Empowering Consumers to Reduce Residential Energy Waste: Designing, Implementing, and Evaluating the Connecticut Neighbor to Neighbor Energy Challenge

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Abstract

This thesis considers behavior change strategies to increase CT residential energy efficiency uptake in the context of an action research pilot. Action research includes experimental pilot deployment within a real-world system, continuously analyzing customers participating in their daily lives. The approach allows for simultaneous planning, execution, and evaluation, as well as concurrent development of major program changes, real-time solutions, and innovative responses.

The Connecticut Neighbor to Neighbor Energy Challenge (N2N), in which my research was conducted, was designed to determine the minimum conditions necessary to administer cost-effective community- and behavior-based energy efficiency programs. Customers in 14 small towns complete energy savings actions, such as efficient lighting, weatherization, and upgrades, like insulation, appliance upgrades, advanced air sealing, and renewable energy installations. N2N meets customers where they are already going (*e.g.,* in the field) by partnering with local community groups, town governments, low income and senior organizations, faith communities, education facilities, and business organizations, and using social and earned media channels.

I describe the N2N opportunity; program design, execution, and evaluation; primary behavioral research, especially the DOE Home Energy Score behavioral economics experiment; and the post-grant transition process. Four main pilot implementation components were used, including: lead generation using behavioral marketing, research, and outreach approaches; a technology platform closely tracking the customer; a continuous process of evaluation; and frequently published results dashboards.

The research discovered gaps in program performance that will hinder meeting CT's long-term energy, efficiency, and carbon reduction goals. N2N is also finding evidence of increasing rates of upgrade uptake, where word of mouth and self-herding (*e.g.,* where people follow past behavior) leads to action for others, as well as additional actions in individual households, respectively. The research finds two main recommendations for CT energy efficiency programs: 1) Continue to fund fast-paced, testing grounds for efficiency programs outside of current regulatory constraints to: inform program design and policy decisions, as well as direct market innovation, and 2) Use social and behavioral approaches to encourage viral spreading of efficiency uptake.

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List of Acronyms and Abbreviations

ACS	American Community Survey
ANOVA	ANalysis Of VAriance regression methodology
ARRA	American Recovery and Reinvestment Act of 2009
BB	Better Buildings
BBNP	(DOE) Better Buildings Neighborhood Program
C&LM	Conservation & Load Management
CBSM	Community Based Social Marketing
CCEC	Connecticut Clean Energy Communities (under CEFIA)
CCEF	Connecticut Clean Energy Fund (now CEFIA)
ccf	hundred cubic feet [of natural gas]
CEEF	Connecticut Energy Efficiency Fund (ratepayer fund)
CEFIA	Clean Energy Finance and Investment Authority
CFLs	Compact Fluorescent Light bulbs
CFM_{50}	Rate of air leakage in cubic feet per minute with building pressurized to 50 Pascal's
CL&P	Connecticut Light & Power (under NU)
Corps, the Corps	N2N Clean Energy Corps, made up of SCA staff
CRM	Customer Relationship Management (IT system and database)
CT	Connecticut
CTCEO	CT Clean Energy Options
CWF	Clean Water Fund
DC	District of Columbia
DEEP	CT Department of Energy and Environmental Protection
DIY	Do-it-Yourself
DOE	United States Department of Energy
DPUC	Department of Public Utilities Commission (now PURA)
EE	Energy Efficiency
EECBG	Energy Efficiency Community Block Grant
EIA	Energy Information Administration
EM&V	Evaluation, Measurement, and Verification
EPA	U.S. Environmental Protection Agency
FOA	Funding Opportunity Announcement
GHG	Greenhouse Gas
HES	CT Home Energy Solutions assessment
HES-IE	CT Home Energy Solutions Income Eligible (low income program)
HEScore	DOE Home Energy Score
HEY	EPA Home Energy Yardstick
HPwES	Home Performance with Energy Star
HVAC	Heating, Ventilation, Air Conditioning
IT	Information Technology
JE	Joint Evaluation
kWh	kilowatt-hour
LCV	Lifetime Customer Value
LEAP	Local Energy Alliance Program (fellow DOE BBNP grantee)
LED	Light Emitting Diode (light bulb)
M&V	Measurement and Verification
MMBtu	Million British Thermal Units
MW	Megawatts

mWh	Megawatt-Hour
N2N	Connecticut Neighbor to Neighbor Energy Challenge
NREL	National Renewable Energy Laboratory
NU	Northeast Utilities (parent company of CL&P)
PAR	Participatory Action Research
PURA	Public Utilities Regulatory Authority (formerly DPUC)
PV	Photovoltaic
Q1, Q2, Q3, Q4	Quarter 1, 2, 3, 4
QA/QC	Quality Assurance/Quality Control
REC/RECs	Renewable Energy Credit(s)
RFP	Request for Proposal
RFQ	Request for Qualification
RGGI	Regional Greenhouse Gas Initiative (*i.e.,* Northeast and Mid-Atlantic carbon market)
SCA	Student Conservation Association (*i.e.,* AmeriCorps and N2N Clean Energy Corps)
SE	Separate Evaluation
UI	United Illuminating (CT utility)
UK	United Kingdom
U.S.	United States of America
WIIFM	What's In It For Me?
WTP	Willingness to Pay and Willing to Pay

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As I finish writing this, the only thing that I am 100 percent certain about is that I have not acknowledged all of those that were integral to my success. For this, I apologize. I am forever grateful to everyone that has helped me, sharing his or her time with me in so many different ways.

Chapter 1 Introduction

In the U.S., residential buildings consume one-fifth of energy use, and homes waste up to 50 percent of energy use mostly through air leakage and behavioral actions (APS, 2008; EIA, 2007; NRC, 2010). The U.S. and the rest of the world are facing energy and climate challenges that require a massive scale up of energy efficiency and clean energy production in residential buildings (M. Fuller et al., 2010). Yet, a well-established literature documents the "efficiency gap", where cost-effective efficiency measures are not completed due to various barriers to the customer, or collectively, the hassle factor of completing upgrades (H Allcott & Mullainathan, 2012; Hunt Allcott, 2009a; Choi Granade et al., 2009; Laitner, Ehrhardt-Martinez, & McKinney, 2009; NRC, 2010; P. C. Stern & Aronson, 1984; Paul C. Stern et al., 1987; L. Wood & Risser, 2009).

Residential efficiency relies on behavior change, where people can either update building envelopes and equipment, or change the operational habits when using equipment that consumes energy. Past energy efficiency research focuses on addressing pieces of the residential puzzle. The CT Neighbor to Neighbor Energy Challenge (N2N) arose to fill the real-world residential energy efficiency gap in CT, where:

- Household electricity use has increased 10 to 15 percent between 2000 and 2010 (DOE, 2013a; Stakeholder3, 2012; Stakeholder8, 2012),

- Electricity rates rose by 90 percent with CT residents paying the second highest rates in the United States (DOE, 2013a), and

- The state set goals to weatherize 80 percent of CT homes by 2030, including 20 percent of homes achieving 25 percent energy savings (Ananthachar et al., 2012; Connecticut, 2011; Stakeholder3, 2012).[1]

Rising rates mean that households that have completed energy efficiency upgrades still pay higher bills over time (Stakeholder10, 2012). This scenario makes driving demand for energy efficiency programs more difficult, as people don't believe the upgrades make a difference in energy use or bills (Shelton, 2012). In other words, customers lack trust of the results and the motivation to take on the hassle of energy upgrades.

At the same time, CT is passing aggressive weatherization goals described above, relying on the utility-administered Home Energy Solutions (HES) assessment and upgrade rebate programs to meet these goals. N2N grant partners recognized an untapped opportunity to pilot program delivery innovations, because: "If CT hopes to meet statewide goals to weatherize 80 percent of CT homes by 2030, the state needs new thinking, new approaches, more stakeholders, and better statewide coordination" (Stakeholder8, 2012) (Stakeholder3, 2012).

In fact, addressing the energy efficiency gap in CT relies on incorporating a systems view to program design, considering numerous interacting and changing subsystems that influence energy efficiency upgrades and operational behavior change, including:

- Contractor and customer incentive structures,
- Program administration and contractor oversight, and

[1] Regarding Stakeholder references, the author conducted 26 in-depth interviews with various stakeholders. Quotes from interviews are anonymous to preserve confidentiality and to encourage critical and honest responses. See the methodology Sections 1.1.3 and 1.2 for more information.

- Customer behavior, including motivations, barriers, and awareness.

All three subsystems exhibit unique behavioral challenges that need addressed. N2N is a large-scale experimental implementation that aims to diffuse a community-based and behaviorally-influenced marketing and outreach program leading to completed whole home energy efficiency projects. The thesis is organized as follows:

Chapter 1: High-level overview, including the opportunity, goals, methodology, data, and key recommendations.

Chapter 2: Pre-experiment research and program design, including the energy behavior change literature review, and the N2N pilot design prior to receiving the N2N grant.

Chapter 3: Program execution and developmental evaluation history for pilot Years 1 and 2, including program start-up, lighting visit execution, and upgrade performance, as well as an overview of the CT regulatory structure;

Chapter 4: Market segmentation research including, analysis and findings from the DOE Home Energy Score (HEScore) experiment, as well as data HES assessment follow up customer survey;

Chapter 5: Transition into a sustainable program model, including N2N lessons learned, recommendations, and future research directions.

1.1 Introduction to N2N

N2N was awarded $4.2 million on August 10, 2010 to run a two-year pilot program (plus one year of transition and evaluation) (Award No. EMCBC- 00969-10).[2] In the fall of 2009, the U.S. Department of Energy (DOE) competitive *BetterBuildings Neighborhood Program* grant announcement provided an opportunity to test an innovative program model and hypotheses for improving Connecticut's residential energy efficiency programs. N2N's goal was to engage 10 percent of households to reduce their energy usage by 20 percent through energy upgrades and clean energy measures.[3] N2N hoped that customers would complete comprehensive home energy efficiency and clean energy measures, and that N2N would achieve broader penetration than existing utility-administered regulated programs.

In the N2N footprint, Connecticut Light and Power (CL&P) provides the electricity and administers the ratepayer fund programs. The original pilot design relied on two ratepayer-funded programs to subsidize the grant's marketing, outreach, and evaluation spending, including:

- Home Energy Solutions (HES) assessments with direct efficiency installations, opening access to
- Follow on rebates for upgrades, such as insulation, appliance, windows, and Heating, Ventilation, and Air Conditioning (HVAC).

The ratepayer fund (*i.e.,* the CT Energy Efficiency Fund (CEEF)) and N2N have a formal partnership agreement to allow N2N to leverage existing state programs and subsidies. However, by the pilot's third year, N2N shifted marketing and outreach resources to acquiring customers straight to the upgrades, including Home Performance with Energy Star (HPwES), independent contractor partnerships, solar

[2] The website provides more information about the CT Neighbor to Neighbor Energy Challenge (N2N): http://ctenergychallenge.com.

[3] This thesis provides the framework for the forthcoming quantitative evaluation (July 2013). Early results show that N2N will not meet the original program goals for reasons explained throughout the thesis, especially Chapter 3.

photovoltaic (PV), *etc.*. N2N almost exclusively acquired leads for the HES assessment program the first two years, having limited N2N influence over the contractor network and heavy reliance on CL&P-selected HES assessment contractors and the HES program incentive structures.

The average CT household spends approximately $3,500 per year on energy (Colton, 2012; Turmelle, 2012). Numerous inefficient homes in CT use about 30 percent more energy than efficient ones use (APS, 2008; NRC, 2010). The N2N pilot was designed to lead to ongoing, sustainable energy efficiency and clean energy diffusion, as well as long-term market transformation in 14 towns in CT, including: Bethany, Cheshire, East Haddam, East Hampton, Glastonbury, Lebanon, Mansfield, Portland, Ridgefield, Weston, Westport, Wethersfield, Wilton, and Windham. See Appendix A for N2N Town Demographics and Electricity Consumption Information tables.

The 14 selected towns include the following characteristics:

- CT clean energy leadership history in related CT programs, such as the CT Clean Energy Communities Program (Stakeholder3, 2012; Stakeholder10, 2012).

- Geographic spread across CT with a mix of:
    - suburban low and medium density and rural geographies, as well as
    - incomes ranging from low-income to affluent.

- Combined population of about 97,000 households.

N2N piloted the following program elements:

- An integrated set of energy efficiency programs, including a comprehensive online platform incorporating needs of policymakers, communities, contractor networks, and households, as well as program administrators, implementers, and evaluators;

- An on-the-ground outreach team conducting community-based social marketing and outreach, acquiring leads and completed actions from community events, call nights, organizational partnership co-marketing, social media, *etc.*;

- A performance-based incentive program to reward towns and community groups for meeting goals and targets; and

- A thorough evaluation program to demonstrate the value of aggregated residential energy savings and to support:

    - Continuous evaluation of the efficacy and economics of each program approach at various phases of deployment, enabling almost real-time course corrections;
    - Identification of best practices; and
    - Aggregation of both in-home lighting visit energy savings and clean energy production to monetize in the state's Renewable Energy Credit (REC) energy trading markets.

N2N required a diverse set of skills; therefore, N2N employed a multi-disciplinary team with expertise in community outreach, energy education, marketing, media relations, social media, behavioral science, project management, policy development, web-based design and software tools, and performance evaluation. Earth Markets, a social venture company, led the development of the grant application,

organizing a consortium of public, private, academic, and non-profit organizations to administer, execute, evaluate, and report on N2N, including the following organizations:

- The Connecticut Clean Energy Fund (CCEF) (now the CT Clean Energy Finance and Investment Authority (CEFIA), or the State's "green bank") for grant and renewables funding administration;
- Earth Markets as program manager, including program design, implementation, and evaluation;
- Clean Water Fund for program implementation to develop and manage outreach and community organizing;
- The Student Conservation Association, acting as the Clean Energy, providing grassroots outreach and the in-home direct install lighting program;
- SmartPower for marketing strategy and implementation;
- Snugg Home, the technology platform development, and Mobile Genius[4], for the lighting mobile application development;
- The Connecticut Energy Efficiency Fund, the state ratepayer funding administrator providing direct install residential efficiency programs, rebates on insulation, appliances, windows, and HVAC equipment, customer financing, and funding for a municipal rewards program; and
- The MIT Field Intelligence Lab and EMpower Devices partnership providing behavioral strategy and messaging advising, program design, and evaluation, measurement, and verification.[5]

See Appendix E for details about the N2N project team and key stakeholder roles.

As author of the developmental evaluation, it is important to note that I have worked closely with the N2N team from grant writing to thesis writing (and the forthcoming research). My main role was to evaluate the program, sometimes in real-time, but I performed several other duties along the way, including:

- Contributing to the grant application,
- Editing marketing and communication materials using behavioral science,
- Training outreach staff on and leading research projects using behavioral techniques,
- Leading development of the technology platform used for data collection, analysis, and reporting, which was an unexpected program need, and
- Leading N2N forthcoming quantitative evaluation and cost-effectiveness models.[6]

The N2N pilot steps customers through energy efficiency and clean energy actions to achieve household energy savings. N2N uses Community Based Social Marketing (CBSM) (D. McKenzie-Mohr, 2008) to

[4] Mobile Genius partnership developed through MIT with Thomas Rand-Nash, MIT ESD PhD.
[5] Note: Kat Donnelly, thesis author, is the Field Intelligence Lab representative, and is leading the evaluation work for EMpower Devices, a consortium primarily of MIT graduate students, recent graduates, as well as academic affiliates, such as in-kind research contributions from MIT, the University of Chicago National Opinion Research Center, Lawrence Berkeley National Lab, the University of Cambridge, and the DOE.
[6] Although I have made every effort to remain neutral and critical, my understanding of human behavior teaches me that it is impossible for me to be completely free of bias. For instance, I am emotionally committed to the success of N2N because the project has consumed my energy for three years.

meet customers where they spend their time (Stakeholder3, 2012; Stakeholder8, 2012) (*i.e.*, in the field) by:

- Partnering with local community groups, town governments, low income and senior organizations, faith communities, education facilities, and business organizations;
- Leveraging social and earned media channels; and
- Partnering with contractors and utility-administrators.

Using a portfolio approach, residents enter the N2N "ladder of sustainable energy actions" (Stakeholder8, 2012) at different points based on their individual household and past behavioral characteristics. After signing up, N2N attempts to continuously engage each customer through a wide variety of communications channels to increase their levels of energy savings and clean energy usage over time. In this way, N2N was set up to bring together the numerous resources in the state and to provide support to the households to complete energy upgrades.

N2N softly launched the pilot in November 2010 without the N2N technology platform in place (*i.e.,* the data collection and tracking system). N2N publically launched in March 2011 (See Section 2.7, High-Level Timeline). Over the course of the grant, N2N built a sophisticated customer relationship management (CRM) platform used for program execution and evaluation. The next research steps include developing a cost-effectiveness and scenario planning tool, as well an approach to calculating the lifetime value of acquiring a customer to a whole portfolio of customer energy actions. A portfolio approach to cost-effectiveness appears to be the future of performance monitoring for energy efficiency, but is not yet fully formed in academia or adopted in practice.

Section 1.2 provides the framework for the N2N program through the research methodology of Community-Based Social Marketing. The remainder of the thesis represents the N2N developmental evaluation based on the author's participation from pilot concept in the program design and administration, marketing and outreach, as well as research and evaluation, focusing on approaches that worked and didn't work throughout the program, as well as the factors shaping these outcomes.

1.1.1 The opportunity for N2N

N2N is an attempt to bring performance-based program administration into CT, using Lifetime Customer Value (LCV) approach adapted to the residential efficiency space.[7] LCV places emphasis on the total customer participation over the program life, spreading out the cost of acquiring this customer over the total number of actions they take (Shaw and Stone 1988). The business goal is to have an ongoing relationship with the customer and place a dollar value on that relationship by cross-selling or upselling additional products and services (*i.e.*, N2N ladder of actions). In the efficiency space, the goal is higher customer energy savings over time as the home becomes more and more efficient and/or generates clean energy. N2N measures the 'V' (Value) in LCV in negawatts[8] (but it can be measured in addition to or instead of revenues or profits, depending on the program).

The LCV approach can be used to improve program cost-effectiveness performance by making the experience more valuable to the customer. In fact, N2N hopes to become a trusted ally to make saving energy in the home easy by:

1. Bringing together available incentives,
2. Selecting pre-qualified contractors,

[7] See Appendix D, The N2N Value Proposition, for more detail.
[8] Amory Lovins of the Rocky Mountain Institute coined the term "negawatts"; he defined a negawatt as one megawatt of electricity conserved for one hour.

3. Understanding and guiding the participant through each step of the process,
4. Helping them track energy savings over time,
5. Providing behavioral prompts, triggers, and reminders (*i.e.,* multiple customer touch points),
6. Connecting them to neighbors to share their experiences, and
7. Helping their community earn rewards.

Improving program performance provides an opportunity to reach N2N goals with little additional costs.

1.1.2 N2N goals

N2N administrative, outreach, and evaluation partners view N2N as "a start for addressing customer needs that will help drive energy efficiency through innovative program design, delivery, data handling, and evaluation work" (Stakeholder8, 2012). By Year 2, N2N and several outside stakeholders recognized the difficulties of operating within the existing utility-administered HES assessment program with limited influence over the contractor network, the customer incentives, and quality assurance programs (Stakeholders1through10, 2012). Despite recognizing the deficient sales pipeline during Year 1, N2N remained focused on piloting within an existing, regulated contractor market[9] to achieve the following goals to:

1. Increase long-term residential energy efficiency upgrade demand and program cost-effectiveness using outreach strategies based on community based social marketing and behavioral strategies;

2. Market the existing Home Energy Solutions (HES) utility-administered program as a first step to lead people to invest in deeper improvements in their home;[10] and

3. Use robust data collection and analysis to support real-time program administration, as well as a variety of research and evaluation initiatives, leading to real-time program course correction and longer-term market transformation and innovation activities (See Appendix B for an overview of N2N's data-driven process).

I used a developmental evaluation research methodology (Patton, 2011) based on Community-Based Social Marketing (CBSM) (D. McKenzie-Mohr, 2008) to pilot solutions to apply in CT and beyond. Importantly, developmental evaluation, or action research, recognizes that both successes and failures will occur (Burns, 2007) before discovering the optimal mix of programs and processes. The N2N approach of testing, learning, and adapting yields small, continuous process refinements and course corrections, using three main components to support the approach:

1. A technology platform that tracks the customer through the entire sales pipeline of energy action;
2. Behavioral research; and
3. Results dashboards frequently published by N2N.

For regulators, cost-effectiveness is the only measure of program success or failure, but for a third-party administrator with outside funding, like N2N, there is room to test, adapt, learn, and refine the processes.

[9] DOE grantees were selected to pilot a variety of program approaches with most programs testing independent third-party administered approaches (*i.e.*, providing incentives directly from grant funds rather than from utility-administered ratepayer funds).

[10] This is the most difficult of the three challenges due to market barriers, such as misaligned contractor incentives for, along with a pervasive attitude towards, the "one and done" of completing the HES assessment and moving on to the next customer (discussed further in Sections 3.3 and 3.4) (Stakeholders1through10, 2012).

1.1.3 Overview of research methodology

Detailed further in Section 1.2, N2N was developed to test a comprehensive, Community-Based Social Marketing (CBSM) field study to better understand residential energy efficiency behavior change potential (D. McKenzie-Mohr, 2008). Spearheaded by the author, N2N's data-driven testing approach is a form of participatory action research, also called developmental evaluation, which enables adaptive program design and implementation. Action research includes continuously analyzing a real-world system (in this case, the N2N Energy Challenge pilot) with actual customers participating in their daily lives (Burns, 2007). Action research is based on "clear performance metrics and targets (the expected outcomes), rapid feedback of results (the actual outcomes), and a culture where small failures are tolerated (and learned from)" with rapid turnaround of iterative solutions" (Honebein et al 2009).

Importantly, N2N uses actual participants acting in their everyday lives within existing programs administered by real people collecting real data. The constantly changing implementation strategies often make it difficult to draw definitive quantitatively supported conclusions.

Still, the N2N team continually assesses progress focused on maximizing completed home energy upgrades and cost-effectiveness. Explained further in Section 2.6.2, N2N staff critically access program dashboards and reports on a weekly basis, meeting with outreach and contractor staff to discuss findings and solutions. N2N has focused on three primary areas:

1. Managing and incrementally improving N2N contractor performance;
2. Measuring and improving N2N staff and volunteer outreach performance; and
3. Assessing and refining N2N marketing messages.

To date, the N2N research methods are mainly qualitative, including data analysis on 26 in-depth stakeholder interviews and numerous technical advisory committee meetings. For instance, I conducted interviews and collected input from N2N-related stakeholders across CT, including N2N staff, community activist, politician, regulator, utility, contractor, participant, early adopter, and community partner stakeholders. The stakeholders represented a mix from all 14 N2N towns, including towns considered both successful and unsuccessful. Stakeholder interview transcripts, testimonials, and meeting participation data were entered into a mixed-methods (*i.e.*, qualitative and quantitative) software program, Dedoose, to enable a grouping of ideas and concepts, as well as the development of necessary follow up research areas. Customer surveys were also collected and analyzed, as well as several program data collection sources used for the listening to the voice of the customer analyses (Burchill & Brodie, 2005).

In addition to the qualitative methods, I conducted primary behavioral research within the N2N population of participants, completing a behavioral economics experiment designed to compare homeowners' willingness to pay (WTP) for upgrades based on receiving varying levels of information about an example home's energy performance. The experiment examined three different housing situations, including people in the market to buy or sell a home, as well as those planning to stay in their current home. The home energy performance information levels were delivered through three different versions of the DOE's Home Energy Score (HEScore) and report that were all modified by the researchers.

Chapters 1, 2, 3, and 5 include the N2N qualitative research, while Chapter 4 is focused on the primary behavioral research, especially the HEScore survey and results.

1.1.4 N2N data

The technology platform has supported N2N by enabling real-time data collection, analysis, and reporting, as well as enabling the team to set and track goals for outreach and contractor performance. The data collected over the course of N2N includes information on:

- Customer leads, including numbers, outreach sources, and contractor follow up levels,
- Household energy efficiency actions,
- Contractor performance,
- Outreach activities and participant outcomes,
- Household energy efficiency action cost and savings, as well as monthly electricity usage provided by CL&P, the partner utility,
- Stakeholder and partner discussion documentation,
- DOE *BetterBuildings* program resources, and
- CT census data.

Table 1 represents N2N program penetration through March 2013 into the 14 towns with approximately 97,000 households.

Table 1 N2N Program Accomplishments (11/1/10 through 3/31/13)

Category	**Totals through 3/31/13**
Coalition partners signed	133
Outreach events	1,000+
Workshops	80
Media Hits	265
Participants	10,870
HES signups (% of participants)	5,784 (53%)
HES visits completed (% of signups)	3,262 (56%)
Upgrades completed (% of HES)	328 (10%)
Upgrades financed (% of total)	22 (8%)

N2N publishes monthly contractor scorecard and program summary visual dashboards, using the results to inform program design and reporting the data to state policymakers on a monthly basis. Transparent data has also enabled a focus on contractor performance, helping streamline customer sales processes.[11]

1.1.5 Key recommendations

N2N has provided a fast-paced, testing ground for energy efficiency programs, not possible within current CT utility-administered programs operating under regulatory constraints and timelines. The program leaves behind assets that CT should use to continue to test, learn, and quickly adapt program design. Based on evaluation to date, the next version of N2N should include a third-party administrator building on the N2N lessons learned in community-based organizing, contractor coordination and support, and behavioral marketing, including recognizing the following general principles:

1. The most important factor driving home energy upgrades is the contractor market. In CT, misaligned contractor and customer incentives leave little motivation to sell the customer to increased lifetime energy savings despite aggressive statewide energy efficiency goals.

[11] Observed from N2N historical contractor data.

2. Developing marketing and outreach approaches using the latest in behavioral science and community based social marketing techniques should result in broader customer reach and increased motivation to complete harder energy upgrades.

3. A sophisticated technology platform supports research and evaluation, data transparency across stakeholders, program reporting, contractor support, and faster market transformation than would otherwise be seen in energy efficiency programs.

In fact, based on 2 ½ years of program operation and continuous evaluation of outcomes, N2N recommends that energy efficiency and clean energy programs include the following specific recommendations at a minimum:

- Social, targeted marketing campaigns and toolkits, including co-marketing with trusted sources;
- Alignment of contractor policies and incentives with structured quality assurance and control programs;
- Well-documented and clear contractor expectations, including providing customer service support and coordination of installations;
- Stable funding for all heating fuels, including electricity, natural gas, oil, propane, wood, *etc.*;
- A well-defined third-party program administration structure; and
- The ability for program administrators to try approaches, fail, and correct, especially in the early years of program administration.

Beginning in June 2013, N2N will compare the cost-effectiveness of the N2N community-based program with the traditional utility marketing approaches in CT. Based on the final results of the cost-effectiveness modeling, N2N will recommend the next program iteration, the N2N Innovation Lab (Stakeholder3, 2012; Stakeholder8, 2012). The intention is to operate in existing N2N towns, and spread into new towns using the most cost-effective outreach, marketing, and contractor approaches. The Innovation Lab could also help the state analyze and resolve issues around serving low-income, elderly, and other problematic market segmentations.

The N2N Innovation Lab concept is unique to CT energy efficiency programs. It would allow quick testing of approaches, integration of a portfolio of energy efficiency and clean energy programs (*e.g.*, lifetime customer value), and a process of continuous improvement that isn't possible within the existing utility-administered programs. The N2N research lays the groundwork to support the need for and program design of the N2N Innovation Lab. Forthcoming N2N quantitative evaluation and cost-effectiveness scenario modeling activities will refine lessons learned and recommendations stemming from the N2N pilot.

1.2 Community-Based Social Marketing Research Methodology

Introduced in Section 1.1.2 and described in more detail next, the N2N pilot program followed the Community-Based Social Marketing (CBSM) research methodology (D. McKenzie-Mohr, 2008).

1.2.1 CBSM background

Human psychology and behavior change methodologies have been surprisingly lacking in energy efficiency programs (D. McKenzie-Mohr, 2008; Midden, Kaiser, & McCalley, 2007). Most programs designed to encourage behavior change generally use one of two approaches:

1. Information-based campaigns to affect attitudes and result in behavior change, and
2. Economic self-interest programs (D. McKenzie-Mohr, 2008).

N2N was designed to explore more complex social, emotional, and cultural approaches to changing behavior.

McKenzie-Mohr highlights that little attention has been paid to ensure a high likelihood of actually achieving results or permanently changing behaviors in his widely referenced book, Fostering Sustainable Behavior (ibid.). He finds that short-term information-based campaigns that aim to educate consumers to enhance knowledge or to change attitudes frequently have little or no effect upon behavior (ibid.). In addition, changing people's behavior can take time. For instance, sometimes people change attitudes slowly over time with public opinion and social norms as evidenced by the change in attitudes towards public cigarette smoking over the last four decades (Christakis & Fowler, 2008), where the prevalence of smoking has declined from 45 percent to 19 percent (CDC, 2013).

In fact, "there is often little to no relationship between attitudes and/or knowledge, and behavior" (D. McKenzie-Mohr, 2008). For instance, a study on the attitudes of recyclers and non-recyclers found that they did not differ (De Young, 1989). There are likely barriers in the way, or limited personal relation to the benefits for those with the same beliefs that are not taking action (D. McKenzie-Mohr, 2008).

Economic self-interest campaigns assume that people take the time to rationally evaluate options to improve the efficiency of their homes (D. McKenzie-Mohr, 2008), which in itself is a time-consuming and costly process. Many programs have approached sustainable behavior change assuming that an information campaign and an adequate financing mechanism will automatically garner success (ibid.). For instance, the CT utility marketing programs largely take this approach, trying to acquire customers using costly, untargeted, and inadequate marketing campaigns. According to a U.S. National Research Council (NRC) study, an economic approach to human behavior overlooks "the rich mixture of cultural practices, social interactions, and human feelings that influence the behavior of individuals, social groups, and institutions (Paul C. Stern, 1992)."

While CT regulators aim for 25 percent household energy efficiency, utility-administered programs aimed at electricity efficiency often result in only two to 15 percent change in behavior, and can cost more than physically making the technology change for the person (*e.g.* adding the insulation, changing out the light bulbs, *etc.*.) (Darby, 2006; Faruqui, Sergici, & Sharif, 2009; Fischer, 2008). The past efficiency approaches, while possibly a first step in changing behavior, address only a few of the barriers that prevent people from engaging in sustainable behavior.[12]

Another difficulty with behavior change strategies is that they need to be specific for each and every different behavior needing changed (D. McKenzie-Mohr, 2008). This means that strategies aimed at turning out the lights are much different that strategies aimed at deep home weatherization. Therefore, programs should start first with determining which individual behavior change actions being targeted by the program (ibid.).

Instead, Community-Based Social Marketing (CBSM) is a social behavior change strategy designed to engage and activate people, drawing heavily on research in social psychology from public health. It has specifically been designed to "foster sustainable behaviors", working in incremental steps because people

[12] For instance, people often take the more convenient, less sustainable approach, such as purchasing a disposable cup of coffee, buying a bottle of water or soda, or throwing away compostable food scraps in the garbage. They may be aware of the environmental impacts, and may even feel a small amount of guilt for the action.

often change their behavior slowly over time. The program design is targeted at the individual's reasons about why they care about energy efficiency. In addition, it should offer people a way to change their behavior when they are ready for it. (D. McKenzie-Mohr, 2008; McKenzie-Mohr, 2009)

1.2.2 Mapping CBSM to N2N

As outlined in

Figure 1, N2N adopted the following five-step CBSM approach to encourage participants to complete progressively harder and harder energy efficiency and renewable actions, including:

1. Identifying barriers to the targeted energy efficient behavior (*i.e.*, literature review, as well as survey, ethnologic, and in-depth interview data);

2. Designing a strategy using behavior change principles and tools (*i.e.*, the program design, behavior experiments, and marketing and outreach interventions);

3. Testing the strategy with a segment of the social community (*i.e.*, 14 N2N towns);

4. Measuring and evaluating the impact (*i.e.*, this thesis, and forthcoming publications); and

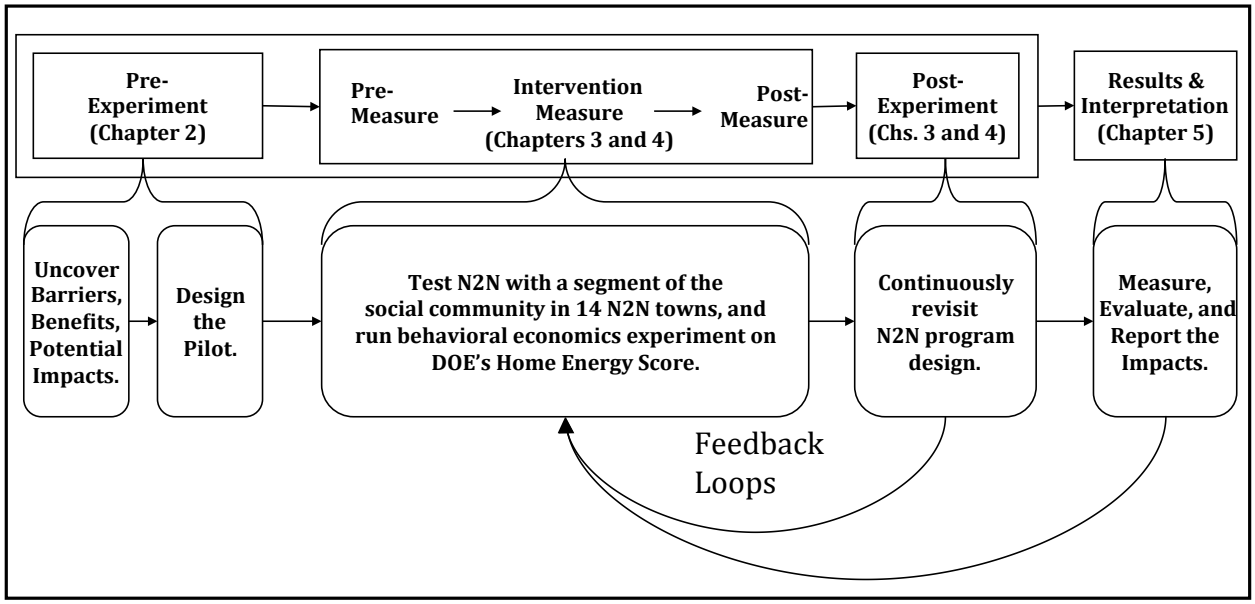
5. Redesigning or refining the strategy (*i.e.*, the developmental evaluation) (D. McKenzie-Mohr, 2008).

Figure 1 provides a framework of the formal research methodology in the top row: a quasi-experimental design based on Campbell and Stanley (Campbell & Stanley, 1963). Mixed-methods experimental approaches combine quantitative and qualitative research methodologies with before and after intervention treatments (Babbie, 2010; J. Churchill, G. A., 1995; Creswell & Plano Clark, 2007; McKenzie-Mohr, 2008).

The bottom row represents the steps taken in the CT Neighbor to Neighbor Energy Challenge (N2N) pilot to test a comprehensive field study. The first two steps in the bottom row, the N2N program design, started pre-grant with the author's PhD behavioral science literature review that explored the barriers, benefits, and potential impacts to individual energy efficient behaviors summarized in Chapter 2 (*i.e.,* the pre-experiment research). The literature review contributed to the design of the experiment, and specifically explores understanding the energy user's psychology, norms, and perceived behaviors to drive demand for home performance upgrades. These pre-experiment findings, along with DOE grant requirements, shaped the program design and the individual and social behavior change approaches used by N2N.

Chapter 2 describes the pre-experiment research and pilot design. Chapter 3 describes the N2N program history and execution in detail, including the first two years of pilot testing. Chapter 4 details the Home Energy Score behavioral economics experiment, in addition to other primary N2N behavioral research. Finally, Chapter 5 ties the results and interpretation together through the lessons learned about the necessary conditions for executing a cost-effective N2N program going forward.

Figure 1 Mapping the N2N CBSM Approach to PhD Mixed-Methods Experimental Design



Methodology based on (Creswell & Plano Clark, 2007) (Sullivan, 2009) (McKenzie-Mohr, 2009) (J. Churchill, Gilbert A. & Iacobucci, 2002). Note that the thesis chapters are mapped to the formal research methodology, and the Chapter topics are shown on bottom row, including the N2N program steps that comprise the real world field experiment (i.e., the CBSM).

Chapter 2: N2N Pre-Experiment Research and Program Design

Chapter 2 describes the individual and social behavior science that informed the pre-grant Connecticut Neighbor to Neighbor Energy Challenge (N2N) program design.

As recognized by energy experts and succinctly stated in a report by the United Kingdom (UK) government: "Most energy is consumed highly inefficiently" (DTI 2006).[13] In fact, a big portion of the remaining cost-effective energy efficiency potential depends on changing the "*behavior* of the technology *users"* (Sullivan, 2009). Several studies find that behaviorally driven changes could enable households to reduce residential energy consumption by almost 30 percent, or about 11 percent of total U.S. energy consumption in the next 5 to 10 years (Choi Granade et al., 2009; Gardner & Stern, 2008; Laitner et al., 2009; Nadel, Shipley, & Elliot, 2004).

Reductions of this magnitude would reduce resource consumption, but more research is needed to understand actual energy use impacts within a real world environment. In fact, getting households to consume less energy is difficult due to two interacting complexities:

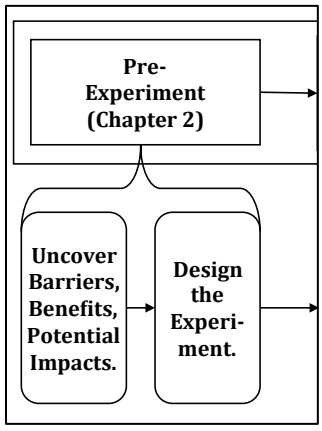
1. The energy system itself, and
2. The combinations of approaches necessary to induce actual energy-related behavior change.

Chapter 2 considers the complexities of human behavior and the process (system) of completing energy efficiency actions by describing two aspects of the pre-experiment research (Figure 2, a subset of

Figure 1):

1. The literature review (*i.e.*, uncovering the barriers, benefits, and efficiency potential of the experiment), and
2. The N2N pilot's experimental design.

Figure 2 CBSM Pre-Experiment/Pre-Pilot Steps



The literature review frames why (*i.e.*, the barriers) and how (*i.e.*, the personal and social behavioral approaches) to incorporate behavior change science to achieve N2N goals (*i.e.*, deeper household savings

[13] The UK government is leading efforts in greenhouse gas (GHG) abatement policy with support from both the Department of Energy and Climate Change, as well as the UK Cabinet Office's Behavioral Insights Team (CabinetOffice, 2011).

and broader community penetration than the utility-administered program would otherwise achieve).

2.1 Layering in Social and Individual Behavior Change Approaches

As further described in this chapter, community-based organizing is built on individual and social psychology to increase effectiveness. As a result, N2N has developed several important first principles, including:

1. Individual psychology approaches, such as:
    a. Keep the message simple and fun.
    b. Anchor the customer on upgrades from the start using priming language.
    c. Communicate the what's in if for me (WIIFM) messaging tailored to that household.

2. Social messaging and approaches because people often look to others for the right behavior, such as:
    a. Frame the injunctive social norm to not waste energy through marketing collateral and messaging in the field.
    b. Reach people through their existing social networks.
    c. Rely on trusted messengers to share testimonies and promote word of mouth diffusion.
    d. Develop a volunteer base of local community leaders that spread the message throughout their social networks.

In fact, prior to entering a community, the outreach team explores the town and social structure, and works with town stakeholders to map the potential for town support and local volunteers. This pre-planning helps:

- Determine whether or not to partner in a community,
- Calculate what the potential uptake could be, and
- Design each town's outreach approaches and calendar of campaigns.

In this way, the team develops rigorous, goal-based campaign plans that create a multi-touch toolset of approaches. (Stakeholder3, 2012; Stakeholder8, 2012)

The next section begins the literature review of behavioral science approaches to reducing individual and aggregate energy use.

2.2 Introduction to Energy Behavior Change

The literature review explored both the social and the individual psychology of energy wasting and energy efficiency behaviors. I define wasting energy as: *using unnecessary energy when an action would pay back through energy savings in less than two years*. I define energy efficiency actions as: *those actions with paybacks longer than two years.* Behavior changes to eliminate energy waste and achieve energy efficiency include one of three types of actions:[14]

1. Small, one-time behaviors, such as purchasing and installing electronic power strips, efficient light bulbs, *etc.*.
2. Changing end-use behaviors and habits, such as thermostat temperature settings, turning out

[14] Research from several authors influenced my selection of three types of energy behaviors (K. Ehrhardt-Martinez, Laitner, & Donnelly, 2011; Karen Ehrhardt-Martinez & Laitner, 2009; P. C. Stern & Aronson, 1984; Paul C. Stern, 2008; G. Wood & Newborough, 2003).

lights, washing clothes in cold water, *etc.*.

3. Large, home performance upgrades, such as attic insulation, space conditioning units, solar photovoltaic systems, *etc.*.

In general, habits and one-time behaviors are energy wasting actions, while large, home performance upgrades do not pay back within two years, and fit into the category of energy efficiency.

From the literature review and almost three years of field study experience, I believe that driving people to substantial household energy waste reduction and whole home energy efficiency will require using both social and individual psychological behavioral science principles. I also believe that energy waste and energy efficiency should be viewed as a public goods problem. In fact, individual use of energy impacts global issues, such as pollution, resource depletion, energy security, *etc.*. In addition, affluent consumers overuse energy resources in general, as well as subsidize those that cannot afford to operate their home comfortably and conveniently (DTI, 2006b).

This literature review and ensuing field research support that solving a public goods problem would require changing culture around the existing social norm of wasting energy. Therefore, a behavior change framework should consider both individual behavior change and social change management approaches, such as described by the social and individual influence dimensions in Patterson et al (Patterson, Grenny, Maxfield, McMillan, & Switzler, 2008). For instance, the behavior change approach should appeal to motivations and benefits that provide the internal sources of influence that determine behavior choices (Grenny et al., 2008).

In fact, changing the behavior of groups of people involves a complex, interdisciplinary approach. It is important to tailor household energy conservation interventions according to individual behaviors, and to target similar groups (Abrahamse, Steg, Vlek, & Rothengatter, 2005, 2007; Abrahamse, 2009). In addition, a combination of interventions is the most effective approach because people have different barriers to change (Abrahamse, 2009; Grenny, Maxfield, & Shimberg, 2008; Patterson et al., 2008).

The N2N household (*i.e.*, the individual) and community behavior change management approaches rely on making it easy for the customer and harnessing peer pressure to promote behavior change. The first row, personal motivations and approaches, relates to an individual's internal sources of influence that determine behavior choices (Grenny et al., 2008) and highlight using benefits and core values to influence behavior. In this case, the benefits focus on those found in literature and in the field research to motivate N2N participants to complete home energy upgrades. For instance, N2N participants value fun, simplicity, comfort, convenience (*i.e.*, reducing hassles of completing an action), as well as core values to help others, protect the planet for future generations and/or their own children, and a "responsibility for doing the right thing" (Stakeholder14, 2012; Stakeholder15, 2012; Stakeholder16, 2012; Stakeholder18, 2012).[15]

The second row of Table 2, social motivations and approaches, focuses on the social aspects of behavior, such as people to do what others do (*i.e.,* descriptive and injunctive norms) and are strongly influenced by what others think (*i.e.,* peer pressure) (R. B. Cialdini, 2001). These influence strategies include providing comparisons and judgment feedback, and developing supportive networks and communities where people go for trusted advice.

[15] These motivators are supported by the literature review and specifically selected based on findings from analysis of program data, such as in-depth interviews, customer testimonials, survey responses, and outreach activities.

Table 2 N2N Behavioral Leverage (Compiled by the author; sourced throughout thesis)

Influence Dimension	Motivators/ Benefits	Behavioral Science Approaches
Individual (Personal Context)	Fun, Simplicity, Comfort, Convenience, Core/Intrinsic Values, Health and Safety, Sense of Ownership, Gain/Fear of Loss.	**Make it Easy and Desirable:** • Default, Frame, Anchor, Prime (Develop persistence) • Goal-setting and Commitments (Get started) • Incentives, Scarcity, Triggers, and Reminders (Get started) • Clear and Actionable Steps (Create actions and habits) • Transparent Feedback: real-time, past, projected (Create learning, actions, and habits)
Group (Social Context)	Social Approval, Peer Pressure.	**Harness Peer Pressure:** • Social Norms (Demonstrate the "right" behavior that others are doing) • Tailored Messaging (Tell the N2N stories): - Behavior Modeling and Earned Media, - Trusted Messengers and Word of Mouth, - Comparisons; • Using communities and their social structure (Optimize existing social networks).

The second row of Table 2, social motivations and approaches, focuses on the social aspects of behavior, such as people to do what others do (*i.e.,* descriptive and injunctive norms) and are strongly influenced by what others think (*i.e.,* peer pressure) (R. B. Cialdini, 2001). These influence strategies include providing comparisons and judgment feedback, and developing supportive networks and communities where people go for trusted advice.

Table 2 *is based on N2N team evaluations and analyses to date, as well as foundational learning from this literature review, especially: (Abrahamse et al., 2007; Abrahamse, 2009; Ariely, 2008; Ariely, 2007; R. B. Cialdini, 2008; Fogg, 2009; Patterson et al., 2008)) and research findings from Karen Ehrhardt-Martinez, Donnelly, & Laitner, 2010 and Honebein, Cammarano, & Donnelly, 2009*

In fact, the literature helped develop the N2N program design, including using behavioral approaches, such as: framing and priming, scarcity, frequent feedback[16], commitment, goal setting, comparisons, normative messaging, and engaging participants in small, actionable steps (K. Ehrhardt-Martinez et al., 2011; Karen Ehrhardt-Martinez, Donnelly, & Laitner, 2010). The second row of Table 2, social motivations and approaches, focuses on the social aspects of behavior, such as people to do what others do (*i.e.,* descriptive and injunctive norms) and are strongly influenced by what others think (*i.e.,* peer pressure) (R. B. Cialdini, 2001). These influence strategies include providing comparisons and judgment feedback, and developing supportive networks and communities where people go for trusted advice.

Table 2 also includes several other behavioral strategies that N2N relies on, having learned lessons from the outreach team's experience in the field followed by qualitative research, including using trusted

[16] Real-time feedback is ideal, since it is available when the customer is ready to engage and provides contextual information about what is happening in that moment.

messengers, the N2N outreach stories and pitches, and based on the already successful CT community rewards programs.

Many past residential energy use pilots and research studies have tested different behavioral approaches, but few studies or pilots have tested several approaches at a time, how the different interventions interact, or how they work in a real-world setting. N2N provided the testing platform for this type of research. N2N found that a consumer's residential energy use actions also vary by the three different types of behaviors listed above, as well as by their own definition of economic rationality. The consumer also relies on government and industry to set the right energy efficiency defaults using building and appliance minimum standards.

The next two sections discuss the individual and the social psychology used to develop the N2N experimental design.

2.3 Understanding the Individual Psychology[17]

Consumers are aware of ways to reduce energy use, but don't act due to barriers (Merrian Fuller, 2008; McKenzie-Mohr, 2008; Shelton, 2012). For instance, many understand that in addition to turning up the thermostat to generate more heat, one could reduce heat loss by wearing more clothing inside, and/or covering up drafts with plastic, towels, or curtains, *etc.*. They may also know that turning down the water heater, changing incandescent light bulbs to Compact Fluorescent Light bulbs (CFLs), or remembering to turn out lights also reduces household energy waste. This chapter explores why consumers often fail to perform these simple behaviors, often despite a rational economic incentive.

How to get people to change energy use behavior doesn't have an easy solution, therefore, programs should first focus on the most promising interventions. To prioritize interventions, one must first examine energy efficiency psychological barriers and the psychological interventions that impact energy consumption. In fact, I identify three major categories of information barriers, and potential behavioral interactions to reduce the barrier's impact (Table 3).

Table 3 Example Individual Barriers and Behavioral Interventions Framework

Barrier Category	Example Interventions
Getting Started	• Goal-setting and Commitments (get started) • Default, Frame, Anchor, Prime (develop persistence)
Information	• Clear and Actionable Steps (create actions and habits) • Transparent Feedback: real-time, past, projected (create actions and habits)
Irrational Spending	• Incentives, Scarcity, Triggers, and Reminders (get started)

2.3.1 The getting started barriers

People find it difficult to change, whether that means trying something new, developing a new habit, or even maintaining an existing one. One of the difficulties of change is that people have a tendency to procrastinate, needing an upcoming deadline to get started on the change (Bryan & Locke, 1967;

[17] The individual and social psychology sections have been drafted several times over the course of my PhD, through general exams and later research proposals. The most public and recent version is here: (Donnelly & Sklarsky, 2010). In addition, Appendix F contains a high-level system dynamics view of overcoming energy efficiency barriers using positive feedback loops.

Latham & Locke, 1975).[18] Even if people are motivated to change a behavior, without setting deadlines or completion goals, most tend to procrastinate, especially on time-consuming or tedious tasks (Ariely & Wertenbroch, 2002). A lack of willpower can also contribute to procrastination (Ariely & Wertenbroch, 2002; N. Burger, Charness, & Lynham, 2008). For instance, taking longer showers may be extra enjoyable for some people, causing a loss of comfort with the new behavior of shorter showers.

In addition, laziness, apathy, forgetfulness and attention deficit psychological barriers can prevent people from completing an energy efficiency behavior (Stokes, Mildenberger, Savan, & Kolenda, 2012). One study found that for turning off TVs, stereos, and other peripherals not in use, attitude barriers stand in the way, such as laziness, forgetfulness, and discomfort (inconvenience) (ibid.).

Structural barriers also prevent people from getting started on habits (Grenny et al., 2008; Patterson et al., 2008), such as difficulties with:

- pushing a baby stroller or luggage through a revolving door, leading to use of the easier side swing door; or
- accessing frequent utility usage data, either on the utility website or on the inconveniently located and hard to understand electricity and natural gas meters, *etc.*.

Several behavioral approaches can help overcome the "getting started" barriers, such as goal setting and commitments. In fact, goal setting and commitments work together to improve individual performance. The goal literature follows the logic of the Prospect Theory, where goals:

- Serve as reference points;
- Alter the value of the outcomes; and
- Exhibit loss aversion and diminishing sensitivity (Heath, Larrick, & Wu, 1999; Kahneman & Tversky, 1979).

Since goals serve as reference points and follow loss aversion principles,[19] it is important to take care in framing the goals and the goal progress. For instance, when goals are framed as commitment to the goal, rather than progress toward the goal, they are more likely to motivate goal-consistent behavior (Zhang, Fishbach, & Dhar, 2007). That is, keep the big picture goal in people's mind, rather than telling them what they completed already, which can encourage them to feel like his or her "job is done" (N2N survey respondent).

Summarizing 35 years of goal research, Locke and Latham describe four goal mechanisms to influence performance, where goals:

1. Directing attention to the intended goal-relevant activities;

[18] The looming deadline may be self-imposed, such as when I promise my spouse that I'll clean my office by next Sunday afternoon, or externally delivered, such as an expiring rebate offer or a mid-term examination.

[19] Similar to reference points, people often think in percentages, being more likely to go across town to save $8 on a $15 calculator (over 50 percent of the purchase price) than to save $8 on a $500 suit (less than 2 percent purchase price) (Ariely, 2007). It is the same absolute amount of money. For instance, feedback based on the dollar amount saved for a specific behavior, day, or even month, is unlikely to motivate individual behavior change. Different energy efficiency feedback units are needed, especially since kilowatt-hours, therms, cubic feet of natural gas, MMBTUs, *etc.* are units difficult for most people to interpret. Dan Ariely suggested testing contextual units, such as computer-hours, or lighting-hours (Personal Communication, July 13, 2011).

2. Energizing the participant to take action with larger goals leading to more effort than smaller goals;

3. Affecting persistence, where hard goals prolong effort; short deadlines increase effort intensity; and long-term goals reduce effort intensity; and

4. Leading to deliberate planning and learning of new skills or approaches to achieving the goal (R. Wood & Locke, 1990). (Locke & Latham, 2002)

Efficiency literature studies find that setting significant, but not overly ambitious goals (along with feedback) allows people to see their progress as well as to identify further necessary progress (Houwelingen, 1989; Sheehy, 2003). Assessing goals may also encourage consumers to work harder towards their goals and to develop new strategies. Setting effective goals can be complicated because they must be reachable and believable with an intermediate level of difficulty, yet not too easy to achieve (Soman, 2004). In one experiment, parties that set a challenging 20 percent energy savings goal were more effective than those setting an easy two percent savings goal (ibid.). Still, those with the challenging goal only achieved 13 to 15 percent (ibid.) energy savings, falling short of their original goals (ibid.). This study also finds that goal-setting consumers often feel better when they achieve their goals (ibid.), providing evidence that unachieved goals could be counterproductive to motivation.

Goal failure may result in decreased self-efficacy and negative emotions that may cause continued poor performance (Soman, 2004). In fact, people may also let themselves go after failing to achieve a goal, leading to the rebound effect (Soman, 2004). Soman and Cochran have termed this the "what the hell" effect (Cochran & Tesser, 1996) , explained by a simple illustration: suppose that a dieter fails to stick with the diet one day by having pizza for lunch. It is much more likely that this dieter will have chocolate cake for desert since they have already broken the diet for the day, possibly thinking they would go back to it in the morning or even giving up on the diet altogether (Ariely, 2007). This behavior can be exhibited in situations involving saving money, shopping, dieting, exercising, *etc.*.

Energy goal setting has been found to be more effective when used in conjunction with commitments and feedback (Abrahamse et al., 2007; Becker, 1978; Houwelingen, 1989; Locke & Latham, 2002; McCalley & Midden, 2002). Commitments such as promising to conserve energy potentially provides a moral obligation to stick to a promise and have been shown to be effective, including in the long run (Abrahamse, 2009).

Several studies show that sustainability actions increase with a signed or otherwise publicly-secured commitment (D. McKenzie-Mohr, 2008; McKenzie-Mohr, 2009). The importance of the public versus private commitment dates back to a 1976 study, where households making a public commitment saved more energy with the effect present after six months (Pallak & Cummings, 1976). In addition, asking for a small commitment first and a subsequent larger commitment, called the "foot-in-the-door" technique, can help get people get started on a new behavior (Ester, 1985; R. Katzev & Johnson, 1987).

Another way to get people started on a new behavior is to make it easy by setting energy efficiency as the default. Studies have shown that defaults achieve better results. For instance, setting cold water wash as the default condition on clothes washing machines increased loads washed in cold water (McCalley, 2006). Another example finds field evidence for higher participation in paying a premium for renewable energy on their utility bill with an opt-out program (Pichert & Katsikopoulos, 2008).

Anchoring also affects energy behavior. Tversky and Kahneman's observed that people start from an initial guess or salient starting point to generate a final decision (Tversky & Kahneman, 1974). Anchors range from pre-existing stereotypes to random, and even unrelated, numbers and prices (ibid..) (Ariely,

2007). In the case of home energy upgrades, which often have a substantial cost, anchoring heuristics should be employed to set realistic expectations of price that may often be higher than a person would expect.

Finally, N2N learned a rough lesson early in program execution, where outreach staff focused on getting people to sign up for the N2N Energy Challenge. The team failed prime customers that whole-home performance was the final goal, and found that participants often failed to complete energy efficiency actions, believing that signing up was the extent of the commitment. N2N made the mistake of using a foot-in-the-door technique, asking for people to signup to N2N, without also priming them for the end-goal (*i.e.,* upgrades) or providing adequate follow up to the next step.

Together, the behavioral science approaches of commitment and goal setting, supported by framing, priming, anchoring, and defaults are important to help people get started on energy efficiency actions, as well as to help develop task persistence.

The information barriers are described next.

2.3.2 The information barriers

The energy user has access to very little feedback about household, appliance, and individual device energy consumption, resulting in information barriers. For instance, consumers are undereducated about energy consumption levels, the environmental and energy security externalities inherent in electricity consumption, and how much electricity that devices consume even when they are not in use.

In fact, the average residential consumer may not see or think about energy usage or how to use less; as energy use may be largely invisible (Darby, 2006). For instance, people generally do not know how many kilowatt-hours (kWh) they consume each day, week, month (ibid.), even though consumption totals are provided on their monthly utility bill. In the U.S., most electricity and natural gas meters are placed on the outside or in the basement of the house with little opportunity to see the spinning dial, which provides a rudimentary real-time feedback method. Add in automatic bill pay features with automatic account deductions of energy use payments reduces a persons propensity to pay attention to the utility bill, taking an extra step to download it from the utility website. Together, these factors almost ensure that the average person's energy use is almost invisible, decreasing the likelihood for people to pay attention to it.

One reason that many people may not participate is because consumers have difficulty processing a lot of information to directly affect their decisions (Hoyer, 2007). In fact, providing customers with too much information could result in "information overload, consumer confusion, and poorer decisions" (Hoyer, 2007). Likely even more true for complex decisions like whole-home energy upgrades, people are less likely to take action when the number of choices increases (Iyengar & Lepper, 2000; Madrian & Shea, 2001).

A final information barrier is that people do not understand the complex system that brings electricity to the outlets of their home (DTI, 2006a). In fact, the home's energy system is also highly complex, but energy is delivered to the point of use automatically by the built-in utility and the household infrastructure.

While it should not be used as an independent strategy, information programs can be used to overcome information barriers, including mass media campaigns, workshops, and mailings (Abrahamse, 2009), as well as additional N2N-employed approaches of social media, passive marketing (*e.g.*, hanging posters in the town hall or at the library), and neighborhood canvassing. Information campaigns have been successful at educating the public, but the knowledge does not necessarily translate into behavior change (Abrahamse, 2007; R. Katzev & Johnson, 1987; Leiserowitz, Maibach, & Roser-Renouf, 2009). In fact,

past literature shows that information techniques have been widely employed, but have been consistently shown to have very little impact on consumption (Katzev and Johnson, 1987, McKenzie-Mohr 2008).

Without evaluating the behavioral effectiveness of the information techniques, it may be that well-crafted information campaigns can be effective at changing behavior. For instance, a study by Abrahamse used a tailored approach through an on-line "advice portal", where the information was personalized based on individual needs, knowledge, and behavior (Abrahamse, 2009). She found that participant households saved more energy, adopted more energy saving actions, and knew more about energy conservation than the control group (ibid.).

In fact, feedback about energy consumption can help an interested energy consumer better manage both their energy use and money. Over 40 studies have identified how both direct and indirect feedback about energy use *can* reduce energy consumption (Abrahamse et al., 2007; Darby, 2006, 2008; Karen Ehrhardt-Martinez et al., 2010; EPRI, 2009; Fischer, 2008).

Table 4 shows the results of 36 feedback studies conducted between 1995 to 2010 by splitting the results into indirect and direct feedback. Of note, indirect feedback is cheaper to implement, but has not been as effective at reducing household energy use as direct feedback. On the other hand, direct feedback is more complex and costly to implement.

Table 4 Household Electricity Savings by Feedback Types: Average and Overall Savings

		Indirect Feedback (After Consumption)			**Direct Feedback (Point of Use)**			
	Feedback Type	**Enhanced Billing**	**Estimated Feedback**	**Daily or Weekly Feedback**	**Real-Time Feedback**		**Real-Time Feedback Plus**	
	Feedback Description	Advice, energy tips	Online audits, on-going tips	Advice, energy tips	Household-level use with in-home display		Device or appliance level use	
	Average Savings/ House	6%	7%	11%	7%	7%	14%	14%
	Program Type	Opt out	Opt in	Opt in	Opt in	Opt out	Opt in	Opt out
Range Low to High	**Participation Rate**	75 to 85%	5 to 10%	5 to 10%	5 to 10%	75 to 85%	5 to 10%	75 to 85%
	Overall Savings	4 to 5%	0.3 to 0.7%	0.6 to 1.1%	0.4 to 0.7%	5 to 6%	0.7 to 1.4%	11 to 12%

Table derived from two major reviews of feedback studies: (Karen Ehrhardt-Martinez et al., 2010; EPRI, 2009). It is based on 36 feedback studies implemented between 1995 to 2010.

Indirect feedback provides pre-processed energy consumption data with a delay before reaching the end-user. Indirect feedback has resulted in participant energy use reductions from zero to 10 percent (Darby, 2006; Fischer, 2008). Indirect feedback is usually less effective then real-time feedback. For instance, enhanced billing, which generally includes utility-designed feedback and sometimes household advice, results in 5.6 percent average household savings (Karen Ehrhardt-Martinez et al., 2010). Estimated feedback, which is more contextual, is provided through Web-based energy audits,[20] billing analysis, and

[20] It remains unclear if many consumers will actually fill out the web audit. For instance, despite my own special interest, I only recently completed a full web-based audit after many dropped attempts over the years due to complexity and length (1 out of 7 attempts).

estimated individual appliance use (6.8 percent average household savings) (ibid.). Daily and weekly feedback provides feedback by mail, email, or self-meter (11.0 percent average household savings) (ibid.).

Direct, real-time, feedback is provided through in-home energy displays and other enabling-technology, such as mobile phone applications and websites.[21] Studies show direct feedback can reduce average participant usage by up to 15 percent finding that real-time feedback using in-home energy displays reduces average household energy use by seven percent (Darby, 2006; Karen Ehrhardt-Martinez et al., 2010; energywatch, 2006; EPRI, 2009). The displays can provide energy users with a learning tool to teach themselves through experimentation, such as watching real-time energy use decrease when turning off different devices (ibid.). In addition, direct feedback can help form habits where people change routines based on new knowledge (energywatch, 2006). Real-time plus feedback provides information about appliance specific data and what types of specific actions a household should take. It is generally more useful for achieving behavior modification, especially for household heating habits and large appliance purchase decisions (Darby, 2006).

Real-time plus feedback includes specific appliance disaggregation and/or automation (14 percent average household savings). For the real-time and real-time plus feedback scenarios, opt in and opt out participation types were compared. While both opt-in and opt-out programs achieved the same average households savings, the opt-out programs had much higher overall savings results when considering both participants and non-participants; however, the energy reductions per average participant are significantly lower indicating some people participate significantly more than others. (Karen Ehrhardt-Martinez et al., 2010)

Breaking down the information barriers by increasing data transparency is a key aspect of engaging people in energy-related behavior change. Simple changes can be made to feedback mechanisms to increase efficacy, especially the primary one today: the utility bill. With smart meter technology installations on the rise, many consumers could have access to more frequent utility data (Darby, 2010). However, the technology is not consumer accessible today. Several private corporations have developed effective feedback approaches, but additional research is needed to determine optimal designs of the feedback visualizations and delivery methods to induce behavior change. In addition to the technology support, the solution will likely require both building labeling and energy bill disclosures at point of sale or rental to provide adequate data transparency.

It is also important that the information is properly framed, because environmentally conscious behaviors most likely follow when consumers believe that their actions will make a difference (Hoyer, 2007).[22] In fact, people "can change attitudes to suit" the new behaviors or habits, or internalize the behavior. This behavior internalization is believed to lead to more sustainable behaviors (creating a positive feedback loop) (D. McKenzie-Mohr, 2008).

2.3.3 The irrational spending barriers

The energy feedback and enabling-technology literature recognize a lack of research analyzing feedback visualization and technology design based on psychology principles impacting how people spend money, such as prospect theory (Kahneman & Tversky, 1979), mental accounting (Thaler, 1985),

[21] Based anecdotally on my research and practical experience: Direct feedback should be provided using technology that the user already has the habit to access. It varies for different consumers, but can include one or more of the following: mobile phone, television, security system, clock, website, microwave display, etc. Creating an additional device that a person must learn to interact with has less chance of succeeding, often ending their useful life in a junk drawer, even for an interested party like me.

[22] Note: This is also consistent with optimistic expectations in goal based choice literature (Zhang et al., 2007).

and the pain of paying and magic number of zero behavior principles (Ariely, 2008; Ariely, 2009b) (Midden et al., 2007). Prospect theory was briefly described above with goal setting.

Thaler and others (Prelec & Lowenstein, 1998; Thaler, 1985, 1999) suggest that people set up mental accounts for separate psychological outcomes, for example, a vacation fund, an entertainment budget, a food budget, or an energy operation and maintenance budget. Mental accounting builds on prospect theory findings that people use reference points to determine their sensitivity to gains and losses (C. F. Camerer & Lowenstein, 2002), which should provide guidance about how creating energy upgrade packages. For instance, when evaluated separately, a gain of $150 along with a loss of $100 will seem unattractive, but if they are combined, the gain of $50 is attractive (ibid.). It may also be possible to induce budgeting of electricity money into a mental account (through commitment and goal setting).

In fact, energy efficiency doesn't yet appear to be top of mind even during major purchase decisions with substantial operating costs, such as new homes, appliances, or remodeling projects. To raise awareness of energy, Ariely describes using the principle of the pain of paying, where real-time feedback about costs can raise awareness of the expenditures. For instance, the pain of paying results from watching a taxi meter or a gas pump tick up higher and higher. Providing real-time feedback about energy use has the potential to instigate the feeling of loss that arises with the pain of paying. Another approach is to count energy consumption backwards in real-time to zero, starting at the end use and money goals.[23] This approach may provide the feeling of a real-time payment, raising awareness levels and encouraging people to pay attention. People might pay even more attention as they get close to what Ariely calls the magic number of zero, simulating that they are running out of money or energy from their budgets. (Ariely, 2007) (Ariely, Fall 2007)

Other market and economic barriers impact how people spend money. For instance, research indicates that energy use may not be highly sensitive to energy price, at least in the long run. A review of residential dynamic pricing pilots found that a tenfold difference in peak and off-peak pricing may be necessary to achieve demand response participation (Faruqui, 2009). In fact, peak-time pricing programs often do not result in overall household energy savings, but instead shift usage to off-peak times (ibid.). People do begin to change consumption habits after sustained periods of high prices; however, if the prices dip back down, consumption levels return to previous levels and higher (*i.e.*, rebound effect) (Lowenstein, 2009). In fact, the average consumer also adapts to higher prices quickly, which could also lead to the rebound effect (*i.e.*, adaptation) (ibid.).[24]

People also have high implicit discount rates that impact their energy upgrade choices (Ariely, 2008; Brekke & Johansson-Stenman, 2008; Merrian Fuller, 2008; Lovins, 2007). For instance, people may be reluctant to complete upgrades with longer payback periods than one to two years (Lovins, 2007).[25] In fact, people have difficulty planning for complicated long-term events in an economically (or environmentally) rational way, especially with short term costs (*e.g.,* payments, efforts, sacrifice) for long-term consequences (*e.g.,* health, money, environmental impacts) (Lowenstein, 2009; Thaler & Sustein, 2008). This difficulty is illustrated through low savings rates (ibid.). Several research findings from N2N support the behavioral economics science, such as:

[23] Note: This experiment has been designed, but not been well executed to report results.
[24] Notes: 1. Despite that people have short adjustment periods to high prices, energy taxes are politically unpopular in the U.S. and little of the energy bill is due to taxes; and 2. Sadly, it's most likely the poor that have a harder time adjusting to volatile gasoline, natural gas, and electricity prices.
[25] Based on personal and N2N qualitative analysis. It is unclear how Energy Star labeling and 2010 Recovery Act appliance rebates (which were gone within two hours in Cambridge) will affect U.S. societal norms about purchasing energy efficient products.

- Uncertainties about length of stay in the home affect people's willingness to purchase upgrades and to take steps to reduce energy use.

- People that don't own the home are often more resistant to taking energy efficiency steps. They also have shorter residence times, don't usually own the appliances, take less ownership of small actions like fixing drafts in a home, and often have less money than homeowners.
- Landlords have less motivation to make energy efficiency investments because they don't experience the benefits of the investment, don't usually pay the utility bills, and believe that tenants often don't take care of appliances.

- For large purchases, homeowners respond more favorably to rebates and grants over loans, and respond more to larger incentive amounts (D. McKenzie-Mohr, 2008).

Past research should inform incentive and disincentive structures to encourage the uptake of energy efficiency. Incentives include utility pricing and on-bill financing programs, monetary rewards, tokens, rebates, rewards points, and prices signals for energy efficiency. Disincentives include contingent costs, inconveniences, and penalties for failing to conserve.[26]
For instance, N2N uses money as a primary motivator, where the energy efficiency actions are supported by state subsidies and also reduce monthly energy bills. However, using money as a message should be done with care. There is evidence that for altruistic type issues, such as those associated with climate change or helping others, adding financial incentives into the mix can actually "trump" the altruistic motivations (Ariely, 2009b; Lindstron, 2008). In other words, people may instead consider if there is enough money to make it worthwhile, instead of taking an action because they feel it is the right thing to do or for other intrinsic motivations.

An early study on using financial rewards and competitions to motivate energy efficiency found that all groups saved energy, but the effects disappeared when the rewards ended (Slavin, Wodanski, & Blackburn, 1981). In other cases, rewards have been used to motivate workers to do labor. However, for complex tasks, rewards should be approached with caution. Not only do payments not always increase performance, but they can change the relationship between how the person thinks about the effort in a drastic way (Ariely, 2009a). For instance, the task may be thought about as work rather than something the participant enjoys doing (ibid.). Instead, social and intrinsic motivators could bring meaning to the action (ibid.). Adding rewards to a program may decrease performance and draw attention away from other intrinsic and social motivating factors (ibid.).

In addition, research about how residential energy consumers respond to virtual points earned after completing an energy efficiency behavior could be used to purchase prizes. This is analogous to credit card rewards points that can be accumulated to purchase any number of travel, electronics, or shopping rewards. Evidence suggests that programs like these used for airline frequent flyer programs encourage people to grow loyal to a certain airline, credit card, department store, *etc.*. (Ariely, 2007)

Lottery incentives may be useful in getting people to participate in programs to reduce energy consumption (Lowenstein, 2009). One type of lottery, the Dutch postcode lottery, selects a winning postcode (*i.e.*, zip code) and each person in the winning postcode that purchased a ticket wins the lottery (Zeelenberg & Pieters, 2004). Research found a word of mouth effect, where people often heard about his or her neighbor winning the lottery and felt a sense of regret for not playing (ibid.). One real-life study of

[26] Although utilities have been using time-of-use (TOU) pricing programs for decades and are now exploring critical peak pricing (CPP) and peak-time rebate (PTR) rates, these types of interventions are not explored in this paper (see (Barbose, Goldman, & Neenan, 2004; Brattle, 2007; Faruqui, 2009; Faruqui & Sergici, 2009; Faruqui & Wood, 2008; IEE, 2009; Star, 2006; UtiliPoint, 2007) for more information on utility pricing strategies).

the postcode lottery found that people "anticipate more regret over not playing when there is feedback about the neighbors winning a prize" (ibid.). In fact, "encouraging people to counterfactualize about possible wins and near misses" is one way to "persuade consumers to participate" (ibid.).[27] The challenge is to design the lottery to determine non-participants will hear about the winners.

A recent study by the Alliance Commission on National Energy Efficiency Policy found that the path to U.S. residential and commercial building energy efficiency requires addressing the information and irrational psychological barriers identified in this section by:

- Developing a secondary market for energy efficiency loans, where investors buy existing loans;
- Revising incentive policies, promoting consumer friendly loan programs such as on-bill or property tax repayment schemes, energy efficiency mortgages, *etc.*.;
- Making energy and efficiency information visible, such as building labeling and energy bill disclosures at time or sale or rental (Rich, 2013).

Although the commission recommendations help, more research is needed to combat the irrational spending barriers, such as how information is presented to incorporate behavioral science, as well as how to encourage the spread of viral messages.

2.4 Understanding the Social Psychology

Research in social norms, networks, and marketing finds that the U.S. has focused on deploying large-scale technology systems, such as the smart grid, without considering the underlying social reasons that motivate people to act (Karen Ehrhardt-Martinez et al., 2010; FERC, 2009). Yet, people are motivated by what others are doing and thinking, as well as what they perceive that others think is the right thing to do (R. B. Cialdini, 2001, 2008); therefore, overlooking social aspects also overlooks potential social action and societal benefits.

The next two subsections discuss social factors that could be used to generate consumer participation in energy efficiency, including looking at:

1. Social groups and descriptive norms, and
2. Behavior modeling.

For instance, descriptive norms are the action "most commonly performed in a given situation" (N. Goldstein, Griskevicius, & Cialdini, 2007). When a behavior is modeled, it provides real-life role models that "show people how to act" (Ester, 1985; R. Katzev & Johnson, 1987). An important factor to both is who is delivering the message: a trusted messenger or not.

The section concludes with a short primer on collective intelligence, providing a framework for designing the N2N community-based social marketing pilot.

2.4.1 Social influence incentives: groups and descriptive norms

The literature review uncovered successful behavior change examples using social groups to drive a cause and/or descriptive norms to influence a specific behavior. For example, in one descriptive norm study, researchers examined the effect of participating in Eco Teams (also combining information,

[27] This view is consistent with Prospect Theory and "hyperbolic discounting" (Kahneman & Tversky, 1979; Prelec & Lowenstein, 1991).

goal setting, and group feedback approaches) (Staats, Harland, & Wilke, 2004). The Eco Teams saved more energy and adopted more energy-saving behaviors compared to the control group (ibid.). In addition, a long-term effect existed two years after the study (ibid.), suggesting that new norms were developed in the social groups. [28]

Recent sustainable behavior studies have examined how descriptive social norms (how most people behave in a situation) are a big driver of sustainable behaviors (N. J. Goldstein, Cialdini, & Griskevicius, 2008). In fact, descriptive norms were said to be a "potentially powerful motivator of pro-social behavior" (ibid.). Instead of trying to influence people's attitudes, descriptive normative messaging may be more effective (D. McKenzie-Mohr, 2008). In fact, recent findings suggest that consumption reductions can be induced by stressing "societal benefits, self-efficacy, and behavioral control" (Hoyer, 2007).

In addition, individual and social contextual messages, such as those using targeted descriptive norms, may be more powerful than monetary incentives. By applying a social and a psychological framing to sustainable behavior messages, Cialdini and others report that social norms are a powerful lever to foster sustainable behaviors (N. Goldstein et al., 2007; N. J. Goldstein et al., 2008; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). In one study designed to encourage customers to reuse their hotel towels, researchers compared message appeals (N. J. Goldstein et al., 2008). They found that messages that tapped into the descriptive norms of the hotel guest's reference group produced significantly higher participation in hanging up towels for reuse (ibid.).

In other words, a message that appeals to a personally contextual reference group was more successful. For example, a message to join fellow guests (*i.e.*, social) of this room (*i.e.*, location context) in helping to save the environment was successful almost 50 percent of the time over an appeal to:

- protect the environment for mother nature (30 percent towel reuse), and
- join the hotel in protecting the environment (16 percent towel reuse) (N. J. Goldstein et al., 2008).

Another recent study about linking social norms to efficient conservation investments found that neighborhood-level social norm programs had significant impacts on program re-enrollment, suggesting that "social norms can be used to leverage participation to enhance the sustainability of conservation benefits" (Chen, Lupi, He, & Liu, 2009). Research also indicates that participants under detect descriptive norm influence, where participants state that they are influenced by factors other than what other people are doing (Chen et al., 2009; Griskevicius, Cialdini, & Goldstein, 2008; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). In fact, social norms may be more powerful because people do not detect the influence of them.

These lessons learned suggest that regulators and utilities should spend effort developing social normative messaging for different customer segments. In fact, the behavioral strategies could be very influential in achieving behavior modifications at little to no extra program cost.

2.4.2 Social influence incentives: modeling

Modeling a behavior provides people with real-life role models that show them the right way to act (Ester, 1985; R. Katzev & Johnson, 1987). Modeling includes participant exposure to live or

[28] There is also anecdodal evidence of social groups influencing behaviors, such as many recent MIT dorm electricity contests, community competitions like the Energy Smackdown (Carpenter, 2009), and collaborations, like the Cambridge Home Energy Efficiency Team "barn-raising" events (J. Schwartz, 2008), the MIT Green Ambassadors group, among many other communities organized around energy efficiency or sustainability issues on MIT's campus and in the nearby communities.

videotaped presentations of models performing energy conserving behaviors (ibid.). It can also include using in person testimonials, where social connections share the benefits associated with and the successful implementation of the behavioral action.

The success of modeling depends on how understandable, relevant, and meaningful the characters are to the audience (Abrahamse, 2009). An early energy-savings TV program, with advice tailored to the audience, found that the group exposed to modeling saved more energy than the control group and had higher energy conservation knowledge after the study (Winett, Leckliter, Chinn, Stahl, & Love, 1985).

One type of model is a serial drama, which has been a successful tool for social change in developing countries such as Mexico and Ethiopia (Charles, 2009). The serial dramas are character driven, depicting three types:

1. Positive characters providing an "ideal to which the audience can inspire";

2. Negative characters that illustrate "negative values" and are "regularly punished for their bad behavior", but don't change their behavior; and

3. Transitional characters that are "most similar to the target audience" and eventually "move toward or away from behaviors" (Ryerson, 2007).

Serial dramas have the benefits of being long-running, which allows viewers to bond with the characters and allows the characters time to evolve their behavior at a believable pace (ibid..) The serial drams are also entertaining and emotional, where viewers become "vested" in the program and/or characters (ibid.). In fact, this type of role modeling or enactment can be very effective, but it can also be costly from a perspective of time and potential mistakes (Armel, 2007).

It is important to apply the lessons learned from modeling behaviors into community-based social marketing approaches to signal to others the correct behavior (Lowenstein, 2009). As previously noted, there are inexpensive ways to provide testimonials from people that have made energy efficiency upgrades in their home to relevant social groups, both in person and on program marketing materials. N2N uses both written testimonials, and other in person behavioral modeling, such as solar open houses or workshop testimonials to share experiences with others.

The next subsection discusses collective intelligence that helped inform the design of N2N, including building up networks to help the diffusion of the N2N pilot.

2.5.3 Collective intelligence

A social movement like N2N should harness collective intelligence. Collective Intelligence entails "groups of individuals doing things collectively that seem intelligent" (Thomas W. Malone, 2006). Collective intelligence can apply to families, companies, on-line or neighborhood communities, countries, *etc.*. (ibid.). Three conditions appear necessary for an intelligent crowd: diversity, independence, and decentralization (Benkler, 2006; Christakis & Fowler, 2009; Thomas W. Malone, 2006; Surowiecki, 2004). Importantly, in today's world of new communication technologies where more and more people are connected to the Internet via mobile phones and computers, any new collective intelligence approach should take advantage of these tools (Christakis & Fowler, 2009). The literature of crowdsourcing and connections informed N2N pilot design (Benkler, 2006; Howe, 2008; T. W. Malone, Laubacher, & Dellarocas, 2009; Thomas W. Malone, 2004; Patterson et al., 2008; Shirky, 2008; Surowiecki, 2004; Watts, 2004).

The first step in designing a collective intelligence program is to decide on the model. Most projects use a combination of three types of crowd wisdom: cognition, coordination, and cooperation (Howe, 2008; T. W. Malone et al., 2009; Surowiecki, 2004; Tapscott, 2008). Research findings indicate that a successful collective intelligence project requires creating conditions under which people will express and share their knowledge (ibid.).

Second, the right crowd must be selected. Not everyone is interested in energy or saving energy (besides not being aware of energy use in their every day life). However, a subset of people are interested, the early adopters (Rogers, 1995), where a small percentage of people at the beginning of the diffusion curve are interested in saving energy for reasons such as: energy independence, saving money, reducing their own carbon footprint, or because they like helping others. This subset would make up the initial pilot participants and volunteers.

Thirdly, one must understand why a social group is motivated to be involved in N2N. Love and glory are two important motivators for a project of this sort (T. W. Malone et al., 2009). For instance, "love" is effective for tasks that relate to some "higher purpose", focusing on creating solutions for a social good like combating climate change (ibid.). A cautionary note for glory indicates that while it can be powerful, it can also "introduce counter-productive competition among performers" (ibid.). On the other hand, rewards programs and leaderboards take advantage of glory.

Another way of motivating participants is through the use of social capital, which is the "store of behaviors and norms in any large group that lets its members support one another" (Shirky, 2008). N2N calls a person with stores of social capital the trusted leader or trusted messenger. There are two types of social capital to focus on:

1. Bonding capital, which is exclusive and happens within social clusters, increasing the depth of connections and trust within a relatively homogenous group; and

2. Bridging capital, which is inclusive and happens between social clusters, increasing the connections among relatively heterogeneous groups (ibid.).

Bonding and bridging capital tie into network theory, which finds that it is important to take advantage of strong and weak social ties to increase the spread of the message (Christakis & Fowler, 2009; Granovetter, 1973; Watts, 2004).

While collective intelligence programs rely on social psychology and networking research, getting users to participate in collective intelligence also involves satisfying closely tied individual psychology and intrinsic motivations. For example, the design should consider Maslow's upper tiers of the hierarchy of needs (Maslow, 1943). At a basic level, N2N may provide a sense of belonging to a community of user innovators. In addition, esteem seems to also play an important role, including self-esteem, confidence, achievement, and respect by others. The most important needs to meet, however, may be the upper tier of self-actualization, including morality, creativity, spontaneity, and problem solving (Howe, 2008). This requires focusing on a combination of psychological, social, and emotional needs of people to encourage participation and leadership.

In fact, collective intelligence programs need both a community, as well as community leaders to provide direction, guidance, answers to participant questions (Benkler, 2006). However, it is important that the leaders not dictate to the community (ibid.). In the case of a complicated collective intelligence project, like Linux, Linus Torvalds made decisions, able to direct efforts using "persuasive, not legal or technical, and certainly not determinative" authority (ibid.). As Jaron Lanier opines in his essay on "Digital Maoism," collectives are guided by "well-meaning individuals" that focus the "collective and in some

cases also correct for some of the common hive mind failure modes" (Lanier, 2006). Lanier indicates that a collective will not be intelligent without a leader to influence the collectives (ibid.). In the case of N2N, the collective intelligence leaders are the outreach staff, transitioning to the volunteers from the community that focuses others to action.

At the heart of Benkler's book is the idea that the crowd is busy, and that although creative capacity and judgment may be universally distributed in a population, people will have very different amounts of time and attention (Benkler, 2006). His solution to this is "modularity", which is the "property of a project that describes the extent to which it can be broken down into smaller…modules that can be independently produced before they are assembled into a whole" (ibid.). According to Malone *et al*, collaboration approaches should be used when it is difficult to break the activity up into small pieces (otherwise one should use a collective approach) (T. W. Malone et al., 2009). To do so, it is useful to manage the dependencies among the pieces (ibid.).

As Malone discusses, Information Technology is exercising a strong force in changing the ways that groups of people collaborate (Malone, 2004).[29] For instance, one of the book's studies finds that average firm sizes in many industries are shrinking correlated to rapidly falling transaction costs associated with efficiencies created by the Internet (ibid.). Large increases in outsourcing are one indication that the firm is changing (ibid.). Malone describes an interesting organizational theory of the evolution of human affairs:

1. Stage one, where people operate in small, unconnected groups;

2. Stage two, where larger groups form and decision-making is centralized; and

3. Stage three, where "the large groups remain, but decision-making becomes more decentralized" (ibid.).

N2N attempts to follow Malone's "amazing pattern" (ibid.). For instance, prior to grant start, N2N started in stage one: organizing the stakeholders. N2N acted as the link between small, unconnected community groups, as well as the leader of the community. Upon grant award, N2N began stage two, taking over N2N execution of marketing and outreach. Now in the final year of operation, the goal of N2N is to build a community that can continue post-grant funding, or stage three where the communities take on their own decision-making related to program execution.

Although there is no generally good tool for collective intelligence, there should be a "goodness of fit" by which to select a tool (Shirky, 2008). The tool should be designed to fit the job being done and must help people do something they want to do (ibid.). In fact, there are several strategies that the tool should help with:

1. Make joining easy;
2. Reserve more complicated actions for more committed individuals;
3. Create personal value; and
4. Allow social value to manifest later (ibid.).

N2N focused on using community-based outreach supported through social media tools, like Facebook and YouTube. To help the collective execute N2N post-grant, N2N has designed a series of best practice guides, campaign calendars, and co-branded marketing material to make it easy for community leaders to implement and adapt the program the way that they want to adapt it.

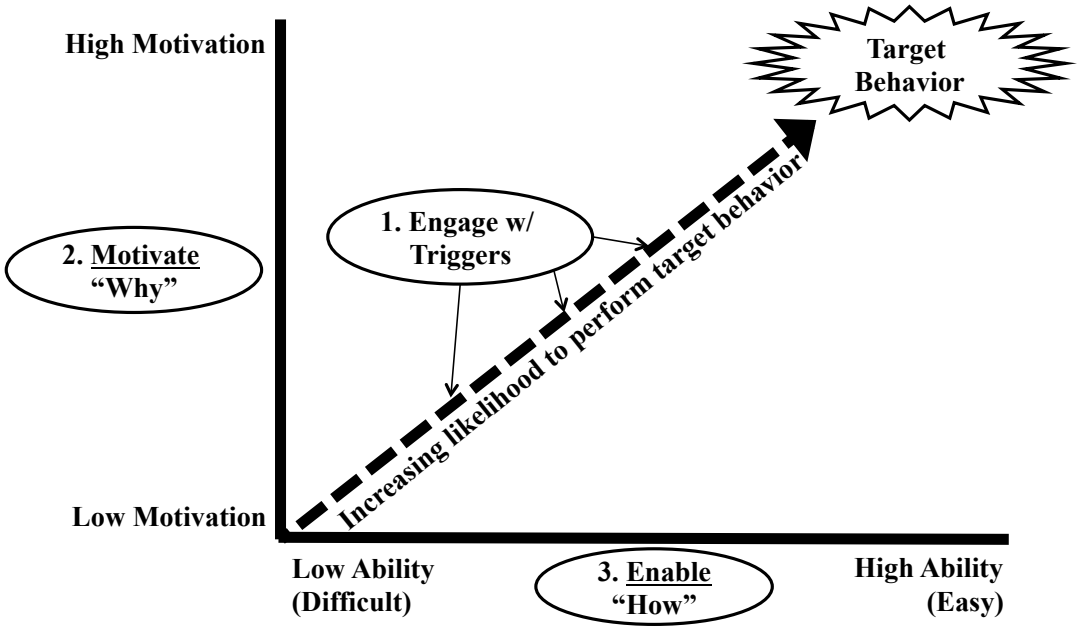
[29] Note, Malone is writing about the firm, but I believe the same principles apply here.

2.5 N2N Individual and Social Behavior Change Approach

As discussed throughout this Chapter, human decision-making systems are complex. In the real world, a comprehensive approach is necessary to motivate, enable, and trigger consumers into action. It should include personal, social, and structural/contextual dimensions. Figure 3 depicts a simplified model of the behavior change strategy that N2N used to design the program marketing materials and outreach approaches. It is based on Fogg's Behavior Change model (Fogg, 2002, 2009), and uses the components from Table 2.

The motivation y-axis, or why people would want to change their behavior, derives from the individual and social benefits in the table. The ability, or the x-axis, represents how or what abilities people need to make a change. The dotted line is a theoretical representation of a person's increasing likelihood to perform the target behavior. As people's motivation and ability increases, so should the likelihood that they will perform the target behavior. N2N focused on using the behavioral science approaches in Table 2 to increase motivation and ability, as well as to engage participants with behavioral triggers to attempt to induce energy efficient behaviors.

Figure 3 Behavior Change Approach (Adapted from Fogg, 2009)



The second half of Chapter 2 describes the pilot design prior to grant award.

2.6 N2N Large-Scale Demonstration Pilot Experimental Design

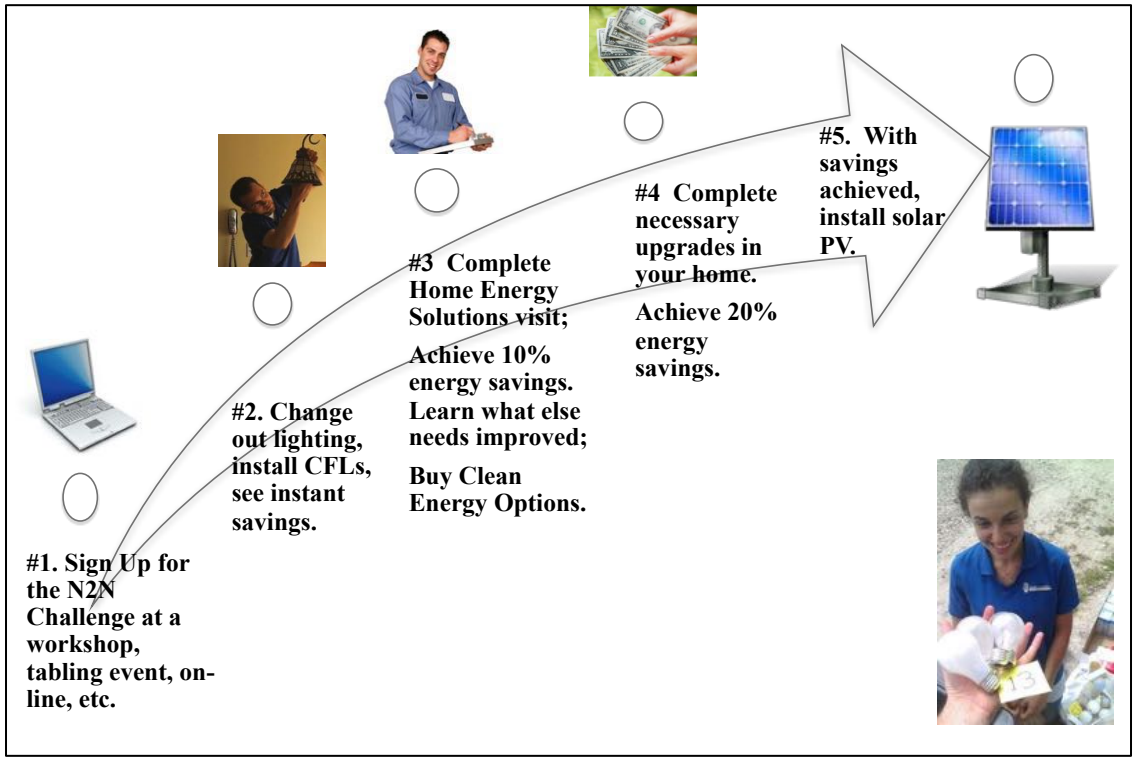
The following topics related to developing the N2N experimental design follow (*i.e.,* prior to grant funding award), including the:

1. Detailed N2N portfolio approach and hypothesis;
2. High level timeline and history; and
3. Pre-N2N History, including
    a. Designing the lighting program, and
    b. Pivoting the grant application to upgrade actions and town partnerships.

2.6.1 N2N's portfolio approach

N2N aims to get residents on the ladder of N2N sustainable energy actions by continuously engaging participants to increase their levels of energy savings resulting from energy efficiency and behavior change, as well as clean energy use (Stakeholder8, 2012). See Figure 4, where the arrow represents a main premise of the program design: that people will complete more actions as they complete more actions. The objective is to internalize the good feeling that comes with thinking of themselves as sustainable (R. B. Cialdini, 2001; D. McKenzie-Mohr, 2008). The arrow thickness also represents the level of commitment and the energy savings achieved by the household. N2N's customer relationship-based approach includes ongoing customer contact using community outreach strategies, email communications, contractor, and N2N energy advisor follow up, as well as a website that provides resources, guides, and social media strategies.

Figure 4 N2N Portfolio of Energy Efficiency and Clean Energy Options (N2N Marketing Collateral)



The N2N design split the pilot actions into smaller pieces for participants, starting with a foot-in-the-door, smaller action and building a customer relationship over time. N2N believes that customer acquisition should be more cost-effective than current CT programs, because people increase energy savings over time through completion of upgrades and, eventually, renewable energy generation projects. Participants start at any step in Figure 4 based on the household's readiness and motivation. For example, a customer that had taken very few energy efficiency steps could enter the pipeline with an in-home lighting visit as a foot-in-the-door measure. Those that have started changing some of their bulbs or could benefit from a blower door test and air sealing could enter the pipeline at the Home Energy Solutions (HES) assessment.

N2N experienced difficulty converting participants from the free or low-cost actions to home energy upgrades and solar. N2N team members state that working within an existing contractor market overseen by the utility-administrator means N2N feeds leads into a contractor pipeline with low upgrade conversion rates (see Sections 3.3 and 3.4 for more information) (Stakeholder3, 2012; Stakeholder8,

2012; Stakeholder10, 2012). Still, continuous evaluation has allowed the N2N team to address barriers and create solutions over time to slightly improve conversion rates discussed throughout the thesis.

N2N's pilot design pivoted from the original proposal to include the following program actions depicted in Figure 4:[30]

- Addressing information barriers, resetting norms, promoting social diffusion, and collecting leads through community workshops and other outreach approaches aimed at educating and informing the public on home performance.

- Completing the N2N lighting program including either in-home installation of efficient lighting or light bulb distribution events. The lighting program was skipped by customers that had either updated their own light bulbs or didn't have enough eligible bulb change outs to substantiate the in–home visit;

- Signing up for the CT Clean Energy Options program for switching to green power on the utility bill;

- Completing Home Energy Solutions (HES) assessment, a CT ratepayer funded and utility-administered program of direct install efficiency measures and assessment of additional energy action recommendations; and

- Completing home energy upgrade recommendations following the HES assessment, such as:

    - Advanced air sealing, insulation, heating ventilation and air conditioning equipment (HVAC), water heaters, appliances, *etc.*., and
    - Clean energy (Year 3 program focus), including solar thermal water heating and solar photovoltaic (PV) installations.

The free, direct install N2N lighting program replaced an average of 15 incandescent bulbs with CFLs in each participating household. The lighting funding ended August 2012, but the program was used in Years 1 and 2 to bring participants into the energy upgrade pipeline.

A Home Energy Solutions (HES) assessment is an existing ratepayer subsidized, three to five-hour in-home service, costing $75 for the customer.[31] It includes blower door and duct testing, light air sealing, duct sealing, water saving measures, and compact fluorescent light bulb upgrades. This customer would receive direct install components adding up to about nine percent energy savings. A customer that completes lighting and HES (without an upgrade) achieves about 14 percent energy savings on average. Completing the HES assessment provides access to CT rebates for home energy upgrades (excluding advanced air sealing), as well as to low interest financing for home energy upgrades.

[30] At grant writing, the portfolio of targeted household energy actions included two strategies later de-emphasized or eliminated:

- Developing a household energy savings plan supported by behavioral strategies (later de-emphasized due to a change in the data platform strategy); and
- Participating in home energy feedback devices (later eliminated from budget).

[31] HES visits all-in cost (*i.e.,* administration, labor, equipment, and customer cost) is about $850 on average. Low-income residents are eligible to receive HES and eligible appliance and insulation upgrades free of charge, but face a cumbersome application process.

The HES assessment is designed to include prioritized recommendations for increased savings at the kitchen table wrap up; however, the HES contractors do not consistently deliver the prioritized recommendations and bids (discussed in Section 3.4). N2N customers completing at least one upgrade save over 20 percent of energy use on average.

Years 1 and 2 focused on using lighting and HES assessment actions to acquire upgrade participants, while Year 3 shifted to acquire customers directly to upgrades, including solar generation.

2.6.2 N2N hypotheses

The N2N pilot design team members hypothesized that CBSM and outreach strategies steeped in social and individual behavioral science could be more cost-effective and achieve higher energy savings than traditional marketing programs (*e.g.,* utility-administered programs). At the heart of the N2N grant application, N2N hypothesized that for energy efficiency programs, traditional marketing can only compete with community-based programs given "a huge marketing budget to saturate the market, which isn't the case for most utility programs" (Stakeholder8, 2012). Instead of using traditional marketing, N2N designed a team of 14 diverse outreach coordinators to connect with organization and community social networks. N2N also planned to grow the word of mouth using free, earned media stories (*e.g.,* television, newspapers, online, *etc.*.). While traditional utility administrators often rely on getting into the customer's home just once, or by using a piecemeal approach with little or no connection between individual program offerings, N2N hoped to gain more social diffusion than an advertising-focused spend would achieve.

N2N is in the process of completing several analyses designed to determine if the hypothesis is true, including the research included in this thesis, as well as the forthcoming quantitative analysis and cost-effectiveness modeling.[32] This thesis is intended to address two research questions leading up to answering the cost-effectiveness hypothesis, including:

1. What conditions facilitate the adoption of energy efficiency?
2. How can community-based, behaviorally focused programs be used to drive higher energy savings per household in a larger portion of a community?

The pilot elements that facilitate answering these questions include using the developmental evaluation approach (*i.e.,* action research) previously described with careful attention to data management and transparent feedback. For instance, N2N built a Salesforce.com customer relationship management (CRM) database to handle the complicated N2N customer support pipeline and additional household energy-related data. The outreach team collects sign ups in the field, and engages with participants regularly through web, social media, and email communications. Managing the customer pipeline data allows N2N to pinpoint issues early, address shortcomings, and quickly adapt with a refined approach. Specifically, the data allows N2N to analyze where outreach resources are best deployed to determine which strategy converts more upgrades (*i.e.*, is more cost-effective), for example, for a canvassing strategy or a free lighting program.

Over time, N2N has learned that a central platform with a customer relationship management (CRM) database is critical for effective program management. The system supports the tracking of individual homes, projects, rebates, and products, as well as the impacts of individual contractors, outreach efforts, marketing pushes, and customer referral networks. In addition, it tracks and calculates energy baselines and impacts, as well as cost savings. The platform provides tools for the various N2N partners and stakeholders, including: homeowners/customers, trade allies (*i.e.*, home performance and solar

[32] In addition, the N2N evaluation team is currently developing cost-effectiveness and business scenario planning models to explore what projects beget success, and the matching outreach elements that are most cost-effective.

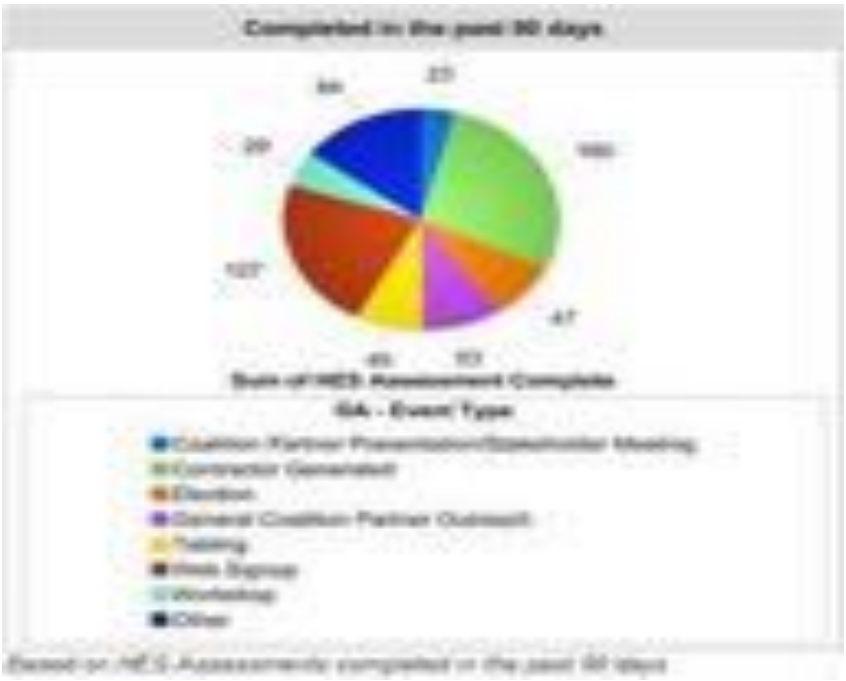
contractors), staff, program administrators, and policy makers. The technology platform also enables data transparency, allowing policymakers to analyze areas of program effectiveness and where program and policy incentives need to change. For instance, contractor statistics are publically available, motivating some contractors to improve their performance.

Goal setting and feedback loops are integral to effective program management and the outreach campaigns that drive program uptake. N2N has leveraged the technology platform to develop sophisticated internal and external dashboards that cover all aspects of driving participation and adoption of more and more complex energy actions. In fact, behavior change often happens incrementally over time, making it necessary to follow and drive the customer from simple behaviors to the installation of measures that achieve increased and more persistent savings. For instance, the N2N team developed a set of customized dashboards and reports, sharing the following:

- Outreach activities held,
- Leads generated by marketing channel,
- Individual household actions completed,
- Various sales pipeline metrics including key points in the process where a customer might drop off,
- Contractor performance,
- Energy savings metrics,
- Social media customer participation, and
- Online metrics.

See Figure 5 for a chart representing one of the numerous N2N dashboards.

Figure 5 HES Assessment Complete by Outreach Activity Type of Sign-Up (Trailing 90 Days)



2.7 N2N High-Level Timeline

Two major themes arise from the 26 N2N stakeholder interviews and the process of continuous developmental evaluation: uncertainty and change. Both often affected program momentum, where various stakeholders had to stop, assess, and refine processes to adapt to external factors.[33] Figure 6 provides a high-level N2N timeline.

The timeline illustrates the fairly constant state of program flux, depicting four distinct time periods, including:

1. Program design (described in this chapter); and
2. Three years of program execution and developmental evaluation (Chapters 3 through 5), including:
    a. Year 1: N2N Start up,
    b. Year 2: Improving the HES assessment program, and
    c. Year 3: Shifting to upgrade customer acquisition.

Starting in early 2009, Earth Markets formed the internal program team and community stakeholder partnerships, and began designing the N2N pilot. On September 14, 2009, the DOE released the Request for Information feedback on the upcoming Funding Opportunity Announcement (FOA) for Energy Efficiency and Community Block Grants (EECBG). One month later, the DOE released the FOA (October 18, 2009), leaving a three-month window to design and write the pilot proposal (due December 14, 2009). Six months later, the DOE announced award to the CT Energy Finance and Investment Authority (CEFIA) (CT Clean Energy Fund (CCEF) at the time) (June 11, 2010). N2N team members immediately began (unpaid) pilot preparation work.

Year 1 program execution started on July 26, 2010 when the grant funding began. The first two months entailed hiring the outreach and management staff and then hiring the Clean Energy Corps (Corps) outreach team. Next, the Corps completed over two weeks of formal N2N training about CBSM, outreach, and the technical aspects of the pilot's energy efficiency actions. Unfortunately, the outreach team was in place before N2N finished refining the pilot design and implementing a data management solution. Unexpected DOE reporting requirements would require designing a new Information Technology (IT) system, as well as hiring a new IT provider. When N2N began outreach in November 2010, the team relied on spreadsheets to collect, track, and analyze data. The IT system contract was signed in March 2011 and implemented in day-to-day operations by August 2011.

Between late March and June of 2011, N2N began a series of formal launch events in the 14 N2N towns, starting with an overall kick-off in March with the CT Governor, Dannel Patrick Malloy, and Energy Commissioner, Daniel C. Esty. The 14 communities publically renewed their formal commitments, and N2N began raising awareness from earned media stories. After the first few months of grant execution and low upgrade conversion rates, developmental evaluation helped N2N understand an important lesson: to prime and commit homeowners for energy upgrades at the first touch point.

On May 1, 2011, just as N2N was kicking off program marketing and outreach efforts, the CT Energy Efficiency Fund (*i.e.,* the ratepayer fund) placed severe caps on the number of oil heated Home Energy Solutions (HES) assessments. Since about 85 percent of N2N homes are heated with fuel oil, N2N participants could not complete HES assessments. With budget caps removed four months later

[33] Program stability and business certainty are necessary to maintain program momentum.

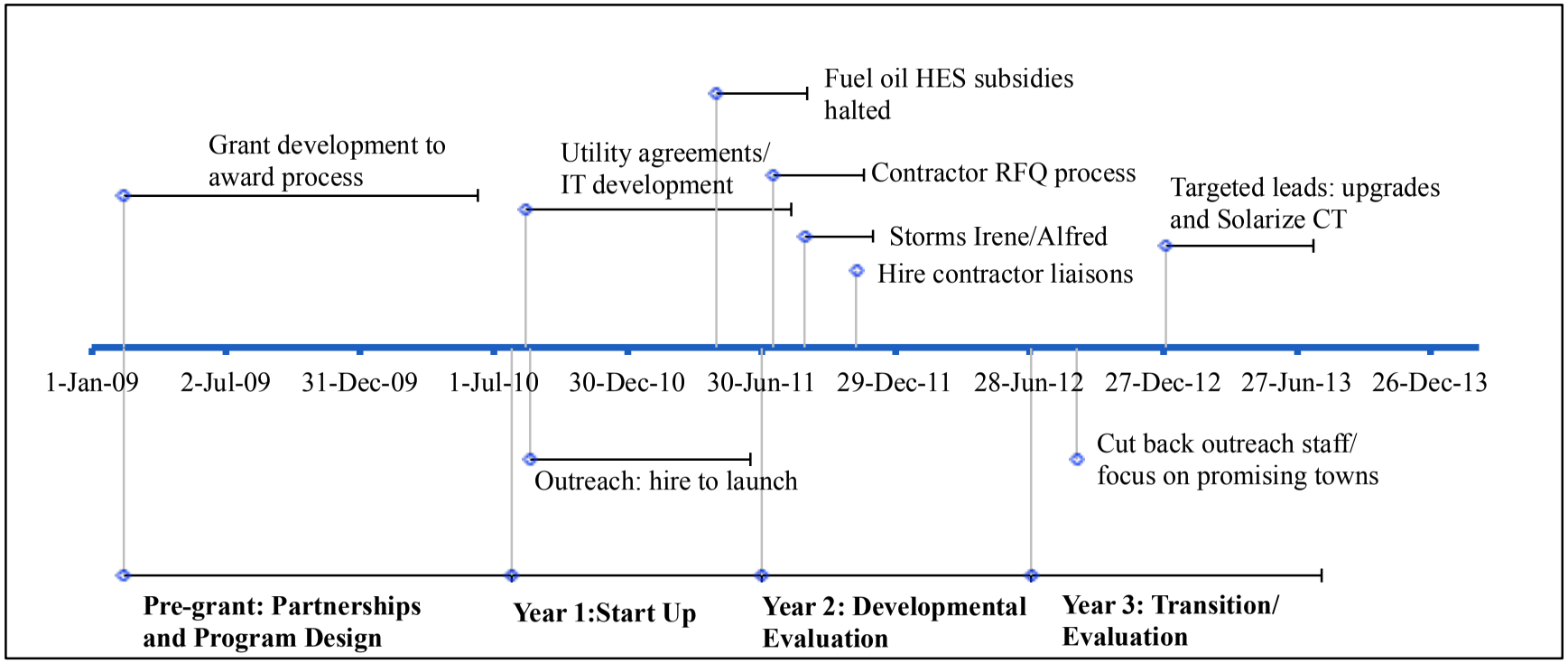
(September 2011) as N2N began Year 2, the funding gap caused substantial contractor layoffs and the loss of numerous N2N leads. At the same time, the Year 1 Corps service period ended. About half of the Corps stayed for a second service year.[34] Going into the 2011 heating season, contractors began to slowly increase fuel oil HES assessment completions, but were hesitant to hire additional contractor teams due to regulatory and market stability uncertainties (Stakeholder3, 2012; Stakeholder4, 2012; Stakeholder8, 2012).

Over the remainder of the Year 2, N2N focused efforts on bringing participants through to upgrades via lighting and HES assessment sign ups. Unfortunately, just as fuel oil funding was reinstated and the N2N technology platform was ready to go, N2N ran into two more program crises. On August 28, 2011, Tropical Storm Irene knocked out power to 670,000 CL&P customers for more than a week. On October 29, 2011, nor'easter Alfred knocked out power to 810,000 customers for up to 11 days (Kane, 2012). Both storms caused CT to virtually shut down, hampering both N2N and contractor operations even after N2N towns had power restored.

During the four-month heating oil-funding hiatus, N2N focused on improving contractor performance. For instance, N2N released a Request for Qualifications (RFQ) to hire and oversee a subset of contractors, selecting the new contractors in October 2011. At the same time, N2N designed the positions and hired two contractor liaisons/energy advisers to assist both contractors and customers through the upgrade pipeline in November 2011. In conjunction with the contractor liaisons, N2N implemented lead priority processes, attempting to deliver leads most likely to complete upgrades to contractors most likely to deliver upgrades.

[34] An updated training program was delivered to the new and returning Corps members.

Figure 6 N2N High-Level Timeline



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In September 2012, N2N cut back to approximately one-third of program support from Years 1 and 2 for outreach, marketing, the technology platform, and administration. Learning from the continuous developmental evaluation, the N2N team concluded that in its current form, the HES program could not be an effective customer acquisition strategy for home energy upgrades, one of the original program hypotheses. Needing to both provide a sustain program design and to close out the grant in Year 3, the N2N team began major program transformations, shifting outreach focus from HES acquisition to direct upgrade customer recruitment, including the following new priorities:

1. Implementing Solarize Connecticut, a CEFIA-funded pilot program in four N2N towns, designed to drive Solar PV in Connecticut. N2N particularly focused on helping CEFIA combine energy efficiency and solar messaging, as well as pulling lost solar leads to energy efficiency (CEFIA, 2013a).[35] Four towns were selected for Solarize Connecticut Phase I and II pilots: Mansfield, Portland, Westport, and Windham.

2. Introducing a vertically-integrated whole home performance energy upgrade contractor into the CT market to test upgrade acquisition strategies.

3. Assigning leads to three out of 10 of the RFQ-selected N2N contractors.

4. Supporting outreach for the CEFIA, Housing Development Fund, and Opportunity Finance Network for Cozy Home loan launch (CEFIA, 2012b).

5. Supporting CEFIA Smart-E loan launch outreach and partnership with contractor mentioned in #2 above. Smart-E will provide $28 million in "private sector capital for investment into deep energy retrofits, renewable energy deployment", and HVAC fuel switching from fuel oil to natural gas (CEFIA, 2012a).

N2N also learned that some communities might be able to independently sustain a volunteer-driven organizational program model, but others could not under present conditions. Therefore, Year 3 included cutting N2N support to six towns.[36] Year 3 N2N outreach will focus on eight N2N communities that had the volunteer resources in place to (hopefully) take over program implementation, including: Lebanon, Mansfield, Portland, Ridgefield, Westport, Wethersfield, Wilton, and Windham.

N2N grant spending ends in the third quarter of 2013. The remainder of Chapter 2 provides detailed history of designing the program and applying for funding.

2.8 N2N Detailed Pre-Grant History

This section describes the major changes to the pilot design from January 2009 up to kick off in July 2010, during which Earth Markets pulled together the internal and external stakeholders and wrote the grant application. On September 14, 2009, the DOE issued a competitive funding opportunity announcement (FOA) in support of The American Recovery and Reinvestment Act (ARRA) of 2009, Public Law 111-5 (DOE, 2009a). The program "represents a Presidential [*i.e.,* President Obama] priority to deploy the cheapest, cleanest, and most reliable energy technologies we have—energy efficiency and conservation—across the country" (DOE, 2012b). ARRA focused on development, promotion,

[35] Approximately 20 percent of the Solarize CT leads convert to solar installations losing others due mainly to siting issues, such as heavy tree cover, roof orientation, and other barriers, such as price, timing, *etc.* (CEFIA, 2013c).
[36] Bethany, Cheshire, East Haddam, East Hampton, Glastonbury, and Weston are not receiving Year 3 active N2N support.

implementation, and management of community energy efficiency and conservation programs that are designed to:

- Reduce greenhouse gases;
- Reduce energy use;
- Improve efficiency in transportation and building sectors; and
- Create and retain jobs (ibid.).

The U.S. DOE competitive grant announcement was an opportunity to pilot an innovative N2N program model supported by rigorous developmental evaluation to test hypotheses related to improving Connecticut's residential energy programs. On June 11, 2010, the N2N pilot won the $4.2 million *BetterBuildings* grant.

2.8.1 N2N lighting program

Prior to N2N, Earth Markets developed a lighting program to capture CT lighting savings potential for Compact Fluorescent Light bulbs (CFLs). In April 2010, CT Department of Public Utilities Commission (DPUC) (now Public Utilities Regulatory Authority (PURA) (formerly DPUC)) funded a study that found substantial CFL potential from:

- High CFL awareness and familiarity; and
- Low CFL penetration of 23 percent (Wilson-Wright, 2010).

The study also found a rapidly changing CFL market, as well as changes to existing programs "needed to boost saturation" (ibid.). Building on the CT lighting opportunity, Table 5 provides the household goals for the N2N lighting program.

Table 5 N2N Lighting Program Individual Household Goals

Yearly Value	Unit	Description
9,250	kWh	Total electricity consumption
1,200	kWh	Lighting electricity consumption (13% of total)
500	kWh	Lighting savings (40% of lighting consumption)
$100	$	Avoided lighting costs (0.18 cents/kWh)

For instance, lighting represents 13 percent of New England household electricity usage, or an average of 1,200 kWh of lighting electricity consumption per household per year (EIA, 2005).[37] Therefore, lighting costs each household about $200 per year (O'Neill & Garcia, 2011). The N2N lighting goal equals 500 kWh of lighting electricity consumption savings per year, for at least $100 of avoided electricity costs (ibid.).

Helping N2N participants understand their home's lighting savings by reviewing and sharing an end of visit report, as well as a later follow up letter (ibid.).The lighting program design influenced the N2N pilot approach for acquiring customers, collecting detailed data, and verifying the energy savings (O'Neill & Garcia, 2011). Importantly, part of the lighting funding would come from selling the energy savings in the CT Class III Renewable Energy Credit (REC) market (ibid.). On January 16, 2009, Earth Markets applied to the CT DPUC for permission to aggregate energy savings to trade in the Class III Renewable Portfolio Standards (RPS) (ibid.). The DPUC granted approval on June 24, 2009 to receive "100 percent of the

[37] Four N2N towns have electricity use below the EIA New England average electricity usage of 9,250 kWh per year per household, two are right at the average, and six are much higher than average with one town double the EIA average. See Appendix A.

value of the Renewable Energy Credits" (RECs) contingent on submitting an M&V plan to the DPUC (DPUC, 2009).

ARRA funding provided an opportunity to demonstrate the lighting program (DOE, 2012b). However, post-grant award, N2N realized that the DOE EECBG grants would focus on upgrade complete rates. Instead of completing the low hanging fruit of lighting, N2N shifted the pilot focus to upgrade complete rates (Stakeholder8, 2012). The N2N lighting program would become a foot-in-the-door customer touch point, hopefully on the path to home energy upgrades and clean energy installations. N2N would rely on Home Energy Solutions (HES) assessments to acquire upgrade customers (Figure 4). Although each CT program is administered and tracked separately, N2N attempted to package flexible energy solutions over time.

The next section continues with pre-grant history, describing another N2N program design shift: developing new municipal partnerships.

2.8.2 Pivot from cities to town partnerships

Town partnership development is a time consuming process, involving a complex network of stakeholder relationships. Earth Markets began partnership development with several larger municipalities in 2008, at least one year before the DOE funding announcement. In fact, several N2N project team members recognized that, "it would have been extremely difficult to pull in all of the necessary partners without being properly prepared" (Stakeholders 5, 8, 10). Preparing for the upcoming funding announcement, the team completed needs assessments and finalized formal agreements the major cities in Connecticut, including Hartford, New Haven, Hamden, *etc.*. by May 2009 (Stakeholder8). The team planned to spread into the suburbs during pilot implementation.

However, the September 2009 funding announcement for community formula grants only included towns smaller than 35,000 people. The team had two months to change the town partner recruiting strategy and to secure new partnership agreements in new municipalities. N2N focused on existing relationships throughout CT, identifying smaller communities that were already active in CT clean energy initiatives. For example, N2N's approach to town selection included conducting quick analyses to identifying promising towns, such as:

- Using CT Clean Energy Communities activity and Clean Energy Options (CTCEO) signups as an indicator of volunteer support in clean energy;
- Identifying a diverse set of demographics, especially median income and household density to enable future comparison between different types of towns (and similar control group towns) and diversify pilot learning.

- Connecting to each of Connecticut's U.S. Senators and Representatives to gain support from Washington, DC (Stakeholders5,8,10).

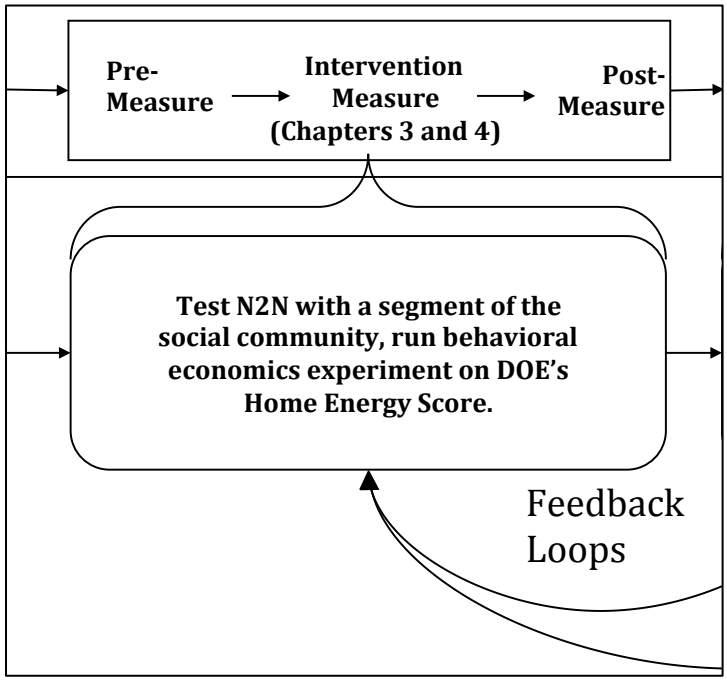
N2N ultimately partnered with 14 of the 15 targeted communities.

Chapter 3 describes the continuous interaction of program execution and developmental evaluation in Years 1 and 2.

Chapter 3: N2N Execution and Developmental Evaluation

Chapter 3 includes the research of the Connecticut Neighbor to Neighbor Energy Challenge (N2N) using the developmental evaluation methodology. Figure 7 excerpts the N2N pilot experiment, including the pre-measure, interventions, and post-measure stages. Developmental evaluation is a research methodology designed for complex systems experiments and programs, such as a Community-Based Social Marketing or participatory action research program (Heiskanen & Rask, 2006; Patton, 2011). It is used to support "innovation *development* to guide the adaptation to emergent and dynamic realities in complex environments" (ibid.). The complexity of N2N, where planning, execution, and evaluation occur simultaneously, requires an evaluation approach that allows for developing major program changes, real-time solutions, and innovative responses (ibid.).

Figure 7 Executing the Experiment using Developmental Evaluation



Chapter 3 will provide support for the following N2N high-level recommendations to support the program during the three following stages, including:

- Startup, pre-test IT systems and program designs, acquire quality leads, follow up for the lifetime customer, and continuously improve processes (Sections 3.1 and 3.2).

- On-going, fix the customer and contractor incentives (including funding all heating fuels), provide third-party administration, and learn from transparent data and results (Section 3.3).

- Innovate, provide IT systems for testing, learning, adapting, co-brand marketing programs, conduct market segmentation research, and develop customer-friendly packages of upgrades (Sections 3.4 and 3.5).

As the primary member of the N2N evaluation team, I have conducted developmental evaluation from grant startup with support and guidance from the rest of the N2N team to varying degrees, as well as

numerous other academic researchers. As a result, I have insider knowledge about the program design, administration, and evaluation. For instance, I understand the intricate details of major program changes as well as the N2N implementation team social interactions, customer reactions, and contractor relationships that would be very difficult for an independent, third-party evaluator to understand the details. I also understand the weakness in the N2N disparate and layered data sets that have been combined into one database for analysis. The task has required immeasurable hours of pre-analysis and pre-reporting clean up and preparation work by the author and numerous project stakeholders, including the N2N evaluation team, technology platform partner, contractor partners, Northeast Utilities, and the DOE and their contractors. While project stakeholders have tried hard to report accurate data to N2N, I am aware of mistakes and holes in the data that have and will continue to impact the forthcoming quantitative analysis.

Being intertwined in the execution also brings biases (Maxwell, 1992). For instance, I am emotionally vested in the success of the program and I am also involved in and influence the social relationships making up the N2N team. Still, I have tried my best to remain aware of my biases and be as critical as possible in the evaluation, while also taking advantage of my detailed knowledge.

The objective of the developmental evaluation is to analyze what worked and didn't work in a behaviorally-focused community-based social marketing program designed for households to complete energy upgrades and clean energy investments in their home. The evaluation explores several systems operating within the CT energy efficiency and clean energy economy, such as the: contractor network, behavioral and social science, technology platform, policy structure, innovation structure, and N2N program administration.

The results led to N2N recommendations and an improved go-forward program design, discussed in Chapter 5. The evaluation also informed the data needs and research questions for the forthcoming N2N quantitative evaluation that will explore the following:

- Penetration and conversion rates of individual N2N programs for both N2N and non-N2N towns,[38] and
- Cost-effectiveness of different outreach strategies and contractors.

The three experimental steps of Figure 7 (*i.e.,* pre-measure, intervention, post-measure) operated in a continuous loop over the four phases of deployment, including: pre-pilot, Year 1, Year 2, and Year 3. This analysis loop provided continuous developmental evaluation of program execution. Chapter 3 describes the evaluation of several real-time crisis situations that involved multiple systems and required N2N to make the following major program changes to:

1. Secure the utility data sharing and security agreements (Year 1) (Section 3.1.1),

2. Develop an IT system to manage and learn from the available data (Year 1) (Section 3.1.2),

3. Launch and continuously improve program outreach and lighting visit approaches, such as scripts for tabling, workshop, and neighborhood canvassing events, as well as overall lighting program process improvements (Year 1) (Sections 3.1.3 to 3.2),

4. Focus on HES contractor management through a RFQ process, extensive oversight, coaching, adapting, and disciplining (Year 2) (Sections 3.3 and 3.4), and

[38] Such as: in-home Lighting replacement visits, HES assessments, and upgrades.

5. Shift lead acquisition approaches away from HES assessments to whole-home performance contractors, solar opportunities, funded low-income programs, and financing strategies (Year 3) (Sections 5.1 to 5.3).

3.1 N2N Startup

In June 2010, the N2N team received notice of the grant award in addition to more stringent DOE reporting and data requirements (see Section 2.7 for timeline details). As a result and also due to yet to be secured utility data sharing agreements, N2N faced substantial internal IT challenges in Year 1. Therefore, Year 1 required developing the beta version of the IT system, including creating data collection templates, transfer procedures to/from DOE and Northeast Utilities/Connecticut Light & Power (CL&P), and calculation and analysis procedures. The IT system would enable N2N's reporting of actionable information to: program staff, the DOE, town stakeholders, contractor partners, and N2N participants.

There are two main areas of startup lessons learned described in the next five 3.1 subsections, including:

1. Incorporate pre-pilot resources for utility data sharing and technology platform development and deployment; and

2. Focus on acquiring quality leads and following up throughout the customer's lifetime sales pipeline.

Year 1 represents the pre-measure stage of research, where the evaluation team organized the IT system (Sections 3.1.1 and 3.1.2), and the outreach team prepared for pilot execution (Sections 3.1.3 to 3.1.5).

3.1.1 Utility data sharing agreement

Although there are numerous utility stakeholders, such as three natural gas companies, numerous fuel oil companies, and Bozrah Light & Power in Lebanon, most N2N participants were in the CL&P territory, under the parent company Northeast Utilities (NU). Therefore, N2N focused efforts on CL&P data access in the 14 N2N towns.[39]

It took seven months to negotiate the data sharing agreement, demanding substantial administrative resources for both N2N and CL&P. The process required CL&P stakeholders from the Information Technology (IT), Conservation & Load Management (CL&M), and Legal departments. For instance, IT needed a process for pulling reports and delivering the data *securely* to N2N on a monthly basis. In addition, the data requests and fulfillments needed to be incorporated into the C&LM plan. The Legal department coordinated the review of release form language and data sharing agreement details.

The agreement was the first time that NU, the parent company of CL&P, would provide direct utility access to an independent third-party (*i.e.,* a third-party not hired directly by the utility). In addition, both NU Legal and N2N were learning in real-time about their own views about privacy, data security, and the breach of data security (Stakeholders 8, 11, 12, 13). Both sides experienced process difficulties, but remained committed to the process.

[39] Home energy data note: N2N and much of the northeast still face the problem of collecting fuel oil usage data. CT has a high percentage of homes that heat with fuel oil (up to 85 percent in N2N towns). CT and the northeast should develop a data management system for fuel oil M&V, even during the natural gas transition period.

The NU data sharing and security agreement covered data use for program administration and research, specifically mentioning DOE and N2N internal partners, such as the 14 towns, and other grant partners involved in data analysis. In fact, all N2N program administrators and affiliated researchers have executed non-disclosure agreements, including signing a data confidentiality agreement. In addition, the internal program partners and staff have had data security training.

The data sharing agreement provided N2N access to the following data:

1. Monthly household level usage data for all N2N participants that sign a release form, including 24 months of historical, as well as ongoing monthly data for electricity and natural gas usage.

2. Quarterly historical and on-going program participation, savings, and cost data on HES assessments, HES assessment-Income Eligible assessments (HES-IE) (*e.g.,* the low income program), appliance rebates, HVAC rebates, and insulation rebates for N2N participant and for the utility-administered program participant totals (including counts, savings, and costs).

3. Monthly community-wide aggregate electricity and natural gas usage, where available, from 2008 forward and broken down by sector, including residential, small business, municipal, government, federal, state, including 24 moths of historical and ongoing monthly data.[40]

While the N2N-NU data sharing set new precedence, it held an unfavorable N2N compromise that meant that customer access to usage data is as long as 60 days after consumption (through the on-line N2N Personal Energy Dashboard).[41] This level of customer feedback is not frequent or soon enough to induce household action in most cases (Karen Ehrhardt-Martinez et al., 2010).

At implementation, NU faced internal IT challenges consolidating the data requests due to multiple IT platforms and limited tracking of savings for oil heated, electric, and natural gas homes, the number of direct installs, and other baseline data. For example, initially, NU could report the total installed measures, but not the measures tied to households by fuel type. NU and N2N extended a large effort to tie the measures together, including multiple rounds of data debugging.

3.1.2 N2N data platform development

N2N developed the beta IT system between August 2010 and March 2011. The task had inadequate resources assigned in the grant application. In fact, N2N had a different IT provider on the team, with an approach misaligned with the subsequent DOE requirements. Adapting to the unforeseen circumstances, N2N hired a new technology provider through a competitive bid process. Prior to releasing

[40] Aggregate town data notes:

1. After attempting to weather normalize aggregate town data, I conclude that 24 months of prior data is insufficient for establishing an accurate baseline. Further study is needed to refine the minimum number of years needed, but I suggest that 10 is the ideal minimum, and five years might suffice. My conclusions are based on research with Joana Abreu and our analysis discussions with David Roberts at NREL. Uncertainty in methodology and validity of results eliminated the aggregate data analysis from this document's write up.
2. Aggregate town-level data does not contain identifiable information, however, large business data was excluded because some towns only have one or two large businesses, making them identifiable.

[41] The delay follows from the data transfer process:

- On the first business Monday of the month, N2N gives NU a list of all existing (and new this month) N2N opt-in utility account numbers (i.e., all N2N participants with a signed release hard copy form on file in N2N's Salesforce.com database originating from a Lighting, HES assessment, or an upgrade completion).
- NU provides N2N with the N2N opt-in utility electricity and natural gas monthly data, as well as detailed household characteristics and savings data (Numbers 1 and 2 in the list above).

the IT RFP, the N2N evaluation team spent three months designing the comprehensive and integrated toolset (see software architecture diagram as designed by the author and Kerry O'Neill in Figure 8).

The process began with determining the data platform needs to support N2N's marketing and operations efforts, the evaluation and analysis tasks, as well as data reporting to the ratepayer funding board and CT regulators. For instance, N2N planned a comprehensive public education and outreach campaign around the local hosting community-based organizations, and needed a way to track the outreach team activities and community group involvement.

Sometimes aided by the DOE, N2N researched the existing market, meeting with numerous providers to learn about the existing capabilities. Building off the IT RFPs from the Local Energy Alliance Program (LEAP) and the New Bedford community programs (LEAP, 2010; NWEAC, 2010), N2N developed the technology platform requirements and prepared a RFP for the new provider (between July and November 2010). The N2N IT Toolset RFP issued on November 29, 2010 sought a technology provider that allowed N2N to track at a high level:

- Outreach Activities, including all community-based outreach activities, meetings, events, attendees, and community partners;

- Participant Activities, including every customer at the every step in the program, as well as their influence to bring other customers into the program (*e.g.*, refer a friend and word of mouth); and

- Project Activity and Savings, including every lighting, HES assessment, upgrade, and solar generation project (N2N, 2011).

Specifically, the author and N2N program manager, Kerry O'Neill, defined the following consumer-facing and program-facing software architecture (*i.e.,* platform elements) shown in Figure 8:

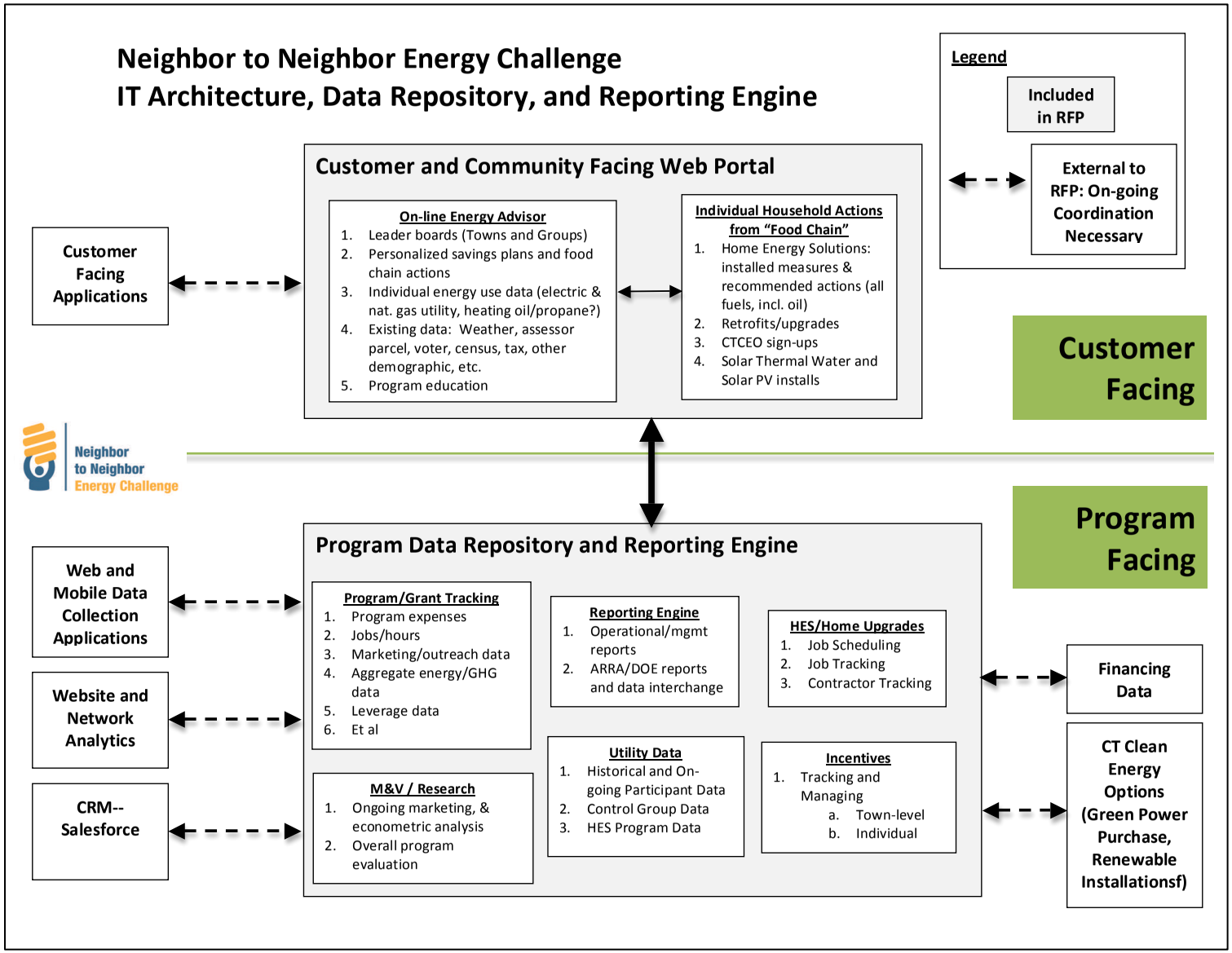
1) Consumer-facing:
    a. N2N website,
    b. Social media and mobilization tools,
    c. Personal Energy Dashboard,[42] and
    d. The Do-It-Yourself Energy Advisor.[43]

2) Program-facing:
    a. A web-based Customer Relationship Management (CRM), data repository, and reporting platform; and
    b. A variety of stand-alone web and mobile applications for program execution, including the outreach team Lighting and Event mobile applications, outreach event sign-up and debrief tools, as well as the Contractor-facing iAudit Pro application by Snugg Home.

The intent was a seamless customer pipeline management and educational toolset for various user groups, including N2N participants, the HES assessment contractor network, the public, media, marketing and outreach staff and volunteers, and program administrators and evaluators, such as N2N, the CT ratepayer funding board, N2N utility partners, and the DOE.

[42] The Personal Energy Dashboard never gained traction in N2N due to: limited program resources, delayed development of customized solutions, overly delayed utility data (*e.g.,* 60 days), and low participant interest.
[43] The Do-It-Yourself Energy Advisor may have potential to prime and support participants to complete upgrades; however, I was unable to execute academically sound experiments.

Figure 8 N2N Technology Platform RFP Requirements (designed by K. Donnelly and K. O'Neill)



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In late December 2010, N2N selected Snugg Home to develop the technology platform and toolset, based on their market and technical experience, as well as their understanding of the complex nature of the required data platform. Snugg provided resources on the platform development beginning in January 2011. It took two months to negotiate the contract terms, especially how to meet the utility security requirements for handling utility data for N2N households. In March 2011, Earth Markets and Snugg Home signed the contract to develop the technology platform.

N2N first defined the data collection requirements and tools needed for each event type, household, and home energy project, including free in-home lighting, HES assessments, and upgrades. The platform required six months to develop and build, and platform maintenance and upgrade work continues today.

The current technology platform allows N2N to track the customer and promote future energy efficiency actions through multi-touch approaches, such as:

- Invitations to local community events;
- Automatic emails at different steps of the customer's ladder of sustainability actions to provide prompts and priming for upgrades;
- Customer segmentation data to support better targeted marketing for customer acquisition, cross-sell, and upsell; and
- Integration of website, Facebook, and other social media analytics.

Even today, program data collection and integrity is a big challenge, but early program experience collected sparse and messy data. N2N addressed most of the early issues by investing more resources to train the outreach staff on the manual processes, developing quality control procedures. Then, over time, N2N layered in the technology platform into the daily operations as it became available. There is widespread consensus that the process of developing and deploying the technology platform was resource intensive, involving numerous deployments of beta versions, using already overcommitted outreach staff to test and help debug the technology platforms (Stakeholders1, and 5-8).

By mid-2011, N2N began to use the Salesforce.com platform for data collection, developing program metrics and dashboards to understand events that led to N2N program activity, as well as how close rates compared by contractor, town, and outreach activity. By the end of 2011, N2N completed development and deployment for most of the comprehensive technology platform shown in Figure 8.

3.1.3 Outreach staff training and soft launch

While the evaluation team developed the IT system, the N2N outreach team began getting ready for program launch, which would include both community outreach activities and in-home lighting visits. First, the on the ground outreach team, consisting of two Clean Water Fund organizers and one supervisor were hired and trained and began developing implementation plans and materials. Shortly thereafter the Clean Energy Corps (*i.e.*, the Corps), was hired, trained, between September and November 2010. The Corps was made up of young adults (*i.e.*, recent undergraduate college graduates) through the Student Conservation Association (SCA). Training included two weeks of intense orientation, team building, N2N program design and background, as well as an introduction to several topics, including:

- Energy and clean energy,
- Behavior and qualitative research,
- Marketing and outreach,
- Community organizing,
- Qualitative analysis methods, and
- Social media.

Responsible for community outreach, as well as delivering the N2N in-home lighting visits described in Section 2.8.1, the Corps also completed the five-day in-home lighting visit technician certificate under the Rensselaer Polytechnic Institute's Lighting Research Center.[44]

The Corps had numerous critiques about the N2N on-boarding process, especially that the Corps' roles and the N2N implementation plan were not yet well formulated. The finding was unsurprising because the N2N program had already changed directions several times. The original intention of the Corps was strictly to conduct the in-home lighting visits, but with the shift in program focus to upgrades, the N2N team hadn't yet formulated a cohesive vision of outreach or a clear internal management structure. In addition, the numerous training sessions illustrate the breadth and depth of activities that each Corps member was expected to master. Later developmental evaluation interviews indicate that outreach staff felt pulled in too many directions and unable to focus on outreach itself (Stakeholder1, 2012; Stakeholder5, 2012; Stakeholder6, 2012; Stakeholder7, 2012).

Before, during, and after training the Corps, the outreach team led by the Clean Water Fund (CWF) completed community asset mapping exercises to determine through which organizations to enter the community, as well as to identify key community leaders and passionate volunteers. From this, the team developed the outreach implementation plans for the 14 communities.

With the outreach team and plans formed, as well as the building community and state agency excitement from being competitively selected by the DOE, pressure to implement N2N began to mount. N2N program administrators noted "little choice but to start program execution without a data platform" (Stakeholder8, 2012). Therefore, the N2N marketing and outreach staff made plans to launch N2N in four clusters of four towns each based on geographical proximity, demographic similarities, and in some cases, the opportunity to develop friendly competitions. N2N held a soft launch on Election Day, November 2, 2010 (about three months into grant administration), where teams of two or three staffed N2N tables of information at polling stations across the 14 towns. Election Day tabling generated the first N2N program leads.

Data collection began manually at first, with plans to layer in the technology platform as development occurred. To start manual data collection, the CWF created an event debrief spreadsheet to record details of each outreach activity, including information about the N2N staff, community volunteers, and local organizations holding the event, as well as the materials and displays, participant sign ups and feedback, and outreach team pitches and approaches. At first, data tracking was limited because the Corps found it hard to remember and/or track 20 fields for each outreach activity. However, N2N developed several simplified in-field data collection tools and customer sign-in sheets that were tailored and shortened by outreach activity. These slowly transformed into the Salesforce.com data entry interfaces for tracking outreach activities.

In November 2010, N2N had begun to roll out the major program components of community outreach and lighting, but staff often experienced frustration from being uncertain about the most current program guidelines that were regularly being changed.[45] In fact, the evaluation team had started the developmental

[44] It wasn't until late Year 1 and into Year 2 as the IT system was iteratively deployed, that the Corps received extensive training on data collection and tracking, including detailed Salesforce.com training. In addition, not identified as a need until Year 2, the Corps also completed training about the technical aspects of upgrades in mid-Year 2.

[45] The lighting startup was smoother than the community outreach startup period. According to the N2N team, this flagship program was more organized, better prepared, and provided detailed training (Stakeholder8, Stakeholder10). The Corps "felt more grounded in the material and process of the in-home lighting visit" (N2N,

evaluation while the pilot planning and execution were also taking place, leading to frequent program changes. The early developmental evaluation research relied on a variety of qualitative and analytical approaches, using N2N data such as weekly debriefs, spreadsheet analysis, and quick post outreach activity customer surveys.

Part of the developmental evaluation to understand why customers were not completing energy actions after they signed up is discussed next. The Year 1 evaluation focused on refining the N2N marketing messages and outreach approaches.

3.1.4 N2N outreach

By mid-2011, N2N program performance resulted in only 4 percent of HES assessments converting into upgrades. This result meant that N2N needed to focus on outreach approaches to source quality leads, as well as the contractor sales pipeline process, likely the two most important factors for achieving completed upgrades. This section discusses the evaluation of the outreach approaches, and Sections 3.3 and 3.4 describe the contractor approaches.

The early N2N outreach produced a large number of participant sign ups in-line with projected numbers necessary to meet program goals. To verify, N2N created program analysis spreadsheets to view a program snapshot of the first month of community outreach (See the first row of Table 6 for all outreach in November 2010).[46]

Table 6 Early N2N Pilot Performance Snapshots

Time Stamp	**Signed up for HES at event**	**Total Scheduled Assessments**	**Inquiry-to-Schedule Rate**	**Total Completed HES**	**Inquiry-to-Complete Rate**	**Total Upgrade Jobs Completed**	**Lead to Upgrade rate**
11/2/2010 to 11/30/2010 (measured 11/30/2010)	27	6	22%	4	14.81%	1	3.7%
11/2/2010 to 12/10/2010 (measured 3/20/2013)	27	28	Unknown	28	112%	6	24%

Note: The second row in Table 6 reflects N2N performance data for outreach events between November 2, 2010 and December 10, 2010, the date of the analysis session; however, it was created on March 20, 2013 (over two years later), showing a system delay where more people complete HES assessments and upgrades over time. At the time of analysis, the first row represented the current program performance.

2010). Less complicated than selling upgrades to unaware participants, the lighting program, launched later, was easier for the public to understand, and simpler to execute and manage (ibid.).

[46] November 2010 outreach consisted mainly of setting up tables in the 14 towns on Election Day and during local festivals.

Unfortunately, the data snapshot revealed that most leads did not sign up for or complete HES assessments (or subsequent energy upgrades). For instance, by the end of November 2010, only 13 percent (27 people) that stopped by the N2N table signed up for a HES assessment. One month after signing up, only 22 percent (6 of 27 people) had completed a HES assessment (with one upgrade completed). In addition, N2N found that contractors were not securing signed release forms (0 percent), and only delivered recommendations and bids for two out of the four completed HES assessments. In fact, N2N sign ups were not yielding adequate energy savings to meet N2N goals.

N2N quickly regrouped to learn and adapt from the outreach experience to date, including learning about: the outreach team's performance, where to improve, and the individual and social characteristics driving sign-ups (*e.g.,* the outreach pitch and impacts of the participant's probability of completing the HES assessment). Based on Drazen Prelec's class of the same name, I led the first of several Listening to the Voice of the Consumer (*i.e.,* the N2N participant) analysis sessions (Burchill & Brodie, 2005; Prelec, 2009) (see Appendix C for details about the session).

The methodology uses ethnographic research techniques to collect participant voices (*i.e.,* raw data). That data is scrubbed, combining the most important characteristics into similar categories for analysis. The participant voices become information that helps the outreach team promote completion of energy efficiency actions. Collected by the outreach team (and manually recorded in the debrief spreadsheets at the time), the analyzed data set included: the marketing pitches, program benefits, word for word participant reactions, sponsoring entity characteristics, trusted messenger introductions, and event characteristics. (Burchill & Brodie, 2005; Prelec, 2009)

The outreach staff was included in the analysis to drive self-education, as well as to "slow down and add structure to the [outreach and evaluation] processes" (Prelec, 2009). Using this process, smaller data sets can return high quality results because the outreach staff can "really listen to and understand the needs of the [N2N participants]" (ibid.). In addition, the outreach team didn't seem to understand the importance of the data collection process, causing incomplete data collection and data entry by the Corps. The evaluation team hoped that the outreach team would discover the difficulty of analyzing an incomplete data set. In fact, the Corps did identify the importance of complete data sets and the need for field data collection and tracking tools through the analysis process.[47]

The results of the analysis revealed several outreach implementation issues contributing to a low number of HES assessment completes from outreach event sign-ups, for instance some people:

- Said yes to the young, enthusiastic outreach staff, but didn't feel bad saying no to the contractor that followed up;
- Only agreed to getting additional information, but Corps staff put them in the scheduling queue; and
- Were confused or thought signing up was enough to support the cause, and became passive participants.

The analysis also revealed three key program deficiencies (Table 7). First, the outreach team's messages (*i.e.,* the pitches, or the ask) were inconsistent and confusing to participants. For example, some leads were surprised about what they had signed up for, or that the HES assessment was their next step. Others seemed to have changed their minds, and some had signed up to volunteer without signing up for a

[47] The toolset needs were defined by how the outreach team found it easiest to collect and record data. It was developed over time and included paper, web, and iPad tools for recording event and participant characteristics, as well as program sign-ups to different energy actions.

program action.[48] Many dropped off somewhere in the process of scheduling the HES assessment due to various barriers, such as needing four weekday hours with someone home. Other household structural barriers prevent the blower door test and postponed the job, such as construction work, gas leaks, asbestos, *etc.*.

Table 7 N2N December 2010 Developmental Evaluation Findings and Corrections

Program Deficiency	Program Correction
Customer confusion	Refine marketing pitches and collateral
Customer skepticism and misconceptions	Use trusted messengers
Outreach team confusion	Complete additional training

Second, potential participants were skeptical because they thought their home was already efficient. They believed they could not benefit from the program or contribute additional savings towards their community's goal. In fact, most homes in CT are older with additional efficiency potential, meaning that most participants had misconceptions about their homes.

Third, the analysis uncovered that the customer's confusion was most likely due to the outreach team's uncertainty with the marketing messages. During the analysis, Corps members indicated they didn't always understand their role, expressing "being intimidated" and that they "had to wing it, for the most part when pitching N2N" (Corps analysis participants). The outreach team was unclear about the details of the energy savings actions that participants were expected to take (except for lighting), including insulation, HVAC, air sealing, and even HES assessments. In addition, the outreach events only allowed a few minutes to talk to each customer, which made it difficult for the outreach staff to set consistent expectations of the participant's next steps.

Corps confusion arose partially because the N2N program design wasn't yet fully developed. The Corps also needed addition training to feel comfortable taking on the complex task of identifying the participant's probable N2N pipeline entry point and pitching to that entry. At the same time, N2N asked them to prime that participant for eventual upgrades. It was also a complicated (and evolving) first job after undergraduate education. In fact, most Corps members were learning a new skill: selling to potential participants in the field about energy technology. But mainly, the team had unclear expectations for the role of the HES program as an acquisition strategy due to an unclear path to upgrades, as well as significantly varied results by different contractors (especially while some Better Buildings programs were achieving 40 to 50 percent conversion rates compared to 10 percent for CT) (Stakeholder5,8).

To address the customer confusion, the N2N evaluation, marketing, and outreach teams focused on refining the marketing messages. The analysis uncovered the need for a better identification of the barriers that hindered and the benefits that motivated N2N participation. For instance, the data showed that subjects responded to both personal (*i.e.,* household*)* and community benefits, but that the benefits had to be clearly communicated.

To address the skepticism of participants learning about N2N for the first time, the outreach team compared the outcomes with and without a community member's presence. The comparisons revealed evidence of the importance of the presence of a trusted messenger at tabling events and workshops.[49] At events without that trusted volunteer, it would be more important to establish a personal connection with

[48] N2N didn't have the infrastructure to put volunteers to work right away, and the majority dropped off without volunteering.

[49] The trusted messenger facilitates introduction into each participant's trusted social circle.

each potential participant.[50] N2N set the guideline to include trusted messengers at events whenever feasible, later canceling events with the double hit of low RSVPs and a missing community ambassador.

Regarding customer misconceptions, N2N needed to educate potential participants about the efficiency potential in their households. This finding prompted the marketing team to develop take away marketing materials, permanent banners, and refined tabling displays to educate homeowners about their energy efficiency potential. The finding also led to more emphasis on the educational workshops, defining programs targeted to the novice to those interested in advanced energy upgrades.

The Corps confusion resulted partially from gaps in the Corps technical and community engagement knowledge, later addressed through additional training. In addition, the Corps didn't believe that households would commit to deeper upgrades in the first customer touch point, and found it difficult to promote. In fact, the outreach team stated that asking a person to commit to solar or upgrades was too much, and even harder if the participant is unaware of easier energy efficient actions. For example, the household hadn't yet completed more cost-effective actions, either on their own or through N2N steps.

The Corps also heard customer feedback that busy people didn't want to (or have time to) think about the difficult task of completing upgrades. This finding is consistent with the sustainable behavior commitment literature, indicating that commitments should start small at first and grow larger over time (Ester, 1985; R. Katzev, and Johnson, Theodore, 1987; D. McKenzie-Mohr, 2008). The analysis exercise identified the need for a balance between priming participants to complete upgrades without overwhelming them at the first touch point.

Despite disappointing lead conversion rates, the analysis fostered optimism. Prior to program launch, the outreach staff had touched a "broad and deep piece of the 14 communities for the first time" on Election Day 2010 (Stakeholder8, 2012). N2N's ultimate goal was to create widespread community involvement and expected that it would take time to develop a social framework to achieve multiple customer touches.

Through process improvement efforts like these, as well as on the job learning from the better-trained and skilled Clean Water Fund (CWF) outreach staff, the Corps began to improve their confidence and skill levels. Even today, CWF outreach staff attempts a delicate balance of customer asks in the field. For instance, rather than asking for a commitment in the field to *complete* an upgrade, but does prime for the upgrade while asking people to do easier steps (*e.g.,* like completing a solar consultation, HES assessment, *etc.*.) (Stakeholder5).

3.1.5 N2N's official launch

N2N publically launched on March 22, 2011 ahead of the data system. Recognizing the importance of political support, N2N had a "compelling story that made sense to emphasize to the CT policymakers and leaders" (Stakeholder8).[51] The team worked hard to make the kickoff event "a splash" (Stakeholder8), gaining exposure from CT political and policymaker leadership. The event also built excitement and momentum amongst N2N and community implementers. In addition, the launch event lifted the mood of the N2N team, which had been frustrated by program startup challenges (Stakeholder5, Stakeholder8).

[50] In Year 2, N2N developed the participant stories or ways for the outreach team to develop personal relationships around benefits that resonate with individual participants (see Section 3.5).

[51] At the DOE *BetterBuildings* (BB) conferences, N2N learned that the N2N program was unique. Unlike other DOE BB grantees, N2N operated within a regulated environment through a partnership with utility programs using an already established contractor network. Most grantees were developing programs independent of existing utility-administered programs, and creating their own contractor networks and incentives (Stakeholder8).

Following the public launch, the outreach team hosted town kick-off events in the 14 N2N towns. The smaller kick-off events leveraged the momentum gained by the official N2N kick-off. To acquire leads and promote the N2N brand, N2N relied on a strong presence at community workshops and local activities, as well as media attention. For instance, the N2N marketing team leveraged free media stories (*i.e.,* earned media). Between March and June 2011, N2N outreach staff described the program as "awesome" and stated that "team spirits were high" (Stakeholder1, 2012; Stakeholder6, 2012). N2N saw a large uptick in program sign ups, as well as earned media coverage, and felt that things were going very well on the outreach side (ibid.).

By now, the outreach team was more proficient, taking on a wide and complex variety of tasks, including executing lighting visits, sourcing HES assessment sign ups, following up with customers, managing volunteers, producing newsletters and blogs, and managing the website and social media processes. Lines of accountability became clearer as CWF staff took on direct management and supervision of the Corps, imposing rigorous outreach planning tools, training and procedures (Stakeholder5). Discussed earlier, the Corps also managed the data collection and tracking. Str*etch*ed thin, N2N program data still indicated that the:

- N2N outreach team struggled to manage the customer sales pipeline; and
- HES contractors failed to deliver assessment completion ratios high enough to meet program goals.[52]

The rest of Chapter 3 is focused on addressing these pilot deficiencies, where:

- Section 3.2 evaluates the N2N lighting program, including lighting visit performance as well as general outreach strategies; and
- Sections 3.3 and 3.4 describe the developmental evaluation of the upgrade customer acquisition approaches in Year 2.

3.2 N2N Lighting

The lighting program ran throughout pilot Years 1 and 2 from December 2010 through July 2012, beginning about one month after the outreach soft launch on Election Day 2010. The N2N lighting program provided a more controlled environment for program evaluation. The program is described next. First, after signing up for a lighting visit at an outreach activity or on-line, the certified Corps members updated household light sockets with CFL bulbs. The incandescent bulbs were later recycled. The visit included careful documentation and tracking of:

- The changed bulbs,
- The location of the light socket,[53] and
- Whether or not the bulb was working and recycled (O'Neill & Garcia, 2011).[54]

The Corps were also responsible for several other tasks during the lighting visit:

[52] Reminder: For the first two years of N2N, N2N relied on the regulated HES assessment program as the first step to upgrades, providing access to State rebates. Despite a HES assessment having an attractive six-month payback period, the contractors struggle with engaging leads to complete HES assessments or follow on upgrades.
[53] High-use sockets were targeted in hallways, kitchens, living rooms, dining rooms, dens, and home offices.
[54] N2N uses the in-home lighting visit data to calculate lighting visit savings under the CT Program Savings Document (*i.e.,* deemed savings calculations) (Ghilani, Gay, Berbrin, & Ananthachar, 2011). N2N is aggregating the verified savings from completed N2N lighting visits to receive Class III RECs payments, being applied towards funding the N2N town rewards program.

1. Collecting two signed program forms to release: RECs, and monthly utility data (Section 2.8.1).
2. Upselling and cross selling HES assessments and CT Clean Energy Options (*i.e.*, the CT green power purchase option).
3. Helping N2N participants understand their home's lighting savings by reviewing and sharing an end of visit report, as well as a later follow up letter (ibid.).

Given the program's pivot to emphasize upgrades and the various outreach tasks assigned to the Corps, N2N struggled to meet the original lighting volume goals of:

3,000 homes X 10 CFLs per home = 30,000 installed CFLs

An unrealistic goal after program changes, the Corps didn't have time to visit 3,000 homes; therefore, the goal shifted to maximize the number of bulbs installed per household, still aiming to install 30,000 CFLs. The lighting program results in Table 8 show an average of 15 and 17 bulbs per home in Year 1 and Year 2, respectively.

Shown in the Year 1 and Year 2 goal results (Table 9), N2N installed just over 17,500 bulbs (Year 1 + Year 2), or almost 60 percent of the original goal. Due to program de-emphasis and inconsistency as to whether Corps members felt it was important enough to promote, N2N did not achieve the 25 percent CTCEO (Clean Energy Options) sign up rate (Stakeholder5).

Still, N2N did accomplish three goals:

1. Saving over 50 Watts per CFL installed,
2. Saving 500 to 750 kWh per visit per year, and
3. Achieving 50 to 75 percent HES assessment sign up rate.

N2N did not explicitly set HES assessment complete or upgrade goals; however, future lighting program design should include these goals.

Table 8 N2N Lighting Program Statistics

Average	Year 1 Corps	Year 2 Corps
Total Jobs	336	737
Percent of Total Jobs	31%	69%
Jobs per week	5	10
Jobs per day	2	3
Time on the job	1:04	0:54
# Bulbs replaced/job	15	17
Total bulbs replaced	5,040	12,529
Watts saved/job	786	842
Average Watts saved/bulb replaced	51	50
Electricity saved (kWh/job/year)	721	705
Electricity saved (kWh/bulb replaced/year)	46	41
Dollars saved/job/year	$130	$125
Dollars saved/bulb replaced/year	$8	$7
Emissions avoided (lbs. CO^2/job/year)	585	567
Emissions avoided/bulb replaced/year (lbs. CO^2)	38	33
Equivalent # of 200W solar PV panels	3.0	2.9
Lighting Visit Components Ratios		
Authorization form signed	94%	96%
ICLs recycled	94%	98%
RECs release signed	90%	99%
HES sign-up	56%	66%
HES complete	56%	41%
CTCEO sign-up	7%	4%

Table 9 N2N Lighting Goal Results

Average	Year 1 Corps	Year 2 Corps	Goal or Goal Range	% of Goal
Total bulbs replaced	5,040	12,529	30,000	59%
Average Watts saved/bulb replaced	51	50	50	100%
Electricity saved (kWh/job/year)	721	705	500 to 750 kWh	100%
HES sign-up	56%	66%	50 to 75%	100%
CTCEO sign-up	7%	4%	25%	20%

Over the course of the lighting program, N2N completed several mid-stream evaluations, including: April, May, and December 2011, as well as July 2012 (Table 10). The first evaluation in April 2011 compared lighting program progress to the program goals, resulting in several program changes and another reevaluation in May 2011.

Table 10 N2N Lighting Program Result Snapshots

Evaluation Date	Cumulative Visit Count	# of Bulbs Replaced	Watts Saved (Demand)	Electricity Savedper year (kWh) (Usage)	Dollars Saved per Year	Emissions Avoided per year (lbs CO^2)	Equivalent # of 200W Solar PV Panels
April 9, 2011	61	663	34,369	33,065	$ 6,127.00	27,489	137.8
Average per Visit		11	563	542	$ 100.44	451	2.3
May 11, 2011	84	1,069	54,601	52,666	$ 9,694.00	43,653	219.6
Average		13	650	544	$ 115.40	520	2.6
December 31, 2011	313	4,934	248,682	219,057	$39,204.00	176,939	891.1
Average		16	797	702	$ 125.65	567	2.9
July 31, 2012	539	8,830	441,365	379,816	$67,844.00	306,204	1558.9
Average		17	828	713	$ 127.29	574	2.9

For instance, the Corps completed 61 visits by April 9, 2011 (including approximately 25 training visits with N2N friends and family members completed between December 2010 and January 2011). At program start, the average lighting visit replaced 11 incandescent light bulbs with CFLs, saving 542 kWh and $100 each year on the utility bill. The Corps signed up 56 percent for a HES assessment; however, at the time only 20 percent had converted into completes.[55]

In April 2011, the evaluation team analyzed the lighting statistics in this snapshot, spoke to customers, reviewed post-visit customer surveys, and conducted a lighting-focused analysis session with the Corps. The evaluation found the Corps technically competent, performing the details of the lighting visits well.[56] In addition, the Corps thought the lighting visit tried to fulfill too many roles, offering a "one-stop shop" and "so many customer asks that dilute our message" (N2N, 2010). The evaluation uncovered the complicated hour-long lighting visit process (from the perception of the consumer), where the team of two would:

1. Create a personal connection with the participant while explaining the upcoming lighting visit;

2. Evaluate the household lighting situation, then discuss each socket and bulb exchange with a household decision-maker prior to replacement;

3. Calculate and discuss the homeowner's electricity, dollar, and emissions reductions from the replacements;

4. Ask the participant to sign the N2N program and release forms;

5. Convince the customer to sign up for a $75 HES assessment (while priming for the upgrade); and

6. Ask the customer to apply the savings from the visit to purchase green energy (*i.e.,* CTCEO, where participants pay a 10 percent premium on electricity bill for green power).

Although it was difficult to disaggregate the reasons for low sign ups at events, the first analysis session developed several hypotheses:

- N2N shifted focus from lighting to achieving upgrades, therefore, the outreach teams and volunteers promoted HES assessments more often, because HES is the step to State rebate access;

[55] By November 8, 2012, 33 percent of lighting visit participants had completed a HES assessment. This is a second confirmation of the pattern of time delay between household actions due to personal and process barriers.
[56] However, as previously discovered in the earlier Listening to the Voice of the Customer analysis (N2N, 2010), the Corps was still learning about the behavioral approaches needed to upsell and cross-sell participants.

- Outreach events offered too many ways for customers to sign onto the N2N pipeline, including signing up for the newsletter, lighting program, HES assessment, and sometimes, solar PV;

- The HES assessment also includes changing out 25 bulbs to CFLs (40 bulbs in Year 2);

- A portion of the N2N event attendees has already upgraded their lighting. Others do not find CFLs aesthetically pleasing. Many participants preferred incandescent, halogen, and newly emerging LED (Light Emitting Diodes) light bulbs; and

- A large number of the 2010 Election Day events leads focused on lighting sign-ups didn't make it through the pipeline due to numerous program execution issues.[57]

Based on the findings, the evaluation team focused on the following N2N lighting program process changes, including:

- Promoting the "refer a friend" campaign;[58]
- Simplifying the lighting visit's call to action to prime for upgrades via HES assessments, eliminating focus on CTCEO; and
- Continuing to improve the release forms signature rates.[59]

The second evaluation in May 2011, after deploying changes for about a month (Table 10), still indicated low lighting completions around 12 percent of the goal projections (*e.g.,* 84 out of 690 completed visits, and 1,053 bulbs out of 10,000 bulbs). The evaluation determined that the Corps members were underutilized on N2N lighting implementation. For instance, shown in Table 11, the Corps completed 6.4 jobs per week on average, well below the original projections of 25 jobs per week.

Table 11 Monthly and Weekly Lighting Jobs

	Dec-10 to May-11	**June-11 to May-12**	**June-12 to Jul-12**	**Program**
	Year 1	**Year 2**	**Year 2**	**Total**
Avg. Monthly Jobs	16.7	29.3	44.0	27.0
Avg. Jobs/Week	4.2	8.3	12.4	7.5
Median Monthly Jobs	18.5	27.5	44.0	24.0
Median Jobs/Week	4.6	7.5	12.4	6.4

Evaluation also uncovered the time consuming process of traveling to and from lighting visits. Because the 14 towns stretch across CT, longer travel times resulted than anticipated in the original grant goals. In fact, analysis found trips up to 90 minutes each way. The average time per job was one hour and 2

[57] Reasons discussed earlier: 1. Unprepared outreach staff, 2. Confused outreach messages, 3. Insincere sign ups (*e.g.,* where people do not plan to follow through when they sign up), 4. Lost leads. By now, N2N realized the difficulty of N2N program execution, evaluation, and adaptation.

[58] The refer-a-friend cards started as a promising research project. The Corps began using them in the field mid-April 2011. Unfortunately, execution lacked, where the post cards were designed to be filled out by a participant and addressed to a friend. The Corps would record the referred friends and mail out the post cards. Instead, the Corps handed out post cards directly to participants to mail out later. The referral connections could not be tracked, and there was little guarantee that the cards were ever mailed. Still, N2N has seen strong evidence of word of mouth as a successful acquisition strategy, which will be evaluated in the forthcoming N2N quantitative analysis document.

[59] Surprising some stakeholders, the release forms turned out to be relatively easy to acquire (*e.g.,* 96 percent for Year 2 lighting).

minutes, or about 33 percent above the application goals of 45 minutes per visit. The evaluation team adapted by decreasing goals and trading off longer in-home job time for extensive data collection. The longer travel time was included in forecasting. N2N dedicated additional Corps resources to lighting, including full time installers, and a full-time scheduler.[60]

In August 2011, the Corps staff members turned over, giving N2N the opportunity to hire, train, and deploy a new outreach and lighting staff based on the lessons learned from Year 1. The overall outreach focus was on heavily promoting insulation and air sealing as solutions to the problem of winter high energy costs and ice dams, as well as encouraging oil-heated customers to take advantage of state rebates and financing incentives. The second Corps was also trained to prime potential customers on the need for upgrades, and instituted follow up call nights that messaged post-HES assessment upgrades. The outreach team also focused on improving volunteer development and increasing the numbers of volunteers to build critical mass for continued action post N2N.

N2N also shifted lighting goals, targeting lighting outreach in six of the14 N2N towns based on program experience and decreasing the travel time between lighting visits. The Year 2 lighting team included experienced Corps members, and a new crew of energetic technicians. The lighting visit statistics continued to improve with the number of bulbs replaced, watts saved, and electricity, dollars, and emissions saved per year steadily increasing at each snapshot (Table 10). In addition, signed release form rates increased from 80 percent in the first six months to 99 percent in the last few months of the program.

N2N also added several process improvements designed to meet program lighting goals. For instance, N2N added a lighting pre-qualification process to move participants with low lighting potential straight to HES assessments. N2N also automated several of the lighting data entry and management processes in Salesforce.com. In addition, the Corps began installing CFLs in sockets in addition to the previous high use area installations, so that each visit would increase the number of bulbs replaced.

With the lighting program performance stabilized, N2N data continued to show numerous issues managing the customer sales pipeline for both N2N outreach and HES contractors. The qualitative research led N2N to refine the outreach pitches and collateral to prime customers that the ultimate goal is whole home performance (*e.g.,* upgrades). In addition, several training programs were added for N2N staff to beef up their technical knowledge about upgrades, as well as to teach them marketing and behavioral science to help speak the customer's language. Small changes have been made to the program that ensure that customers understand what they are signing up for, such as implementing a receipt for the sign-up in the field that details next steps and serves as a reminder of the commitment. N2N also provided additional customer touch points such as an email confirmation including the outreach event where they signed up and the name of the contractor who would be contacting them.

[60] The Year 1 evaluations uncovered that manual data entry hindered data analysis. Therefore, several members of the N2N team, including Corps members, the evaluation team, Mobile Genius, and Snugg Home, built a mobile application in Year 2 for in-home data entry during lighting visits. The iPad mobile application replaced worksheets and computer spreadsheets data collection, as well as Class III RECs and Measurement and Evaluation spreadsheet calculations. The mobile application was designed to reduce the number of full-time lighting Corps members to four, optimizing the lighting program operations. For instance, three full-time installers, and another to handle scheduling and fulfillment tasks. The mobile application would also allow for almost real-time program evaluation decisions based on how Corps members were performing individually, as teams, and collectively. In actuality, the Light Saver mobile application was not fully implemented prior to lighting program completion due to execution failures, such as: database connection issues and bugs, the Corps status quo behavioral barrier (*e.g.,* they didn't want to learn a new process), limited internal Corps management, and lack of a dedicated N2N project manager (*i.e.*, many involved, no one in charge).

In addition, the team communicated Year 1 accomplishments and lessons learned, as well as changes in the program for Year 2 to program stakeholders, including CT Energy Efficiency Fund Board members and consultants, program administrators, as well as community partners.

While Year 1 focused on developmental evaluation of the outreach and lighting strategies, Year 2 focused on improving the contractor pipeline from lead assignment to HES assessment to upgrade. An integral piece of this was layering in the data platform as it became available.

3.3 CT Regulatory Structure for Upgrades

N2N executed the N2N pilot within the existing regulatory and market construct in CT, relying on HES assessment and follow on rebate funding. A major Year 1 and part of Year 2 program approach has been to promote upgrades via the HES assessment program in the 14 N2N towns.

This section describes the developmental evaluation research during Years 1 and 2 related to regulatory and market barriers preventing widespread uptake of upgrades. N2N recommends the following regulatory changes to overcome contractor market structure barriers, where State policymakers should:

1. Fund a continuous source of fuel oil incentives (Section 3.3.1).[61]

2. Create a program-neutral, third-party administration team of outreach, marketing, and contractor oversight to manage the CT customer pipeline and contractor network (Section 3.3.2).[62]

3. Publish transparent performance data and contractor advising services (Section 3.3.3).

4. Redesign the HES assessment contractor and customer incentives to encourage upgrades (Section 3.3.4).[63]

Evidenced early in the pilot, oil-heated homes are not as likely (as electric and natural gas homes) to complete a HES assessment (Stakeholders5,8,10). For instance, unstable funding levels and less utility program marketing have impacted oil-heated HES and upgrade completions. At the same time, oil-heated homes have higher energy savings rates for HES assessments and upgrades (ibid.). N2N attempted to mitigate oil-heated funding deficits with limited success.

The following four sections briefly discuss the four regulatory structure impacts based on N2N's implementation experience.

3.3.1 Fuel oil funding

Heating-oil funding waivered throughout the N2N pilot. For example, Table 12 includes several instances where fuel oil funding was halted with little indication about when it would be reinstated.

[61] The stops and starts in the fuel oil funding have greatly impacted the contractor market's ability to deliver upgrades, impacting N2N pilot outcomes.
[62] The administrators would combine State clean incentives to match customer needs, provide close contractor oversight and quality control, act as advisers to the contractors and intermediaries between contractors and customers, *etc*.
[63] Rather than the current structure that overpays for completed HES assessments and underpays for upgrades.

Table 12 Oil-Heated Homes Funding Uncertainty Timeline (During N2N Years 1 and 2)

Date	Regulator Action Impacting Oil-Heated Program Performance
1/1/11	Stopped rebates for insulation and windows (9 months) Stopped HES assessment program due co-pay questions temporarily
5/1/11	Implemented severe HES program funding limits (5 months)
6/1/11	Increased financing interest rate to 9.25%
9/1/11	Resumed rebates retroactive to 1/1/10 (insulation & window rebates)
9/1/11	Resumed HES program funding
12/1/11	Sustained market and regulatory uncertainty about 2012 HES assessment funding (*i.e.,* On December 14, 2011, DEEP requested RGGI funds for oil and propane through Feb/Mar 2012) (2 months)
1/31/12	Resumed oil-heated rebates retroactive to 1/1/12 through between March and May 2012 Sustained uncertainty about long-term program funding due to $500K budget cap
2/1/12	New insulation loan program, 0% for $1000-$2500
4/4/12	Home Performance with Energy Star (HPwES) launched in CT
5/15/12	Low funding reserves decrease community groups', contractors', and N2N's willingness to promote HES assessments
6/12/12	Remove $500K fuel oil and propane conservation cap (Senate Bill 501)
1/1/13	Attic and wall insulation rebate up to $1.00/sq. ft. (from $0.50/sq. ft.) up to 50% of installation cost. Redemption period expanded to 120 days (from 90 days).

In early 2011, the ratepayer fund began rationing HES assessments for oil-heated homes, limiting the winter fuel oil marketing efforts.[64] At the same time, the DPUC temporarily halted the oil-heated HES assessment program due to differences in electric and natural gas co-pay. In May 2011, HES assessment and upgrade activity "came to a screeching halt across the state" (Stakeholder8), and especially for N2N because approximately 85 percent of N2N customers heat with fuel oil. In June 2011, oil-heated loan interest rates increased to 9.25 percent from between 0 and 2.99 percent, depending on the measure.

With a fully funded team in place to promote HES assessments and upgrades, N2N program operations were deeply impacted. Needing an immediate solution, N2N dedicated resources working with the state policymakers to resume N2N operations. N2N tried requesting priority for N2N leads to get served over other programs, but was unsuccessful (Stakeholder8).[65] Instead, it took four months for HES program funding to resume on September 1, 2011,[66] a hard hit in terms of the N2N grant period and the peak season of upgrades (Fall/Winter).

During the wait, N2N shifted focus to homes heated with electricity and natural gas. In addition, N2N increased resources to lighting visits in some communities, while struggling to manage the HES assessment pipeline in others. N2N scrambled day-to-day to find capacity for N2N-generated leads, despite halting most outreach directed at lead generation. In fact, the HES assessment contractor market had laid-off between 80 and 90 technicians, greatly impacting HES assessment volume (Stakeholder3,

[64] Winter is an active time for HES assessments and upgrades, as people notice house problems related to comfort more often in the winter in CT.
[65] N2N also attempted to create an independent program, where N2N subsidized the HES assessment with grant funds, charging customers $50 co-pay. N2N approached program administers, attempting access to oil-heated rebate funds. Oil-funding was reinstated before N2N could wrap up the deployment requirements. (Stakeholder5)
[66] In September 2011, the ratepayer fund discovered about two million dollars in 2011 unspent funds.

2012; Stakeholder8, 2012; Stakeholder14, 2012; Stakeholder15, 2012; Stakeholder16, 2012).[67] Additionally, program experience indicates that contractors did not rebound and have not rehired their technician teams back to pre-crisis levels (Stakeholders5,8). N2N, the utility-administered programs, and the contractors lost momentum.[68] The contractor reluctance to staff up technician teams resulted in increased average complete time for HES assessment, negatively impacting N2N complete rates.

Still, additional oil funding market uncertainties impacted the contractor market development. For instance, in December 2011, oil-heating funding ran low, and DEEP requested RGGI funds for oil and propane through February or March 2012. With only a few months left and another two months until the request was approved, many oil jobs booked in December for January went without service.

N2N continued to meet with state policymakers about the problems surrounding energy conservation for oil-heated homes, pushing for sustainable program funding and financing solutions. Looking for an alternative, N2N began exploring how to leverage a Home Performance with Energy Star (HPwES) model for oil-heated homes, hoping to use the whole-home approach to address some of the problems with the HES assessment program design. Note, N2N hoped HPwES would help solve the lack of upgrade focus in the HES assessment program for all homes, not just oil-heated (Stakeholder5).

For instance, in mid-2012, N2N attempted to emulate the Mass Save (Massachusetts Saves [Energy]) residential upgrade model, working to introduce a vertically-integrated whole-home performance contractor into CT. N2N wanted a lead contractor to help manage the contractor network and the customer pipeline. After a lengthy time spent convincing the contractor to partner with N2N, and the ensuing approval process, utility administrator approval for access to customer incentives and rebates was granted in early March 2013.

At the same time, the HES assessment contractors were reluctant to hire to meet demand without funding certainty in place. Reinforcing this mindset, the ratepayer funding reserves ran low again in May 2012. N2N used the looming deadline to induce scarcity, encouraging oil-heated homes to complete their HES assessment and upgrades before funding ran out. After months of uncertainty, the CT General Assembly held a special legislative session on June 12, 2012 and lifted the $500,000 heating-oil funding caps (Connecticut, 2012; CWF, 2012). Firms still exhibited reluctance to hire to fill backlogs heading into summer, a traditionally slow time for HES assessments and upgrades (Stakeholders2,5,8). N2N was once again impacted by the contractors' abilities to handle N2N volume in a timely manner (Stakeholders5,8).

As a first step to stimulating the contractor market, CT policymakers should fund a continuous source of fuel oil incentives and financing programs, including heating-oil and propane. The oil-heated timeline illustrates a reinforcing feedback loop of sporadic funding and contractor uncertainty that has impacted the State's ability to drive upgrades. The stops and starts in the fuel oil funding have greatly impacted the contractor market's ability to deliver upgrades and negatively impacted N2N outcomes.

The next section describes N2N's Contractor RFQ process for increased customer oversight, an attempt at more robust program administration.

3.3.2 Third-party administration

N2N worked with the utility-selected contractors operating in the 14 N2N towns. However, N2N recognized a need for tighter management of contractors to increase rates of: assessments, bid deliveries,

[67] Although I don't know for certain, 85 technicians is about one-half of the total HES contractor market at the time. There are 26 HES vendors in CT (out of 130 applications), and most contractors have a small number of technician teams (HDF, 2012; Stakeholder5, 2012).

[68] N2N also lost a backlog of scheduled leads through Summer 2011.

and upgrades (Stakeholder8, Stakeholder5). Therefore, N2N developed a Contractor RFQ to select a subset of the highest performance HES assessment contractors.[69] The goal of the RFQ (and the later added new contractor liaison team discussed next) was to add a layer of quality control for the HES assessments and upgrades. In fact, a lack of quality control is a huge barrier for promoting upgrades because stories of poor contractor work get passed around quickly through word of mouth hindering program uptake (Stakeholder14, 2012; Stakeholder15, 2012; Stakeholder16, 2012).

The resource intensive process of developing the RFQ allowed N2N to work through both N2N and contractor process challenges. In late summer 2011, N2N issued the RFQ to formally select contractors to work under detailed guidelines and expectations that governed:

- service level agreements for customer service and data reporting,
- expectations for bid and upgrade rates, and
- acknowledgement of the public contractor scorecard (including firm names) shared at CT ratepayer fund meetings and with utility program administrators.[70]

In October 2011, N2N selected 10 contractors, including six of the 13 previous contractors. Along with monthly contractor scorecards with customer pipeline statistics, N2N also instituted monthly contractor group meetings and identified the need for contractor sales training. As a result of intensive focus on the bid process, N2N saw several contractors increase their bid rate and a small improvement in the overall upgrade rate (contractor performance results discussed in Section 3.4).

In addition to adding a third-party administrator like N2N, CT policymakers should add a second layer of contractor oversight. For instance, in Massachusetts, NStar employs Conservation Services Group to provide third-party contractor oversight administration (Roche, 2012). N2N recommends a joint third-party approach for CT to manage the customer pipeline and contractor network, and track project performance. It would also allows N2N and the contractor lead to combine State energy incentives to match customer needs, to provide close program contractor oversight, and to increase quality control and data reporting of jobs.

Despite the contractor improvements from the additional guidelines, further improvements to contractor performance were needed. The N2N contractor liaisons are discussed next.

3.3.3 Contractor liaisons

Gratefully acknowledged in contractor interviews and also noted by N2N staff, a large portion of N2N program administration and outreach team resources were spent helping partner contractors manage the customer pipeline (Stakeholder3, 2012; Stakeholder4, 2012; Stakeholder5, 2012; Stakeholder8, 2012). N2N contractor support ramped up in early 2011, with increasing resource allocations as N2N continued.

N2N's biggest contractor-only staffing allocations began in November 2011, when N2N introduced two part-time contractor liaison/energy advisor team members and a full-time data analyst to support contractors in improving their processes and customer interactions. Also available to customers with questions about recommended next steps or the upgrade process, the contractor liaison team uses the data platform to manage N2N's customer pipeline, working with each contractor to follow each customer to upgrades.

[69] The RFQ was based on lessons learned from other DOE *BetterBuildings* programs that were achieving higher audit-to-upgrade conversion rates than N2N.

[70] Initially, each contractor's individual scorecard results were shared only with that contractor. N2N also shared the program average and some commentary on where each contractor ranked compared to other contractor partners.

Over the fourth quarter of 2011, the N2N contractor liaisons provided training to the contractor staff about the N2N data system and program requirements. In conjunction with the N2N marketing team, N2N began developing co-branded N2N and contractor marketing materials, and providing N2N contractors with materials and scripts to concentrate on selling deeper improvements. This included training each contractor's in-home technicians about how to speak about N2N. In addition, N2N led development of N2N/Contractor co-marketing campaigns, such as letters to customers regarding insulation rebates for oil-heated homes, the Share the Warmth campaign that donated a blanket to a needy family for each upgrade, *etc.*.

N2N instituted monthly all-contractor meetings for boosting communication, sharing, and learning among contractors and N2N staff. Over the course of this learning process, N2N developed formal evaluations of contractor performance. Specific contractor issues began showing signs of process improvements, including improving lead response and/or customer follow up time, as well as increasing rates of delivering recommendations and project bids.

N2N developed a QA/QC program for upgrade installations that doesn't exist today in the utility-administered program. Noted earlier, quality control helps protect against negative word of mouth impacts. Finally, N2N identified a training need, and sponsored two Dale Carnegie contractor sales performance training sessions, subsidizing 50 percent of the training fees for the18 attendees. Following the training, N2N identified companies that needed to develop written sales protocols, and supported them in the development. The goal was to help contractors speak the customer's language, leading to sales and higher upgrade completion rates.

While N2N saw some program improvement through contractor oversight, at the same time, N2N has remained constrained by the contractor and customer incentive structures as discussed next.

3.3.4 Contractor and customer incentives

For both the contractor and the customer, the HES assessment incentives are very attractive.[71] For instance, in 2013, the customer pays either $75 for electricity and natural gas heating, or $99 for oil-heated home HES assessments (CEEF, 2013). The assessment delivers $750 worth of services, and customers can save an average of $350 on their yearly energy bills (CEEF, 2013; Faesy, 2013). At the same time, contractors are reimbursed well for their time (Stakeholders3, 5, 8, 10). Examining the 2012 HES assessment results indicated that approximately 65 percent of the program funding goes to HES assessments with the remainder spent on upgrades (CEEF, 2013; Faesy, 2013).[72]

N2N believes that more study is needed to better align customer and contractor incentives, including the timing of the rebates, who gets what amount, and the alignment towards the goal of increased households savings through upgrades. In fact, the state should consider backing off incentive levels for HES assessments and increasing incentive levels for upgrades to line up contractor sales and operational investments to promote upgrades.

3.4 N2N Upgrade Performance

Despite the contractor market set backs and program recommendations described in the previous section, N2N was able to systematically address some of the N2N and other stakeholder performance issues. For

[71] In fact, one of N2N's contractors started out as a whole home performance contractor with the highest upgrade conversion rates among N2N partner contractors. N2N data indicates that the company may have slipped into the HES-only business delivery model, dropping bid delivery and upgrade completion rates significantly.

[72] For example, the 2012 total HES program budget was $23 million, serving approximately 17,000 HES assessment customers at an average cost of $850 per assessment. Therefore, approximately $14.4 million of the budget was spent delivering HES assessments.

instance, the focus on contractor-related process improvements led to several changes in the program design, where N2N:

- Distributed leads to contractors within one day, wherever possible, and expected less than two day follow up by the contractors.
- Improved process flows for the customer pipeline, adding automatic customer communications through the Salesforce.com interface, and
- Updated contractor marketing communication language.

To improve CT upgrade performance, N2N recommends the following high-level program changes, including:

- Use IT systems to track, analyze, report on, and adapt the program;
- Co-brand between programs using trusted, third parties, such as N2N, towns, contractors, State and Federal agencies, *etc..; and*
- Develop market segmentation research to develop consumer packages of incentives and upgrade actions.

N2N evaluated contractor performance often during Years 1 and 2, leading to program design adaptations. Over time, N2N attempted to narrow gaps in the participant drop-off at different points in the pipeline. Evaluations focused on close rates for HES assessments, which should include prioritization of additional energy upgrades (*i.e.*, the bid), as well as close rates for upgrades.

3.4.1 The contractor sales pipeline

In the first two months of field operations, N2N achieved a HES assessment close rate of only 26 percent (*i.e.*, the ratio of leads completing HES assessments). N2N assumed low close rates were due to poor lead quality given the newly trained-outreach staff, and addresses several issues with the qualitative analyses previously described (Section 3.1.4). However, N2N also undertook mixed-methods quantitative and qualitative analyses to verify additional causes.

N2N found a high degree of probability that after handing leads to the utility to assign to contractors, the leads were falling through the cracks or going cold.[73] N2N identified several instances where leads were significantly delayed in being assigned to contractors by the utility, and sometimes the leads were lost entirely. Further analysis of how long before contractors received a lead from (N2N and then) the utility and the first customer contact revealed instances where contractors receiving the leads within a day and processing them within a day had higher HES assessment close rates.

The N2N dashboard report revealed that the HES lead conversion to completed assessment was low across the board, but extremely low for one particular contractor that also happened to be getting the majority of leads. In this case, it turned out that the contractor was simply not reporting completed assessments to N2N (*e.g.,* over 50 percent of customer records were missing entirely).

N2N implemented process changes in lead assignment to ensure fast turnaround times to the contractor's first contact. This included eliminating an extra step in lead assignment. N2N began assigning the leads directly to the contractors instead of feeding leads to the utility administrator to assign. In addition, Salesforce.com improvements were implemented to automatically create a HES assessment project and contractor follow up tasks associated with the project, increasing accountability for following up with the

[73] Leads become cold with a smaller probability of moving forward if they are not contacted shortly after signing up because they forget, or lose momentum and motivation (Stakeholder8).

lead. N2N also created automatic follow up communication materials after HES assessment completion to educate customers about their upgrade options, as well as to collect customer survey satisfaction data.

Next, N2N focused on the extremely low upgrade rate of 4 percent (*i.e.,* the number of homes completing an upgrade after completing the HES assessment). N2N used the data platform to develop a contractor scorecard that reported a number of metrics, including the HES assessment leads assigned by contractor and the rates of:

- HES assessment lead conversion;
- Customer releases signed (which N2N needs to receive individual household monthly, HES assessment, and upgrade data from the utility);
- Contractor assessment reports uploaded to the N2N platform;
- HES assessments with an upgrade bid delivered to the customer, and
- HES assessments that completed an upgrade after a HES assessment.

The contractor scorecard immediately revealed wide variations between the lowest and highest performing contractors for each of the metrics. For instance, some contractors had almost 100 percent completion rates for attaching the customer release and assessment report to Salesforce.com, where others struggled in the 50 to 60 percent range. Most revealing, three contractors that were handling 40 percent of the N2N HES volume had an upgrade bid rate (percent of HES assessment homes receiving a follow up bid) of just 2 percent on average, and an upgrade rate of 0 percent, dragging down the average upgrade rate for the pilot. Even the highest performing contractors had bid rates under 50 percent and upgrade rates in the low- to mid-teens. Analyzing the bid rates uncovered a key problem: on average, about one in four customers completing a HES assessment received a bid for upgrades, despite an aging housing stock indicating that most needed insulation at a minimum.

In May 2011, N2N surveyed approximately 100 participants that had completed a HES assessment and not made any upgrades to better understand the customer dynamics impacting upgrade rates. The survey revealed low awareness or acknowledgement levels of receiving recommendations for additional energy upgrades. It also revealed that numerous customers wanted more information about upgrades and how to move forward, including information about the availability of rebates and incentives. Customer wanted more information, most of which should have been delivered at the end of the HES assessment.

Dashboards allowed N2N to identify contractor partners performing well, those needing additional support, and others needing removed from the pool of N2N participating contractors. The following two Year 2 and Year 3 contractor dashboards illustrate slow, but continuous improvement of pipeline statistics. Table 13 is an example N2N contractor scorecard, representing a program snapshot between September 2011 and April 2012 (*i.e.,* post oil-heated funding reinstatement). The data still exhibits a wide variety of contractor performance between 32 and 71 percent of HES assessment completes. The same is true of upgrade percentages ranging between 0 and 17 percent, where unfortunately it is the smaller N2N contractors with the highest conversion rates to upgrades.

The contractor scorecard also shows that upgrade completion ratios have increased to 6.6 percent (from 4 percent early program). N2N HES assessment close rates increased to 47 percent in April 2012, after holding steady at 26 percent from September 2011 through February 2012. It may be that the contractor liaisons, scorecards, and N2N process improvements were beginning to improve contractor performance.

Table 13 N2N Example Contractor Scorecard (Leads received between 9/1/11 and 4/30/12)

HES Program Status	Project Owner (Contractor Names have been redacted)											Grand Total Or Program Average
	1	2	3	4	5	6	7	8	9	10	11	
HES Total Leads	132	125	81	98	71	319	120	68	384	207	241	**1846**
HES Visits Completed	91	48	45	48	22	168	82	48	272	104	150	**868**
Avg. Days to Complete	46	32	36	36	37	65	25	81	42	38	43	**44**
% Completed	69%	38%	56%	49%	31%	53%	68%	71%	71%	50%	62%	**47.0%**
% Scheduled	5%	9%	4%	5%	11%	7%	5%	1%	5%	0%	4%	**5%**
% Lost Projects	17%	34%	32%	36%	4%	31%	8%	28%	15%	48%	26%	**26%**
HES Savings Data												
Avg % Savings from HES	9.3%	5.2%	8.9%	7.3%	16.1%	6.9%	10.8%	7.9%	10.0%	9.1%	8.1%	**8.8%**
Savings >15% (% of visits)	7%	6%	0%	0%	60%	10%	15%	10%	14%	6%	7%	**11%**
Bids and Upgrades												
Bids Delivered	9	22	22	3	11	60	30	1	53	10	17	**238**
Bid Rate	10%	46%	49%	6%	50%	36%	37%	2%	19%	10%	11%	**27%**
Upgrades from HES Leads	3	1	1	0	1	6	14	1	23	2	5	**57**
Total Completed Upgrades	4	1	1	0	1	8	14	2	23	2	6	**62**
Upgrade % (of bid)	33%	5%	5%	0%	9%	10%	47%	100%	43%	20%	29%	**24%**
Upgrade % (of HES)	3%	2%	2%	0%	5%	4%	17%	2%	8%	2%	3%	**6.6%**
Completed Upgrade HEY Tools	3	1	1	0	1	5	14	1	21	2	4	**53**
HEY % Rate	100%	100%	100%		100%	83%	100%	100%	91%	100%	80%	**93%**

Table 14 provides a Year 3 snapshot between September 1, 2011 and February 28, 2013, providing further evidence that process improvements and contractor prioritizations may be working. For instance, average days to HES complete have decreased to 39 from 44 on average. The percent completed HES visits has increased to 62 percent (from 47 percent). Year 3 contractors have uploaded to N2N's database signed customer release forms almost 90 percent of the time, and HES assessment reports (*i.e.,* the Field Service Tool (FST)), 95 percent of the time.

By Year 3, the upgrade rate from HES assessment had increased to 8.0 percent from 6.6 percent. At the same time, bid rates had decreased to 21 percent from 27 percent.[74] The Year 3 scorecard also tracks average savings per HES assessment in Million British Thermal Units (MMBtu), showing an average of 11.23 MMBtu per household.

Beginning in January 2013, N2N again restructured contractor support to focus on highest performing contractors. N2N cut back contractor lead assignment to a subset of three Year 2 contractors, three new solar contractors, and a vertically-integrated whole home performance contractor (March 2013), except where overflow service was needed. The forthcoming quantitative evaluation will analyze findings.

[74] However, bid information is not consistently reported by contractors and is necessary to calculate bid rates.

Table 14 N2N Example Contractor Scorecard (Leads received between 9/1/2011 and 2/28/2013)

HES Program Status	Project Owner											Grand Total Or Program Average
	1	2	3	4	5	6	7	8	9	10	11	
HES Total Leads	227	160	131	182	81	647	316	87	715	360	319	**3225**
HES Visits Completed	127	73	83	93	39	377	215	57	546	193	197	**2000**
Avg. Days to Complete	34	35	43	27	56	48	34	47	37	32	45	**39**
% Completed	56%	46%	63%	51%	48%	58%	68%	66%	76%	54%	62%	**62%**
% Scheduled	7%	6%	2%	5%	0%	4%	0%	1%	4%	1%	0%	**3%**
% Inquiries/Multiple Attempts	0%	3%	2%	2%	0%	3%	14%	7%	2%	7%	2%	**4%**
% Lost Projects	37%	46%	34%	42%	52%	35%	17%	26%	18%	38%	36%	**31%**
HES HEY tools and Release Forms												
Completed FSTs	71	69	77	90	37	365	214	54	537	186	197	**1897**
FST % Rate	56%	95%	93%	97%	95%	97%	100%	95%	98%	96%	100%	**95%**
Completed Releases	105	63	75	84	37	353	189	48	469	166	193	**1782**
Release %	83%	86%	90%	90%	95%	94%	88%	84%	86%	86%	98%	**89%**
HES Savings Data												
# Visits w/ Savings Data	59	51	45	73	33	200	97	42	328	109	171	**1208**
Avg mmBTU Savings from HES	9.67	9.75	9.68	8.84	15.46	9.37	14.49	8.90	12.75	10.67	11.16	**11.23**
Avg % Savings from HES	9.09%	9.27%	8.11%	8.39%	12.83%	9.91%	11.77%	8.73%	11.54%	10.94%	9.37%	**10.33%**
Avg $ Savings from HES	$ 307.89	$ 305.49	$ 335.07	$ 304.55	$ 508.76	$ 285.71	$ 463.70	$ 285.56	$ 384.35	$ 333.25	$ 371.11	**$ 354.15**
Savings >15% (# visits)	4	5	0	8	9	23	26	3	47	18	23	**166**
Savings >15% (% of visits)	7%	10%	0%	11%	27%	12%	27%	7%	14%	17%	13%	**14%**
Bids and Upgrades												
Bids Delivered	14	26	29	10	19	120	42	1	109	25	24	**419**
Bid Rate	11%	36%	35%	11%	49%	32%	20%	2%	20%	13%	12%	**21%**
Upgrades from HES Leads (received 9/1/11-2/28/13)	7	1	6	6	1	25	21	1	68	12	11	**159**
Total Completed Upgrades (created 9/1/11-2/28/13)	11	1	6	7	1	29	30	10	82	15	11	203
Upgrade % (of bid)	50%	4%	21%	60%	5%	21%	50%	100%	62%	48%	46%	**38%**
Upgrade % (of HES)	6%	1%	7%	6%	3%	7%	10%	2%	12%	6%	6%	**8%**
Completed Upgrade FSTs	6	1	2	5	1	20	16	1	62	7	10	**131**
FST % Rate	86%	100%	33%	83%	100%	80%	76%	100%	91%	58%	91%	**82%**

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3.4.2 The N2N hot leads

After several months of new contractor protocols and additional contractor liaison support, as well as upgrade focused messaging, N2N once again focused on improving the HES assessment complete rates. The next step was to prioritize which leads to focus more time and attention on and which to let go cold.

Learning from N2N's contractor partner with the highest upgrade rate, N2N again modified the lead assignment process, developing leads that N2N flagged as hot leads beginning in March 2012 and fully implemented into the lead process by summer 2012. N2N uses four survey questions to separate customers into tiers based on interest and likelihood to undertake upgrades, customizing program follow-up based on that tier. For instance, N2N collects data about heating fuel type and the following four pieces of information:

1. Energy upgrades that the household is interested in learning more about,
2. Problems existing in the home already,
3. How serious the problems are to the participant, and
4. How long the participant plans to stay in the home.

Participants ready to solve their existing and serious home performance problems are distributed to the top performing contractors. Customers in the different priority levels are tracked to determine ways that the N2N contractor liaisons and outreach team can support them to complete upgrades. As a result of on-going evaluation, the outreach team developed focused call-nights and workshop invitations for the hot leads.

Unfortunately, early findings suggest most customers that self-identify for problems and/or specific upgrades during sign up are not receiving bids more than other customers. Follow up survey data indicates several reasons that people do not complete an upgrade after the HES assessment, including:

- The upgrade is less of a priority,
- Project costs are too high,
- No home problems, upgrade recommendations, or assessment report provided, and
- Have contractor or energy adviser follow up questions.

N2N will re-examine findings from the hot lead process with the forthcoming quantitative analysis.

3.5 N2N Participants

The previous section identified the need to develop target marketing of customized upgrade packages. In addition, as discussed in Section 3.1, the Corps needed a way to focus the participant ask and make a personal connection in during outreach activities. Therefore, N2N began analyzing program data to tune the marketing messages that the Corps would use to engage participants in upgrades. Based on the database of participant testimonials, in-depth interview data, lighting visit data, and lessons learned from other *BetterBuildings* programs, N2N developed several different stories to create participant action, such as:

- Increasing home comfort with upgrades, especially in cold and drafty homes;

- Protecting the value of the home from damage caused by ice dams and water leaks;
- Doing the responsible thing for their children's future, and in selected cases for the future of the planet;
- Saving money and investing in future energy bill savings; and
- Protecting the health and safety of their family from improper ventilation, mold, and gas and carbon monoxide leaks.

However, the story development methodology was qualitative due to the nature of outreach, where numerous organizers talk to numerous potential N2N participants. There is little opportunity for academic verification. Instead, N2N began the process of identifying N2N customer market segmentations based on their likelihood to complete upgrades. For instance, built off of the stories, the N2N survey and hot lead data helped further sk*etch* out data collection needs for market segmentation work.

Chapter 4 presents the N2N behavioral economics experiment that tested the DOE Home Energy Score (HEScore) and its impact on participant's willingness to pay (WTP) for home energy upgrades. The HEScore research represents the beginning of N2N research to determine CT home energy upgrade market segments. N2N has also collected a rich dataset of demographic survey and interview data, as well as revealed preference (*i.e.,* what participants actually did). Chapter 4 provides market segmentation analysis of customer preferences for upgrades.

Chapter 4: N2N Consumer Behavior Research

In August 2012, N2N began exploring N2N participant purchase preferences and market segmentation through the experimental analyses of two data sources:

1. DOE Home Energy Score (HEScore) behavioral economics experiment,[75] a stated preferences survey eliciting willingness to pay (WTP) for energy efficiency actions and designed to compare subject reactions to:

    a. Varying levels of home energy performance information and recommendations (*i.e.,* delivered via one of three DOE HEScore and/or report version), given the

    b. Homeowner's housing situation (*i.e.,* staying in the house vs. in the market to buy or sell).

2. N2N market segmentation and customer profile data, including:

    a. HEScore survey demographics,

    b. Revealed preferences for energy actions, such as lighting, Home Energy Solutions (HES) assessment, and upgrade completions through N2N, and

    c. N2N HES assessment follow up customer survey data.

Chapter 4 provides analysis of purchase preferences through the DOE HEScore experiment, including the literature review, hypotheses, experimental set up, methodology, results, discussion, and future research. The final section presents analysis of customer profile survey data to begin developing N2N customer market segments. The goal is to learn about what type of participant would purchase simple home technologies, a HES assessment, an upgrade, or an efficient automobile, or a combination of them.[76]

4.1 HEScore Survey Overview

Appendix G includes a description of the HEScore and a complete five-page report for a sample Wethersfield, CT home. The HEScore experiment and survey was designed to:

- Understand under what conditions homeowners are motivated to invest in upgrades, as measured by stated willingness to pay (WTP), especially:
    - Level of information, and
    - Housing situation;
- Provide background for a larger policy context of when and how to implement energy labeling for homes; and
- Begin to explore the actual preferences and market segments for the N2N population.

[75] The experiment was conducted under Professor Dan Ariely, Duke University. The author partnered with Kristen Bremer, Duke University Master of Environmental Management student, to administer the survey, and coordinated with the DOE for guidance.

[76] The market segmentation work should inform future N2N research to develop target marketing of customized upgrade and incentive packages to hopefully improve energy savings per household.

4.1.1 Background

Chapter 1 describes the efficiency gap, where although energy efficiency upgrades are cost-effective, people often fail to complete these actions (Choi Granade et al., 2009; M. Fuller et al., 2010; Merrian Fuller, 2008). In fact, past researchers explain several barriers from behavioral economics and social psychology research that provide insight into why people often act against their economic self-interest. Our research explored ways to overcome two specific barriers from the literature, including that:

1. Too many energy efficiency recommendations (choices) can make people feel overloaded and less likely to take action (Iyengar & Lepper, 2000; Madrian & Shea, 2001; B. Schwartz, 2004; Simon, 1991); and

2. People are more sensitive to losses (*i.e.,* costs of upgrades) than gains (*i.e.,* future utility bill savings) (Kahneman & Tversky, 1979; Magat, Payne, & Brucato, 1986; Paul C. Stern, 1986; Paul C. Stern et al., 1987), and therefore, may be more likely to take action when purchasing a home and aggregating upgrade costs into the overall mortgage.

To better understand the choice overload barrier, we tested varying levels of whole home performance information and recommendations delivered to survey subjects via one of three DOE HEScore report versions plus a control group. To search for ways to overcome loss aversion, we tested varying homeowner housing situations, such as those staying in the house versus those in the market to buy or sell a home.

Decision-making environments and processes are complex. For instance, people view decisions as choices between alternatives (Christopher K. Hsee, 1999; Hsee, Lowenstein, Blount, & Bazerman, 1999). (Also see discussion about mental accounting in Section 2.3.3.) When presented with a decision about how much money to spend on attic insulation, the decision is made considering a complex set of alternatives and trade-offs, such as other uses for the money, or the amount of time and effort required to complete the action, *etc.*. As an illustration for our survey, people may be thinking, "Should I insulate my attic or spend the money on", for example:

- New countertops,
- A piano for my daughter,
- Unexpected health care costs, *etc.*.?

Therefore, the survey design elicited WTP in two different decision-making contexts: joint evaluation (JE) and separate evaluation (SE) mode (Hsee et al., 1999), where WTP values are likely overestimated in the SE mode and more accurate in the JE mode. For instance, in the SE mode, subjects consider one upgrade at a time, like attic insulation, rather than adding up the cumulative amount of stated WTP after each question. In the JE mode, when evaluating attic insulation, duct sealing, and air sealing together, the subject considers all three options together, likely lowering cumulative WTP values.

4.1.2 HEScore experimental design

Varying the level of whole home energy performance information and recommendations, we presented subjects with one of four reports and/or survey language containing the same information about a typical CT sample home in Wethersfield, CT. Providing all subjects information on the same house, we held constant the housing characteristics affecting the purchase decisions (Magat et al., 1986). The four experimental versions were delivered via the researcher-modified version of the DOE HEScore and reports depicted on the next few pages, including the: Control, HEScore only, Basic Report, and Detailed Report experimental groups.

1. Control group (no report), receiving survey instructions only stating that their score would increase from a 4 to a 9 by making the recommended home energy upgrades.

2. HEScore only group, receiving only a score page without supplemental information about the recommendations (Figure 9);

Figure 9 Home Energy Score Only Group

3. Basic Report group**,** receiving the same HEScore page (Figure 9) and a second page (Figure 10) of high-level recommendations.

Figure 10 Basic Report, Page 2 (of 2)

4. Detailed Report group**,** including the first HEScore page (Figure 9) and the following three pages of detailed recommendations with photos and upgrade details, such as benefits and costs (Figure 11), (Figure 12), and (Figure 13).

Figure 11 Detailed Report, Page 2 (of 4)

Figure 12 Detailed Report, Page 3 (of 4)

Figure 13 Detailed Report, Page 4 (of 4)

To identify decision points to target potential customers, survey participants were sought from three housing situational factors, including those:

1. Staying put in their home,
2. About to buy a home, and
3. About to sell a home.

However, we found it difficult to reach subjects in the market to buy or sell a home. In fact, numerous attempts yielded only 36 completed survey responses. Although the results showed statistical significance for several experimental groups, I conducted a second survey using the same population to randomly split people into two additional conditions to:

4. Imagine you are about to buy this example home, and
5. Imagine you are about to sell this example home.

4.1.3 HEScore WTP dependent variables

This section describes the WTP dependent variables, including variable descriptions and calculations. See Appendix H for further information about the survey questions and participant reactions. The survey had 61 questions, including 19 separate evaluation (SE) WTP survey questions in Table 15 for

six individual energy actions (*i.e.,* CFLs, outlets, attic insulation, duct sealing, air sealing, and a more efficient automobile).[77]

Table 15 Willingness To Pay (WTP) Questions

Question WTP Action	Average Cost	Savings/Year
House		
1. 25 CFLs	$100	$220
2. Two Smart Outlets and Two Power Strips	$40	$80
3. Attic Insulation	$1,100	$450
4. Duct Sealing	$950	$380
5. Air Sealing	$1,400	$250
Subtotal House	**$3,590**	**$1,380**
Automobile		
6. More efficient Automobile	$5,000	$400
Total Actions	**$8,590**	**$1,780**

For each of the six individual energy actions, participants answered the WTP questions three different ways, including:

- Yes/no for the average cost (*i.e.,* the anchor price);
- Yes/no for 11 different costs; and
- Maximum WTP for each upgrade.

Following the Table 15 WTP survey questions, participants answered three joint evaluation (JE) survey questions including the maximum WTP for all six actions (3 questions), including:

- With a $1,500 Tax credit;
- For the Neighbor to improve score; and
- For the Neighbor to improve score if the score is public.

Most of the analysis uses the participant's stated WTP for the dependent variable, although WTP was also explored as an independent variable impacting people's propensity to complete an upgrade (Section 4.4.2). Four main WTP dependent variables were calculated from the survey questions, including the following (Table 16):

1. Self, Separate Evaluation (SE): Sum average of different individual purchase actions, such as:
    a. DIY actions (*i.e.,* CFLs, automatic power strips);
    b. Upgrade actions (*i.e.,* attic, and duct and air sealing);
    c. House actions (*i.e.,* DIY + upgrade actions);
    d. Automobile purchase; and
    e. Total actions (*i.e.,* House and Automobile actions).

[77] Plus one question about WTP $8.00 to purchase three CFLs to install in the shed on your property.

2. Self, Joint Evaluation (JE): The $1,500 Tax Credit maximum WTP for all improvements.

3. Other's JE: The Neighbor's WTP for all improvements to increase score.

4. Other's JE Public: The Neighbor's WTP for all improvements to increase score if the score is public.

Table 16 WTP Variables by Decision Environment and Hypothetical Framing

		Hypothetical WTP Set Up	
		WTP Self	**WTP Neighbor's (Other's)**
Decision Environment	**Separate Evaluation (SE)**	Average WTP All Actions (House + Auto)	*N*/A[78]
	Joint Evaluation (JE)	Neighbor's Maximum Tax Credit Maximum	Neighbor's Maximum Neighbor's Public Maximum

4.1.4 Valuing hypothetical goods and survey design

There are risks associated with using stated WTP surveys where subjects state a value for hypothetical goods, including:

Information barriers:[79] Laboratory decisions could restrict the generality of the results during real-world experiences (Kahneman & Tversky, 1979). Still, hypothetical choices can be used as a surrogate to measure behavior of choice scenarios (ibid.). The hypothetical response validity is based on the assumption that "people often know how they would behave in an actual situation of choice" and further that "subjects have no special reason to disguise their true preferences" (Kahneman & Tversky, 1979).

Unfortunately for this study, people may not know how they would behave in the actual situation, because people are often unaware or uneducated about energy upgrade decisions (M. Fuller et al., 2010; Shelton, 2012). People likely do not have an understanding of what upgrades entail, how much they cost, or the energy and money savings associated with action, leading to an underestimate of these amounts. In fact, in a national on-line survey of 505 participants, subjects slightly overestimate savings from low-energy activities, such as turning out lights, and made large underestimations of savings for high-energy activities, such as home energy upgrades (Attari, DeKay, Davidson, & Bruine de Bruin, 2010). The authors further find that "well-designed efforts to improve the public's understanding of energy use and savings could pay large dividends" (ibid.).

In addition, for a hypothetical set-up where the subject doesn't pay for actual services, a person may focus disproportionately on the benefits over the cost (Carlsson, Daruvala, & Jaldell, 2010; Carson, Flores, Martin, & Wright, 1996). Previous research also finds that the hypothetical survey could reveal the attitudes of the subject rather than the actual preferences (Kahneman & Sugden, 2005). Kahneman and Sugden find that when reporting "hypothetical willingness to pay (WTP) for goods that they have no experience or expectation of actually buying or selling, responses tend to express attitudes" rather than actual intended behaviors (Kahneman & Sugden, 2005). In other words, subjects may overinflate their

[78] Unfortunately, I forgot to ask a self-evaluation question about maximum WTP for all actions. I made an incorrect assumption at survey development that the neighbor's (other) JE WTP answer would serve the same function as the self-evaluation JE answer. That is, I accounted for looking glass perception effect, but not better-than-average effect.
[79] See information barriers literature review in Section 2.3.2 that discusses that respondents are, in fact, faced with an information barrier about energy upgrade decision that could subsequently impact WTP.

WTP because they believe in purchasing energy upgrades; however, in practice, energy upgrades may never actually get done. At the time of the survey, the participant may not consider the barriers or costs of getting the upgrade done, such as taking time off work, finding a contractor, paying $1,400 out of pocket, trust issues with having a contractor in the home, or for those doing it themselves, moving up the learning curve to enable quality installation of the upgrade.

Especially where subjects are unsure of actual value, price anchors matter. For instance, stated WTP amounts can be inflated simply by writing down a higher two-digit number prior to answering (Ariely, Lowenstein, & Prelec, 2003). In other words, those anchored on lower numbers stated lower average WTP, and vice versa for higher anchors (ibid.). In this case, we provided the anchors of the average cost and savings for each decision. Anchors can provide a real-world starting point for calculating WTP dollar amounts (ibid.), and in this case, may also mediate against information barriers.

Public goods: Subjects may focus on benefits over costs especially in the case of "self-image" situations such as risk, donations, and the provision of public goods (Carlsson et al., 2010). Donations to the public good have been described in some research as a purchase of moral satisfaction (Kahneman & Knetsch, 1992) or due to positive self-image motives, such as altruism or warm-glow (*i.e.,* egoism) (Andreoni, 1990; Carlsson et al., 2010).

In fact, energy use and/or efficiency may be considered a public good by some, especially where a person believes that they are:

- already doing enough,
- paying reasonable energy bills, and/or
- comfortable in their home.

Others may view it as a public good because they disagree with the validity of climate change science, or have strong right-wing political beliefs (*e.g.,* members of the Tea Party). In this case one might overuse energy by right, as long as one can afford it.

Neighbor's WTP: Subjects may use a "looking glass perception" to determine neighbor's WTP for energy efficiency, thinking others would pay amounts similar to oneself (Fields & Schuman, 1976). The results from Carlsson *et al* find evidence of a "self-enhancement effect where the respondents derive satisfaction from favorable social comparison" (Carlsson et al., 2010). In other words, it may be that people believe they would pay more for home energy upgrades than their neighbors would because they feel themselves to be better-than-average (Alicke, 1985; Alicke & Klotz, 1995; Guenther & Alicke, 2010; Hoorens, 1993). In addition, people often feel that they have done or are doing all they can do (OpinionDynamics, 2009). On the other hand, having subjects value their neighbor's WTP might mediate against the effects of higher self-WTP separate evaluation by reflecting their true preferences.[80]

Based on the WTP literature, the survey design mediates against state valuation of hypothetical goods using several behavioral principles. For instance, we provided consistent anchors, framing, and context to signal the costs and savings associated with individual energy upgrade actions throughout the survey, including in the instructions, and on the HEScore page and supplemental report page(s), if applicable (*i.e.,* for the Basic and Detailed report versions).

[80] Subjects may evaluate others using themselves as a reference point and the effect may be larger on positive and controllable dimensions than negative uncontrollable ones (Alicke, 1985). Therefore, WTP may actually depend on how positive and controllable a subject views home energy upgrades.

We also included separate (A) and joint (B) evaluation questions, for example:

(A) Please move the slider to the MAXIMUM you would be willing to spend to have a professional come into your home and seal your home.

(B) Please move the slider to the MAXIMUM you would be willing to spend for all of the recommended improvements if you receive $1,500 in rebates and tax credits.

We attempted to compensate for hypothetical value measurement error risk by:

1. Checking consistency: Three repeated measures of each individual energy action in SE.

2. Comparing self and others: JE of total WTP for all improvements in three different questions: with a $1,500 tax credit, the neighbor's score, and the neighbor's score if public.

3. Examining revealed preferences: Compared actual energy actions taken by participants (*i.e.,* their revealed preferences) with their stated preferences in a hypothetical survey situation.

Still, stated WTP surveys limit how the research conclusions, because it is likely that stated spending amounts cannot be trusted as actual spending amounts. Therefore, the conclusions are based on patterns of absolute WTP differences.

4.1.5 Statistical results

The survey was designed to compare homeowners' WTP based on the experimental conditions Table 17 includes the number of responses for the four report versions (*e.g.,* levels of information) and the five housing situations. Detailed survey results are included in Section 4.2.

Table 17 N2N Survey Completes

Report Version	Housing Situation					Total
	Imagine Buy	Imagine Home	Imagine Sell	Actual Buy	Actual Sell	
Control	54	67	28	6	4	**159**
HEScore	27	67	48	4	5	**151**
Basic	34	61	36	5	3	**139**
Detailed	40	48	40	6	3	**137**
Subtotal	**155**	**243**	**152**	**21**	**15**	**586**
Total	**550**			**36**		

The survey took about 24 minutes on average to complete. For the N2N population, the HEScore survey produced the following results based on three main research hypotheses, where:

- People in the market to buy are WTP more for upgrades than people selling or staying put in their home (*e.g.,* buyers are less likely to experience loss aversion than those paying for upgrades out of pocket): Hypothesis confirmed with a small response rate.

- HEScore WTP (*i.e.,* less information) is greater than Detailed or Basic WTP (*i.e.,* more information): Hypothesis confirmed across the survey population and for some experimental groups, especially actual buy conditions.

- SE WTP is greater than a JE WTP: Hypothesis confirmed.

In addition, the following findings resulted from the analysis process, including:

- A $1,500 tax credit and/or making the score public can increase WTP.

- The average WTP is significantly higher than the average cost for DIY actions (*e.g.,* CFLs and smart outlets), and significantly less for upgrade and automobile actions.

- The HEScore version of the report resulted in higher WTP than other report types for both upgrade and automobile actions.

- Almost 60 percent of respondents indicated that they prefer to complete home projects involving tools and ladders themselves. These DIYers state a statistically significant lower WTP for upgrades, purchasing a more efficient automobile, and with a tax credit than non-DIYers.

- N2N participants that have already completed an upgrade are WTP more for upgrades, but it does not hold true for those completing a HES assessment with no follow on upgrades.

- Most subjects are willing to share their home's energy report with a potential buyer and are WTP more than those not willing to share the report, including for house and automobile actions, and with a $1,500 tax credit.

- Participants are WTP more for an efficient automobile than home efficiency actions.

4.1.6 Discussion

The survey results indicate that housing situation matters, especially for those in the market to purchase a home. It is harder to draw conclusions about the level of information delivered by the report version. In general, the HEScore only results in higher WTP than the other report versions. However, combinations of housing situation and report versions show varying results (see Section 4.2). The findings indicate that WTP varies by other demographic and psychographic characteristics. For instance, those that have completed an upgrade state higher WTP for additional upgrades. In addition, those that prefer to complete home projects themselves (*i.e.,* DIYers) state lower WTP for upgrades. Therefore, instead of the Basic and Detailed report types directly influencing WTP, it could be that certain market segments will already pay more than others. They are also more likely to pay attention to a more detailed report. In other words, different people are interested in reviewing different levels of report details, which could also vary by a subject's current housing situation.

The survey results indicate that people do very much follow specific heuristics in how they spend money. For instance, people evaluate separate evaluation and joint evaluation questions consistent with the literature with higher SE and lower JE total WTP amounts, respectively. Unfortunately, the results for comparing self and other's WTP are inconclusive due to an omitted testing variable. Still, the results indicate that, in SE, people state WTP for completing several, if not most, of the recommendations, but will only actually state WTP for a subset of them in JE. Results also indicate that tax credits have the potential to increase WTP amounts, often by more than the tax credit itself. In addition, participants state higher WTP than average for smaller, DIY actions, such as CFLs and outlets, but lower than average for upgrade and automobile actions. These findings indicate the importance of careful delivery of the recommendations, considering the psychology of how people spend money and prioritizing optimum home performance energy savings (*i.e.,* taking a systems view to create packages of recommendations, carefully considering presentation of costs and benefits).

In general, the results show a pattern that as people take action, they are willing to pay more to take additional actions. This pattern is consistent with research on 'self-herding', where past actions direct current and future actions (Ariely & Norton, 2008). These findings combined with the results of higher perceived neighbor's WTP with a public score, as well as higher WTP for those also willing to share the home's report with a potential buyer. Together, the findings show a pattern of higher levels of awareness and engagement leading to higher WTP in a positive feedback loop that also leads to higher levels of awareness and engagement.

4.1.7 Conclusions and policy recommendations

As CT regulators consider rolling out the DOE HEScore, the survey findings support the following recommendations:

1. Use home energy scoring, but don't over rely on it. Results indicate that the HEScore and/or the report may impact some respondents, while others may not be impacted. For instance, the HEScore and report doesn't provide those not ready for upgrades the opportunity to step on the ladder of sustainable energy actions by taking the first, low-hanging fruit actions. Past research finds that people are motivated by customized and tailored information; therefore, a one-sized fits all approach to report design will not motivate everyone. Instead, the HEScore should be customizable. It should also be one part of a comprehensive approach using social campaigns and a comprehensive design that includes: community outreach and education, awareness building (*i.e.,* norm resetting), a customer pipeline database, educational websites, social media, earned media, contractor co-marketing, supportive policies, and home energy scoring.

2. Less could be more. Many participants seemed to experience information overload from too much information about recommended upgrades. The score itself and the normative messaging may have been the main drivers of WTP responses. Prior to rolling out a solution, CT regulators should gain a more thorough understanding of the available scoring methods, taking care to customize lengths for those disinterested in a detailed report. The report should be delivered in person using trained salespeople for those completing a HES assessment (or other home energy services), and on-line for those doing research on their own.

3. Recognize the DIYer. Over 60 percent of respondents indicated a preference to complete repairs requiring tools and ladders themselves or with the help of a friend or family member. In addition, WTP for DIY actions is proportionately higher than for larger actions. CT needs processes and program infrastructure to supports DIY projects, including: training courses, financing options, and inspection procedures to capitalize on this yet untapped energy efficiency market.

4. Don't overlook the automobile. Survey respondents indicated WTP to purchase a more efficient automobile in addition to home energy upgrades. Reducing automobile emissions would help meet CT emission reduction goals; therefore, regulators should examine ways to transform this untapped market potential.

5. Strike while the iron is hot. Respondents in the market to buy a home are WTP more for upgrades. Combining upgrade costs with the mortgage almost hides them. Paying for upgrades separately is more painful, where upgrades will compete with other household budget priorities, such as kitchen upgrades, aesthetic improvements, daily household operating expenses, *etc.*.

6. Public scores can be influential. Especially for those in the market to buy a home, making the score public can increase willingness to pay for upgrades. In the long run, a public score can be used to drive the culture across CT to not waste energy and resources unnecessarily (*i.e.*,

establishing a new injunctive social norm). CT should make the score public to take advantage of the opportunity for social contagion and leading by example towards a new social norm in CT (*e.g.,* a culture of reducing energy waste and GHG emissions).

7. Explore meaningful metrics. Goal setting and commitments with meaningful progress-oriented feedback should be more effective at achieving upgrade completes than the DOE HEScore. For instance, most people have a ballpark estimate of their monthly energy bill, and are likely to make upgrade and house rental decisions based on knowing the building's approximate energy bill. In addition to setting energy bill disclosure policy, CT regulators should provide feedback about the household performance against CT GHG 2020, 2030, and 2050 goals.

8. Upgrade options matter. Unsurprisingly, many responded to tax credits with higher WTP for upgrades. To take advantage of those that will pay more with incentives, CT regulators should enable easy access to a comprehensive set of upgrade packages, rebates, tax incentives, transparent data and feedback, and financing options, including those targeted directly at homebuyers. The ultimate goal is to aggregate the benefits of savings, and soften the impacts of costs into a customized package of upgrades.

9. Build consumer involvement with small, easy actions. Most subjects report taking conservation actions (99 percent), with 72 percent reporting additional action due to N2N participation. For those not ready to complete upgrades, the HEScore doesn't provide the opportunity to step on the ladder of sustainable energy actions through simple, conservation actions. If fostered, small actions lead to bigger actions over time, providing a lifetime customer value.

10. Understand the customer. Although several market segment indicators were explored in this research, few stood out from all the others. Further study is needed to understand the market segments, including to:

    a. Develop marketing packages of upgrades that take advantage of the psychology of money for each customer segment.

    b. Understand how residents respond to specific features of a home asset rating and report, as well as energy bill disclosure policies;

    c. Confirm HEScore findings across a general population;

    d. Ensure that the score is calibrated to diffuse upgrade behavior change; and

    e. Learn how the HEScore fits into a portfolio of customer friendly approaches based on further market segmentation work.

4.2 HEScore Survey Detailed Analysis and Results

4.2.1 Survey administration

A large portion of the N2N survey population contains early adopters. For instance, the list is drawn from N2N participants that signed up for N2N sometime between fall 2010 and summer 2012, and may or may not have completed one or more N2N energy actions. Exposure to N2N, and the resulting sign up, occurs at a local event or meeting, due to a friend's testimony or recommendation, after reading a newspaper article, from Facebook, *etc.*. Almost two-thirds of survey respondents have engaged in energy efficiency in their home by completing the N2N lighting visit, a HES assessment, and/or an upgrade(s) (*i.e.,* the revealed preferences).

Appendix H describes the survey design and participant reactions, including:

- Survey design details;
- Demographic indicators, such as socio-economic indicators, housing buy or sell mindset, household characteristics related to energy use, and participant attitudes about increasing the home's energy score;
- Reactions to the survey; and
- Indicators of survey response legitimacy and survey measurement errors (*i.e.,* survey validity).

An email invitation to the web-based survey was sent on June 27, 2012. The invitation offered survey respondents a chance to win one of 10-$250 Amazon.com gift certificates. The survey sample was drawn from people across Connecticut that have signed up for N2N sometime between fall 2010 and summer 2012, mainly in 14 small participating N2N towns. All available households were included in the mailing list regardless of their level of N2N participation.

Due to a small response from those in the market to buy or sell, I attempted a second concentrated push to reach CT homebuyers and sellers through 35 local real estate agents. Focusing on N2N partner agents and members of the Green Realtors trade association resulted in only seven survey completes. For instance, four agents completed the survey, and one realtor posted the survey on his blog, resulting in one survey response. Another agent had four clients start the survey with one completed survey. The remaining 29 actual buy and sell respondents were from the N2N mailing list.

A combination of factors may have blocked survey distribution in the real-estate market, including: depressed housing prices, low housing turnover (*i.e.,* a small market), part–time realtors, the real-estate market lag, and a complicated survey. For instance, CT has small number of households (*i.e.,* 1.45 million) (CERC, 2012) and a low rate of turnover of two to three percent per year (CERC, 2012; Popoff, 2012). During the survey request, several agents were leaving larger brokers, and many CT real-estate agents only worked part-time (Popoff, 2012). In fact, the CT real estate market experienced a downturn. For instance, CT topped the list of the eight U.S. states with declining home prices during the survey (Phaneuf, 2012; Popoff, 2012).Evidence from recent pilot findings also finds low interest from the real estate market in the DOE HEScore, and a market that lags behind, rather than sets, trends (DOE, 2012a, 2013c; Stukel, 2012).

After the failed survey distribution through the realtors, I emailed a second survey to the N2N mailing list on August 7, 2012, asking participants to imagine they are in the market to buy [or sell] the example home.

There were 586 completed surveys and approximately 500 survey dropouts (Survey dropouts are discussed in detail in Appendices H1 and H.2). For the first distribution, about 10 percent started the survey, and approximately 50 percent of these dropped out. For the second distribution, the survey flow randomly split respondents into two new imagine buy and imagine sell housing conditions. Again, about 10 percent started the survey and about 50 percent dropped out. In fact, subjects dropped out at different points in the survey, including the following (with potential behavioral barriers in parenthesis):

- At the instructions (*e.g.,* looks complicated; you want me to pay attention?);

- Somewhere in the process of seeing the HEScore and/or report (*e.g.,* too much information; I don't understand the report; it's not my house; this is pointless);

- At or after the first Yes/No matrix question, where at least one-quarter dropped off (*e.g.* too much effort because have to click the mouse 11 times per question, survey fatigue);

- At the neighbor's WTP questions (*e.g.,* how do I know?); and

- During various demographic questions (especially income) (*e.g.,* privacy concerns; survey fatigue).

Both the survey responses and respondent comments illustrate that the survey, the report, and the topic of whole-home energy use is a complex matter. It is difficult to get people to engage in the topic; however, for this survey, it may be that the more a person knows about their home's energy use, the more likely they are to answer the survey.

All surveys completed through the WTP questions were analyzed, including the 18 responses that dropped out before finishing the last set of demographic questions.

4.2.2 Analysis of Variance methodology

Due to the complexity of finding subjects in the market to buy or sell a home, the survey resulted in a 4X5 factorial data set. The two main study independent variables, housing situation and report version, created the factorial design (Table 18).

Table 18 Factorial Design (4 x 5): Number of Survey Responses for each Independent Variable

Report Version	Housing Situation					Total
	Imagine Buy	Imagine Home	Imagine Sell	Actual Buy	Actual Sell	
Control	54	67	28	6	4	**159**
HEScore	27	67	48	4	5	**151**
Basic	34	61	36	5	3	**139**
Detailed	40	48	40	6	3	**137**
Subtotal	**155**	**243**	**152**	**21**	**15**	**586**
Total	**550**			**36**		

All subjects were asked to imagine the example home and report, while some subjects were also asked to imagine their housing situation as follows:

1. 4X2 factorial, where subjects actually in the market to buy or sell their home imagined they were buying or selling the example home; and

2. 4X3 factorial, where subjects imagined they were living in, buying, or selling the example home.

An Analysis of Variance (ANOVA) regression methodology was used to compare means using full 4X5 factorial of the independent variables (*e.g.,* all housing situations and report versions), as well as the 4X2

and 4X3 factorial designs described above.[81] ANOVA regression allows comparisons of two or more WTP means using the method of least squares to minimize the sum of the squared residuals (Sall, Lehman, Stephens, & Creighton, 2012). That is, the least squares method minimizes the difference between the stated WTP and the WTP predicted by the line of fit (ibid.). For instance, each experimental group's mean is fit to each data point in that experimental group (JMP, 2013b).[82] The linear model calculations use the nominal variables of report version and housing situation to create a series of dummy variables, predictor variables, and error terms (J. Churchill, Gilbert A. & Iacobucci, 2002).

The variance is a measure of both the variation and dispersion of the data in each experimental group (J. Churchill, Gilbert A. & Iacobucci, 2002), and depends on two degrees of freedom values corresponding to the mean square difference between the subject's response and the:

1. Overall survey mean, and
2. Experimental group mean (*i.e.,* the report version and housing situation mean) (Table 18) (ibid.).

The analysis used two primary statistics to test for significance. First, the Student t-test rejects the null hypothesis if the WTP value or the differences of means follow a Student's t-distribution based on the degrees of freedom (Hinkle, Wiersma, & Jurs, 2003). The t-distributions follow a normal, bell-shaped curve centered on the mean (ibid.). The second statistical test, the F-test, rejects the null hypothesis if the WTP value or the differences of WTP means follow a F-distribution based on the degrees of freedom (Hinkle et al., 2003). For instance, the between group compares each WTP variable's mean to the survey population mean (*e.g.*, the between groups), while the within group compares each WTP variable's mean with the mean of that experimental group (*e.g.*, the mean difference) (J. Churchill, Gilbert A. & Iacobucci, 2002). That is, the between group F-test tests that the difference across the pair of WTP responses is different in different groups, while the within group F-test checks that the average WTP response is different in different groups (JMP, 2013a).

4.2.3 WTP dependent variables

Appendix I.1 provides detailed information about the distributions of several WTP variables, including discussion of each of the WTP variables in The WTP distributions contain values at the extremes of $0 and the maximum scale amounts. The outlier values cause skewing, mostly positive due to the top end of the scale at $20,000. Some subjects are willing to pay nothing and others state WTP well above survey-stated average costs. For instance, the DIY SE WTP has means significantly higher than the supplied average cost anchor (shown shaded in the table), such as:

- CFLs (m=$125.68, avg. cost=$100, p<.0001),
- power strips/smart outlets (m=$48.99, avg. cost=$40, p<.0001), and
- DIY actions combined (m=$174.68, avg. cost=$140, p<.0001).

The average WTP for DIY actions (*e.g.,* CFLs and smart outlets) is $175, skewed to the right, and shows that about one-third of subjects are in fact willing to pay $200 (*i.e.*, over 50% higher than the average cost anchor of $140). Almost 40 percent of subjects have upgraded their household lighting through N2N lighting and/or HES assessments. Others have likely updated their lighting or added outlet control on their own, although the survey does not collect this data.

[81] Note: The author fit several types of linear regression models based on different combinations of report versions and housing situations, as well as by eliminating outliers. The author also used factorial modeling (*i.e.,* Principal Component Analysis) to explore the data. The results are consistent with the ANOVA models included in this document.

[82] For a detailed look at how the statistical software package, JMP®, completes this type of regression, see http://www.jmp.com/support/help/Examples_with_Statistical_Details.shtml

Table 19. SE questions are on the top half and JE whole house energy actions are on the bottom.

The WTP distributions contain values at the extremes of $0 and the maximum scale amounts. The outlier values cause skewing, mostly positive due to the top end of the scale at $20,000. Some subjects are willing to pay nothing and others state WTP well above survey-stated average costs. For instance, the DIY SE WTP has means significantly higher than the supplied average cost anchor (shown shaded in the table), such as:

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The average WTP for DIY actions (*e.g.,* CFLs and smart outlets) is $175, skewed to the right, and shows that about one-third of subjects are in fact willing to pay $200 (*i.e.*, over 50% higher than the average cost anchor of $140). Almost 40 percent of subjects have upgraded their household lighting through N2N lighting and/or HES assessments. Others have likely updated their lighting or added outlet control on their own, although the survey does not collect this data.

Table 19 Means of Average WTP for Different Combinations of Actions

<table>
<tr><th colspan="4">Separate Evaluation (SE) Actions[83]</th></tr>
<tr><td>CFLs</td><td>$125.69</td><td rowspan="2"><u>DIY Actions</u>
$174.68</td><td rowspan="5"><u>House Actions (no Auto)</u>
$2,831.78</td></tr>
<tr><td>Power Strips/Outlets</td><td>$48.99</td></tr>
<tr><td>Attic Insulation</td><td>$1,032.53</td><td rowspan="3"><u>Upgrade Actions</u>
$2,657.09</td></tr>
<tr><td>Duct Sealing</td><td>$791.23</td></tr>
<tr><td>Advanced Air Sealing</td><td>$833.34</td></tr>
<tr><td>Efficient Auto</td><td>$3,018.13</td><td>N/A</td><td><u>All Actions (w/ Auto)</u>
$5,849.90</td></tr>
<tr><th colspan="2">Joint Evaluation (JE) Actions</th></tr>
<tr><td>Tax Credit</td><td>$4,669.77</td></tr>
<tr><td>Neighbor's Score Increase</td><td>$3,884.22</td></tr>
<tr><td>Neighbor's Score Increase, if public</td><td>$4,801.07</td></tr>
</table>

Table Notes: Shaded cells have significantly higher WTP than average cost. Un-shaded cell means are significantly lower than average costs.

In The WTP distributions contain values at the extremes of $0 and the maximum scale amounts. The outlier values cause skewing, mostly positive due to the top end of the scale at $20,000. Some subjects are willing to pay nothing and others state WTP well above survey-stated average costs. For instance, the DIY SE WTP has means significantly higher than the supplied average cost anchor (shown shaded in the table), such as:

- CFLs (m=$125.68, avg. cost=$100, p<.0001),
- power strips/smart outlets (m=$48.99, avg. cost=$40, p<.0001), and
- DIY actions combined (m=$174.68, avg. cost=$140, p<.0001).

[83] In this case, I used the most conservative WTP calculation, where the yes or no question was included in the average for both answers. For instance, including the $0 value for no answers will decrease the WTP average amount, lowering WTP values.

The average WTP for DIY actions (*e.g.,* CFLs and smart outlets) is $175, skewed to the right, and shows that about one-third of subjects are in fact willing to pay $200 (*i.e.*, over 50% higher than the average cost anchor of $140). Almost 40 percent of subjects have upgraded their household lighting through N2N lighting and/or HES assessments. Others have likely updated their lighting or added outlet control on their own, although the survey does not collect this data.

Table 19, the un-shaded cells have significantly lower means than the average cost, including:

- attic insulation (m=$1,032, avg. cost=$1,100, p<.0001),
- duct sealing (m=$791.23, avg. cost=$950, p<.0001),
- advanced air sealing (m=$833.34, avg. cost=$1,400, p<.0001),
- the three previous upgrade actions combined (m=$2657.09, avg. cost=$3450, p<.0001), and
- an efficient automobile (m=$3,018.12, avg. cost=$5,000, p<.0001).

The summations of all of the separate evaluation questions have means significantly lower than the average cost, including:

- house actions without automobile (m=$2,831.78, avg. cost=$3,590, p<.0001), and
- total actions with automobile (m=$5,849.90, avg. cost=$8,590, p<.0001).

For instance, only 3 subjects (< 1 percent) stated no WTP for any house or automobile upgrades. Most respondents are willing to pay at least $1,000 for an upgrade (*n*= 535, 91 percent). Some subjects will pay a small amount for each action, and others will pay for one upgrade such as attic insulation, but not other upgrades. In a few cases, the values are spread thinly across the actions indicating a small WTP for any one action.

For the house actions:

- Most are WTP for all five energy actions, in addition to a more efficient automobile.

- About 25 percent are WTP average cost or more for all five actions and a more efficient automobile (*n*=157, 26.7 percent).

- WTP values cluster between $2,000 and $3,750 (*n*=328, 56 percent).

For the automobile:

- Most respondents state WTP over $1,000 for an energy efficient automobile (*n*= 496, 85 percent).

- Twenty-five subjects state WTP $20,000 or more for a more efficient automobile (four percent).

- Twelve subjects state $0 WTP for an automobile, but would pay between $1,143 and $4,239 for house actions.

- Twelve state less than $87 WTP for a more efficient automobile, but between $260 and $4,404 for house upgrades.

- Twenty respondents state WTP between $100 and $500 for an efficient automobile, with a range of house actions amounts between $0 and $3,679, with most WTP over $700.

The joint evaluation actions all show significantly lower stated WTP than average costs, including the following:

- a $1,500 tax credit (m=$4,669.77, avg. cost=$8,590, p<.0001),
- neighbor's WTP with increased score (m=$3,884.22, avg. cost=$8,590, p<.0170), and
- neighbor's WTP with increased score (m=$4,801.07, avg. cost=$8,590, p<.0001).

For instance, when offered a $1,500 tax credit and asked to state the maximum WTP for all actions:

- Five subjects stated WTP $0, two stated $50, and 16 stated between $145 and $500.

- About half stated WTP $2200, almost one-quarter $5,000 or more, about 60 percent between $1,000 and $5,000, and about 30 percent state between $5,000 and $20,000.

When asked the maximum amount their neighbor would be willing to spend for all of the recommended improvements to increase their home energy score from a 4 to a 9:

- Eighteen subjects stated neighbor's WTP as $0, 98 subjects between $29 and $1,000 WTP, 108 stated $2,000, and 72 subjects stated their neighbors would be WTP over $7,500.

- In the middle of the distribution are clusters of stated WTP amounts at $500 increments between $2,500 and $5,000, as well as three clusters at $6,000, $8,000, and $10,000.

Unfortunately, the distribution data doesn't show a consistent pattern about how calculate what they think their neighbor's WTP would be. In fact, it may be that several explanations are true, where some people answer:

- Their own WTP, such as when indicating their neighbor would pay less than the summation of the average SE WTP (*i.e.,* the looking glass perception);

- A WTP that makes them feel better, such as stating the neighbor would pay less than they themselves would pay (*i.e.,* better-than-average); and

- What they believe the actions actually cost, such as when stating similar WTP as their neighbors in JE (*i.e.,* looking glass perception).

For neighbor WTP if the score were public on Zillow or Google maps, most subjects believe their neighbors would be willing to pay more, where:

- Eleven subjects stated their neighbors would be willing to pay $0, 90 subjects believed between $29 and $1,000 WTP (and most indicating similar neighbor's WTP, non-public), 89 believed $2,000, and 124 subjects stated over $7,500 (with a mixture of neighbor's WTP, non-public being lower, the same, or higher).

- In the middle of the distribution are clusters of WTP amounts at $1,000 in increments up to $10,000.

4.2.4 Analysis of Variance hypothesis testing

Appendix I.2 provides detailed Analysis of Variance (ANOVA) hypothesis testing, results, and figures.[84] Table 20 includes the means of each WTP dependent variable by experimental report version and housing situation. Table 21 includes several hypotheses test results followed by detailed discussion of each.

Table 20 Means of WTP Dependent Variables

	Imagine Buy	Imagine Home	Imagine Sell	Actual Buy	Actual Sell
	House Actions WTP (CFLs, Outs, Attic, Duct, Air Sealing)				
Control	$2,858.50	$2,885.31	$2,710.06	$3,800.61	$2,444.13
HEScore	$2,891.21	$3,005.82	$3,062.08	$4,035.79	$2,523.67
Basic	$2,745.16	$2,658.17	$2,546.63	$2,899.43	$2,079.61
Detailed	$2,883.80	$2,775.38	$2,623.46	$2,845.69	$3,203.06
	Efficient Automobile Mean WTP				
Control	$3,268.10	$2,948.45	$2,239.63	$2,669.89	$1,832.38
HEScore	$2,420.48	$4,289.29	$3,371.49	$5,863.50	$2,573.20
Basic	$2,680.63	$2,807.48	$2,692.43	$2,286.30	$4,227.44
Detailed	$3,074.54	$2,748.09	$2,333.75	$3,282.33	$2,093.33
	Tax Credit WTP				
Control	$3,811.85	$4,151.91	$4,478.79	$6,520.17	$2,965.75
HEScore	$4,043.41	$5,909.73	$5,493.71	$9,735.50	$3,081.20
Basic	$4,131.41	$4,573.00	$4,116.53	$5,456.80	$3,661.00
Detailed	$4,063.40	$5,131.50	$4,299.00	$8,338.33	$5,395.33
	Neighbor's WTP to Increase Score				
Control	$3,040.41	$4,838.55	$3,249.71	$6,028.83	$3,587.50
HEScore	$3,567.74	$4,379.69	$4,444.90	$4,484.00	$4,138.60
Basic	$3,557.24	$4,039.25	$3,448.81	$5,167.80	$1,001.67
Detailed	$3,689.18	$3,722.10	$3,393.05	$3,030.83	$1,348.67
	Neighbor's WTP to Increase Score, if Public				
Control	$3,816.28	$5,599.24	$4,905.89	$5,874.50	$4,467.50
HEScore	$5,106.11	$5,458.22	$5,304.08	$10,781.75	$5,826.40
Basic	$4,600.32	$4,474.80	$4,346.36	$5,578.40	$1,050.00
Detailed	$4,339.63	$4,608.50	$4,257.98	$3,857.33	$2,052.33

Table Note: See Appendix I.2.1 for two graphical representations of this table.

[84] When analyzing the report versions or housing situations separately, the results are from the 4X2 and 4X3 factorial ANOVA regression results; however, when analyzing the differences between the interactions of report version and housing situation, results are from the 4X5 ANOVA regression models. The actual housing situations (4X2 models) have small numbers of response rates, *n*, and degrees of freedom, affecting the results reliability. For instance, the HEScore, Actual Buy condition may be overly influenced by a three high WTP stated values, and Basic may be overly influenced by a few low WTP stated values.

Table 21 ANOVA Hypothesis Testing Results

Dependent WTP Variables	Variable Means	Means Mean (Between Group)	Mean Difference (Within Group)	Significance testing
SE > JE				Std. Err. =$158
Average SE All Actions >	$5,850 >			Prob.>|t|=.0001
Neighbor's to Increase Score	$3,884	$4,867	$1,966	Correlation = 0.34
Tax Credit > SE				Std. Err. =$177
Tax Credit >	$4,670 >			Prob.>|t|=.0001
Neighbor's	$3,884	$4,277	$786	Correlation = 0.41
Public JE Other > JE Other				Std. Err. =$79
1. Neighbor's Public >	$4,801>			Prob.>|t|=.0001
Neighbor's	$3,884	$4,343	$917	Correlation = 0.86
				Std. Err. =$169
2. Neighbor's Public ≅	$4,801≅			Prob.>|t|=.4380
Tax Credit	$4,670	$4,736	$131	Correlation = 0.51

4.2.4.1 Separate Evaluation WTP > Joint Evaluation WTP

In addition to showing significance across the survey (Table 22), SE WTP is higher than JE WTP (*i.e.,* neighbor's WTP) for most pairs of independent variables (Prob.>F: Mean Difference=0.14, Between Groups=0.08) Table 22, where:

- Actual Buy and Actual Sell do not show significance across all report versions.
- Imagine Home, Imagine Buy, and Imagine Sell are statistically higher, except for Imagine Home/Control ($p<0.05$).

Table 22 Matched Pairs Analysis of Total SE and Neighbor's WTP Variables

Shaded and bold is significant ($p<0.05$) Each cell includes: WTP Mean Difference $ Amount, p-value, Between Groups	Situation				
	Actual Buy	**Imagine Buy**	**Imagine Home**	**Actual Sell**	**Imagine Sell**
Control	$442	**$3,086**	$995	$689	**$1,700**
	0.392	**0.0001**	0.053	0.251	**0.001**
	$6250	**$4,584**	$5,336	$3,932	**$4,100**
HEScore	**$5,415**	**$1,744**	**$2,915**	$958	**$1,989**
	0.038	**0.005**	**0.0001**	0.0205	**0.0001**
	$7,192	**$4,440**	**$5,837**	$4,618	**$5,439**
Basic Report	$18	**$1,869**	**$1,426**	**$5,305**	**$1,790**
	0.492	**0.007**	**0.004**	**0.013**	**0.0001**
	$5,177	**$4,492**	**$4,752**	**$3,654**	**$4,344**
Detailed Report	**$3,097**	**$2,269**	**$1,801**	**$3,948**	**$1,564**
	0.019	**0.0001**	**0.0001**	**0.049**	**0.001**
	$4,579	**$4,824**	**$4,623**	**$3,323**	**$4,175**

The F-tests do not indicate significant difference in the variance to each group's mean or to the survey mean. In other words, the across and between report version and housing situation treatment group means

are not significantly different from each other. This indicates that it is difficult to distinguish between treatment groups, although some treatment groups do show significance between total WTP and neighbor's WTP variables.

The results support that people are more likely to state higher WTP in separate evaluation (SE) than in joint evaluation (JE).

4.2.4.2 Tax Credit and Neighbor's Public Score JE > Neighbor's JE WTP

Additional one-way t-tests explored the hypothesis that a $1,500 tax credit and/or a public score would increase WTP, including three separate evaluations:

1. Tax Credit WTP > Neighbor's WTP,
2. Neighbor's Public WTP > Neighbor's WTP, and
3. Tax Credit WTP ≅ Neighbor's Public WTP.

To test whether if WTP with a $1,500 tax credit increases WTP, the results were compared with Neighbor's WTP JE.[85] In this case, neighbor's score increase WTP is used as a surrogate for a subject's WTP for all actions. Across the survey population, the mean of Tax Credit WTP is significantly higher than the neighbor's score WTP (Mean Difference=$786, Prob.>|t|=<0.0001).

Table 23 shows the means comparisons across experimental groups (Prob.>F: Mean Difference=0.10, Between Groups=0.21), where the Actual Buy conditions do not show significance across any report version. For the Control group, both the Imagine Buy and Imagine Sell conditions have a statistically higher mean for Tax Credit WTP. For the HEScore, Imagine Home and Imagine Sell conditions also show significant difference. The Detailed report, Imagine Home, Imagine Sell, and Actual Sell conditions exhibit higher tax credit WTP. Again, the F-tests do not show significant difference in the variance to each group's mean or to the survey mean, indicating indistinguishable treatment groups.

Table 23 Matched Pairs Analysis of Neighbor's – Tax Credit WTP Variables

Shaded and bold is significant (p<0.05) Each cell includes: WTP Mean Difference $ Amount p-value Between Groups	**Situation**				
	Actual Buy	**Imagine Buy**	**Imagine Home**	**Actual Sell**	**Imagine Sell**
Control	-$491 0.361 $6,275	**-$771** **0.038** **$3,426**	$687 0.129 $4,495	$622 0.364 $3,277	**-$1,229** **0.001** **$3,864**
HEScore	-$5,252 0.113 $7,110	-$476 0.266 $3,806	**-$1,530** **0.015** **$5,145**	$1,057 0.118 $3,610	**-$1,049** **0.026** **$4,969**
Basic Report	-$289 0.426 $5,312	-$574 0.176 $3,844	-$533 0.215 $4,306	-$2,659 0.092 $2,331	-$668 0.119 $3,783
Detailed Report	-$5,308 0.061 $5,686	-$374 0.213 $3,876	**-$1,409** **0.026** **$4,427**	**-$4,047** **0.029** **$3,372**	**-$906** **0.042** **$3,846**

[85] Note that the overall survey results indicate that a tax credit increases WTP, where the mean difference between the tax credit maximum WTP and the sum of SE all house actions WTP is $1,838 (p=0.01).

The results indicate that providing a tax credit (*e.g.*, an incentive) can increase stated WTP.

Second, the neighbor's WTP with a public score is statistically greater than the neighbor's score (Mean Difference=$917, Prob.>|t|=<0.0001).
Table 24 shows the means comparisons across experimental groups (Prob.>F: Mean Difference=0.0001, Between Groups=0.21), where all Imagine Buy, Imagine Home, and Imagine Sell conditions have a higher WTP with the public score. The results are not statistically significant across the Actual Buy and Actual Sell conditions, except for HEScore, Actual Buy. The F-tests do not indicate much difference in the variance to the survey mean, while the Mean Difference is significant, where the change in WTP is different for different experimental groups.

Table 24 Matched Pairs Analysis of Neighbor's Public – Neighbor's WTP Variables

Shaded and bold is significant (p<0.05) Each cell includes: WTP Mean Difference $ Amount p-value Between Groups	**Situation**				
	Actual Buy	**Imagine Buy**	**Imagine Home**	**Actual Sell**	**Imagine Sell**
Control	-$154 0.363 $5,951	**$776** **0.0001** **$3,428**	**$761** **0.002** **$5,219**	$880 0.256 $4,028	**$1,656** **0.0001** **$4,078**
HEScore	**$6,298** **0.022** **$7,633**	**$1,538** **0.05** **$4,337**	**$1,079** **0.0001** **$4,919**	$1,688 0.189 $4,983	**$859** **0.002** **$4,874**
Basic Report	$411 0.175 $5,373	**$1,043** **0.005** **$4,078**	**$436** **0.031** **$4,257**	$48 0.169 $1,026	**$898** **0.0001** **$3,898**
Detailed Report	$827 0.084 $3,444	**$650** **0.001** **$4,014**	**$886** **0.0001** **$4,165**	$704 0.086 $1,701	**$865** **0.002** **$3,825**

The results indicate that making a score public can increase stated WTP, especially for the HEScore version and except for people in the market to sell their home.

Third, the $1,500 tax credit was compared to the neighbor's public score, expected to have similar effects on WTP.[86] Across the survey population, the mean of Tax Credit WTP is not significantly different than the neighbor's public score WTP (Mean Difference=$131, Prob.>|t|=.4380).
Table 25 shows the means comparisons across experimental groups (Prob.>F: Mean Difference=0.13, Between Groups=0.11), where the Actual Buy, Imagine Buy, and Imagine Sell conditions do not show significance across report versions. However, the Control, Imagine Home group and the HEScore, Actual Sell group do show a statistically higher WTP for all actions with a public score. Again, the F-tests do not indicate significant difference in the variance to each group's mean or to the survey mean.

The results do not show a significant difference between the stated neighbor's public WTP and the tax credit WTP.

[86] Note, the survey results do not include information about the interaction effects of tax credit and public scores.

Table 25 Matched Pairs Analysis of Neighbor's Public – Tax Credit WTP Variables

Shaded and bold is significant (p<0.05) Each cell includes: WTP Mean Difference $ Amount p-value Between Groups	**Situation**				
	Actual Buy	**Imagine Buy**	**Imagine Home**	**Actual Sell**	**Imagine Sell**
Control	-$646 0.314 $6,197	$4 0.496 $3,814	**$1,447** **0.007** **$4,876**	$1,502 0.262 $3,716	$427 0.092 $4,692
HEScore	$1,046 0.390 $10,259	$1,063 0.065 $4,575	-$452 0.242 $5684	**$2,745** **0.037** **$4,454**	-$190 0.337 $5,399
Basic Report	$122 0.457 $5,518	$469 0.183 $4,366	-$98 0.437 $4,524	-$2,611 0.090 $2,356	$230 0.348 $4,321
Detailed Report	-$4,481 0.080 $6,098	$276 0.242 $4,202	-$523 0.233 $4,870	-$3,343 0.066 $3,724	-$41 0.474 $4,729

4.2.5 Analysis of additional HEScore hypotheses

In addition to the WTP analysis, the HEScore data enabled supplemental analysis of additional dependent variables and hypothesis with the following findings (Table 26):

1. Residents actually in the market to buy a home stated the highest willingness (WTP) for home energy efficiency upgrades (significant with a small response rate).

2. The HEScore version of the report resulted in higher WTP than other report types for both house and automobile actions.

3. Almost 60 percent of participants indicated that they prefer to complete home projects involving tools and ladders themselves (*i.e.,* DIYers) (*i.e.,* 58.9 percent, *n*=345 of 586). There are two major findings about DIYers:

    a. DIY participants have a lower WTP for home energy actions and for purchasing a more efficient automobile than non-DIYers.
    b. DIY participants have a lower WTP with a $1,500 tax credit for all actions.

4. N2N participants that have already completed an upgrade are WTP more for upgrades, but it does not hold true for those completing a HES assessment with no follow on upgrades.

5. Eighty-three percent are willing to share their home's energy report with a potential buyer and are WTP more than those not willing to share the report, including:

    a. For house and automobile actions, and
    b. With a $1,500 tax credit.

6. Participants are WTP more for an efficient automobile than home efficiency actions.

Table 26 HEScore Only vs. Other Report Version WTP t-Test Results

Finding #	Two-sample t-test with equal variances	Means	Mean Difference (Std. Error)	p-Value
1	House WTP Actual Buy > House WTP Actual Sell	$3,358.01 > $2,549.52	$808.49 ($375.12)	0.0192
	House WTP Actual Buy > House WTP Imagine Home	$3,358.01 > $2,839.80	$518.21 ($299.64)	0.0425
	House WTP Actual Buy > House WTP Imagine Buy	$3,358.01 > $2,845.87	$512.14 ($267.32)	0.0285
2	House WTP HEScore Only > Control, Basic, Detailed	$3,014.53 > $2,768.33	$246.19 ($115.40)	0.0167
	Auto WTP HEScore Only > Control, Basic, Detailed	$3,648.26 > $2,799.39	$848.87 ($243.50)	0.0003
3a	House WTP DIY < House WTP, no DIY	$2,715.27 < $2,998.57	$283.30 ($102.30)	0.0029
	Auto WTP DIY < AutoWTP, no DIY	$2,729.57 < $3,431.20	$701.63 ($216.73)	0.0006
3b	Tax Credit WTP DIY < Tax Credit WTP, no DIY	$4,075.92 < $5,519.88	$1,433.96 ($363.83)	0.0000
4	Upgrade WTP w/ upgrade > Upgrade WTP, no upgrade	$3,059.08 > $2,598.99	$460.09 ($147.39)	0.0009
	Upgrade WTP w/ HES > Upgrade WTP, no HES	$2,701.65 > $2,600.45	$101.20 ($99.35)	0.1544 (Not Significant)
5a	House WTP share report > House WTP no share	$2,938.84 > $2,292.04	$646.80 ($133.67)	0.0000
	Auto WTP share report > Auto WTP no share	$3,187.73 > $2,163.11	$1,024.62 ($286.39)	0.0002
5b	Tax Credit WTP share > Tax Credit WTP, no share	$4,905.92 < $3,479.30	$1,426.62 ($484.56)	0.0017
6	Auto WTP > House WTP	$3,018.13 > $2,831.77	$186.34 (98.79)	0.0299

4.3 Researcher Modifications of the DOE HEScore Report

Although it was not the goal of our study to test the design of the report itself, I believed it was important to update the DOE report (*i.e.*, the consumer feedback) to the current behavioral best practices prior to administering the survey. Specifically, I felt that the DOE report version does not account for consumer behavior sufficient to drive action. This section presents the literature review background for the researcher modifications to the DOE HEScore and report prior to survey execution. Many of the changes have been influenced by multiple behavioral science principles and findings.

Make it fun: The DOE shared draft results of a previous HEScore experiment that tested 12 different design elements and concluded that the report should use simple, friendly, and personal language (Case, 2012).[87] We agreed with the results, believing that the current DOE iteration is not fun or visually engaging. In fact, increasing the fun factor of the feedback should increase report engagement (Bang, Torstensson, & Katzeff, 2006; Belcaid, Dana, Donnelly, Hamman, & Puttnam-Farr, 2009; Carpenter,

[87] The DOE made small changes to the behavioral language, and now shows dollar savings for 10 years.

2009; Mehta & Kass, 2012; Wagner, 2009). Increasing the fun factor could include approaches like adding visual elements, games, mascots, friendly competitions, collaborations, flashy copy, *etc.*.

Goal Setting and Feedback: The HEScore may act as a goal that is achieved and rewarded by completing the suggested upgrades (*i.e.,* feedback and reward). The HEScore, much like a goal, has the potential to motivate or discourage action (see Section 2.3.1.). Personal communication with several experienced HEScore pilot administrators supports the behavioral research that the DOE HEScore and report cannot be used to drive behavior change, at least in its current iteration (Golden, 2013; S. Stern, 2013). In fact, the review finds that the current scale is not sensitive enough to motivate most people to take action, with:

- A lack of pre/post score improvement and scale sensitivity, and
- Overestimated or a heavily weighted baseload (Stern, 2013).

This means that people "feel like they should have a much higher score" than they have both before and after the improvements (Ellman, 2013; Hamlin, 2013) . This is especially true for larger homes designed to score low (Ellman, 2013; Glickman, 2012). Many homes in CT are larger than 3,500 square feet, and would automatically receive a low score.[88] Yet, larger homes often have more energy efficiency potential than smaller homes.

Instead, consumers need to start with lower scores and show substantial progress after undertaking the complex process of completing home energy upgrades. I believe to motivate those that have done very little past energy efficiency work, the reward is the experience of a significant jump in score from a bad score to a good score.[89]

In addition, feedback needs to be personalized to the household, which will exhibit unique characteristics and abilities to complete different actions (see Section 2.3.2). For instance, some houses may not have completed the easy, low cost actions, such as changing out Compact Fluorescent Light bulbs (CFLs). Others may not be inclined to take on tasks as expensive or complex as adding insulation and advanced air sealing. Still others may be ready to commit to and complete a whole-home energy performance project.

Finally, we removed the three middle pages of Home Facts from the report due to length and overly technical concepts, such as unknown units of measurement.[90] For instance, the Home Facts pages include detailed housing and energy-related subsystem information (*e.g.,* HVAC systems, walls, windows, *etc.*.). In addition, the air tightness is provided as, for example, 3,800 CFM_{50} and the wall construction at R-11. It's unlikely the customer will understand how much air is escaping in cubic feet per minute when the house is pressurized to 50 Pascal's, or what is a good R-value. A more meaningful measure that most customers can visualize is the equivalent sized hole in the wall to the outside. In addition, an R-11 wall needs a supplemental scale of good or bad to inform the customer's action (*i.e.,* the injunctive norm discussed next).

[88] The first N2N case study found that a home with attic insulation at R-49 (*i.e.,* an efficient value), decent windows, and a heating system less than 10 years old scored a 3 out of 10. It is partially due to house size, but is also due limitations of the scoring tool (*i.e.,* unable to indicate previous air sealing and recommend advanced air sealing) (Hamlin, 2013).

[89] Smaller jumps with packages of upgrade options should also be tested to determine optimum score sensitivity.

[90] Likely to confuse consumers and decrease attention, there are five different types of units provided without explanation or scale, removing the chance to induce the effect of an injunctive norm or reference point (i.e., CFM50, R-values, AFUE, SEER, EF).

Social Motivations: Social motivations can also encourage people to take action, such as people doing the same action as their reference group, especially to avoid disapproval (R. B. Cialdini, 2008; Hofmeister, 2010). The effect is increased for ambiguous situations and when people are unsure of themselves (ibid.) (see Section 2.4). For instance, numerous studies have analyzed the positive impacts of social norms on energy behavior, such as adding descriptive norms about what others are doing, as well as injunctive norms about "what people typically approve or disapprove" (Hunt Allcott, 2009b; Ceniceros & Bos, 2009; Robert B. Cialdini, 2003; Lindenberg & Steg, 2007; Nolan et al., 2008). Normative studies have also reported the importance of the proximity of the reference group, both from a physical standpoint (Claire Loock, Landwehr, Staake, Fleisch, & Pentland, 2012), and regarding those to which one can best relate (Claire Loock et al., 2012; McFerran, Dahl, Fitzimons, & Morales, 2009). (See the normative literature in Section 2.4.1). In fact, the injunctive norm may be necessary to prevent low energy users from rebounding to higher usage to match other's higher consumption levels (Hunt Allcott, 2009b; Fischer, 2008; Claire Loock et al., 2012; Schultz et al., 2007).

In addition, people often do want to "Keep up with the Joneses" and many want to "Be the Joneses" (Belcaid et al., 2009). At least some versions of the DOE report convey a lower score than the neighbor's score after making all of the report recommendations. For instance, the sample CT home could only score a 6, while the neighbor's score was an 8. This type of feedback could instead produce a "what the hell" effect (Cochran & Tesser, 1996), where the hassle of time and effort to make an upgrade could override the benefit of *almost* keeping up with the Joneses.

Resulting HEScore Report Modifications: The following report modifications were based on the behavior literature findings, including to:

- Color the scale to improve visual aesthetics, as well provide an normative injunctive signal of bad (red) vs. good (green);
- Update the report's language to friendly, actionable, and personal language, referring to "your neighbors", 'repair now", and removing ambiguous units (*e.g.,* including DOE Home Facts, *etc.*.)
- Increase the jump in score from bad to good, advancing five steps to provide feedback of a major achievement in exchange for a major undertaking (*i.e.,* the goal and reward for the behavior).
- Increase normative influence, including:
    - Creating a close proximity reference group of "Your neighbors with similar homes and completed improvements score here"[91];
    - Inducing a need to keep up with the Joneses, instead of giving up, by having a goal score equal to the neighbor's score with an already efficient home; and
    - Increasing the visibility of the color scale injunctive norm.
- Add two DIY actions to make it easy for people to compare low-hanging fruit actions to upgrades.[92]
- Remove the three middle pages of Home Facts from the report due to information overload.[93]

[91] The current normative language is subtler, stating the "top 20% of similarly sized homes score here or better".
[92] The goal was to add easy to make, quick payback actions to learn about: DIY personality types, and preferred packages of upgrade options.

The modified report versions are a first iteration towards making the report more accessible to the average consumer, but more research is needed to answer questions about the impact of the design changes, as well as to understand other report changes needed. For instance, the DOE should test language and aesthetics to improve the current report's consumer friendliness and ability to influence consumer behavior.

4.4 N2N Market Segmentation Indicators

The HEScore survey has rich detail of demographic, attitude, discretionary time and money, propensity to conserve, housing buy/sell mindset, and survey engagement measures (see Appendix H.2 for details). In addition, N2N existing data includes revealed preferences of energy actions, such as N2N lighting, home energy audits (HES assessments), and upgrades. Almost two-thirds of survey respondents have engaged in energy efficiency by completing a N2N lighting visit, a HES assessment, and/or an upgrade(s) in their home. Those with completed actions are likely to be early adopters of energy efficiency in CT.

I hoped to use the survey results to look for a target market, where households would have higher WTP amounts and/or be more likely to complete upgrades, including exploring the following:

- Socio-economic characteristics, such as housing characteristics, education, income levels, number of children, political beliefs, and local organization participation, *etc.*. that could impact WTP and/or propensity to act. For instance, people with discretionary time and income are more likely to complete upgrades.

- Those with higher stated WTP should also be more likely to have completed actions.

4.4.1 Survey demographic indicators

I explored patterns of WTP using the following demographic findings (detailed in Appendix H.2). In general, the subjects are affluent, well educated, liberal to moderate homeowners. Subjects stay and plan to stay in their current homes for long periods of time, but there is still some housing turnover available for target marketing. Most respondents are engaged in their household energy use and express support for a home energy labeling system, such as the HEScore.

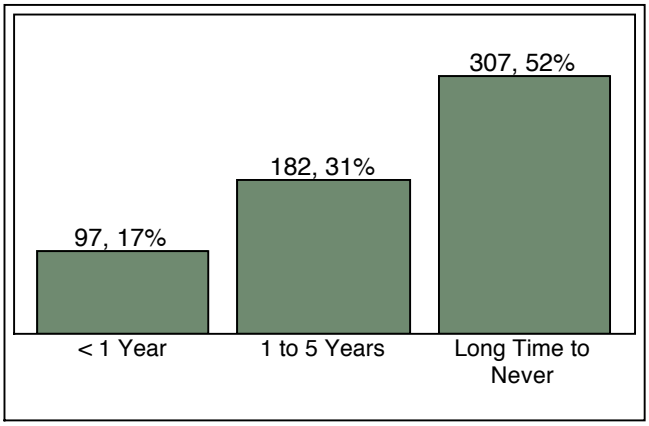
Socio-economic characteristics: The sample is affluent with almost 90 percent earning at least $50,000 to over $150,000. Only ¼ has experienced one or more years of poverty in their lifetime. Two-thirds are employed full-time, and almost 80 percent are married or living with a partner. Over 90 percent have graduated from a university. The mean number of household occupants is just over three, and over half have children living at home. Almost 80 percent of subjects are involved in the community, stating belonging to one or more local organization. Almost half state political affiliation of Democrat, one-third Independent, 13 percent Republican, and eight percent miscellaneous. About half consider themselves moderately to strongly liberal, 30 percent in the middle, and almost 20 percent moderately to strongly conservative.

Buy/sell mindset: I explored a respondent's ability to imagine if they are in the situation of buying or selling a home. Since memory is stronger for recent events than distant events, the intention was to better understand how effectively subjects could imagine they were in the market to buy or sell their house. I used six household tenure questions, including how long the participant has lived and planned to live, and details about their experience and timeframe with selling or buying their home.

[93] For survey purposes, we also removed reference to the DOE in case of potential bias, where subject's preconceived opinions about the DOE could impact their answers.

While most subjects are staying put in their current home, there is still a substantial number of subjects changing homes. For instance, about half of subjects have lived in their home over 10 years, with about one-quarter for over 18 years. Three-quarters of subjects plan to stay in their home for more than five years, and 20 percent for less than five years. Most survey respondents have no plan to buy or sell a home, with less than three percent planning to move in the next year. Figure 14 combines the six buy/sell mindset answers, where 17 percent of respondents have either: 1) bought and/or sold a home less than a year ago, or 2) planned to buy or sell in the next year.[94] Almost one-third have bought or sold, or plan to buy or sell within one to five years, and over half have no plans or haven't done so in more than five years.

Figure 14 How Recently or Soon in the Market to Buy or Sell a Home



Household energy use characteristics: Ninety-five percent of subjects live in a suburban or rural area, while 92 percent own their home. Almost all households state that they try to conserve energy and over 80 percent live in a comfortable household. Half believe their energy costs are reasonable, 40 percent think they are high, and less than 10 percent state low energy costs. Those with high energy costs are less likely to be comfortable than those with reasonable and low energy costs. In addition, those with completed HES assessments or upgrades are more likely to be comfortable.

Attitude about increasing the home's energy score: Most respondents felt that increasing the HEScore would motivate home energy upgrades (81 percent), would be interested in seeing the score for a home they were purchasing (95 percent), and would be interested in sharing the score for a home they were selling (83 percent). Money was the most common reason for supporting or disagreeing with the effectiveness of the HEScore, such as save money on utility bills, increase or decrease home value, understand home value, too costly to implement, projecting costs of utilities and household ownership. Other supporting reasons were to save energy, support the environment, improve household comfort, increase knowledge to enable action, and increase home's comfort. Other disagreeing reasons were distrust, lack of need, slow down house sell, apathy, and privacy issues.

Time and money barriers: Many N2N households face time-related barriers to completing energy upgrades. For instance, households with one head of household or where two adults work fulltime may be short on time make it difficult to meet a contractor at the home for four hours for a HES assessment or for

[94] This first group of buy/sell mindset could be considered those most likely able to imagine purchasing or selling the example home. Analysis found no significant difference between the three buy/sell mindsets in WTP dependent variables.

two or more days for upgrade work. It would also be difficult to find the time to do the work themselves, although many are inclined to do so. In addition, households with school age children often have busy schedules full of extra curricular activities (and driving to get there). Many of these busy households are also tight on money, especially in today's downturned economy.

On the other hand, households with retired members have more time, but often lack the information, skills, and/or discretionary income necessary to complete costly energy upgrades. Seniors often lack trust that contractors will do competent work, to have contractors in their home, that the house even needs the work at all, or that the payback period is short enough to realize the benefits.

Information barriers: Survey responses support pre-testing findings of complexity of the HEScore survey, the report, and the general topic of whole-home energy use. In fact, the data indicates that the survey population is sometimes confused by the survey, especially the hypothetical situation to imagine this is your house, and even more for imagine you are buying or selling this house. Some subjects also reported having a hard time calculating WTP answers for an example house. In addition, numerous subjects emailed or indicated in open text comments that this is not my home, opening up uncertainty about what percentage of people had a hard time with the imaginary situation without mentioning it.[95]

4.4.2 Regression modeling of revealed preferences

Using the demographic indicators as the independent variables, and the revealed preferences and WTP amounts as dependent variables, I ran logistical regression models (see details in Appendix J.1). For instance, the following completed N2N actions were used as dependent variables (*i.e.,* revealed or actual preferences), including:

1. Home energy upgrade;[96]
2. Free in-home lighting visit; and
3. HES assessment.

Table 27 Logistical Regression Model Parameters

Model Parameter	Energy Upgrade	In-home Lighting Visit	HES Assessment
n	428	512	553
Chi^2	168.77	209.26	136.54
Prob.>Chi^2	0.0001	0.00001	0.00001
Pseudo R^2	0.44	0.43	0.18

Appendix J.1 contains the tables of significant regression indicator variables and statistics for subjects more likely to complete an upgrade, N2N lighting visit, and HES assessment. The upgrade and lighting results discussions are combined due to similar findings, with both revealed preference variables fitting the model better than the HES assessment model.

Upgrade complete: A few indicators have an impact on the likelihood to complete an upgrade. Perhaps due to the unbalanced socio-economic nature of the sample (*e.g.,* affluent, educated, *etc.*.), few demographic characteristics significantly impact likelihood to complete an upgrade, except living in an

[95] To test the impact on WTP, I ran analysis using a constructed buy or sell mindset variable based on how long it had been since they bought or sold and/or planned to buy or sell. The analysis that found similar results to the experimental housing situation analysis and is not included in this document.

[96] Further supporting that N2N participants are early adopters, those completing an upgrade were 10 times less likely to drop out of the survey with the detailed report. This may indicate a stronger interest or understanding of energy, as well as acceptance of more detailed information.

urban area and having lived in poverty. Those buying or selling their home are much more likely to complete an upgrade than those staying put, as are those willing to share their home's report when selling it. In addition, the likelihood to complete upgrades increases with length of time lived in the home. Those planning to stay in their home longer are more likely to complete an upgrade, as are never planning to sell their home soon over those planning to sell in over five years from now. If the household conserves, they are much less likely to complete an upgrade than those that don't make an effort to conserve.

Lighting visit complete: A lighting visit showed similar findings with a few additions that lower incomes are more likely to complete a lighting visit. The same is true for those that would not change household decisions based on an energy report, which may also be due to low incomes. Those that would not change the bulbs in the shed are more likely to complete a lighting visit.

HES assessment complete: The HES assessment reveled preference doesn't fit the model well. In fact, it is likely that a wider demographic completes the HES assessment due to the HES assessment market structure in CT (see Chapter 3, Sections 3.3 and 3.4 for detailed description of HES assessment program). In addition, the HES assessment has a quick, six-month payback, costing only $75 for $750 worth of contractor services, saving customers about $200 per year in utility bills. There are also fewer barriers and costs to completion than an upgrade or lighting visit.[97] For these reasons, it is more difficult to single out significant indicator variables for HES assessments completions than for upgrade or lighting visit completions.

Still, there are some HES assessment findings. Those completing a N2N lighting visit are more likely to complete a HES assessment, indicating some foot-in-the-door impact. Still, either there is system delay or completing a lighting visit does not necessarily translate into an upgrade. Those that have recently purchased a home are much more likely to complete a HES assessment than others, as are those active in four or more organizations (again potentially indicating N2N influence). Those that are comfortable in their home are more likely to complete a HES assessment, as are those that do not attempt to conserve.

4.4.3 Regression modeling of WTP dependent variables

To determine which indicator variables exhibited statistical significance, I ran regression models for six WTP dependent variables (see details and results in Appendix J.2). I include the results most applicable to developing a description of each action's market segment, including:

Average house WTP: The findings are consistent with those completing upgrades, where those in the market to buy a home now or in the near future and/or those living in their home longer state higher WTP. The same is true for those engaged in the HEScore report and those willing to share their report with a potential buyer. Consistent with earlier findings, DIYers state lower WTP.

Upgrade actions only WTP: Upgrade findings closely follow average house WTP. In addition, subjects are more likely to complete attic insulation than duct sealing and air sealing.[98] Subjects state higher attic WTP after living in their home for over one year. Subjects comfortable in their home state lower WTP for upgrade actions.

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[97] While the free lighting visit would seem to have fewer costs and barriers, several do exist. For instance, one still has to be home for the visit (for less payback than the HES assessment), many homes don't qualify due to insufficient number of standard light sockets, the early adopters have already upgraded their lighting in CT, the program had limited availability and customer reach, and the HES assessment also includes up to 40 free CFLs, essentially embedding the free lighting visit within the HES assessment.

[98] Several factors may explain this finding, including that CT has a rebate for insulation, it was the first of three upgrades in the survey, not everyone has ducts, and people may have more awareness for attic insulation than duct and air sealing.

CFLs and outlets WTP: The more liberal a participant rates himself or herself, the higher the stated WTP.

Tax credit WTP: Unmarried, male, low energy bills, and single-family home characteristics result in higher stated WTP with a tax credit. In addition, those unlikely to make repairs themselves, including both upgrades and CFLs in the shed, are WTP more with a tax credit. Again, those willing to share the home with potential sellers state higher WTP.

Neighbor's public score WTP: Those that have recently purchased a home believe a public score would lead to higher neighbor's WTP. The same is true of those willing to share the report with potential sellers, as well as those not in the real-estate sector.

Efficient automobile: Subjects in the market to buy or sell a home state lower WTP, as do upgrade DIYers (although those that would change their CFLs in the shed state higher WTP). Subjects with low home energy costs state higher WTP, as do those that state the HEScore would impact their energy efficiency purchases.

4.4.4 HES assessment follow up survey results

N2N began sending HES assessment follow up customer surveys in April 2012, receiving 449 completed surveys to date. The results are to further explore market segments for HES assessment and upgrade packages, including the following (see details and results in Appendix K):

Conservation actions: Almost three-quarters of subjects state they have made conservation behavior change as a result of N2N participation (72 percent), and almost all respondents reported completing conservation actions, including: flipping out lights is the most common action (95 percent), followed by almost 80 percent reporting keeping the thermostat set at 68 degrees or lower in the winter. Other behaviors reported by the majority of respondents include washing clothes in cold water, using low flow shower heads, and setting the temperature to 78 degrees or higher in the summer. Less than half of people reported unplugging unused devices, using a toaster oven, hanging clothes to dry, and other actions.

HES assessments: People state two primary motivations to complete a HES assessment, to: 1) reduce energy bills, and 2) address problems in the home.[99] Some people state to reduce energy waste, and a few state to protect the environment or increase household comfort. During the assessment, most people had drafts identified and some learned about disproportionately high heating and/or cooling bills. A few stated they learned about other household problems, such as mold, gas leaks, asbestos, water damage, and not sure. Over 90 percent of participants are satisfied or very satisfied with their experience, with less than five percent stating dissatisfaction.

Upgrades: The percentage of participants starting and/or completing energy improvements has increased over time from 1.6 to 2.0 per household, where one-third of subjects complete 1, 2, or 3 or more upgrades. The top three upgrades are: additional air sealing, insulation, and CFLs and LEDs (in order, approx. 50 percent each). The next most popular upgrades are appliances, other, windows, heating systems, and hot water heaters. Most participants complete some of the upgrade work themselves or with the help of a friend (61 percent), while less than 20 percent use the same HES contractor and about one-third use a different contractor.

One-third of subjects state that household energy issues are a top priority to address and plan to move forward; while almost half state that it depends on cost and financing. In fact, almost two-thirds of subjects later state that rebates and financing are very or extremely important for them to complete

[99] Results from this type of question may not be reliable as participants often don't know their true preferences or motivations.

upgrades. Only 20 percent state not energy issues are not a household priority at this time, and some state that the home is already comfortable (13 percent). Of those that have completed a HES assessment, but haven't started upgrades, about 40 percent state financial barriers, including too expensive, low payback, and need financing. Over one-third state contractor-related barriers, including no recommendations or bid received, and/or need a contractor or contractor follow up. Others reported not moving forward because the house doesn't need upgrades or the household is too busy to complete upgrades.

4.4.5 Market segmentation discussion

N2N survey participants from both surveys (*i.e.,* DOE HEScore and N2N HES assessment complete follow up) have already completed energy efficiency and/or conservation actions on their own or as part of N2N program participation. Many of the market segmentation findings are prominent in the HEScore WTP survey findings, such as tax credits, financing, and public scores increase likelihood to complete energy actions, as does willingness to share the report with a potential homebuyer (and interest in the score/report, in general).

The market segmentation analysis also contributed new findings, such as:

Smaller actions: Almost all N2N participants report taking conservation actions. In addition, lighting can be used a foot-in-the-door acquisition strategy for HES assessments. At the same time, a lighting visit does not necessarily translate into upgrades, and needs to be carefully marketed for end goals.[100]

HES assessment: HES assessment completes encompass a large and diverse target market. Marketing efforts should be focused on addressing core needs, enhancing key benefits, and priming customers for upgrades. In addition, HES assessments should be marketed to various customers from those that just purchased a home to those in the house for a long time. CT has a substantial supply of older homes with high energy efficiency potential. Subjects state two primary reasons for completing a HES assessment, including reducing energy bills and addressing problems in the home; however, after the visit, most subjects found the primary benefit to be that contractors fixed drafts in the home.

Upgrades: There is evidence that the average number of upgrades for each household that starts upgrades after the HES assessment is increasing over time. Although people state the lowest WTP to air sealing (and N2N records don't reflect air sealing completions), subjects report completing it most often, providing evidence that some are doing it themselves and/or that contractors are not reporting the services to N2N. In fact, over 60 percent of subjects report completed upgrade work by his or herself or with a friend.

Those that have not completed upgrades state financial concerns and contractor related issues as the most common barriers.[101] Most people stated that upgrades would be a household priority depending on cost and financing, but N2N has experienced a drop off in interest post-HES assessment because upgrades are too expensive, have a long payback period, or customers need financing. In fact, there has been very little uptake of the CT financing option for N2N upgrades, indicating inadequate options, poor marketing, and/or other issues.[102]

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[100] Note several possible reasons: 1) a recognized system delay to upgrades, 2) that low income customers stall out in the HES-IE (Income Eligible) approval process, 3) lack of priming whole home upgrades (and lack of handholding through the process), or 4) people want the free lighting program and that's enough, *etc.*

[101] However, the findings also show time and money related barriers for participants.

[102] The average stated WTP is $4,800 for four overall survey WTP variables (*i.e.,* SE WTP, Tax Credit WTP, Neighbor's WTP, and Neighbor's Public WTP). Estimating that the average person could be convinced to spend one-quarter to half of their stated WTP, perhaps the survey could be used as a marketing tool after pre-priming subjects with the survey and stated WTP. Following the N2N multi-touch approach to marketing and outreach, following up with survey subjects should be more likely to gain customer commitment and completed upgrades.

Upgrade marketing efforts should be focused on addressing core needs and enhancing key benefits. For instance, one approach is to emphasize uncomfortable homes through seasonal, limited-time campaigns in peak heating and cooling seasons.

Energy interest: An overreliance on the score and the accompanying report is risky. The analysis finds that over half of respondents spent less than one minute looking at the report. HEScore survey interest was highest among subjects that had already taken steps to make their home more efficient. These same people were willing to pay more for home energy upgrades than those that had completed a HES assessment or had not completed lighting, HES assessment, or upgrade actions. The results could be measuring the anchoring effect, where those that have paid for an upgrade understand the cost of it, while those not completing them believe upgrades should cost less. The results could also be due to self-herding, where people look to past actions about how to act now and in the future (Ariely & Norton, 2008).

Still, there is preliminary evidence of a positive feedback loop, where as people complete more energy actions, they become willing to pay more for the next action and are more receptive to engaging in topics related to their home's energy use (*i.e.,* HEScore and/or HES assessment follow up surveys). For the N2N pilot, people have a tendency to complete actions in a step-wise manner over time rather than all at once.[103]

4.4.6 Market segmentation recommendations

To promote widespread energy behavior change, the consumer needs a simple, well marketed, portfolio of energy actions, including supportive financial incentives. Otherwise, people are most likely to stop after one action, believing they've done enough. The market segmentation research supports five major recommendations, including:

1. It is important to follow the customer to encourage more upgrades over time, leading to increasing energy and dollar savings (*e.g.*, because as people complete upgrades, WTP increases for upgrades and/or subjects complete more upgrades).

2. Home energy actions should be packaged to match how people think about costs and savings in the most positive way (*i.e.,* considering the psychology of money). For instance, incentives structures should under-incentivize smaller actions, and over-incentivize larger actions,[104] such as including the following whole home performance upgrade example packages:

    a. A $5,000 to $10,000 package of upgrades rolled into the mortgage.[105]

    b. An automobile and home energy upgrade package, where higher average automobile WTP to subsidize energy upgrade costs.

    c. CFLs and LED lighting packages add-ons with higher than cost prices to subsidize energy upgrade costs.

[103] While behavior change usually happens incrementally, N2N results may be overly influenced by HES program and N2N pilot designs.
[104] For instance, the analysis found subjects were often willing to pay above average prices for smaller, DIY actions, such as CFLs and outlets, but less than the mean amount for upgrades.
[105] The mortgage payment increase is small and spread out over time, making it almost invisible compared to paying $5,000 out of pocket, and because people are more likely to act when purchasing a home.

3. Federal incentive packages for energy efficiency could alleviate much of the confusion and uncertainty barriers facing action today, including the following examples:

    a. Fanny Mae could back loans, including:
        i. Green mortgages that reduce loan points for a high HEScore, and
        ii. Home equity lines of credit for upgrades, where payments are automatically deducted from the utility bill from energy savings.

    b. A federal green automobile loan entity (as seamless interface to Fanny Mae) to provide low interest loans for efficient automobiles.

    c. Packages of the above incentives, in addition to other federal tax credits and rebates for efficiency.

4. Engaging the real estate market is key to building labeling implementation success. For instance, after purchasing a home, there is a delay where the house payment can overwhelm household budgets and/or people focus household budgets to aesthetic improvements. The DOE should consider a required national training program for real estate agents to enable speaking to clients buying and selling their home about the HEScore. The agent is better trained to speak the customer's language than most home inspectors and/or contractors. However, the real estate industry may not embrace this change. Therefore, a careful process of stakeholder engagement should be followed during incremental implantation.[106]

5. The DOE HEScore is a good first step, but the U.S. needs a widespread change in awareness, involving social normative actions away from building energy waste. Therefore, the DOE should increase the scope of the HEScore to include a national campaign directed at energy efficiency and upgrades in the home through many stakeholders. This campaign would include a comprehensive channel approach using policy, trusted local messengers, television, radio, newspaper, and social media. The key is to drive awareness, education, and acceptance as the right action: reducing energy waste.

    In fact, behavior change happens with repeated messaging from multiple trusted messengers to eventually shift normative beliefs and ensuing habits. But, it also needs to be easy for people to take part with limited barriers, whether they hire a contractor or DIY. The marketing message needs to prime people to complete numerous big energy efficiency actions in their home (*i.e.*, taking a systems view), one of two ways: over time, or all at once.

4.4.7 HEScore and market segmentation future research

The HEScore and N2N HES follow up customer surveys both have different primary functions than market segmentation (*e.g.* elicit WTP for upgrades and discover upgrade process improvements, respectively). However, the surveys provided a way to begin exploring N2N early adopter market segments. There are still many remaining questions requiring future study, including:

- While some tested indicators provided insight into customer preferences, the results only weakly supported the hypothesis that subjects with discretionary time and income are more likely to complete upgrades. Future research should further explore energy upgrade market segments, including the socio-economic, buy/sell mindset, energy use characteristics, energy labeling impact, *etc.*.

[106] My impression is that the DOE is, in fact, running numerous pilot programs and involving stakeholders in discussion during the pilot phase of HEScore.

- To encourage report engagement, the report format needs tailored per household based on a few key housing situation and characteristic questions to return a package of applicable actions with a packaged price and incentive deal. The costs should be packaged in a way that matches how that person thinks about the costs in the most positive way. Future research should develop an on-line DIY energy adviser tool,[107] as well as customizable, friendly reports for in-person sales-focused delivery.

- Survey evidence and N2N experience indicates that it may be best to market the following related to home sales (and always priming for upgrades):

    - Upgrades to the buyer prior to the home sale, and
    - HES marketed after the sale, if necessary.

Chapter 5 describes the N2N transition strategy.

[107] Note: Snugg Home developed the DIY Energy Adviser, also tailored for behavioral impact by the author (see http://diy.ctenergychallenge.com/). Unfortunately, sample sizes have been too small to generate insight.

Chapter 5 Transitioning Beyond N2N

Operating from July 2012 to the end of June 2013, Year 3 was a time of transition. The grant was written so that staffing resources focused on executing Years 1 and 2, decreasing significantly in Year 3 to begin transitioning communities to a non-N2N supported model. For instance, program management resources decreased by one-third, intensive marketing support ended, and outreach staff was decreased to about one-third of staffing levels to four Clean Water Fund (CWF) community organizers. Given lessons learned to date, the contractor liaison resources remained intact. In addition, Measurement and Verification (M&V) program resources increased to further inform the lessons learned and program outcomes, including forthcoming:

- Data and reporting clean up processes,
- Quantitative evaluations,
- Cost-effectiveness modeling, and
- Market segmentation research.

Outreach approaches followed a sequential process from Year 1 to Year 3. In Years 1 and 2 CWF organizers focused on building and managing coalition partners, community leaders, and town officials, and leading workshops and public presentations from the backseat with the trusted messengers front and center. Especially in Year 1 with a misaligned SCA management structure of the Corps, large portions of CWF staff time were spent managing the Corps' community outreach and lighting visit duties. A restructuring of the Corps' leadership and management approach enabled increased outreach effectiveness in Year 2. After restructuring the management in Year 2, the Corps began helping CWF manage volunteers. Finally, in Year 3, the Corps funding period ended and CWF began directly managing and transitioning N2N outreach to the core volunteers.

Part of the difficulty with achieving outreach momentum derived from the continuous flux of new outreach staff and organizers intended to diffuse N2N. For instance, both the Year 1 and Year 2 experienced uncertainty about the complex technical and process pieces of N2N. The Year 1 Corps expressed the most frustration because N2N was still developing scripts and clear processes, always in a state of process improvement. Year 2 staff struggled at the beginning, too, despite well-refined and organized training and protocol modules, and the availability of Year 1 program alumni that provided mentoring and on-the-job training. In fact, each new staff member or volunteer starts at the beginning. CWF provides hands-on training and support to bring each person to a comfort level for N2N outreach.

In addition, the N2N pilot has been a frustrating experience for the experienced CWF outreach team that is used to better performance outcomes (Stakeholder5,8). The largest frustration comes from feeding leads into a contractor network that does not understand the complexity of the sales process required to achieve completed HES assessments, let alone whole home performance upgrades and renewable generation (ibid.). Although the outreach team experienced two program high points (*e.g.,* after public launches around June 2011 and with the new Corps in fall 2012), the momentum didn't last due to a mild 2011 to 2012 winter season that made it harder to get customer attention, and the team's frustration with the flawed HES assessment gateway to upgrades.

Year 3 marketing and outreach is focused on promoting upgrades to hot leads, both on their own as well as through the Solarize CT efforts (described in the next section). Switching to solar and upgrades has helped keep the team together, but underlying frustration with contractor performance remains. For instance, by Year 3, N2N understood that the pilot would not meet the original grant application target goals, including lighting, HES assessments, upgrades, or clean energy. Previous discussed, several factors contributed to this, including three main ones:

- Delayed N2N startup during unexpected task of data platform development;
- DOE post-award emphasis on upgrades, shifting the N2N focus and resources; and
- Consistent HES assessment program failure to convert N2N leads to efficiency upgrades.

For Year 3 and like other *BetterBuildings* programs, N2N focused less on the original pilot goals and more on defining replicable and scalable go-forward models (Stakeholders1,5,8). Most importantly, it was apparent that N2N could bring residents into the pipeline, but that the HES program delivery system did not result in upgrade complete rates even close to industry achievable rates of 30 to 50 percent (Stakeholder8). The evaluation team began an extensive process of data clean up and organization, including working with the utilities, NREL, DOE, and NORC to ensure data quality, security, and readiness for forthcoming analyses.

Making it difficult to understand true program performance, N2N results experience three main system delays, where preliminary outcomes do not represent final pilot impacts, including:

1. Customers take time to make an upgrade(s),
2. Reporting takes several months to receive and process contractor and utility data, and
3. N2N began providing leads exclusively to upgrade pipelines in Year 3.

The last system delay occurs because N2N has shifted Year 3 resources from trying to drive upgrades through the HES assessment program, and began piloting strategies with potential for better upgrade complete rates, such as HPwES contractor partnerships, and other home performance and solar contractors. The partnerships have enabled specific technology-focused outreach with contractors offering, for example, ductless mini-split systems (*e.g.,* combination heat pumps and air conditioner) weatherization packages of air sealing and insulation, as well as solar photovoltaic (PV) systems.

N2N reports the following high-level findings that future program iterations should

- Rely on performance-based community-based social marketing and outreach incorporating rigorous campaign planning and goals.

- Promote comprehensive whole-home performance marketing and contractor approaches, *e.g.* under a "Better Together!" umbrella (*e.g.,* N2N Marketing Strategy), where lighter efficiency measures are promoted with deeper upgrades, or efficiency is promoted with solar generation;

- Provide implementation resources, such as best practice manuals, campaign toolkits, *etc.*., to enable partners to implement personalized program versions;

- Develop an Innovation Lab that aims for continuous improvement of program execution based on past program N2N lessons learned; and

- Achieve cost-effective implementation by developing a sophisticated program and contractor sales delivery technology infrastructure.

The next three sections describe the Year 3 N2N focus areas at a high level, including:

1. Transitioning from the HES assessment program,
2. Empowering communities and contractors, and
3. Sustaining the momentum post-N2N.

5.1 Focus on Upgrades and Solar Contractors

In Year 3, N2N focused on maintaining N2N contractor liaison resources and shifting projects to home performance contractors and solar photovoltaic (PV) jobs, launching the following outreach approaches, including:

- Running solar workshops with solar contractors across pilot towns, introducing energy efficiency into solar education materials;
- Promoting outreach resources to solar photovoltaic (PV) to reach a new segment of upgrade participants, pairing solar contractors with home performance contractors;
- Encouraging solar contractors to educate customers about combining energy efficiency with solar to decrease system sizes; and
- Testing targeted direct mailing campaigns supported with community outreach to oil, natural gas, and electric-heated homes focused both generally on home performance improvements as well as specific technologies such as ductless mini-split systems, as well as those eligible for participation in the HPwES program.

For example, N2N partnered with Solarize CT, a Clean Energy Finance and Investment Authority (CEFIA)-funded pilot program to increase solar PV diffusion and reduce customer acquisition costs. The pilot aggregates solar customers in a town to benefit from economies of scale, where prices decrease as participants increase in a tired pricing structure (Stakeholders5,8,10) (CEFIA, 2013a). Each town competitively selects one solar installer, thereby aggregating customers for the installer and providing better customer service for the participant (ibid.).[108] The program supports both leasing and purchasing options (ibid.), although the loan and lease options had low uptake for N2N participants (Stakeholder5).

The Solarize CT pilot design uses short program cycles to drive "bursts of solar installations in communities" (Stakeholder10). There were two program phases, where communities answer a Request for Information (RFI) to compete for incentives. Phase I lasted about 20 weeks, started September 2012 and ended mid-January 2013 (CEFIA, 2013a). N2N selecting four towns, including two N2N towns: Westport and Portland (ibid.). The N2N role was to:

- Coordinate N2N and Solarize CT efforts among N2N community partners,
- Support cross selling of HES assessments and upgrades, especially where households didn't qualify for solar, and
- Help with data collection and tracking.

Combined with the two other Phase I (non-N2N) towns (*i.e.,* Durham and Fairfield), Solarize CT achieved approximately 300 completed projects (CEFIA, 2013d). Phase 2 includes a partnership with two more N2N towns: Mansfield and Windham, and started after competitive selection of solar contractors

[108] Solarize CT is modeled after programs in Oregon and Massachusetts, and supported by the Massachusetts Clean Energy Center, the John Merck Fund, and SmartPower.

(CEFIA, 2013a). The first community workshop was held on March 11, 2013 with 150 attendees.[109] The Phase 1 results are shown in Table 28, Phase 2 results are not yet available.

Table 28 Phase 1 Solarize CT Program Results (March 8, 2013) (CEFIA, 2013c)

Solarize Community	**Durham**	**Fairfield**	**Portland**	**Westport**	**Total**
Installer	BeFree Solar	Astrum Solar	Real Goods Solar	Encon Solar	
Initial Interest Contacts	544	389	211	307	**1451**
Site Visits Scheduled	427	241	121	136	**925**
Site Visits Completed	431	232	116	129	**908**
Contracts Signed (Total)	117	76	45	58	**296**
Contracted Capacity (kW) (Total)	1012	614.7	328.6	382.1	**2337.5**
Contracts Signed/ Initial Interest Contacts	22%	20%	21%	19%	**20%**
Contracts Signed/ Site Visit Completed	27%	33%	39%	45%	**33%**
Site Visits Scheduled/ Initial Interest	78%	62%	57%	44%	**64%**
Average System Size	8.65	8.09	7.30	6.59	**7.90**

In 20 weeks, the Phase 1 of Solarize CT almost tripled solar PV installations in the four towns over the last eight years of capacity, adding 2.2 MW of new (CEFIA, 2013c). All towns hit Tier 5 pricing (*i.e.,* the lowest aggregate price) with a cumulative savings of over $2.2 million (ibid.). In addition, the program experienced significantly lower all-in customer acquisition costs of about $135/kW compared to industry average of $670/kW (per DOE analysis) and local installers' estimates between $250 and $500/kW (ibid.). Consistent with N2N research, financial benefits (*e.g.,* discount pricing and lower monthly energy bills) and financial barriers (*e.g.,* high out of pocket costs) both impact solar PV complete rates (ibid.). This finding supports N2N's finding for the need for financing products to increase complete rates (ibid.).

Learning from N2N outreach, including early lessons from N2N's round 1 Solarize CT experience, in winter 2013, N2N developed messaging directed at combined energy efficiency and solar upgrades, including Better Together! customer value propositions:

1. Break free, self reliance, self sufficiency, a message about reducing reliance on the utility, and achieving U.S. energy independence;

2. Optimize your household, a message about running the house like a tight ship, based on pride; and

3. Take responsibility, a message about doing the right thing, accomplishing more together.

In solar marketed towns, N2N cross-sells participants to upgrades in two cases, where:

1. The home is inefficient, where solar can create a sense of ownership (and awareness) of a household's energy use from generating and tracking the electricity, and

[109] See http://solarizect.com/our-towns/solarize-mansfieldwindham/.

2. The household doesn't qualify for solar.

For customers that don't qualify for solar,[110] the marketing includes priming the customer for energy efficiency. The contractor team has responsibility for delivering the N2N message: "Let's still complete Energy Efficiency!" (Stakeholders1,8) by recommending upgrade packages, such as: insulation and air sealing, or insulation and equipment upgrades. For customers that have completed a HES assessment, the N2N team also uses behavioral language, such as "don't let your HES investment go to waste" and suggesting upgrade packages of HES plus different upgrades (Stakeholder1).

In addition to working with new solar companies, Section 5.1 previously discussed N2N's shift to work with vertically integrated home performance contractors that complete assessments and whole home climate control solutions, including: ductless mini-splits, windows, weatherization, insulation, and solar services. N2N also selected three of the 11 N2N HES assessment contractors to which to continue providing prioritized leads starting in January 2013. The shift is providing N2N the opportunity to work with a smaller set of contractors, including those most focused on responsiveness to delivered leads, maximizing MMBtus saved, and achieving upgrades.

5.2 Empowering Communities to Take Over

Year 3 outreach focused on exciting communities to execute N2N after the grant funding ends. The team began the process of shifting outreach responsibilities and best practices to volunteers and task force members in continuing communities. In early May 2012 (during Year 2), the team began developing the N2N transition plan. The idea was to use town performance, along with N2N's deep experience working with the contractors and town leadership to assess the probability of sustaining N2N, or pieces of N2N.

N2N divided the 14 N2N towns into four brackets based on the town's ability to independently support N2N. Shown in Table 29, these four brackets were eventually collapsed into active (*i.e.,* top half) and non-active (*i.e.,* bottom half) towns for the first quarter of 2013. Table 29 illustrates an outreach planning tool used to track and improve lead generation. It includes goals and outcomes for HES assessment and solar PV sign ups and completes. The snapshot shows more success meeting upgrade and solar PV goals than HES assessment goals. In addition, substantial spillover is observed (*i.e.,* bottom half), where towns not receiving active outreach support still show program momentum, especially in non-N2N towns.

The first bracket included towns that had shown substantial N2N activity. N2N defined the transition path over several months, including providing resources such as a tool kit of planning materials, as well as handbooks of best practices.[111] The second bracket included towns that showed promise, but needed more N2N support to succeed than the first bracket towns did. The N2N team immediately began providing support to bring them up to bracket one's readiness levels.

[110] Approximately 85 percent of CT homes don't qualify for cost-effective solar PV due to tree cover (Stakeholder10).

[111] Note that CWF has produced 18 best practice guides for the following types of partnerships, including: business, coalition partners, earned media, education, faith, lighting, seniors, social media, social services, tabling, testimonial, canvass, volunteer, workshop, campaign planning, presentations, realtor, and town.

Table 29 N2N 2013 Quarter 1 Goals and Accomplishments (April 4, 2013 Snap Shot)

Weeks in Quarter	Weeks Completed	% Weeks Completed
18	18	100%

Last Updated
4/3/13

Active Outreach	HES Sign Ups Goal	HES Sign Ups To Date	HES Sign Ups % to Goal	2012 Q4 HES signup	HES Completes	EE Upgrade Interest Goal	EE Upgrade Interest To Date	EE Upgrade Interest % to Goal	Completed Upgrades	Solar Completes
Lebanon	60	31	52%	50	3	15	9	60%	0	0
Mansfield	60	46	77%	10	22	20	13	65%	1	0
Portland	45	20	44%	45	23	20	16	80%	1	11
Ridgefield	105	61	58%	82	44	40	43	108%	7	0
Westport	50	32	64%	32	26	50	23	46%	9	14
Wethersfield	110	162	147%	78	88	15	72	480%	5	1
Wilton	127	45	35%	123	42	40	41	103%	4	0%
Windham	60	33	55%	40	5	20	11	55%	1	0%
Subtotal	**617**	**430**	**70%**	**460**	**253**	**220**	**228**	**104%**	**28**	**26**

Non-Active Outreach	HES Sign Ups Goal	HES Sign Ups To Date	HES Sign Ups % to Goal	2012 Q4 HES signup	HES Completes	EE Upgrade Interest Goal	EE Upgrade Interest To Date	EE Upgrade Interest % to Goal	Completed Upgrades	Solar Completes
Non-N2N town Spillover		62		51	37		23		0	0
Bethany	10	10	100%	8	2		2			1
Cheshire		10		5	5		5		1	1
East Haddam		3		4	1		3			0
East Hampton		1		2			3		2	0
Glastonbury		9		9	10		4			0
Weston		3		11	2		3		1	0
Subtotal	**10**	**98**	**980%**	**90**	**57**		**43**		**4**	**2**
TOTALS	**627**	**528**	**74%**	**550**	**310**	**220**	**271**	**113%**	**32**	**28**

Table 30 Upgrade and Solar PV N2N Summary Dashboard (through 3/31/13)

UPGRADES	TOTAL 2010	TOTAL 2011	TOTAL 2012	JAN 2013	FEB 2013	MAR 2013	Q1 2013	PROGRAM TO DATE
Post-HES bids delivered	10	317	350	23	19	33	75	**752**
Bid rate	45%	28%	23%	23%	24%	37%	28%	**26%**
Upgrades completed	3	95	117	8	13	9	30	**245**
Quarterly upgrade rate by % of HES	14%	8%	8%	8%	16%	11%		
Cum. upgrade rate by % of HES	14%	8%	8%	8%	8%	8%		**8%**
Cum. upgrade rate by % of bids	30%	30%	32%	32%	33%	33%		**33%**
Audit reports received	3	81	100	7	9	8	24	**208**
Cum. audit reports rec'd rate	100%	86%	86%	86%	85%	85%		**85%**
# of upgrades financed	0	1	16	4	1	0	5	**22**
% of upgrades financed	0%	1%	14%	50%	8%	0%		**9%**
% of upgrades heat w/ oil/prop.	100%	79%	91%	88%	85%	67%		**85%**
% of upgrades heat w/ elect/gas	0%	21%	9%	13%	15%	33%		**13%**
Total $ amt. of upgrades	$6,505	$455,528	$498,057	$25,878	$41,685	$22,574		**$1,050,227**
Avg. $ amt. of upgrade	$2,168	$4,795	$4,257	$3,235	$3,474	$2,508		**$4,304**
RENEWABLES								
Solar Thermal								
Sign-ups	N/A	N/A	22	0	2	8	10	**32**
Contracts signed	N/A	N/A	4	0	0	0	0	**4**
Contract sign rate (cum.)			18%	18%	17%	15%		**13%**
Installs	0	0	3	0	1	0	1	**4**
Complete rate (cum.)			14%	14%	15%	13%		**13%**
Solar PV								
Solar PV sign-ups	N/A	N/A	418	10	83	148	241	**659**
Solar PV contracts signed	N/A	N/A	53	15	0	4	19	**72**
Solar PV sign rate (cum.)			13%	14%	13%	12%		**11%**
Solar PV installs	0	1	18	11	20	11	42	**61**
Solar PV complete rate (cum.)			4%	6%	7%	7%		**9%**

The third bracket was more challenging, consisting of towns "on the fence" (Stakeholder8). This group received a presentation, including what N2N and the town had accomplished, best practices, the challenges, what other communities are doing, and clear expectations and goal time frames. In addition, N2N planned the town's path forward with goals and decision time points, enabling N2N to cut support when it wasn't working out (*e.g.,* avoiding the trap of sunk costs). These last chance meetings focused on the town energy task forces, and asked the stakeholders difficult questions about proceeding or not.[112]

The fourth bracket recognized that some towns didn't have the leadership, resources, or interest necessary to operate N2N. These towns received a report out of what had been done, including the town's N2N journey and the broader N2N program, town accomplishments, and the opportunity to continue participation in the CT Clean Energy Communities (CCEC) program. N2N evaluators planned to later analyze active and non-active N2N outreach towns to measure what extent the social network continues to propagate N2N (*e.g.,* through word of mouth). On September 5, 2012, N2N held a Celebration Picnic, recognizing the success of Years 1 and 2 and thanking the Corps for their service. It became the official divide of towns into active and non-active towns. Then, N2N drafted campaign plans for the remaining active towns through February 2013, slowly transitioning monthly strategy meetings to N2N town volunteers and coalition partners.

Table 30 is the N2N program summary dashboard for upgrade and Solar PV projects through March 31, 2013. As N2N transitions to focusing on upgrades and solar projects, the results are beginning to show program improvements for upgrades, solar thermal, and solar PV completions, where 2013 upgrade rates have increased to over 11 percent from eight percent cumulative program average. In addition, solar PV contracts show significant growth from nothing at program start to 72 signed contracts in Year 3. A disappointing result for the N2N team, bid rates have not improved over the pilot lifetime.

Table 31 is the N2N program summary dashboard for HES assessment projects through March 31, 2013. As N2N focuses on four vertically integrated contractor partners (*i.e.,* performance beyond HES assessment core services), HES completion rates show improvement in Year 3, increasing from 61 percent cumulative program average through Year 2 to 64 percent in Year 3. As data continues to roll in, Year 3 rates are showing further improvement. Unfortunately, HES-IE (*i.e.,* income eligible program) results continue to hold steady at 23 percent.

[112] The good news for N2N was that no matter the outcome, the town was still participating in the Connecticut Clean Energy Communities program funded by CEFIA and the Connecticut Energy Efficiency Fund (i.e., the ratepayer fund). The program provides "qualified towns and cities with performance-based incentives that include clean energy systems and 'Bright Idea Grants' that can be used for energy-saving projects" (CEFIA, 2013b).

Table 31 HES Assessment N2N Summary Dashboard (through 3/31/13)

	TOTAL 2010	TOTAL 2011	TOTAL 2012	Q1 2013	PROGRAM TO DATE
HES					
HES signups	62	2194	2109	417	**4782**
HES visits completed	22	1147	1493	266	**2928**
HES complete rate (of leads received in month or quarter)	35%	61%	64%	64%	
Cumulative HES complete rate (from Oct 2010 to current month)	35%	52%	61%	61%	**61%**
Field Service Tools (FST)	19	1012	1430	236	**2697**
FST received rate (cum.)	86%	88%	92%	92%	**92%**
HES IE (Income Eligible)					
HES IE signups	0	215	188	31	**434**
HES IE visits completed	0	37	57	7	**101**
HES IE complete rate (cum.)		17%	23%	23%	**23%**
HES IE upgrades completed	0	4	16	3	**23**
HES IE upgrade rate (cum.)		2%	21%	23%	**23%**
RELEASE FORMS SIGNED					
HES, HES IE, & Lighting	16	1170	1533	221	**2940**

5.3 Sustaining the Momentum: The N2N Innovation Lab

Still, N2N has much work to do to sustain the program momentum, as well as make sure the Federal investment into the CT efficiency market continues past the N2N grant. The focus of state policy makers is to evolve the residential energy efficiency programs to result in deeper residential energy efficiency savings. N2N's program model is aligned with these goals and through the Federal investment has developed unique assets in its technology platform and campaign methodology and tools to support that. In fact, N2N is currently designing the next iteration of N2N that the team calls the N2N Innovation Lab. N2N has called it the Innovation Lab because the program design allows for:

1. Quick testing of approaches focused on solving specific customer adoption/market segment challenges;

2. Integration of a portfolio of energy efficiency and renewable energy offerings, and

3. A process of continuous improvement not possible within the larger utility-administered programs.

Because residential energy efficiency programs can be expensive to implement within a regulatory framework, the N2N Innovation Lab aims to demonstrate the conditions under which performance-based community-based program models can deliver more impact per dollar spent than traditional program marketing, particularly when coupled with a Lifetime Customer Value (LCV) approach (see Appendix

D). In fact, the N2N team is in the process of building out a customer acquisition cost model and LCV analysis, undertaking this from both a regulatory lens, as well as from the stand-alone business lens. The regulatory lens is to provide a comparison of a community-based program with other regulated program models.[113] The business lens is to develop a portfolio of cost-effective strategies for future implementation, including understanding how different funding approaches, such as contractor fees, referral fees, loan origination fees, sponsorships, *etc.*., would contribute to revenue.

The information gathered by the N2N team and supported by the N2N platform enables ongoing improvements as detailed in this document by:

- Improving stakeholder communication;

- Creating more informed and integrated relationships between marketing efforts and program implementation, as well as between the program and critical trade allies; and

- Instigating program evolution and market transformation in the broader statewide program, such as described in Section 5.4.4.1 on market innovation findings.

In fact, the biggest accomplishment of N2N may be innovating strategies that are then adopted or adapted by the ratepayer-funded residential efficiency program or participating contractors. The N2N Innovation Lab provides an opportunity to incorporate the key N2N lessons learned that are discussed next.

5.4 N2N Lessons Learned

The N2N program design post-grant reflects the needs of three separate interests, including the:

- DOE grant and program requirements,
- Existing CT regulatory environment, and
- Evolving N2N program objectives.

N2N design is based on both the N2N lessons learned and the analysis of progress towards the original program goals, including:

1. Using community-based and behaviorally-focused outreach strategies should increase demand and cost-effectiveness for residential energy efficiency home performance upgrades;

2. Marketing HES assessment (HES) assessments as a first step should lead people to make deeper home energy improvements; and

3. Investing in state of the art data systems should improve community based program results.

While the analysis is not complete with this document, the following findings about the above three hypotheses hold that:

1. N2N is optimistic that community-based programs can be operated using performance-based approaches. The forthcoming quantitative analysis will build upon this document and end of program data, attempting to prove this hypothesis and the conditions under which it is best employed, including the program cost structure and the following elements of the cost structure:

[113] Several utility cost-effectiveness tests will be compared, such as Total Resource Cost and Societal Cost Benefit tests, where non-energy benefits and costs are included (*e.g.,* avoided greenhouse gas emissions, health, etc.).

a. Leads generated;
b. Upgrade conversion rate; and
c. Energy and cost savings.

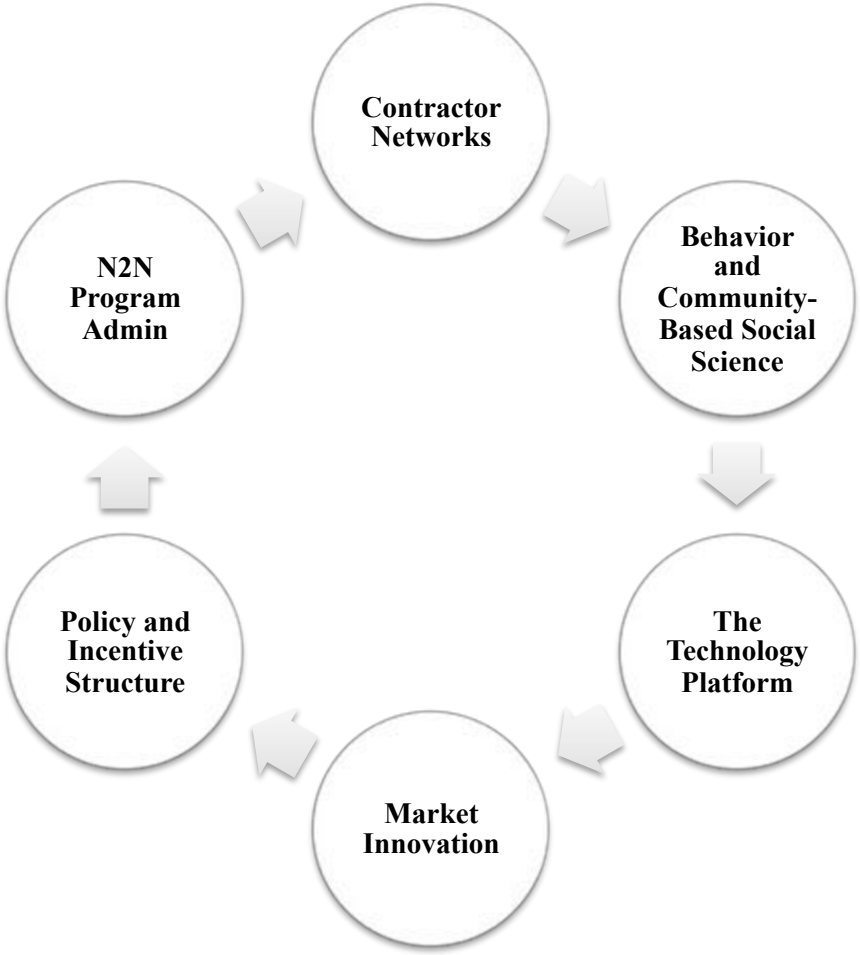
2. The current contractor compensation incentives favor contractors that operate in a HES core services business model, leaving N2N leads unlikely to complete energy upgrades. While utility program administrators are moving contractor compensation towards deeper upgrades, N2N has not yet seen that translate into a high enough conversation rates to rely solely on HES contractors. In fact, N2N is now focused on expanding outside of the HES program to diffuse energy upgrades.

3. Third, robust data collection and analysis supported through innovative technology has enabled real-time program administration and a variety of research and evaluation initiatives, ultimately contributing to market transformation.

N2N believes that the next iteration of the Innovation Lab can be applied in CT and beyond, and includes the following six major categories of lessons learned for achieving wider penetration of deeper household energy savings (Figure 15):

1. Contractor Networks,
2. Behavior and Community-Based Social Science,
3. The Technology Platform,
4. Market Innovation,
5. Policy and Innovation Structure, and
6. N2N Program Administration.

Figure 15 Six Areas of N2N Lessons Learned



Section 1.1.5 contains the N2N high-level key recommendations and the next six sections describe each topic in more detail. Importantly, the six areas interact. Implementing any one set of recommendations alone will not be enough to drive diffusion of whole-home performance upgrades. For instance, while N2N finds the sales delivery infrastructure is necessary to support upgrade conversions, the lead quality developed through behavioral methods impacts the contractor's ability to convert that lead. In addition, the policy and incentive structure impacts the contractor's ability to deliver sales, as well as the customer's motivation to purchase upgrades, and so on, where each system affects the other five systems.

First and foremost, N2N believes that the program and contractor sales delivery technology infrastructure is critical for both achieving upgrade conversions and delivering a cost-effective program. For instance, a sophisticated Customer Relationship Management (CRM) toolset promotes cost-effective program delivery by:

- Keeping track of where a customer sits in the pipeline,
- Enabling multiple customer sales touch points targeted at the next action;
- Spreading the costs of acquiring a customer across a lifetime of customer energy savings actions; and
- Supporting program lessons learned across lessons learned topics.

5.4.1 The contractor market

A well-developed contractor network is the most important factor for achieving:

1. higher upgrade pull-through rates (*e.g.*, completed upgrades), and
2. cost-effective program operations.

Dominating other factors, like behavioral interventions, program administration, outreach approaches, *etc.*, N2N data repeatedly tells the same story that:

> The utility-administered, pre-approved HES assessment contractor network was not prepared to handle the customer sales processes necessary to drive upgrades.

Unfortunately, prior to starting the pilot, the N2N team did not understand the contractor challenges of managing the customer pipeline in CT. However, by early 2012, N2N realized the grant goal to convert 25 percent of HES assessments to upgrades was unachievable for the following contractor barriers:

1. N2N does not manage the contractor network;

2. The N2N market of 97,000 households is too small to require drastically higher performance standards to 13 of 26 contractors under current administration;

3. Driven by current contractor and customer incentives, most HES program savings come from core weatherization services delivered on a first visit.

At the same time, the contractors are willing, active, and collegial partners, eager to share or learn best practices, N2N research, and other DOE grantees findings. The contractors support N2N's model of transparency and data sharing of performance metrics. Contractors embraced weekly discussions of the customer pipeline, where one-on-one meetings were used to analyze contractor trend data and develop plans for increasing customer upgrades. The N2N approach of close support and oversight is valuable to the contractors, evidenced by the almost half/half split of N2N and contractor lead generation.

In fact, there have been positive changes in the HES contractor network and upgrade follow up processes, achieving:

- A substantial increase the rate of completed Field Service Tools (FSTs) that track data about the energy audit and/or the upgrade.[114]

- Ninety five percent signed release forms by N2N participants, showing that customer releases are not a barrier to participation.

- The first quarter of 2013 upgrade rates in N2N towns have increased to 11.3 percent from 7 percent program average (*i.e.,* of completed HES assessments).[115]

[114] Note that while N2N has seen some improvement in the data quality of the FST, the tool itself is inadequate for driving customer decisions to complete upgrades and for tracking lifetime savings data.

[115] Upgrades include measures such as insulation and HVAC systems but not appliances, windows, or lighting (as compared to NU 10 percent upgrade rates (Feasy, 2013)). The upgrade percentage does not take into account whether the residence had an opportunity, because N2N believes most homes do have an opportunity. Still, the upgrade numbers are very low when compared with top N2N grantees achieving 30 to 50 percent upgrade rates. utility programs achieving 10 percent (Feasy, 2013). Seven percent upgrade conversions is within the bottom quartile of DOE grantee results.

In addition, the N2N contractors have learned the benefits of closely tracking customers to enable a long-term customer relationship. After a steep learning curve, both N2N and the N2N contractor network are using the Salesforce.com (the CRM), the N2N contractor scorecards, and the customer pipeline tools to increase upgrade performance.

Over the course of the grant, there have been positive changes by the ratepayer fund in HES assessment program design. For instance, in 2012 the ratepayer fund changed three HES assessment criteria:

1. 20 percent higher average savings per household requirements,
2. 10 percent of HES assessments required to save 25 percent or more per household, and
3. Increased opportunity for socket change outs from 25 to 40 Compact Fluorescent Light bulbs (CFLs).[116]

The ratepayer fund also approved Home Performance with Energy Star (HPwES), launched by the utility administrators in April 2012 to provide a market for hundreds of CT contractors locked out of HES program dollars, although this program has not yet seen significant contractor or customer participation.[117]

5.4.1.1 CT contractor market findings

The bullets below contain N2N findings about the HES core services program design from three primary areas: contractor skills, low public awareness, and program design/administration approaches.

- While potentially effective at achieving its program goals to reach a broad audience with 10 to 15 percent energy savings, the HES assessment program design during the grant period has been an ineffective approach for driving demand for upgrades into households and across communities.

- The CT home performance industry lacks economies of scale for home performance work.[118]

    - Substantial grant resources were devoted to the contractor customer pipeline, as well as to guiding contractor focus on upgrades.

    - Contractors benefited from the N2N contractor liaisons and other program staff providing small business support and development assistance, such as sales training, sales process development, data management, and customer pipeline analyses skills.

- A large gap between performance-based (*e.g.,* cost-effective) customer follow up procedures and actual contractor follow up exists. For instance, customers receive inadequate feedback (*e.g.,* handholding) throughout the confusing upgrade and customer incentive process.[119]

[116] Unfortunately, the first and second criteria were not quickly enforced, nor backed up with published contractor performance data like N2N provides.
[117] In the HES program, only 26 contractors each year are selected to gain access to contractor reimbursement, as well as customer rebates and financing. NU recently announced the 2013 round of HES vendors. N2N has worked with about half of the vendors.
[118] Current contractors tend to be smaller, independent operations with limited back office, operations technology, or marketing capabilities to sell upgrades.
[119] For the first time, HES contractors received leads that didn't have a pre-identified problem that needed fixed immediately. Instead, N2N participants join a community-wide movement of sorts, without the pre-awareness of a strong need for a contractor (for example to solve drafty rooms, ice dams, broken HVAC, etc.). That is, N2N leads required more attention than HES contractors were used to providing.

- There are low public levels of awareness about the home performance industry, and high levels of uncertainty about which contractors to trust for quality assessment and upgrade work.[120]

- The HES program has not focused the same level of program administrator oversight or quality control of the upgrade process after delivery of HES assessment core services, resulting in highly uneven customer experiences. Areas of opportunity for additional program focus include:

    - Customer feedback oversight of upgrade recommendations and bids, [121]

    - More data transparency on the quality of upgrades being performed in the program; and

    - Upgrade-focused marketing materials that include guidance from behavioral marketers, and support for more frequent updating, as well as social and earned media support.

- Although it is too early to know, the current HPwES program design is unlikely to drive whole home performance upgrades, or wider upgrade and clean energy penetration. For instance:

    - While HPwES opens access to rebates and financing to a wider contractor network, N2N and the utilities have found it difficult to recruit contractors into the program and have seen extremely low customer participation.[122]

    - Community-based programs are disadvantaged because HPwES doesn't include program marketing dollars, therefore, missing an opportunity to build brand awareness, branded collateral, community partnerships,[123] or any of the necessary sales tools.

5.4.2 CT contractor market recommendations

Standing up the contractor market of the future starts with ensuring participating contractors have a whole home performance orientation and well defined sales process as a condition to participate in the program. It also involves investments in marketing tools to support contractors. In addition, the customer needs information to better select a contractor. For instance, CT should ensure robust quality control on upgrades through published scorecard data and customer reviews, which will allow market forces to weed out poor performing contractors and support well performing contractors. Program administrators should continue to monitor and remove contractors that do not meet performance standards.

The bullets below provide recommendations to help CT achieve a contractor network with the core business to drive whole home energy performance, where CT needs to do the following:

[120] The mistrust arises partially from large fluxes in contractor staffing levels driven by policy uncertainty, leaving an impression of fly by night operations (which is not warranted, but is still a perception encountered). In addition, outside of HES, many companies sell single products, for instance HVAC only, versus solutions to whole home problems, such as air sealing, insulation, and HVAC.

[121] N2N found that basic program requirements, such as filling out the ineffective Field Service Tool (FST) (formerly the Home Energy Yardstick (HEY tool)), weren't being well managed.

[122] Without contractor reimbursement for the assessment itself, HPwES contractors may not be able to fairly compete with HES contractors. For instance, the HPwES contractor has to decide whether to complete the assessment and paperwork: 1) as a loss leader to acquire an upgrade customer, or 2) by charging the customer. Neither option is as financially attractive as the HES incentives.

[123] For instance, HES contractors and community groups use the HES assessment reimbursement to acquire leads together. The partnership is win-win, providing previously untapped leads for the contractor, as well as fundraising for the community group.

- Provide reimbursement incentives geared towards deeper savings, oversight, sales skills and sales process training, working capital loans, and small business development support, including on-going support for the enabling technology and customer relationship management (CRM) database (also see Technology Platform and Policy and Incentive Structure discussions below).

- To take a flexible approach where HES assessment core services are the first in-home visit of many customer touch points on the ladder to deep household energy savings. There must be an ongoing sales, cross-sell, and upsell processes that moves people to more and more energy savings and renewable energy actions.

- Conduct further study about how the HES and HPwES programs co-exist and to design a holistic programmatic approach. For example, N2N plans future research about promising market segmentation that would enable target marketing to reach:

    1. HPwES for customers ready to implement upgrades; or

    2. HES marketing to customers unlikely to complete upgrades, not psychologically primed for upgrades, or that would prefer Do-It-Yourself (DIY)) upgrades.

- A portfolio approach to home performance, where the HES and HPwES programs do not compete.
    - Contractors should be encouraged to get creative to cross and up sell between programs and partners.
    - State program marketing approaches need updating, with HES, new HPwES, and other third-party marketing dollars distributed to enable co-branded town, contractor, and third-party marketing efforts.

5.4.2 Behavioral science and community-based social marketing

A program approach that embraces community-based social marketing and behavior change science is more likely to achieve deeper household savings and broader community penetration than current CT programs. N2N has focused on reaching people outside of the traditional HES assessment marketing channels that are primarily focused on fixing household problems as needed. In fact, N2N meets people where they are already going at local community events and meetings, and leverages participants' existing social networks to further diffuse participation.

N2N has achieved 137 signed community partnerships with local organizations, including:

- community groups,
- town governments,
- libraries,
- faith communities,
- education and schools,
- real estate industry, and
- businesses.

N2N tested three rewards programs, where:

1. Towns competed for points to select rewards from a catalog of energy efficient prizes;

2. Local organizations, called community partners, received $25 per completed HES visit; and

3. Community group programs, testing two iterations, including

    a. Year 1, where the top three community groups in each community won a prize, and the overall winner won the grand prize; and
    b. Year 2, where community groups received a set dollar amount for each upgrade.

For the first type, town rewards, preliminary findings suggest that the prizes did not motivate towns by themselves, but that the leaderboard that showed each town's position relative to other N2N towns was motivating.[124] For community partner rewards, experience finds they were compelling as fundraisers for local organizations that have enough social capital to convince members to complete HES or an upgrade. The first year's program design was too complicated, but Year 2 shows promise as N2N is beginning to see increasing upgrade rates. The Year 2 program is similar to solar PV contractor and community group partnerships, where community groups are paid for their leads.

Partnered with a local organization, N2N community outreach includes a trusted messenger/local leader at every event, including the following:

- co-convening workshops with local organizations,
- holding tabling events,
- canvassing neighborhoods,
- following up through call nights, and
- meeting at the neighbor's home through open houses and house meetings.

Several N2N outreach strategies have resulted in promising conversion rates, including:

- Contractor partner[125],
- Community partner,
- Town-endorsed sign ups (*e.g.,* town website promotion, permanent displays, *etc.*.),
- Earned media,
- Referrals (*e.g.,* word of mouth and community partnerships),
- Targeted workshops, and
- Web sign ups (*e.g.,* a culmination of the other outreach and marketing efforts in this list).

While showing promise for sourcing leads through many organizations and strategies, N2N also ran into program structure barriers, such as:

- A lack of funding and policy support for co-branding and creating new marketing and outreach materials.
- A difficult low-income customer approval and delivery program processes, including:

    - lengthy HES-IE (Income Eligible) application processes and upgrade approvals, and
    - structural barriers of customer mistrust, difficulty missing work, and lack of awareness and education about energy efficiency.

[124] For instance, the leaderboard was often the topic of conversation at town task force meetings.
[125] Note that contractor partners don't always report lost leads for their own generated leads (unless the project was lost after entering it into Salesforce.com). In addition, contractor generated leads often derive from word of mouth participation through another N2N participant, or from fixing already identified home problems.

Combining individual and social behavioral science helps develop brand promise and trust. Two keys to long-term program sustainability and lifetime household participation are providing:

- a simplified process (*i.e.,* motive and enable), and
- a quality lifetime customer experience (*i.e.,* continuously engage).[126]

5.4.2.1 Behavior and community findings

N2N employs a portfolio strategy, where the following bullet points describe the behavioral and community-based outreach program findings:

- Customers are at different points of readiness for different energy savings actions; therefore, taking a one-size fits all approach will not capture a broad enough market of participants. N2N finds that a multi-channel, multi-touch strategy is required to gain the trust of and brand recognition with customers, both necessary to drive continued demand.

- Several concurrent community-based campaign approaches of limited duration can be run to increase effectiveness (*i.e.,* the team is spreading through the community's network in a spider web-like pattern). The following factors support more successful campaigns:

    - Set specific goals,
    - Give feedback,
    - Engage with social strategies,
    - Activate with behavioral marketing,
    - Evaluate with continuous analysis, and
    - Correct with near real-time adaptations.

- For instance, effective social strategies encourage participants to engage others, such as:

    1. Using trusted messengers that cross a wide social network;

    2. Driving word of mouth (*e.g.,* a person tells a family member, friend, or neighbor);

    3. Using testimonials (*e.g.,* in-person testimonials during meetings, written trusted messenger testimonials in communications and marketing materials); and

    4. Creating friendly competitions and rewards within communities and across borders.

- In addition, effective behavioral marketing messages tell the right stories in the right way, by:

    1. Priming people immediately to the final outcome of deeper upgrades;

    2. Driving scarcity and urgency (*e.g.,* limited-time, limited number, or pre-qualified rebates; seasonal marketing opportunities)

    3. Providing target marketing to market segments to focus on the benefits that matter, (*e.g.,* increasing personal comfort, fixing a house problem, reducing energy waste and energy bills, achieving energy independence, or helping others, the community, or the

[126] Achieved partly because N2N is administered by a third-party, trusted source (*i.e.,* through people's trusted messengers), and partly because N2N reduces the hassle-factor by operating seamlessly across several independently-administered state programs.

environment)[127];

4. Handling uncertainties by promoting trust and making it easy (*e.g.,* compiling program components for the customer; providing high quality, pre-approved, vetted upgrade contractors).

- There are several promising and scalable community/social structure characteristics, including:
    - Strong and active municipal leadership;
    - Solid municipal support for reducing energy waste;
    - A base of core volunteers with broad and also non-overlapping social circles; and
    - Existing town activities, gathering places, and community groups where people get together and exchange ideas.
- Self-identified, or passive, sign up approaches are a growing and promising lead generator,[128] such as:
    - Word of mouth and refer a friend;
    - Earned media, and
    - Town-endorsed passive displays.
- Campaign outreach strategies require using rigorous data driven approaches to enable regular shifting and reallocation of resources to strategies that are working, and away from strategies that have run their course or weren't working in the first place.[129]

5.4.2.2 Behavior and community recommendations

The bullets below provide recommendations to help CT achieve a broad base of participants willing to make whole-home energy performance upgrades, with the following guidelines:

- Approaching program marketing and outreach using individual behavioral science and community and social networking theories is critical for finding and targeting a broader audience to complete deeper measures. The recommended approach involves changing the household behaviors, as well as the social fabrics of CT communities (*e.g.,* culture, social norms, and attitudes) surrounding energy waste and energy efficiency, including:
    - Using behavioral science should attract people's attention and promote action based on the N2N message of whole home energy performance; and
    - Using social psychology should develop program momentum, where social networks continuously drive demand for home performance.

[127] Early participant profiles indicate that upgrade customers are often educated, dual income couples aged 45 to 65 years with above median income, living in older homes. Note that this profile did not emerge from the data in Chapter 4, but future N2N market segmentation research will analyze N2N customer profiles.
[128] While these customers signed up passively, it may be that they had heard about or seen N2N previously.
[129] N2N operated in a pilot and learning environment, testing and piloting numerous approaches, but not always optimizing for cost-effectiveness.

- N2N recommends a portfolio approach that maps outreach strategies and marketing channels to each targeted social group. This provides different ways for people to take action depending on their personal situation, such as:

    - Some would attend an ice dam workshop at a library with an immediate problem, while

    - Others may see N2N at a festival table, signing up for a newsletter, lighting visit, HES assessment, or upgrade action, and

    - Others could read about N2N in the local newspaper, see it on Facebook, or hear about it from a trusted messenger and take action.

- Specifically, N2N recommends further building out several approaches to increase program cost-effectiveness through higher HES assessment and upgrade complete rates, such as:

    1. Co-branding and outsourcing email communications to Towns, community, and contractor partners to further tap into existing trusted outreach communication resources like leading community group and Town web pages, the CT state events calendar, other mailing lists, *etc.*. ultimately creating coordinated databases and email blast functionalities;

    2. Expanding on the multi-touch strategy by integrating community-based outreach with sophisticated on-line campaign strategies on Facebook, YouTube, *etc.*.

    3. Combining creative outreach strategies with in-depth market intelligence to support broader market penetration in a cost-effective way[130]; and

    4. Setting up a State of CT stakeholder group set up to reimagine the residential energy programs to support community-based outreach. CT needs a coordinated, customer-focused program delivery model.[131]

- The customer relationship data management (CRM) platform should track all participants (including those that drop out) to later re-engage in additional actions. This lifetime customer, or business portfolio, approach enables continuous upselling, cross selling, and engaging of the participant and their social networks.

5.4.3 The N2N technology platform

N2N did not expect the time-consuming task of building out the N2N data platform at grant application.[132] Instead, N2N spent approximately 50 percent of pilot administration and evaluation staff resources designing the technology platform for the first eight months, including:

1. Defining and releasing the Request for Proposals (RFP) to select a technology platform provider;
2. Building the data platform backbone, and
3. Iteratively releasing and deploying the platform.

The N2N platform addresses the feedback needs of three stakeholders of pilot implementation: the

[130] Note that N2N has forthcoming research to collect and analyze CT market segmentation data.
[131] The N2N Innovation Lab would provide a continuous testing environment to test and optimize stakeholder recommendations.
[132] DOE post-grant award data requirements required a new approach.

program, public, and customer. For example, for program-facing implementation, the N2N platform supports N2N data collection efforts, where N2N enters leads using two types of entry:

1. In-field paper worksheets, spreadsheets, and web forms,
2. Computer software applications like the N2N LightSaver App, N2N Event App, and Snugg Home SnuggPro contractor tool. [133]

For the public-facing implementation, the N2N platform enables data transparency, promoting market innovation to both N2N participants and N2N partners, including contractors, CEEF, CEFIA, and the utilities, as well as to state policymakers and regulators (See next section on market innovation).

Although N2N considers the consumer-facing toolset an essential element of any community-based program, it turned out to be harder than expected to build, deploy, and drive participation. For instance, N2N faced a trade-off between off-the-shelf and customized products (*e.g.,* between implementation timelines and system upgrades vs. branded tools). In addition, due to limited resources, N2N only scratched the surface of beta testing pieces of the optimum consumer-facing tools, which could include feedback, such as:

- A Personal Energy Dashboard, allowing customers to set goals and receive feedback about progress (*i.e.,* see their monthly electricity bill or even better, hourly smart meter data); and [134]
- The DIY Energy Advisor, an on-line tool prioritizing each household's behavioral and upgrade energy savings actions based on a quick survey about household characteristics and energy use patterns.[135]

Proving difficult to gain full program implementation, staff needed continuous training and coaxing to use the data platform.[136] Contractor partners increased platform use and proficiently over time, but still struggle with the additional task of N2N data collection and reporting (*i.e.,* in addition to utility-administrator data requirements).

5.4.3.1 Technology platform findings

Program administration and evaluation is only as strong as the data. Like the utility-administered program, community-based outreach cannot achieve wider community penetration and deep household energy savings by itself without robust data. N2N reports the following findings:

- Achieving aggressive program goals requires a sophisticated data collection and management

[133] The N2N-developed Salesforce.com technology platform is the multi-faceted technology platform supporting all other data management tools. The N2N-developed LightSaver iPad application is designed to collect N2N in-home lighting visit data and report back to the customer and to the Regional Greenhouse Gas Initiative (RGGI) market for Class III Renewable Energy Credits (RECs). The N2N-developed Event App enables event related data collection for the event itself and for participants attending the event. The Snugg Home SnuggPro software tool, an advanced version of the HES assessment data collection tool (the Field Service Tool), allows data collection to take place over the course of the assessment, producing results and reports for contractors, customers, and program administrators.
[134] Done properly, the customer can learn on their own about energy savings actions to take from waste reducing habits to small DIY one-time actions to upgrades as a result of feedback.
[135] This type of tool could hold promise as an acquisition tool for HES assessments (or upgrades), while also priming customers to the ultimate upgrade and renewable energy actions. The theory is to anchor people's expectations of their household's ultimate needs, immediately framing the solution with respect to upgrades.
[136] For instance, Year 1 outreach staff used spreadsheet data collection tools and participated in platform design. Year 1 staff had to change work protocols on a regular basis, something that staff often openly resisted. The Year 2 outreach team came on board to an almost completely developed data management platform with experienced trainers and refined training materials. Year 2 staff found the system easier to use and widely accepted the platform.

toolset, including a Customer Relationship Management (CRM) database, that:

- Keeps track of exactly where each customer sits in the sales pipeline, and
- Enables multiple customer sales touch points targeted at the next action or the next few actions.

- Programs must invest pre-program and throughout in data collection tools and a robust CRM system. In fact, technology development and implementation should not be taken lightly. N2N's task of developing a technology platform was a complex activity, requiring substantial program resources to both build it and to grow user proficiency.[137]

- The sales delivery technology platform supports the following program aspects:

1. Customer follow up on the path to upgrade conversions;
2. Quality control processes;
3. Cost-effective program delivery for both contractors and program administrators by tracking and spreading customer acquisition costs across the lifetime of that customer's energy savings actions *(i.e.,* strong measurement, evaluation, and verification)
4. A testing ground for program administration and design, analysis, lessons learned, and redeployment;
5. Business scenario planning and modeling; and
6. Data reporting, and sharing/transparency to a variety of internal and external stakeholders, leading to market innovation.

5.4.3.2 Technology platform recommendations

The N2N recommended data platform should cover three areas of program implementation:

1. Program-facing to enable robust:

   a. Data collection and data quality checks for the outreach and contractor teams when collecting leads and household data.

   b. Measurement, evaluation, and verification; and

   c. Coordinated marketing efforts and program implementation for program administrators, as well as between program administrators, trade allies, and stakeholders.

2. Public-facing to regularly publish and react to contractor and program performance dashboards.

3. Consumer-facing side to encourage goal setting and feedback loops to participants.

5.4.4 Driving market innovation

Only a three-year pilot, N2N set an ambitious and transparent data, research, and evaluation agenda. The DOE funding enabled N2N to act as an innovation laboratory, quickly testing and reshaping numerous strategies and tactics. N2N has and will continue to document the evaluation by:

- Participating in DOE and CT policymaker meetings, conferences, workshops, and webinars;

[137] In fact, N2N continues to experience frequent data quality issues despite continuous staff and contractor reminders of proper data management.

- Writing this developmental evaluation document; and

- Completing three forthcoming deliverables, including:

    - Completing the N2N quantitative analyses;
    - Studying N2N and CT market segments; and
    - Developing the planning and business scenario modeling toolset, including an examination of pilot cost-effectiveness.

Not only has N2N committed to extensive program evaluation, but many outside organizations have also contributed in-kind to research and evaluation. N2N embraced partnerships across academia and industry, including with the MIT Field Intelligence Laboratory (FIL), Center for Collective Intelligence (CCI), Duke University's Fuqua School of Business, the DOE Home Energy Score (HEScore), the National Opinion Research Center (NORC) at the University of Chicago, and the National Renewable Energy Laboratory (NREL). The partnerships provide additional lessons learned and insights from respected thinkers across disciplines.

N2N's market transformation efforts in CT rely on the N2N summary program dashboards and reports, because data sharing and transparency enables:

- Focusing stakeholders on the opportunities and issues, not just in N2N's program, but also in the broader statewide programs; and
- Helping drive broader policy discussions about needed changes and possible approaches, bringing a level of specificity not previously possible in the policy debate.[138]

N2N, partners, and stakeholders regularly use three other types of dashboards to instigate program evolution and market transformation in the broader statewide program:

1. The DOE summary dashboard that helps N2N and DOE track program statistics, such as completed upgrades and signed utility releases.

2. The detailed contractor pipeline dashboards and reports that enable a view of recent N2N contractor activity, such as created leads, open projects, lead to conversion rates, upgrade bid to conversion rates, HES assessment conversion rates, average age of projects, data entry on Salesforce.com, *etc.*.

3. Town aggregate electricity use dashboards, including weather normalization, using the Northeast Utilities (NU)-provided data.[139]

Despite the comprehensive technology platform and data set, more data is needed to add rigor to the

[138] For instance, in debating whether the statewide program could implement a process change to get a customer release for access to utility data, N2N demonstrated that half of its contractors had a release complete rate of greater than 92 percent, indicating statewide collection of data releases is possible by sharing best practices among contractors. Similarly, in discussing the low HES-to-upgrade conversion rate in the statewide program, N2N was able to provide detailed data on the variability of bid rates among contractors, highlighting the need for process improvements, contractor engagement (meetings, liaison staff, sales training), and potentially a realignment of expectations for participating contractors in the statewide program. (Livingston, Donnelly, & O'Neill, 2012)

[139] N2N considers the town dashboards a missed opportunity. They provided the towns a first look at aggregate electricity data and should have been used to drive town energy planning, but there is no evidence of this.

analysis. For instance, N2N recently requested data from towns with similar defining characteristics as N2N towns to create control group comparisons for HES and upgrade participants.

5.4.4.1 Market Innovation Findings

N2N has had the luxury of DOE funding to operate a pilot program outside of CT regulatory constraints. N2N developed a laboratory of 14 small communities using a subset of the HES assessment contractor base. N2N's ability to closely oversee program design and operations in an experimental environment has led to market innovation. N2N has simultaneously implemented, tested, evaluated, and adapted program design, continuously discovering new lessons learned to improve program execution. N2N has the following market innovation findings:

- The N2N technology platform is key to data transparency.
- N2N shows early signs of market innovation, including DOE discussions about broader programmatic and policy improvements, as well as influence at the statewide ratepayer program level, where CT programs have incorporated elements piloted in N2N, including:
    - Increasing data sharing and transparency;
    - Issuing a request for proposals for technology solutions specifically to support HES;
    - Instituting new performance metrics and lead distribution for contractors that track and reward the ability to drive deeper savings per household;
    - Running lead by example campaigns that leverage community influencers and public official press conferences;
    - Developing a new training curriculum for contractors, including sales techniques;
    - Supporting N2N control-town utility data requests;
    - Inviting N2N to policymaker stakeholder processes;
    - Implementing customer data releases into loan funding programs, *etc.*. (Stakeholders1,5,8,10).
- Examining CT public utility commission meeting agendas also shows evidence that N2N is contributing to an open statewide dialog around driving demand for upgrades.

5.4.4.2 Market Innovation Recommendations:

Despite the ambitious research strategy, N2N recognizes a need for policymakers to focus on evaluation and more research. An investment in data and technology data management systems enables more cost-effective and deeper energy savings among a wider range of customers. N2N makes the following recommendations to CT policymakers:

- Take a more proactive approach to program management, dedicating resources to data and program oversight to improve data quality, as well as measurement, verification, and evaluation work, including the following data details:[140]

[140] Note, this requires dedicating more resources to the technology tools that support data management.

- Customer pipeline data from lead acquisition strategy to lifetime energy actions;
- Customer demographic and psychographic profiles to understand marketing strategies; and
- Contractor performance data.

- Understand how to achieve effective target marketing of upgrades in CT, which will allow the design of customer upgrade packages of incentives and measures.[141] In fact, CT policymakers should quickly focus attention towards completing this research, as well as understanding the best practices of consumer marketing strategies.

- Support the N2N Innovation Lab concept, which should continue to operate outside of the current regulatory structure to identify strategies that address specific market challenges, and would continue:

    - quick testing of approaches,
    - integration of a portfolio of energy efficiency and clean energy programs, and
    - a process of continuous improvement.

5.4.5 Policy and utility incentive structure

N2N's experience in marketing HES as an acquisition strategy for upgrades highlights both successes and challenges in pivoting beyond the HES direct install model towards upgrades (achieved through multiple customer touch points). For instance, Table 32 provides a comparison between N2N's HES assessment conversion to upgrade rate compared to a scenario of what HES conversion rates could be compared to other similar DOE pilots.[142] For instance, instead of 281 upgrades, CT would achieve 977 upgrades (Table 32).

Table 32 N2N Actual and Scenario Model of Upgrade Conversions

	N2N Actual (March 29, 2013)	**Scenario Model**
HES leads completing HES assessment	3,259	3,259
HES leads completing upgrade	281	977
Conversion ratio from HES assessment to lead	8.7%	30%

Table Notes: 1) N2N actual numbers include program to date (March 29, 2013) for HES and HES-IE programs, including N2N spillover towns. 2) Approximately 30 percent of N2N leads do not complete a HES assessment.

The state should align interests of and increase communications among all program stakeholders consistent with the policy and utility incentive findings discussed next.

[141] The DOE has identified a lack of market and consumer research as a significant barrier to upgrade uptake across the U.S., encouraging N2N to pursue a targeted marketing research to understand consumer segments of attitudes towards energy efficiency statewide (including awareness, demographic, psychographic, purchase behavior, and discretionary time characteristics), comparing participants and non-participants in the 14 N2N communities, as well as in similar non-N2N towns around CT.

[142] The best performing DOE Better Buildings programs overseeing the contractor sales pipeline and contractor operations have conversion rates at 30 to 50 percent.

5.4.5.1 Policy and incentive structure findings

The HES assessment program is successful, reaching approximately two to three percent of CT households each year and achieving the original program goals (Ben Foster, 2012). Unfortunately, discussed throughout the document, the current HES assessment (HES) program design, incentives, data requirements, and marketing approaches do not support achieving upgrades at scale. There is an opportunity to re-envision the HES program as the first step in a program that is focused on deeper upgrades, and to realign customer and contractor incentives towards installing upgrades.

In addition, the financing programs in existence during the N2N grant period were nowhere near the scale necessary to drive upgrade financing.[143] For the lenders to trust and support the loan product, the financing program needs to demonstrate that upgrades are happening at scale (which would lead to significant lending volume), that they are generating real savings, and that consumers have protection if issues arise.[144] For programs like N2N and for the CT green bank (CEFIA), the utility data can facilitate financing upgrades in three ways:

1. During the loan origination, the underwriter needs proof that the utility bill will actually decrease in order to give credit to reduce the cash flow.[145]

2. On the back end, private capital providers are concerned about consumer fraud and want to be assured that upgrades are installed correctly and the customer is actually saving energy, to ensure that loans are repaid.[146]

3. By demonstrating net savings to the end investor financing the loans, there is an opportunity to define a new asset class that takes into account the energy savings as an asset, as opposed to only the financial performance of loan repayments. (Stakeholder8).

Sharing utility data on contractor quality and customer energy savings can contribute to a robust financing program. This needs to be tracked over the course of several years, as private capital providers expect a data set that ultimately is as deep as the length of the loans in the portfolio.

With scalable customer financing in place, the contractors will need to learn how to sell the financing solutions, for example, like car salesmen know how to sell loans. To support the sales process, consumers need access to consumer friendly reports on energy usage, benchmarking, and feedback towards the goal.[147]

5.4.5.2 Policy and incentive structure recommendations

CT needs further evaluation of the mix of ratepayer fund dollars subsidizing HES core services versus whole-home performance, including rebates, financing, performance-based contractor incentives, marketing dollars, *etc.*. Based on N2N experience to date, N2N recommends an integrated policy environment focused on whole-home performance, which would require several CT policy and incentive structure changes to support:

[143] Unlike CT, other DOE Better Buildings programs have momentum with contractor-driven financing models.
[144] Note: CT Public Act 11-80 created a CT energy office, a CT green bank (CEFIA), and the right for consumer access to data on their utility bill. For NU, the N2N data sharing agreement should be an opportunity to leverage the IT and legal processes to comply with the new legislation. CEFIA is using the N2N release template to develop their own release form for their residential financing products. The DOE also requested permission to include N2N's release form in the best practice manuals.
[145] Even discounting the expected savings by 40 to 50 percent is better than zero.
[146] If there are no energy savings, the risk is that the consumer will default on the loan.
[147] For example, a third-party program, such as OPOWER, Efficiency 2.0, one of many Green Button independent software applications, and other similar consumer-facing dashboards, as well as asset mapping benchmarks like the DOE Home Energy Score, Energy Points, Energy Performance Score, EPA's Home Energy Yardstick, etc.

- A portfolio of customer and contractor incentives focused on targeted market segments and based on customer needs that promotes the following:
    - Whole-home performance packages, including aspects of the following program types, each representing different ways a customer might enter a sales pipeline culminating ultimately in an upgrade, though it could be many months up to a few years down the road:
        - Lighting (*i.e.,* especially towards transforming to LED lighting), HES assessments, and HES-IE assessments as customer acquisition strategies for driving customers to deeper upgrades;
        - HPwES for customers already interested in a whole home performance solution;
        - Solar and other clean energy programs, to capture customers interested in renewables, as a way to cross-sell them into efficiency upgrades, *etc.*.
    - Increased quality control and post-completion inspection procedures for all portfolio actions, with a particular focus on upgrades.
    - Program cross-collaboration, where contractors are rewarded for selling between programs and focused on performance-based results.
    - All-fuels energy efficiency programs with stable funding, especially for oil and propane.[148]
    - Customer and contractor business incentives aligned to promote upgrades. In fact, CT should strongly consider changing funding splits between HES and upgrades to shift the balance of incentives toward whole-home performance packages. Consider following a model like MassSave, where air sealing and insulation are packaged together with 75 percent reimbursement incentive (CSG, 2013), rather than partially sealing homes in non-insulated homes through HES assessments.
    - Multi-year budgets with clear performance metrics for getting to deeper upgrades.[149]
    - Third-party (or third-parties) program administration and marketing for targeted market segments, with an adaptive program administration of portfolio management, able to implement lessons learned about program design, marketing, and outreach.
    - Scalable customer financing and feedback solutions that work for all-fuels and reach a broader segment of the market.

[148] Stops and starts to oil funding in an oil-dominated market has created contractor uncertainty, as well as hiring, training, laying off, and hiring staff again. This creates an unsustainable business model, especially for the small contractor teams working in the HES program. Contractor companies do not have time to gain momentum with their business and in-home technicians do not have time to gain proper experience to learn solid customer service and sales skills.

[149] Multi-year budgets give programs time to iron out the kinks, and help create contractor market stability, which would end the uncertainty caused by the stop and start oil-heated funding of the past.

- Scalable contractor working capital or partial upfront incentive payments to help contractors manage cash flow.[150]

- A focus on co-branding approaches to increase customer trust and buy-in by significantly increasing program administrator, town, local organization, business, and contractor co-marketing initiatives and budgets.

5.4.6 N2N Program administration redesign

Although the N2N team exhibited passion and flexibility through the grant that enabled a friendly working environment toward a common goal, the N2N team structure was weak with unclear lines of authority and partner hierarchy. In fact, N2N did not exist as a formal organization. Instead, N2N is a loose federation of partners, which as structured, is a suboptimal organizational structure for cost-effective operations, teamwork distribution, and accountability.[151]

5.4.6.1 Program structure findings

N2N found four main program administration design structure findings:

1. Bringing together a team of passionate industry thought leaders that understood and embraced a pilot environment made N2N nimble, able to quickly recognize and deploy real-time program course corrections with varying degrees of execution success.[152]

2. On the other hand, some N2N partners were disconnected from administering a cost-effective and performance-based energy savings program, as well as from the fast-paced, constantly changing style of implementing guerilla marketing For example:

    a. The N2N Clean Energy Corps outreach team made up of AmeriCorps recent college graduates was internally mission driven. While it may have helped with community relationships, the Student Conservation Association (SCA) aims for professional development and work experience rather than optimizing performance or cost-effectiveness.

    b. Partner pre-program expectations paired against the reality of implementing an on the fly program caused tension within the N2N organization at times, where some partners resisted an approach of real-time evaluation and course corrections.

3. The town recruitment strategies created both strong and weak town partnerships.

4. The next N2N program iteration, the Innovation Lab includes a systematic and solutions-oriented program design focused on the:

    a. Contractor,
    b. Program partner,

[150] For instance, CEFIA solar rebates offer 40 percent payment at material delivery and 60 percent at solar PV install. New CEFIA loan programs offer a 1/3 progress payment to contractors at start of job, and 2/3 at customer sign off of work completed.

[151] N2N was designed as a pilot structure to test numerous approaches to see what sticks. The program's cost-effectiveness was impacted by heavy startup tasks, continuous testing and evaluation, oil-heated funding stops and starts, HES incentive structures, *etc.*

[152] In fact, the team's passion led to substantial hours of in-kind work on the pilot, for instance, for working to catch up after a hurdle, as well as to meet the next last-minute opportunity to further N2N's lead generation, policy influence, or funding opportunities, etc.

c. Customer, and
d. Program design elements, including the technology backbone, program design, market innovation activities, and the policy environment.

5.4.6.2 Program structure recommendations

Moving forward, a third-party, non-profit organization should be created to house the N2N assets and intellectual property so that CT does not lose the $4.2 million investment of the DOE grant. Numerous State programs exist that could benefit from N2N's marketing and outreach, contractor oversight, and performance-based program management skills. As one example, the third-party organization could implement the on-the-ground marketing efforts of Energize CT.[153]

While N2N needed flexibility to develop the program design, N2N recommends adding more structure into the program partners. For instance:

- For the internal team, N2N recommends a model that has more staff working directly for a newly created non-profit organization, and specialized functions performed by partners or vendors in formal partner roles with formalized program expectations.

- For program partners, N2N recommends structured partnership agreements for town partners, as well as external utility, community group, contractor, and customer stakeholders. In fact, like Solarize CT, future programs should consider competitive selection processes for town partners to assess and ensure community commitment, buy in, and minimum support levels.

If a Corps outreach model is used in the future, separate funding should be secured that is aligned to the mission of experience-based professional development, as opposed to performance-based funding typically available in the energy space.

Each program design and execution decision should meet the needs of the contractor, the customer, and the program administrators and partners.

5.5 Final Thoughts

With the right customer and contractor incentives layered on top of a behaviorally focused marketing approach, HES assessments (HES) could be one of several programs marketed as customer acquisition strategies for upgrades. However, the complete portfolio of programs should include:

- N2N-like outreach efforts in receptive communities, employing an on-the-ground outreach team that is integrated with other statewide (or regional) marketing efforts.

- Intensive engagement across the entire community, employing the outreach approaches outlined in this document, such as partnerships, challenges, competitions, testimonials, word of mouth, workshops and local events, community meetings, volunteers, co-branding communications, *etc.*.

N2N believes that using an Innovation Lab approach combined with solid performance metrics and data systems, would achieve higher levels of participation by:

1. Creating an environment of testing and learning, such as trying seasonal specials, scarcity programs, incentive payments to contractors versus customers or community groups, *etc.*.

[153] Note: Energize CT is an energy efficiency and clean energy portfolio offered by the ratepayer fund, CEFIA, DEEP, and CT electric and gas utilities from utility bill systems benefits charges.

2. Creating community outreach and marketing partnerships by adding a third-party program administrator with investment and participation from utility partners.

3. Achieving scale by thinking like the customer by:

    a. applying market research, segmentation, and behavior-based practices, and
    b. driving these approaches through all marketing channels and outreach collateral.[154]

4. Developing value proposition marketing grounded in behavioral science to support customer education on why market segments should complete upgrades. For example:

    a. What's in it For Me?
    b. What are the right behaviors that others do?

5. Integrating social media strategies into all marketing and outreach efforts to reach a broader customer base.

6. Reorienting all program marketing to position upgrades, rather than, for example, HES assessments being the end goal.

The previous document should illustrate the complexity of achieving whole-home performance upgrades in the residential market, as well as why a systems approach to implementation should be used. Future N2N quantitative evaluations will further develop the N2N lessons learned and market segmentation research.

[154] These are competencies most readily found in specialized marketing and advertising firms.

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Appendix A: N2N Town Demographics and Electricity Consumption Information

Table 33 Demographics: Bethany, Cheshire, E. Haddam, E. Hampton, Glastonbury, Lebanon, Mansfield

Town Demographics	Bethany	Cheshire	East Haddam	East Hampton	Glastonbury	Lebanon	Mansfield
Population (2010 ACS)	5,563	29,261	9,232	14,302	33,097	7,308	24,726
Households per town (CL&P, Dec 2010)	2,063	9,953	3,557	5,557	13,771	2,009	5,888
Average Home Size (sq. ft.) (calculated)	2,330	1,970	1,850	1,880	1,820	1,760	1,980
Median Home Size (sq. ft.)	2,196	1,862	1,749	1,701	1,608	1,546	1,843
Average Year Built	1974	1978	1978	1975	1961	1974	1967
Single-Family Homes	65.70%	92.40%	92.40%	81.10%	68.80%	82.70%	70.30%
Property Tax	$2,792	$4,191	$4,191	$4,768	$6,018	$3,589	$4,361
Yearly Residential Electricity (mWh)							
2008 CL&P Residential Electricity Use	22,314	111,774	36,647	51,173	128,655	22,314	49,403
2009 CL&P Residential Electricity Use	21,788	108,623	36,091	50,374	122,534	21,788	49,020
2010 CL&P Residential Electricity Use	22,904	113,765	37,666	52,387	132,409	22,904	49,650
2011 CL&P Residential Electricity Use	22,277	111,971	37,508	52,309	127,533	22,277	50,512
2008 to 2011 CL&P Average Use	22,321	111,533	36,978	51,561	127,783	22,321	49,646
Avg. Residential Electricity Consumption / Household (kWh)							
2,008	10,816	11,230	10,303	9,209	9,342	11,107	8,390
2,009	10,561	10,914	10,147	9,065	8,898	10,845	8,325
2,010	11,102	11,430	10,589	9,427	9,615	11,401	8,432
2,011	10,798	11,250	10,545	9,413	9,261	11,089	8,579
Avg. Consumption per Household 2008 to 2011 Average	10,820	11,206	10,396	9,279	9,279	11,110	8,432
2008 to 2011 Electricity Intensity (kWh/sq. ft./year)	4.64	5.69	5.62	4.94	5.1	6.31	4.26
2008 to 2011 Residential Average Electricity Consumption/person/year	4,012	3,812	4,005	3,605	3,861	3,054	2,008

Table 34 Demographics: Portland, Ridgefield, Weston, Westport, Wethersfield, Wilton, and Windham

Town Demographics	Portland	Ridgefield	Weston	Westport	Wethersfield	Wilton	Windham
Population (2010 ACS)	9,508	24,073	10,179	26,391	26,668	18,794	24,699
Households per town (CL&P, Dec 2010)	4,052	9,399	3,653	10,525	11,505	6,396	9,000
Average Home Size (sq. ft.) (calculated)	1,900	2,590	3,000	2,690	1,780	2,780	1,730
Median Home Size (sq. ft.)	1,696	2,494	3,022	2,560	1,536	2,678	1,514
Average Year Built	1960	1968	1967	1959	1957	1966	1966
Single-Family Homes	84.90%	78.60%	96.70%	86.00%	84.60%	85.50%	65.70%
Property Tax	$5,768	$10,428	$16,062	$13,397	$5,407	$12,924	$2,792
Yearly Residential Electricity (mWh)							
2008 CL&P Residential Electricity Use	34,403	119,359	66,853	161,649	88,054	96,551	63,979
2009 CL&P Residential Electricity Use	33,171	114,985	64,473	156,849	84,742	92,878	63,396
2010 CL&P Residential Electricity Use	35,573	120,993	68,491	169,212	90,295	99,350	66,265
2011 CL&P Residential Electricity Use	34,912	118,356	66,957	170,086	90,145	97,305	67,230
2008 to 2011 CL&P Average Use	34,515	118,423	66,694	164,449	88,309	96,521	65,217
Avg. Residential Electricity Consumption / Household (kWh)							
2,008	8,490	12,699	18,301	15,359	7,654	15,095	7,109
2,009	8,186	12,234	17,649	14,902	7,366	14,521	7,044
2,010	8,779	12,873	18,749	16,077	7,848	15,533	7,363
2,011	8,616	12,592	18,329	16,160	7,835	15,213	7,470
Avg. Consumption per Household 2008 to 2011 Average	8,518	12,600	18,257	15,625	7,676	15,091	7,246
2008 to 2011 Electricity Intensity (kWh/sq. ft./year)	4.48	4.86	6.09	5.81	4.31	5.43	4.19
2008 to 2011 Residential Average Electricity Consumption/person/year	3,630	4,919	6,552	6,231	3,311	5,136	2,640

Appendix B: N2N's Data-Driven Outreach Approach

The CT Neighbor to Neighbor Energy Challenge (N2N) was designed to meet State objectives, as well to enable a test bed of approaches. One end goal is to understand the cost-effectiveness of different approaches. N2N's program design is rooted in behavioral science, and based on an organizational change management approach called Community Based Social Marketing (CBSM) (McKenzie-Mohr, 2008). A major tenant of N2N, the team believes that a CBSM approach is more cost-effective than a traditional utility marketed program.

One of the cornerstones of CBSM, or action research, is learning early and continuously, and then changing course as often as necessary. To conduct action research, N2N relies heavily on intensive data collection and transparency, which allows not only constant refinement of the strategies employed, but also a self-reflective approach to incrementally build upon lessons learned to inform and generate increasingly sophisticated tools for planning and modeling.

N2N's approach is divided into six parts:

1) Outreach strategies are tracked in real-time through the Salesforce.com database (see Figure 16 on next page). Organizers enter detailed information for each campaign or event, including:

    - Event type - workshop, canvassing, tabling event, mailing, *etc.*
    - Total planning and deployment time
    - Staff and volunteers involved
    - Host or sponsor organization type (*e.g., a* town, school PTO, *etc.*)
    - Location – from town to table position to weather conditions
    - Materials and messaging employed
    - Successful approaches, resident feedback, and thoughts for improvement

    Most importantly, each generated lead is associated with their primary outreach activity and/or referral contact, allowing review of attendance, sign-up rates, and eventual complete rates of each outreach activity and related community leaders. Information updates from participating contractors and utilities grant access to savings data and pull-through to additional measures. N2N can track leads from the outreach activity where they signed-up (including refer-a-friend activity) through to upgrades to calculate the household's entire portfolio of energy saving actions.

2) From there, organizers and evaluators review reports of recent events and leads on a weekly basis to identify patterns and consistencies in those that garnered high attendance and high rates of sign-ups per hour and per staff hour. Through real-time updates from contractor partners, we see which leads are responding to contractor follow up to schedule assessments, and how many are expressing a lack of interest. Eventually, this careful, continuous analysis allows organizers to set baselines and goals for performance by strategy, pursuing only strategies that meet key performance-based success indicators.

Figure 16 Screenshot of Event Tracking Report in Salesforce.com database

3) N2N findings have informed the development of overall best practice guides by strategy (*e.g.,* workshop, canvassing, tabling, *etc.*) that lay out which event features to avoid and how to maximize opportunities. By employing best practices for each strategy, N2N is able to effectively employ a wide range of outreach activities in a comprehensive quarterly campaign.

4) Effectiveness of outreach events by strategy is summed and reviewed quarterly, informing the next quarter's campaign plan and goals. Following two years of outreach, N2N built a model based on signups per hour for each strategy by quarter, enabling a ranking of strategies from high to low investment of staff time. To determine overall cost-effectiveness, HES complete and upgrade rates by strategy were built on top of the direct outreach and program administrative costs. This allows for scenario modeling of a portfolio of high-investment and low-investment strategies to maximize resources and impact.

5) The detailed outreach model has informed a higher-level scenario model driven by more detailed cost-acquisition metrics. Incorporating and breaking out program administrative, direct outreach, indirect outreach, M&V, and startup costs, the management team is able to determine the full cost of each lead, customer, and saved MMBtu to the program. The enhanced visibility allows goal setting for success based on these metrics, as well as scenario modeling with different mixes of program overhead costs, revenue streams, complete rates, *etc.*

6) Finally, these tools and pilot lessons learned were used to develop a model delivered to the Clean Energy Finance and Investment Authority (CEFIA) to inform campaign plans and goal setting for a comprehensive upgrade and renewable loan package. The framework includes other acquisition strategies and energy reduction measures, and incorporates proven customer pull-through rates from one measure to another. Tracking and distributing the cost of acquiring a customer across the lifetime of that customer's

energy-saving actions results in a sophisticated and flexible tool for scenario planning, and allows N2N's program model and lessons learned to be adapted and applied to a broader market context.

The technology and program management tools help structure N2N's large data repository, keep all of N2N's partners on the same page, and instigate program evolution and market transformation in the broader statewide program. In the end, this may be the biggest accomplishment of N2N - driving changes in how ratepayer funded residential efficiency programs are administered. The N2N Energy Challenge uses the data platform to continuously drive forward on implementing existing, and discovering new, best practices to improve program execution. In addition, the platform firmly supports N2N program design, lessons learned, redeployment, and scenario planning and modeling tasks. It is also important for proper data collection, management, relationship building, customer follow up, quality control, and measurement, evaluation, and verification.

Appendix C: Listening to the Voice of the Consumer Details

The following process and results are detailed in Section 3.1.4.

To learn from our execution, N2N needed the outreach team's eyes and ears to report what was happening in the field. In addition, I believed that including the outreach team in the analysis would lead to more careful future data collection and entry. In fact, I needed better data to evaluate N2N. To encourage analysis participation by the outreach team, I set up a session to include two hours of additional and reminder behavior training. I also described the methodology for the upcoming research session and presented examples of using it to improve implementation.

The N2N Clean Energy Corps spent 2.5 hours analyzing the existing data set following the methodology based on the approach taught by Drazen Prelec, Voice of the Consumer (Prelec 2009 (Burchill & Brodie, 2005)), completing the following steps:

- Collect and record raw data at each outreach activity (*e.g.,* workshops, tabling events, in-home lighting visits, *etc.*). For this analysis session, the team selected the most complete event debriefs from six tabling sessions in five diverse N2N towns: Bethany, Portland, Ridgefield, Wethersfield, and Windham (*i.e.,* on Election Day 2010 (November 2)).

- As a group, define the key research question: "What are the most effective ways to engage the target audience?"

- Individually sift through the event debriefs word for word, pulling out the salient raw customer voices that express underlying customer benefits or needs (*e.g.,* in the customer's exact words, or as close as data allowed in this case);

- Work in teams of three to four to:

    - Combine duplicate individual customer voices (*e.g.,* exact customer needs or benefits that two or more people wrote down),
    - Generalize the data by grouping the individual customer voices into closely similar needs, ideas, and statements. Determine a title for each cluster of underlying customer benefits and needs (Level 1);
    - Categorize the data by grouping the Level 1 benefits and needs together to understand bigger picture process improvement needs. Create Level 2 titles that summarize the grouped customer benefits and/or needs (level 2);
    - Create the output by record the team's findings in an affinity diagram (see Figure 17).

- Come back together as a group to combine the three affinity diagrams into one that depicts the answer to the research question from the perspective of the N2N customer. A small subset of the combined affinity diagram is included in Figure 17.[1]

[1] Note that Meghan Billingsley from LBNL presented the methodology and results from the N2N write up of the December 10, 2010 analysis session: http://drivingdemand.lbl.gov/reports/participantvoice.pdf

Figure 17 December 2, 2010 Partial Affinity Diagram from Voice of Consumer Analysis

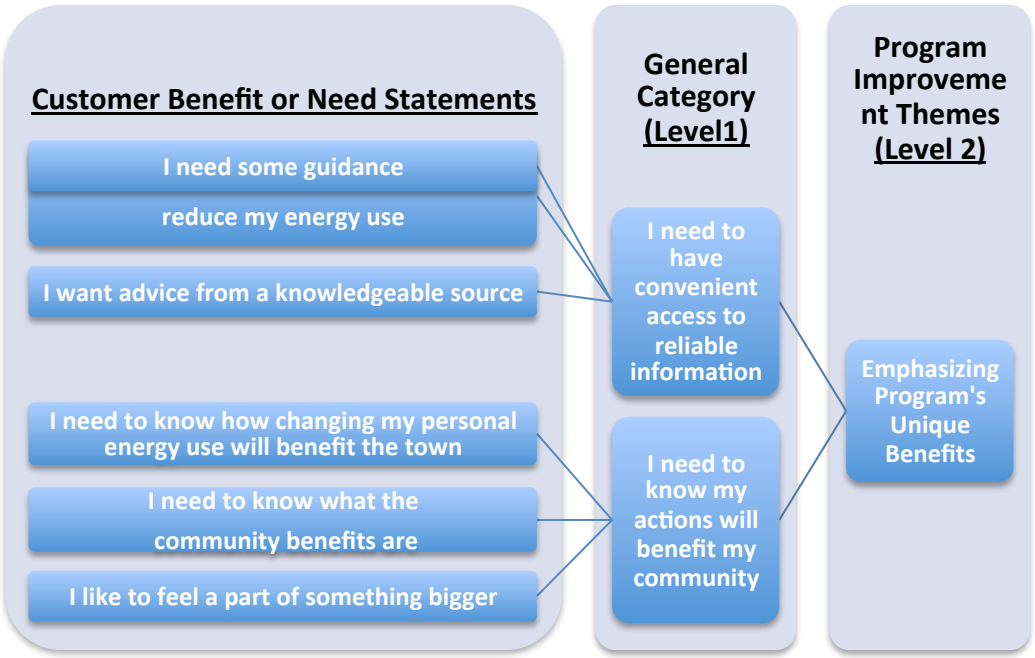


Figure source: (LBNL, 2011)

As a group, N2N also discussed participant needs and benefits to evaluate the best ways to address them from an outreach perspective. At the end of the session N2N discussed the importance of a high quality data recording necessary to complete program evaluation, and the barriers experienced during the analysis. Finally, having the responsibility for a post-analysis report also led the Corps to identify their own needs that weren't being met as program implementers.

Appendix D: The N2N Value Proposition

The N2N program framework has adapted the Lifetime Customer Value (LCV) to the residential efficiency space. Typically not used in utility-administered energy efficiency programs, LCV places emphasis on the total customer participation over the program life and spreads out the cost of acquiring this customer over the total number of actions they take (Shaw and Stone 1988). The business goal is to have an ongoing relationship with the customer and place a dollar value on that relationship by cross-selling or upselling additional products and services (*i.e.,* N2N ladder of actions). In the efficiency space, the goal is higher customer energy savings over time as the home becomes more and more efficient and/or generates clean energy. N2N measures the 'V' (Value) in LCV in negawatts[2] (but it can be measured in addition to or instead of revenues or profits, depending on the program).

N2N employs community-based strategies to systematically overcome barriers to residential participation in energy programs.[3] Strategies include providing motivation to reduce energy waste in the home, as well as education on available state programs and incentives, how to prioritize energy improvements, and how to find trustworthy contractors. A community-based approach was selected to allow for a trusted messenger strategy for outreach and marketing to support increased participation – both for reaching more participants and for having those participants achieve deeper energy savings. (Fuller, Kunkel, Zimring, Hoffman, Soroye, and Goldman, 2010; Michaels 2009)

The N2N outreach team focuses on nurturing community leaders to become N2N trusted messengers, including tailored strategies for libraries, faith-based groups, community and civic groups, schools, local businesses, social service agencies serving the elderly and low-income residents, municipal leaders, and community leaders. Strategies include educational workshops, tabling at local events/meetings, neighborhood canvassing, "lead by example" campaigns with community leaders, word of mouth, social media, earned media stories, contractor co-marketing, among others.

N2N relies on multiple customer touch points to build customer awareness and trust, and bring customers into the energy efficiency upgrade sales pipeline. N2N especially focusing on touching those that may not otherwise participated in a traditional program model. N2N is supported by proven behavior-based strategies, including framing, social norming, friendly competition, peer pressure, scarcity, goal setting, feedback loops, and a strong focus on language and messaging (Abrahamse 2009; Ehrhardt-Martinez, Donnelly, and Laitner 2010; Honebein, Cammarano, and Donnelly 2009; Lutzenhiser 2009).

The N2N value proposition for customers (*i.e.,* N2N participants) is a trusted ally to make saving energy in the home easy by:

1. Bringing together available incentives,
2. Selecting pre-qualified contractors,
3. Understanding and guiding the participant through each step of the process,
4. Helping them track energy savings over time,

[2] Amory Lovins of the Rocky Mountain Institute coined the term "negawatts"; he defined a negawatt as one megawatt of electricity conserved for one hour.

[3] The Clean Water Fund has developed an extensive tool kit to support community asset assessment, campaign management, and an approach testing, learning, and adapting.

5. Providing behavioral prompts, triggers, and reminders (*i.e.,* multiple customer touch points),
6. Connecting them to neighbors to share their experiences, and
7. Helping their community earn rewards.

Appendix E: The N2N Project Team/ Key Stakeholder Roles

This Appendix describes the N2N stakeholders, including partnership history and their roles next.

In early 2009, three important connections were made between Earth Markets founders Kerry O'Neill and Bryan Garcia,[4] as well as Roger Smith from Clean Water Fund/Clean Water Action.[5] They began forming the stakeholder connections. Earth Markets also began coordinating with SmartPower, an established marketing partner in the State of CT that provided most of the marketing support, including brand design, media strategies, customer service follow up, and traditional marketing. Note that Kerry and I met at the April 2008 MIT Energy Conference Poster Session, where I was presenting my poster on energy behavior and feedback. Kerry and I stayed in touch, developing ideas for a community-wide, behavioral science pilot.

A program like N2N requires "heavy-duty relationship management with internal program implementation staff, as well as with numerous external stakeholders" (Stakeholder8). For instance, the N2N implementation team is a loosely structured team of eight partners with a common network connection, Kerry (see Section 1.1 for internal partners). Clean Water Fund and Earth Markets coordinated daily operations, marketing, contractor, and internal stakeholder relationships. In addition, Earth Markets manages the lighting program, the data platform contract with Snugg Home, including data collection and project reporting to the DOE and state regulators, as well as budgeting and prioritizing tasks for the N2N team. Roger Smith and the Clean Water Fund team specialize in community organizing and outreach, managing the outreach and marketing team, as well as providing leadership to the Clean Energy Corps.

Snugg Home built the data platform and consumer-facing tools, SmartPower developed the marketing materials in Year 1 and Year 2, and I developed the experimental and evaluation work. As author of this evaluation document, I have worked closely with the N2N team from grant writing to thesis writing. My main role was to evaluate the program, often in real-time, but I performed several other duties along the way, including:

- Contributing to the grant application,
- Editing marketing and communication materials using behavioral science,
- Training outreach staff on and leading research projects using behavioral techniques,
- Leading development of the technology platform used for data collection, analysis, and reporting (*i.e.,* an unexpected evaluation need), and
- Leading N2N future quantitative evaluation, cost-effectiveness models, and market segmentation work.

Prior to winning the grant, one of Earth Markets main strategies was to increase penetration of CFLs in the 14 towns. Earth Markets envisioned a young team of certified technicians upgrading lighting and capturing the still available low-hanging fruit in CT. With a mission of conservation and on-the-job training, the Student Conservation Association (SCA) was recruited to fulfill this role. Over time, grant requirements changed the SCA and CWF outreach roles, where the SCA evolved into an on-the-ground outreach team managed by CWF, called the Clean Energy Corps

[4] Note: Earth Markets co-founders Bryan Garcia and Kerry O'Neill left in Fall 2011 and April 2013, both joining the CT Clean Energy Finance and Innovation Authority (CEFIA), the N2N grant administrator. Kerry continues to manage N2N grant close out, while other team members took up Bryan's tasks.
[5] CWF has 15,000 members in the state and has extensive experience mobilizing communities around energy issues.

(aka "the Corps"). For instance, lighting visits required about 25 percent of their working time, with the rest of their time filled with event-based outreach, call nights, social media, program news, *etc.*. In addition, the experienced outreach coordinators from CWF became managers for SCA team members, expending most of their time managing, training, and turning over non-performing SCA staff.

DOE grant applications required a government sponsor. With its history of supporting community-based energy outreach, the legislatively-created Connecticut Clean Energy Fund was the idea grant application sponsor.[6] Now called CEFIA, or the Connecticut Clean Energy Finance and Investment Authority. With a mission is to "achieve cleaner, cheaper, and more reliable energy through clean energy finance", CEFIA was an ideal grant application sponsor. [7]

N2N also developed a formal partnership with the ratepayer funding board, the Connecticut Energy Efficiency Fund. The ratepayer board, which is a volunteer stakeholder board not an incorporated entity, oversees the energy efficiency programs, including the utility administrators. N2N needed the efficiency ratepayer fund to bring in the utilities as partners for data access. Utility data is needed to evaluate whether N2N or its individual program approaches are cost-effective. Access to utility data may "was unchartered CT policy territory" (Stakeholder8). However, because the utility data is critical to a test, learn, adapt approach, N2N was careful to set initial expectations with the ratepayer fund and the utilities.

The public meeting for data sharing was adversarial. N2N was asking to co-market and co-administer HES and rebates by forming a strong partnership with the utility administrators. CEEF supported N2N and have facilitated utility partnership development. However, N2N handled the utility partnership tasks, including developing the unprecedented data sharing agreement and data transfer processes.

The partnership is designed to foster data sharing, data transparency, and rigorous evaluation. The ratepayer fund delivers savings to a large number of customers, primarily through HES assessments (*e.g.,* the energy assessment and direct install service that achieves about 15 percent savings on average) (CEEF, 2013). And, over the last few years, CEEF's focus is shifting to require administrators to deliver additional energy upgrades after HES to yield deeper energy savings.

CEEF board members have showed interest in expanding community-based outreach approaches. N2N "essentially wrapped around the existing HES assessment program using a multiple customer touch approach with a trusted messenger model" instead of utility marketing approaches in Years 1 and 2. N2N focused on other programs from its toolkit in Years 2 and Years 3, such as solar and whole home performance. However, CEEF is constrained by [outdated] cost-benefit requirements in its ability to run large innovative pilots, such as N2N (Stakeholder8). The opportunity to use federal grant funding to test the N2N program model afforded CEEF the ability to partner with the program and access the lessons learned, including using technology to enhance traditional Evaluation, Measurement, and Verification (EM&V) procedures.

Earth Markets and Clean Water Fund team members attend monthly CEEF meetings to report on N2N progress and lessons learned, particularly those of interest to the broader HES assessment

[6] Public Act 11-80, An Act Concerning the Establishment of the Department of Energy and Environmental Protection and Planning for Connecticut's Energy Future (http://www.cga.ct.gov/2011/act/pa/2011PA-00080-R00SB-01243-PA.htm).
[7] http://www.ctcleanenergy.com/Default.aspx?tabid=62

program and the goal of driving more energy upgrades. The CEEF monthly meetings draw a broad stakeholder group, including ratepayer fund board members and consultants, utility program administrators, loan program administrators, contractors, policymakers, and environmental advocates. Providing both a gathering place to discuss administering energy efficiency programs and to create social relationships, the CEEF monthly meetings appear to be the forum to influence market transformation.

N2N also manages numerous external stakeholders, including partners from the 14 N2N towns, the DOE team of stakeholders, three utilities, up to 13 contractor partners at any one time, local organization partner, volunteers, customers, and numerous policy partners in the state of Connecticut. These stakeholders exist within their own networks of connections that need monitored and/or managed. For instance, N2N interacts at the nexus of several stakeholder systems, including:

- the N2N data system / contractors / utilities;
- the N2N / DOE data systems; and
- the policy / N2N / utility / contractor nexuses, *etc.*

At the outset, NU devoted resources from several teams, including conservation and load management, financing, IT, data extraction, data reporting, regulatory, and legal departments. The early days involved sharing capabilities and requirements of coordinating N2N and utility systems, especially NU learning about N2N's technology platform capabilities, the mobile applications, and the Snugg Home consumer and contractor technologies. As discussed in Year 1 history, most startup issues have been worked out, and today's relationship focuses on data management and transfers to N2N.

Not surprisingly, the contractors are the linchpins to achieving deeper energy upgrades. They create relationships with the customer by providing pre-upgrade and energy upgrade follow on work inside the customer's home. Contractors are also responsible for managing the customer sales pipeline. N2N brings in leads, but the contractors are responsible for closing and upselling those leads. Although N2N knew the importance of contractors during pre-grant design, unfortunately the team underestimated its importance. Earth Markets was optimistic because Kerry O'Neill had met and established relationships pre-grant with several of the service provider organizations, as well as coordinating with them in CEEF and other regulatory proceedings.

At the utility/contractor nexus, NU distributed N2N leads evenly to all of the NU RFP-selected HES assessment contractors in the N2N towns at program start. Aside from the few innovative contractors, the remaining contractors were performing under N2N standards, taking a week on average to make first contact with the lead. In addition, a number of leads were being lost somewhere between N2N lead acquisition, utility distribution to contractors, and contractor initial customer contact. As a result, N2N took over lead distribution within six months of grant execution.

In fact, a handful of contractors stand out from the NU contractor pool, using non-traditional business models and approaches further refined through N2N program participation, such as:

1. HES assessment core services contracting with established partnerships with energy upgrade vendors;
2. Home performance companies, using HES assessments as a "foot in the door" to deeper energy upgrades;

3. Growing sophistication in customer pipeline sales (especially aided by the contractor support and training provided by N2N);
4. Innovative marketing approaches, especially relying on social tactics, like word of mouth and community partnerships; and
5. Leadership, including starting the CT Efficiency First chapter, the leading whole home performance contractor trade organization, as well as contributing to the regulatory process to increase whole home energy performance legislation.

Pre-grant and during Year 1, N2N focused on developing the technology backbone and data collection system, which was a necessary component that slowed both the N2N operations and my ability to conduct research. In the meantime, the author supported marketing strategies and tactics, and attempted several small-*n* field experiments that failed statistical significance mostly due to execution in the real world.

The DOE released the grant on October 18, 2009 and applications were due on December 14, 2009 (DOE, 2009). The grant application and reward caused N2N a fair amount of scrambling between October 2009 and the end of Year 1. For instance, pre-grant N2N pivoted from city to town partnerships and from lighting to upgrade focus, leaving a lot of new program design to finish in a short time, including what types of outreach activities, community groups, and neighborhood strategies to include. Due to all of the changes, Year 1 turned into program design and ramp up to program launch, including the N2N startup period discussed in Sections 3.1.1 to 3.1.3.

In addition, as detailed in Sections 3.1.3 to 3.1.5, N2N startup included several early N2N process, contractor process, and customer evaluations, implementing as many of the recommendations as possible. In Year 1, my research focused on quick process evaluations based on early data. In Years 2 and 3, my focus has been on formal program evaluation, including the research in this document and forthcoming N2N evaluations.

Even today, program data collection and data integrity are big program challenges, but in the early days, N2N data was sparse and messy. N2N addressed most of the early data collection issues by investing more resources to train the outreach staff on the manual processes and to develop quality control procedures. Then, over time, N2N layered the technology platform as it became available into the daily operations. There is widespread N2N team consensus that the process of developing and deploying the technology platform was painful, involving numerous deployments of Beta versions, using the already thinly stretched outreach staff to test and help debug the technology platforms.

Still, N2N developed a complicated data system, fulfilling needs of several stakeholders: outreach, administration, evaluation, contractor, and the participant. By mid-2011, N2N began to use the Salesforce.com platform for data collection. As a result, Earth Markets developed program metrics and dashboards to help understand which events led to N2N program activity, as well as how Home Energy Solution (HES) assessment and upgrade close rates compared by contractor and outreach activity. By the end of 2011, Snugg Home had completed development for most of the comprehensive technology platform built on top of Salesforce.com.

Also beginning in Year 2, N2N further limited lead distribution to a subset of NU-approved contractors that N2N had recruited through a Request for Qualifications (RFQ) process. As described in Sections 3.3.2 and 3.3.3, a large portion of N2N resources have been and remained dedicated to supporting growth of a CT contractor network focused on a customer pipeline through solar generation.

In Year 3, N2N continues to build a comprehensive energy savings model including customer acquisition metrics, such as lifetime value of a customer in terms of carbon, energy, and dollar savings. The model assumes a multi-touch strategy, or a portfolio approach, to spread out the cost of acquiring the customer throughout the customer's lifetime of actions. The intention was to later prioritize outreach approaches that drove the most upgrades and renewables.[8]

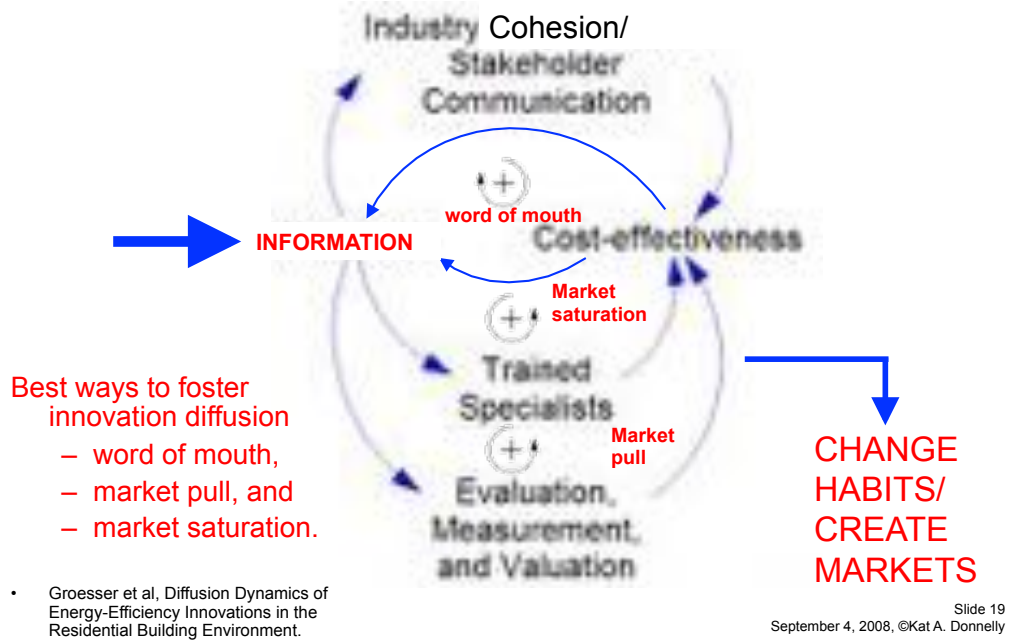
[8] Note: N2N is currently working on building a new and improved model expected Q3 2013.

Appendix F: System Dynamics View to Overcoming Efficiency Barriers with Positive Feedback Loops

Figure 18 represents a system dynamics view of the barriers to diffusing energy efficiency in the residential sector. The idea of the map is to identify the points in the system needing attention, and where the technology platform can support N2N execution. These leverage points can be targeted to turn the barriers into opportunities, where the interactions between information and cost-effectiveness create reinforcing feedback loops (indicated by the plus symbol surrounded by the direction of the feedback loop).

I first drew Figure 18 for a 2008 presentation about mapping electricity use information at the Precourt Institute of Energy Efficiency at Stanford University Energy and Feedback Workshop (September 4, 2008).[9]

Figure 18 A System Dynamics Model to Energy Efficiency Diffusion



Later, I ran across a Swedish study targeting residential building energy efficiency diffusion identified the three best ways to diffuse innovation in the energy efficiency domain are by:

1. Word of mouth;
2. Market pull; and
3. Market Saturation (Groesser, Ulli-Beer, & Mojitahedzadeh, 2006)

[9] Note, Professor Carrie Armel invited me to create the presentation, and she and Professor Banny Banerjee helped me frame the discussion. http://piee.stanford.edu/cgi-bin/docs/behavior/workshop/2008/presentations/01-04_Mapping_Electricity_Use_Information_Benefits_of_Barriers_to_and_Solutions_for_Leveraging_Information.pdf

For instance, the top, reinforcing loop of increasing (or decreasing) information to increase (or decrease) stakeholder communication to increase (or decrease) cost-effectiveness would include the social phenomenon of word of mouth, where people share information and stories with others. In addition, data and information could be fed to both train specialists and educate them on the nature of the opportunity. As the number of (informed) trained specialists increased or decrease, so does the economy of scale of the services, which impacts cost-effectiveness in the same direction. This could represent a market saturation feedback loop.

Finally, the lower feedback loop represents the market pull. It includes using solid measurement, evaluation, and cost-effectiveness approaches to remove uncertainty from the market to encourage additional market participants, as well as driving existing players to improve their products and services to meet customer needs.

These three feedback loops align well with the N2N pilot findings, including the individual feedback loops where:

1. Program outreach and word of mouth drives social diffusion of the N2N program;
2. CT contractor performance and incentive structures affect market saturation; and
3. Continuous data collection, process evaluation, cost-effectiveness, and process improvement being used to direct the next generation program implementation (*i.e.,* market pull).

Appendix G DOE Sample Home Energy Score Report

The HEScore is a report for a homeowner, or a perspective homebuyer, that aims to further the understanding of their home's energy performance (DOE, 2013). The score varies on a scale from one to 10, with 10 being best (ibid.). Similar to a vehicle's mile-per-gallon rating, it intends to communicate the efficiency level of a particular house, focusing on the home's assets (*e.g.,* heating system, wall construction, window type, insulation levels, *etc.*) (ibid.).

A home's customized HEScore and supplemental report are created after a walk-though by a HEScore-certified inspector or home performance professional (ibid.). It is calculated based on the housing characteristics, such as home size, heating and cooling systems, as well as roof, wall, floor, and window characteristics (ibid.).[10] The DOE has developed a standardized home energy report to accompany the score that provides information about the home's characteristics and performance, as well as prioritized upgrade recommendations (ibid.). An example five-page DOE HEScore is found at this link and below: http://homeenergyscore.lbl.gov/public/documents/HESTLabel-Sample.pdf (DOE, 2012).

For most people, completing the HEScore upgrade recommendations would require hiring a contractor or having a minimum level of contractor know-how to do the work themselves. Because it delivers a building asset rating, or score, the report excludes household energy operations and occupancy levels. Therefore, it excludes recommendations for behavioral actions like setting the thermostat, as well as one-time energy efficiency actions that people can take themselves (*e.g.,* upgrading light bulbs, using a power strip, *etc.*).

[10] The home score data collection sheet can be downloaded here: http://apps1.eere.energy.gov/buildings/publications/pdfs/homescore/data_collection_sheet.pdf.
Note: The DOE HEScore can also be produced from HES assessment data. Partnered with United Illuminating (UI), N2N is testing the HEScore during the N2N upgrade quality control program (with expected completion 2013 Q3).

Figure 19 DOE Sample Home Energy Score and Report (5 pages)

Page 2

Page 3


Home Energy Score
Sample Only

Page 4


Home Energy Score
Sample Only

Page 5

Appendix H: Survey Design and Participant Reactions

Appendix H.1 Survey Design Details

The survey included 61 total survey questions taking participants almost 24-minutes on average to complete, including the following survey flow (Details follow the list.):

- Instructions page;
- Housing situation survey questions (7 questions);
- Context page about the HEScore and report;
- Experimental group assignment, including instructions about the:
    - Housing situation assignment (which is based on real-world housing situation); and
    - Report version (*i.e.,* level of information) random assignment, and a reminder to pay attention to your 1-, 2-, or 4-page report.
- Home energy report with text explanation, except for control group that only saw text explanation;
- Context instructions that
    - your home is wasting energy, and
    - investing in energy efficiency can improve the energy score from a 4 to a 9.
- WTP SE survey questions (19 questions), including three different question types for six individual actions as follows:
    - Yes/no for average cost (*i.e.,* the anchor price); [11]
    - Yes/no for 11 different costs; and
    - Maximum WTP for each upgrade.
- WTP JE survey questions for the maximum WTP for all actions (3 questions):
    - With a $1,500 Tax credit;
    - For the Neighbor to improve score; and
    - For the Neighbor to improve score if the score is public.
- Confidence, comprehension, and attention measurement questions (5 questions);
- Household and personal demographic questions (27 questions); and
- Thank you page, inviting further comment, and email entry for the survey raffle.

For instance, the instructions page informs participants about the survey, including:

- The survey topic: your home energy decisions,
- The researchers: from MIT and Duke University,
- Your participant rights: the survey is voluntary, confidential, non-identifying, and you can exit any time;
- Your possible reward: the $250-raffle for an Amazon.com gift certificate, and
- The survey commitment to: pay attention to report, answer all the questions, and be over 18 years old.

[11] Plus one question about WTP $8.00 to purchase three CFLs to install in the shed on your property.

Then, respondents are asked seven short questions about their housing situation, including:

- Whether buying or selling;
- Last time bought or sold, and next time buy or sell your home;
- Household ownership; and
- Professional real-estate industry involvement.

Next, subjects view a page of context about the HEScore and Report (Figure 20).

Figure 20 Home Energy Score and Report Survey Context

Then, depending if they are staying in their home, or in the market to buy or sell their current home, are split into groups asked to: imagine they are buying, selling, or staying in this home (*e.g.,* home depicted in). Early in the survey, subjects viewed the photo of the house in Figure 21 three times to (hopefully) increase their ability to imagine it was their home.

Figure 21 Example Survey Home for all Respondents

Next, the subject views one of four report versions:

- Control group (no report),
- HEScore (1 page),
- Basic Report (2 pages), and
- Detailed Report (4 pages).

Except for the control group, we remind them to review and pay attention to "your X-page home energy report" (See report versions in Section 4.1.2).

Included each page of the energy report is text explaining the report, including:

> "This is your home's energy score. This page shows your home's current score, and how high your home could score by making the recommended home performance improvements.
>
> Your home energy decisions will impact the score, energy performance, utility bills, comfort, and health and safety of your home.
>
> Please carefully review your home's energy score before moving to the next screen."

For instance, subjects seeing the four pages of the detailed report had to read at least twice as many instructions and report pages than those in the other report levels.

After the report, subjects received more contextual instructions:

> "Now that you have had a chance to review your report, you can see that your home is currently wasting energy.
>
> You can improve your home's conditions and your energy score from a 4 to a 9 by investing in energy efficiency improvements, such as upgrading your standard light bulbs to compact fluorescent lighting (CFLs) or having a professional come into your home to seal air leaks and ducts, and insulate your attic."

Subjects saw one more reminder of the example home and were asked to imagine, for example, "you are buying this home with this energy report". Then, subjects answered 18 different household energy WTP questions about the six upgrade actions in three different ways, including:

For instance, the first WTP question asked subjects if they would be willing to pay the average cost for the home energy action, where the average cost was assumed from the yes/no question. After the yes/no average cost WTP, participants answered a random yes/no question about spending $8.00 for three CFL bulbs for the shed. The second WTP question version was a table of 11 yes or no responses, each requiring an answer (Figure 22).

Figure 22 First of Six Yes/No Matrix Questions

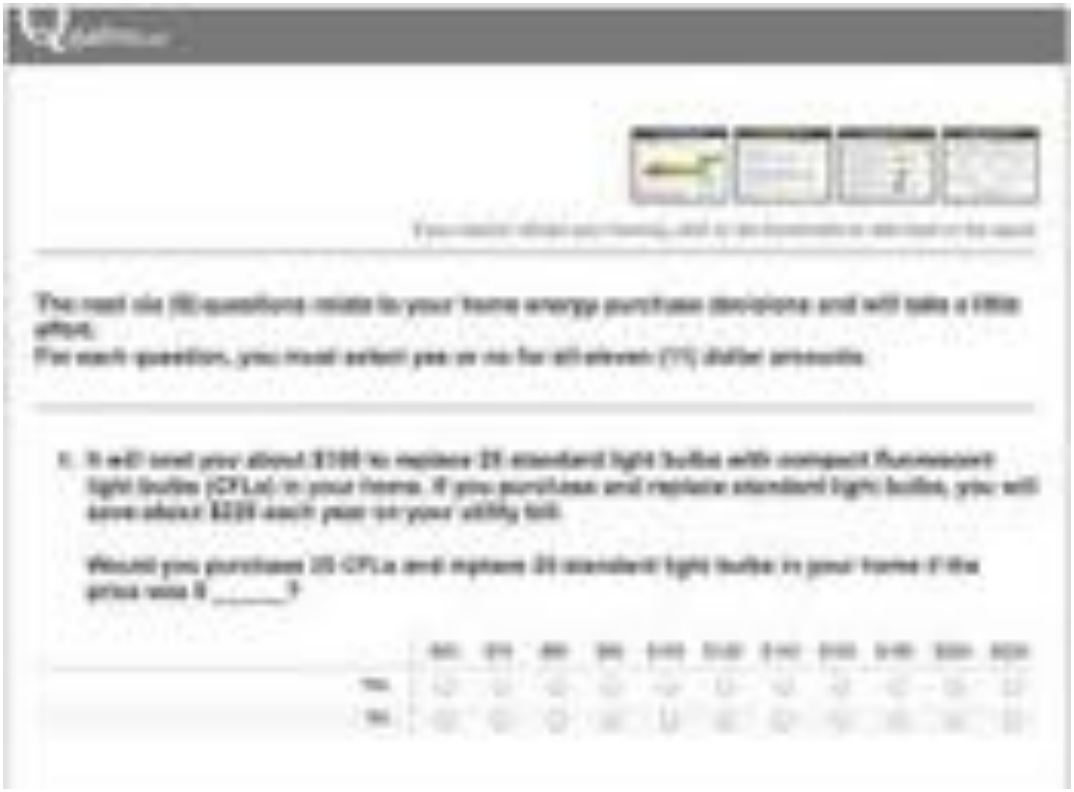


Figure Note: Respondents had access to their report while they answered the WTP questions. Clicking on the thumbnails in the upper right corner of the survey zoomed into the report details (e.g., detailed report in this case).

The third WTP question version was a slider version of each action to elicit the maximum WTP for each of the recommended improvements.

Three WTP questions followed to elicit the Joint Evaluation (JE) WTP for all actions, as well as how people reacted to tax credits and public scores (for a total of 22 WTP questions):

1. The maximum they would be willing to pay for all the improvements that they would make if they had a tax credit.
2. The maximum amount their neighbor would be "willing to spend for all of the recommended improvements to increase their home energy score from a "4" to a "9"."
3. Again the maximum the neighbor would pay, but this time the score is publically available, such as on Zillow or Google maps.

Then, discussed in more detail in Appendix H.4, respondents answered five questions to measure subject's:

- Confidence in their Willingness to Pay (WTP) answers;
- Comprehension of the report (and if they were paying attention to report details); and

- How much they were paying attention to the survey instructions (from Dan Ariely's "attentional filter").[12]

After the WTP survey section, 27 household and personal demographic characteristics are answered with instructions to "think about your current home" and a reminder that the demographic questions would be kept confidential, including:

- Reactions to the home energy report (3 questions);
- If increasing their score would affect their current home energy upgrade choices, and why or why not (1 question);
- If they would be interested in seeing the HEScore for a home they were buying and for a home they were selling (2 questions);
- Demographic questions (17 questions), such as
    - How long they had and planned to stay in their home, and
    - Education, age, income, household energy characteristics (*e.g.*, comfort, energy costs, who does energy repairs, household conservation mentality, *etc.*)[13];
- Open-ended text for if it would be helpful for every home to have an energy performance report, or only in certain circumstances, and why or why wouldn't the report be useful.

The self SE WTP dependent variables were calculated in two ways based on the participant's WTP for the average cost for each action (or not). For instance, each subject has one of two WTP calculations for each individual action (*i.e.,* CFLs, outlets, attic insulation, duct sealing, air sealing, and an efficient automobile from Section 4.1.3), including either:

1. <u>If Yes:</u> Average of the three WTP question types for the same action.

2. <u>If No:</u> Average of two WTP question types without the yes or no average question.

Then, the average of the SE questions are added together in different combinations for total WTP amounts.[14] Table 35 describes the survey question WTP amounts and answer ranges. In addition, the table includes calculations that subjects may or may not have been thinking about during survey completion that add context to the survey results, such as:

1. A benefit/cost ratio based on the yearly savings amount and the average price of the action indicated by the first yes or no WTP question;
2. An average based on the average of the three question type;
3. The maximum value that the participant could pay for each action; and
4. The total of all house decisions derived from summing CFLs to shed actions.

[12] The analysis also checked for a valid answer to the matrix of yes/no questions by building a pattern recognizer. Patterns should be all No, or some number of Yesses in a row followed by all No, or all Yes.
[13] Note, some of the household energy characteristics questions are from (Ingle et al., 2012).
[14] Note: several other SE WTP variables were constructed for analysis including the minimum, maximum, and difference of each purchase action and sums of these variables. Analysis found similar regression results to using averages; therefore, only the averages are presented in this document.

Table 35 WTP Survey Questions and Characteristics

Question Characteristics			Range of Question Values			Question Calculations		
Purchase Action	Evaluation Type	Yearly Savings Amount	Y/N	Matrix of 11 Y/Ns	Slider	Pseudo Benefit/Cost Ratio	Pseudo Average	Question Maximum
CFLs (Replace 25)	Separate, Self	$ 220	$ 100	$60 - $220	$0 - $260	2.20	$ 103	$ 260
Outlets	Separate, Self	$ 80	$ 40	$10 - $80	$0 - $100	2.00	$ 42	$ 100
Attic Insulation	Separate, Self	$ 450	$ 1,100	$600 - $1,850	$0 - $2,000	0.41	$ 908	$ 2,000
Duct Sealing	Separate, Self	$ 380	$ 950	$500 - $1,650	$0 - $1,800	0.40	$ 808	$ 1,800
Air Tightness	Separate, Self	$ 250	$ 1,400	$400 - $2,400	$0 - $2,800	0.18	$ 1,267	$ 2,800
Shed (Replace 3 CFLs)	Separate, Self	$ -	$ 8	N/A	N/A	No benefit		$ 8
Total All House	Separate, Self	**$ 1,380**	**$ 3,598**	N/A	N/A	Unable to calculate	**$ 3,128**	**$ 6,968**
Tax Credit	Joint, Self	One Time Savings $1,500			$0 - $20,000		$ 10,000	$ 20,000
Neighbor's Score	Joint, Other	N/A			$0 - $20,000	Unable to calculate	$ 10,000	$ 20,000
Neighbor's Score if Public	Joint, Other	N/A			$0 - $20,000		$ 10,000	$ 20,000
Automobile	Separate, Self	$ 400	$ 5,000	$500 - $20,000	$0 - $20,000	0.08	$ 8,250	$ 20,000

Instead of calculating a benefit/cost ratio, participants may have calculated payback time, where CFLs have the shortest payback time and automobiles the longest. The purchase decisions were ordered in the survey from most to least cost-effective (Magat, Payne, & Brucato, 1986).

Appendix H.2 Detailed Demographic Indicators

Numerous demographics were measured because of pre-survey hypotheses of potential impact to WTP, including the household:

- Socio-economic indicators;
- Buy/sell mindset;
- Energy use characteristics; and
- Attitudes toward the HES score.

H.2.1 Socio-Economic Indicators

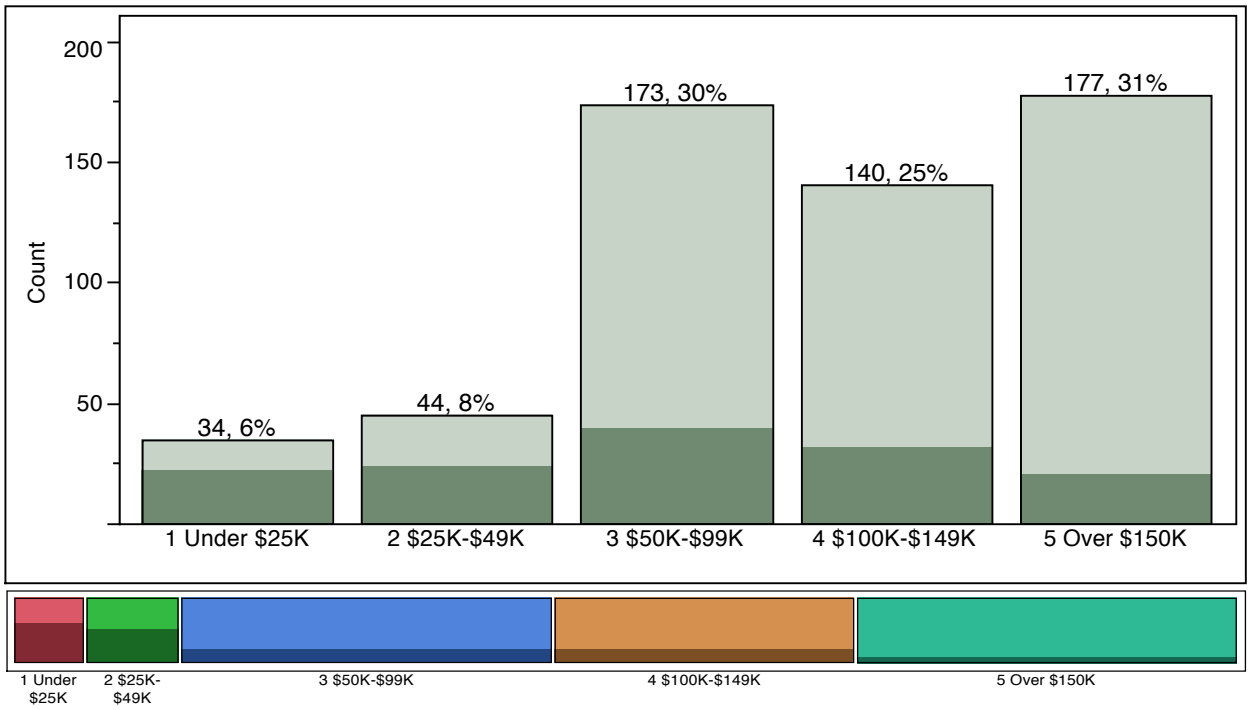
The sample is affluent with almost 90 percent earning at least $50,000 to over $150,000. Only ¼ has experienced one or more years of poverty in their lifetime. Two-thirds are employed full-time, and almost 80 percent are married or living with a partner. Over 90 percent have graduated from a university. The mean number of household occupants is just over three, and over half have children living at home. Almost 80 percent of subjects are involved in the community, stating belonging to one or more local organization. Almost half state political affiliation of Democrat, one-third Independent, 13 percent Republican, and eight percent miscellaneous. About half consider themselves moderately to strongly liberal, 30 percent in the middle, and almost 20 percent moderately to strongly conservative. The socio-economic characteristic detailed findings follow.

The N2N sample exhibits the following yearly income statistics:

- One-third earn over $150K,
- One-quarter earn between $100K and $150K,
- One-third earn between $50K and $99K (*i.e.,* 29 percent), and
- Twelve percent earn under $50K with five percent of these under $25K.

In addition, one-fourth of respondents say they have experienced poverty for at least one year in their life, with higher proportion in the lower income brackets.[15] For instance, Figure 23 shows the distribution of those that have lived in poverty for at least one year in dark green with those that have not in lighter green. The bottom part of Figure 24 is a graphical representation of the two-way frequency, or contingency table, of household income and poverty. The width of the bars is the number of responses for that category. The lighter shading again represents those not living in poverty for a year, while the darker have. Lower income brackets (under $50K) have a higher percentage of subjects and the higher income brackets (over $50K) categories contain a proportionately smaller number that have lived in poverty for one year.

Figure 23 Survey Household Income by Poverty (Poverty = Yes is dark green)



Related to income, we collected statistics on employment levels (Table 36), where

- Two-thirds are employed full-time or part-time (*n*=391), and
- One-third are retired, student, homemaker, temporarily unemployed, or other (*n*=189)

[15] Question wording from Charles Murray, Coming Apart: "Have you ever lived for at least a year in the United States at a family income that was close to or below the poverty line? You may answer "yes" if your family income then was below $30,000 in 2010 dollars. Graduate school doesn't count. Living unemployed with your family after college doesn't count." (Murray, 2012) This question was included because I suspected that, like me, people that had experienced poverty at one time in their lives paid more attention to conservation actions, including not wasting money or energy. In addition, my parents charged me a nickel of my allowance if I got caught leaving the lights on in early childhood. I formed lifetime habits and intrinsic motivation to reduce waste around my own household.

Table 36 Employment Levels

			Respondent Employed?	
Employment Level	**Count**	**Percent**	**Yes**	**No/Other**
Full Time	314	53.6%	314	
Part Time	77	13.1%	77	
Retired	98	16.7%		98
Student	5	0.9%		5
Homemaker	50	8.5%		50
Temporarily Unemployed	20	3.4%		20
Other	16	2.7%		16
Missing	6	1.0%		
Total	**586**	**100.0%**	**391**	**189**

Almost 80 percent of respondents are married or living in co-habitation, and 11 percent are separated or divorced. Unfortunately, without partner information, the picture of discretionary income and time is incomplete.

Shown in Table 37, women were more likely to respond to the survey than men (53 and 46 percent, respectively).

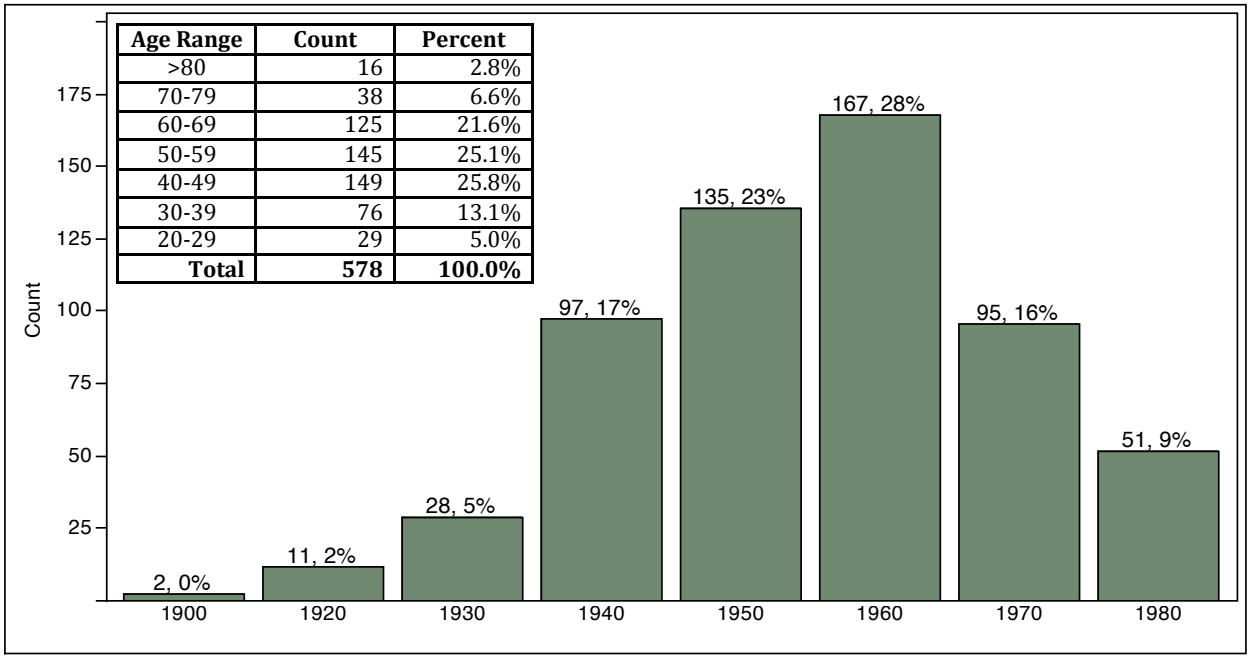
Table 37 Gender of Survey Respondents

Female	311	53%
Male	269	46%
Missing	6	1%
Total	**586**	**100%**

We also tracked the age of respondents in Figure 24, where:

- Over half of survey respondents were between ages 40 and 59,
- One-third are over age 60 (*i.e.*, 31 percent), and
- About 18 percent are age 39 or younger.

Figure 24 Age Statistics



- The N2N sample is a well-educated group (Table 38), where:

- Over 90 percent have graduated from college (*n*=525), including
  - 41 percent with undergraduate degrees (*n*=238),
  - 36 percent with Master's degrees (*n*=210), and
  - 12 percent with doctoral or medical degrees(*n*=75); and

- About 10 percent have high school or equivalent degrees, some college, or graduated from a two-year technical school (*n*=61).

Table 38 Education Levels

Education Level	**Count**	**Percent**
High School or Equivalent	19	3.2%
Technical College (2 Year)	6	1.0%
Some College	36	6.1%
College Degree (4 Years)	238	40.6%
Master's Degree (MS)	210	35.8%
Doctoral Degree	28	4.8%
Prof. Degree (MD, JD, *etc.*)	43	7.3%
Missing	6	1.0%
Total	**586**	**100.0%**

The mean number of household occupants is just over three, where:

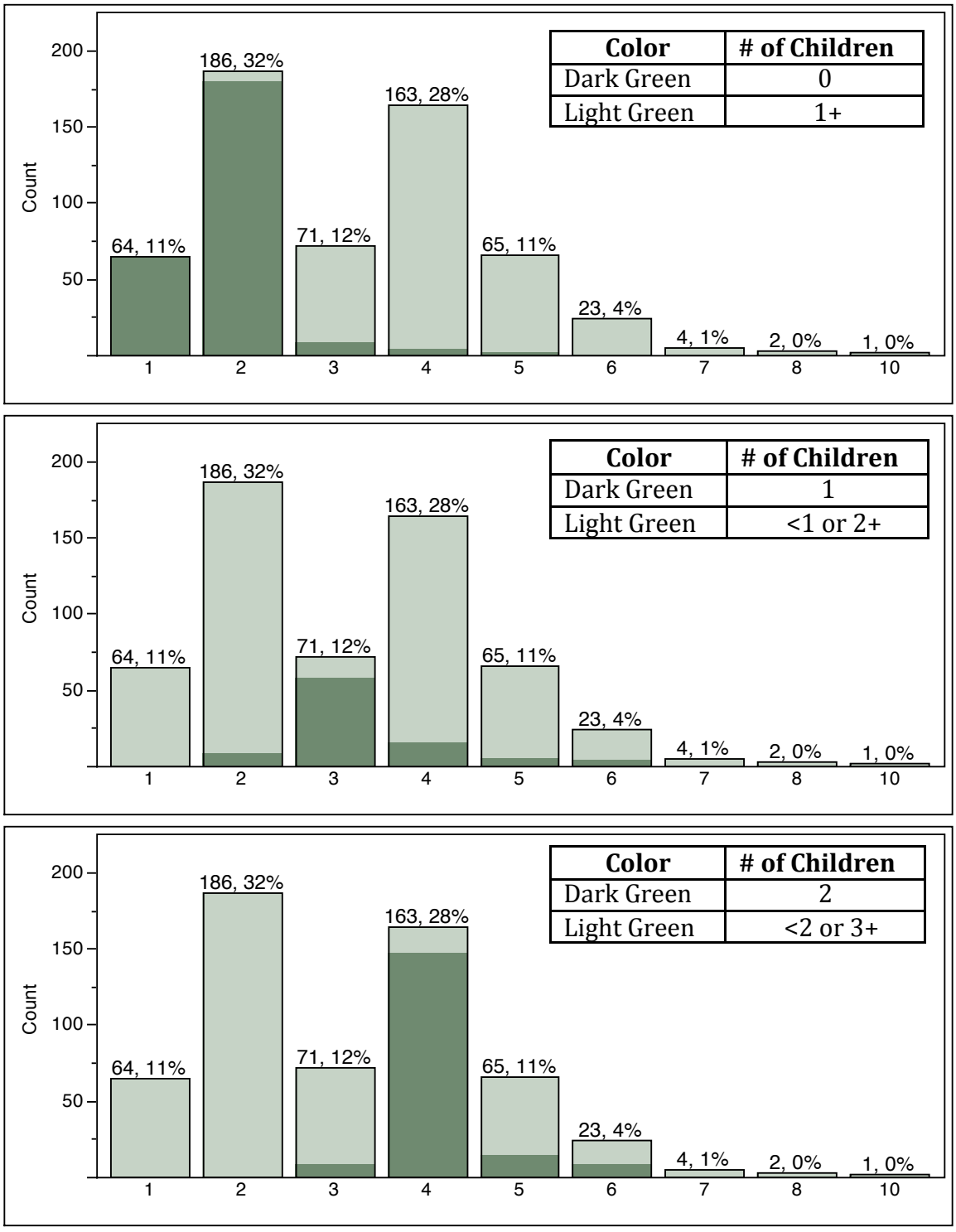
- Forty-three percent have two or fewer occupants (*n*=250),

- Twelve percent have three occupants (*n*=71), and
- About 44 percent have four or more occupants (*n*=258);
- About half of the homes have children under age 18 (47 percent, *n*=306), including
    - Thirteen percent with one child (*n*=78),
    - One-quarter with two children (*n*=145), and
    - Nine percent with three or more children (*n*=50); and
- About 13 percent of households have one child over 18 living at home (*n*=76), and less than five percent have two or more (*n*=22); and
- Fifty-six percent have one or more children of any age living at home (*n*=325, M=1.13 children at home).

Figure 25 also shows three different views of household occupants by number of children, where the dark and light green colors represent subsamples with a legend shown on each graph.[16] Most households with two or fewer occupants do not have children under age 18 living at home, while most households with three or more do. Of those with children, most are working full- or part-time, or are a homemaker, while most retired workers live in households with two or fewer occupants.

[16] For instance, the first graph is dark for those without children under 18, while light green represents those with one or more children (about a 50/50 split). The second graph highlights in dark green those with one child and light green for all other numbers of children. The third graph highlights two children under 18 in dark green.

Figure 25 Household Occupants (Dark Green represents Number of Children)



N2N households seem active in the community (Figure 26),[17] where:

- Approximately one-quarter are involved in one activity (*n*=155),
- One-fifth in two activities (*n*=119), and
- One-third in three or more activities (*n*=184), while
- Twenty-two percent (*n*=128) are not involved in any local organizations.

Figure 26 Local Activities and Organization Participation

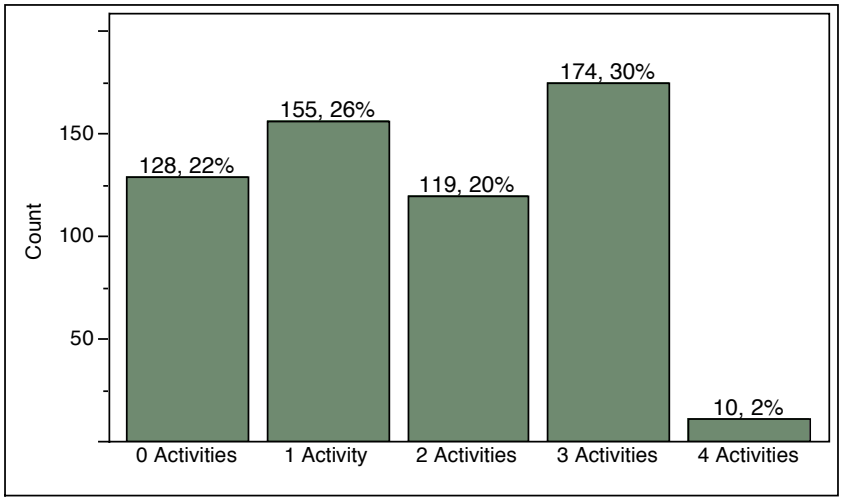


Figure 27 depicts political affiliations by self-rating on a scale from very liberal (0) to very conservative (100). The N2N sample leans left, heavily influenced by Democrats, including the following breakdown:

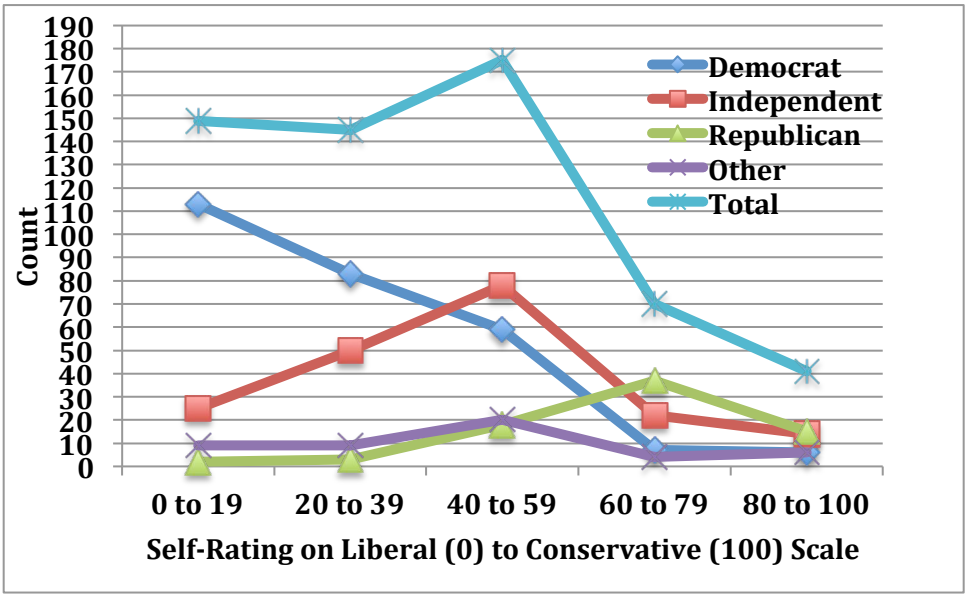
- Democrats: *n*=268 (46 percent),
- Independents: *n*=189, (33 percent),
- Republicans: *n*=75 (13 percent), and
- Miscellaneous political affiliations: *n*=48 (eight percent), such as
    - Libertarian,
    - Green Party,
    - "vote candidate, not party" (fill in the blank text),
    - dismayed, and
    - other.

Political affiliation is generally consistent with how respondents rated themselves on a scale from strongly liberal to strongly moderate, where:

- Half consider themselves moderately to strongly liberal (0 to 39) (*n*=294),
- Thirty percent rate themselves in the middle (40 to 59) (*n*=175), and
- Nineteen percent rate themselves in the moderately to strongly conservative (60 to 100) (*n*=111).

[17] The question asked respondents to select involvement in activities, such as volunteering, contributing money, and attending local events, such as meetings or sporting events. Several people indicated attending church in the "other" open text.

Figure 27 Political Affiliation by Self-Rating Liberal to Conservative Scale



The household's characteristics, attitudes, and actions about energy use are discussed next.

H.2.2 Housing Buy or Sell Mindset

I explored a respondent's ability to imagine if they are in the situation of buying or selling a home. Since memory is stronger for recent events than distant events, the intention was to better understand how effectively subjects could imagine they were in the market to buy or sell their house. I used six household tenure questions, including how long the participant has lived and planned to live, and details about their experience and timeframe with selling or buying their home.

While most subjects are staying put in their current home, there is still a substantial number of subjects changing homes. For instance, about half of subjects have lived in their home over 10 years, with about one-quarter for over 18 years. Three-quarters of subjects plan to stay in their home for more than five years, and 20 percent for less than five years. Most survey respondents have no plan to buy or sell a home, with less than three percent planning to move in the next year.

Figure 28 depicts how long people have been in their home (blue) and how long people plan to stay in their current home (red).

Figure 29 depicts four questions related to home purchases and sales for subjects, including the last and next time people plan to buy and sell their home.

Figure 28 Household Tenure: Years in House and Years Plan to Stay in House

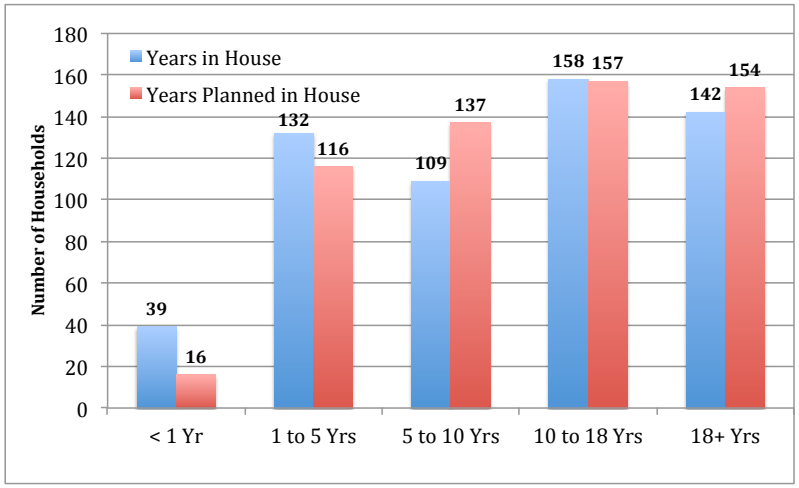
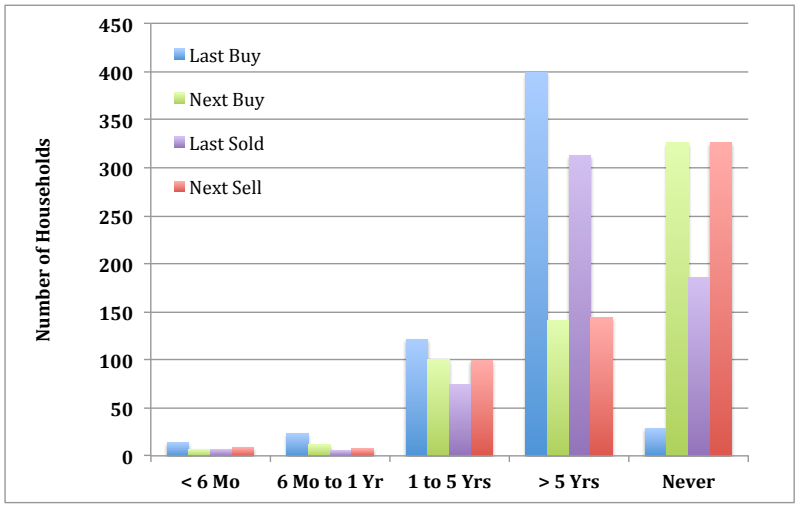


Figure 29 Household Tenure: Length of Turnover Periods



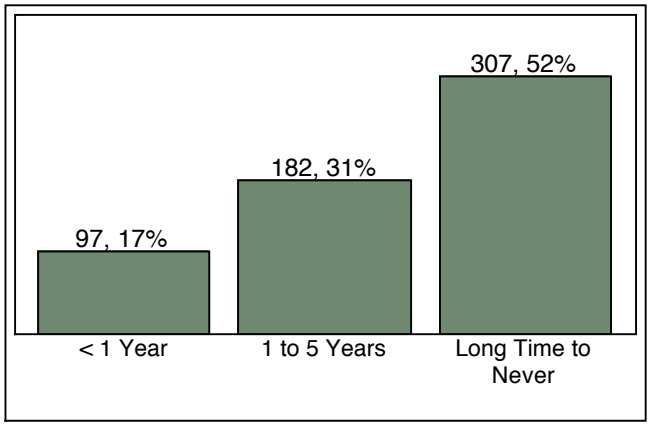
The respondents exhibited the following specific household tenure-related characteristics:

- About 50 percent have lived in their home over 10 years, with half living there for more than 18 years.
- Twenty-two percent have moved into their current home in the last 1 to 5 years (*n*=132), while 6.7 percent have moved in the last year (*n*=39 with all but two buying the home).
- Less than three percent plan to move in the next year (*n*=16).
- About four percent of respondents work in or are closely affiliated with the real estate industry (*n*=23).
- Respondents plan to stay in their home long-term, with:
    - Three-quarters plan to stay in their current home for more than 5 years (*n*=448), and 20 percent plan to stay for 1 to 5 years (*n*=116).
    - Over 50 percent planning more than 10 years, and half of those planning more than 18 years.

    - Almost 50 percent evenly split between both living and planning to live in a home for one to five and five to 10 years, respectively.
- Most survey respondents have no plans to buy or sell a home (94 percent).

Figure 30 combines the six buy/sell mindset answers, where 17 percent of respondents have either (*n*=97): 1) bought and/or sold a home less than a year ago, or 2) planned to buy or sell in the next year.[18] Almost one-third have bought or sold, or plan to buy or sell within one to five years (*n*=182, 31 percent), and over half have no plans or haven't done so in more than five years (*n*=307, 52 percent).

Figure 30 How Recently or Soon in the Market to Buy or Sell a Home



H.2.3 Household Characteristics Related to Energy Use

Most N2N survey sample households live in a suburban area (*n*=403, 69 percent), while 27 percent live rural (*n*=150), and less than five percent live in an urban area (*n*=27). Given that over half are employed full-time, it is reasonable to assume an automobile commute to work for many full-time workers. Most survey respondents own their homes (*n*=542, 92 percent) and live in a detached single-family home (*n*=511, 87 percent) (Figure 31). Six percent live in an attached single–family home (*n*=36), and almost six percent live in a multi-family building split evenly between owners and renters (*n*=31).

Figure 31 Housing Types

Housing Type	Count	Percent
Single-family Detached	511	87.2%
Single-family Attached	36	6.1%
Multi-family 2 to 4 Units	15	2.6%
Multi-family 5+ Units	16	2.7%
Mobile Home	2	0.3%
Missing	6	1.0%
Total	**586**	**100.0%**

[18] This first group of buy/sell mindset could be considered those most likely able to imagine purchasing or selling the example home. Analysis found no significant difference between the three buy/sell mindsets in WTP dependent variables.

We asked a few questions related to the household's attitude towards energy use, such as conservation habits, comfort levels, energy costs, and home repairs. Almost all respondents answered that either everyone (*n*=286, 49 percent) or some (*n*=268, 46 percent) in their household try to conserve energy. Only one percent said that nobody tried to conserve energy (*n*=6). Most respondents felt that their home was comfortable (*n*=482, 83 percent), with seven percent unable to stay comfortable in the home (*n*=45), and another nine percent unable to stay comfortable either in the summer or winter (*n*=52).

Almost half of subjects feel their energy costs are reasonable (*n*=286, 49 percent), while 42 percent think their energy costs were high (*n*=247), and eight percent believe they pay low energy costs (*n*=46). Table 39 depicts comfort levels and energy costs together, where 43 percent are able to maintain household comfort with reasonable energy costs (*n*=250) and 32 percent with high energy bills (*n*=189). The 17 percent unable to stay comfortable in the home (*n*=97) breaks down into 10 percent with high (*n*=58), six percent with reasonable costs (*n*=36), and 0.5 percent with low energy costs (*n*=3).

Table 39 Energy Costs by Household Comfort

	High		**Reasonable**		**Low**		**Total**	
	n	**% of Total**	***n***	**% of Total**	***n***	**% of Total**	***n***	**% of Total**
Not Comfortable	58	10.0%	36	6.2%	3	0.5%	97	16.8%
Comfortable	189	32.6%	250	43.2%	43	7.4%	482	83.2%
	247	42.66%	286	49.4%	46	7.9%	579	

Table 40 takes a second view to household comfort, comparing comfort by the N2N upgrade actions taken in the home. Those without a HES assessment are less likely to report a comfortable household (74 percent) than those that have completed a HES assessment (85 percent) or an upgrade (on top of a HES assessment) (78 percent).

Table 40 Reported Household Comfort by N2N Action

Completed N2N Actions	**Count Uncomfortable**	**Count Comfortable**	**Percent Comfortable**
No HES assessment	52	203	74.4%
One HES assessment	43	277	84.5%
Two HES assessments	2	2	50.0%
One Upgrade	13	59	78.0%
Two Upgrades	0	2	100.0%

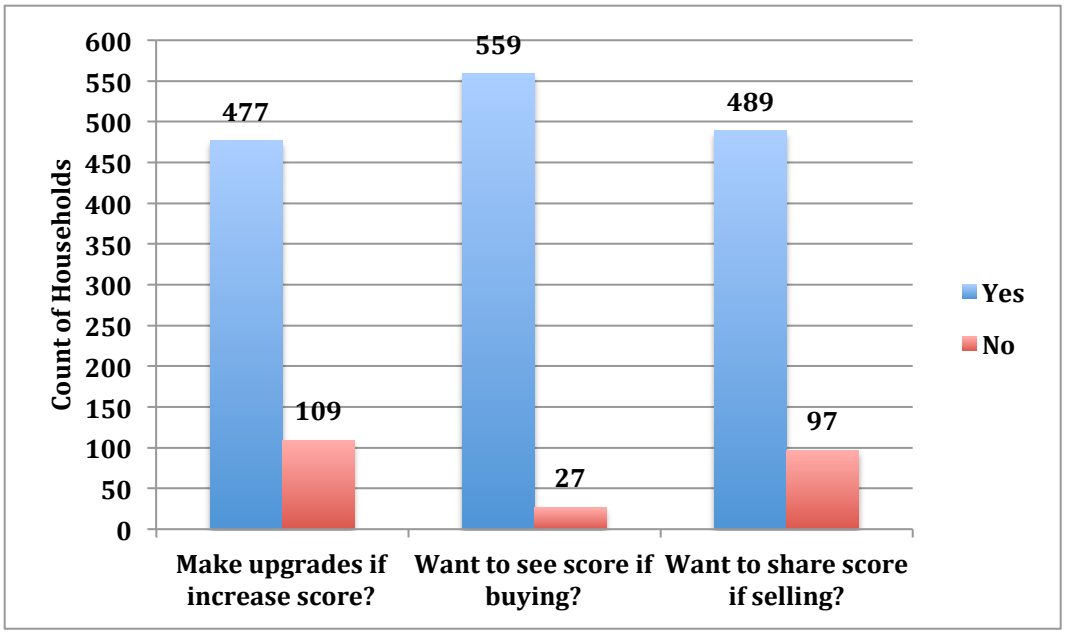
About 60 percent of respondents said they handled repairs themselves that require a ladder and tools (*n*=345), while 40 percent hire a handyman or contractor (*n*=241). By commenting in the open text questions, several respondents emphasized the fact that they themselves, a family member or friend, a superintendent or homeowner's association, or church member would complete repairs for the family.

H.2.4 Attitude about Increasing the Home's Energy Score

Most respondents felt that increasing the HEScore would motivate home energy upgrades (81 percent), would be interested in seeing the score for a home they were purchasing (95

percent), and would be interested in sharing the score for a home they were selling (83 percent). Figure 32, depicts the three questions used to understand how subjects responded to the home energy score.

Figure 32 Respondent's Attitudes Towards the Home Energy Score



Money was the most common reason for supporting or disagreeing with the effectiveness of the HEScore, such as save money on utility bills, increase or decrease home value, understand home value, too costly to implement, projecting costs of utilities and household ownership. Other supporting reasons were to save energy, support the environment, improve household comfort, increase knowledge to enable action, and increase home's comfort. Other disagreeing reasons were distrust, lack of need, slow down house sell, apathy, and privacy issues. The findings are discussed in detail next.

After respondents reviewed the report and answered all of the WTP questions, three questions measured how the subject responded to the HEScore, [19] including:

- Would increasing the score cause you to make upgrades? (*i.e.,* yes=477, no=109)
- Would you want to see the score of a home that you're buying? (*i.e.,* yes=559, no=27)
- Would you share your home's score if you were selling? (*i.e.,* yes=489, no=97)

For instance, eighty-one percent of N2N respondents said that increasing their score from 4 to 9 would make a difference in their home upgrades for the following reasons (*n*=477):

- Save money on utility bills;
- Save energy;

[19] Note: Kristen Bremer of Duke University led the categorical analysis for questions. About 40 percent of people didn't fill in the text on these questions because it was not a forced response. For each question, there are a small number of unsure, blank, and nonsensical answers.

- Good for the environment or other conservation reasons;
- Improve comfort;
- Value add or increase home price;
- Increase knowledge or know what to improve; and
- Other reason (*e.g.,* improve home's safety or fix a problem, sell the house quicker, should be opt-in depending on party's interests, *etc.*)

Eighteen percent said increasing the score would not make a difference (*n*=109) for the following reasons:

- Affordability or too costly to implement in current economy;
- Not necessary;
- Improvements already made or it's a new home;
- Don't care;
- Distrust the scoring (*e.g.,* "if it were scientific", "another rip off by the crooks");
- Moving and/or selling home soon (*e.g.,* will sell house slower); and
- Other reason (*e.g.,* privacy issues).

In addition, over 95 percent said they would be interested in seeing the score if they were buying a home (*n*=559) to:

- Project costs of utilities and ownership;[20]
- Better understand the home's energy and efficiency levels;
- Achieve environmental or conservation goals;
- Understand household's comfort levels;
- Better determine the value of the home; and
- Understand home energy performance and learn what needs improvement.

The five percent not interested in seeing the score of a home they were interested in buying (*n*=27) gave similar reasons as the previous question, such as: too costly; not necessary; won't affect home purchase decision; don't care; distrust the scoring; and can find out the information in other ways.

About 83 percent of respondents said they would be interested in sharing their home's score if they were selling (*n*=489) for the following reasons:

- So the buyer would know the costs of ownership;
- So buyer can see the home's energy efficiency;
- Environmental or conservation reasons;
- Pride or so buyer can see they took care of the house and/or made improvements;
- Selling point or to get more for the house;
- Buyer knowledge or so buyer can see what needs improvement; and
- Only if the score is high.

[20] Although the HEScore and report does not explicitly help homeowners figure out utility costs, subjects believed that it could give them a ballpark answer. I'm not convinced it can, further supporting the case for energy bill disclosure policies to provide consumers with a metric that they can relate to and/or understand.

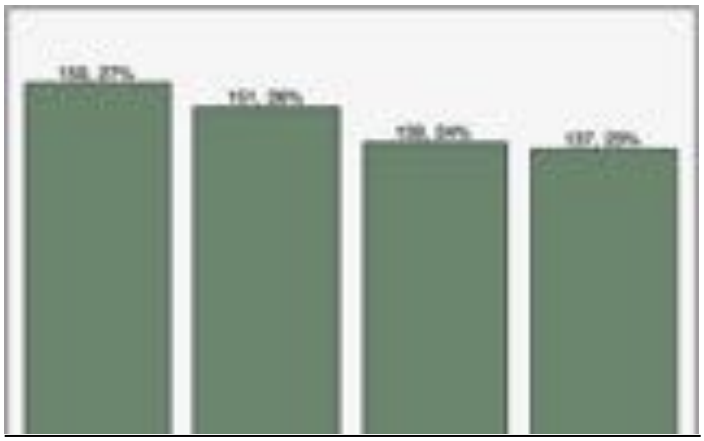
The 17 percent not wanting to share their score (*n*=97) noted reasons similar to the two no answers above, including affordability, don't care, and distrust the score. In addition, respondents were concerned that it might affect the resale value of home, be a low score, and that it's no one's business or not the seller's responsibility. Some respondents indicated shame in showing a low score.

Appendix H.3 Respondent Reactions to the Survey

Prior to administering the survey, we understood that the complexity of: the stated Willingness to Pay (WTP) survey, the report, and the subject, in general. For instance, during the survey, we asked people to pay close attention to the report and calculate WTP values, which both required cognitive energy (*e.g.*, effort) to complete. In fact, after taking numerous practice survey runs ourselves, we believed answering the survey would feel like work for most people. Consequently, we added the $250 Amazon.com gift certificate raffle entry for completing the survey. We mentioned the raffle in the survey email invitation and in the survey instructions (*i.e.,* the first screen of the survey). We stated that 10 winners would be selected from those that "pay attention to the upcoming home energy report and finish the entire 20-minute survey". We hoped that reading these instructions would cause subjects that continue on to make a commitment to pay attention and answer thoughtfully. In return, we offered them the chance for a large reward.[21]

Illustrating the complexity of the report, Figure 33 illustrates question drop-off rates that show a pattern of more survey drops off with more complex reports. The Control survey (no report) (*n*=159) received almost 14 percent and 13 percent more completed surveys, respectively, over the four-page Detailed (*n*=137) and two-page Basic (*n*=139) report versions.

Figure 33 CT Survey Responses by Home Energy Score Report Type



Report Type:	**Control**	**HEScore Only**	**Basic**	**Detailed**
Report Length:	**(No Report)**	**(1 Page)**	**(2 Pages)**	**(4 Pages)**

***N*=586**

To properly analyze the survey, it was important to explore WTP means and differences according to answers and reactions to several research questions and the survey in general. Given how much can be gleaned from "Listening to the Voice of the Consumer" (Chapter 3), we ran

[21]Raffles can be motivating rewards because people overestimate their chance of winning, and we believed $250 to be an especially attractive prize. Readers interested in learning more about commitments and raffles, please refer to Chapter 2.

content analysis on the open text responses. In addition, I personally answered each email from survey participants that wrote mostly because they were emotionally charged up in some way by the survey.

In fact, the survey incited a love or hate feeling in many people. Subjects often emailed in a somewhat aggravated manner to tell us that they had abandoned the survey for any number of reasons. For example, see Box 1 below. These same people usually softened up after receiving a personal reply from me that acknowledged their experience and assured them that the research was legitimate. Others appreciated the subject matter and the survey complexity, or expressed feeling good about taking it or relating to the subject. Some poked light-hearted fun at the encouraging words throughout the survey ("You're almost finished", *etc.*).[22] Respondents also left both positive and critical survey design comments, as well as appreciation and abhor that someone cared about and was working on the topic. We saw acceptance of and rejection of the validity of the report, and even that "MIT needs to get a team. Go Blue Devils".

Most likely a result of the survey and topic complexity, the subjects that did complete the survey are often already interested in energy, which we can measure with their participation levels in N2N. Perhaps unsurprisingly, completing more expensive and complicated energy efficiency actions in the home increases the likelihood of completing this survey. For instance, at the time, the N2N mailing list contained about 180 households that had completed a home energy upgrade out of about 5,300 (3.4 percent). However, 72 of the survey responses completed a home energy upgrade out of 586 completed responses (12.3 percent). In addition, almost 40 percent of N2N participants that have completed an upgrade completed the HEScore survey, an extremely high survey response rate.

Box 1. Respondent Survey Reaction

Researcher note: Although this is admittedly one of the more extreme responses, it is a fun example that illustrates just how much emotion the survey incited in many people from the survey design to the survey software to the unexpected (and varied) customer barriers to adoption. The respondent is referring to the slider versions of the question (the third time they were asked the same question). To select "$0", one had to click on the most right-hand side of the slider. Others also found this unfriendly.

"This survey is poor. I started then abounded [abandoned] it

1. The whole page does not fit on the screen.
2. Asks some of the questions repeatedly, is this a psychological game.

As a point, it asks the power strip and timer question. Well, I would not spend a dime on one. It does not let me answer 0 in one of the questions and asks the same question about 3 times. Why. I would not spend a dime, because I had one and I had a cat. The cat was sick and had an accident on one and it caught fire. So, it's a safety issue.

A similar car question comes up. I again would spend $0 dollars and it's not happy with that answer in one of the version on the questions. Survey needs work."

[22] The survey was designed consistent with approaches to improve survey usability, including progress indicators, multiple screens, and a simple layout, hopefully maximizing survey completions (Dillman, 2007).

Appendix H.4 Indicators of Survey Response Legitimacy

Of the 586 completed responses, there is evidence that participants did take time to respond thoughtfully to the survey. For instance, survey completion time fits a log normal distribution with the median response time at 21 minutes, and the mean at 24 minutes. About 98 percent spent at least 10 minutes on the survey, and about one percent took fewer than five minutes. On the other extreme, about 17 percent of respondents took over 45 minutes to complete the survey, sometimes taking up to 20,000 minutes. We assume these subjects left the survey and came back to it at a later time. There is no way to know at what point they stopped in the survey (*e.g.,* before or after completing the WTP questions) or if they re-reviewed the home energy report before continuing again.

Confidence Indicator. After completing about four-fifths of the survey, including the WTP questions, we asked five questions designed to measure the reliability and validity of the survey responses. In other words, the questions were meant to detect measurement errors in the survey instrument. The first was a slider question anchored at 0% on the left end and 100% on the right end with delineations along the scale at increments of 10 percent, the confidence slider was worded as follows:[23]

> "How confident are you that you have provided an accurate assessment of the amount that you would be willing to spend in real life for the recommended improvements? Please move the slider to the percentage that represents your confidence level."

Only 26 people felt less than 50 percent confident about their response accuracy (< 5 percent) (Figure 34). The mean confidence is 81 percent, with 17 percent stating 100% confidence (*n*=97). Almost three-quarters stated 75 percent or more confidence levels (*n*=440). People may have a tendency to overestimate their confidence. For instance, people usually think about themselves as above average (Alicke & Klotz, 1995). In addition, there may be a psychological minimum grade that people will give themselves and still feel good about their efforts. Rating their confidence between 50 and 79, or below average in the adjusted curve, may indicate that 25 percent of subjects didn't feel good about their ability to imagine the situation, comprehend the report, or they selected dollar amounts for improvements they didn't intend to make (*e.g.,* subjects may have some of the barriers indicated in the open text questions).

[23] As a reminder, the respondent could not click back on the thumbnails of the HEScore report while answering these questions.

Figure 34 CT Respondent Self-rated Confidence Level

Comprehension Questions. The next three questions asked respondents:

1. "How much will your carbon footprint decrease if you make all of the home energy report's recommended improvements?" (Correct=44 percent)
2. What color represents a home that uses the most energy? (Correct=81 percent)
3. What score do your neighbors with similar homes and completed improvements usually get? (Correct=60 percent)

The results are mixed, where almost 30 percent got all three of these questions right, almost 36 percent missed one, 26 percent missed two, and almost nine percent missed all three. Our goal was to use the first and third questions about the carbon footprint and the neighbor's score to measure if the person paid attention to and/or understood the report; one-third of N2N participants answered both questions right, indicating that they did pay close attention to the report (Note: about three percent got the two difficult questions right, but missed the seemingly easier color question.).

Over half of subjects missed the carbon footprint question about the percentage reduction. The footprint information, shown in Figure 35, was on the last page of the report for the Basic and Detailed report versions (*i.e.,* not in a prominent spot). For the HEScore and Control groups, it was not on the report. All respondents saw instruction text that summarized the report, including pointing out that your home is currently wasting energy, as well as the possibility to improve the score from a 4 to a 9 and decrease your carbon footprint by 80% by investing in energy efficiency improvements. It is likely that some people don't pay attention to what may still be an abstract concept, difficult to understand.

Figure 35 HEScore Report Carbon Footprint Information

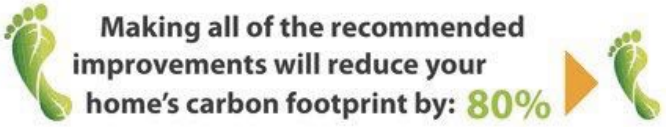


Figure 36 includes the similar neighbor's score in the bottom right hand corner.[24] Only the control group saw instruction text about the similar neighbor's score, because they didn't see a report. Although it seems promising that 60 percent paid attention to a similar neighbor's score, it could be a lucky guess for some because it was the same score as your home with improvements. It could also be that when subjects don't know the correct answer that they answer about their perceived neighbor's score (Kahneman & Knetsch, 1992). A small number selected neighbors with a higher score of 10 (two percent) to lower scores than my HEScore of 4 or 6 (combined 38 percent).

Figure 36 Home Energy Score Scale

The second question about what color represents using more energy was meant to be intuitive and easily answerable if the person paid attention to the report. Still, it is possible that I was hindered by the curse of knowledge, where it was impossible for me to imagine not knowing the answer to this question (Camerer, Lowenstein, & Weber, 1989). I felt that everyone should know that red represents bad and green represents good in terms of a scale. While 80 percent answered this question correctly, a large number got it wrong (110 subjects). Accepting orange as a valid response adds almost two percentage points. The remainder of the subjects split almost evenly between yellow and green.

Attentional Filter. We also asked respondents an "attentional filter" question designed by Dan Ariely to test if people read and pay attention to long, multi-part directions (or not) (Figure 37). In the N2N sample, 65 percent read the directions and responded correctly, while the remaining checked up to nine moods. It was fun to review the words that people chose to describe how they currently felt (and it seemed that it was often used to describe their feelings toward the survey). [25]

[24] Reminder, this graphic is pulled from the center of the first page of the HEScore report.
[25] My favorite was "Attentive" that a few selected, including my husband during a pre-test round. I asked him why he checked it and he said he "felt like he was taking a test and had to pay close attention". Despite

For instance, the open text was sometimes used to criticize the survey design or express subject frustration.

Figure 37 Attentional Filter Question Text

Defining Bad Responses. There is uncertainty if some subjects finished the survey without paying attention, instead working in automated mode. Daniel Kahneman describes this automated brain behavior where part of the brain takes over when one doesn't really want or need to pay attention (Kahneman, 2011).

Although I explored several paying attention metrics, the human decision process is incredibly complicated. I found it impossible to know for sure the validity of each subject's responses. To compensate, I developed a dummy variable, bad responses, combining the attentional filter and number of comprehension questions wrong. I compare different arbitrary thresholds of missing comprehension questions in addition to the attentional filter as a bad response. Both sets of sample data were analyzed, including the entire survey sample, and the sample without the bad responses. The patterns of results were similar; therefore, bad response regression models and results have been excluded from the document.

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getting it wrong, my husband is capable of deciding how much he would pay for insulation in our home with that report. Ultimately, I had trouble interpreting the results of the attentional filter.

Appendix H.5 Survey Measurement Errors

Every effort was made to reduce measurement error, including making the best effort to meet the following:

- Question wording that provides respondents with the necessary information to answer;
- Questions asking for information the respondents have and can retrieve; and
- All respondents understand questions the same (Collins, 2003).

The results indicate potential for survey measurement error. For instance, question wording most likely impacted how different DIY personalities constructed their WTP responses. About two-thirds of the survey subjects prefer to do projects themselves or with a friend or family member when using ladders and tools. Many people responded in open text that they would "not", "never", "prefer not" to hire a contractor for any of the home upgrade actions, indicating mistrust. Yet, this market segment may not have enough information available to them to complete complex home energy upgrade projects themselves.

Specifically, the question wording may have impacted DIY subject's WTP responses when answering about the seven actions in three different ways. That is, I asked all the upgrade questions as if a contractor were going to the work. But, many respondents indicated in open text spaces that they would do the work themselves rather than hiring a handyman. In some cases, I know how they compensated their answer because they indicated it. Others might have assumed that they were doing the work themselves and possibly discounted the price of the upgrade. Others just said no to the energy upgrade. There are likely other ways that people corrected for my error.

During survey pre-testing, we found that the second version of the WTP questions was tedious to people to varying degrees. The matrix nature of this question required that subjects check yes or no 11 times for each of the six questions, which meant a minimum of 12 mouse clicks per page with no mistakes. In fact, numerous respondents dropped off the survey at the second or third yes or no matrix question and most subjects answering the six matrix questions completed the rest of the survey.

In addition, the maximum WTP slider questions were frustrating for some people to answer because they found it difficult to select zero or to land it on an even number, depending on the zoom of the web browser. Although it was indicated in the question directions that one could type the exact WTP number to the right of the slider, there is little evidence that people typed in even numbers. Instead, it appears that most people slid it to an approximate number.

A few people noted the difficulty they had with adding up the separate evaluation questions to come up with a total WTP for their neighbors (*e.g.*, "well, you know, math"). One or two pointed out "errors" in our tax credit maximum since there are "currently higher tax credits available for hybrid vehicles". Several people noted that they had "no idea what" or "trouble figuring out" what their neighbors would pay, and expressed different emotions from being perplexed about how to figure it out to a general annoyance at the task.

On the other hand, we were pleasantly surprised to receive rich text answers, indicating that despite all that we put them through with the survey, the early adopter market, at least, is interested in taking the time to let us know their viewpoints on energy, as well as the HEScore and accompanying home energy report.

Appendix I Regression Modeling of WTP Variables

Appendix I.1 Separate Evaluation and Joint Evaluation WTP Variables

1. SE DIY Actions;
2. SE Whole House Energy Actions;
3. SE An Energy Efficient Automobile;
4. SE Tax Credit;
5. SE Neighbor's WTP to improve score; and
6. SE Neighbor's WTP to improve score, if the score is public.

1) People are willing to pay more than the average cost for small DIY actions, including replacing CFLs and installing smart outlets and power strips

Table 41 DIY Mean Differences for Different WTP Calculation Methodologies

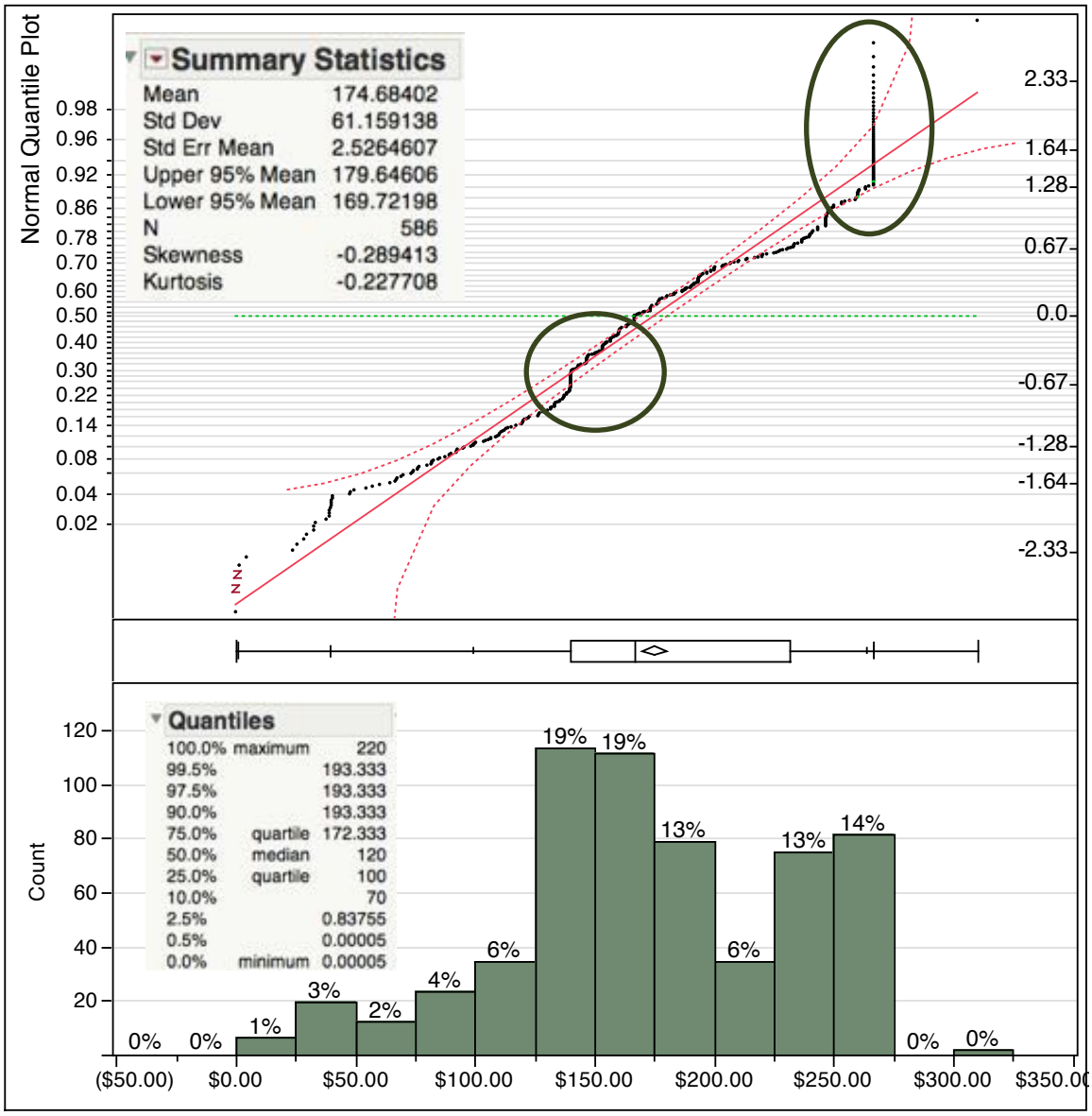
WTP Variable Comparison	Mean Difference	p-Value
Maximum CFLs – CFLs Cost	$53	0.0000 (Significant)
Table of CFL prices – CFLs Cost	$46	0.0000 (Significant)
Maximum Outlets – Outlets Cost	$22	0.0000 (Significant)
Table of Outlet prices – Outlets Cost	$17	0.0000 (Significant)
Maximum DIY – DIY Cost	$75	0.0000 (Significant)
Table of DIY prices – DIY Cost	$63	0.0000 (Significant)

Table 42 Percent WTP +/- for CFLs ($100), Outlets ($40), and DIY ($140)

Percentile	Maximum CFLs – CFLs Cost	Table of CFL prices – CFLs Cost	Maximum Outlets – Outlets Cost	Table of Outlet prices – Outlets Cost	Maximum DIY – DIY Cost	Table of DIY prices – DIY Cost
10	-$18	-$10	-$5	-$10	-$12	-$20
20	$0	$0	$0	$0	$0	$0
30	$0	$0	$0	$0	$8	$10
40	$11	$20	$10	$0	$21	$20
50	$20	$20	$10	$10	$35	$40
60	$40	$40	$20	$10	$53	$60
70	$60	$60	$21	$20	$78	$75
80	$81	$80	$40	$40	$116	$100
90	$139	$120	$60	$40	$180	$160

The average WTP for DIY actions (*e.g.*, CFLs and smart outlets) is skewed to the right and shows that about one-third of subjects are in fact willing to pay $200 (*i.e.*, over 50% higher than the average cost anchor of $140) Figure 38. CFLs have a proportionately higher influence on the distribution that also exhibits two main clusters of responses (circled below).

Figure 38 Distribution of Average WTP for DIY Energy Actions

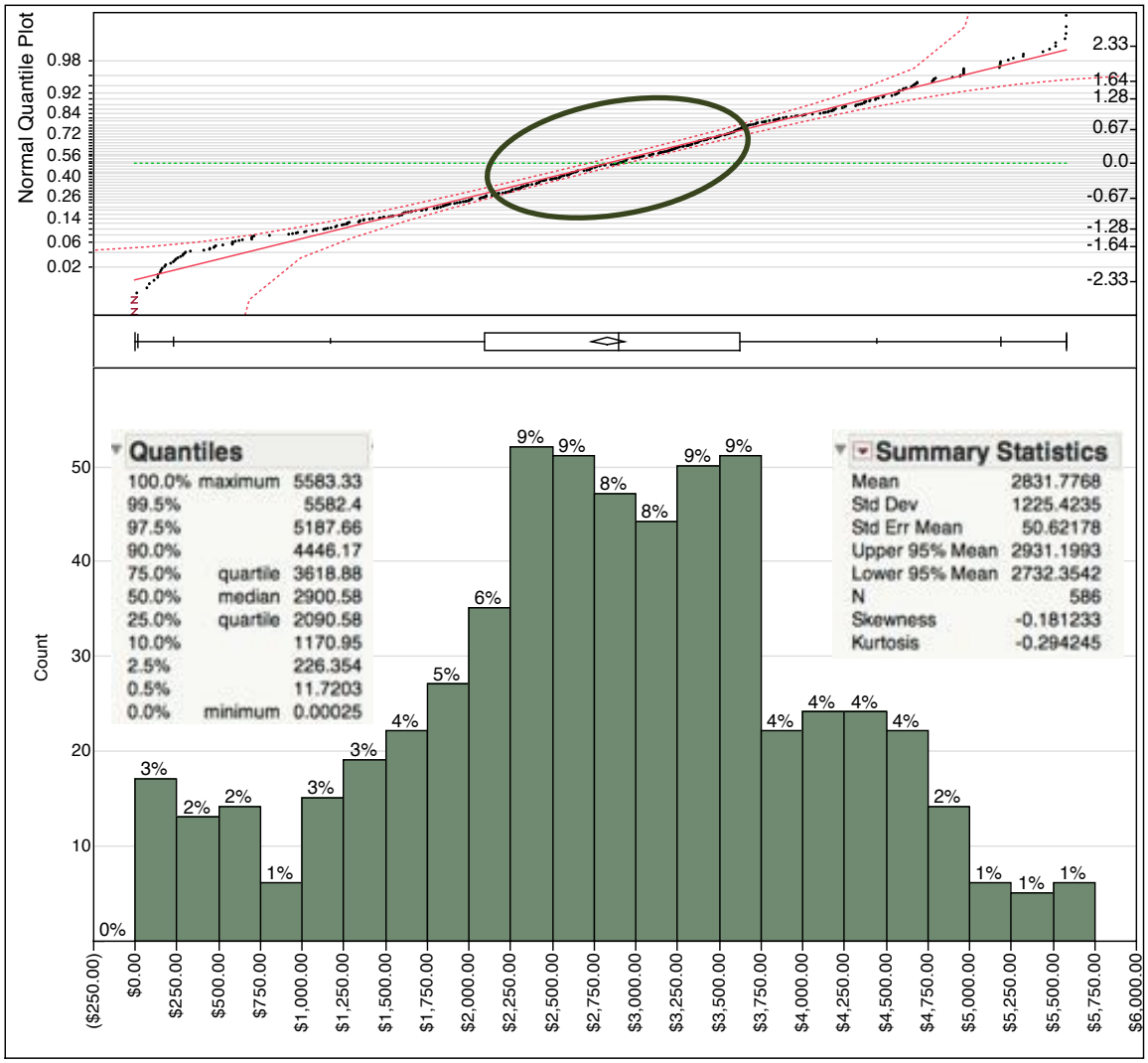


The first cluster starts just below the average ($125) peaks just above the average ($150) and slows down around $166 (*n*=205, 35 percent). The second cluster begins at $220 and goes up to $266 for 22.5 percent of subjects (*n*=132). The highest WTP for CFLs and outlets was $310 for one person from a maximum available response of $360. The most common answers were the average of $140 and a higher maximum of $267. In fact, almost 40 percent of subjects have upgraded their household lighting through N2N lighting and/or HES assessments. Others have likely updated their lighting or added outlet control on their own, although the survey does not collect this data.

2) People are willing to pay less than the average cost for upgrade actions, including attic insulation, duct sealing, and advanced air sealing.

The average WTP for the attic insulation, and duct and air sealing home energy upgrade is examined (within the distribution of the whole house actions without automobile average WTP (Figure 39)). Only 3 subjects (< 1 percent) stated no WTP for any home or automobile upgrades. Most respondents are willing to pay over $1,000 for an upgrade (*n*= 535, 91 percent). Upgrade actions have a proportionately higher influence on the whole house actions average WTP. Some subjects will pay a small amount for each action, and others will pay for one upgrade such as attic insulation, but not other upgrades. In a few cases, the values are spread thinly across the actions indicating a small WTP for any one action.

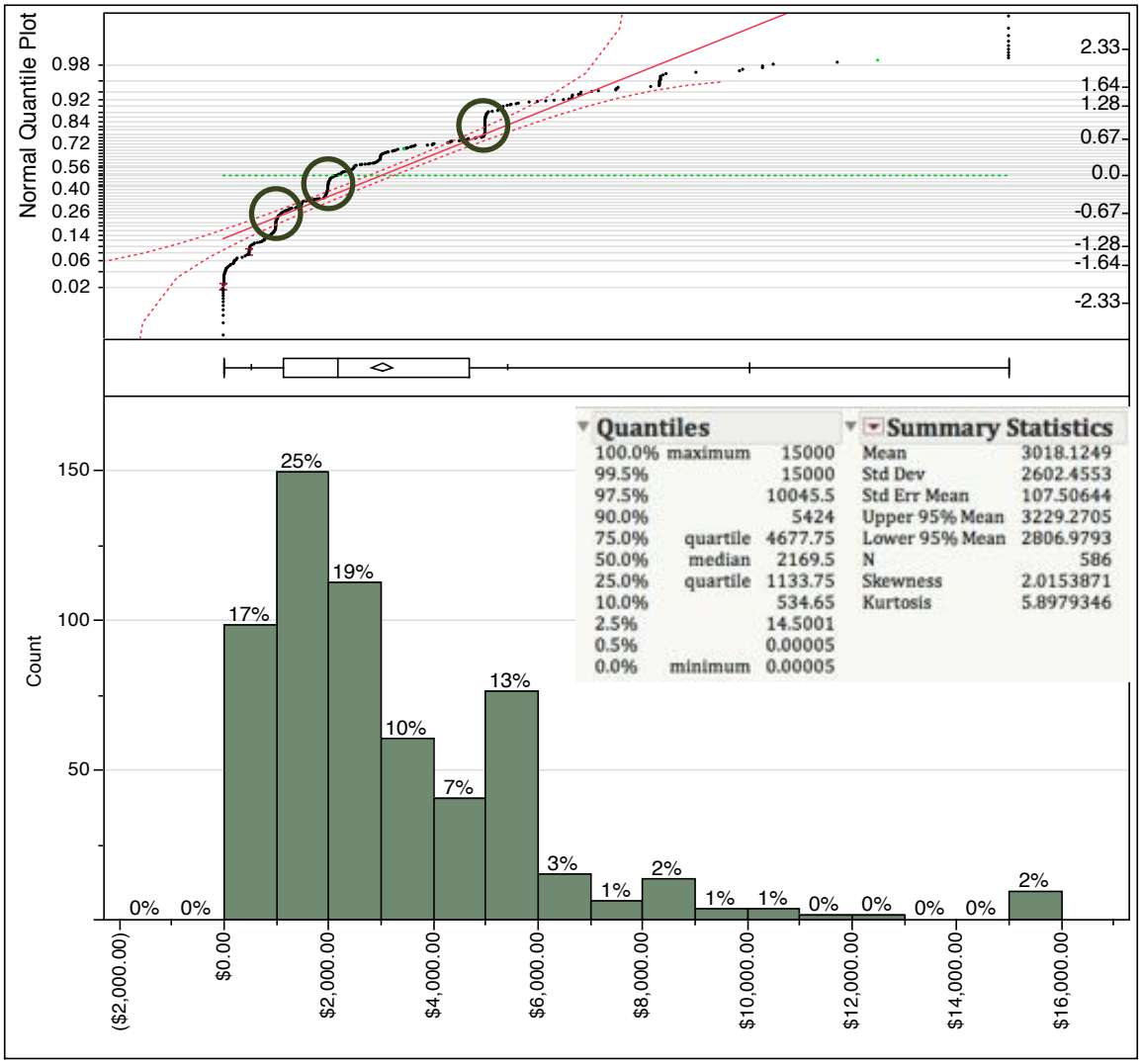
Figure 39 Distribution of Average WTP for House Actions (No Auto)



The average WTP distribution for an efficient automobile exhibits significant kurtosis, resulting in a higher peak than a normal curve Figure 40. Most respondents are willing to pay over $1,000 for an energy efficient automobile (*n*= 496, 85 percent). Twelve subjects state WTP of $0 for an automobile, but would pay between $1,143 and $4,239 for energy actions. Another twelve would pay less than $87 for a more efficient automobile, but over $260 and $4,404 for house upgrades. Twenty respondents state they will pay between $100 and less than $500 for an efficient automobile, with a range of house actions WTP amounts between $0 and $3,679, with most

willing to pay over $700 for home energy upgrades. About half of subject would pay $2200 extra for a more efficient auto, and almost one-quarter would pay $5,000 or more.

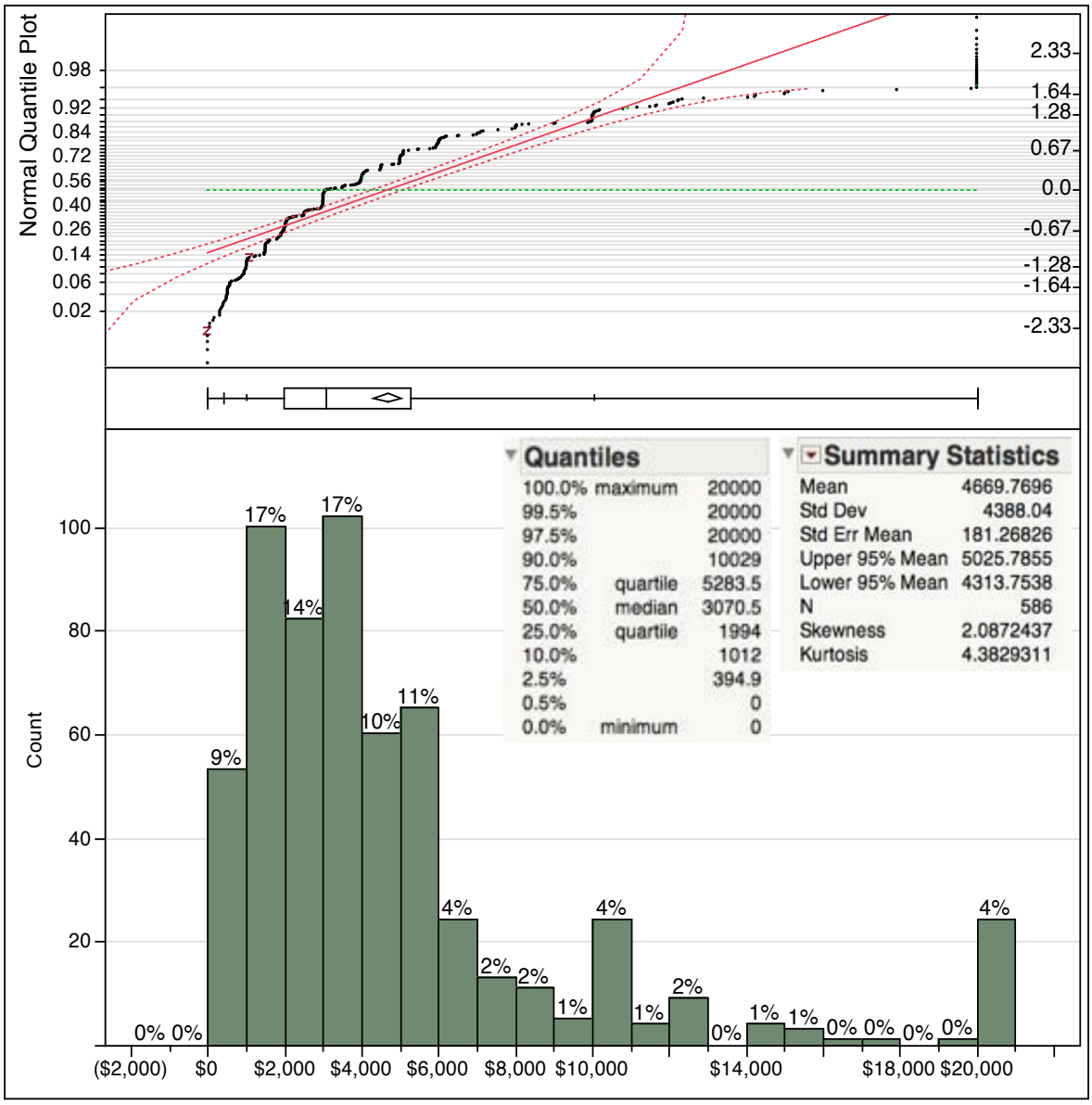
Figure 40 Distribution of Average WTP for an Efficient Automobile



The survey majority is willing to pay for all five home energy actions, in addition to a more efficient automobile. About 25 percent are willing to pay the average cost or more for all five actions and a more efficient automobile (*n*=157, 26.7 percent). The distribution exhibits a positive kurtosis, indicating a flatter curve than normal. This is shown in the cluster of WTP values around the middle, between $2,000 and $3,750 (*n*=328, 56 percent).

When offered a $1,500 tax credit and asked to state the maximum they would be willing to pay for all the improvements, five subjects stated $0, two stated approximately $50, and 16 stated between $145 and $500 (almost four percent total) (Figure 41).

Figure 41 Distribution of Maximum WTP for All Actions with a $1,500 Tax Credit

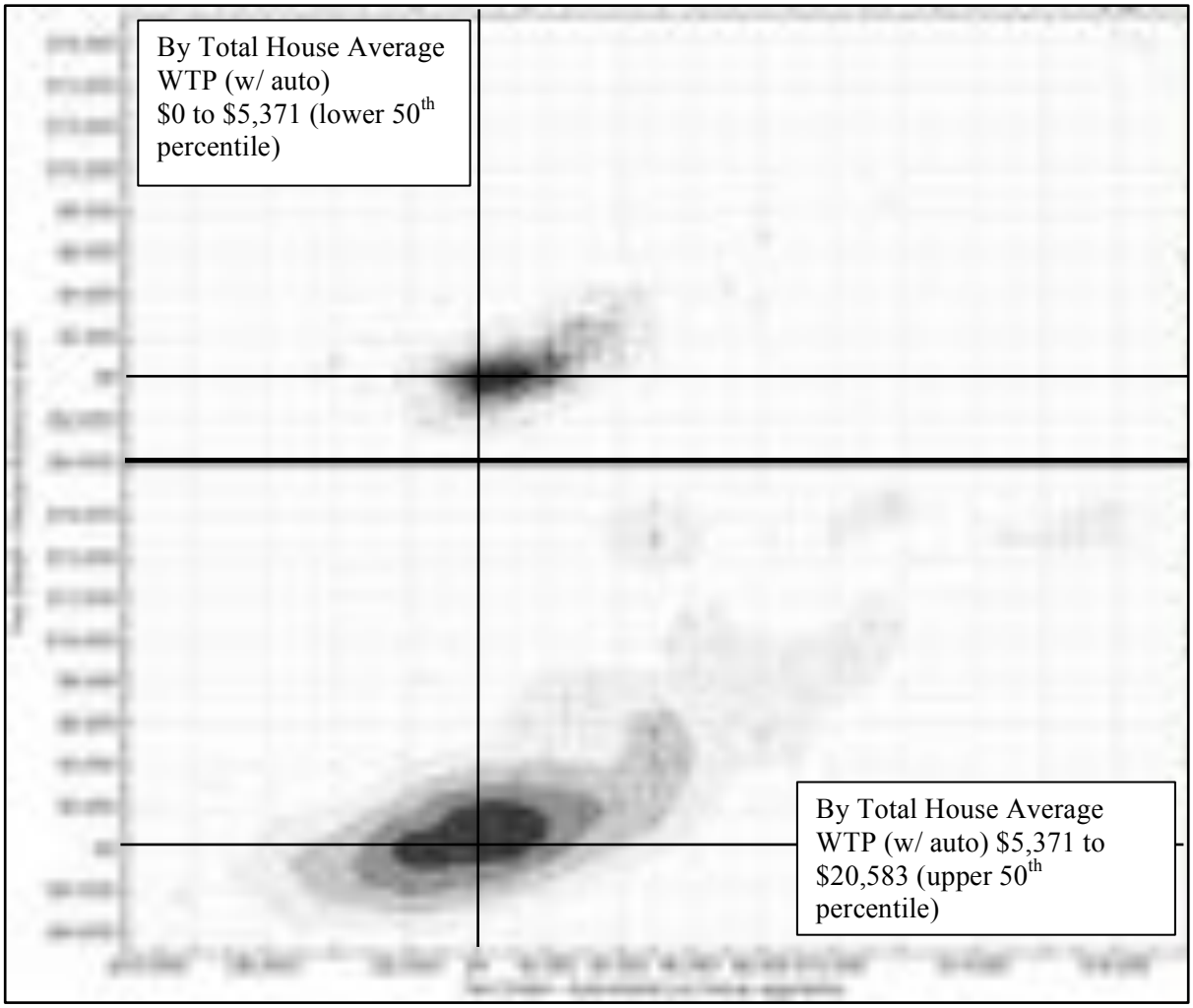


With a tax credit, almost 10 percent of subjects stated a WTP between $500 and $1,000 (within +/- 10 percent) (*n*=52). Another 37 respondents stated $1,500 WTP (within +/- 10 percent) (about six percent). Another cluster exists, where 74 subjects state $2,000 WTP (within +/- 10 percent) (13 percent of subjects), as well as around $3,000 where 81 subjects state WTP within +/- 10 percent (14 percent of subjects). Three slightly smaller clusters exist at $4,000, where 63 subjects state WTP within +/- 10 percent (11 percent of subjects), $5,000, where 56 subjects state WTP within +/- 10 percent (10 percent of subjects), and $6,000, where 35 subjects state WTP within +/- 10 percent (6 percent of subjects). Several smaller clusters (*n*<25) exist at $2,500, $3,500, $4,500, $7,000, $8,000, $10,000, and $20,000.

Figure 42 shows the difference between the tax credit stated WTP and either a more efficient automobile (*i.e.*, the x-axis) or the house actions (the y-axis). The top graph is a density map of

those that are in the lower 50th percentile of total WTP for house and automobile actions, and the bottom graph represents the upper half of the responses. The cross hairs represent (0,0) for both graphs. Many subjects are willing to pay over $1,500 more for the home energy upgrades, an efficient automobile, or both (*e.g.,* to the right of $1,500 on the x-axis and/or above $1,500 on the y-axis). In fact, about one-third of subjects are willing to pay over $1,500 more with a tax credit than they are willing to pay for the house upgrade actions (excluding the automobile) (*n*=201, 34 percent); about 41 percent are WTP over $1,500 more than for the automobile (*n*=239, 41 percent); and almost 11 percent of subjects are willing to pay over $1,500 more with a tax credit than they are willing to pay for all actions (including the automobile) (*n*=64, 11 percent).

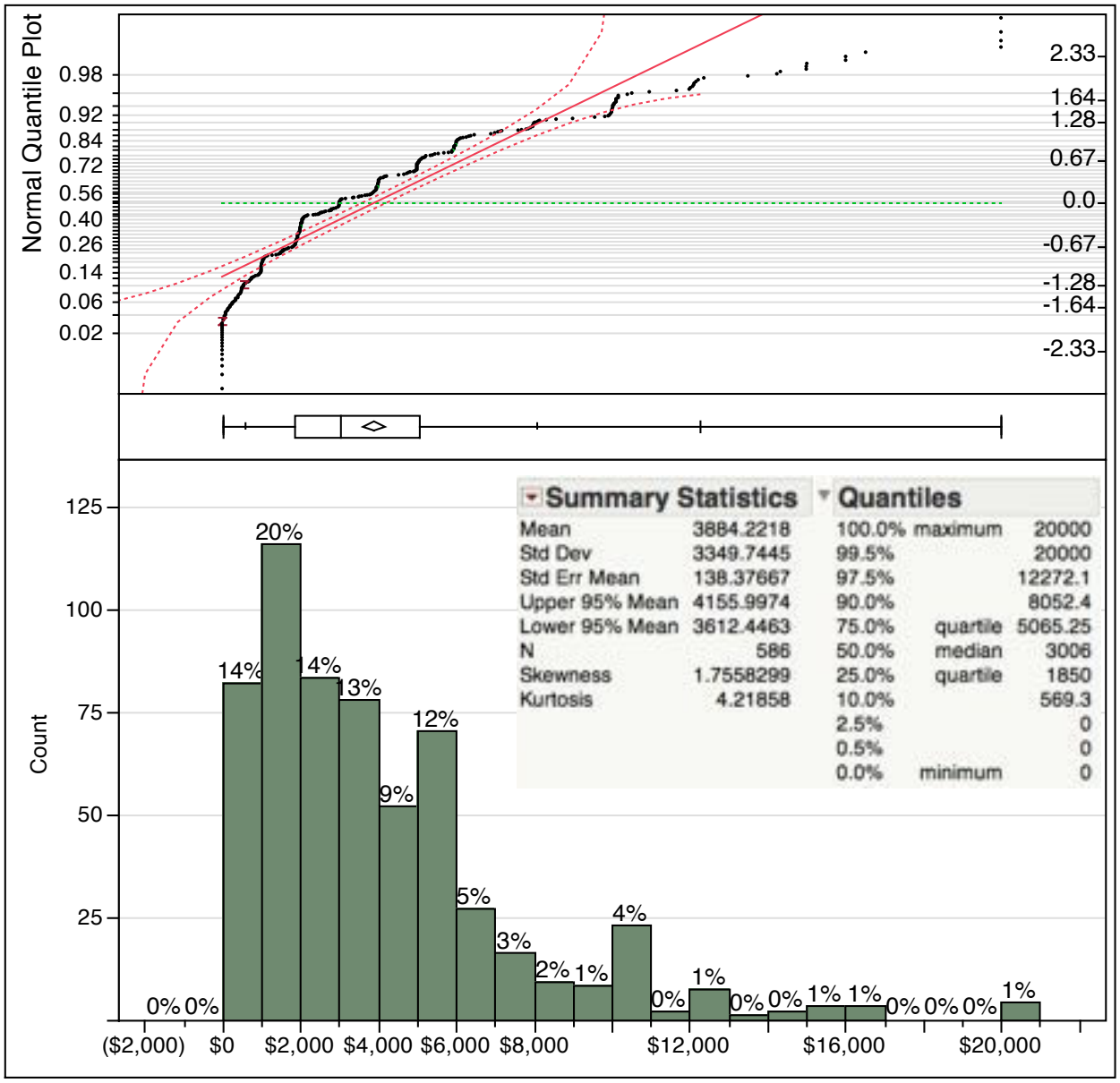
Figure 42 (Tax Credit - House Actions) vs. (Tax Credit - Automobile) WTP by Total WTP (house plus automobile)



When asked the maximum amount their neighbor would be "willing to spend for all of the recommended improvements to increase their home energy score from a 4 to a 9", 18 subjects stated their neighbors would not be willing to pay anything ($0, three percent) (Figure 43). Another 98 subjects believed their neighbors would pay between $29 and $1,000 WTP (within +/- 10 percent) (16.7 percent). Only 8 of these subjects rated their WTP lower than their neighbors. Another 108 subjects stated their neighbors would be WTP $2,000 (within +/- 10 percent) with 83 of them (77 percent) rating their WTP higher than their neighbors. In the middle

of the distribution are clusters of WTP amounts at $500 increments between $2,500 and $5,000, as well as three clusters at $6,000, $8,000, and $10,000. In all, 72 subjects stated their neighbors would be WTP over $7,500 with a mixture of their own stated WTP being lower, the same, and higher.

Figure 43 Distribution of Neighbor's Maximum WTP for All Actions



The last WTP question about the maximum amount their neighbor would be willing to spend if the score were public, such as on Zillow or Google maps, 11 subjects stated their neighbors would not be willing to pay anything ($0, two percent). Another 90 subjects believed their neighbors would pay between $29 and $1,000 WTP (within +/- 10 percent) (15.4 percent), with most indicating similar Neighbor's WTP even without a public score. Another 89 subjects stated their neighbors would be WTP $2,000 (within +/- 10 percent) (15 percent). In the middle of the distribution are clusters of WTP amounts at $1,000 increments up to $10,000. In all, 124 subjects

(21.1 percent) stated their neighbors would be WTP over $7,500 with a mixture of their own stated WTP being lower, the same, and higher.

Figure 44 Distribution of Neighbor's Public Maximum WTP for All Actions

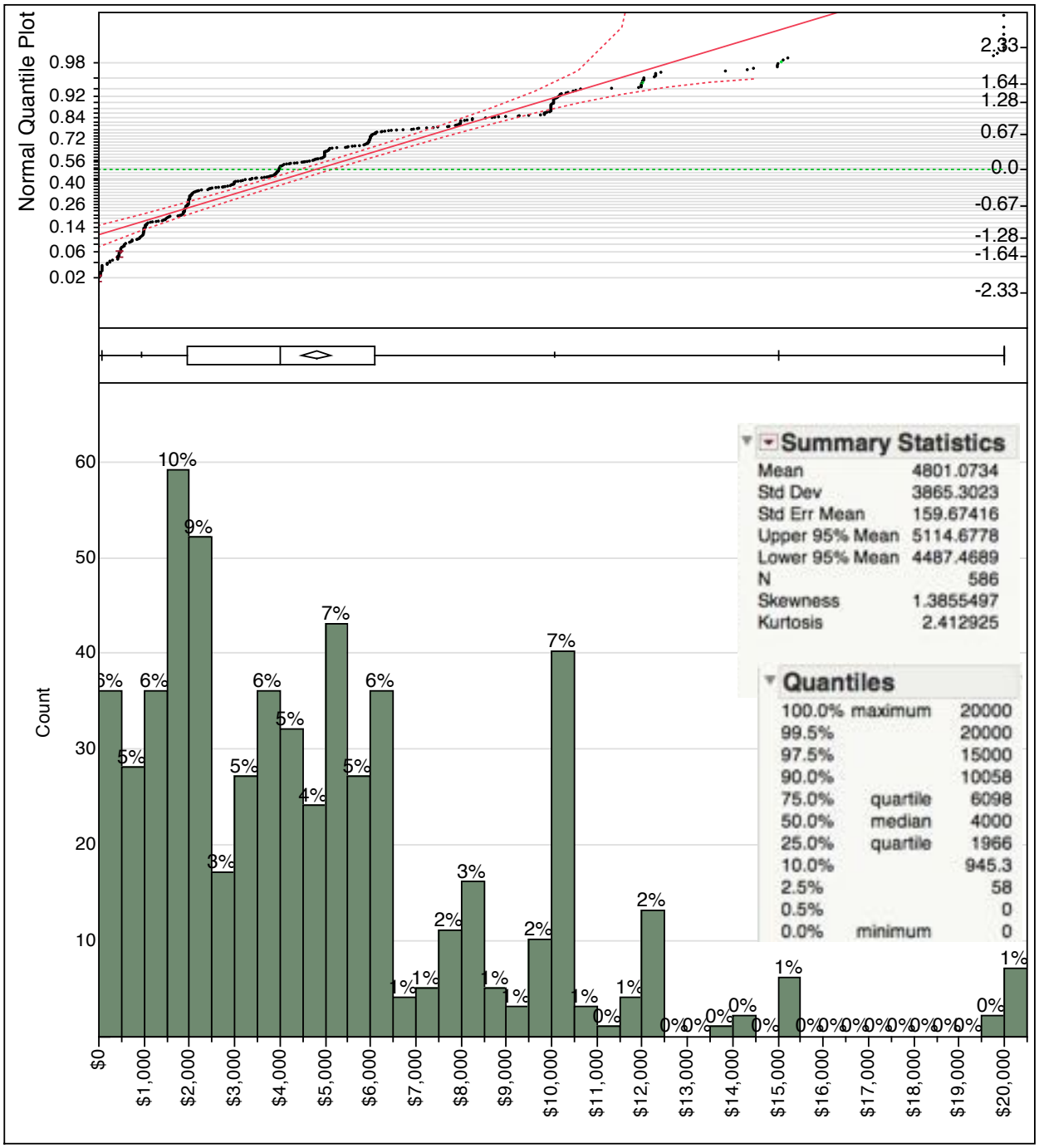


Figure 45 compares each person's stated neighbor's public with increased score WTP (*i.e.*, the x-axis) and the same WTP if the score is public (the y-axis). The top graph is a density map of those that are in the lower 50th percentile of total WTP for house and automobile actions, and the bottom graph represents the upper half of the responses (median=$5,371). The diagonal line represents equal WTP for neighbor's score increase and neighbor's public score increase. In both

halves, people more often think their neighbors will pay more if the score is public, as seen by more shading below the line.

Figure 45 Neighbor's WTP vs. Neighbor's Public Score by Total WTP (house plus automobile)

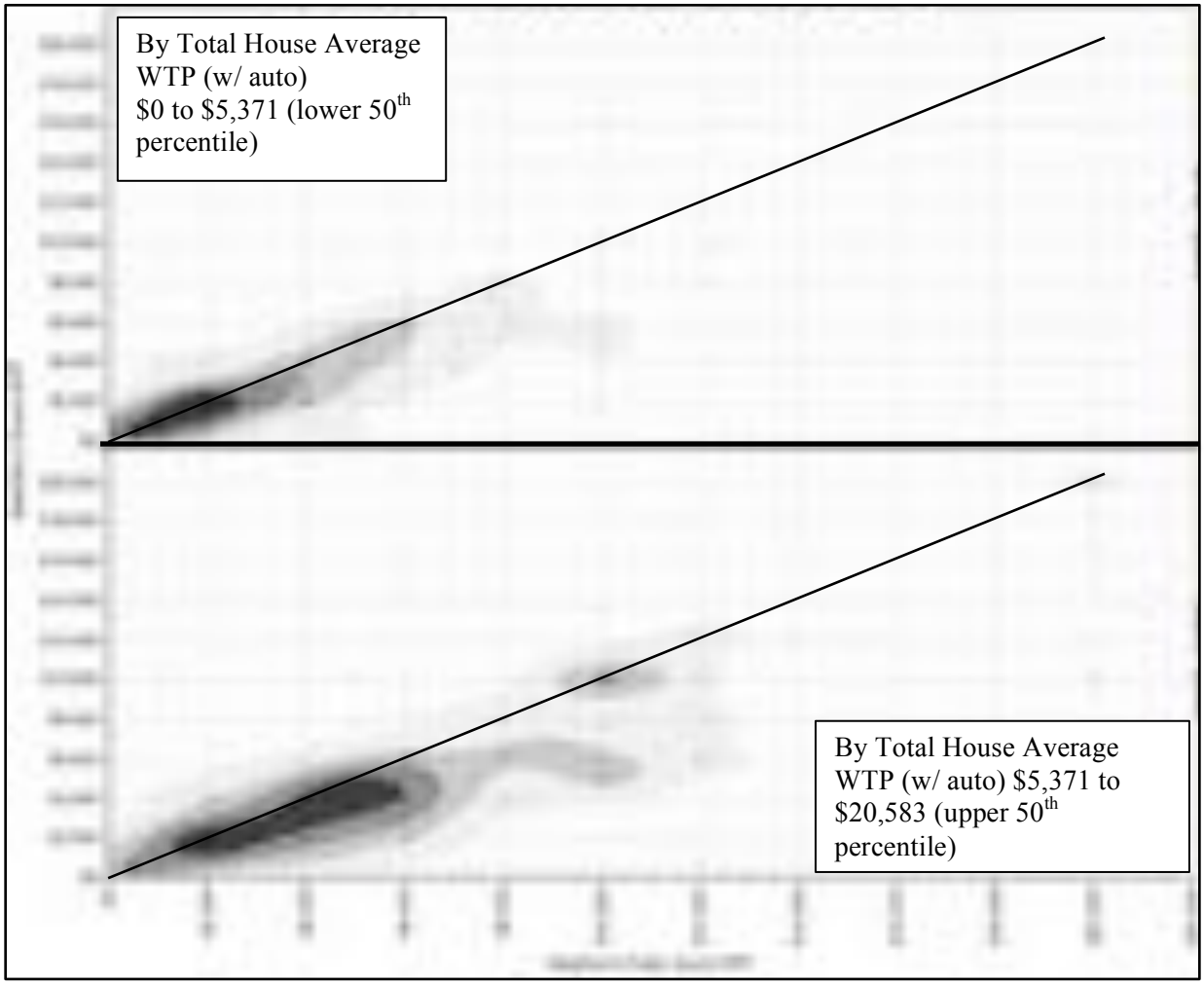
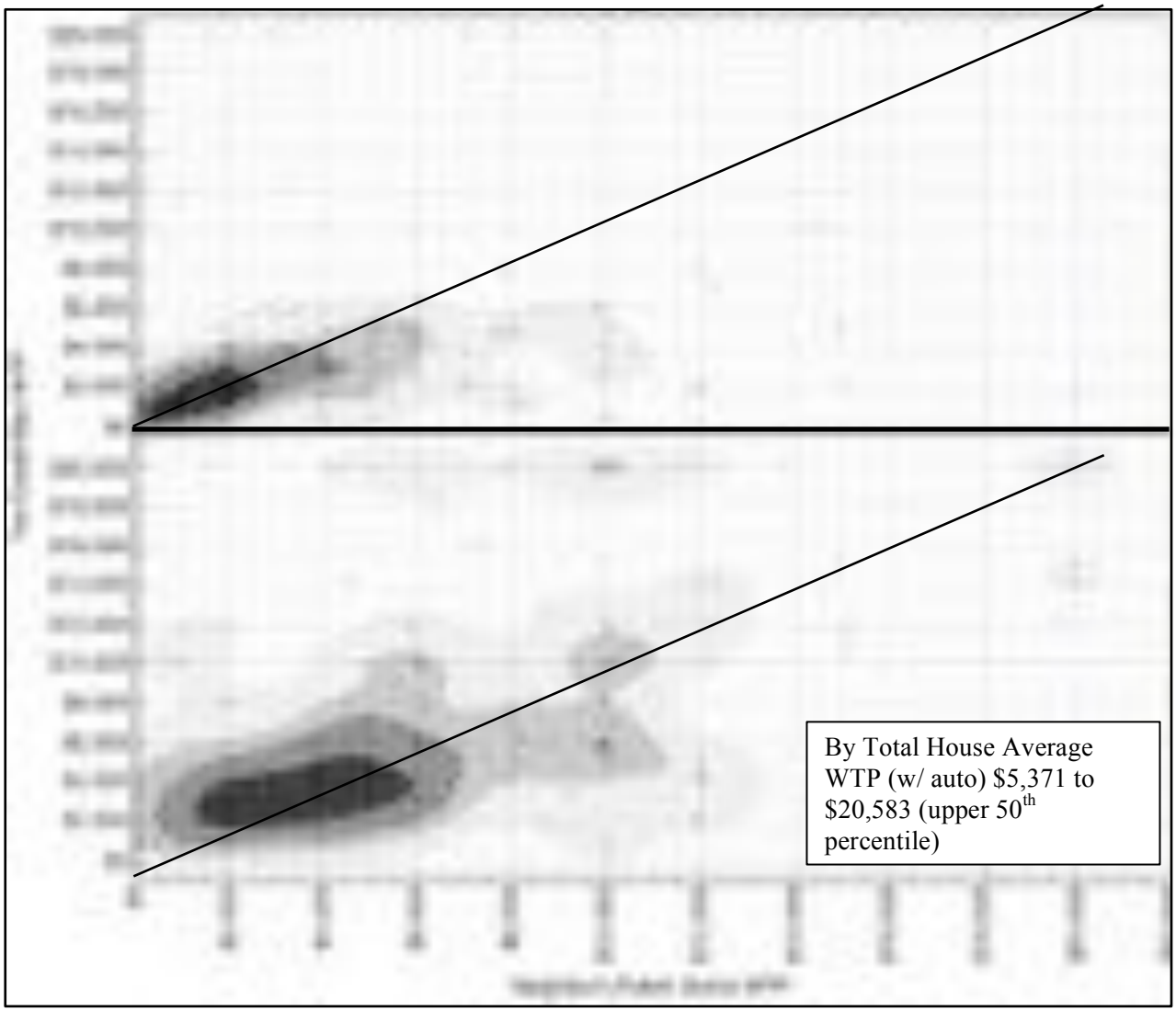


Figure 46 compares each person's stated tax credit maximum WTP for all improvements (*i.e.*, the x-axis) and the neighbor's WTP if the score is public (the y-axis). The top graph is a density map of those that are in the lower 50th percentile of total WTP for house and automobile actions, and the bottom graph represents the upper half of the responses. The diagonal line represents equal tax credit maximum and neighbor's public score WTP. In the lower 50th percentile of total average WTP for home and automobile, subjects more often think their neighbor's will pay more if the score is public than they themselves will pay with a $1,500 tax credit, as seen by more shading below the line. For the upper 50th percentile of total house WTP, differences between neighbor's public score (mean=$4,801, median=$4,000, std. deviation=$3,865) and tax credit WTP (mean=$4,670, median $3070, std. deviation=$4,338) are more varied.

While the two WTP values have similar means, the public values in general are less varied than tax credit that shows several high-end outliers greatly raising the mean score. The pattern is more pronounced in the upper 50th percentile of total WTP responses.

Figure 46 Tax Credit WTP vs. Neighbor's Public Score by Total WTP (house plus automobile)



Described next, several statistical tests were run to compare the means of the different WTP variables across survey conditions.

Appendix I.2 Regression Modeling of WTP Variables

I.2.1 One-Sided t-Tests of WTP Means (Pairwise Comparisons)

The two figures depict the variation in several WTP variables for the three imagine and two actual housing conditions, respectively. The figures include the 50 percentile in the box with the mean indicated with a vertical line in the center. In addition, the range of the variables is indicated through the confidence bars.

Figure 47 WTP Means by Report Version and Imagine Housing Situations

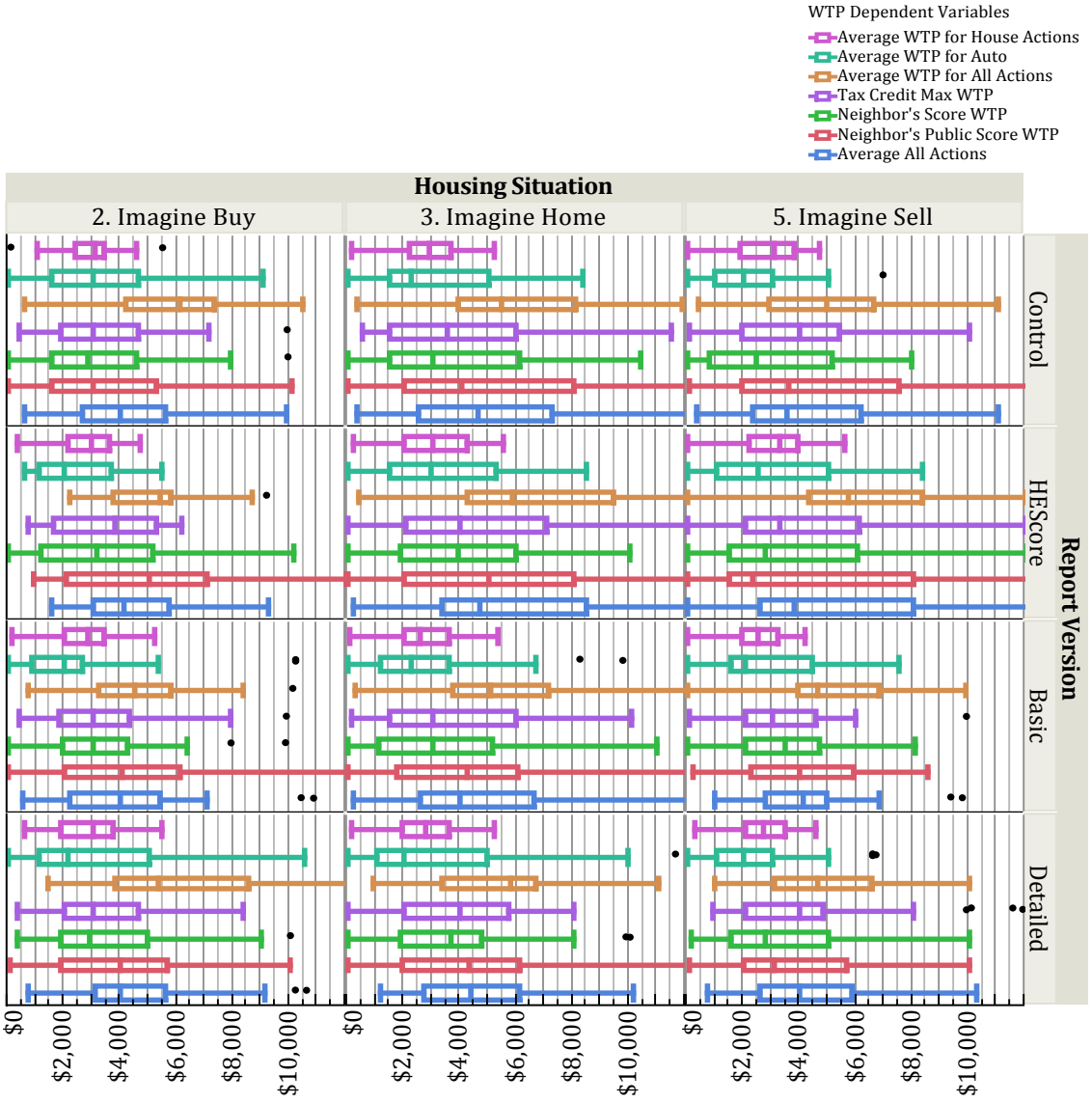
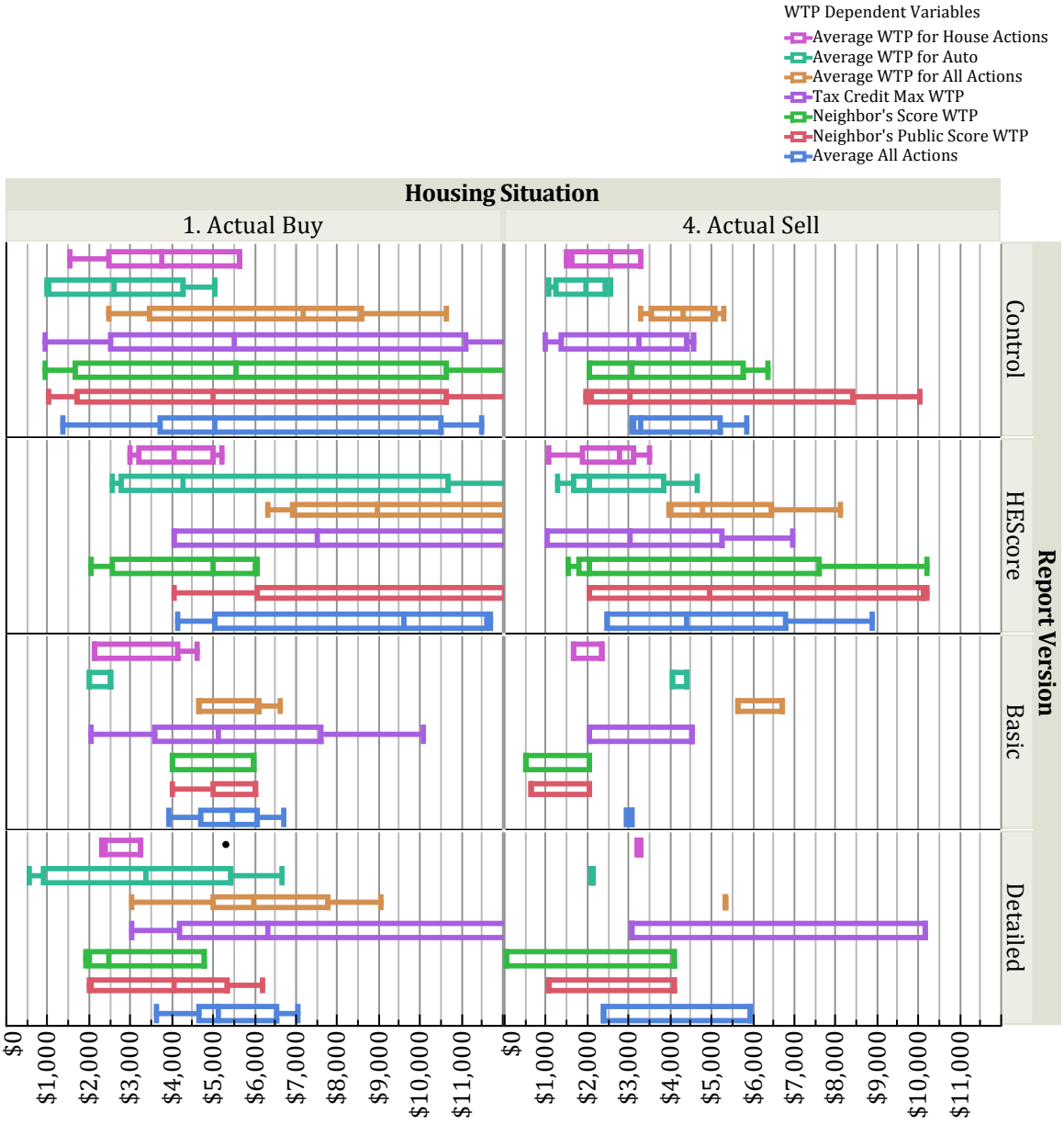


Figure 48 WTP Means by Report Version and Actual Housing Situations



I.2.2 Least Square Means ANOVA Analysis of WTP Variables

I.2.2.1 Average WTP for House Actions (No Automobile)

For average WTP for house actions without a more efficient automobile, the overall model is not significant (Prob>F=0.53) and doesn't predict the variance in the means better than the mean of all subjects otherwise would (R^2=0.03) (JMP, 2013). Still, several report groups are significantly greater than others (see Table 43).

Table 43 Average WTP for House Actions (No Auto) Significant Paired Differences

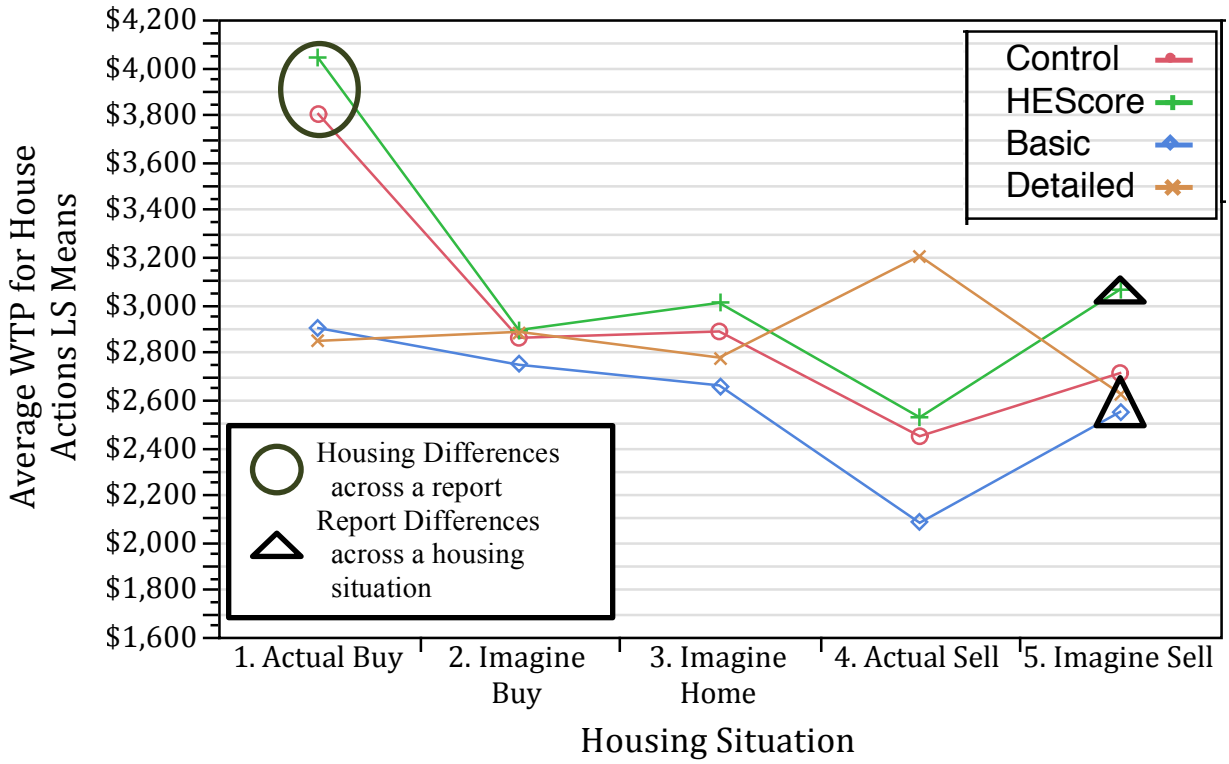
Level	-Level	Mean Difference	Standard Error	DF	Prob>|t|	Prob<t
Control, 1. Actual Buy	Control, 2. Imagine Buy	$942.11	$527.82	566	0.075	**0.037**
Control, 1. Actual Buy	Control, 3. Imagine Home	$915.30	$522.68	566	0.081	**0.0402**
Control, 1. Actual Buy	Control, 4. Actual Sell	$1,356.49	$713.70	28	0.068	**0.039**
Control, 1. Actual Buy	Control, 5. Imagine Sell	$1,090.60	$551.78	566	**0.049**	**0.0243**
HEScore, 1. Actual Buy	Detailed, 1. Actual Buy	$1,190.10	$713.70	28	0.107	0.053[A]
HEScore, 1. Actual Buy	HEScore, 2. Imagine Buy	$1,144.58	$657.13	566	0.082	**0.041**
HEScore, 1. Actual Buy	HEScore, 4. Actual Sell	$1,512.13	$741.70	28	0.051	**0.0255**
HEScore, 5. Imagine Sell	Basic, 5. Imagine Sell	$515.45	$271.70	538	0.058	**0.0292**
HEScore, 5. Imagine Sell	Detailed, 5. Imagine Sell	$438.63	$263.86	538	0.097	**0.0485**
[A] Not significant, but still indicates a higher WTP with the HEScore report version than Detailed.						

Figure 49, Figure 50, Figure 51 present the significant experimental groups circled for housing situation differences across a report version, or wrapped in a triangle for report differences across a housing situation)), including:

- The Control, Actual Buy situation is statistically greater than all other Control housing situations.
- HEScore, Actual Buy is statistically higher than HEScore, Imagine Buy and HEScore, Actual Sell.
- HEScore, Imagine Sell is greater than both Basic and Detailed, Imagine Sell.

These results indicate that including more information about the home energy actions reduces some people's and increases other's WTP over those that only viewed information through the HEScore page and survey instruction text, or the survey instruction text alone, including: the before and after score, the neighbor's score, the average savings, and the average upgrade costs.

Figure 49 Least Squares Means of Average WTP for House Actions (No Automobile)



Further examination of the 4X3 Imagine housing conditions (R^2=0.015, Prob>F=0.71) and 4X2 Actual housing conditions (R^2=0.28, Prob>F=0.19) models, the Actual housing situation model fits the data better, but the results are suspect due to small *n* sample sizes. Different combinations of significance show up, including:

- The 4X3 Imagine (that you are buying, staying put in, or selling the example home) did not show significance across housing situations, but the difference between the HEScore and Basic reports were statistically significant (diff.=$336.38, std. error diff.=$157.18, DF=538, Prob>|t|=.0328) (shown circled in Figure 50).
- The 4X2 Actual Buy and Actual Sell housing situations did not show significance across report versions, but did show a statistically significant difference between Actual Buy and Actual Sell WTP amounts (diff.=$832.77, std. error diff.=$381.03, DF=28, Prob>|t|=.0374) (shown circled in Figure 51).
- The three Imagine housing situations WTP means show much less variance than the Actual housing situations.

Figure 50 Least Squares Means Plot Imagine Buy, Home, and Sell

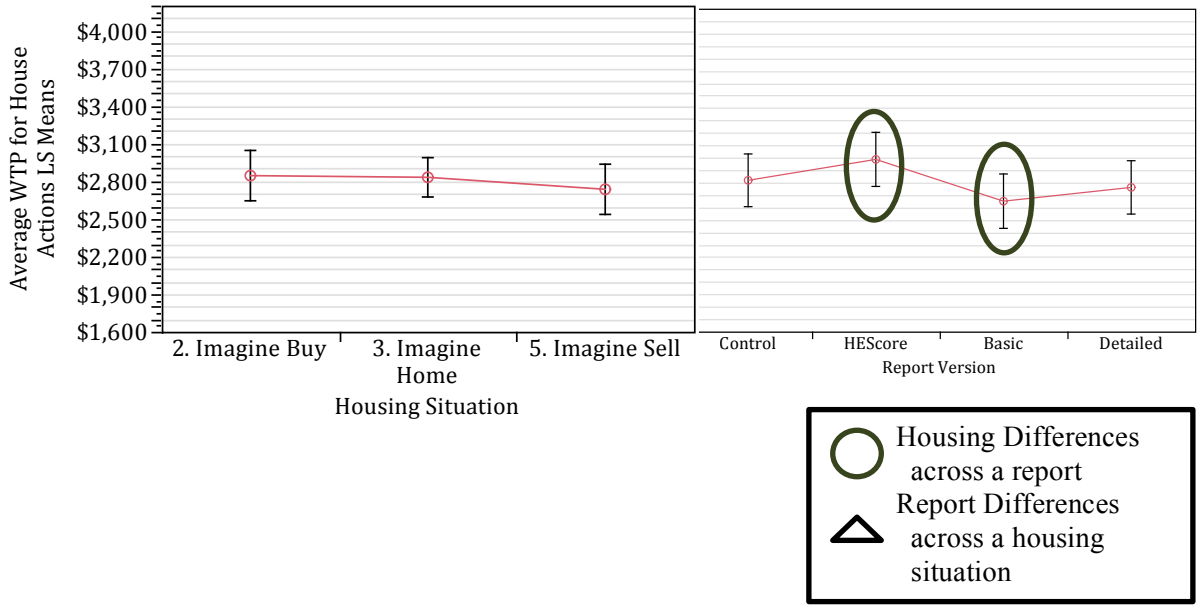
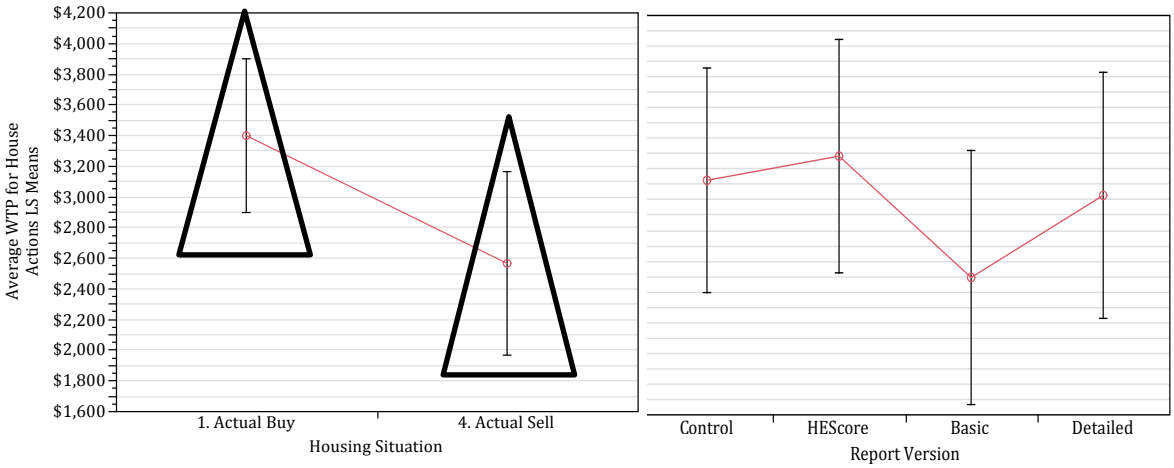


Figure 51 Least Squares Means Plot Actual Buy and Sell



The data indicates that, in general, subjects seemed to perceive they would be willing to pay less for home upgrade actions if they were buying or selling a home than those that were actually buying or selling stated they are WTP.

I.2.2.2 Average WTP for a More Efficient Automobile

For the average WTP for a more efficient automobile, the overall model is significant (Prob>F=0.0188), but still doesn't predict the variance in the means better than the mean of all subjects otherwise would (R^2=0.0573) (JMP, 2013). Several report groups are significantly greater than others (see Table 44 and Figure 52). For instance:

- the HEScore WTP is statistically greater than the other three Imagine home report situations (*i.e.*, the Control, Basic, and Detailed reports).
- Imagine Sell, HEScore is statistically greater than the Control and Detailed reports.
- The HEScore WTP is statistically higher for Imagine Home (staying put) than for Imagine Buy or Sell, while

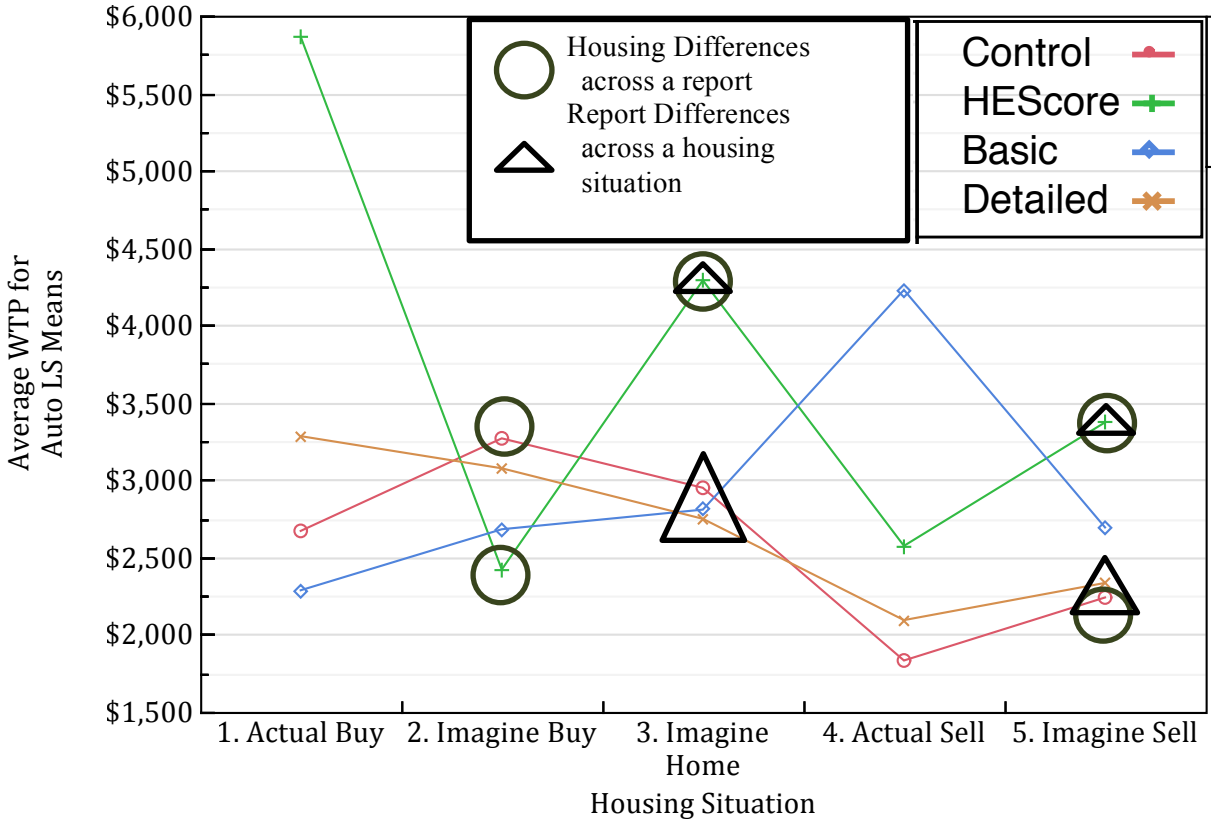
- the Control group, Imagine Buy is greater than the Imagine Sell group.

Table 44 Average WTP for Automobile Significant Paired Differences

Level	-Level	Mean Diff.	Standard Error	DF	Prob>|t|	Prob<t
Basic, 1. Actual Buy*	HEScore, 1. Actual Buy*	$3,577.20	$1,337.18	28	**0.0123**	**0.0062**
Control, 1. Actual Buy*	HEScore, 1. Actual Buy*	$3,193.61	$1,286.70	28	**0.0193**	**0.0097**
HEScore, 4. Actual Sell*	HEScore, 1. Actual Buy*	$3,290.30	$1,337.20	28	**0.0203**	**0.0101**
Detailed, 1. Actual Buy*	HEScore, 1. Actual Buy*	$2,581.20	$1,286.70	28	0.0546	**0.0273**
Control, 5. Imagine Sell	Control, 2. Imagine Buy	$1,028.50	$604.4	538	.0894	**.0447**
Control, 3. Imagine Home	HEScore, 3. Imagine Home	$1,340.85	$448.40	538	**0.0029**	**.0015**
HEScore, 2. Imagine Buy	HEScore, 3. Imagine Home	$1,868.82	$591.60	538	**0.0017**	**0.0008**
Control, 5. Imagine Sell	HEScore, 5. Imagine Sell	$1,131.90	$61.20	538	0.0672	**0.0336**
HEScore, 5. Imagine Sell	HEScore, 3. Imagine Home	$917.8	$490.80	538	0.0620	**0.0310**
Basic, 3. Imagine Home	HEScore, 3. Imagine Home	$1,481.80	$459.30	538	**0.0013**	**0.0007**
Detailed, 3. Imagine Home	HEScore, 3. Imagine Home	$1,541.20	$490.8	538	**0.0018**	**0.0009**
Detailed, 5. Imagine Sell	HEScore, 5. Imagine Sell	$1,037.70	$555.60	538	0.0623	**0.0312**
HEScore, 2. Imagine Buy*	HEScore, 1. Actual Buy*	$3,443.00	$2,376.3	566	**0.0126**	**0.0063**
HEScore, 2. Imagine Buy	HEScore, 3. Imagine Home	$1,868.82	$585.57	566	**0.0015**	**0.0007**
HEScore, 5. Imagine Sell*	HEScore, 1. Actual Buy*	$2,492.00	$1,336.9	566	0.0628	**0.0314**
*Not shown in Figure 52 due to small *n* outlier influence.						

As with the average WTP for house actions, these results indicate that in many situations, less information could be better. However, unlike the house actions WTP dependent variable, the HEScore shows a higher WTP than the Control group (diff.=$1,112, std. err. Diff.= $516, DF=566, Prob>|t|=0.0316).

Figure 52 Least Squares Means of Average WTP for a more Efficient Automobile



Further examination of the 4X3 Imagine housing conditions (R^2=0.047, Prob>F=0.0067) (Figure 53) and 4X2 Actual (R^2=0.31, Prob>F=0.1293) (Figure 54) housing situation models, different combinations of significance show up, including:

- Again, the Actual housing situations fits the model better than the Imagine situations, and the Imagine housing situations WTP means show much less variance than the two Actual housing situations (*i.e.,* like the average house WTP variable).
- The average WTP for automobile also has better fit than average WTP for house actions (R^2=0.047> R^2=0.015).
- For the Imagine housing situations, the WTP for automobile HEScore is statistically higher than the Control (diff.=$541.7, std. err. diff.=$325.9, DF=538, Prob>t=0.0486), Basic (diff.=$633.6, std. err. diff.=$331.0, DF=538, Prob>t=0.0281), and Detailed (diff.=$641.6, std. err. diff.=$327.9, DF=538, Prob>t=0.0254) report versions.
- The Imagine Home (staying put) condition WTP is higher than the Imagine Sell housing situation (diff.=$539.00, std. error diff.=$272.51, DF=538, Prob>|t|=.0484).
- The 4X2 Actual Buy or Sell housing situation model showed the HEScore significantly higher than the Control group (diff.=$1,967.22, std. error. Diff.=$927.85, DF=28, Prob>|t|=.0215).
- The Actual Buy or Sell conditions did not show significance for WTP based on Buy or Sell conditions.

Figure 53 Least Squares Means Plot Imagine Buy, Home, and Sell for Automobile

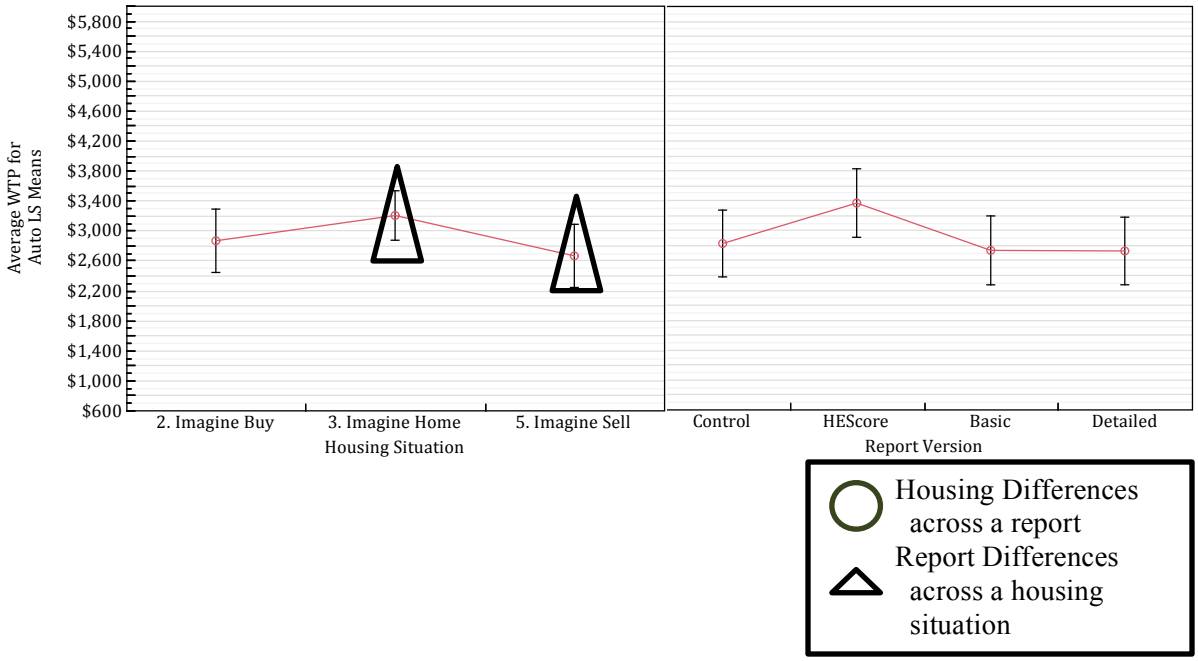
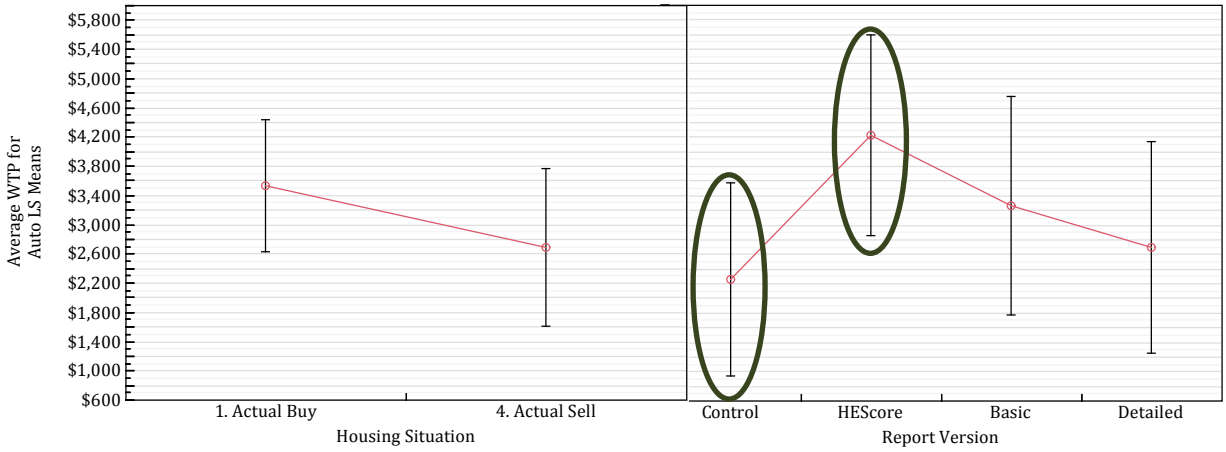


Figure 54 Least Squares Means Plot Actual Buy and Sell for Automobile



Since the Actual housing situations have small *n* values (3<*n*<6), the outliers can have a significant impact on the results, including:

- The HEScore, Actual Buy experimental group does contain a high outlier that impacts the average (*n*=4, m=$5,863.50, median=$4225.50, Std. Dev.=$4,542.46, Std. Error Mean=$2,271.23).
- The HEScore Imagine Home also contains six outliers of $15,000 (*n*=67, m=$4,290, median=$2,924.50, Std. Dev.=$4,058.29, Std. Error Mean=$$495).

Still the data indicates that, in general, subjects perceived they would be willing to pay more for an efficient automobile if they were buying or selling than those that were actually buying or

selling stated. It could be that not being in the situation makes it difficult to imagine how you would spend money if you were in the market to buy or sell a home.

I.2.2.3 $1,500 Tax Credit Maximum WTP

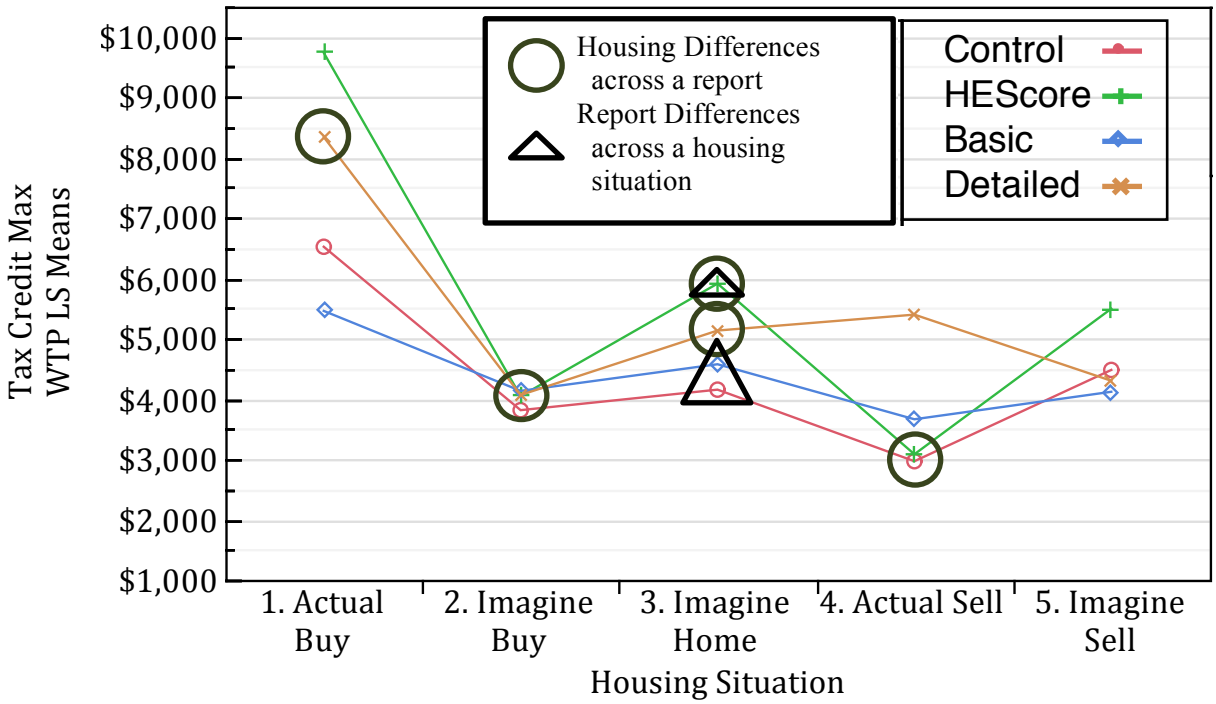
For maximum WTP for all home energy actions with a $1,500 Tax Credit, the overall model is not significant (Prob.>F=0.1390) and may not predict the variance in the means better than the mean of all subjects otherwise would (R^2=0.0437). Nine experimental groups are significantly greater than others (see Table 45) and the significant experimental groups circled (differences across report versions) or in a triangle (differences across housing situations) in Figure 55. For instance,

- The HEScore Imagine Home WTP is statistically greater than the Control and Basic Imagine Home report situations, as well as the HEScore Imagine Buy and Imagine Sell conditions.
- The Imagine Buy condition shows very little differences between report types, while the Imagine Home and Imagine Sell conditions show more variety with the HEScore only report showing the highest WTP.
- Similar to the previous WTP dependent variables, the pattern holds of people stating lower WTP in imagine buying compared to actually in the market to buy conditions, and stating higher WTP in imagine selling compared to those actually in the market to sell conditions.

Table 45 Maximum WTP with $1,500 Tax Credit Significant Paired Differences

Level	-Level	Mean Diff.	Standard Error	DF	Prob.>|t|	Prob.<t
HEScore, 4. Actual Sell	HEScore, 1. Actual Buy	$6,654	$3,105	28	**0.0410**	**0.0205**
Control, 3. Imagine Home	HEScore, 3. Imagine Home	$1,758	$751	538	**0.0197**	**0.0098**
HEScore, 2. Imagine Buy	HEScore, 3. Imagine Home	$1,866	$991	538	0.0602	**0.0301**
Basic, 3. Imagine Home	HEScore, 3. Imagine Home	$1,337	$770	538	0.0829	**0.0415**
HEScore, 2. Imagine Buy*	HEScore, 1. Actual Buy*	$5,692	$2337	566	**0.0152**	**0.0076**
HEScore, 5. Actual Sell*	HEScore, 1. Actual Buy*	$4,242	$2,270	566	0.0622	**0.0311**
Detailed, 2. Imagine Buy	Detailed, 1. Actual Buy	$2,274	$1910	566	**0.0256**	**0.0128**
Detailed, 3. Imagine Home	Detailed, 1. Actual Buy	$3,207	$1889	566	0.0901	**0.0451**
Detailed, 5. Imagine Sell	Detailed, 1. Actual Buy	$4,039	$1,910	566	**0.0349**	**0.0174**
*Not shown in figure due to small *n* outlier influence.						

Figure 55 Least Squares Means of Maximum WTP with a $1,500 Tax Credit



Further examination of the 4X3 Imagine (R^2=0.024, Prob.>F=0.2703) (Figure 56) and 4X2 Actual (R^2=0.24, Prob.>F=0.3098) (Figure 57) housing situation models finds different combinations of significance show up, where:

- Again, the Actual housing situations fits the model better than the Imagine situations, and the three Imagine housing situations WTP means show much less variance than the two Actual housing situations.
- The maximum WTP with a $1,500 tax credit has a slightly better fit than average WTP for house actions (R^2=0.024> R^2=0.015).
- For the 4X3 Imagine Buying Housing situation model,
    - Staying put in, or Selling the example home, the maximum WTP with a Tax Credit HEScore is statistically higher than the Control (diff.=$1001, std. err. diff.=$546, DF=538, Prob.>t=0.0336), and the Control and Basic combined (Prob.<F=0.0498) report versions.
    - The Imagine Home condition WTP is higher than the Imagine Buy housing situation (diff.=$929, std. error diff.=$457, DF=538, Prob.>|t|=.0427).
- For the 4X2 Actual Housing situation model,
    - The Actual Buy is significantly higher than the Actual Sell group (diff.=$3,737, std. error. diff.=$1,595, DF=28, Prob.>|t|=.0265).
    - The report type conditions did not show significance for WTP based on Actual Buy or Sell conditions.

Figure 56 Least Squares Means Plot Imagine Buy, Home, and Sell for $1,500 Tax Credit

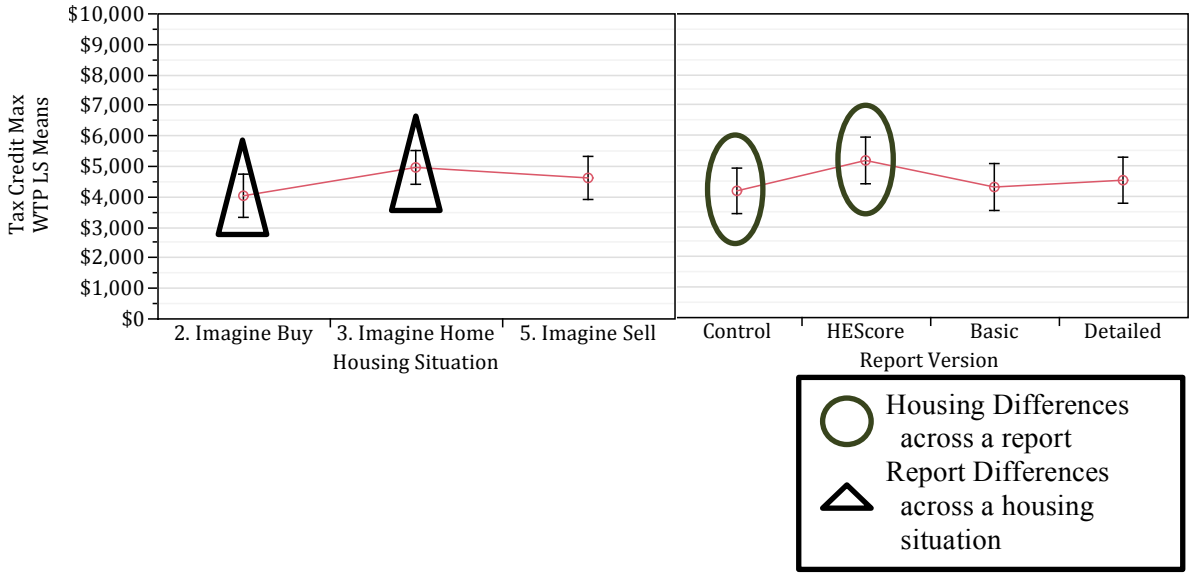
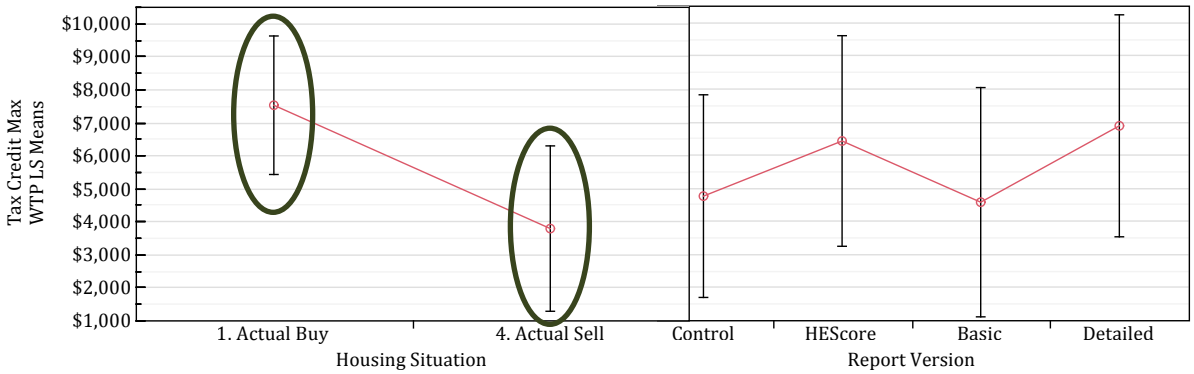


Figure 57 Least Squares Means Plot Actual Buy and Sell for $1,500 Tax Credit



The small *n* Actual housing situation groups ($3<n<6$) have Tax Credit outliers that can have a significant impact on the results, where:

- For Actual Buy, both HEScore and Detailed have one outlier each at $20,000, while
- Control has an outlier of $14,000.

Removing those outliers does bring the report means closer together, but Actual Buy is still significantly higher than Actual Sell, even without removing any Actual Sell outliers (diff.=$1,912, std. err. Diff.=$1,073, DF=25, Prob.<t=0.0435). The data indicates that subjects in the market to buy a home could be WTP more than those in the market to sell a home.

I.2.2.4 Neighbor's Maximum WTP to Increase Home Energy Score

People stated what their neighbors would be willing to pay for all home energy actions if the home energy score went from a 4 to a 9. The overall model is not significant (Prob.>F=0.2444) and doesn't predict the variance in the means better than the mean of all subjects otherwise would (R^2=0.039). The maximum neighbor's WTP to increase score has a

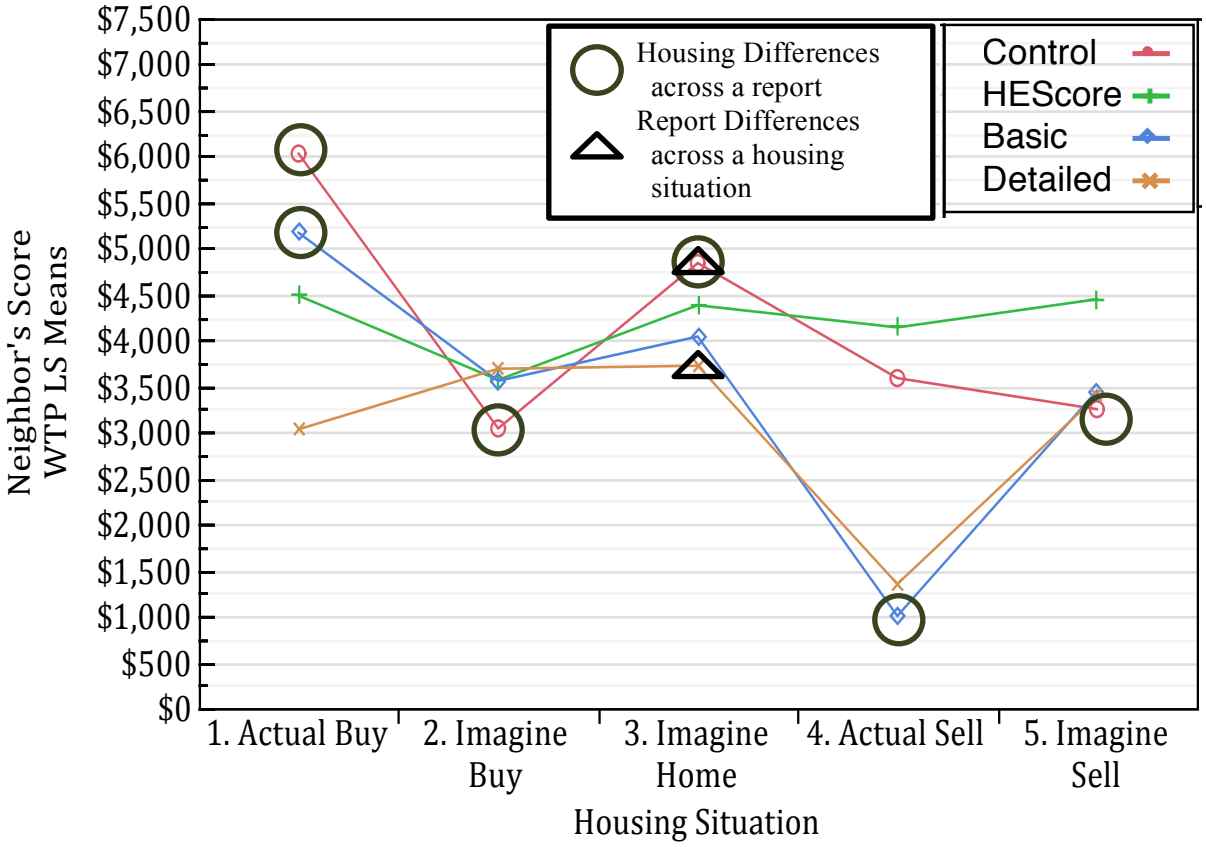
better model fit than average WTP for house actions (R^2=0.039 > R^2=0.015). Seven experimental groups are significantly greater than others (see Table 46 and the significant experimental groups circled (differences across report versions) or in a triangle (differences across housing situations) in Figure 58), including:

- For the neighbor's WTP, the HEScore does not stand out from the other report versions.
- The Control, Actual Buy and Control, Imagine Home groups are both significantly higher than the Control, Imagine Buy and Control, Imagine Sell.
- The Basic, Actual Buy is statistically higher than Basic, Actual Sell.
- The Control, Imagine Home group is significantly higher than Detailed, Imagine Home experimental condition.

Table 46 Maximum Neighbor's WTP to Increase Score Significant Paired Differences

Level	-Level	Mean Diff.	Standard Error	DF	Prob.>|t|	Prob.<t
Basic, 4. Actual Sell	Basic, 1. Actual Buy	$4,166	$1,966	28	**0.0431**	**0.0216**
Control, 2. Imagine Buy	Control, 3. Imagine Home	$1,798	$616	538	**0.0037**	**0.0018**
Control, 5. Imagine Sell	Control, 3. Imagine Home	$1,589	$758	538	**0.0366**	**0.0183**
Detailed, 3. Imagine Home	Control, 3. Imagine Home	$1,116	$637	538	0.0802	**0.0401**
Control, 2. Imagine Buy	Control, 1. Actual Buy	$2,988	$1,437	566	**0.0380**	**0.0190**
Control, 5. Imagine Sell	Control, 1. Actual Buy	$2,779	$1,502	566	0.0648	**0.0324**
Control, 5. Imagine Sell	Control, 3. Imagine Home	$1,589	$751	566	**0.0349**	**0.0174**

Figure 58 Least Squares Means of Maximum Neighbor's WTP to Increase Score



Further exploration of the 4X3 Imagine (R^2=0.027, Prob.>F=0.1899) (Figure 59) and 4X2 Actual (R^2=0.30, Prob.>F=0.1484) (Figure 60) housing situation models, different combinations of significance show up, as follows.

- Again, the Actual housing situations fits the model better than the Imagine situations, and the three Imagine housing situations WTP means show much less variance than the two Actual housing situations.
- For the 4X3 Imagine Buy, Stay, or Sell the example home,
  - the WTP for tax credit for Imagine Home is significantly higher than the Imagine Buy (diff.=$781.2, std. err. diff.=$354.36, DF=538, Prob.>t=0.0279) and Imagine Sell (diff.=$610.8, std. err. diff.=$353.7, DF=538, Prob.>t=0.0424) housing situations.
  - The report versions are not statistically significant.
- For the 4X2 Actual Housing situation model,
  - Actual Buy is significantly higher than the Actual Sell (diff.=$2,158.8, std. error. diff.=$927.8, DF=28, Prob.>|t|=0.0274) condition.
  - The Detailed report produces significantly lower WTP than the Control group (diff.=$2,618.4, std. error. diff.=$1,288.9, DF=28, Prob.<t=0.0259).

Figure 59 Least Squares Means Plot Imagine Buy, Home, and Sell for Maximum Neighbor's WTP

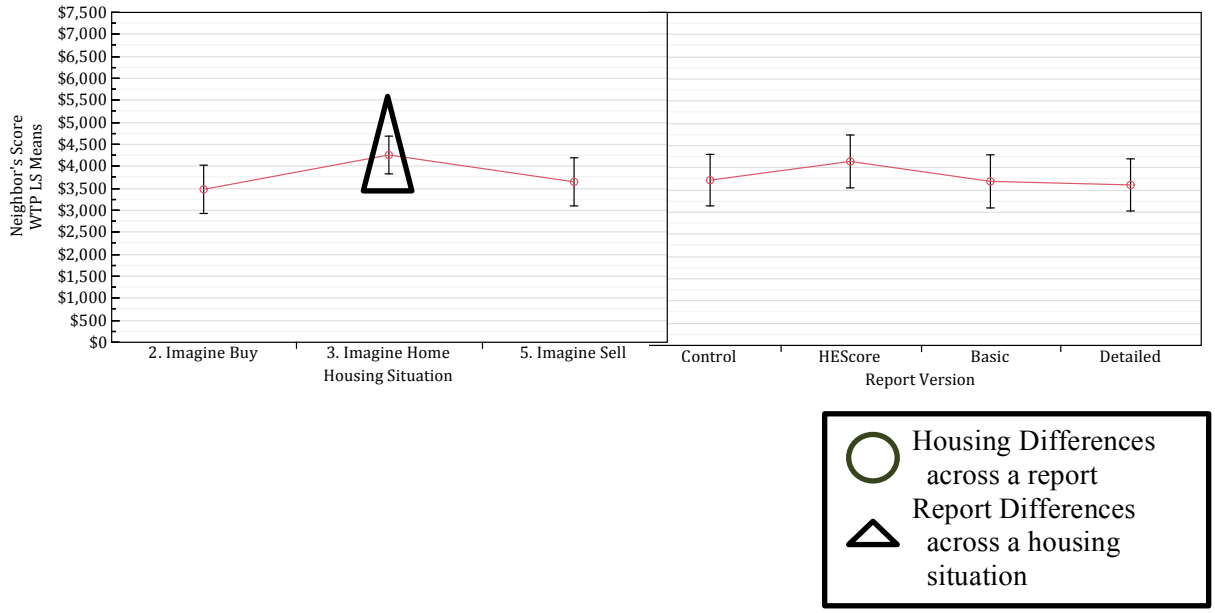
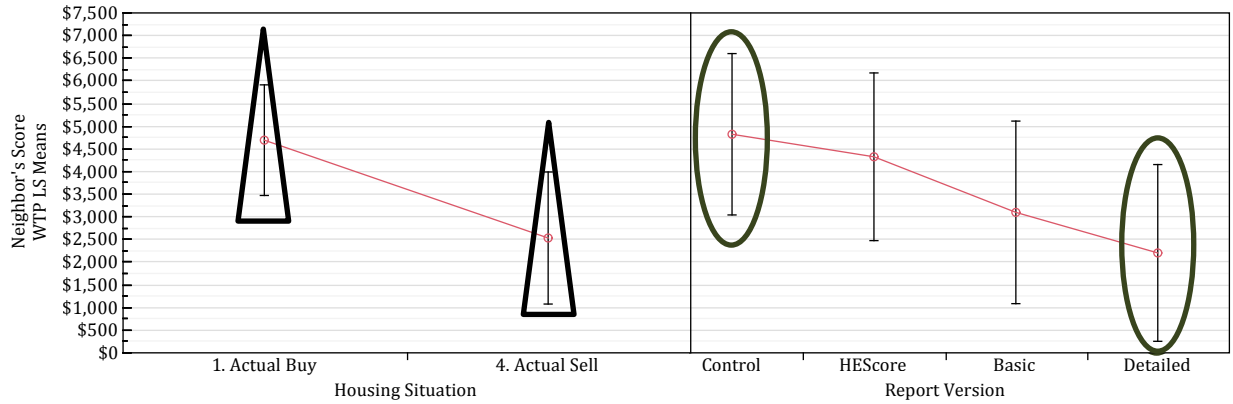


Figure 60 Least Square Means Plot Actual Buy and Sell for Maximum Neighbor's WTP



Again, the small *n* values ($3<n<6$) of the Actual housing situations impact the results; in this case, the Control group has two outliers over $10,000. Unfortunately, it's difficult to draw conclusions from the Maximum Neighbor's WTP variable.

I.2.2.5 Neighbor's Maximum WTP to Increase Public Home Energy Score

People stated what their neighbors would be willing to pay for all home energy actions if their publically-available score went from a 4 to a 9. The overall model is not significant (Prob.>F=0.0984) and may not predict the variance in the means better than the mean of all subjects otherwise would (R^2=0.04637). Several report groups are significantly greater than others (see Table 47 and the significant experimental groups circled (differences across report versions) or in a triangle (differences across housing situations) in Figure 61. For instance,

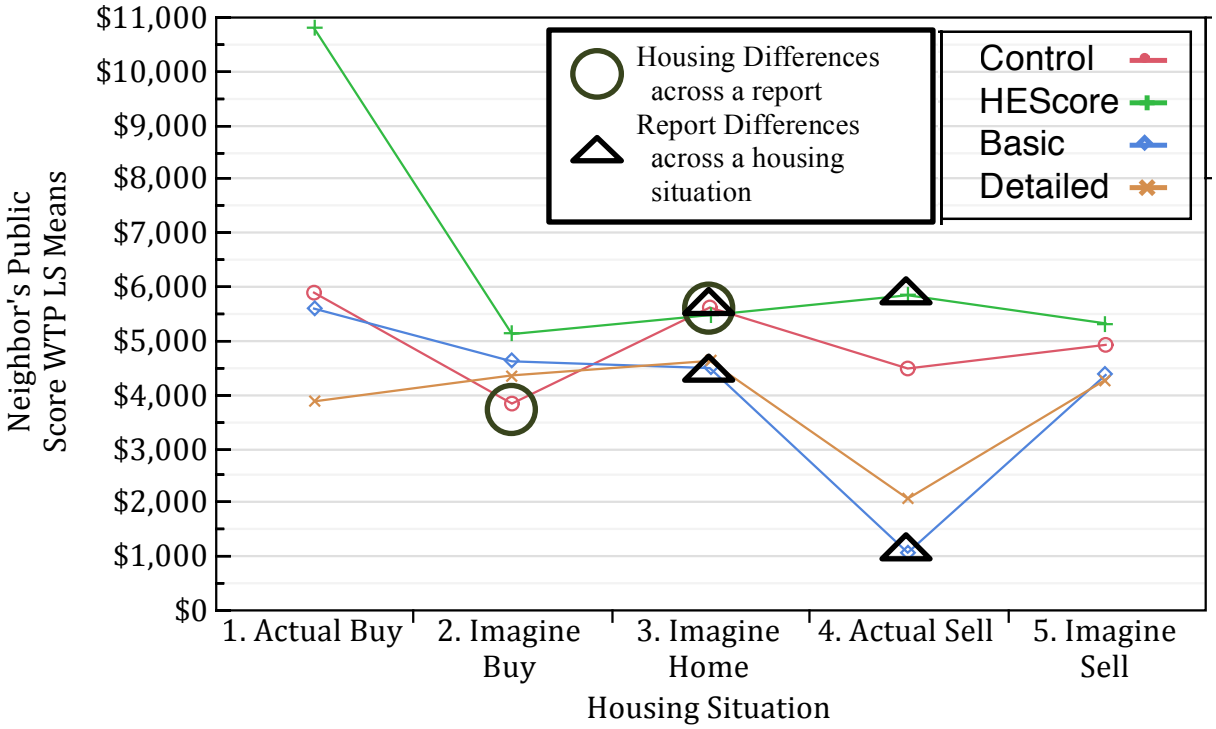
- The HEScore Actual Buy WTP is statistically greater than other report situations (*i.e.*, the Control, Basic, and Detailed reports) and housing situations, except Imagine Buy (*i.e.*, Imagine Home, Imagine Sell, and Actual Sell).

- For the Actual Sell condition, the HEScore yields a higher WTP than the Basic condition.
- For the Control group, the Imagine Home condition is significantly higher than the Control, Imagine Buy and the Basic, Imagine Buy experimental groups.

Table 47 Maximum Neighbor's WTP to Increase Public Score

Level	-Level	Mean Diff.	Standard Error	DF	Prob.>|t|	Prob.<t
Control, 1. Actual Buy*	HEScore, 1. Actual Buy*	$4,907	$2,132	28	**0.0290**	**0.0145**
Basic, 1. Actual Buy*	HEScore, 1. Actual Buy*	$5,203	$2,216	28	**0.0261**	**0.0131**
Detailed, 1. Actual Buy*	HEScore, 1. Actual Buy*	$6,924	$2,132	28	**0.0030**	**0.0015**
HEScore, 4. Actual Sell*	HEScore, 1. Actual Buy*	$4,955	$2215	28	**0.0335**	**0.0167**
Basic, 4. Actual Sell	HEScore, 4. Actual Sell	$4,776	$2,412	28	00709	**0.0355**
Control, 2. Imagine Buy	Control, 3. Imagine Home	$1,783	$707	538	**0.0119**	**0.0060**
Basic, 3. Imagine Home	Control, 3. Imagine Home	$1,124	$684	538	.01006	0.0503*
HEScore, 2. Imagine Buy*	HEScore, 1. Actual Buy	$5,676	$2056	566	**0.0060**	**0.0030**
HEScore, 3. Imagine Home*	HEScore, 1. Actual Buy*	$5,324	$1,975	566	**0.0072**	**0.0036**
HEScore, 5. Imagine Sell*	HEScore, 1. Actual Buy*	$5,478	$1,997	566	**0.0063**	**0.0031**
*Not shown in figure due to small *n* outlier influence.						

Figure 61 Least Square Means of Maximum Neighbor's WTP to Increase Public Score



Further examination of the 4X3 Imagine (R^2=0.021, Prob.>F=0.3815) (Figure 62) and 4X2 Actual (R^2=0.42, Prob.>F=0.0194) (Figure 63) housing situation models, a few significant experimental groups show up, including:

- Again, the Actual housing situations fit the model better than the Imagine situations, and the three Imagine housing situations WTP means show much less variance than the two Actual housing situations.
- The Actual housing situation model is significant.
- The maximum neighbor's WTP for an increased score if public fits the model about the same as average WTP for house actions (R^2=0.021 ≅ R^2=0.015).
- For the 4X3 Imagine Buy, Stay, or Sell,
  - the three housing situations are not significant from one another.
  - The HEScore is significantly higher than both the Detailed (diff.=$815.6, std. err. diff.=$492.7, DF=538, Prob.>t=0.0492) and the Basic (diff.=$815.6, std. err. diff.=$492.7, DF=538, Prob.>t=0.0492) reports, but not the Control group.
- For the 4X2 Actual Housing situation model,
  - the Actual Buy is significantly higher than the Actual Sell (diff.=$3,173.9, std. err. diff.=$1,138.1, DF=28, Prob.>|t|=.0094).
  - The HEScore neighbor's public score WTP is significantly higher than the Control group (diff.=$3,133.1, std. error. diff.=$1,537.4, DF=28, Prob.>t=.0256), Basic (diff.=$4,989.9, std. error. diff.=$1,637.6, DF=28, Prob.>|t|=.0050), and Detailed (diff.=$5,349.2, std. error. diff.=$1,609.6, DF=28, Prob.>|t|=.0025) reports.

Figure 62 Square Means Plot Imagine Buy, Home, and Sell for Maximum Neighbor's Public WTP

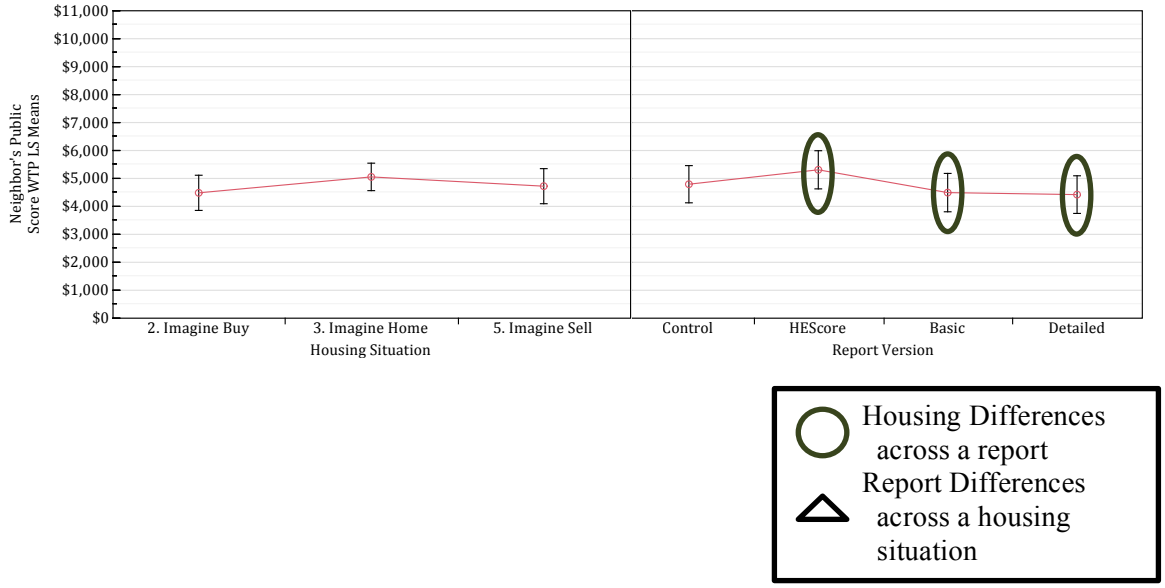
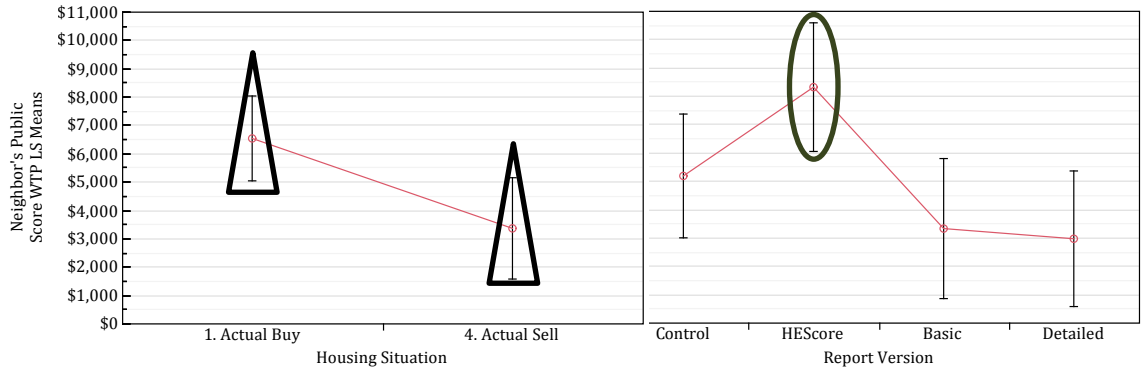


Figure 63 Least Square Means Plot Actual Buy and Sell for Maximum Neighbor's Public WTP



Since the Actual housing situations have small *n* values (3<*n*<6), each point can have a significant impact on the results. In fact, the HEScore, Actual Buy experimental group (mean=$10,782, *n*=4: $4,017, $12,023, $12,428, $15,087) has a greater WTP than the Basic report (mean=$5,578, *n*=5: four WTP=$5,983, and one WTP=$3,960) partially due to outliers. Still, the data indicates that making the score public could increase WTP for home energy upgrades.

Appendix J HEScore Market Segmentation Results

To hopefully determine N2N market segments, I present the survey demographic indicators and results of revealed preference regression models, where WTP values are the dependent variables demographic indicators are the independent variables.

Appendix J.1 Regression of Revealed Preferences
Table 47, 48, and 49 contain the significant regression indicator variables and statistics for subjects more likely to complete an upgrade, lighting visit, and HES assessment, respectively (overall results described in Sections 4.1.5 and 4.2).

The following characteristics are more likely for each type of demographic indicator for the combined upgrade/lighting results:[26]

1. Buy/Sell Mindset:
    a. Be in the market to buy or sell, or
    b. Have no plans to sell over those planning to sell in five years or more.
    c. Have lived in their home longer.
    d. Plan to stay in their home for one to five or 10 to 18 years over those leaving in the next year. For upgrades, likelihood increases with length of time in the home, while it decreases for lighting.
2. Household Energy Indicator:
    a. Are willing to share their report with a prospective buyer (and also more likely to want to see or act upon the report).
3. Socio-Economic Indicators:
    a. Live in an urban area than those in suburban areas and rural for upgrades.
    b. Have lived in poverty.
    c. Are female.

In addition, a few indicators were specific to the respective upgrade and lighting models only, including:

4. Upgrade only:
    a. Are involved in one or two local organizations.
    b. Don't conserve over those that conserve.
    c. Missed the report comprehension questions.

5. Lighting visit only:
    a. Have lower incomes.
    b. Would not change their bulbs in the shed.
    c. Would not change their home decisions based on the home energy report.

In fact, the upgrade and lighting regression findings include both expected and surprising results as follows:

- Expected:

[26] Note: For any of these indicators, it could be that this type of situation makes a person more likely to complete the survey, rather than more likely to complete the energy action.

- Consistent with previous findings of higher WTP in Actual Buy survey conditions, people that are in the market to buy or sell are more likely to have already completed upgrades and lighting.
- The length of time in the home affects the likelihood to complete actions in general, especially for those staying longer.
- Those that have lived in poverty for at least one year are more likely to complete an upgrade and/or lighting.

- Surprising:

  - Those living in urban areas are more likely to complete an upgrade and/or lighting. While urban dwellers do seem a likely target market for upgrades, only five percent of survey respondents live in an urban area, making the significance stand out.
  - Those that would not change their home energy decisions based on the home energy report are more likely to complete a lighting visit. It could be tied to the lower incomes expected for lighting market segments, as well as upgrade costs and process barriers.
  - I expected household incomes to be higher for subjects completing upgrade (and HES assessments), but it was not significant in the models.
  - Those that do not conserve are more likely to complete an upgrade than those that do conserve. It may be that:
    - those that have completed upgrades feel that the home improvements eliminated their need to consciously conserve, or
    - No strong connection between household conscious conservation and upgrade completes.
  - Those that had completed a lighting visit would not change the bulbs in the shed. Perhaps because:
    - the N2N lighting visit focuses on the top 20 fixtures and/or incorrectly primes people not to change bulbs in low use areas, or,
    - subjects completing the lighting visit do not want more CFLs or prefer not to DIY.
  - Those that missed the report comprehension questions were most likely to complete an upgrade (and to a lesser strength a HES assessment).
    - I hypothesized that N2N would bring awareness and interest, which should make the report easier to understand (and lead to more correct answers).
    - Maybe instead, knowing about energy in their home meant they paid less attention to the report (and scale colors, score movement, and neighbor's score).
    - Either way, the scale colors may not be as intuitive as I hoped and/or people experience survey fatigue here (late in the survey).

Table 48 Logistical Regression Significant Results: N2N Home Energy Upgrades

			n=428, Chi^2=168.77, Prob.>Chi^2=0.00001, Pseudo R^2=0.44	
Variable	**Odds Ratio**	**1/Odds Ratio**	**Coeff.**	**Sig.**
Report Version (Detailed)				
Detailed	9.78		2.28	**
HES	5.74		1.75	*
Housing Situation (Stay, Imag. Stay)				
Stay, Imag. Buy	0.17	5.97	-1.79	**
Buy, Imag. Buy	182.65		5.21	**
Sell, Imag. Sell	59.15		4.08	*
Next Sell (Never)				
Over 5 Years	0.01	129.86	-4.87	*
How long lived (<1 yr.)				
1 to 5 years	0.03	37.77	-3.63	**
5 to 10 years	0.01	87.87	-4.48	**
10 to 18 years	0.01	179.43	-5.19	***
> 18 years	0.00	350.91	-5.86	***
How long plan live (<1 yr.)				
1 to 5 years	9.62		2.26	*
10 to 18 years	5.51		1.71	**
Share if Sell Yes	10.51		2.35	**
HH Density (Urban)				
Suburban	0.03	36.58	-3.60	**
Rural	0.02	54.01	-3.99	**
Local Orgs (None)				
One Local Org	14.28		2.66	**
Two Local Orgs	13.66		2.61	**
Gender Male	0.29	3.41	-1.23	*
HH Conserves Yes	0.02	46.79	-3.85	***
Poverty >1 yr. Yes	0.15	6.73	-1.91	**
Comprehension ?s Wrong	2.05		0.72	*

Table 49 Logistical Regression Significant Results: N2N Lighting Completes

Lighting Visit Completed				
Variable	**Odds Ratio**	**1/Odds Ratio**	**Coeff**	**Sig.**
HH Income	0.60	1.66	-0.51	*
Local Orgs (None)				
Three Local Orgs	0.23	4.37	-1.48	*
Year Born (Younger)	1.12		0.11	***
Real estate prof. Yes	14.30		2.66	**
Last Buy (<6 mo.)				
6 mo. to 1 yr.	172.07		5.15	*
1 to 5 yrs.	69.69		4.24	*
> 5 yrs.	105.51		4.66	**
Next Buy (Never)				
> 5 yrs.	14.06		2.64	**
Next Sell (Never)				
> 5 yrs.	0.13	7.61	-2.03	*
How long lived (<1 yr.)				
1 to 5 years	303.44		5.72	**
5 to 10 years	216.78		5.38	*
10 to 18 years	189.62		5.25	*
> 18 years	116.67		4.76	*
Score impact actions Yes	0.37	2.71	-1.00	*
Gender Male	0.09	11.70	-2.46	***
HH Density (Urban)				
Suburban	0.17	5.72	-1.74	*
Employed (Full Time)				
Part-time	0.20	5.09	-1.63	*
Homemaker	0.07	15.20	-2.72	**
Own Home Yes	0.02	56.73	-4.04	**
HH Comfortable Yes	3.85		1.35	*
Change Shed Lights Yes	0.31	3.20	-1.16	**
_cons	0.00		-227.28	***

Subjects are more likely to complete HES if they:

1. N2N Influence:
    a. Have completed a lighting visit.
2. Buy/Sell Mindset:
    a. Bought their house six months ago over those never buying.
3. Socio-Economic Indicators:
    a. Never lived in poverty.
    b. Have fewer adults in the household.
    c. Are Democrat (over "other" political party, including liberal, vote the candidate not party, *etc.*)
4. Household Energy Indicators:

a. Have comfortable households.
b. Don't conserve.
c. Missed comprehension questions.
d. Correctly answer the attentional filter.

In fact, the findings include both expected and surprising results as follows:

- Expected:
    - Those completing lighting are more likely to complete HES, a finding consistent with N2N marketing strategy to use lighting as an acquisition strategy into HES assessments, where:
        - Lighting complete to HES assessment sign ups is 64 percent, and
        - HES sign up to HES complete is 45 percent.
    - Democrats were statistically more likely to complete than those with "other" affiliation.
    - Those that bought a home less than six months ago are very likely to complete a HES assessment. This could be due to N2N partnerships with the CT real estate market.

- Surprising:
    - Those never living in poverty are more likely to complete a HES assessment, which is opposite to lighting and upgrades. It could be because:
        - Three-quarters of respondents have not lived in poverty, and
        - Those experiencing poverty for at least one year in their life have lower incomes.
    - Households with fewer adults are more likely to complete HES.
    - Local organization involvement didn't predict HES assessment completion, perhaps because almost 80 percent of respondents participate in one or more organization.
    - Like upgrades, HES assessment completions increase among subjects that don't conserve and those getting the attentional filter question wrong were more likely to complete HES (see previous discussion).
    - Those with HES assessment completes report more comfortable homes more often. It could be that the HES assessment and/or upgrade made their home comfortable and decreased their desire or need to conserve.

Table 50 Logistical Regression Significant Results: N2N HES Assessments

Variable	Odds Ratio	1/Odds Ratio	Coeff.	Sig.
Last Buy < 6 Months	70.91		4.26	**
Poverty >1 yr. Yes	0.56	1.79	-0.58	*
hhadults	0.59	1.69	-0.52	*
Local Org 4	0.12	8.09	-2.09	*
Political Other	0.30	3.28	-1.19	**
Employed (Full Time)				
Temporarily Unemployed	5.80		1.76	**
Other Employment	4.99		1.61	*
HH Comfortable Yes	1.84		0.61	*
HH Conserves Yes	0.27	3.73	-1.32	*
Lighting Visit Complete	2.22		0.80	*
Comprehension ?s Wrong	1.28		0.25	*
Attentional Filter Wrong	0.60	1.66	-0.51	*

Table 51 Lighting Program Performance and HES Statistics (October 2012)

	Total	Average/Visit	Rate
Total Visits Completed	542		
# of Bulbs Replaced	8830	17	
Wattage Saved	441365	828	
Dollars Saved	67844	127	
Emissions Avoided	306204	574	
Equivalent # 200 Watt Solar Panels	1559	3	
HES assessment Sign Ups	346		64%
HES assessment Completes	177		45%

Appendix J.2 Regression of WTP Variables

Table 52, Table 53, and Table 54 contain the results of six additional linear regression models using WTP variables as the dependent variable, including:

1. For average House WTP, subjects are WTP more if they:
    a. Buy/Sell Mindset:
        i. Have lived in their home for five to 10 years or 10 to 18 years than those living there less than one year.
        ii. Plan to buy a home in the next one to five years than those with no current plans.
        iii. Are in the market to buy a home.
    b. Household Energy Indicators:
        i. Pay low energy prices than those with reasonable energy costs.

ii. Do not complete repairs requiring a tool and ladders themselves or with the help of a friend or family member.
iii. Would change to CFLs in the shed.
iv. Are willing to share their home's energy report to potential sellers.
v. Said that raising their home energy score would impact their home energy action decisions.
vi. Are interested in seeing the report on a home they are purchasing.
vii. Correctly answer the attentional filter.
viii. Socio-Economic Indicators: Are older and male

2. For average Attic, Duct, Air Sealing (Tight) WTP, and upgrades combined, the models repeat most of the findings from Average House (above), with the following additions, where subjects:
    a. Prefer attic insulation of the three energy upgrades, perhaps because it is first in question order and/or the most dominant upgrade in N2N and CT.
    b. Are WTP more for attic insulation after one year in their home.
    c. That are not comfortable in their home are WTP more.

3. For average CFLs and Outlets, and DIY combined, the models repeat most of the findings from average House (above), with the following additions, where subjects:
    a. Missing comprehension questions are WTP less than those getting them right.
    b. Involved in three local organizations are WTP more for CFLs.
    c. Are WTP more for CFLs the more liberal they self-rate.

4. For the Tax Credit WTP, subjects are WTP more if they:
    a. Buy/Sell Mindset
        i. Are in the Market to buy a home.
    b. Household Energy Indicators
        i. Pay low energy prices than those with high and reasonable energy costs.
        ii. Would change to CFL bulbs in the shed.
        iii. Do not complete repairs requiring tools and a ladder themselves or with the help of a friend or family member.
        iv. Are willing to share their home's energy report to potential sellers.
    c. Socio-Economic Indicators
        i. Are male.
        ii. Are not married.
        iii. Do not live in multi-family buildings.

5. For the Neighbor's and Neighbor's Public Score WTP scenarios, subjects think their Neighbors are WTP more if they:
    a. Buy/Sell Mindset
        i. Bought a home less than six months ago over those never buying a home.
    b. Household Energy Indicators
        i. Pay low energy prices than those with reasonable and high energy costs.
        ii. Are willing to share their home's energy report to potential sellers and are interested in seeing the report for a potential home purchase.
    c. Socio-Economic Indicators
        i. Are not married (not significant for public score).
        ii. Are not in the real estate profession.

6. For purchasing a more efficient automobile, subjects are WTP more if they:

a. Buy/Sell Mindset
    i. Are not in the market to buy or sell.
b. Home Energy Indicators
    i. Pay low energy costs.
    ii. Do not complete repairs requiring tools and a ladder themselves or with the help of a friend or family member.
    iii. Would change bulbs in the shed.
    iv. Believe the home energy score would impact their home energy purchases, and those interested in seeing the report for a potential home purchase.

Table 52 Average House, Tax Credit, Neighbor Score, Neighbor Score Public, and Efficient Auto WTP Regression (Sign. Only)

	Average House			Tax Credit			Nghbr Score WTP			Nghbr Public Score			Efficient Auto		
Variable (Reference Case)	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.
Report Version (Control)															
Housing Situation (Stay, Stay)															
Imagine Buy	164	0.06		-419	-0.04		-785	-0.10	*	-456	-0.05		110	0.02	
Actual Buy, Imagine Buy	853	0.12	*	3502	0.15	*	977	0.05		1391	0.07		-1865	-0.13	*
Actual Buy, Imagine Sell	-505	-0.06		-2330	-0.08		-688	-0.03		-804	-0.03		-2497	-0.14	**
Attentional Filter (AF) Wrong	-277	-0.10	*	-219	-0.02		-282	-0.04		-609	-0.07		-435	-0.08	
Local Org Participation (0)															
Year Born (Getting Younger)	-16	-0.17	*	-16	-0.05		6	0.03		15	0.05		13	0.06	
HH Adults	137	0.06		316	0.04		186	0.03		42	0.01		543	0.12	*
Real Estate Dummy	233	0.03		-1515	-0.06		-1964	-0.11	*	-1638	-0.08		-310	-0.02	
Last house bought (Never)															
Less than 6 months ago	712	0.09		-2058	-0.07		5253	0.24	**	3803	0.15	*	850	0.05	
Plan Buy Next House (No Plans)															
One Year to Five Years	708	0.20	**	1522	0.13		907	0.10		533	0.05		1451	0.20	*
How Long in Current House (< One Year)															
1 to 5 Years	703	0.23	*	1504	0.14		557	0.07		550	0.06		928	0.14	
10 to 18 Years	729	0.25	*	1081	0.11		1233	0.16		-24	0.00		1267	0.21	
Increase Score Influence WTP? Dummy	423	0.13	**	-665	-0.06		438	0.05		496	0.05		-818	-0.12	**
See Score if Buy? Dummy	526	0.09	*	1707	0.08		2172	0.14	**	2410	0.13	**	1407	0.11	*
Show Score if Sell? Dummy	557	0.16	***	1281	0.11	*	1228	0.13	**	1168	0.11	*	566	0.08	
Gender Male															
Gender Male	259	0.10	*	900	0.10	*	490	0.07		513	0.07		24	0.00	
House Type (Detatched Single Family)															
MF 2 to 4 units	-208	-0.03		-2452	-0.09	*	-908	-0.04		-1378	-0.06		-977	-0.06	
Employed															
Other	325	0.04		2133	0.08		2441	0.12	**	2165	0.09	*	1119	0.07	
Married Dummy	206	0.06		-1802	-0.16	**	-1283	-0.15	**	-875	-0.09		364	0.05	
Energy Cost (Low)															
Reasonable	-477	-0.18	*	-2968	-0.33	***	-1292	-0.19	*	-1920	-0.25	**	-1804	-0.33	***
High	-251	-0.10		-3220	-0.36	***	-955	-0.14		-1521	-0.19	*	-1862	-0.34	***
HH DIY Repairs Dummy	-357	-0.13	**	-1235	-0.14	**	-417	-0.06		-417	-0.05		-733	-0.13	**
Change CFLs in Shed Dummy	344	0.13	**	829	0.09	*	285	0.04		211	0.03		697	0.12	**
Constant	32966	.	**	34655	.		-11657	.		-25986	.		-24922	.	
N	568			568			568			568			568		
Adjusted R^2	0.21			0.19			0.15			0.14			0.17		
Root Mean Standard Error	1156			3982			3115			3610			2493		

Table 53 Average Combined (Top 3) and Separately: Attic Insulation, Duct Sealing, and Air Sealing WTP Regression (Sign. Only)

	Top 3			Attic			Duct			Tight		
Variable	**Coeff.**	**Beta**	**Sig.**	**Coeff.**	**Beta**	**Sig.**	**Coeff.**	**Beta**	**Sig.**	**Coeff.**	**Beta**	**Sig.**
Housing Situation (Stay, Stay)												
Actual, Imagine Buy	833	0.12	*	153	0.06		221	0.10		458	0.16	**
Attentional Filter	-270	-0.10	*	-94	-0.10	*	-89	-0.10	*	-88	-0.08	
Year Born	-16	-0.17	*	-4	-0.12		-4	-0.14	*	-8	-0.19	**
Plan Buy Next House (No Plans)												
One Year to Five Years	687	0.20	**	147	0.12		189	0.17	*	351	0.24	**
Plan Sell Next House (No Plans)												
One Year to Five Years	-476	-0.14		-99	-0.08		-132	-0.12		-245	-0.16	*
How Long in Current House (< One Year)												
1 to 5 Years	723	0.24	*	251	0.23	*	196	0.20		276	0.21	
5 to 10 Years	634	0.20		256	0.22	*	184	0.18		193	0.14	
10 to 18 Years	747	0.26	*	315	0.30	*	233	0.25	*	199	0.16	
18 Years	564	0.19		289	0.27	*	143	0.15		132	0.10	
How Long Plan Live in Current House (< C												
1 to 5 Years	-733	-0.23		-185	-0.16		-277	-0.27	*	-271	-0.19	
Increase Score Influence WTP? Dummy	414	0.13	**	156	0.13	**	132	0.12	**	126	0.09	
See Score if Buy? Dummy	490	0.08		198	0.09	*	224	0.12	**	69	0.03	
Show Score if Sell? Dummy	535	0.16	***	184	0.15	***	164	0.15	***	187	0.12	**
Gender Male	256	0.10	*	116	0.13	**	73	0.09		67	0.06	
House Type (Detatched Single Family)												
Attached SF	317	0.06		10	0.01		39	0.02		268	0.12	*
HES Upgrade Complete	270	0.07		121	0.09	*	106	0.09	*	43	0.03	
HH Comfort Dummy	-418	-0.12	**	-160	-0.13	**	-119	-0.11	*	-140	-0.09	*
Energy Cost (Low)												
Reasonable	-467	-0.18	*	-115	-0.12		-85	-0.10		-267	-0.24	**
HH DIY Repairs Dummy	-343	-0.13	**	-137	-0.14	**	-74	-0.09		-132	-0.12	*
Change CFLs in Shed Dummy	319	0.12	**	118	0.12	**	101	0.12	**	100	0.09	
Constant	32226	.	**	8311	.		8105	.	*	15810	.	**
N	568			568			568			568		
Adjusted R^2	0.20			0.20			0.19			0.14		
Root Mean Standard Error	1135			414			371			516		

Table 54 Average Combined (DIY) and Separately: CFLs and Outlets

Variable	DIY			CFLs			OUTS		
	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.	Coeff.	Beta	Sig.
Report Version (Control)									
Detailed	-20	-0.14	**	-13	-0.11	*	-7	-0.15	**
Comprehension Questions (3)	-12	-0.18	***	-9	-0.17	***	-3	-0.15	***
Local Org Participation (0)									
Three Local Orgs	22	0.17	**	18	0.18	**	4	0.09	
Year Born (older)	0	-0.07		0	-0.02		0	-0.17	*
Last house sold (Never)									
Over 5 Years	-13	-0.07		-5	-0.03		-8	-0.14	*
Plan Buy Next House (No Plans)									
Over 5 Years	22	0.13		14	0.11		8	0.15	*
See Score if Buy? Dummy	35	0.12	**	34	0.15	***	2	0.02	
Show Score if Sell? Dummy	22	0.13	**	14	0.10	*	8	0.16	***
Liberal to Conservative (Liberal)	0	-0.11	*	0	-0.12	*	0	-0.07	
HH Type									
Mobile Home	-72	-0.07		-29	-0.04		-42	-0.13	**
Married Yes Dummy	18	0.11	*	10	0.08		8	0.16	**
Race (White)									
Hispanic, Latino, or Spanish	-47	-0.08	*	-31	-0.07		-16	-0.09	*
Other	-18	-0.06		-10	-0.04		-9	-0.09	*
Completed HES Upgrade	21	0.12	**	18	0.13	**	4	0.07	
HH DIY Yes Dummy	-13	-0.10	*	-12	-0.12	**	-1	-0.04	
Change CFLs in Shed Dummy	25	0.19	***	19	0.19	***	5	0.13	**
Constant	740	.		220	.		520	.	**
N	568			568			568		
Adjusted R^2	0.24			0.20			0.20		
Root Mean Standard Error	54			43			17		

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Appendix K HES Assessment Market Segmentation Results

The main survey findings are as follows:

1. Planned years in home
    a. About half of people plan to be in their home for 10 or more years (*n*=181, 51 percent), and one-third between 2 and 10 years (*n*=117, 33 percent).[27]

2. Conservation actions
    a. Almost three-quarters state they have made conservation behavior change as a result of N2N participation (*n*=176, 72 percent), and almost all respondents reported taking conservation actions, including:
        i. Flipping out lights is the most common action (*n*=245, 95 percent), followed by almost 80 percent reporting keeping the thermostat set at 68 degrees or lower in the winter (*n*=200, 78 percent).
        ii. Other behaviors reported by the majority of respondents include washing clothes in cold water, using low flow shower heads, and setting the temperature to 78 degrees or higher in the summer.
        iii. Less than half of people reported unplugging unused devices, using a toaster oven, hanging clothes to dry, and other.

3. HES assessment stated reason[28]
    a. People state two primary reasons:
        i. Reduce energy bills (*n*=157, 37 percent), and
        ii. To help address problems in my home (*n*=157, 37 percent).
    b. Some people state:
        i. My responsibility to reduce energy waste (*n*=54, 13 percent).
    c. Few people state:
        i. To protect the environment (*n*=13, 3 percent), a primary message motivating the N2N and key volunteers.
        ii. To increase my household comfort (*n*=14, 3 percent), one of the main N2N and industry messaging strategies. Still, the next question indicates increased comfort to be the main post-HES assessment benefit.

4. Problems identified during the HES assessment
    a. Most state drafts around windows, doors, attic entrance, recessed lighting, *etc.* (*n*=336, 80 percent), where over half do not state another finding (*n*=238, 53 percent), providing evidence that HES increases comfort for most homes.
    b. Some state disproportionately high heating and cooling bills (*n*=38, 9 percent).
    c. Other answers hold true for less than five percent of subjects each, including mold, gas leaks, asbestos, water damage, and not sure.

[27] N2N has seen evidence of utility administrators discouraging contractors from selling upgrades with payback periods over 10 years.
[28] Results from this type of question may not be reliable as participants often don't know their true preferences or motivations.

5. HES assessment satisfaction
    a. Less than five percent are dissatisfied or very dissatisfied with their experience (*n*=18, 4 percent), or neutral (*n*=17, 4 percent).
    b. Over 90 percent are satisfied or very satisfied with their experience (*n*=414, 92 percent).

6. Energy upgrades
    a. The percent starting and completing energy improvements has increased over time (*n*=277, 56 percent).[29] Several factors may have contributed, including:
        i. Changes in messaging to focus on improvements (implemented over time),
        ii. New energy advisors hired (November 2012),
        iii. Hot leads launched (March 2012), and
        iv. Year 3 focus on upgrade lead acquisition (June 2012).
    b. The number of upgrades per person has increased from 1.6 to 2.0 between August 2012 and January 2013, where one-third of subjects complete 1, 2, or 3 or more upgrades, including:
        i. The top three upgrades are: additional air sealing (*n*=129, 52 percent), insulation (*n*=125, 50 percent), and CFLs & LEDs (*n*=121, 49 percent).
        ii. The next most popular upgrades are appliances (*n*=53, 21 percent), other (*n*=39, 16 percent), windows (*n*=37, 15 percent), heating systems (*n*=29), and hot water heaters (*n*=23, 9 percent).
    c. Many complete some of the upgrade work themselves or with the help of a friend (*n*=102, 61 percent), while less than 20 percent use the same HES contractor (*n*=30, 18 percent) and about one-third use a different contractor (*n*=54, 33 percent).

7. Priority of addressing household energy issues
    a. Most state somewhat of a priority that depends on cost and financing (*n*=198, 47 percent). Almost two-thirds of subjects later state that rebates and financing are very or extremely important for them to complete upgrades (*n*=293, 65 percent).
    b. One-third state a top priority with plans to move forward with recommendations (*n*=145, 35 percent).
    c. Almost 20 percent state not a priority at this time (*n*=75, 18 percent).

8. Written recommendations
    a. Most people state they received recommendations (*n*=374, 81 percent), but
        i. Many are not receiving recommendations (*n*=58, 13 percent), and
        ii. Some are unsure if they received recommendations (*n*=31, 7 percent).
    b. Interestingly, these numbers are much higher than the bid rates found on the N2N contractor scorecard, where contractors provide bids for upgrade recommendations (*i.e.,* 21 percent of HES assessments receive bids).

9. No energy upgrades
    a. Almost 40 percent hadn't started upgrades due to financial concerns, including (*n*=72, 39 percent):
        i. Too expensive,

[29] Note that N2N contractors report approximately 10 percent upgrade rates post HES assessment. Although it is likely that those making upgrades could be more likely to complete the survey, there is also a strong possibility that N2N upgrades are underreported.

    ii. Low payback, and
    iii. Need financing.
b. About one-third stated contractor-related issues, including (*n*=58, 32 percent):
    i. No recommendations received,
    ii. No bid received, and/or
    iii. Need a contractor.
c. About one-third stated upgrades were a low priority (*n*=33, 18 percent) or the home is already comfortable (*n*=23, 13 percent).
d. About one-quarter stated other reasons (*n*-49, 27 percent), such as no improvements needed, too busy, need contractor follow up, *etc.*