Setting Net Energy Impact Baselines: Building Reliable Evaluation Approaches

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ABSTRACT

One of the most critical components of any evaluation effort is the selection of the appropriate baseline (what would have happened absent the intervention). This selection has an enormous influence on the way in which freeriders and net savings are calculated. It often results in double deduction of freerider savings. In an informal review of 12 evaluation studies published on an evaluation reports website the authors found that more than half of these studies were, to some degree, double counting freeriders and underestimating net savings. In these studies the pre-condition baselines that were selected partially or substantially already included the actions of freeriders, then those same freeriders were again deducted via a self-report freeridership adjustment. This paper demonstrates that the selection of a pre-condition baseline or, a what-would-have-happened baseline dictates the freeridership analysis approach that can be used. The authors note that if a baseline approach already has freeriders in it, there is often no need to readjust the savings calculation to account for freeriders a second time.

Baseline selection needs to be informed by the condition of the market and the program's impact on that market. Programs influence adoption behavior of both participating and nonparticipating customers as well as behavior of trade allies within territories served. In other words, energy efficiency programs often cause energy savings beyond those associated with direct participation. In the years before a program intervention customers may undertake all or some of the program actions on their own based on their own opinions, beliefs, financials and other motivations. They do so in both un-subsidized and subsidized markets. As programs develop and mature, portions of the "freeriders" are actually a part of a "market effect net impact." Market transformation is very much due, in part, to the influence of the programs. However, traditional evaluation methods which are largely based on participant self-reporting are punitive in estimation of program-induced effects.

INTRODUCTION

The program evaluation planning function requires that evaluation experts plan a set of data collection and analysis efforts that allow for the computation of net energy savings from a specific program or market intervention. The energy savings calculation typically must include the assessment of the impacts beyond what would have occurred without the program – the counter factual. Thus, the evaluation planning function must be established so that the gross and net assessment efforts are coordinated with the selected baseline data collection and analysis efforts. Unfortunately, many evaluations have had their gross impact assessment processes established separately from the selected approach for assessing net effects. In many evaluations this has led to the double subtraction of freeridership savings and the exclusion of other savings achieved by the program. Often a standard market practice baseline is used to identify what some evaluation experts call gross savings when these savings are actually more net than gross. Furthermore, evaluators often still apply another adjustment mislabeled as "freeridership" that is obtained through self-reporting or some other mechanism, thus underestimating achieved results. In addition to this double counting of freeriders, more often than not, evaluations have ignored the additional impacts indirectly caused by the program through the short and long-term effects of spillover and market effects. Yet, we still report the results of these assessments as

net energy impacts when they are actually only a fraction of the total net effects. Our terminology needs updating.

In this paper we briefly focus on three types of evaluation baselines: refrigerator recycling, CFL, and code based building baselines. In these examples, the estimated impacts are directly net savings and there is no need for any further adjustments.

CODE VS. CODE WITH A COMPLIANCE ADJUSTMENT

Many of our past baselines have used a building code or an appliance standard as the energy impact baseline coupled with a NTG battery to adjust for net savings. But what if you could start with code and a compliance adjustment factor that would reflect not what is supposed to be being built, but what is being built - the actual counter-factual instead of the assumed (and often inaccurate) expected counter-factual? This would, in effect, be the same as applying a standard market practice baseline and therefore would not require substantial or any adjustments to estimate net savings because the result would already be reliably net. Thus, setting the baseline at code with a compliance adjustment would allow you in many cases to bypass gross savings estimates. This approach may or may not have some complicating issues because compliance is not uniform. Non-compliance can be substantial not only from state to state, but also from city to city within a state. In one Michigan study, we found that code was routinely not followed in commercial building new construction because there was little code enforcement. In another study in California we found that no contractors built to code for a specific technology. When code is used as a baseline, the NTG battery has to focus on what construction approach or equipment characteristics would have occurred without the program, thus adjusting it to an "as complied" net baseline. Why not start with a compliance baseline in the first place (when possible) rather than relying on after-the-fact questions?

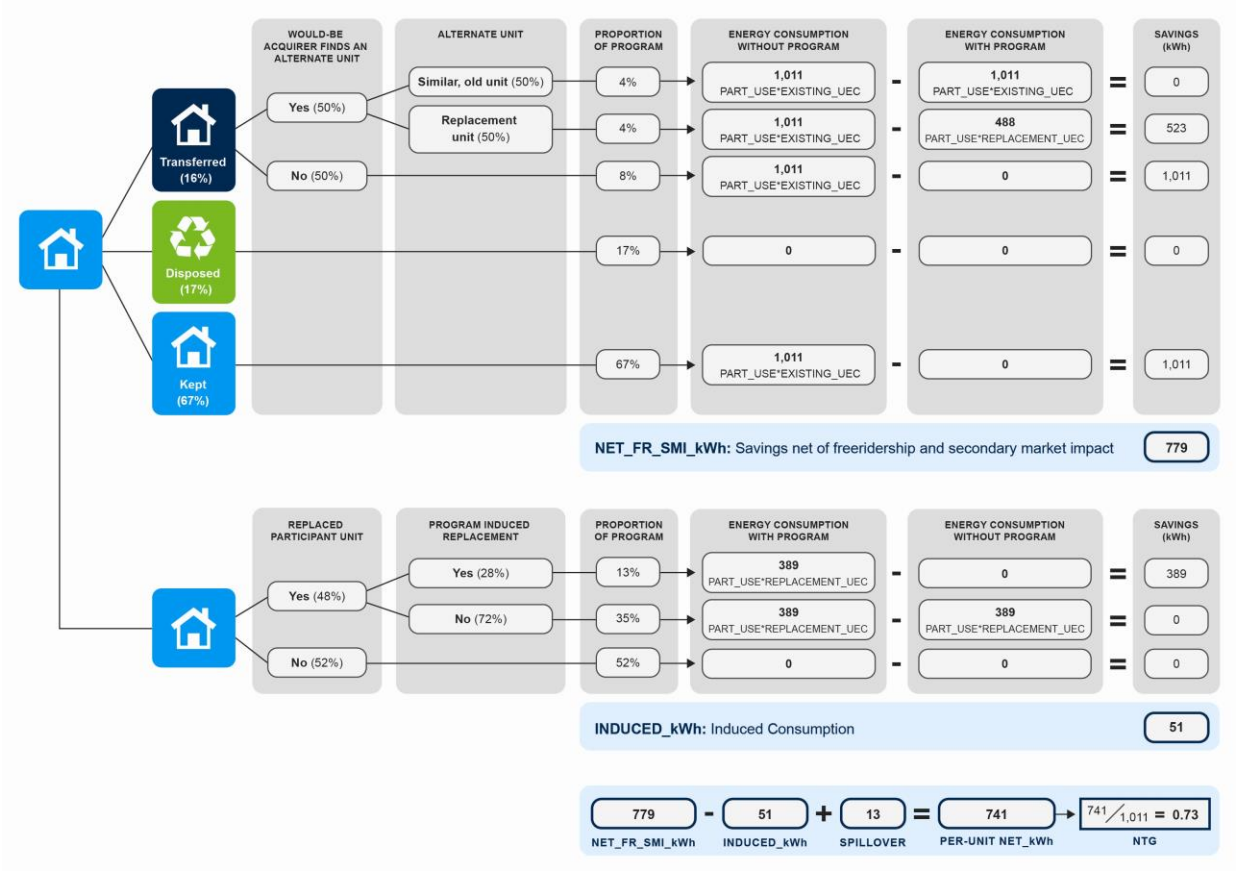
REFRIDGERATOR RECYCLING

Studies of refrigerator recycling programs impact the energy consumed in the homes of participants but also significantly change the energy consumption of impacted non-participants. Another way to think about this is to consider all refrigerator recycling programs as market impact efforts rather than resource acquisition programs. That is, they impact savings by changing how the new and used refrigerator markets work. If we only look at participants, we are missing a substantial amount of the net savings. These programs are not replacing a low efficiency widget with a high efficiency alternative. Savings are achieved by impacting the operations of the refrigerator use and sales market; both new and used. For these programs the baseline is not the energy use of the old refrigerator, but rather is the energy use associated with the pre-program operations of these markets in the homes of to be impacted participants and non-participants. One has to examine the net impact on *the grid* not the impact in the homes of participants. Energy consumption on the grid is influenced by the total effects of the program on participants, non-participants, and the associated used and new refrigerator dealers. Impact assessments have to focus on the many ways in which the program has impacted energy use.

What does this mean for program evaluation planning? Evaluation planners need to identify all the impact routes associated with the counter factual, and plan evaluation efforts to assess each of these routes of influence. Figure 1 below displays the counter factual impacts analysis paths for refrigerator use impacted by the program.[1]

[1] The analysis approach was developed by the Cadmus Group for inclusion into the Uniform Methods Protocol prepared for the United States Department of Energy (2013).

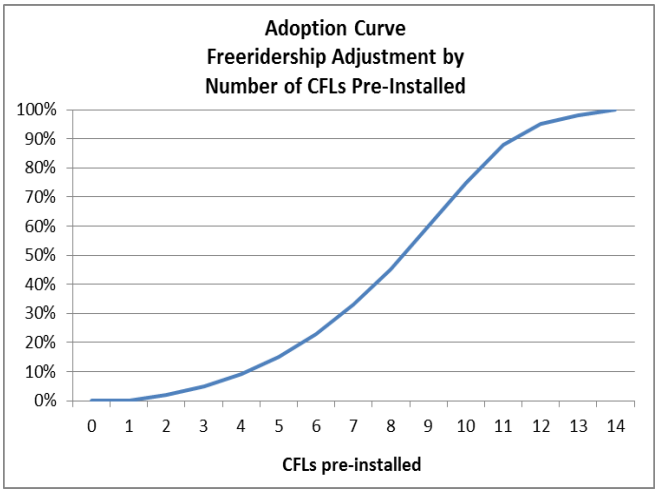
Figure 1 Uniform Methods Protocol Refrigerator Net Impacts Analysis Approach



COMPACT FLOURSECENT LIGHTS

Evaluations of compact florescent light programs can also use a standard market practice approach. A possible net analysis baseline approach is grounded in market adoption theory. It is based on the behavior of each participant as an individual. For CFLs there are substantial market barriers that must be overcome in order for them to penetrate beyond the non-program induced pace. That adoption pace, as reflected in national sales data, show that CFLs have achieved about a 30% penetration, but that penetration is not uniform. Starting with previously constructed curves for numerous consumable products with barriers similar to CFLs, one can build an adoption curve based on similar products and associated rates of adoption. Each participant's position on the adoption curve can be estimated via a participant phone survey with questions regarding past adoptions of CFLs. Thus, if you can classify the adoption point of each participant, you can establish a net baseline for that participant. Because the application of an adoption curve can be used for each participant, it automatically adjusts for the net savings appropriate for each participant as they move up or down the adoption curve. An example of an adoption curve established to assess net impacts of the next acquired bulb can be seen in the diagram below.

Figure 1 Adoption Curve Net Analysis Allocations



REPORTED NET IS ALMOST NEVER ACTUAL NET

Few evaluations conducted today accurately report net savings. In a review of published studies to support testimony for a deemed savings value to be used in the state of Michigan we were unable to find a single published study that accurately reported total net savings, yet almost all of them identified their findings as net. Even the studies examined that included assessments of spillover and market effects impacts did not report total net savings. Net savings reported in one study often do not use the same definition for "net" used in others. Our industry has been using the term "net" inconsistently, causing the results of our studies to be mischaracterized and misapplied. These issues have also given the false impression that programs are saving only what is reported in the evaluation report as net savings. The old formula of (gross–freeriders=net savings) is not a good way to present net savings. The more often applied formula of (gross–freeriders+spillover=net savings) is also incorrect, or at least under-specified. Spillover has multiple components. Each of the components requires a separate estimation approach and therefore needs to be reported separately. The evaluation report has to identify which of the net savings components are included in the evaluation's estimated net savings and identify which are not. For example, spillover includes at least the following components:

Short term participant spillover is the savings achieved by the actions taken by participants that are caused by the program. They are typically implemented between the time of the program's intervention and the date of the evaluation's spillover data collection. These savings are often reported in the evaluation reports.

Mid to long term participant spillover is the savings achieved by the actions taken by participants that are caused by the program but which occur over a longer period of time. That is they occur typically after the program evaluation has been completed and are therefore missed in the evaluation's impact estimates.

Short term non-participant spillover is the saving that occur within non-participating populations and occur at the same time or nearly at the same time as the short term participant spillover savings are occurring. These can estimated through non-participant or general population surveys. In rare cases, we see these reported in evaluations.

Mid to long term non-participant spillover are the savings that occur within non-participating populations over the longer period. Again, these can be the higher cost, higher impact measures, such as the purchase and use of high efficiency central air conditioning units. These are very difficult to assess.

Mid to longer term market effects are the savings that are caused by the way in which a program or a portfolio affects the operations of a market. These changes typically result in more efficient equipment being stocked and sold in the market, sales staff that focus more sales attention on the higher efficiency equipment, or changes in manufacturing and distribution approaches that result in more efficient equipment being sold and used. Market effects or market transformation research is substantially different than program impact evaluation. The people who buy and use the more efficient line of equipment do not typically know that their decisions have been influenced by the programs offered.

CONCLUSIONS

In the opinion of the authors of this paper, direct net impact baseline approaches have the potential to make the impact estimation process less subjective, less uncertain and more reliable. It is not always necessary to assess gross program impacts when a direct net analysis approach can be used. The use of a net analysis baseline approach may simplify the evaluation effort and at the same time reduce the amount of uncertainty around the net savings estimate. The key question that the evaluation professional needs to be asked is not if a direct net baseline approach is accurate (which is important), but is it more accurate than our current gross to net post-program self-reporting survey analysis approach. The authors of this paper are not suggesting that direct net analysis approaches should be used in all evaluations or that they can be applied to all types of program configurations or target markets. The purpose of this paper is to bring attention to the fact that not all studies need to estimate gross effects and then convert to net effects. And it acts to caution information consumers that they need to make sure the studies that they are reviewing use the right baseline and do not double count freeriders.

It is also the purpose of this paper to bring added attention to the fact that spillover savings are complex and that no studies of which we are aware have ever estimated all of the spillover or market effects that are occurring as a result of a program or portfolio of programs interventions, and as a result are not reporting net savings, but are reporting a part of the net savings. We need new definitional frameworks for reporting net savings.

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