CONSTRUCTING AN INITIAL DATA COLLECTION PLAN FOR A BEHAVIORAL ENERGY EFFICIENCY PROGRAM

by

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ABSTRACT

Existing residential energy efficiency programs, using energy audits and rebates to address barriers to homeowner participation, have experienced anemic participation and savings rates. A new generation of local efficiency programs, encouraged by U.S. Department of Energy funding, are using the tenets of behavioral economics to address non-rational economic attitudes preventing homeowners from implementing energy saving actions. But rigorous evaluation techniques are required to assure that these programs are providing better performance. This project creates an evaluation prototype for a case study program: the Neighbor-to-Neighbor Energy Challenge (N2NEC) in Connecticut. This prototype is specifically based on a snapshot of the N2NEC program activities and program documentation after their initial program planning and immediately prior to program start-up. This original evaluation prototype uses a process framework to specify the activities to be evaluated, and uses an evaluation plan framework to specify the evaluation to take place. The process framework model and evaluation plan framework have been specifically customized for this research project, though they are based in the evaluation literature and community-based programs best practices. A specific priority is that the frameworks be feasible for implementation by a community-based program. The evaluation plan consists of research questions, associated research and analysis methods, and the data requirements needed to satisfy the question. As a second research component, the data requirements for the prototype are then compared to an inventory of actual data fields that N2NEC planned to collect, derived from a review of N2NEC planning documents. The comparative analysis shows that the prototype data requirements are covered fairly well by N2NEC's available data, though it would be useful to have more formalized data on collaborations with community organization, information that is likely informally held by program staff, and information on how the commitments by program participants are recognized publicly to reinforce their effect.

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TABLE OF CONTENTS

INTRODUCTION & METHODS

I. The Basics of Behavioral Residential Energy Efficiency Programs

Behavioral Residential Energy Efficiency Programs as Compared to Conventional Residential Energy Efficiency Initiatives

The goal of residential energy efficiency programs is to encourage homeowners to implement activities and adopt behaviors that reduce their home energy use. If sufficient numbers of homeowners adopt these behaviors, then overall energy production can be reduced, resulting in fuel savings and environmental benefits.

There are two types of changes these programs usually seek to promote: 1) changes to everyday behaviors, such as turning off lights when they're not needed or turning down thermostats and 2) investment in energy efficiency improvements in the home. This investment can be as small as replacing an incandescent light bulb with a compact fluorescent light bulb, or as significant as installing an energy efficient furnace or installing insulation throughout a home. While both provide energy savings, investments in energy efficiency improvements are expected to bring the higher returns because they create permanent savings that do not depend upon residents of the home continuing repeated actions in the long-term, behavior which tends to degrade over time.[1]

We can illustrate the typical goals of an energy efficiency program through some of the goals of our case program, the Neighbor-to-Neighbor Energy Program (N2NEC) in central Connecticut. These are the more typical actions they are seeking to encourage (Table 1):

[1] Ferraro, P. and M. Price. 2010. Using Non-Pecuniary Strategies to Influence Behavior: Evidence from a Large-Scale Field Experiment. Unpublished Working Paper. Georgia State University.

Table 1: N2NEC Program Goals

Action	Number of Households Making Commitment
Retrofit lighting for efficiency	7000
Complete a Home Energy Solutions Assessment of Household Energy Use and Efficiency	6250
Major Home Retrofit to install energy efficient infrastructure	1250

How Does a Residential Energy Efficiency Program Seek to Get these Behaviors Adopted?

Here we will review the strategies used by both conventional energy efficiency programs and behavioral efficiency programs. This will highlight the differences between earlier iterations of residential energy efficiency incentives, and the current new wave of programs based in behavioral economics. This section will also show specifically how behavioral analysis is applied to energy efficiency behaviors as a part of these programs, using our case program as an example. This introduction is key, as these strategies are the basis of the activities that the prototype evaluation seeks to analyze.

Conventionally, policies to encourage residential energy efficiency behaviors were based on the assumption of two main barriers to widespread implementation. The first barrier assumed that homeowners did not improve the efficiency of their homes because it did not make sense for them economically. Either they did not have access to the capital required, or other investments provided a better rate of return. This led to policies like subsidies, tax credits and rebates for investment in energy efficiency.[2] The second assumption was that homeowners did not have sufficient knowledge to allow them to make the economically rational decision.[3] They may not know about the inefficiencies in their home and their economic loss, or know of available programs that made improvements less expensive. This led to extensive educational campaigns and one of the dominant model programs offered by utilities: voluntary home energy audits which informed homeowners about the improvements they could make to their home to save energy.

[2]Gillingham, Newell, and Palmer, Energy Efficiency Economics and Policy, Resources for the Future, RFF DP 09-13, April 1009.
[3]Stiglitz, "Information and Change in the Paradigm of Economics," *The American Economic Review*, June 2002.

Unfortunately, when these types of programs have been implemented, they generally have very low participation numbers and very few of the participants end up implementing significant energy efficiency actions. A significant example is the Residential Conservation Service (RCS), a federal program created in 1978 that implemented both financial and educational components. RCS required utilities to provide free residential energy audits which were frequently paired with contractor referrals and subsidized loans. Program results were disappointing. Less than 3% of households adopted new actions and the program only registered a 2-3% reduction in energy use.[4]

The Basics of Behavioral Analysis as Applied to Conventional Programs

When conventional energy efficiency programs resulted in low participation and little energy savings, program proponents began to turn to the field of behavioral economics for answers. Behavioral economics examines the reasons for the irrational economics decisions that individuals commonly make. Some of the key findings of behavioral economics include the following[5]:

- **Loss Aversion**: individuals value avoiding a loss much more than a gain, even if the loss and gain are of equal amounts or even if the gain is greater. Often energy efficiency action is seen as a financial gain, and not as an ongoing inefficient loss in energy costs, as it could easily be described.
- **Hyperbolic Discounting**: A dollar promised in the far future has almost no value to most individuals. Returns on energy efficiency investments by their nature increase over the long-term through utility bill savings, but these savings are generally hyperbolically discounted by homeowners.
- **Social Utility and Bounded Self-Interest**[6]: Individuals do not make economic decisions in isolation and solely considering economic gains. The social impacts of a decision have a significant impact on economic choices. This means that social norms and how individuals conform to peer groups is very important in economic decision making. Few conventional energy efficiency programs took into account the influence of peer groups in encouraging action.

[4]Fuller et al., Driving Demand for Home Energy Improvements, Lawrence Berkeley National Laboratory, LBNL-3960E, September 2010.
[5]Camerer, Behavioral economics: reunifying psychology and economics, Proc. Natl. Acad. Sci USA, Vol. 96, pp. 10575-10577, September 1999.
[6] Meier, A Survey of Economic Theories and Field Evidence on Pro-Social Behavior, Federal Reserve Bank of Boston, Paper No. 06-6, January 2006.

- **Bounded Rationality and Experience-Informed Decision making**[7]: Even in an environment of perfect information, humans may imperfectly process the information given. They will tend to overvalue information that they received recently or from what they see as a trusted source. They can also only process a certain amount of information, and can begin to ignore information in a non-rational way when experiencing information overload. Often, energy efficiency information, as a low-priority decision with small, long-term returns, is ignored as unnecessary information. Also, conventional programs have not considered who homeowners see as the information source. They have not tried to utilize trusted sources, and have not even considered the fact that one of the primary sources of energy efficiency information is seen as an untrustworthy source by the homeowner: namely their electrical utility.
- **Devaluing invisible benefits**[8]: Humans will discount benefits that don't have a visible and regular impact on their daily lives. This particularly affects energy efficiency, as other home improvements, such as cosmetic renovations, have a much more visible and regular impact on homeowners.

Analysis of the Main Conventional Strategies: Economic and Educational Barriers

Here I specifically analyze conventional strategies that address financial and education barriers, and apply behavioral analysis to them:

1. **Rebates for energy efficiency investment:** utilities provide rebates to customers who have purchased energy efficiency technologies for their homes. These may be a small as a coupon for a compact fluorescent bulb, or as significant as rebates for a new home heating system. This is meant to overcome the financial barrier to implementing energy efficient behavior change.

   Behavioral Pros: This financial incentive can promote technology purchases from a rational and non-rational perspective. Rebates do lower the price and therefore the marginal cost to each customer. The incentive can also be a non-rational promotion to act, as people see an opportunity to gain something valuable. Some programs have used time limits or quantity limits on rebates to further promote purchases, adding urgency and also framing missing out on the program as a loss. This has been successfully used in the North Carolina appliance rebate programs, where the

[7]Mullainathan and Thaler, Behavioral Economics, Massachusetts Institute of Technology Department of Economics, Working Paper 00-27, September 2000.
[8]Fuller, ibid.

North Carolina Energy Office advertises the availability of a limited number of appliance rebates to be made available on a particular day, 2-3 times per year. These rebates have always been oversubscribed.

Behavioral Cons: Many of these programs provide the rebates only after the customer has purchased the product. This means the customer must invest the full cost of the purchase initially, and wait for a rebate at an uncertain time in the future, encouraging hyperbolic discounting of the savings. Also, the rebate process is generally entirely separate from the product purchasing process, so there is an entirely different task that a customer must start to get the rebate. Some programs have also been criticized for being administratively burdensome. These problems are all a disincentive to action.

2. **Home Energy Audits:** Utilities frequently offer free home energy audits to customers to inform them of how their homes can be made more energy efficient. Generally, customers make an appointment with the auditor, who then visits the home and provides the homeowner with a report on possible improvements to their energy use. This is meant to overcome the educational barrier.

   Behavioral Pros: These energy audits overcome the problem of insufficient information. Most problems with the energy efficiency of houses are not visibly apparent to the homeowner. Once these problems are specified, the homeowner may be more apt to act to remedy the problem.

   Behavioral Cons: Audit programs as currently structured are often difficult to access. The customer must make the initiative to make the appointment, and there may need to be several points of communication before the appointment is made, increasing the barriers between participants and the benefit. There is frequently a delay before the customer receives the results of their audit, encouraging hyperbolic discounting. Also, frequently the process to receive the benefits of the audit – namely making improvements and receiving energy savings – are completely separate from the audit process and also require independent initiative on the part of the customer. The language of the word “audit” itself is seen as negative: people don’t like to be audited.

The reason for this lack of success for conventional programs may be due to the behavioral challenges described above. However, others have also proposed that simply addressing financial and educational barriers are not the only barriers to action for most homeowners. Homeowners still do not act even when

they knew of the problem and it was economically rational for them to do so.[9] There are other barriers that keep homeowners from acting and making energy efficiency behaviors a priority. This rationale is the basis of behavioral residential energy efficiency programs, which are further described below.

Strategies of Behavioral Residential Energy Efficiency Program: Addressing Non-Rational Behaviors

The new generation of behavioral programs seeks to address non-rational behaviors that keep homeowners from taking action in the area of energy efficiency, even after they have been provided sufficient information and rebates that eliminate economic barriers and the barriers. Some of the key strategies are detailed below:

- Programs seek to **enhance the effectiveness of conventional program models by acknowledging logistical barriers** to action within these programs. New programs seek to streamline processes such as energy audit sign-up and implementation, contracting for improvements, and administration of rebates.[10] An example of a very simple marketing change is changing the name of energy audits to energy assessments.
- Program provides **knowledge through trusted sources** by working with community leaders and community organizations to tell homeowners about the program. Frequently, these programs also seek to encourage word-of-mouth marketing for their programs, in which homeowners hear about the program from neighbors, co-workers, friends and other sources. This is based on the fact that people are more likely to remember and act on information that they heard from a trusted source.[11] This also helps to contribute to a **community norm** around participation in the program.
- Individual are shown how their progress toward energy saving goals **compares with neighbors**. This creates awareness that others are involved in the program, and makes participants desire to do as well as their peers. This is inspires both a sense of **competition** and contributes to a **community norm** of participation in the program, similar to involving community leaders.[12] Sometimes this competition is formalized. Program may have individuals or communities participate in formal competitions, which use all of the mentioned incentives while raising the

[9] McKenzie-Mohr and Smith, Fostering Sustainable Behavior, New Society Publishers: 1999, pp. 9-14.
[10] U.S. Department of Energy Better Buildings Program, Better Buildings Program Innovations, http://www1.eere.energy.gov/buildings/betterbuildings/neighborhoods/innovations.html, last accessed on April 20, 2012.
[11] Stern, Information, Incentives, and Proenvironmental Consumer Behavior, Journal of Consumer Policy, ISSN 0168-7034, 12/1999, Volume 22, Issue 4, pp. 461 – 478.
[12] Black, Stern and Elworth, Personal and Contextual Influences on Household Energy Applications, Journal of Applied Psychology, 1985, Vol. 70, No. 1, pp. 3-12.

profile of the program and encouraging new homeowners and organizations to get involved. This is the case with the Energy Smackdown Program in Boston, Massachusetts, coordinated by the Brainshift Foundation.[13] Our case study program, N2NEC, also include a small competition component for one of their goals: the first of their 14 communities to get 100 homeowners to sign up for Connecticut's Clean Energy electricity option will receive a prize given to the town. Organizations and towns are also competing against each other to achieve the maximum number of redeemable points for prizes.

- **Each action is rewarded with incentives**, specifically points that can be redeemed for rewards. These points accrue to the individual, to their community, and to any community-based organization that the individual chooses to associate themselves with, thus providing individual reward and social benefits. Individual and community winners receive **public recognition**.

Behavioral incentives and social marketing seek to address these non-economic characteristics, and seek to reduce barriers to action and increase behavioral incentives to act. The selection of behavioral incentives we have chosen to specifically examine in this case include[14]:

- **Knowledge through Trusted Sources or Trusted Messengers**: Risk aversion and social utility mean that individuals place a greater value on information that they receive from people they know and trust. This means that marketing from word of mouth, social networking and trusted advocates in the community is particularly valuable. N2NEC also seeks to solicit commitments through collaborating local organizations, which spread the message of the program to their membership and other associated members of the local community.
- **Community Norms**: Individuals are much more likely to adopt a new behavior if they know people they consider their peers are doing the same. Therefore, if a program can specifically frame their desired action as a community norm, it is much more likely to be adopted. This is facilitated by making the behavior visible, such as giving individuals comparison to how much electricity their neighbors are saving, or the presence or absence of the bright blue recycling box at the end of the driveway, which clearly indicates whether you are recycling or not. Pro-social tendencies make individuals want to be seen as an upstanding citizen by their peers and adhering

[13] Copeland, "Neighborly Competition," The Boston Globe, August 17, 2008.
[14] Behavioral strategies are primarily drawn from Doug McKenzie-Mohr, "Fostering Sustainable Behavior," New Society Publishers, June 29, 1999, as well as from Fuller and the popular books of Dan Ariely, *Predictably Irrational* and *The Upside of Irrationality*.

to community norms.[15] A community norm strategy is reinforced by Trusted Messengers and visible actions.

- **Immediate and visible rewards**: Individuals will discount the value of investments that don't provide immediate and visible benefits to them as individuals. Energy efficiency investments are challenged on both these fronts. After a large initial investment, the returns from energy efficiency investment are returned in small amounts over time. Energy investments are also frequency not visible to homeowners on a daily basis. Homeowners will not notice the benefit of new insulation in their walls as much as they will notice their new bathroom renovation. This is also a bias of the real estate sector, which still does not uniformly add energy efficiency improvements into the value of a house.[16] These rewards can be provided in the form of prizes or in the form of feeling part of a community norm. This reward can also be provided through a competition, which can provide the feeling of accomplishment from winning, along with the any associated prizes. In the N2NEC program, the first action of a participant is a public, signed commitment to participate, many of them collected at events where they are publicly recognized or through a collaborating organization promoting this to their membership. Thus the participant receives the immediate reward of approval from their peers for contributing to the community, and they are also accountable to their peers to follow through on their commitment. This is also facilitated by the fact that the program has an intensively local focus to create a local critical mass. The Energy Advisor, N2NEC's online homeowner tool, also compares your actions to those of your neighbors, which has been shown to encourage greater action.[17]
- **Targeting individuals at the point of action**: Imperfect information processing means that individuals are unlikely to use information they are given if it is received at a time remote from the relevant point of action. Therefore, information should be given to individuals as close in place and time to the point of action as possible.
- **Commitments**: Individuals are much more likely to take action when they have made a public commitment to do so. Additionally, a competition can be a strong reinforcement for adopting that behavior, as it includes a public commitment to action as well as creating a social norm and stimulating competitive instincts. This behavioral strategy is a dominant component of the program activities that this report analyzes.

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[15] Meier, A Survey of Economic Theories and Field Evidence on Pro-Social Behavior, Federal Reserve Bank of Boston, Paper No. 06-6, January 2006.
[16] Marks, Green building costs not always included in home appraisal, Christian Science Monitor, April 7, 2010, accessible online at: http://www.csmonitor.com/Environment/2010/0407/Green-building-costs-not-always-included-in-home-appraisal.
[17] Carroll, Hatton and Brown of Franklin Energy, Residential Energy Use Behavior Change Pilot, Minnesota Department of Commerce, April 20, 2009.

II. Program Activity and Evaluation Frameworks for Behavioral Residential Energy Efficiency Programs

So How Do You Evaluate the Effectiveness of an Energy Efficiency Program?

Conventionally, evaluation of energy programs has focused exclusive on simple metrics: number of participants and energy saved, particularly energy saved per dollar spent. These were the dominant evaluation metrics when programs were generally utility run and standardized: market materials, energy audits and rebates for energy improvements. However, as stated above, these programs did not provide hoped for program results.

While new behavioral programs have developed innovative strategies, they have also often developed more sophisticated strategies for evaluation of programs. This is likely due to two reasons[18]:

1) Funding requirements: Rather than being funded and run by utilities or their contractors, these programs are usually smaller and funded through competitive grant programs sponsored by federal or state governments, particularly after a large amount of stimulus money was directed toward energy efficiency programs.[19] These grant programs generally have rather rigorous reporting and evaluation requirements. For an example, see the U.S. Department of Energy Better Buildings Program reporting requirements[20] and the Massachusetts Green Communities Designation and Grant Program Guidance[21].
2) Cultural precedent: These programs take as their philosophy Behavioral Economics, an academic discipline, and often reflect an academic mindset based in data and research. These programs are also focused on examining data for indications of behavioral tendencies. Therefore even for-profit programs, like O Power, which contracts for utilities, have used their extensive data analysis for program evaluation.[22]

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[18] National Action Plan for Energy Efficiency, Model Energy Efficiency Program Impact Evaluation Guide, prepared by Steven R. Schiller, Schiller Consulting, Inc., 2007, available online at http://www.epa.gov/eeactionplan.
[19] U.S. Department of Energy, Recovery Act: DOE Recovery Act Field Projects, http://energy.gov/recovery-act, last accessed April 20, 2012.
[20] U.S. Department of Energy, Better Buildings Neighborhood Program Grant Recipient Management Handbook, Version 2.0, January 2012: Chapter 6.
[21] Massachusetts Department of Energy Resources, Green Communities Designation and Grant Program Guidance, March 14, 2012, can be accessed online at: http://www.mass.gov/eea/docs/doer/green-communities/grant-program/gc-program-guidance-spring-2012.pdf.
[22] Carroll, Hatton and Brown of Franklin Energy, Residential Energy Use Behavior Change Pilot, Minnesota Department of Commerce, April 20, 2009.

Therefore, there is much more evaluation literature available on energy efficiency programs, and many more ideas on how to evaluate these programs.

The EPA's Model Energy Efficiency Program Impact Evaluation Guide provides the following two helpful objectives for evaluation[23]:

1. *To document and measure the effects of a program and determine whether it met its goals with respect to being a reliable energy resource.*
2. *To help understand why those effects occurred and identify ways to improve current programs and select future programs.*

The first has been emphasized in previous iterations of energy efficiency programs. The latter is becoming a greater focus of energy efficiency programs. Evaluation, data collection has not just been emphasized by the academic literature of behavioral programs. One of the leading guides for practitioners has also emphasized observation, experimentation and data analysis as a way to inform and improve programs. This handbook: Fostering Sustainable Behavior by Doug McKenzie-Mohr and William Smith, has become a valuable resource for many program practitioners.[24]

McKenzie-Mohr emphasizes that key to a successful evaluation of this type of program is evaluative isolation of the behavioral aspect of the program. This means at minimum specifying the behavioral strategy being implemented, and trying to find a data strategy that isolates the effect of that strategy as much as possible, and thus determines its effectiveness. This can be particularly challenging when a program, such as N2NEC, is attempting to implement multiple behavioral strategies at once, and there may be behavioral incentives implicit in some program actions that aren't even accounted for.

I have created my own very basic program logic model and evaluation framework that attempts to isolate behavioral aspects, and at minimum forces the evaluator to specify the behavioral strategies at play and provide specific requirements to assure that the behavior aspects of the program are accounted for. Again, we will review the basics of this framework, and then apply it to evaluation of behavioral energy efficiency programs.

[23] National Action Plan for Energy Efficiency, Model Energy Efficiency Program Impact Evaluation Guide, prepared by Steven R. Schiller, Schiller Consulting, Inc., 2007, available online at http://www.epa.gov/eeactionplan.
[24] McKenzie-Mohr and Smith, Fostering Sustainable Behavior, New Society Publishers: 1999, pp. 9-14.

General Evaluation Framework for Behavioral Energy Efficiency Programs

I based my evaluation framework on the U.S. Department of Energy evaluation framework provided in the EERE Guide for Managing General Program Evaluation Studies.[25] This maximizes the usefulness of the framework to N2NEC and other Better Buildings programs, since this is an evaluation framework which they will need to be responsive to. Therefore it is a significant source for much of the following material, though I have also confirmed certain components using complementary literature. However, I found that it still did not maximize the extent to which behavioral strategies could be further emphasized through the framework. Therefore I have also customized the Evaluation Framework Model, as described below.

I also provide examples of how these methods will or will not be applied to our N2NEC case study:

1. **Needs or Market Assessment Evaluation** – this type of evaluation includes both basic assessment as to the need for the program, and market assessments to inform program strategy.

   In the field of energy efficiency, it is generally assumed that communities are reflective of the general United States population in not utilizing electricity in a maximally efficient way. Few states have made significant strides in energy efficiency policy: California has traditionally been the leader in the field, though they have recently been passed by Massachusetts for their more recent extensive set of programs implemented under the 2008 Green Communities Act.[26] Therefore, there is a generally acknowledged need for energy efficiency programs. However, a needs assessment should be more specific. In this case, it can study how a community uses energy, what are the sectors in which efficiency measures can have the greatest benefit (is the residential sector the most desirable target, or should the program aim for commercial, industrial or institutional customers?), and what are the resources that can best be used in an energy efficiency program. This is especially key in a behavioral program, where the program should seek the unique economically irrational behaviors that are blocking participation, and seek unique potential levers to eliminate those barriers. Unfortunately, analyzing and creating a prototype needs assessment was beyond the scope of this report, because the relevant documents and data were not available. Also, it should be noted that a thorough needs assessment is often beyond the

[25] Barnes, EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need, US Deparment of Energy Office of Energy Efficiency and Renewable Energy, February 2006, p. 8.
[26] Sciortino et al., The 2011 State Energy Efficiency Scorecard, American Council for an Energy-Efficient Economy, Report No. E115, October 2011.

capacity and funding time lines of community-based organizations, something that is not an ideal circumstance.

It should also be noted that needs assessments may focus on other criteria that are key to the program implementation. Recently, that has frequently been economic development and production of employement. If this is a primary driver, then it should be included in the needs assessment and other evaluation components. And example is the California Workforce Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response.[27]

2. **Process or Output Evaluation** – evaluating the effectiveness of program activities in providing the immediate program result.[28]

This is a dominant component N2NEC program evaluation, as it focuses on evaluation of the implementation of initial program components and the immediate results. In this study, the dominant immediate result studied is commitments to the program, though the evaluation also examines other metrics of program activities, such as the number of events held or number of organizations collaborated with. The N2NEC program states a key output goal in the following goals statement:

"**Target participation of 10 percent of households to set specific, measurable stretch goals to voluntarily reduce conventional energy consumption** by 20 percent from estimated 2008 levels, and provide support to assist them in achieving these goals by the end of 2013."

In their program activities, they seek this commitment to energy reduction through their signed commitment document. They seek to get 10% of households to make a commitment to energy reduction goals. This is a specific quantifiable output goal.

3. **Outcome Evaluations** – Success in reaching program objectives. This type of evaluation seeks to examine how successfully the program activities and outputs result in the program outcomes. These are the immediate benefits that follow your program results. A commitment to the program

[27] Zabin et al., the California Workforce Education & Training Needs Assessment for Energy Efficiency, Distributed Generation, and Demand Response, Donald Vial Center on Employment in The Green Economy, UC Berkeley, 2011.
[28] National Action Plan for Energy Efficiency, Model Energy Efficiency Program Impact Evaluation Guide, prepared by Steven R. Schiller, Schiller Consulting, Inc., 2007, available online at http://www.epa.gov/eeactionplan.

is a useful output, but only if it results in the committing participant takes an energy saving action. N2NEC separates their outcomes into small, medium, and larger actions, as expressed in their program objectives. These are specified below.

In this study, we will only be focusing on what N2NEC defines as small actions. This is because these are the actions that will be most directly related to the recruitment activities in our scope. We will generally refer to these as "Initial Actions," as the small actions are intended to be the first steps on the N2NEC pathway of actions. These Initial Actions are (as listed in Table 2):

- Small one-time actions:
  - Complete a Home Energy Solutions Assessment
  - Retrofit of household lighting
- Small continuing action
  - On-line personal savings plan through Energy Advisor
  - Connecticut Green Electricity Product Sign-up
  - Install Energy Feedback Devices to Change Daily Behavior (pilot program)

The medium and larger desired actions, the other outcomes of the program, are outside the scope of this paper. They are as follows:

- Medium Action: Home weatherization
- Large Actions:
  - Major retrofit of home energy infrastructure
  - Renewable energy installation: solar thermal water heating, space heating or solar photovoltaic systems

4. **Impact Evaluations –** this type of evaluation examines the extent to which the program or program components contribute to the achievement of ultimate program goals. Note the difference between impacts and outcomes. Outcomes are the initial desired goal, the action to save energy. Impacts are the ultimate goal, the extent to which the program actually results in savings, in this case, commitment to energy savings, energy savings, financial savings and

avoided CO2 emissions. Sometimes this may also include co-benefits such as air quality, health benefits and jobs.[29]

This is a significant part of N2NEC's evaluation plan overall. Their stated future outcomes they wish to effect are as follows:

- N2NEC expresses their potential impacts are through specific estimated energy savings, financial savings and avoided emissions, see Table 2.

The precise goals that N2NEC has set for its outputs, outcomes and impacts are provided in Table 2, with each class of goal for those within the scope of this study indicated by color. You will note that the commitment and Energy Advisor savings plan goals are combined, so they are seeking to assure that all those who commit will use the Energy Advisor, with savings goals that depend upon those circumstances.

Table 2: N2NEC Quantified Goals, Highlighted by Evaluation Plan Applicable

Actions	Participant Targets	Energy Savings (MMBtu)	Energy Savings ($'s)	Emissions Avoided (MTCO2)
Commitment / Advisor	8,000	89,106	$3,288,622	5,992
Home Energy Solutions	6,250	144,700	$6,410,725	11,540
Lighting Retrofit	7,000	17,273	$1,080,146	2,151
CTCEO Sign-Up	5,000	269	($685,165)	27,295
Feedback Devices	200	1,152	$71,114	142
Major Retrofit	1,250	56,600	$1,207,148	2,068
Solar Thermal	200	3,345	$179,403	333
Solar PV	125	3,960	$528,786	1,048

Red = Output Orange = Outcomes Blue = Impacts Black = Out of Scope

Source: N2NEC, N2NEC_Goals_Objectives_Performance Incentives_V6, document provided to author.

1. **Cost-Benefit Evaluations –** This type of evaluation compares the relative value of the costs of the program as compared to the monetized benefits.

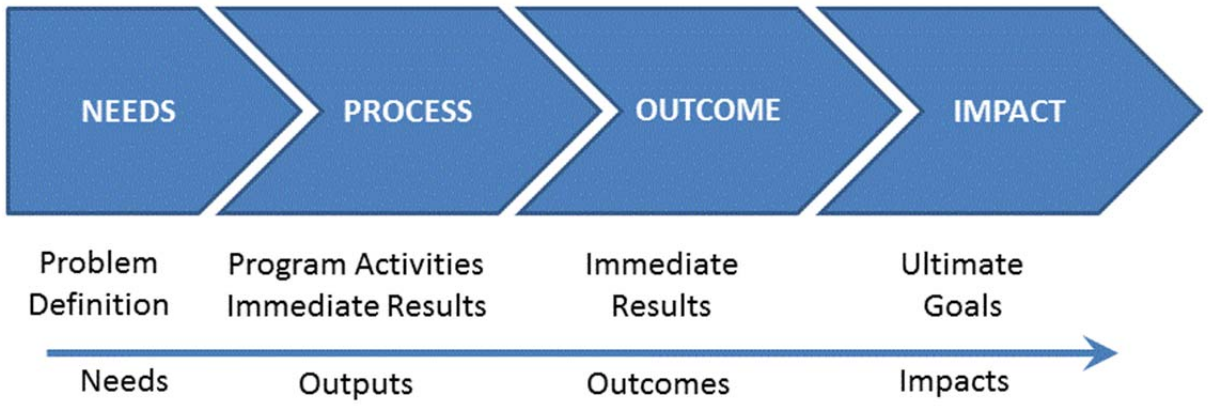
[29] National Action Plan for Energy Efficiency, Model Energy Efficiency Program Impact Evaluation Guide, prepared by Steven R. Schiller, Schiller Consulting, Inc., 2007, available online at http://www.epa.gov/eeactionplan.

In the initial planning for the project, N2NEC does not plan to implement a cost-benefit analysis, though they will be collecting relevant cost data that can inform such studies. Cost-benefit analyses are also not a focus of this specific study. It should be noted that they are also often beyond the capacity of a community-based program.

This framework can be viewed as moving from a basic program data analysis and quality evaluation framework to more advanced analysis of program impact and the specific effectiveness of particular program components. As is said above, this study will concentrate on (2) Process or Implementation Evaluation, (3) Outcome Evaluations and (4) Impact Evaluations.

I have taken these general evaluation types and made them components of my customized evaluation plan, as shown in Diagram 1. Now that we have clarified the specific evaluation types that this project focuses on, we can examine which particular types of metrics are useful for analyzing this behavioral program within each of these evaluation types, and what kind of data needs to be collected to best inform this analysis. We will then compare that data to the actual data collection documents that reflect the initial implementation of the N2NEC evaluation.

Diagram 1: Evaluation Process Framework[30]



[30]Based upon the following resource, with my own specific customizations: Barnes, EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need, US Deparment of Energy Office of Energy Efficiency and Renewable Energy, February 2006.

Developing a Program Logic Model

The next step in creating an evaluation is specifying very clearly the activities to be analyzed. This will make your program structure clear and better inform your research questions and ultimate conclusions. The Program Logic Model is a useful tool in mapping program activities. It describes the problem that the program seeks to address, the activities that seek to address it, the outputs from the program that will be used to address it, and the outcomes and impacts that the program planners hope will result.

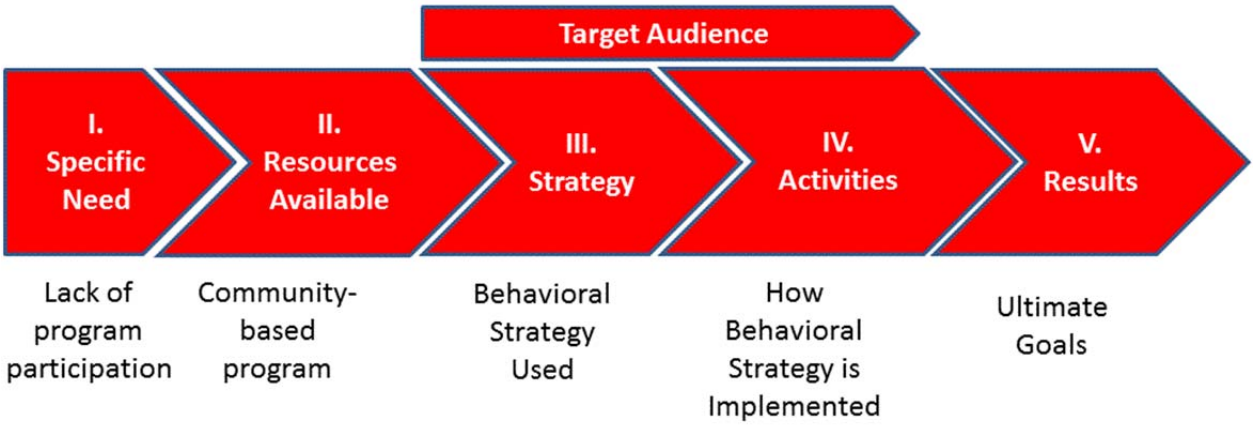
In this paper, I have developed my own customized framework for a program logic model, based on evaluation research and best practices. I started with the DOE Simplified Logic Model for a Deployment Program and, informed by other program literature and practical experience, made alterations based upon other literature and best practices.[31] My customizations have also optimized the model to reflect behavioral and community-based programs.

The most significant changes this project has made are the following:

- I have included an initial needs component in our theoretical model, which is not included in the DOE model. The components of the logic model naturally stem from the needs, but including explicitly stated needs in the logic models further assures that these are kept in mind during program implementation and evaluation, and that the evaluation is developed with an emphasis on whether the needs are specifically addressed. Even though we actually can't precisely characterize the need for our case study, this shows the extent to which specifying need is discounted in energy efficiency program planning. Therefore, it should be integrated into the model
- Strategy: This component of my logic model helps to isolate the desired behavioral change and focus the activities proposed. This is a particular emphasis of behavioral economics and related social sciences.

[31] Barnes, EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need, U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, February 2006.

Diagram 2: Logic Model Framework[32]



As stated in the chart above, the logic model specifies the following:

I. **Needs**: This component explicitly states the need which the specific program component seeks to fulfill.

II. **Resources**: These are the financial, non-financial, material and staff components of the program available to implement the activities. This analysis will not focus on this component in depth, but it is of use to compare resources to results to examine program effectiveness.

III. **Strategy**: This component elucidates what behavioral strategy is being used to address the need with the resources available. This information is drawn from the literature such as is outlined in the behavioral economics introduction above. Strategies can be determined by reading literature and making a decision, but ideally may be backed up by some experimentation at the pilot scale to determine if the strategy is effective in practice.[33]

IV. **Activities**: This is a specific description of how the behavioral strategy is to be implemented in the program to be evaluated. This activity should bear a strong relationship to the previous categories: assuring that it meets the need using the resources available to implement the relevant strategy. This component of specifically outlining the activity to be implemented serves both actual program implementation and the evaluation.

V. **Results** of the activities, which can be specified in the following ways, as introduced above:

[32] Based upon the following resource, with my own specific customizations: Barnes, EERE Guide for Managing General Program Evaluation Studies: Getting the Information You Need, US Deparment of Energy Office of Energy Efficiency and Renewable Energy, February 2006.
[33] McKenzie-Mohr and Smith, Fostering Sustainable Behavior, New Society Publishers: 1999, pp. 9-14.

A. **Outputs**: These are the immediate results of program implementation, such as number of initial commitments gained. This is the type of data that would be reflected in the process evaluation. This can also include the characteristics of activities including the number of events held and the number of individuals contacted.

B. **Outcomes**: These are the desired actions that directly result from the program outputs, such as an initial small action to save energy.

C. **Impacts**: These are the indirect and ultimately desired effects of program activities. This would include impacts such as amount of electricity or money saved. One challenge of evaluating impacts is assuring that the impacts measured are associated with the program activity (causation).

The model also specifies the **Target Audience:** This is a statement of specifically to whom the behavioral strategy is targeted. Specific audience characteristics may include conventional marketing demographics including location, age, gender and income. It may also include other characteristics related to behavioral strategies, including social connections and relationships in the community.

Besides explicit changes in the specific logic model, we have also customized our implementation of it to specifically address behavioral programs. In creating a behavioral program model, it is useful to isolate specific behavioral components of the program. This means specifying the behavioral barrier to be addressed, the type of behavioral strategy to be used to address it, the specific way the strategy will be applied through a program activity, and the expected output, outcome and impacts. From this will follow the next steps, in which we can determine what data analysis method can be used to test whether the logic model is successful and what data is needed to inform the analysis method.

In creating a plan for evaluation, it is extremely helpful to clarify specifically what problem you are addressing from a behavioral standpoint, what program activity you are implementing to address that particular behavioral problem, and then provide multiple specific metric that you will be using to measure whether that activity results in a change in that particular problem. This process can be standardized into this framework, which we will apply to the issues listed above which the N2NEC program is seeking to address.

First, we shall provide some information on the business process of the N2NEC program, to provide some context for the program activities on which this paper's evaluation planning will be focused.

III. The Neighbor-to-Neighbor Energy Challenge: The Context of our Case Study

The Neighbor-to-Neighbor Energy Challenge is a regional initiative in fourteen communities in Central and Southern Connecticut. This initiative was developed by Connecticut Clean Energy Fund, which received $4.17 million in funding from the U.S. Department of Energy Better Buildings Program.[34]

Participating Towns:
Bethany
Cheshire
East Haddam
East Hampton
Glastonbury
Lebanon
Mansfield
Portland
Ridgefield
Weston
Westport
Wethersfield
Wilton
Windham

The purpose of this program is to provide incentives to homeowners in these participating communities to adopt a series of energy saving actions, ranging from committing to change their lighting to a major home retrofit project and the installation of renewable energy.[35] Their strategy, based in behaviorism, is to take participants through a pathway of small to large energy saving actions for which they receive incentives and intensive one-on-one assistance throughout the process. The first step is a declared commitment, ideally signed and made public, to accomplish specific goals for energy savings and clean energy usage, which makes them a participant in the program. The second step is for them take one or more initial small actions. Two possibilities are small one-time actions: a home energy assessment and a lighting retrofit. Two other possibilities are small continuous actions: participation in the Energy Advisor, an online personal savings program, and signing up for delivery of Connecticut's green energy product. A small pilot program to install electronic energy use feedback devices may be available to some participating homes (this is being implemented at a later time than the rest of the program). The small actions are then meant to lead to a medium term action of home weatherization, which then leads to implementation of larger one-time actions: a significant home improvement and installation of renewable energy systems.

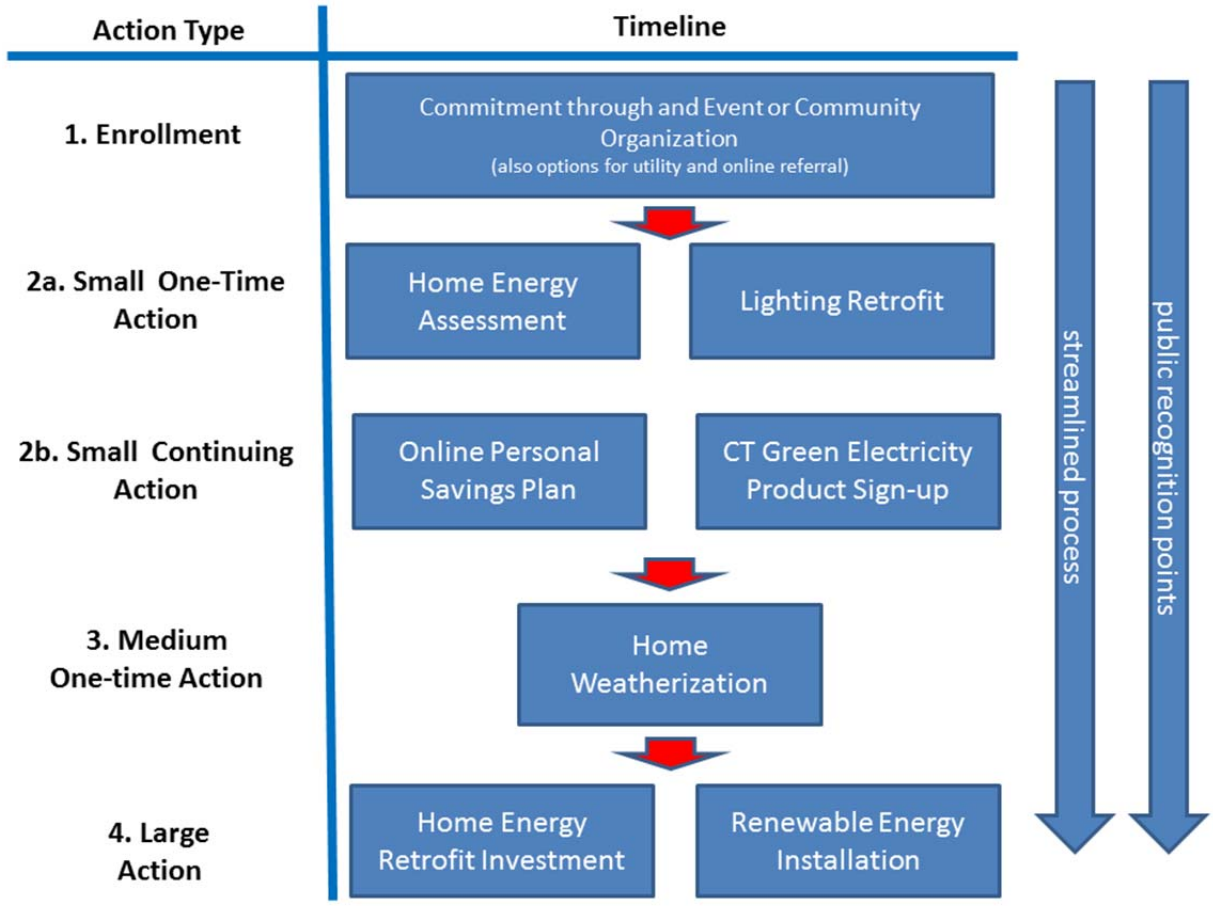
This pathway of actions is supplemented by several support tools. First, the small action of using the Energy Advisor actually supports and reinforces other actions by allowing participants to make an online energy assessment that they can reference throughout their participation in the program, which also compares their results to their peers in the program. Second, N2NEC has significant local staff support to assist participants with their actions. There are three local coordinators who coordinate activities in 4-5

[34] Neighbor-to-Neighbor Energy Challenge, http://ctenergychallenge.com/about_us, accessed most recently on March 31, 2012.
[35] This case study reflects a snapshot of the implemented and planned programs and activities of the N2NEC program at the conclusion of their program planning and just prior to the kick-off of their program. It is not meant to reflect the current status of their program or activities.

communities. They are also supported by the N2NEC Clean Energy Corps, eight staff who focus their activities on two of the fourteen participating communities.[36] The program also provides redeemable points to the individual and any collaborating organization that they choose to associate themselves with, which can be redeemed for products. This is further described below under the review of N2NEC's behavioral strategies.

The overall pathway of actions is shown in Diagram 3 below.

Diagram 3: Neighbor to Neighbor Energy Challenge Pathway of Actions



N2NEC states their program goal for participation and energy savings as follows, "Target participation of **10 percent of households** in 14 Connecticut communities to set specific, measurable stretch **goals of 20**

[36] Neighbor-to-Neighbor Energy Challenge, http://ctenergychallenge.com/about_us, accessed most recently on March 31, 2012.

percent for energy savings and clean energy usage, and provide support to assist them in achieving these goals."

N2NEC has specified goals for each action, quantified in participants, energy savings, financial savings, and emissions avoided. These goals are provided in Table 2 above.

RESULTS

I. The Logic Model for the Case Study

As stated above, the Logic Model is intended to specify the activities to be analyzed in the evaluation, particularly the behavioral components. The scope of this logic model is limited to the initial activities of the program regarding recruiting the initial commitment. As stated above, homeowners make a Personal Commitment to participate in the program, which serves as a behavioral milestone obligating them to future action. It also is a logistical milestone, as it enrolls them in the program and the online Energy Advisor.

This logic model specifically outlines two possible venues through which participants may be recruited: events and collaborating organizations. Of course, N2NEC welcome participants recruited through other venues, and they actively recruit participants on their website. However, these are two venues that include a behavioral component most strongly.

The Logic Model for the N2NEC program is provided in outline form below.

N2NEC Logic Model

Program Activity in Scope: Commitment

Needs:

Need 1: Residential energy efficiency program participation rates are low, frequently less than 10% of the target population, and generally closer to 1-2%.[37] This program seeks higher participation rates, and is using behavioral strategies to attempt to increase enrollment.

Need 1 Related Resources: N2NEC staff, DOE grant funds, established local events, collaborating community organizations, local community volunteers.

[37] Fuller et al., "Driving Demand for Home Energy Improvements," Lawrence Berkeley National Laboratory, LBNL-390E, September 2010.

Strategies:

Commitment Behavioral Strategy 1 – Signed and Public Recognized Commitment at Local Events: Participants make a publicly recognized commitment at established community events to participate in the program. Events provide the unique opportunity to interact with a large number of people and publicly recognize the commitments made at the event to all the attendees. These may be events hosted by N2NEC, identified as "workshops", or through N2NEC outreach at external events, simply referred to as events. The latter also offers the opportunity to be associated with an established community event that acts as a trusted source.

Strategy 1 Behavioral notes: The first key behavioral strategy here is Commitment: the participant makes their signed commitment in person at an event where it is publicly recognized in front of peers. A second key behavioral strategy is Commmunity Norms, because the visibility of the commitment helps to make it a community norm to participate. The final key behavioral strategy for Activity 1 is the **Trusted Messenger**: event staff are volunteers who are locally recruited members of the community rather than program or utility staff from outside the community. Homeowners are likely to place greater value and have a higher tendency to remember a message from someone that they know or feel is associated with their community. Trusted Messenger also applies to the fact that the outreach takes place at established local community events, associating the message with the community, rather than an unrelated mailing or, worse, a utility bill.

Commitment Behavioral Strategy 2 – Trusted Sources in the local community, in the form of collaborating organizations, are a conduit for recruiting Commitments: Participants are found through relationships with community institutions that are uniquely networked within each of the participating communities. These may be organization members or loosely associated community members. The benefit for the organization is that they receive points for every new committed participant who indicates an association to their group.

Activity 1 - Events: Public commitment at events.

Subactivity 1 - Preparation: Recruit local outreach volunteers in each community. Brainstorm a list of existing local community events and commit volunteers for outreach at these events.

Subactivity 2 - Implementation: Have homeowners sign a pledge at this public community event. Post the names of those who have signed the pledge at the event.

Subactivity 2 Behavioral Notes: The key behavioral strategy here is *Commitments.* This strategy includes the fact that an individual is more likely to follow through when they have signed the commitment and when that commitment is made public.

Subactivity 3 – Rewarding and Making it Public: Publish the commitment on a local website or in a local newspaper. Sign the participant up for the N2NEC Social Networking platform, where they can see who else in the community has pledged to participate and can connect with them around their energy commitments.[38] Finally, the individual is given reward points which can be redeemed for energy efficiency related goods, and community groups they are associated with are given points that can be redeemed for goods useful to these groups.[39]

Subactivity 3 Behavioral Notes: Key behavioral strategies are again *Commitments* along with *Peer Group Comparisons* and *Immediate Rewards*. The social networking site acts as a platform for *Peer Group Comparisons*, as homeowners can see who in their community is participating, and if they hear others are participating, they don't want to be seen as out of the community norm. As for *Immediate Rewards*, since the money saving benefits of this action are far in the future, the redeemable points provide an immediate reward for this action.

Activity 2 – Community Organizations: Connecting to participants through community trusted organizations.

Subactivity 1 – Partnering: Program staff and volunteers partner with unique local organizations in each community that are well-connected to many community members. The local organizations work with the program staff to provide outreach to the organization's local members.

Subactivity 2 – Indirect Outreach through Partners: This can be through websites and mailings.

[38]Not all participants may want to participate in the social networking site, but here another behavioral economics strategy is useful – participants are automatically signed up for the site unless they opt out of it. This strategy has been shown to be very effective for increasing participation rates in programs as varied as retirement programs and national organ donor registries (Villevieille, Behavioral Economics: Opt out versus Opt in, Lyris HQ, http://www.lyris.com/integrated-marketing/638-Behavioral-Economics-Opt-out-versus-Opt-in, last accessed on April 20, 2012.

[39]This program, likened to the "green stamps" programs of the mid-1900's, plays a significant role in the larger strategy for N2NEC, as both homeowners and community organizations can collect redeemable points at every point along the food chain of energy efficiency actions. This program would be a fascinating in-depth evaluation case that unfortunately is beyond the scope of this paper.

Subactivity 3 – In-person Outreach through Partners: Ideally at organization meetings, where the members can immediately make the commitment, which is made public at the meeting.

Subactivity 4 – Rewarding Partners: The program and partnering organization can also announce how many redeemable points the community organization has received because of the commitments made at the meeting. This is ideally done at the meeting during which the members have committed to the program.

Activity 2 Behavioral Notes: This uses the *Trusted Messenger* strategy, along with elements of *Commitments, Peer Group Comparisons* and *Immediate Rewards* when considering the strategy for recruiting at meetings.

Target Audiences:

Target Audiences for Activity 1 – Events: Homeowners in the local community. One challenge for this in all of these scenarios is that one must assure that those making the commitment are homeowners, not renters or members of households who have limited influence on the homeowner themselves. One useful alternative is giving renters the chance to be a volunteer for the program as an alternative to direct participation.

Target Audiences for Activity 2 – Community Organizations: Local community organizations and their members who are homeowners in the community. The key criterion for partnering with organizations is the extent of their connections to the community and a good standing and reputation in the community. These organizations do not need to be environmental or energy related, in fact it may be a better idea to choose many organizations that are not, as you will likely already be picking up members of local environmental organizations as early adopters of your program anyway.

II. The Evaluation Plan for Our Case

Specifying Outputs, Outcomes and Impacts: Moving Toward Evaluation Planning

Specifying outputs, outcomes and impacts will inform both program planning and evaluation. For the evaluation side of the project, these will specify what areas you will be examining for your process,

outcome and impact evaluations, as described above. Here, we specifying exactly what outputs (direct program results and activities), outcomes (program results that address desired outcomes), and impacts (indirect program results that address the ultimate program goals) that your program should be producing.

These steps also move more purely into evaluation planning. These defining these three sets of program goals determine very specifically the "what" of what you are trying to evaluate, the method by which you will evaluate, and the data you need to accomplish the research. These "what's" should be stated in specific measurable quantities of activities, things or action. Then, your evaluation can measure how closely your program came to producing these results.

In evaluation planning, this step of specifying the criteria will be followed by developing precise research methods to measure progress toward these goals, followed by a specific plan for what data is required to inform these research methods. These activities will be outlined in the sections that follow.

Process Evaluation Plan: Outputs

The logic model outline above details my simple model for how Commitment Activities 1 and 2 are structured. For each of these activities and subactivities, I have developed several Process Evaluation Research Questions, each with a related Research and Analysis Method, and potential Data Requirements. This list of Research questions can be a basis for evaluating the effectiveness of their project. As above, these are organized by project activity and subactivity.

I have implemented the same method for both outcomes and impact evaluations. However, process evaluation is the best part of the evaluation to examine to introduce these concepts, because the outputs are most directly related to their research questions, methods and data requirements, and the analysis methods are relatively simple. Again, process evaluation is basically assessing program effectiveness at delivering the immediate results of activities. Outcome and Impact evaluations, on the other hand, focus on how effective the program is at achieving the wider and more indirect goals of the project.

The entire process evaluation plan is provided in Appendix A. Here I provide a sample research question with related parameters in outline form:

Activity 1 – Events:

- **Output for Subactivity 1 – Preparation:** Effective recruitment actions to find volunteers

- **Process Evaluation Research Question:** What type of recruitment actions were the most effective for volunteer recruitment (in each community)?
- **Research and Analysis Method:** Observation and statistical analysis (multi-variate regression analysis, utilizing categories)
- **Data Requirements:** Type of recruitment action, Number of volunteers recruited

Table 2: N2NEC Quantified Goals, Highlighted by Evaluation Plan Applicable

Actions	Participant Targets	Energy Savings (MMBtu)	Energy Savings ($'s)	Emissions Avoided (MTCO2)
Commitment / Advisor	8,000	89,106	$3,288,622	5,992
Home Energy Solutions	6,250	144,700	$6,410,725	11,540
Lighting Retrofit	7,000	17,273	$1,080,146	2,151
CTCEO Sign-Up	5,000	269	($685,165)	27,295
Feedback Devices	200	1,152	$71,114	142
Major Retrofit	1,250	56,600	$1,207,148	2,068
Solar Thermal	200	3,345	$179,403	333
Solar PV	125	3,960	$528,786	1,048

Red = Output Orange = Outcomes Blue = Impacts Black = Out of Scope

Source: N2NEC, N2NEC_Goals_Objectives_Performance Incentives_V6, document provided to author.

Implicit in this process is setting specific numerical goals for each output; as N2NEC has done in Table 2 (provided again for your reference here) for its primary outputs, outcomes and impacts; and comparing results against those goals. N2NEC did not provide me with specific process goals, such as for number of volunteers to recruit or number of events to be held in a year. Therefore, I have provided a proposed list of related outputs below:

Here are my proposed outputs for evaluation:

- **Activity 1 – Events**:
  - **Outputs for Subactivity 1 – Preparation**
    - Effective recruitment actions to find volunteers
    - Sufficient volunteers from each community
    - Calendar of events at which volunteers will recruit participants

    - **Outputs for Subactivity 2 – Implementation**
        - Signed Commitments
    - **Outputs for Subactivity 3 – Rewarding and Making it Public**
        - Effective Rewards Provided for Participant Commitments
        - Public recognitions of the Commitment
- **Activity 2 – Community Organizations**:
    - **Outputs for Subactivity 1 – Partnering**
        - Community organizations collaborating with the program in each community
    - **Outputs for Subactivity 2 – Indirect Outreach Through Partners**
        - Instances of Indirect Outreach Through Partners (i.e. print, internet and miscellaneous organizational activities)
    - **Outputs for Subactivity 3 – In-person Outreach Through Partners**
        - Instances of In-person Outreach Through Partners (program staff or volunteers have an outreach opportunity at each organizations' events)
    - **Outputs for Subactivity 4 – Rewarding Partners**
        - Rewards Provided for Participant Commitments Associated with the Organization

Providing recommendations for quantitative output goals for these non-primary program components would require a more detailed needs assessment than I was provided with or could feasibly complete. Therefore quantifying these goals is outside the scope of this study.

Outcome Evaluation Plan

In creating proposed outcome and impact evaluation plans for Activities 1 and 2, I used the same steps as used in creating the process evaluation: listing the activity, the related outcome and impact, planned research and analysis methods and potentially required data. However, activities and their relationship to outcomes and impacts will be handled differently than they were for the output based process evaluation.

Reframing Activities for the Outcome and Impact Evaluation

In order to be useful, the process evaluation needs to have a sufficient level detail in the program activities it explores. That's why it was necessary, in our logic model, to include sub-activities that outline

specific steps in our program activities. However, for the outcome and impact evaluation, these sub-activities do not hold as much meaning for the evaluation, as the smaller steps don't necessarily inform the questions exploring the less direct outcomes of activities. Instead, the outcome and impact evaluation seek to find research questions that can quantify these indirect relationships, and the extent to which the behaviors encouraged by the program promote them. This is the focus of the outcome and impact evaluation. So we have left out the sub-activities and provided evaluation criteria only at the activity level.

Reframing the Outcomes for Our Evaluation

The outcome evaluation plan, as explained above, seeks to see how effectively program activities and outputs lead to desired outcomes, as expressed by the participant target component of the program goals in Table 2, which highlights the goals by which are applicable to Outputs, Outcomes and Impacts.

Specifically in the N2NEC program, the outcomes are the participants targets listed for initial actions above, which are meant to be the direct result of program outputs. Again, the scope of this study only encompasses the initial activities of the program: recruitment through events and related organizations, and the related initial energy savings. Therefore, for the purposes of this study, the relevant outcomes to relate these initial steps to is the extent to which they result in the participant taking an initial step to change their energy behaviors. This change is behavior is likely to be embodied by one of the following subset of outcomes, those highlighted in orange above:

- Small one-time actions:
    - Complete a Home Energy Solutions Assessment
    - Retrofit of household lighting
- Small continuing action
    - On-line personal savings plan through Energy Advisor
    - Connecticut Green Electricity Product Sign-up
    - Install Energy Feedback Devices to Change Daily Behavior (pilot)

The rest of the outcomes are meant to be larger commitments later on in the pathway of actions that N2NEC seeks to incent their participants to complete and thus relevant to later steps in the program activities. Early activities may affect the extent to which later activities are adopted, but this is something that we will approach in the Impact evaluation. Therefore, for the purpose of the initial activities and outcomes, the specific differences between these actions are not particularly meaningful. The key

question for the initial program activities we are examining for the purpose of the outcome evaluation is this: To what extent do the initial commitment activities affect the extent to which the participant makes some kind of initial action (any of the above) toward saving energy?

Here is the list of outcome research questions that I have developed for the prototype research plan. The plan, complete with research and analysis methods, and data requirements, is available in Appendix B.

Outcomes:

Activity 1 – Recruitment Through Events

- What percentage of participants who made the commitment through events follow through with an initial action?
- Is recruitment of participants who end up taking initial actions evenly distributed across events, as compared to event attendance (aka is the proportion of action taking correlated to the number of people to which there was an opportunity to recruit?
- Is a particular event type correlated with an increased likelihood for participants to complete an initial action?
- Does the likelihood of a participant taking an initial action correlate with having an existing relationship with the recruiting volunteer?
- Does a participant recruited by a volunteer with a relationship to a collaborating organization have a higher likelihood to take an initial action?
- Does a participant whose commitment was made public at an event or in local media have a higher likelihood to take an initial action?

Activity 2 – Community Organizations

- What percentage of participants who made the commitment through a collaborating organization follow through with an initial action?
- Are participants recruited at a collaborating organization's event more likely to take an initial action?
- Is in-person or indirect outreach through organizations more effective for participants that take initial actions?

- Are recruitment participants who took initial actions evenly distributed across organizations, as compared to organizational membership (aka is proportion of action taking correlated to the number of people whom there was an opportunity to recruit?
- Is a particular type of organization (or specific organization within a community) correlated with an increased likelihood for participants to complete an initial action?
- Does a participant whose commitment was made public through a collaborating organization have a higher likelihood to take an initial action?
- Does the likelihood of taking an initial action correlate with the participant having a stated relationship with an organization (as illustrated by asking to contribute reward points to that organization?
- Does a participant whose commitment was made public through a collaborating organization have a higher likelihood to take an initial action than a participant whose commitment was made public through outlets unaffiliated with an organization?
- Is a participant with multiple organizational affiliations more likely to take an initial action than a participant with only a single organizational affiliation?
- Does the extent of an organization's internet presence affect the likelihood that an associated participant will take an initial action?
- Is an organization that redeems its reward points more likely to have associated participants who take an initial action?

General Recruitment Actions

- Does recruitment through events or through organizations more highly correlated with taking an initial action?
- If the initial action taken by the participant is the creation of an energy savings plan in Energy Advisor, are they more likely to take other initial actions?
- Is a participant with an associated organization (whether recruited through an event or through a collaborating organization) more likely to take an initial action?
- Are participants who have more social connections on the Energy Advisor more likely to take an initial action?

Experimental Research Questions for Outcomes (see below for more on experiments)

- If the participant is notified about reward points immediately following making the commitment, are they more likely to take an initial action?

- If taking initial first actions provide sufficient reward points, when added to commitment points, to redeem for products, does this make participants more likely to take an initial action?

Impact Evaluation Plan

The impact evaluation plan, as explained above, seeks to see how effectively program outputs and outcomes lead to the ultimate program goals, as expressed by the savings in energy, money and carbon emission expressed in Table 2 above, highlighted in blue. These are the ultimate impacts that the program seeks to have occur as a result of their activities.

Again the energy savings, financial savings and emissions savings relevant to the following participant actions are the impacts relevant to the initial activities in the scope of this study:

- Small one-time actions:
  - Complete a Home Energy Solutions Assessment
  - Retrofit of household lighting
- Small continuing action
  - On-line personal savings plan through Energy Advisor
  - Connecticut Green Electricity Product Sign-up

Unless otherwise noted, for the purposes of this evaluation, the impacts of energy (mmBtu), energy ($), and Emissions (MTCO2) are considered to be uniformly proportional to each other, and the following research questions use the generic term savings. This assumes a constant rate for electricity and a standard fuel mix for electricity production and heat consumption. This allows us to focus on the behavioral aspects of the program. This is accurate for electricity, as all participating communities are served by the same utility with the same fuel mix, assuming little or no contributions from home-based renewables initially. However, the program may want to investigate the relative savings gained from households using the two different dominant fuel options: fuel oil and natural gas. The program might also want to investigate how savings are affected with the installation of rooftop renewables and the adoption of a green electricity product.

Here is the list of outcome research questions that I have developed for the prototype research plan. The plan, complete with research and analysis methods, and data requirements, is available in Appendix C.

Impacts:

Activity 1 – Recruitment Through Events

- Do participants recruited through events have differing savings based on the type of event at which they were recruited?
- Does a participant have a higher rate of savings if they knew the volunteer who recruited them at an event?

Activity 2 – Community Organizations

- Does any particular initial action taken by a participant result in more significant savings after 1 year?
- What combination of initial actions maximizes energy savings after 1 year?

General Recruitment Actions

- Does any particular initial action taken by a participant result in more significant savings after 1 year?
- What combination of initial actions maximizes energy savings after 1 year?
- Is recruitment through events or through collaborating organizations more likely to be correlated with savings maintained over the long term (least drop-off of savings over 1-5 years)?
- Is the number of connections that a participant makes in Energy Advisor correlated with greater savings?
- Does a participant whose commitment was made public more likely to have higher energy savings?
- Does a participant whose commitment was made public maintain savings over the long term?
- What is the extent of energy savings are made by individuals who never move beyond small actions? Is it sufficient to be of value?

Comparative Impact Analysis compares the results of this program against the existing utility programs. At its most simplistic, a back-of-the-envelope analysis will simply compare the percentage of program participants as part of the target population (usual a municipality or utility territory) and the % energy saved. To provide a more meaningful analysis, an analysis would also provide cost information, such as cost per participant.[40] You may have a successful program, but at a cost per participant which is not feasible outside of a well-funded local pilot program. The N2NEC program is well-placed to complete such an analysis, as it is part of a larger efficiency program with publicly available results.

[40] Joosen and Harmelink, Guidelines for the Ex-Post Evaluation of 20 Energy Efficiency Instruments Applied Across Europe, ECO FYS, January 2006, accessible online at: http://www.aid-ee.org/documents/00MethodologyExpostevaluation.PDF.

Looking beyond just evaluating the targeted program activities in the scope of our study, there are some key parameters by which comparative judgments can be made:

- Number of participants as a proportion of the target population
- Dollar amount of appliance rebates redeemed
- Percentage energy savings as a proportion of participant energy use
- Program cost per participant
- Energy savings per participant and as a proportion of the target population

These can also be taken into account in a larger evaluation plan.

Key Issues and Opportunities with Developing an Evaluation Plan

Statistical Power & Experimentation

Statistical Power, which characterizes the likelihood that the researcher will avoid a Type II error, and finding effect where there is not, is a key problem with this type of community based analysis. The sample sizes are likely to be small and, specifically when dealing with energy, financial, and emissions savings, the resulting effect is also small. I would advise N2NEC to keep a close eye on power and to try to make their sample sizes as large as possible by doing analysis encompassing multiple communities.[41]

If the organization has a capacity for implementation of experiments, it can be useful to lend credibility to causation claims that your program makes. However, in order for the experiment to be statistically effective, it is more effective to have the experimental dependent variable (result) be a participant action, rather than your ultimate goals of energy, financial or emissions savings. Because the savings gained from energy efficiency programs are relatively small, it is likely that your experiment will lack sufficient power to make your claims credible. Therefore we have suggested experimental models in the Outcomes Evaluation Plan, but not for the Impact Analysis.

The other key problem with experiments for community-based organizations is just capacity and logistics. The experiments we have proposed for outcomes require two different groups that receive a specifically timed message. In order to achieve a sufficient sample, these likely needs to happen across multiple communities, and attention must be paid that there is not leakage of information across groups, affecting construct validity. Therefore, experiments may be difficult to undertake.

[41] Abrahamse et al., A Review of Intervention Studies Aimed at Household Energy Conservation, Journal of Environmental Psychology, Volume 25, Issue 3, September 2005, Pages 273–291.

Other opportunities for experiments may arise when differing circumstances happen to occur across your program. If the difference suggest some interesting questions, and provide enough of a sample size, this sort of opportunistic experiment-like conditions can be of use. One example of constructing a simple experiment to test the effectiveness of Trusted Messengers as a behavioral strategy is to see if volunteers from one of your communities can recruit more, less or equally effectively in another community. You can specifically assign volunteers from different communities to take recruitment shifts. Also, it may even occur that personnel requirements mean that this happens anyway in the course of program implementation. If this occurred multiple times, it is possible to take that data and compare it to the effectiveness of your volunteers working in their own communities.

Making Sure Questions Agree with Reality

There are some questions that seem like they are useful, but they need to be carefully checked against the logistics of the program to assure they are feasible. This is the case with the following question: "Are participants who redeem their reward points more likely to take a first initial action?" This seems to be an effective way of judging whether rewards have an impact on a participant taking an initial action. However, if the point system is structured such that the participant only has sufficient points to redeem a product until after the first action is taken, then the question is invalid. Participants who have not taken the first action will not have redeemed any points. Thus, due to logistics, this question is not meaningful.

Research questions can be quite similar, and yet need very different research methods. For example, consider the following two research questions:

1. How many program commitments were recorded in which volunteers and participants knew each other (i.e. neighbor, fellow member of community organization)?
2. Did an existing relationship between volunteer and participant increase the likelihood of a commitment?

These questions explore similar issues – the impact of existing relationships on the likelihood of the volunteer successfully recruiting a participant. However, the first question simply requires a simply analysis of the percentage of commitments on which the volunteer recorded that he or she knew the participant. The second implies a much more complex bivariate analysis that requires data on whether or not the volunteer had a relationship with a potential participant and whether that interaction resulted in a commitment. While the second question may more accurately analyze the question, it requires much more work in data collection and analysis. When creating a pragmatic evaluation plan for a community

program, considering how much resources will be required to answer your evaluation program will be very important. The first version of the question is included in our evaluation plan.

III. The Comparative Analysis of Data Requirements to Actual Data Field Inventory

Introduction & Methods

I was given access to an inventory of the evaluation and program development documents for the initial planning and implementation phase of the Neighbor-to-Neighbor Energy Program that ended just prior to the program kick-off. This included all planning that was completed prior to program implementation, ranging from overarching strategy documents outlining goals and objectives for evaluation and the program as a whole, down to logistical documents and data collections forms, such as and implementation documents including data collection sheets and guidance provided to on-the-ground program staff. A list of these documents is provided in

I created an inventory of these documents and used it for quantitative (using data collection documents with data fields listed) and qualitative analysis (using data collection documents and more general strategy documents). The quantitative analysis involved creating an inventory of the 243 data fields listed on their data collection documents. I then eliminated duplicate data field, and created a list of 167 unique data fields gleaned from these planning documents, which would be the data available if the initial data collection plan for the program was implemented as proposed. To complete the quantitative analysis, I compared this list of available unique data field to the data requirements for my prototype evaluation plan. This allowed me to analyze what data collection resources were available to answer particular evaluative questions.

I would like to put two disclaimers on this analysis. This is a snapshot of data that was provided to me from N2NEC. For the purpose of this study, we are considering this a comprehensive reflection of the N2NEC data collection at the conclusion of their initial data and evaluation planning prior to program implementation. However, this should not be considered a comprehensive reflection of all the evaluation activities of N2NEC at this time, and their evaluation planning and data collection may have changed from the snapshot of time from which these documents originate. Also, I only reviewed the actual data fields. I did not review any actual collected data, which would have required human subjects authorization.

Results:

While the data fields available outnumbered the data requirements, the data fields generally were much more specific in content and generally multiple data fields applied to each data requirement. I found that there was detailed information available particularly on events, with over twenty fields defining event characteristics. There were fewer fields available for organizational affiliation, with less than 5 fields relevant. There were also several data fields which are not reflected in the data field inventory, but are actually fields that would be internally produced within N2NEC, such as the occurrence of a participant taking an action. These were indicated as such in my analysis; there were 10 fields in that category.

I found that 18 (32%) of the data requirements were not covered by the N2NEC data fields, they are provided in Table 3. The data requirements for which I found no corresponding actual data tended to be in the areas collaborating organizations and public recognition. It is likely that these areas are being tracked by the organization, but in an informal manner. I would advise N2NEC to formalize data collection if they have not already, to facilitate quantitative analysis.

A program evaluation is only as effective as the data upon which it is based. Conversely, the data collected should have a strong relationship to the program evaluation plan and the program goals and objectives. When evaluation is done in conjunction with the implementation of a community program such as a residential energy efficiency initiative, it's important to have a solid data collection plan in place prior to program implementation. However, another important component of data collection is feasibility, and some research questions, while useful, may simply need to be eliminated due to feasibility of collection. There is only so much data a volunteer can collect while trying to run a recruiting event.

Table 3: Data Requirements without Corresponding Unique Data Fields

Organization Name
Organization Type
Total number of public recognitions of commitments
Town associated with organization
Does the organization have the following: a web site, a Facebook profile, a twitter account, or other social media tools?
Energy Savings post-enrollment years 2-5
Number of instances of collaborating organization recognizing commitment
Number of instances of internet outreach for program by other organizations
number of instances of organization action reported to the program
Number of instances of print outreach for program by other organizations
Number of instances of program outreach by other organizations by miscellaneous methods – i.e. leaders at other events, recognition of the program through awards, etc.
Number of organization members
Number of print articles in which the commitment was recognized
Number of recruitment actions
Number of significant in-person interactions with organizations by program representative
Number of significant in-person outreach opportunities with other organization's memberships
Volunteer demographic characteristics – i.e. age, occupation, neighborhood, home ownership status
Was the commitment made public at the event?

Conclusion

I. Initial Conclusions

Logic Model and Prototype Evaluation

Reviewing the program practices literature and government funding documents regarding behaviorally based program provides one importance advantage to this first generation of programs: an emphasis on evaluation and analysis. One of the most commonly cited pieces of literature is the book Fostering Sustainable Behavior by Doug McKenzie-Mohr and William Smith. While written explicitly for the practitioner, it emphasizes the use of analysis, observation and experimentation in program development. The U.S. Department of Energy is also requiring extensive reporting by programs funded by their Better Buildings Program. The fact that N2NEC already has 167 unique data fields that they are recording

shows an extensive evaluative infrastructure. A program that has such a well-developed evaluation program is likely placing a higher priority on evaluation, both in how it informs program activities moving forward and in how it can thoroughly defend its model as effective.

This project has explored evaluation of behavioral residential energy efficiency programs through the creation of a prototype evaluation plan for a select set of activities of the N2NEC program. I created a customized framework based largely upon U.S. DOE guidelines, with some changes informed from literature. While this prototype has yet to be tested, it served as a useful tool for clarifying what particular activities needed to be analyzed, what research questions were relevant for analysis, and what data was required to inform the questions. This prototype is likely not meant for use, but instead could be used as a tool for program staff to understand how to construct their own initial program plan.

The prototype also brought to the front the key question of how much initial recruitment steps may affect, on their own, the extent that people will implement major energy savings behavior further on in the program. This question is directly examined in our impact analysis, but it is difficult to draw definitive conclusions directly, because the power of such statistical analysis is likely to be low, because of small sample size and the relatively small proportion of energy savings.

To answer this question, is more effective to see how successful commitment activities are in achieving their output and outcome goals. The greatest effect these initial steps will have is if they are effective in originally attracting participants to the program, and successful get them to the step of initiating initial action. These questions are likely to shed more light on the success of the commitment and recruitment process, rather than trying to directly trying to find connections between commitment activities and energy saving impacts through quantitative analysis.

It has still be a challenge to precisely isolate the impacts of behavioral incentives. Especially when the strategies implemented tend to implement a combination of behavioral incentives, for example recruitment through events used Making Rewards Visible, Trusted Messengers and Community Norms. Further conflating results is the fact that commitments are obtained at events – is it the signed commitment that spurred further action by the participant, or the other behavioral incentives above implemented through the event? Again, in the pragmatic world of community-based evaluation, there is a limited extent to which we will be able to disentangle these phenomena.

I would be hesitant to add much more detail to the evaluation prototype. For community-based organizations, a simple and approachable structure for evaluation is useful, as there is limited capacity and funding for evaluative efforts. This prototype would not be appropriate for academic research, where the emphasis is on analysis and evaluation and frameworks for analysis are generally far more extensive.

Comparative Data Analysis

Regarding the comparative data requirement and actual data field inventory analysis, I found that 68% of my proposed data requirements had analogs in the inventory of actual data fields that I derived from the N2NEC documents. This seems to indicate a fairly good overlap of data, which would make much of my prototype evaluation feasible for the program to implement. Events were extensively described by data field available, and collaborating organizations were less. This has a potential to introduce bias into an evaluation plan based on the data fields in the inventory. However, I would conjecture that the data on organization is available from program staff and documents; it just had not been formalized into any data collection documents that were made available to me. It may be that formalizing the organization of that information into a standard format is sufficient to make it available for quantitative analysis.

I. Possible Next Steps

Comparing to Baseline Data

This program is setting itself up for success by collecting significant program up front regarding program implementation, data which we are proposing to use extensively in this evaluation plan. Also key is to attain sufficient baseline data to which energy savings can be compared. This data ideally shows energy consumption with the following characteristics:

- Time period and resolution: a year of past energy consumption data is ideal, so seasonality can be captured. The finer time resolution the better, ideally having peak vs. off-peak data is useful, but data is likely to be a monthly metered amount.
- Spatial resolution: It is ideal to have this data at a household level, which N2NEC is trying to gain from the utility. Aggregate data by town is also of analytical use.

The best case scenario is receiving this data from directly from the utility. It renders unnecessary the participant taking the time and effort to find and report the data, and is more accurate that estimates. However, utilities are often reluctant to provide this data, even to state approved independent efficiency

programs. N2NEC is fostering a long-term relationship with Connecticut Light & Power, the utility in their region, and has convened formal communications with the utility to request this data.[42] N2NEC is also having all participants sign a release form so their utility data can be released to N2NEC.[43] Estimates of baseline data can be used where necessary, but this inevitably introduces significant inaccuracies.

Quantifying Free-Ridership

Comparative analysis also allows for a measurement of free-ridership – basically what percentage of your participants would have acted anyway under existing programs, or under no program at all. Free ridership can often be estimated through survey data, though survey participants can be an extensive project.[44] Existing figures can give some estimate of free-ridership under a no program scenario. Finding some way of approximating free ridership gives a much more accurate perspective on how much your program is accomplishing. There are several model studies available that show examples of quantifying free ridership.[45]

Qualitative analysis

Valuable program information can be gained from non-quantitative analysis. Can be observational or experimental, but likely observational. This is most helpful when quantitative analysis would be needlessly complicated for a community-based program. Qualitative data is useful for internal program improvement, but is also very useful for program reporting. DOE and other funding programs require a program narrative as part of reporting and are also in search of compelling program success stories to inform their own outreach for the funding program as a whole. Key qualitative information is participant, program staff and volunteer narratives about recruitment experiences, what they gained from their experiences and what they have witness regarding the program benefits for participants. However, if this is to be used for evaluation and not just for marketing, having these narratives collected and rendered anonymous by a third party will facilitate the capacity to be honest. However, even if this isn't feasible, incidental collection of narratives as happen to come can be very useful.

[42] An example is a letter to Mr. Richard Steves, Chair, Energy Conservation Management Board; and Ronald Araujo, Manager, Conservation and Load Management Department, Connecticut Light and Power, August 2, 2010, provided to the author by N2NEC.
[43] CT N2N Utility Release Authorization v1.2, July 29, 2011, provided to the author by N2NEC.
[44] National Action Plan for Energy Efficiency, Model Energy Efficiency Program Impact Evaluation Guide, prepared by Steven R. Schiller, Schiller Consulting, Inc., 2007, available online at http://www.epa.gov/eeactionplan.
[45] Rathbun et al., National Grid, NSTAR Electric, Northeast Utilities, Unitil, Cape Light Compact Standardized Methods for Free-Ridership and Spillover Evaluation—Task 5 Final Report (Revised) June 16, 2003, can be accessed on the internet at: http://www.cee1.org/eval/db_pdf/297.pdf.

DOE Reporting: Help or Hindrance?

As was previously stated, DOE has set up extensive program reporting requirements for the behavioral programs they are funding through the Better Buildings Program. It would be of interest to determine if the data requirements of DOE reporting coincide with the evaluative priorities of the behavioral programs. How do DOE reporting requirements enhance program evaluation efforts or do they burden them with data collections that are not internally helpful?

Final Thoughts

Overall, a more comprehensive evaluative model is needed for the N2NEC program that analyzes the capacity of their pathway plan to bring people from commitment through smaller steps to major investments. It is difficult to balance an evaluative method across these heterogeneous activities while maintaining statistical integrity. This would be a great meaty research challenge to investigate moving forward.

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
Activity 1 – Events				
Subactivity 1 – Preparation				
	1. Effective recruitment actions to find volunteers	a. What type of recruitment actions were the most effective for volunteer recruitment (in each community)?	observation and statistical analysis (bi-variate regression analysis)	Type of volunteer recruitment action Number of volunteers recruited Community name
		b. What number of recruitment actions were required to recruit a sufficient number of volunteers (in each community)?	observation and statistical analysis (bi-variate regression analysis)	Type of volunteer recruitment action Number of volunteers recruited Community name
		c. What community organizations are volunteers associated with?	observation and monovariate analysis	Volunteer - community organization associated with
	2. Sufficient volunteers from each community	a. What were the general demographic characteristics of volunteers?	observation and monovariate analysis	Volunteer demographic characteristics – i.e. age, occupation, neighborhood, home ownership status
	3. Calendar of events at which volunteers will recruit participants	a. Was the program able to schedule the minimum number of events proposed?	observation and monovariate analysis	Number of events
		b. What types of events were the most frequently scheduled?	observation and statistical analysis (bi-variate regression analysis)	Event type Number of events
		c. What types of events resulted in the largest Commitments/participants?	observation and statistical analysis (bi-variate regression analysis)	Event type Commitments/participants
		d. What type of event outreach resulted in the largest Commitments/participants?	observation and statistical analysis (bi-variate regression analysis)	Event outreach type (i.e. booth, circulating volunteers, givaways, games, keynote speaker) Number of events
		e. Did the number of participants recruited vary between volunteers? Was this correlated to any particular volunteer characteristics?	observation and multivariate analysis	Commitments/participants Volunteer who recruited participant

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
				Volunteer demographic characteristics – i.e. age, occupation, neighborhood, home ownership status
Subactivity 2 – Implementation				
	1. Signed Commitments	a. Was the program able to meet commitment goals?	observation and monovariate analysis	Commitments/participants
		b. What are the characteristics of homeowners who signed up as participants?	observation and monovariate analysis	Participant demographic characteristics – i.e. age, occupation, neighborhood, home ownership status
		c. Did the program meet its goals to make all commitments public at events?	observation and monovariate analysis	Was the commitment made public at the event?
		d. What percentage of commitments were recorded in which volunteers and participants knew each other (i.e. neighbor, fellow member of community organization)?	observation and monovariate analysis of a subset of data	Volunteer have existing connection to participant? Commitments/participants
		e. What percentage of interactions resulted in a commitment? What percentage resulted in walk-aways?	observation and monovariate analysis of a subset of data	Commitments/participants Number of walkaways
		f. Is there any outreach method that resulted in fewer walk aways?	observation and statistical analysis (bi-variate regression analysis)	Number of walk aways from commitment offer (Note, due to feasibility, this is the only data point recorded on walk-aways) Event outreach type (i.e. booth, circulating volunteers, givaways, games, keynote speaker)
Subactivity 3 – Rewarding and Making it Public				
	1. Effective Rewards Provided for Participant Commitments	a. Did participants utilize their reward points? (In other words, did the participants find their reward points of value)?	observation and monovariate analysis of a subset of data	Amount of points awarded to the participant for commitment Amount of points used by participants

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
	2. Public recognitions of the Commitment	a. How often were commitments publicly recognized?	observation and monovariate analysis or qualitative, often of a subset of data	Total number of public recognitions of commitments Number of print articles in which the commitment was recognized Online publications in which the commitment was recognized Instances that the commitment was recognized at the live event
		b. In what format were commitments most frequently recognized?	observation and monovariate analysis	Total number of public recognitions of commitments Print publications in which the commitment was recognized Online publications in which the commitment was recognized Instances that the commitment was recognized at the live event
Activity 2 – Community Organizations				
Subactivity 1 – Partnering				
	1. Community organizations collaborating with the program in each community	a. What community or communities is the organization involved in?	observation and monovariate analysis	Town associated with organization
		c. What is the current membership of the organization?	observation and monovariate analysis	Number of organization members
		d. Internet presence of the organization	observation and monovariate analysis	Does the organization have the following: a web site, a Facebook profile, a twitter account, or other social media tools?
		e. What is the prevalence of community events by this organization?	observation and monovariate analysis	Following organizational event characteristics: number of events per year, approximate attendance
		f. Does the size of an organization's membership correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Commitments/participants indicating organizational affiliation Number of organization members

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
		g. Does the extent of an organization's internet presence correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations Does the organization have the following: a web site, a Facebook profile, a twitter account, or other social media tools?
		h. Does the number of events held by an organization correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations number of organization events per year
		i. Does the total or average attendance at events held by an organization correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations event approximate attendance
		j. Does the number of total direct and indirect outreach actions by an organization correlate with a larger or smaller percentage of members making commitments? Which is type of outreach is more highly correlated with larger percentage of commitments by organization members?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations Number of Commitments through collaborating organizations Number of instances of indirect outreach for program by other organizations Number of significant in-person interactions with organizations by program representative

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
		c. Did in-person outreach at associated organizations' event have a lower percentage of walk-aways than general community events?	observation and monovariate analysis	Commitments/participants Number of walkaways Commitments/participants marked from community events
Subactivity 2 – Indirect Outreach Through Partners				
	1. Instances of Indirect Outreach Through Partners	a. How often is the program mentioned in each organization's print outreach?	observation and monovariate analysis, may be qualitative	Number of instances of print outreach for program by other organizations
		b. How often is the program mentioned in each organization's internet outreach?	observation and monovariate analysis, may be qualitative	Number of instances of internet outreach for program by other organizations
		c. How often is the program mentioned in other forms of outreach by partner organizations?	observation and monovariate analysis, may be qualitative	Number of instances of program outreach by other organizations by miscellaneous methods – i.e. leaders at other events, recognition of the program through awards, etc.
		d. Does the number of print/internet/misc outreach by an organization correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations Number of instances of print outreach for program by other organizations Number of instances of internet outreach for program by other organizations Number of instances of program outreach by other organizations by miscellaneous methods – i.e. leaders at other events, recognition of the program through awards, etc.

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
		e. Does the number of total indirect outreach actions by an organization correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of Commitments through collaborating organizations Number of instances of indirect outreach for program by other organizations Number of instances of internet outreach for program by other organizations Number of instances of program outreach by other organizations by miscellaneous methods – i.e. leaders at other events, recognition of the program through awards, etc.
Subactivity 3 – In-person Outreach Through Partners				
	1. Instances of In-person Outreach Through Partners	a. How often did program staff or volunteers have an outreach opportunity at each organizations' events?	observation and monovariate analysis	Number of significant in-person outreach opportunities with other organization's memberships
		b. Does the number of direct outreach by program staff at an organizations' events correlate with a larger or smaller percentage of members making commitments?	observation and statistical analysis (bi-variate regression analysis)	Number of significant in-person interactions with organizations by program representative Number of Commitments through collaborating organizations
Subactivity 4 – Rewarding Partners				
	1. Rewards Provided for Participant Commitments Associated with the Organization	a. Did community organizations utilize their reward points? (In other words, did the organizations find their reward points of value)?	observation and monovariate analysis of a subset of data	Amount of points awarded to the related community organization for participation
		b. Were community organizations who redeemed their reward points more likely to have members make commitments than organizations who did not?	observation and monovariate analysis or qualitative	number of instances of organization action reported to the program

Appendix A. Output Evaluation Plan (aka Process Evaluation)

Activity	Outputs	Process Evaluation Research Question	Research and Analysis Method	Data Requirements
		c. What was the percentage of all commitments made by participants who were associated with a participating organization?	observation and monovariate analysis or qualitative	Points awarded to individuals associated with the organization for their commitment as a participant Commitments/participants

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
Note 1: Unless specified, we are treating the initial actions listed below as a uniform set of outcomes, weighted equally.			
8000 Commitments to Use On-line Energy Advisor			
Installation of 200 Energy Feedback Devices to Change Daily Behavior			
7000 Retrofits of Household Lighting			
6,250 Complete a Home Energy Solutions Assessment			
Activity 1 – Events			
	What percentage of participants who made the commitment through events follow through with an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Event associated with commitment/participant
			Initial action - participant has taken an initial action
	Is recruitment of participants who end up taking initial actions evenly distributed across events, as compared to event attendance (aka is the proportion of action taking correlated to the number of people to which their was an opportunity to recruit?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Event associated with commitment/participant
			Event approximate attendance
			Initial action - participant has taken an initial action
	Is a particular event type correlated with an increased likelihood for participants to complete an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Event associated with commitment/participant
			Initial action - participant has taken an initial action
			Event type
	Does the likelihood of a participant taking an initial action correlate with having an existing relationship with the recruiting volunteer?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
			Initial action - participant has taken an initial action Volunteer have existing connection to participant? Volunteer who recruited participant
	Does a participant recruited by a volunteer with a relationship to a collaborating organization have a higher likelihood to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Initial action - participant has taken an initial action Volunteer - community organization associated with Volunteer who recruited participant
	Does a participant whose commitment was made public at an event or in local media have a higher likelihood to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
Activity 2 – Community Organizations			
			Initial action - participant has taken an initial action Instances that the commitment was recognized at the live event Online publications in which the commitment was recognized Number of print articles in which the commitment was recognized
	What percentage of participants who made the commitment in association with a collaborating organization follow through with an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Number of Commitments through collaborating organizations Initial action - participant has taken an initial action

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
	Are participants recruited at a collaborating organization's event more likely to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Event associated with commitment/participant
			Event associated with collaborating organization?
			Initial action - participant has taken an initial action
	Is in-person or indirect outreach through organizations more effective for participants that take initial actions?	observation and monovariate analysis (simple percentages) or multi-variate analysis	Commitments/participants
			Number of Commitments through collaborating organizations
			Number of Commitments associated with in-person outreach through collaborating organizations
			Number of Commitments associated with indirect outreach through collaborating organizations
	Are recruitment participants who took initial actions evenly distributed across organizations, as compared to organizational membership (aka is proportion of action taking correlated to the number of people whom there was an opportunity to recruit?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Number of Commitments through collaborating organizations
			Number of organization members
			Initial action - participant has taken an initial action
	Is a particular type of organization (or specific organization within a community) correlated with an increased likelihood for participants to to complete an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
			Number of Commitments through collaborating organizations Initial action - participant has taken an initial action Organization Type Organization Name
	Does a participant whose commitment was made public through a collaborating organization have a higher likelihood to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Number of Commitments through collaborating organizations Initial action - participant has taken an initial action Number of instances of collaborating organization recognizing commitment
	Does a participant whose commitment was made public through a collaborating organization have a higher likelihood to take an initial action than a participant whose commitment was made public through outlets unaffiliated with an organization?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
			Initial action - participant has taken an initial action Number of instances of collaborating organization recognizing commitment Number of Commitments through collaborating organizations Instances that the commitment was recognized at the live event Online publications in which the commitment was recognized Number of print articles in which the commitment was recognized

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
	Is a participant with multiple organizational affiliations more likely to take an initial action than a participant with only a single organizational affiliation?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Number of commitments indicating organizational affiliation Initial action - participant has taken an initial action
	Does the extent of an organization's internet presence affect the likelihood that an associated participant will take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Number of Commitments through collaborating organizations Initial action - participant has taken an initial action Does the organization have the following: a web site, a Facebook profile, a twitter account, or other social media tools?
	Is an organization that redeems its reward points more likely to have associated participants who take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Number of commitments indicating organizational affiliation Initial action - participant has taken an initial action Amount of points used by organization
Recruitment General			
	Is recruitment through events or through organizations more highly correlated with taking an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Initial action - participant has taken an initial action Number of commitments marked from community events number of commitments indicating organizational affiliation

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
	If the initial action taken by the participant is a commitment to join the online Energy Advisor, are they more likely to take other initial actions?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Initial action - participant has taken an initial action Initial action - action type
	Is a participant with an associated organization (whether recruited through an event or through a collaborating organization) more likely to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Initial action - participant has taken an initial action Number of commitments indicating organizational affiliation
	If the participant is notified about reward points immediately following making the commitment, are they more likely to take an initial action?	Experiment (see narrative for further details)	Commitments/participants Amount of points awarded to the participant for commitment Timing of award point notification Initial action - participant has taken an initial action
	If the participant is notified about reward points immediately prior to the request for initial action, are they more likely to take an initial action?	Experiment (see narrative for further details)	Commitments/participants Amount of points awarded to the participant for commitment Timing of award point notification Initial action - participant has taken an initial action

Appendix B: Outcome Evaluation Plan (aka Immediate Results)

Activity	Outcomes Evaluation Research Question	Research Method	Data Requirements
	If taking initial first actions provide sufficient reward points, when added to commitment points, to redeem for products, does this make participants more likely to take an initial action? (challenge is heterogeneous point programs)	Experiment (see narrative for further details)	Commitments/participants Amount of points awarded to the participant for commitment Point program type in which participant is enrolled Initial action - participant has taken an initial action
	Are participants who send invitations to others through the Energy Advisor more likely to take an initial action?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Initial action - participant has taken an initial action Number of invitations participant has sent through Energy Advisor

Appendix C. Impact Evaluation Plan (aka Ultimate Results)

Activity	Impacts	Impact Evaluation Research Question	Research Method	Data Requirements
Note: Unless otherwise noted, for the purposes of this evaluation, the impacts of energy (mmBtu), energy ($), and Emissions (MTCO2) are considered to be uniformly proportional to each other, and the following research questions use the generic term savings. This assumes a constant rate for electricity and a standard fuel mix for electricity production and heat consumption. This allows us to focus on the behavioral aspects of the program. This is accurate for electricity, as all participating communities are served by the same utility with the same fuel mix, assuming no contributions from renewables initially. However, the program may want to investigate the relative savings gained from households using the two different dominant fuel options: fuel oil and natural gas. The program might also want to investigate how savings are affected with the installation of rooftop renewables and the adoption of a green electricity product.				
Activity 1 – Events				
	General			
		Do participants recruited through events have differing savings based on the type of event at which they	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Event associated with commitment/participant Event type Energy Savings post-enrollment 1 year
		Does a participant have a higher rate of savings if they knew the volunteer who recruited them at an event?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Volunteer have existing connection to participant? Energy Savings post-enrollment 1 year
Activity 2 – Community Organizations				
		Do participants recruited through community organizations have differing savings based on the type	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants Number of Commitments through collaborating organizations Organization Type Energy Savings post-enrollment 1 year
		Is recruitment through events or through collaborating organizations more likely to be correlated with	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants

Appendix C. Impact Evaluation Plan (aka Ultimate Results)

Activity	Impacts	Impact Evaluation Research Question	Research Method	Data Requirements
				Number of Commitments through collaborating organizations Organization Type Energy Savings post-enrollment 1 year
Activity 2 – Recruitment General				
		Does any particular initial action taken by a participant result in more significant savings after 1 year?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
				initial action - participant has taken an initial action initial action - action type Energy Savings post-enrollment 1 year
		What combination of initial actions maximize energy savings after 1 year?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
				initial action - participant has taken an initial action initial action - action type Energy Savings post-enrollment 1 year
		Is recruitment through events or through collaborating organizations more likely to be correlated with savings maintained over the long	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
				Number of Commitments through collaborating organizations Organization Type Energy Savings post-enrollment 1 year Energy Savings post-enrollment years 2-5
		Is the number of connections that a participant makes in Energy Advisor correlated with greater savings?	observation and statistical analysis (multi-variate regression analysis)	Number of connections participant has on Energy Advisor Commitments/participants

Appendix C. Impact Evaluation Plan (aka Ultimate Results)

Activity	Impacts	Impact Evaluation Research Question	Research Method	Data Requirements
				Energy Savings post-enrollment 1 year
		Does a participant whose commitment was made public more likely to have higher energy savings?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
				Number of instances of collaborating organization recognizing commitment
				Instances that the commitment was recognized at the live event
				Number of print articles in which the commitment was recognized
				Online publications in which the commitment was recognized
				Energy Savings post-enrollment 1 year
		Does a participant whose commitment was made public maintain savings over the long term?	observation and statistical analysis (multi-variate regression analysis)	Commitments/participants
				Number of instances of collaborating organization recognizing commitment
				Instances that the commitment was recognized at the live event
				Number of print articles in which the commitment was recognized
				Online publications in which the commitment was recognized
				Energy Savings post-enrollment years 2-5
		What is the extent of energy savings are made by individuals who never move beyond small actions? Is it	observation, statistical analysis (multi-variate regression analysis) and qualitative analysis	small actions taken by participant

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