards towards which market transformation programs were targeted.

If a program passes the utility cost test it demonstrates that it is lower cost for a utility to 'nudge' a customer into changing their behaviour instead of supplying the energy that would otherwise be wasted.

It is important to not discount energy efficiency programs that can have significant benefits (such as advertising or educational programs) just because their energy savings can be hard to measure. Some level of judgment is therefore required. In British Columbia, utilities are required to offer education programs as part of their portfolio of energy efficiency offerings. Other effectiveness considerations in putting together a portfolio include minimizing 'missed opportunities' and maintaining customer and trade relationships.

Lost opportunities occur where there is a limited time window to encourage improved customer efficiency (for example, new building construction or factory retrofit), such that if the energy efficiency investment is not made at that time it can be significantly more expensive to undertake later on. It therefore might be appropriate to include higher cost programs in the portfolio targeted at minimizing lost opportunities. Energy efficiency programs can also benefit from building relationships with partners, such as customers, retailers and trade organizations. It can be useful to ensure that the portfolio includes programs that maintain these relationships.

Another consideration in designing energy efficiency programs is to look at the whole system (such as the whole house or factory) rather than individual measures. An example of this is a British Columbia utility's commercial performance program for existing buildings. This includes funding for energy efficiency audits, funding towards the cost of cost-effective capital investments, and additional bonus funding if the customer successfully implements one or more approved conservation measure In British Columbia, the cost-effectiveness tests can also be applied at the portfolio level (instead of at the program level). This gives the utility increased flexibility to include 'hard to measure' or higher cost programs in its portfolio.

Other Tests

Other energy efficiency program tests include the participant cost test and the rate impact test. While they are not included in the effectiveness considerations above, they can provide useful information:

- **Participant cost test**: this test measures the payback period to a customer of participating in the energy efficiency program – for example, a lighting program could have a payback period of a couple of years. The participant cost test result can be useful in setting the incentive level (for example, if a customer requires a payback period of 2 years before making an energy efficiency investment, the incentive level could be set to provide this). However, the need for a low payback period to 'nudge' a customer into changing their behaviour could also indicate that other market barriers (such as a lack of time or information) might be a more appropriate target of energy efficiency programs.
- **Ratepayer impact test**: this test identifies whether customers who do not participate in an energy efficiency program will still benefit from other utility customers becoming more efficient. Generally, all customers benefit from energy efficiency programs offered to an unprofitable customer (i.e. where incremental revenues do not cover incremental costs). While a utility can use energy efficiency programs to reduce sales to unprofitable customers, a more appropriate action could be to change the rate design such that incremental sales to the customer at least recover incremental costs.
  The ratepayer impact test is, however, used in British Columbia to evaluate fuel switching programs to 'nudge' customers to switch from fossil fuels (for their cooking, heat, power, etc. needs) to cleaner electricity. Utility funded fuel switching programs pass this test when the net income from additional utility sales (revenues less marginal costs) exceeds the utility cost required to obtain them.

BALANCE

The effectiveness considerations above should result in identification of cost-effective energy efficiency programs that 'nudge' customers into reducing their waste of energy.

Assuming the cost of these programs are recovered from all customers through the utility rates, the next step is to ensure that all customers have a reasonable opportunity to participate in them.

This 'Balance' step requires a review of the utility programs by customer group (e.g., residential, commercial, industrial) and/or by region (e.g., rural vs. urban) to ensure that a reasonable level of funding is allocated to each group. Useful metrics to perform this analysis can include energy efficiency spend by customer group as a percentage of group revenue, and energy efficiency MWh savings by customer group as a percentage of group MWh sales. There is no requirement that percentage funding levels are similar for each customer group, however this step will ensure that energy efficiency funding is not just targeted towards the lowest cost customer group.

Balance considerations also require a review of energy efficiency programs to ensure that they include programs specifically designed to target 'hard to reach' customers such as low-income customers and renters. Low-income customers and landlords with tenants who pay the electricity bill are less likely to participate in traditional energy efficiency programs. In British Columbia, there is a requirement that utility energy efficiency programs include programs that specifically target these 'hard to reach' customer segments.

DEALING WITH UNCERTAINTY

It is fairly straight forward to install a meter on a generator to measure the amount of energy generated, but the amount of energy delivered from energy efficiency programs can be harder to measure. This measurement uncertainty can make it harder to obtain funding for cost-effective energy efficiency programs.

The level of measurement uncertainty inherent in energy efficiency programs can, however, be reduced significantly by following established protocols for evaluation, measurement and verification (such as International Performance Measurement and Verification Protocols). If a region does not have expertise in this area, training programs may need to be established.

Lack of adequate metering can also result in measurement uncertainty. One way of addressing this is to develop a 'Deemed Savings Manual' which estimates energy savings for installed energy efficiency measures per unit (e.g., efficient light or pump installed). While this takes some coordination and effort up-front, the results can provide relative accuracy on average. An example is California's Database for Energy Efficiency Resources (DEER).

Some level of uncertainty may also be acceptable where the estimated cost of energy efficiency programs is significantly lower than supply side costs.

Another concern that is sometimes levied on energy efficiency programs is that the customer may change their behaviour after making an energy efficiency investment. For example, an industrial customer may increase their production after they improve the efficiency of their equipment, or a residential customer may set their thermostat to a more comfortable level after improving the efficiency of their home.

In addressing this concern, it is important to look at what is driving the increase in consumption and cycle back to the definition of success outlined above. 'Success' is a reduction in waste of electricity, not just less use of electricity. Provided the customer is not wasting this additional electricity consumed, any increase in consumption can be ignored when it comes to evaluating the cost-effectiveness of the program.

However, if the increase in consumption is due to a waste of electricity (for example, the customer installs LED lights but then leaves them on when not needed), then this waste should be deducted from the estimated electricity savings.

CONCLUSION

Energy efficiency programs that encourage customers to be more efficient in their use of energy can be a low-cost way of meeting a jurisdiction's energy needs.

It is hoped that this article will assist organizations secure funding for energy efficiency programs by providing a 'plain English' overview of how we can ensure these programs are cost-effective and address equity concerns around who pays and who benefits

Utilities can also be a valuable vehicle to fund and deliver cost-effective and balanced energy efficiency programs. As noted by a utility energy efficiency expert in Britsh Columbia, "If we can give utilities the mandate to support energy efficiency and the economic driver, they will pursue it."

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DISCLAIMER

This article does not represent the views or opinions of the BCUC, nor does it express, or intend to express, any opinion on pending or future matters before the BCUC. The analysis and information contained within this paper were compiled personally by the author, and not in a professional capacity as an employee of the BCUC.

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