A Synthesis of the Department of Energy's Better Buildings Neighborhood Program

Victoria Glasgow

Schar School of Policy and Government, George Mason University

POGO 646: Policy and Program Evaluation

Katrin B. Anacker

Due Monday, April 18th, 2022

Introduction

The very buildings in which people live, work, and conduct business have a profound impact on the economy and environment. In 2010, buildings accounted for 40% of U.S. energy consumption and greenhouse gas (GHG) emissions; aggregated energy bills cost residents $300 billion annually; and homeowners wasted $200-$400 monthly due to basic issues such as drafty doors and windows (Office of Energy Efficiency & Renewable Energy, 2022). Simple energy efficiency upgrades could reduce building energy use by 15-30%. Both the effects of efficiency upgrades on consumer incomes and implications for climate change spurred Congress to pass the American Recovery and Reinvestment Act of 2009 (ARRA or Recovery Act), which sought to "[make] supplemental appropriations for job preservation and creation, infrastructure investment, energy efficiency and science" (American Recovery and Reinvestment Act, 2009, n.p.).

The act allocated $80 billion towards energy and environment, triggering the Department of Energy (DOE) to set up the Better Buildings Neighborhood Program (BBNP) which distributed $508 million of this funding to 41 programs of varying municipal scope across the country (Office of Energy Efficiency & Renewable Energy, 2022). The program was lauded as a "Retrofit Ramp-Up" by then Vice-President Biden because of its intention to 1) provide reliable, accessible energy information to citizens; 2) finance projects that reduce energy use in buildings; and 3) increase the stock and skills of the workforce so that efficiency upgrades can occur on a national scale (Office of Energy Efficiency & Renewable Energy, 2022). Money was awarded as one-time formula and competitive grants based on resident and commuter populations, who then partnered with stakeholders, both private and public, to develop incentives that facilitate both residential and commercial energy upgrades (Government Accountability Office, 2011; Office of Energy Efficiency & Renewable Energy, 2022). The GAO reports that all 50 states, Washington

D.C., five territories, and tribes were eligible for funding: towns needed to have more than 35,000 residents while counties or parishes needed more than 200,000.

The DOE identified three main components of implementation of the Better Buildings Neighborhood Program (BBNP). The first component, Better Buildings, calls for enhanced insulation, air and duct sealing, heating/cooling upgrades, improved lighting, and home energy monitors (U.S. Energy Department Better Buildings Neighborhood Program, n.d.). The second component, Better Workforce, calls for science training, business development support, and increasing the number of building performance certifications such as ENERGY STAR® appliances. Lastly, the third component, Better Neighborhoods, focuses on helping neighborhoods by providing accessible energy efficiency assessments, facilitating access to service providers and contractors, offering financing options, and educating the public on the value of saving energy. Such goals would not be attainable without ENERGY STAR®, a program developed by both the Environmental Protection Agency (EPA) and DOE (Office of Energy Efficiency & Renewable Energy, n.d.). While not always specified in the evaluations, ENERGY STAR® appliances, specifications, and procedures are the default for determining energy saved in the BBNP, likely due to its ubiquity in both agencies' policies.

During its 2010 -2013 duration, the BBNP's overall goals were to 1) create energy retrofit and upgrade programs; 2) upgrade over 100,000 buildings; 3) save consumers $65 million on annual energy bills; 4) install upgrades that effectively conserve 15-30% energy; 5) reduce cost of existing energy efficiency program deliveries by 20% or more; and 6) create and retain between 10,000 and 30,000 jobs (Office of Energy Efficiency & Renewable Energy, 2022). The DOE states that these goals were successfully reached by the program's completion in 2013: however, the DOE's conclusion of success looks at the summation of all programs throughout the country, rather than what percentage of programs in individual localities met their initial goals.

This synthesis will look at a variety of BBNP evaluations across the country and determine the degree to which these programs implemented the aforementioned goals. One evaluation is of an individual city, Greensboro, North Carolina (Brown et al., 2014); one is that of Denver City and County, Colorado (Strife & Yancey, 2013); the three evaluations from the Greater Philadelphia Region (Gajewski, 2014), cities of Bainbridge Island and Bremerton, Washington (Kraus, 2014), and cities of Indianapolis and Lafayette, Indiana (Trovillion, 2014) deal with joint localities; and the final evaluation assesses Connecticut's statewide program (Donnelly, 2014). After examining the separate evaluations, this synthesis will look at the different ways that programs measure success and whether data collection challenges were resultant of program design or simply lack of recipient resources.

Overall, this synthesis will examine the degree to which the BBNP impacted these governments along with how they individually achieved federal goals and evaluated the results. The program has since expired and transitioned into a "voluntary, national residential energy efficiency membership network" (Office of Energy Efficiency & Renewable Energy, 2022, n.p.). In light of the program's demise, this synthesis may also help determine whether a revival of the BBNP would be pertinent in today's time, particularly as part of legislations such as the Build Back Better Act.

Literature Review

Energy Efficiency Job Creation

The American Council for an Energy-Efficient Economy (ACEEE) analyzed the current practices of job creation within energy efficiency policies and provided recommendations (Bell et al., 2015). Bell et al. found that a typical economic analysis determines that jobs are created via shifts in spending patterns from one industry to another, which can be compared to the resources needed to employ someone either full time or part time. Green jobs are those that either “benefit the environment and conserve natural resources”, or those where the processes of an industry uses fewer resources as a result of the job’s efforts (2). “Green jobs” are created in one of two ways: either by implementing an efficiency project, which is a very short period, or by the spending of whatever money is saved from energy bills. This transfers the spending from utility companies to other industries, such as entertainment or food. With these definitions in place, it follows that energy efficiency falls under the “green jobs” umbrella. Jobs created can also be evaluated by the degree to which they impact an economy: “direct jobs” are classified as change in spending through a direct effort such as installing energy retrofits, “indirect jobs” are those supply chains and industries that support the direct effort, and “induced jobs” are those supported when people spend their saved utility income in other ways (3).

There are three typical stages of gathering jobs created data through energy efficiency programs analysis: ex ante, which is done prior to the start of the program and helps predict potential impacts; midstream, which help predict future impacts and evaluate current trends; and ex post, which are done after the program has been successfully implemented (Bell et al., 2015). There are also two approaches that programs can take to determine jobs created: bottom-up, which looks at head counts or databases, and top-down, which is modeling and otherwise known as input-output (IO) models. IO is the most commonly used approach for measuring energy efficiency programs at all levels of government because they have a low cost and are "reasonably accurate" (7).

It is important to note, however, that models cannot distinguish between hiring new people and having existing workers work for a couple more hours a week instead (Bell et al., 2015). Models are further limited because different localities and programs often have different qualifications of how many hours equal one job-year, making standardization difficult. Another difficulty in modeling is the cost of this analysis, which is a confounding factor for many government agencies.

Bell et al. recommends using a head-count or bottom-up approach for energy efficiency programs (2015). Their proposed guidelines were to create a contractor database at the start of the program and to track full-time employment (FTE) for any staff used to deploy the program in addition to contractors, contractor hires, and re-spent utility savings information.

Financing Energy Efficiency

Koutsandreas et al. reviewed literature concerning energy efficiency financing and found risks that adversely affect program effectiveness (2022). In the developmental phase, policymakers must take care to include adequate evaluation criteria and establish a strong program design. A lack of staff, technological support, and risk sharing among stakeholders should be the key concerns of programs during their implementation phase. The authors also found that the rebound effect – when energy efficiency program participants end up saving less energy than when they started the program – and poorly performing retrofits also hamper loan success. Any economic factors regarding interest rates, energy prices, taxes, and weather changes also impact participation. The repayment risk – people being unable to repay the loans – is also a concern, albeit one that is anticipated for any type of loan program.

Program Education through Outreach

Strohm, of the University of Geulph, examined the effectiveness of outreach strategies in energy-efficiency programs that included voluntary audits and energy-efficiency retrofits (2011). Strohm found that research does not support the effectiveness of information-intensive campaigns, which attempt to change people's behaviors by providing knowledge and encouraging environmental mindsets. Contrary to the approach of many BBNP programs, pamphlets and workshops were particularly ineffective: there might even be a "disconnect between people's expressed concern for the environment and their own energy use" (5). Additionally, surprisingly enough, showing people that saving energy is in their financial best interest is not effective. Community-based social marketing (CBSM) appears to be the best path forward due to its steps of 1) identifying the behavior to be promoted, 2) determining the behavior's barriers and benefits, 3) creating a strategy using behavior change tools, 4) deploying said strategy, and 5) evaluating the outcome, then distributing it broadly.

Successful approaches used in energy efficiency programs include physical prompts that remind people of the desired behavior change, making a public written pledge in a group setting, financial incentives when motivation is particularly low, and making the program convenient for users to utilize (Strohm, 2011). Additionally, Strohm found that social diffusion, the act of people being influenced by their communities, is crucial for program success, and that training assessors in communication led to a 60% conversion rate in a PG&E retrofit experiment (7).

Reduced Energy Consumption

McAndrew et al. examined the effectiveness of energy efficiency policy interventions and found that most did result in reduced energy consumption (2021). Their largest finding was that not having consistent reporting put in place for interventions makes determining policy recommendations difficult, since outcomes need to be adequately measured to be evaluated. The authors suggested that having randomized control trials might help determine impact of programs to a better degree and better identify how direct policy interventions affect energy usage. Additionally, a tailored approach to implementation might better help reduce energy savings: low-income people and older people may have a harder time participating in programs, even though they tend to live in older buildings that would most benefit from energy efficiency retrofits. There is also danger in failure: on an individual level, if participants do not have as much of a utility bill reduction as they'd like, this might have a negative impact on program participation overall. Despite all these considerations, McAndrew et al. found that the most important aspect of program effectiveness is having a clear definition of energy efficiency.

Data

Each evaluation in this synthesis drew upon data that measured program rollout success in their respective municipalities, referred to as BBNP "partners" by the DOE (Office of Energy Efficiency & Renewable Energy, n.d.). Data were collected by partners or the groups they collaborated with as per the grant's conditions to implement the BBNP. All BBNP programs had two distinct components – residential and commercial – which drew upon different data sets at times. Partners provided the DOE with program data reported from July or September 2010 through September 2014. Due to the dissimilar nature of these data sets, each one will be grouped by their class and then discussed individually. Most, save for the survey data, were collected because the DOE required it.

This synthesis will examine the evaluations of four urban-suburban areas and two rural areas. Of the six evaluations, two utilized designated energy auditors for data collection and four utilized a 3rd-party platform that stakeholders contributed to.

Survey Data

Program Participant Satisfaction Surveys

While surveys serve an important role in gauging program receptivity, the DOE did not require them and the data were not reported to the federal agency. However, such data were useful for those localities who gauged public support for continuing or expanding aspects of the BBNP past the program's lifespan. These surveys should not be ignored just because they are incomplete or voluntary.

Two of the six partners reached out to their program participants after the conclusions of their upgrades and collected the resultant responses. The City of Greensboro administered a survey to those who received funding for energy efficiency upgrades, yet such data were not reported in the evaluation (Brown et al., 2014). The Indianapolis partner, consisting of the cities of Indianapolis and Lafayette, sent out postcards presenting four questions to 800 recipients and received 98 responses for a return rate of 12% (Trovillion, 2014). It was not mentioned whether reminders were sent out or not. These responses were measured via a 5-point Likert scale that ranked participant answers. The partner of Denver, CO, consisting of Denver City and County, also utilized a 5-point Likert scale examining participants' program and contractor experience, yet the evaluation did not disclose the number of responses nor the means of acquiring them (Strife & Yancey, 2013).

Administrative Data

Homes Assessed, Retrofits, Square Footage

Greensboro collected their home assessment, retrofits, and square footage data via a third-party data management system named "TrackVia" that contractors also had access to, resulting in 1,837 home energy efficiency assessments logged (Brown et al., 2014). These data were then accessible by the City of Greensboro and were used to keep tabs on projects as they moved forward, determine what percentage of those who applied to the program followed through with upgrades (conversion rates), and review uploaded pictures to determine quality of work. This proved to be helpful when corrective actions were needed: reinspected projects could then be compared with the original pictures to confirm repair.

The partner of Indianapolis collected its building and upgrade data directly from a designated energy auditor for the Residential Sweeps BBNP program, who then reported to the localities (Trovillion, 2014). The Commercial Sweeps BBNP program had no need for secondary collection by designated auditors because commercial square footage was already publicly available via City Building Records and confirmed by the application: the program progress data on all participating buildings were collected by Indy-east Asset Development (I-AD) and their subcontractor Purdue Technical Assistance Program (TAP).

For the partner of Denver City and County, all building, assessment, and upgrade data was uploaded by contractors and residents to the third-party platform "Salesforce" and verified by municipal staff using the Office of the Assessor's records and utility information (Strife &

Yancey, 2013). Utility data can be difficult to collect because the providers are private entities, but Denver City and County had access to this data due to their strong partnership with Xcel Energy, the local utility company. Data on commercial buildings were collected using Xcel Energy's Demand Side Management program.

The Greater Philadelphia Area partner collected all reported utility data using ENERGY STAR®'s online portfolio manager, which was set up by the consultant Practical Energy Solutions that evaluated the BBNP (Gajewski, 2014). The City of Philadelphia has a benchmarking law that requires commercial buildings to publicly report utility data, which simplified the data collection and analysis that some partners struggled with. Residential applicants agreed to release their utility data as part of their application, which was sourced by PECO utility company and Philadelphia Gas Works. Eight commercial and 2,688 residential assessments were completed and audit data was reported bi-weekly.

The Bainbridge Island and Bremerton partner was a curious case: its evaluation is included in this synthesis because of its rural nature while being in close proximity to the energy-conscious large city of Seattle. While it reports figures to the DOE, it did not establish an online data management system that could be accessed by contractors, citizens, and program staff (Kraus, 2014). This lack of centralization was attributed to how several contractors were not "highly computer literate" and only sent in handwritten monthly progress reports (p. 28). However, Bainbridge Island and Bremerton's BBNP energy advisors were able to record 675 assessments from which they then reported to the DOE and applied basic evaluative methods.

The fourteen localities that made up the partner of Connecticut utilized a Customer Relationship Management (CRM) Tracking Database that contractors, administrative staff, and customers all had access to, resulting in both primary and secondary data collection (Donnelly, 2014). Contractors assessed 3571 buildings for home energy savings.

Jobs Created and Retained through the BBNP

BBNP grant recipients depended on contractors to report primary data for a variety of applications. The Greensboro partner sought to calculate the number of jobs created through hours worked on BBNP projects, which were reported by contractors to the TrackVia system (Brown et al., 2014). However, conversations and observation led the City to believe that contractors were underreporting both these hours as well as the number of workers on site. In addition to hour estimations, Brown et al. (2014) noted that job hours did not include commercial or multifamily homes, which made up a total of 514 upgrades out of 1,171 (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d). Jobs created were more accurately catalogued by the City of Greensboro when contractors that attended BBNP specific training for efficient certifications were successfully referred to projects, making this a more accurate means of collecting jobs created data than relying on contractors.

The Indianapolis partner likewise found that their provision of vocational training and certification through the Working 4 Green workforce development group led to more accurate data (Trovillion, 2014). By tracking participants after the completion of the training, the Indianapolis partner determined that all 10 trainees were placed in jobs. The Denver partner, rather than determine jobs created through hours worked or trainings held, based their jobs created number off of the number of energy efficiency upgrades completed (Strife & Yancey, 2013). Considering the varying installation times of different upgrades, this method deserves questionable scrutiny. The Denver partner also drew upon a report provided by MRG &

Associates that was prepared for all of Colorado's participating BBNP programs for determining jobs created (Goldberg, 2013).

Gajewski experienced a similar problem as Greensboro: Philadelphia contractors were unwilling to comply with Davis Bacon wage requirements due to their hefty cost (2014). Contractors thus either underreported figures or abandoned projects. Bainbridge Island and Bremerton, WA received employment data from a network of "trade allies" that focused "solely on the contractor experience" and ensured quality control (Kraus, 2014, p. 7). These individuals would be contacted by homeowners looking to pursue BBNP upgrades and would obtain a contractor bid on the homeowners' behalf: 40 contractor hires resulted from the BBNP in addition to 13 program staff.

The State of Connecticut did not continue its BBNP in any form once the program terminated and thus did not provide no figures on job retention (Donnelly, 2014). Rather than focus on indirect jobs or economic impact, Donnelly found that the BBNP worked within an existing market of 26 contractors.

Loans Provided to BBNP Participants

DOE partners developed relationships with loan servicers who reported secondary data regarding number of loans provided, average monetary amounts, and respective interest rates as part of the BBNP. Greensboro partnered with three local lenders who provided these figures: Greensboro Municipal Federal Credit Union, Choice Community, Credit Union, and Carolina Bank (Brown et al., 2014, p. 13).

The Indianapolis partner's loan data was collected by the EcoHouse Loan Program, which was administered by the Indianapolis Neighborhood Housing Partnership (IHNP)

(Trovillion, 2014). The program used its initial $3m loan loss reserve to raise an additional $6m from other institutions. This program existed throughout the entire duration of the BBNP, after which it turned to an equipment-only program and was joined by the AFC First Financial Corporation, which managed loans for those that participated in offshoot energy efficiency programs. One-hundred thirty-eight loans were administered during the BBNP.

Denver City and County worked with Elevations Credit Union which, in turn, partnered with EnergySmart and the Denver Energy Challenge to administer loans (Strife & Yancey, 2013). The Philadelphia partner received loan application, funding amount, loan terms, and customer income information from AFC First Financial (Gajewski, 2014). The Pennsylvania Treasury also played a role in providing data on loan support costs: however, Gajewski did not clarify whether the Treasury retrieved its data from EnergyWorks and DEP – an undefined acronym – or vise-versa.

The partners in Bainbridge Island and Bremerton, WA consecutively worked with two separate local credit unions: Kitsap Credit Union (KCU) and Puget Sound Cooperative Credit Union (PSCCU) (Kraus, 2014). The Bainbridge partner switched the administrator of its $350k revolving loan fund – a source of money reserved for projects related to small businesses – because they found KCU to be more “rigid” (p. 27). Participation increased after the income cap was lowered, the energy assessment requirement was removed, and there was no longer a requirement to live in the structure for two years. The evaluation states that 65 loans totaling $575, 516 were issued by KCU and 22 at $238,832 were issued by PSCCU, yet the DOE received no loan information from this partner (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-b).

The Connecticut partner drew its data from loan companies as well as the loan servicers themselves (Donnelly, 2014). The Smart-E Loan had $2.5m as loan loss reserve to go towards technologies that fall under Comprehensive Energy Strategy goals; the Cozy Home Loan with $460,000 on reserve to attract private capital by installing technologies for households below 80% AMI in Fairfield, Litchfield, and New Haven; and the CT Solar Lease with $3.5m loan loss reserve, $7.6 debt and equity to attract $40m private capital, used for solar PV and hot water systems for homeowners that have FICO scores over 640. However, despite these four financers and out of 3,141 home assessments, only 2 loans were administered for a total of $8,090 (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c). This might have been a result of post-recession loan aversion or how "unlike CT, other DOE Better Buildings programs have momentum with contractor-driven financing models" (p. 31).

Energy Efficiency Education Efforts

One of the challenges in a media-focused world is determining how many people are impacted by program outreach. While all programs have participant data, determining how many people were educated on energy efficiency is more difficult to collect. However, DOE partners were able to determine this to varying degrees and address the BBNP goal of education (Office of Energy Efficiency & Renewable Energy, 2022).

Greensboro tallied the number of visits their Home Energy Response Officers (HEROs) conducted regardless of whether the household in question participated in the BBNP or not (Brown et al., 2014). Trovillion mentioned in the evaluation that when Energizing Indiana staff went door-to-door and recruited participants, the percentage of participants that went on to complete the program – otherwise known as the conversion rate – was low at 30%, yet offered no numbers on this nor any other types of outreach (2014). Denver County and City took a more meticulous approach: every single communication with program participants was tracked and logged in Salesforce, though outreach efforts were not (Strife & Yancey, 2013). Gajewski wrote how the Philadelphia partner marketed their BBNP through the Mayor's Office of Sustainability, who managed Neiman Group and LvLane's marketing approaches, yet offered no numbers on the people reached through these two businesses (2014). EnergyWorks, the consultant behind Philadelphia's evaluation, hosted a specific website and put out mailings along with emails: however, unless recipients respond with what they learned, there is no direct way to gauge how many people were educated.

Bainbridge Island and Bremerton, WA likewise did not collect comprehensive data on who was reached (Kraus, 2014). The partner did gather information on those whose homes received free 90 minute energy assessments: however, rather than focus energy education, it found that a larger marketing challenge lay in how its more affluent locality already responded to conservation messages but how the lower-income one needed more messaging on job creation. The partner did host a successful community event that ran for an entire day: the number of those who attended is not in the evaluation, but Kraus did note that 35% of people in attendance made 2 or more efficiency upgrades to their homes. The Connecticut partner had a robust outreach program and logged their data in a easily-accessible Tracking Database (Donnelly, 2014).

Changes in Energy Consumption

The Department of Energy is, fittingly, concerned with improving energy efficiency on a national scale. The Better Buildings Neighborhood Program set its overall conservation goal at 15%, which the localities in each evaluation either attempted to reach or surpassed. While the means for calculating this level was not always addressed in the evaluation – as will be discussed in “Weather Normalization: Multiple Regression” under “Methods” – all data was reviewed and verified by the DOE at the completion of the BBNPs.

Brown et al. wrote that the Greensboro BBNP has two distinct components: providing grants for those with incomes below 250% the national poverty level and creating incentives to improve energy efficiency (2014). Trovillion began Indianapolis’ evaluation by describing how the BBNP grant recipient was chosen due to its newly emerging energy efficiency market, which needed nurturing if it were to feasibly grow (2014). Denver’s BBNP evaluation was one of two that mentioned the weather normalization process for determining energy savings: Strife & Yancey wrote that the DOE’s calculator for determining electricity and natural gas savings appears to be underestimating energy savings compared to weather-normalization conclusions (2013). They also mentioned how energy savings were turned into an advertisement tool for local business, which qualified for a decal if they saved a certain amount, and that the BBNP only funded solar after a home demonstrated 15% energy savings through other efficiency retrofits. Full-scale gut rehab projects in Philadelphia needed to demonstrate that the retrofits resulted in at least 25% reduced energy (Gajewski, 2014). Bainbridge Island and Bremerton, Washington determined that the highest potential for energy savings were in pre-1980 buildings and focused their program attention on providing retrofits to houses that fell within this category (Kraus, 2014). Lastly, Connecticut’s BBNP displayed energy savings along with weather normalization on electricity use dashboards to showcase program progress for residents in real-time (Donnelly, 2014).

Other Datasets

The Indianapolis partner used census tract data to determine which of its residents were below 200% of the federal poverty threshold: however, the evaluation did not mention which particular dataset (Trovillion, 2014). Considering that the program ran from 2010 to 2014, it is most likely that the partner used data from the 2010 census. This dataset was likewise utilized by Denver to determine the number of owner-occupied households along with those below the poverty level (Strife & Yancey, 2013). The Connecticut evaluation mentions “CT census data” but does not specify in what way it was used: due to the similar structure of BBNP programs, it can be assumed that N2N used it to identify which homes were below the poverty level (Donnelly, 2014). Connecticut did, however, use the 2010 American Community Survey (ACS) to determine the population of the 14 towns. Bainbridge Island and Bremerton, WA used GIS data to identify pre-1980 homes: again, this particular dataset used was not specified (Kraus, 2014).

Methods

Descriptive Statistics

Descriptive statistics are the most basic means of representing a population or sample size (Hayes, 2022). Rather than describe the population of those who participated in the program regarding demographics, Greensboro included information on building types and square footages in its evaluation (Brown et al., 2014). Audits administered were broken down into residential single family; residential multifamily units; residential multifamily buildings; commercial buildings; and public school buildings. It also included the minimum, maximum, and averages of loans provided, yet did not include standard deviation to measure the spread of data. The partner of Indianapolis utilized average loan amount with minimums and maximums, average interest rate, average project costs, and average annual savings (Trovillion, 2014). It was the only partner to report the minimum, maximum, and average FICO credit scores of program participants.

Denver County and City provided descriptive statistics on the average project cost along with the percent of households enrolled that were single-family or multi-family (Strife & Yancey, 2013). The Philadelphia DOE partner provided information on the average and medium income of participants over the course of the program, along with the total number of projects, average loans, and what percent of projects were residential or commercial (Gajewski, 2014). Bainbridge Island and Bremerton, WA provided normal and weighted averages on data such as energy savings, number of improvements per home, upgrade cost, and loan amounts (Kraus, 2014). Kraus provided the mode for upgrade type, ranking the three most popular ones per county, but not for any other figures. Lastly, Connecticut state's evaluation included a comprehensive profile of average annual utility bill, upgrade averages, average building age, percent single-family homes, total number of households, average electricity use, and even electricity intensity (kWh/sq. ft./year) (Donnelly, 2014).

Conversion Rates

All partners utilized conversion rates that showed the percentage of participants who initially started the program that ended up completing energy efficient retrofits. Conversion rates were determined from those assessed to those who completed upgrades; from those who expressed interest to those who completed upgrades; and even from those who expressed interest to those who received assessments but no further work, such as is the case for Greensboro's BBNP evaluation (Brown et al., 2014).

Community Based Social Marketing (CBSM)

The strongest outreach approach of all BBNP programs was that of Connecticut's Community Based Social Marketing (CBSM), or "action research", where collected data was entered in the Tracking Database (Donnelly, 2014, p. 58). Staffers engaging in CBSM logged each outreach event type, the time it took to plan and implement, those involved in running it, type of sponsor or host, location and weather conditions, materials and messaging, along with any resident feedback and what approaches worked. Data was revisited weekly to update which events were most successful and which were lacking in participation.

Weather Normalization: Multiple Regression

Weather Normalization is perhaps the most important method examined in this synthesis because, whether stated in the evaluations or not, it is how the BBNP funding recipients derived their figures on energy savings. These numbers will be further explored in the "Results" section.

To determine energy savings, ENERGY STAR® looks at weather variations from year to year and adjusts for anomalies in energy demanded using regression analysis (ENERGY STAR® Portfolio Manager®, 2020). Cooling Degree Days (CDD) – or the sum of differences of temperatures above 65°F, which necessitates air conditioning – are an independent variable along with Heating Degree Days (HDD), the sum of differences of temperatures below 65°F, which necessitates heating the building. Any gaps in data on the subject building's weather collected by weather stations are provided by the Environmental Protection Agency (EPA).

Despite being a "government-backed symbol for energy efficiency", ENERGY STAR® is a business that has little incentive to provide its regression equation to the public (Environmental Protection Agency, 2022). However, the equation is based off of a tool named ETracker that uses regression to create a line of best fit of typical energy usage under normal conditions without efficiency upgrades (ENERGY STAR® Portfolio Manager®, 2020; Kissock, 2003). ETracker uses energy use data from buildings after retrofits and compares it to a model of energy consumption if not retrofitted by plotting temperature on the x-axis and monthly energy expenditures on the y-axis. The difference between measured after-upgrade energy usage and energy usage without upgrades is considered the amount of energy saved by the retrofit. Energy usage without upgrades, normalized for weather events, can be found using the following general equation:

$$E = a*HDD + b*CDD + c*days$$

Where E = energy usage over the time period, HDD = Heating Degree Days during time period, CDD = Cooling Degree Days during time period, days = time period in days, and the remaining variables are regression coefficients that are different for every regression (BizEE Degree Days, n.d.). At least a year's worth of weather data is required for the model.

Two DOE partners explicitly mentioned Weather Normalization in their evaluations: the Denver partner and the Connecticut partner. Denver City and County drew monthly energy usage data from their local utility company, Xcel, and explained that weather normalization was used to compare estimated savings to actual savings (Strife & Yancey, 2013). The Connecticut partner included how weather normalization was displayed on a town dashboard showing town aggregate electricity use derived from utility data (Donnelly, 2014). While the other partners did not explain how they determined their energy savings, comparing actual utility data with weather-normalized regression figures appears to be the most likely manner, especially considering how the Greensboro partner, Philadelphia partner, and Bainbridge Island partner all mentioned ENERGY STAR® trainings in their evaluations (Brown et al., 2014; Gajewski, 2014; Kraus, 2014).

Results

Energy Efficiency Job Creation

The DOE defines job hours as those worked administrating or executing projects funded by BBNP funds, including but not limited to "administrative staff, consultants and contractors involved in the management or deployment of upgrade and assessment activities" (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-h). Trained workers are those who were trained using BBNP funding, and certified workers are those who received nationally-recognized certifications or justifications using BBNP funding.

Greensboro's BBNP trained 38 workers over the course of the program and certified 0 (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d). 51,058 job hours were generated as a result. However, the City believed that job hours were underreported due to contractor misunderstandings, and the average of 8 jobs generated per quarter does not include hours related to commercial or multi-family projects (Brown et al., 2014). Indianapolis' program was less effective at training and certification: the figure for both fields is 0 (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-e). The program generated 64,431 job hours regardless of lack of contractor support.

Denver County and City's BBNP, like that of Garfield County, was a subset of the Boulder County BBNP (Strife & Yancey, 2013). While Denver's program was evaluated separate from Boulder County's, its data were lumped with both Boulder and Garfield County's results when reported to the DOE. The Denver evaluation does state, however, that 11 full time jobs were created from Denver's program but does not provide total job hours, trainings, or certifications. Philadelphia's BBNP program did not train or certify any contractors yet generated 308,271 job hours (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-f). Bainbridge Island and Bremerton, Washington's BBNP trained 129 workers, certified 29 contractors, and provided work for 16 active contractors (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-b).

While most of the evaluations referenced job retention in their evaluations, Donnelly wrote that job retention data was not something the Connecticut BBNP even attempted to collect. Considering the overall strength of this particular evaluation and that job retention is one of the DOE's BBNP goals, this lack of information is surprising. Regardless of this missing figure, the DOE did receive data that the program generated 96,602 job hours (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c). The evaluation does state that 85.31 jobs were created, yet it is not explained whether these were full time or not or how this figure was derived.

Financing Energy Efficiency

Greensboro's BBNP is the first of two evaluations that did not have numbers to report for this section: while it had ample funds available, no residents or businesses took advantage of the BBNP's loans (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d). $645,000 was put on deposit, but over half of the funding was removed to be used as grants instead, leaving $285,000 remaining on deposit at the end of the program. This lack of participation likely attributed to how participants are reluctant to go into debt after the 2007 - 2009 economic recession (Brown et al., 2014). Indianapolis provided 122 residential loans for a total of $952,458 yet did not provide any commercial loans (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-e).

Denver City and County's evaluation provided specific figures that were not lumped with other Colorado programs: 49 loans were residential for a total of $490,371, and 5 loans were provided to commercial participations for a total of $313,080. 91% of loans provided were residential, with an average loan size of $10,000; 9% were commercial, for an average size of $62,616 (Strife & Yancey, 2013). The Philadelphia BBNP provided 1617 residential loans at a total of $17,616,238, averaging 10,894 per loan, and 3 commercial loans at a total of $6,256,613, averaging $2,085,538 per loan (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-f).

The Bainbridge Island and Bremerton, Washington BBNP experienced the same problem as Greensboro: residents were reluctant to take out loans after a period of economic uncertainty (Kraus, 2014). No residential or commercial loans were provided even though the partnerships were securely in place and $814,348 of program funding was put on reserves. The Connecticut BBNP also experienced this reluctance in that no commercial loans were provided, but the program did provide 2 residential loans for a total of $8,090 and an average of $4,045 per loan (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c).

Program Education through Outreach

This synthesis will examine the results of eight separate outreach techniques. 1) "Business organization outreach_Number attending session" refers to the number of buildings owners that attended a meeting to learn more about the program; 2) "Direct mail_Number of direct mail slips" is number of direct mail pieces sent out; 3) "Direct mail_Number of applications with direct mail IDs" were the number of applications solicited by direct mail, which determines the conversion rate and effectiveness of mailing outreach; 4) "Door to door_Number of homes visited" tallied the homes that were visited in door to door outreach; 5)

"Door to door_Number of homes agreeing" is the number of homes that agreed to sign up, which is also used for determining conversion rates; 6) "Hotline_Number of calls" is the number of hotline calls; 7) "Hotline_Number of calls that lead to applications" is used for determining hotline call conversion rates; and 8) "Neighborhood Meeting_Number Attended" is the amount of building owners that attended a neighborhood meeting (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c, "Data Dictionary" sheet). It is unclear whether "Business organization outreach_Number attending session" refers to commercial building owners or all building owners, but due to the word "business" in the label, this section will paraphrase it as "commercial outreach".

Greensboro's BBNP reached 867 in commercial outreach, experienced a direct mail application conversion rate of 1.16%, had an assessment conversion rate for door-to-door visits of 9.64%, found that 13.26% of hotline calls led to program applications, and had a total of 412 neighborhood meeting attendees over the course of the BBNP (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d). Indianapolis reached 523 commercially, had a direct mail application conversion rate of .22%, an assessment conversion rate of 17.12% for door-to-door visits, a rate of 20.10% hotline calls that resulted in applications, and 1,398 neighborhood meeting attendees (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-e). The City and County of Denver, surprisingly enough, did not report their outreach efforts to the DOE (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-g).

In Philadelphia's BBNP, 370 were reached through commercial outreach, the application assessment conversion rate for door-to-door visits was 0%, the hotline application conversion rate was 66.66%, and 1 person attended neighborhood meetings over the course of the multi-year program (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-f). While technically reported, the direct mail figure is listed as 2 and the direct mail to application number is 6, which is likely resultant of data error: a conversion rate of 300% is unfeasible.

The BBNP of Bainbridge Island and Bremerton, Washington, had 321 participants in its commercial outreached, a direct mail to application conversion rate of .15%, experienced a door-to-door visit to assessment agreement conversion rate of 1%, a 0% conversion rate for hotline calls, and 278 neighborhood meeting attendees (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-b). Connecticut's BBNP reached 273 through commercial outreach, experienced a direct mail to application conversion rate of .55%, had a door-to-door visit to assessment agreement conversion rate of 57%, and reported 1,681 neighborhood meeting attendees (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c). The program also reported 191 hotline calls and 191 hotline calls that led to applications, which is questionable: either the conversion rate was 100%, there was a recording error, or program staff misinterpreted what should be reported.

Reduced Energy Consumption

Reductions in energy consumption were reported via five categories: 1) electricity in kilowatt-hours (kWh); 2) natural gas in 100,000 British thermal units (therms); 3) heating oil, such as kerosene (gallons); 4) LPG, also known as propane (gallons); and 5) the monetary amount of energy savings in dollars (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d).

Greensboro experienced savings of 3,720,612 electric kWh, 88,179 natural gas therms, 819 heating oil gallons, 0 LPG gallons, and energy cost savings of $602,956 with their $5,000,000 BBNP grant (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-d). Indianapolis' savings were 2,917,049 electric kWh, 237,172 natural gas therms, 0 gallons of heating oil or LPG, and energy cost savings of $583,569 with their $10,000,000 BBNP grant (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-e). Denver City and County experienced 2,948,949 electric kWh, 632,770 natural gas therms, 0 heating oil and LPG gallons, and $886,814 savings with their $4,945,595 BBNP grant (Strife & Yancy, 2013).

Philadelphia generated a savings of 6,774,483 electric kWh, 203,782 natural gas therms, 115,987 heating oil gallons, 4,609 gallons of LPG, and $1,821,016 in energy cost savings with their $25,000,000 BBNP grant (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-f). Bainbridge Island and Bremerton, Washington's savings amounted to 9,056,332 electric kWh, 5,901 natural gas therms, 52,270 gallons of heating oil, 47,785 gallons LPG, and $2,609,646 with their $4,884,614 BBNP grant (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-b). Lastly, the state of Connecticut achieved savings of 5,234,774 electric kWh, 70,739 natural gas therms, 261,003 gallons of heating oil, 0 LPG gallons, and $2,135,635 cost energy savings with their $4,171,214 BBNP grant (U.S. Energy Department Better Buildings Neighborhood Program, n.d.-c).

Limitations

The DOE had a strict schedule of quarterly deadlines and reporting requirements throughout the duration of the BBNP (Office of Energy Efficiency & Renewable Energy, 2022, n.d.-h). However, despite such standards and goals provided since the inception of the program, the evaluations neglected to contain aspects that policy analysts would typically not omit. The methods used were limited and not as thorough as would be expected of policy evaluations, yet what was provided is an important indicator of BBNP's success.

One of the largest limitations of all evaluations was regarding data. Even though the DOE required such collection, the BBNP would have benefitted from including quality stipulations as part of the program or, at the very least, provided best practices for gathering data. Denver discussed outreach and advertising in its evaluation but reported none of this to the DOE, resulting in missing data (Brown et al., 2014; U.S. Energy Department Better Buildings Neighborhood Program, n.d.-g). While such gaps could be attributed to program administration, some of the largest roadblocks to data collection were the stakeholders themselves. All programs had frustrations either with recruiting contractors, ensuring the contractors reported accurate job numbers and employees, or facing a reluctance to pay full wages as part of the Davis Bacon Act.

Multiple programs were unable to access utility data while others enjoyed strong partnerships with local utility companies: in this case, the private nature of a widely-used service made for difficulties in evaluating. Additionally, evaluations reported lump figures on reduced energy usage and energy costs. Comparing the scale of the program and examining the degree to which localities experienced energy savings would be more useful when original energy usage is available. Considering how energy prices and standards of living vary, adjusting the energy cost savings to a standardized relative value would illustrate the "real" value of savings. Taking note of the housing stock and presenting figures of the percentage that received retrofits would also showcase how much the BBNP affected communities. Widespread and required satisfaction surveys for those who completed the program across all localities would help guide the formation of future energy-conservation policies.

Conclusion: Hindsight for the 2020s

Analysists must determine three aspects of policy implementation to determine program efficiency: 1) the degree to which individual programs met their goals, 2) whether the policy significantly impacted the localities, and 3) whether a revival of the federal policy would be pertinent in today's time. This conclusion will look at all three in the context of the DOE's Better Buildings Neighborhood Program.

Individual locality goal achievement was varied. Greensboro met 75% of its 4 goals: the City developed a financing program even though it was not utilized, provided training for green jobs, and conducted general neighborhood outreach (Brown et al., 2014). Its retrofit work goal of 300 buildings was not met, and while it mentioned its goal of 15% energy savings, it did not disclose whether this was achieved. Indianapolis exceeded its retrofit goal of 1500 buildings, utilized a robust loan program, and exceeded the DOE's 15% energy savings goal by 1.41% (Trovillion, 2014). The locality did not establish outreach goals nor jobs-created goals. Denver City and County states that it "met all of its goals" under its BBNP grant: it utilized loans, determined an average savings of 16%, met its upgrade goals, provided technical training, and employed over 150 contractors (Strife & Yancey, 2013, p. 54). Philadelphia was 271 retrofits away from its 2500 target at the time of the evaluation, which stated that "smaller, specific goals tied to performance" would have been better for identifying trends (Gajewski, 2014, p. 38). The remaining goals were so broad that it was "not possible to measure whether real growth had occurred" (p. 38). The Washington communities met 63% of their assessment targets, 49% retrofits, 82% new jobs, and 30% percent energy savings for each house on average (Kraus, 2014). Connecticut's numerical goals were limited to a variety of 8 retrofit upgrade types, none of which were achieved (Donnelly, 2014).

The literature review may provide further insights on the BBNP's success. Five of the evaluations were for programs that utilized the recommended bottom-up approach for determining jobs created (Bell et al., 2015). Even if relying on contractors to report their data led to inaccurate data at times, direct head-counts were more accurate than the IO modeling approach. Four evaluations utilized 3rd party databases, which was also recommended by Bell et al. Many aspects of the best-practices structure were in place, indicating that accuracy could have been enhanced with more funding and technical support rather than design changes. The design of BBNP loans was carefully integrated with existing loan partners, yet most participants were unwilling to take on debt due to the recession, which Koutsandreas et al. forecasted (2022). When reaching out to residents, the Connecticut partner used CBSM while other partners used information-intensive campaigns or financial-interest campaigns, which the literature does not support (Donnelly, 2014). Brown et al. did mention that word of mouth was the most effective way to spread the program and, in doing so, mentioned effective social diffusion in definition if not in name (2014). Lastly, regarding energy reduction in efficiency programs, McAndrew et al. mentioned how the strongest indicator of reduced energy consumption was having a clear definition of efficiency in the program (2021). The DOE and all of its partners were quite clear on its definition of 15% reduction, and this appeared to be the most widely-achieved metric across all evaluations.

Donnelly writes that the ultimate goal of Connecticut's BBNP was "to achieve long-term cultural shifts in how people think about and use energy" (2014, p. 6). While the demonstrated achievement of program goals may appear underwhelming, it is important to note that the impact of programs need not be monumental to be worthwhile. Program critics may reference low program conversion rates, educational event attendance, and low energy cost savings compared to the size of the awarded grant as evidence that the BBNP was a waste of taxpayer money. However, this program was not developed with the intent of reaping a return on investment but rather for investing in opportunities to better participants' lives. Brown et al. wrote that word of mouth was the most effective means to garner interest for energy efficiency retrofits: people must talk about and experience technologies before they become demanded and widespread (2014). While the evaluations consistently mentioned frustrations with contractors and difficulty in determining or creating jobs, the BBNP brought to light technologies and techniques which might have been previously unknown to this sector. Systemic and behavioral shifts are made through compounding factors: programs that invest in energy efficiency provide the resources and structure that create opportunity for lasting change.

If the BBNP were to be deployed today, policy designers must take current economic conditions into account. The evaluations mentioned how reluctance to take out loans was attributed to the 2007-2009 Great Recession. It is both understandable and predictable that recent economic turbidity would make citizens reluctant to acquire more debt. The 2021-2022 Inflation Surge and the 2020-2022 COVID-19 pandemic have created similar conditions that indicate future programs should focus on providing grants and rebates rather than loans. However, higher prices mean that people are more conscious of energy cost and may be more willing to participate in efficiency efforts, making such programs more successful. Another condition that the DOE should consider is that of housing shortages. Evaluations such as Denver's noted that their focus was on single-family residential and commercial buildings rather than multi-use: a growing demand for missing-middle housing may indicate that an additional quota requirement is needed. Including more types of buildings within the program, however, may only be attainable through further technical assistance. Localities face funding constraints due to the bare-bones budget attitude of their elected officials and citizenry. Accessory staff can be viewed as frivolous and a waste of taxpayer money. Data collection in the BBNPs– and therefore program evaluation – may have been more rigorous if grant recipients did not have the pressure of other workloads or needing to hire the lowest-bidding consultant. Many localities may be unfamiliar with the weather normalization, data collection, or energy efficiency in general: in such a case, a more hands-on, back-and-forth relationship with the DOE would be beneficial to both parties and the BBNP.

Overall, the BBNP achieved its energy efficiency and educational goals but could benefit from stricter requirements, more guidance, and additional administrative support. A program design that is sensitive to budding socioeconomic conditions will only further contribute to its popularity, efficacy, and success.

References

American Recovery and Reinvestment Act of 2009, 111 U.S.C. No. 111-5 (2009). https://www.congress.gov/bill/111th-congress/house-bill/1/text

Bell, C. J., Barrett, J. & McNerney, M. (2015, September). *Verifying energy efficiency job creation: current practices and recommendations.* American Council for an Energy-Efficient Economy. https://www.aceee.org/sites/default/files/publications/researchreports/f1501.pdf

BizEE Degree Days (n.d.). *Regression analysis of energy consumption and degree days in Excel.* BizEE Degree Days: Weather Data for Energy Saving. https://www.degreedays.net/regression-analysis

Brown, D., Harris, B., Blue, C., & Gaskins, C. (2014, September). *Energy Efficiency and Conservation Block Grant (EECBG): Better Buildings Neighborhood Program final report.* City of Greensboro. https://doi.org/10.2172/1156831

Donnelly, K. A. (2014, January). *Energy Efficiency and Conservation Block Grant (EECBG): Better Buildings Neighborhood Program final report.* CEFIA-CT Clean Energy Finance and Investment Authority. https://doi.org/10.2172/1114148

Energy Star® Portfolio Manager®. (2020, August). *Technical reference: climate and weather.* Energy Star®. https://www.energystar.gov/sites/default/files/tools/Climate_and_Weather_2020_508.pdf

Gajewski, K. (2014, February). *EnergyWorks: A Better Buildings Neighborhood Program in the five-county Greater Philadelphia Region.* City of Philadelphia. https://doi.org/10.2172/1122132

Goldberg, M. (2013, September). *Statewide economic impact analysis of six Colorado counties' energy programs: summary report.* MRG & Associates.

Government Accountability Office. (2011, April). *Recovery Act: Energy Efficiency and Conservation Block Grant recipients face challenges meeting legislative and program goals and requirements.* (GAO publication No. 11-379). U.S. Government Printing Office. https://www.gao.gov/assets/gao-11-379.pdf

Hayes, A. (2022, March). *Descriptive Statistics.* Investopedia. https://www.investopedia.com/terms/d/descriptive_statistics.asp

Kissock, K. (2003, July). *ETracker user's manual.* University of Dayton, Ohio, Department of Mechanical Engineering.

Koutsandreas, D., Kleanthis, N., Flamos, A., Karakosta, C., & Doukas, H. (2022, January). Risks and mitigation strategies in energy efficiency financing: a systematic literature review. *Energy Reports 8*(2022) 1789 – 1802. https://doi.org/10.1016/j.egyr.2022.01.006

Kraus, Y. X. (2014, February). *Bainbridge Energy Challenge: Energy Efficiency and Conservation Block Grant (EECBG) - Better Buildings Neighborhood Program.* Conservation Services Group, WA. https://doi.org/10.2172/1120149

McAndrew, R., Mulcahy, R., Gordon, R., & Russell-Bennett, R. (2021, March). *Household energy efficiency interventions: a systematic literature review*. Queensland University of

Technology & University of the Sunshine Coast. https://doi.org/10.1016/j.enpol.2021.112136

Office of Energy Efficiency & Renewable Energy. (2022, January). *History: Better Buildings Neighborhood Program.* https://www.energy.gov/eere/better-buildings-neighborhood-program/history

Office of Energy Efficiency & Renewable Energy. (n.d.). *Better Buildings partners: Better Building Neighborhood Program.* https://www.energy.gov/eere/better-buildings-neighborhood-program/better-buildings-partners

Office of Energy Efficiency & Renewable Energy. (n.d.) *ENERGY STAR®.* https://www.energy.gov/eere/buildings/energy-starr

Strife, S.; Yancey, L. (2013, December). *Energy Efficiency and Conservation Block Grant (EECBG) Better Buildings Neighborhood Program: Final report.* Boulder County. https://doi.org/10.2172/1116563

Strohm, S. (2011, December). *Community-level energy efficiency programs: a literature review of best practices for promotion and recruitment.* University of Geulph. https://atrium.lib.uoguelph.ca/xmlui/bitstream/handle/10214/9313/Strohm_CommunityLevelEnergyEfficiency_2011.pdf?sequence=3&isAllowed=y

Trovillion, K. (2014, November). *City of Indianapolis Better Buildings Program.* City of Indianapolis. https://doi.org/10.2172/1169450

U.S. Census Bureau. (n.d.). *Greensboro, N.C. demographic and housing estimates, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?q=greensboro&tid=ACSDP1Y2011.DP05

U.S. Census Bureau. (n.d.). *Greensboro, N.C. selected economic characteristics, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP03&g=0400000US37_1600000US3728000

U.S. Census Bureau. (n.d.). *Indianapolis, IN. demographic and housing estimates, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP05&g=0400000US18_1600000US1836003

U.S. Census Bureau. (n.d.). *Indianapolis, IN. selected economic characteristics, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP03&g=0400000US18_1600000US1836003

U.S. Census Bureau. (n.d.). *Denver, CO. demographic and housing estimates, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP05&g=0400000US08_1600000US0820000

U.S. Census Bureau. (n.d.). *Denver, CO. selected economic characteristics, 2014 American Community Survey 5-year estimates*.

https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP03&g=0400000US08_1600000US0820000

U.S. Census Bureau. (n.d.). *Philadelphia, PA. demographic and housing estimates, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP05&g=0400000US42_1600000US4260000

U.S. Census Bureau. (n.d.). *Philadelphia, PA. selected economic characteristics, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP03&g=0400000US42_1600000US4260000

U.S. Census Bureau. (n.d.). *Bainbridge Island, WA. demographic and housing estimates, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP05&g=0400000US53_1600000US5303736

U.S. Census Bureau. (n.d.). *Bainbridge Island, WA. selected economic characteristics, 2014 American Community Survey 5-year estimates*. https://data.census.gov/cedsci/table?tid=ACSDP5Y2014.DP03&g=0400000US53_1600000US5303736

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-a). *Better Buildings for a Better Future. [Fact Sheet]*. https://www.energy.gov/sites/default/files/2013/12/f6/bb_factsht_final7-2-12.pdf

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-b). *Bainbridge Island program dashboard: connecticut_bb_an_0003806_pmc_dashboard_y13-q3.xls [Microsoft Xcel Sheet]*. https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/bainbridge-island-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-c). *Connecticut data dashboard: bbnp_bb_an_0003805_pmc_dashboard_y14-q3.xlsm [Microsoft Xcel Sheet]*. https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/connecticut-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-d). *Greensboro data dashboard: bbnp_bb_an_0003567_pmc_dashboard_y14-q3.xlsm [Microsoft Xcel Sheet]*. https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/greensboro-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-e). *Indianapolis data dashboard: bbnp_bb_an_0003577_pmc_dashboard_y14-q3.xlsm [Microsoft Xcel Sheet]*. https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/indianapolis-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-f). *Philadelphia data dashboard: bbnp_bb_an_0003568_pmc_dashboard_y14-q3.xlsm [Microsoft Xcel Sheet]*. https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/philadelphia-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-g). *Philadelphia data dashboard: bbnp_bb_an_0003554_pmc_dashboard_y14-q3.xlsm [Microsoft Xcel Sheet]*.

https://www.energy.gov/eere/better-buildings-neighborhood-program/downloads/boulder-county-data-dashboard

U.S. Energy Department Better Buildings Neighborhood Program. (n.d.-h). *Better Buildings Neighborhood Program reporting and information system.* https://www.energy.gov/eere/better-buildings-neighborhood-program/better-buildings-neighborhood-program-reporting-and

U.S. Environmental Protection Agency. (2022, February). *EPA launches Energy Star home upgrade to take U.S. households into the clean energy future.* https://www.epa.gov/newsreleases/epa-launches-energy-star-home-upgrade-take-us-households-clean-energy-future

Appendix A. Information on Evaluations and Target Populations

	Brown et al, 2014 (Greensboro, NC)	**Trovillion, 2014 (Indianapolis, IN)**	**Strife & Young, 2013 (City and County of Denver, CO)**	**Gajewski, 2014 (Greater Philly Area)**	**Kraus, 2014 (Bainbridge Island + Bremerton, WA)**	**Donnelly, 2014 (Connecticut)** *(*2010 ACS)*
Grant allocated	$5,000,000	$10,000,000	$4,945,595	$25,000,000	$4,884,614	$4,171,214
Program length	Jun 2010 – Mar 2014	Spring 2011 – Nov 2014	Oct 2010 – Sept 30, 2013	Nov 2010 – Dec 2013	Aug 1, 2010 – Mar 30, 2014	Aug 2010 – Aug 2013
2014 Population: ACS 5-year est.	9,750,405	6,542,411	5,197,580	12,758,729	-	263,801*
2014 Housing Units:	4,385,668	2,811,617	2,238,624	5,578,393	-	97,328*
2014 AMI	57,328	60,440	73,817	67,521	-	-

Appendix B. Literature Review

	Brown et al, 2014 (Greensboro, NC)	**Trovillion, 2014 (Indianapolis, IN)**	**Strife & Young, 2013 (City and County of Denver, CO)**	**Gajewski, 2014 (Greater Philly Area)**	**Kraus, 2014 (Bainbridge Island + Bremerton, WA)**	**Donnelly, 2014 (Connecticut)**
Jobs Created through the BBNP		x	x			
Loans Provided to BBNP Participants	x	x	x	x	x	x
Residents Educated Through Outreach	x	x				x
Reduced Energy Consumption			x			x

Appendix C. Data

Table 1.1: Survey Data

	Brown et al, 2014 (Greensboro, NC)	**Trovillion, 2014 (Indianapolis, IN)**	**Strife & Young, 2013 (City and County of Denver, CO)**	**Gajewski, 2014 (Greater Philly Area)**	**Kraus, 2014 (Bainbridge Island + Bremerton, WA)**	**Donnelly, 2014 (Connecticut)**
Program Participant Satisfaction Surveys	Incomplete – collected but not reported	X – 5-point Likert Scale	X – 5-point Likert Scale			

Table 1.2: Administrative Data

	Brown et al, 2014 (Greensboro, NC)	**Trovillion, 2014 (Indianapolis, IN)**	**Strife & Young, 2013 (City and County of Denver, CO)**	**Gajewski, 2014 (Greater Philly Area)**	**Kraus, 2014 (Bainbridge Island + Bremerton, WA)**	**Donnelly, 2014 (Connecticut)**
Homes Assessed, Retrofits, Square Footage	X – 3rd party database	X – designated auditor	X – 3rd party database	X – 3rd party database	X – designated energy advisors	X – 3rd party database
Other Datasets		X – 2010 census			X - GIS	X – 2010 ACS

Appendix D. Methods

	Brown et al, 2014 (Greensboro, NC)	Trovillion, 2014 (Indianapolis, IN)	Strife & Young, 2013 (City and County of Denver, CO)	Gajewski, 2014 (Greater Philly Area)	Kraus, 2014 (Bainbridge Island + Bremerton, WA)	Donnelly, 2014 (Connecticut)
Descriptive Statistics	x	x	x	x	x	x
Conversion Rates	x	x	x	x	x	x
Weather Normalization: Multiple Regression			x			x

Appendix E. Results

	Brown et al, 2014 (Greensboro, NC)	Trovillion, 2014 (Indianapolis, IN)	Strife & Young, 2013 (City and County of Denver, CO)	Gajewski, 2014 (Greater Philly Area)	Kraus, 2014 (Bainbridge Island + Bremerton, WA)	Donnelly, 2014 (Connecticut)
Jobs Created through the BBNP	x	x			x	
Loans Provided to BBNP Participants		x	x	x		x
Residents Educated Through Outreach	x	x		x	x	x
Reduced Energy Consumption	x	x	x	x	x	x