

Unleashing Local Green Jobs Through Energy Savings

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Abstract

Saving energy creates well-known benefits including cost reductions, commodity price risk reduction, natural resource conservation, and the reduction of greenhouse gas (GHG) emissions. The standard policy argument is that jobs are also created from energy savings, through the workforce that installs insulation, weatherization and energy efficient products. The model introduced in this entry provides a new and significantly larger package of economic development and jobs, via a community-based program that links residential energy conservation to rewards from local merchants. This entry outlines the challenge for residential savings, highlights the results of our recent behavior change study, and details the creative model that provides local government with a new tool to unleash local economic growth through energy savings. A major city in Silicon Valley, California, will be rolling out this program in 2011.

Table of Contents

Residential Sector Challenge—The Case for Change	1
<i>Fragmented</i>	1
<i>Large Variation</i>	1
<i>No Silver Bullet, Only “Silver Buckshot”</i>	3
<i>Traditional Utility-funded Efficiency Programs Have Low Results</i>	4
Residential Solutions for Energy Savings	5
Figure 3. Three-Legged Stool for Maximum Energy Savings	5
Source: Tabitha Crawford, CEM and Richard Lucy, CPA, CEM.	5
<i>Three-Legged Stool for Maximum Energy Savings</i>	5
<i>Technology—Engaging Web Platform</i>	6
<i>Behavior Change—In-Home Coaching</i>	6
Figure 4: Program Overviews for Benicia & Travis AFB, CA.....	7
Source: Ennovationz, Inc.	7
<i>Boundaries – Rules and Context Make a Difference</i>	8
Economic Development Opportunity	9
<i>Identify Residents Ready to Invest in Efficiency</i>	9
<i>How Savings Become Spending</i>	10
Summary	11

Residential Sector Challenge—The Case for Change

There are substantive challenges to creating large pools of energy savings from individual homes and neighborhoods – a challenge so large that it gets its own acronym: HTR or “hard to reach.” Traditional utility programs have not made significant inroads into engaging consumers.

While residential sector energy savings are HTR, they are worth pursuing as many of our nation’s cities have huge suburban areas within the city limits or in the surrounding towns. For these locales, carbon emissions from the residential sector can be 35 – 70% of the total municipal footprint. For this reason, the residential sector is not only HTR, but VIP.

Fragmented

Consider the following thought experiment: It is estimated that the Empire State Building will use about 55 million kilowatt hour (kWh) per year, the same amount used by 7,500 typical homes (at 20 kWh per day). Suppose the goal is to save 10% of energy consumed. For the skyscraper, there is one owner and a similar configuration of lighting and windows on each floor. Figure out a solution, and deploy 100 times (excluding the top and bottom floors.) This type of retrofit solution is relatively straightforward, creating a predictable cost and savings model, and thus financeable.

Now try to save 10% of the electricity used in 7,500 homes. That’s 7,500 different owners -- and some absentee owners may be, renting out their homes. The solutions will vary by house, depending on the age of the home, orientation to the sun, number of occupants, last remodel and other variables. The savings in each home are relatively small, the solutions varied, and there are a huge number of decision makers. This lack of predictability creates uncertainty for capital providers. For these key reasons, large-scale residential efficiency programs have not traditionally been considered as a viable financial investment opportunity.

Large Variation

The second challenge of the residential market is that there is no one-size-fits-all solution. Take any 12 – 15 homes in a neighborhood. Chances are the same developer will have built the homes; after all, 70% of homes in the U.S. are within 200 feet of a home built at the same time. Yet, energy use per home varies enormously.

Consider the following table from 150 homes in Benicia, CA. The residents in these homes voluntarily submitted their energy bills when they received a free energy audit provided by the city. Free energy audits may attract those with very high bills (Help me save money!) and those with very low bills (I’m green! Prove it!), but regardless, the range of variation in energy bills for homes in the same town is large. Electricity use has a 5:1 ratio from the highest home to lowest, while natural gas has a 12:1 ratio. Some homes may use gas for heating, cooking and hot water, some just for hot water, so we would expect the gas variation to be larger than for electricity. As table 1 shows, the large range of variation extends to water use as well.

Table 1. A Huge Range of Variation in Energy and Water Use for Homes in Benicia, CA

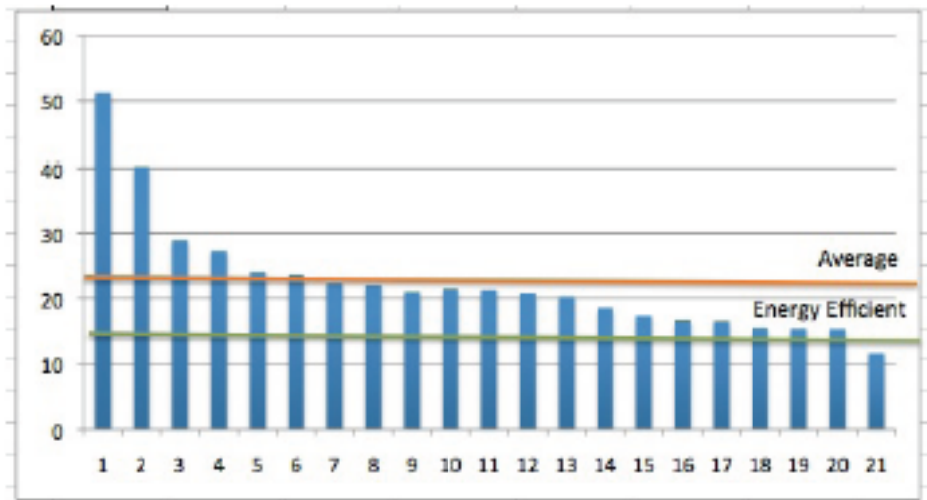
Annual Electricity Consumption (150 homes)		Annual Natural Gas Consumption (150 homes)	
Highest	15,278 kWh	Highest	1,150 therms
Average	7,752 kWh	Average	501 therms
Lowest	2,993 kWh	Lowest	102 therms

Annual Water Consumption (144 homes)	
Highest	365 CCF
Average	162 CCF
Lowest	30 CCF

Source: Ennovationz, Inc.

Now consider the range of average daily electricity use for a small sample of homes at Travis AFB, outside of the San Francisco Bay Area. Again we see a huge variation in electricity use, about a 5:1 ratio from top to bottom. The orange line on the table indicates the average daily electricity use in the sample, and the green line shows the average daily electricity use for a group of comparable, efficient homes off-base.¹

Figure 1: kWh per Day for Homes in Pilot



Source: Ennovationz, Inc.

Digging a layer deeper, the Travis study reveals why there is so much variation in energy use per home, as shown in Figure 1. The participants all lived in relatively new housing, 12 years old or less. The houses ranged from 1800 – 2200 square feet, with few exceptions. All had heating and cooling systems that complied with California’s aggressive energy building code, known as Title 24. The point? The houses are not the source of the observed variation in energy use. This shifts attention to the occupants –

their behavior and their personal inventory. For example, some homes in the Travis study had three refrigerators plugged in, and others had only one. The small variation in housing quality at Travis points to the human element as the explanation for the large variation in energy use per home.

This finding is also present in non-military communities. Inside a single housing development -- where the houses are cut from a small number of floor plans and built all at the same time -- there are huge variations in energy use. Most of this range can be attributed to occupant behavior and personal inventory (since homes were carefully selected for number of occupants).

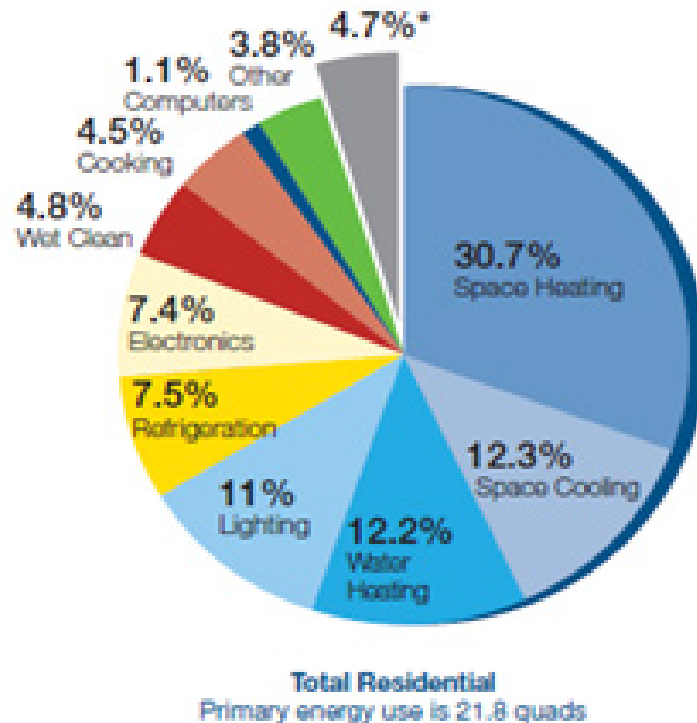
No Silver Bullet, Only “Silver Buckshot”

Further complicating the energy saving challenge in the residential sector is the multitude of end-uses in the home. No single end-use dominates. The following chart breaks down residential energy consumption and is an average across a large sample of U.S. homes. In fact, the actual variation will be much larger as the significant regional differences in climate and building stock are masked by the overall average. For example, Benicia, CA has a very mild climate so few homes have air conditioning. In other regions, air conditioning can account for 40% of the annual electricity bill or up to 25% of total energy use.

Figure 2 brings out two important features of residential energy savings:

- First, there is no single “silver bullet”. Even saving 20% on heating energy only reduces the overall energy use by 6 - 7%.
- Second, without a single driver, a savings program in the home must touch a number of end-uses. One or two will not be enough. A familiar phrase in the energy efficiency industry that describes savings opportunities is, “There is no silver bullet, only silver buckshot.”

Figure 2: Residential Energy Consumption by Use Type



Source: DOE; 2005. Drawn from RECs data.

Traditional Utility-funded Efficiency Programs Have Low Results

To tackle the challenges of the residential energy market, utilities have used brochures, online tools and subsidies. While it is easy to say “utilities are not good at marketing”, there are some substantive reasons why these programs have not worked.

1. *Education alone does not work.* Research on utility programs and social psychology has shown that there is zero correlation between the education of adults and a sustained behavior change.² This should not be a surprise. If information alone worked on our brains, we would be able to lose weight by reading educational tips. In a recent project that extended across a number of military bases, over 70,000 homes in total, the results were that more was spent on the educational materials than was earned back through energy conservation.³
2. *Relevance is critical to success.* Because our homes are so varied in their energy use, a single one-size-fits-all list of tips is not helpful to residents. Often they don't see the path between the list and what actions would fit best in their home. The residents wanted to work towards an energy savings goal but did not know where to start. In our Travis study, residents were very appreciative of the specificity of the personal coaching, telling us, “Now I know *what* to do.” They then took action.

Energy conservation should be treated the same as any other sales and marketing campaign – after all, the same rules of human behavior apply. Consider, as an example, the success of the “Feed the Children” campaign. A request to “Do something to save the millions who are starving!” creates anxiety, while a relevant request to “Call this number to send \$10 each month to feed Johnny,” is an action that is easy to understand—so people are much more likely to engage. A leading green market researcher, Suzanne Shelton, has the same criticism of most utility and state programs: Broad messages around polar bears do not work.⁴

3. *Online resources must be resident savvy.* Turning to online tools provided by utilities, a lesson from web design is that good online tools require constant iteration to get right. The user interface must be tweaked and re-tweaked until the small frictions that cause small frustrations are removed. This requires micro attention to detail. The typical online energy audit tool offered by a utility has less than a 5% completion rate. In contrast, Ennovationz has refined, and continues to improve, its online tool and has achieved a better than 85% completion rate. There is a poor cultural match between the constant refinement needed to create engaging web technology and the many layers of approval needed for change in a standard utility program.
4. *Traditional energy audits cost too much and deliver too little.* Utilities have offered free or subsidized energy audits for years but with little success. Participation rates are below 2% of the population, even when the audits are free. Our experience is that consumers see two very big negatives with energy audits. First, while the monetary cost may be low, the time an audit takes can be relatively high – three to six hours. It may also take some weeks to get a report back, so it takes time to re-engage. In our busy lives, the time cost of an audit is a barrier.

Second, the benefits of an audit are not clear to the consumer. The audit often produces a technical report that justifies spending more money. Yet, the consumer wants to know how to fix a specific problem or issue, such as rooms that are too hot or cold. So the audit detail feels misguided. And for a consumer who is not yet sure they want to spend more money on home improvement, the audit seems like a first step in the wrong direction.

Utility funding has also been limited. Most programs are paid out of the systems-benefit charge, a small (3%) tax on every residential energy bill. In most states, a regulated utility makes more money by selling more energy, so energy efficiency is treated as a token action funded through a side budget. While the system-benefit charges add up to \$7 billion per year nationwide, by design, this is a very small amount of spending relative to the size of the residential energy market.

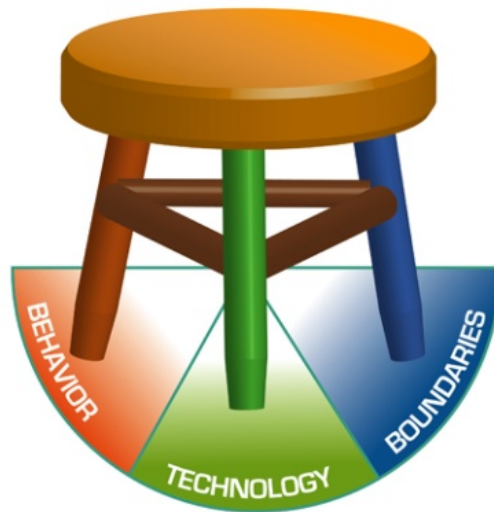
Residential Solutions for Energy Savings

The elements of the energy savings challenge in the residential sector also form the basis of the solution.

- Fragmentation is addressed by broad participation, engagement and aggregation using **web technology**.
- The large variation in energy use across homes is addressed through personalized energy saving recommendations or **boundaries**.
- The multitude (or “silver buckshot”) of small energy savings opportunities is addressed through **behavior changes** that can touch many of the end uses.

Together, these define a new and more effective approach to residential energy savings. All the elements are needed to form a complete solution. To increase engagement, the program is delivered through in-home coaching. And to address the larger home improvements, the program also offers a connection service, matching homes in need of upgrades to qualified contractors. Residents appreciate these connections as it helps them navigate through a myriad of technologies and solutions and provides an initial filter of the contractor market.

Figure 3. Three-Legged Stool for Maximum Energy Savings



Source: Tabitha Crawford, CEM and Richard Lucy, CPA, CEM.

Three-Legged Stool for Maximum Energy Savings

- In previous papers we have introduced the three-legged stool framework for energy savings programs (Figure 3). All three legs are needed for a successful program. The three legs are:
- *Technology*: This includes the physical attributes of a structure, such as the building shell,

mechanical systems, ducting and so on. This is the focus of well-known energy efficiency programs such as: Leadership in Energy and Environmental Design (LEED) through the U.S. Green Building Council and Energy Star through the U.S. Department of Energy. Other examples include: solar, geothermal, lighting, insulation, or management control systems.

- *Behavior:* Approximately half of the emissions created from homes depend upon the choices made by occupants. A review of 38 feedback studies, carried out over a period of 25 years, shows resident behavior alone can reduce consumption by 5 - 20%.⁵ There are two implications from these facts. First, the technology focus on green homes is just the start, because behavior adds much more. Second, unless people change their behavior, sizable savings will not be achieved. People must be motivated to change; it cannot be assumed that they will operate their homes efficiently.
- *Boundaries:* Boundaries are the social and policy norms that define the energy use; the context that keeps us “in-bounds”. Boundaries create the limits or rewards that influence actions, choices or inaction. For example, in the U.S. Army, on-base residents only pay for energy use over a baseline amount. There is also a “buffer”, so that the housing provider doesn’t have to chase after every penny. These practices create the boundaries or norms for on-base energy use.⁶

Note that traditional programs focus solely on the technology – such as rebates for better heating systems. But, by adding the behavior and boundary components to a program, change can be achieved at an accelerated rate.

Technology—Engaging Web Platform

Web technology is a relatively low cost way to aggregate micro-transactions and drive them to scale. Examples of this type of aggregation include Weight Watchers (personalized online weight-loss coaching for millions of users) and PayPal (millions of micro-transactions that sum to a substantial online bank). Ennovationz has been developing a leading web platform to provide this foundation to residential energy savings. Features include content, a suite of tools and group functionality. The latest release can be seen at www.ennovationz.com.

Residents can engage directly with the web tools, or are introduced to the site via a group, or in-home coaching visit. Because research shows that information alone doesn’t work, website access without the in-home visit will be less compelling to residents. Ennovationz tries to combat this drop off in interest with engaging, personalized tools such as “Is Solar Right for Me?”, a wizard that personalizes the cost-benefit calculations of a solar system by zip code and size of electricity bill.

Behavior Change—In-Home Coaching

The keys to residential energy savings are engagement and personalization. An in-home visit by a friendly energy savings coach enhances the program attributes. Web tools alone can be emotionally cool, and much market research shows that home improvements and energy efficiency need a warmer touch. An in-home coaching visit increases personalization, education and warmth. It builds trust in the energy coach and thus program, increasing program success.

The two pilot studies referenced in this entry -- the City of Benicia, CA and Travis AFB -- used personalized in-home coaching and have achieved energy savings far beyond traditional programs. The following chart shows the program structure and results:

Figure 4: Program Overviews for Benicia & Travis AFB, CA



Source: Ennovationz, Inc.

As Figure 4 shows, there were considerable energy savings from behavior change. In addition, the programs catalyzed savings in two unexpected ways:

- Even the residents with very low bills, who had a strong interest in all things eco-friendly and green, went on to save additional energy after the in-home coaching visit; and
- Residents voluntarily purchased energy efficient appliances and completed home upgrades based on knowledge gained through personal coaching.

For example, at Travis, one resident replaced their fish pump within 24 hours, after he realized his inefficient pump was about 25% of the home’s electricity use. This purchase is even more surprising because base residents do not directly pay their energy bills. In both Benicia and Travis, we have seen residents buy front-loading washers and Energy Star TVs after their coaching sessions.

The in-home coaching visits accomplish a short list of objectives within a 45-minute visit:

- Quick Home Inventory – What is on? What is plugged in? What are the obvious energy using habits?
- Select Energy Savings Actions that Fit Your Lifestyle– The resident chooses the behavior changes that fit their lifestyle from a localized menu of actions.
- Goal Setting – Everyone can save 10%; so we ask residents to select between 15 and 20% savings goals.
- Visibility – Place the pledge to do 5 energy saving actions on the refrigerator to get the whole family going.
- Establish Trust – The resident knows the coach and the emotional engagement of the visit can carry forward into phone and email support.
- Financial Review – We walk through bi-monthly statements, goals and rewards opportunities

“The check list of steps made it very easy to save energy, and once the actions became habit, it was even easier....The best thing about the program was the awareness of energy conservation, having someone come to our home to talk to about ways to save energy, and the checklist....The program brought a lot of attention to what steps we could take to save energy.” (Resident, Travis AFB)

In-home coaches are not energy auditors. This opens up the job to part-time workers who have varied educational backgrounds. In-home energy coaching is an entry-level green job, and one that is open to many more in the work force than is typical in this sector.

Suzanne Shelton, a market researcher on green consumers, describes why traditional utility funded programs do not work. Further, a “coach” is more effective than an “auditor”. In a controlled study, she found that:

“...educating Americans about all the horrible outcomes of their unfriendly-to-the-planet lifestyles doesn't actually result in shifting attitudes and behaviors. What actually works is talking to those consumers about what they care about the most: themselves. Couching the benefits of environmentally friendly products in terms of being smart, feeling in control, winning respect, finding ways to be more comfortable, etc., wins the day.

All the science of behavior theory/behavior change (of which much has been written about in 2010) definitely applies here as well. For instance, you can't move someone who's more extrinsically motivated to do a thing with the promise of an intrinsic reward ("you'll feel so good about yourself!"), and you don't move people forward with broad, ill-defined requests and benefits ("Make your home more energy efficient!" "Save money!"). As in all advertising, it's really about understanding the target, knowing their deepest desires, and going for the jugular in promising to fulfill those desires. That's how we can nudge overweight doctors to go on diets, dentists to floss regularly, bankers to save more, and consumers to stop guzzling energy.”⁴

"It's not only about the money you save, it is also that we all have a role to reduce our carbon footprint. I had a great time with the program. I've had a number of energy audits, but this one was different because it drilled down and coached me exactly how to save." (Elizabeth Patterson, Mayor of Benicia, CA)

Boundaries – Rules and Context Make a Difference

The third leg of the stool, the boundaries, creates context and norms for energy savings. Boundaries are man-made, and are the set of rules, prices, penalties and limits that define what is acceptable. For example, during separate prolonged water shortages, Australia and coastal communities in California provided a daily ration of water. It became socially unacceptable to cheat on the ration. Another example is the use of increasing rates for electricity (the more you use, the more you pay). People who complain the most find themselves deemed “energy hogs”, and outside of the social norm.

In contrast to the boundaries in the previous paragraph, that define excessive consumption, a rewards program creates a positive aspiration to change high energy use. For example, one of the most powerful charts we showed to residents in the Travis community showed the daily energy use of various homes in the program, ranked from highest to lowest. Residents found their daily use on the chart and could see where they fell in the group. The high and low users had a sharp reaction to this information. The sting of high use was removed by the coaching and rewards program;, which made it socially acceptable to have the opportunity to save.

Mark DuPree, Project Director Privatized Military Community, Travis AFB, CA summarized the reasons for success: *"Balfour Beatty Energy and Ennovationz's energy savings program has shown incredible results in our Travis AFB community. The families have been cooperative and excited to learn how to save energy. The coaching team engaged our residents and together successfully cut consumption quickly using real time monitoring, personalized education of all family members and its innovative rewards program."*

Economic Development Opportunity

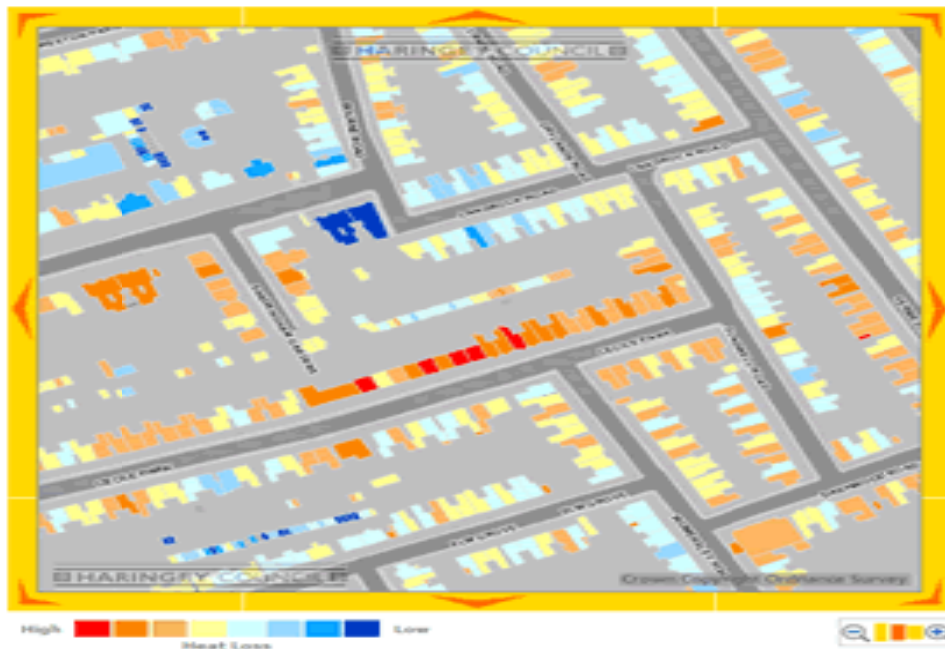
Identify Residents Ready to Invest in Efficiency

As the business model for our program develops, it will provide enough economic stimulus to stand alone as a profitable entity. Without government subsidy, a business needs to leverage the savings from city “A” to start up city “B” and so forth. Social media and modeling are critical components to driving the participation rates needed to create a sustainable, financially feasible investment strategy for a stand alone business.

A successful residential energy saving program includes tracking progress, applauding *individual* successes and politely targeting laggards. The program will also report GHG reductions, energy savings and energy-saving actions and provide social-media driven feedback. Larger savings are gained through personalized in-home coaching and connections to products, incentives, financing, and contractors; the visits accelerate energy savings by giving residents the specific coaching advice that fits their home and lifestyle. “Weeding through” to find the highest consumers of energy and those most likely to change habits (by conserving) is a critical step in making a residential efficiency program more cost effective.

Figure 5 below illustrates the need to identify the residents who have a substantial savings opportunity. The map is from a fly-over of central London by a plane equipped with a thermal imaging camera. The data was then normalized to make the results more clear. The red homes had the highest level of heat loss into the cold London night. The blue homes had no heat loss. Overall, the map shows which homes could save money on their heating bill by sealing the building envelope. Although indicative of only one energy end-use, heating, the map illustrates how scattered the savings opportunities are in a single neighborhood.

Figure 5: Thermal Image of Heat Loss from London Neighborhood



Source: Borough of Haringey, London, UK.

http://www.haringey.gov.uk/index/housing_and_planning/housing/housingadvice/homeheatloss.htm

The second layer of identification that must be done is willingness to pay. Many residents have multiple goals for their discretionary spending, and even when presented with an attractive financial opportunity, would rather use their spending money for something else. It is no surprise that residential solar programs in the U.S. took off when innovative financing removed the up-front costs.

With a home improvement and financing program in place, the key to success becomes low cost customer acquisition. The process we have proven to be more successful than traditional utilities-sponsored residential efficiency programs creates a “funnel” using inexpensive social marketing and web-based techniques to identify residents who are ready to invest in an energy audit and/or significant home improvements.

Through our approach, the cost to reach a home is around \$50, while traditional efficiency programs spend approximately \$800 per home on outreach, promotion, auditor staffing, etc. Further, our program delivers energy savings from the first visit through behavior change. Imagine being able to reduce acquisition costs by over 93% to identify a customer who is prepared to pay for an audit and direct installation program! Table 2 compares our community program (noted as BB Energy) to EPA benchmark costs.⁷

Table 2. The Coaching Program Versus EPA Benchmark Results

BB Energy Program Vs. EPA Benchmarks					
Program	Cost per Home	Source Mbtu Saved per Home	Participation	No. of Homes	Program MBTUs
BB Energy	\$49	20	12.2%	17,000	341,219
Tier 1 Audit & Direct Install	\$800	5	1.5%	2,085	1,038
Home Performance	\$7,000	60	0.3%	417	830
HVAC	\$280	10	1.5%	2,085	1,660
EPA Rapid Deployment for Energy Efficiency Toolkit, Dec 2009					
www.epa.gov/cleanrgy/documents/suca/rdee_toolkit.pdf					

(Sponsored by Balfour Beatty Energy and Implemented by Ennovationz)

How Savings Become Spending

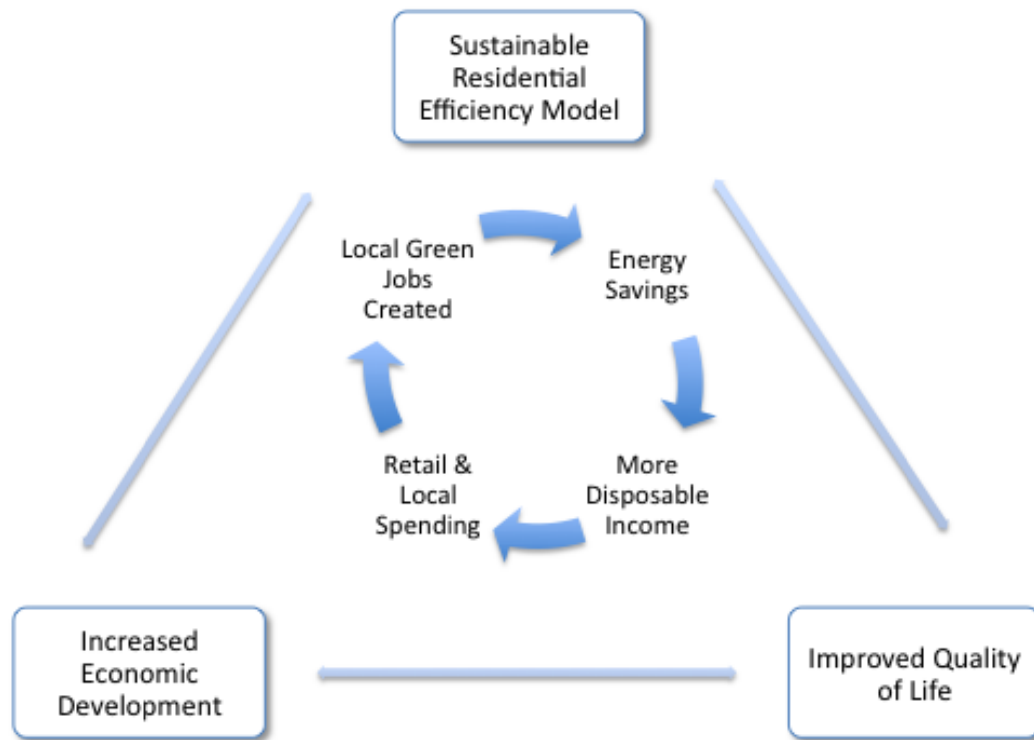
Experience managing utility costs across 70,000 homes throughout each major climate area of the U.S. taught us that energy is one of the largest expenses for residential living. In fact, in every income bracket, energy expense is typically larger than property taxes. For someone in the 35% overall tax bracket (state and federal), every dollar saved is the same as \$1.30 in pre-tax salary. Saving \$25 per month is the same as a nearly \$400 per year salary increase.

Academic studies show that the majority of an increase in personal disposable income is spent in the retail sector. A study from UC Berkeley elaborates this chain of logic. First the study documents that as a result of landmark energy efficiency policies, California has broken away from national trends of ever-increasing energy use per capita. Between 1972 and 2006, California held per capita energy use constant, and ended with demand levels 40% lower than the rest of the country. The study goes on to document that this energy savings was a key catalyst to economic growth in the state. Representing over 70 percent of

Gross State Product (GSP), household consumption is the most powerful driver of economic activity in the state. The energy savings increased the force of this driver.⁸

The Berkeley study found that between 1972 and 2006 energy efficiency measures have enabled California households to redirect their expenditures toward other goods and services, creating about 1.5 million full-time-equivalent jobs with a total payroll of \$45 billion, driven by well-documented household energy savings of \$56 billion. In other words, 80% of energy savings dollars stayed in the state in the form of increased payroll, creating millions of jobs paying \$15 per hour on average. Figure 6 below illustrates how all the pieces of our community program come together.

Figure 6. The Model of Job Creation Through Energy Savings



Source: Martha Amram, PhD and Tabitha Crawford, CEM

Summary

Traditionally, the residential sector creates a challenge for utility companies, energy efficiency providers, and financial providers. Its fragmented variation among similar house types, coupled with utility-funded energy efficiency programs, result in failure to provide significant, savings, spending and job creation. The Three-Legged Stool approach of leveraging technology, behavior change, and personal boundaries provides a cost effective way to complement existing residential efficiency programs. Proven to outperform EPA benchmarks and the results of existing utility programs, our approach engages the entire community with directed spending and economic development. Unleashing green jobs through energy savings is possible—and it can be done at a fraction of the cost communities and utilities are currently spending for less effective programs.

About the Authors

We have joined together to offer community programs based on the lessons learned from our combined experience.

Martha Amram is founder and CEO of Ennovationz, Inc. and is a respected leader in energy and economics. An experienced executive, Martha was CEO of Vocomo Software, a voice software company, Chief Economist of PLX Systems, a patent and copyright software company, and co-founder of Glaze Creek Partners, a consulting firm she sold to Navigant Consulting (NYSE: NCI). Martha is the co-author of two books published by the Harvard Business School Press (*Value Sweep* and *Clean Options*). Martha is a frequent speaker on residential energy efficiency and business strategy. She is a Senior Fellow of the Milken Institute, where she has written reports on financial innovations for the biotech and cleantech industries. Martha holds a PhD in Applied Economics from MIT's Sloan School of Management.

Tabitha Crawford is president of Balfour Beatty Energy Solutions and is a national leader in financial payment systems and sustainability. She has held several key executive positions: as CEO of Military Assistance Company (developed the first direct interface into Department of Defense payroll systems); SVP Sustainability & Innovation for Lend Lease Americas (created “Saving Your Nation’s Energy”, SYNERGY™ now included in the Mayoral Climate Handbook distributed to 700 cities globally); and was founder and president of Rayan Solutions, a consulting firm that advised on renewable energy, efficiency and sustainability to firms on the Dow Jones Sustainability Index. Tabitha is author of several industry papers for *Defense Communities* and the *Urban Land* magazines as well as co-author of another paper published in an earlier edition of *Encyclopedia of Energy Engineering & Technology*. She is a Strategic Advisor to the Sustainable Development Institute at Lipscomb University and represented the development sector for the Presidential Climate Action Plan. She is also a Certified Energy Manager.

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