Chapter for:
Sustainable Business Practices: Challenges, Opportunities, and Practices.

Suggested Chapter Title:
"Aligning Consumer Decisions and Sustainability Objectives: Energy Efficiency in the Residential Retrofit Market."

Authors & Affiliations:
Charlie Wilson
Tyndall Centre for Climate Change Research
University of East Anglia, UK

Hadi Dowlatabadi
Institute for Resources, Environment & Sustainability
University of British Columbia, Canada

Acknowledgements:
The research described in this chapter was made possible through support from the Climate Decision Making Center (CDMC) located in the Department of Engineering and Public Policy at Carnegie Mellon University, created through a cooperative agreement with the National Science Foundation (SES-0345798).

Abstract:
Making existing homes more energy efficient is an important challenge for sustainability, and particularly greenhouse gas emission reduction. Homeowners' decisions to retrofit their homes with efficient building envelope and energy system technologies play a crucial role in this challenge. The policy and business communities try to induce and influence these decisions through an 'inform, incentivize and assure' approach. This approach has had only limited success in stimulating energy retrofits over the last 30 years despite the apparent cost-effectiveness of energy efficiency. This stands in stark contrast to the ever-growing popularity of amenity retrofits such as remodeled kitchens, loft or basement conversions, and landscaped gardens. Such retrofits received no inducements and often cost more than their energy retrofit counterparts. An investigation of homeowners' retrofit decisions helps explains why: amenity retrofits are motivated by emotional, aesthetic, and social signaling characteristics which energy retrofits lack. This points to an unexploited potential for an alternative 'piggybacking' approach to promoting energy efficiency in the home. Such an approach would reduce the effort, cost and inconvenience of distinct energy retrofit decisions by packaging energy efficiency measures into amenity retrofits. As well as allowing businesses in the amenities supply chain to differentiate their service offering, this 'piggybacking' approach would also help align policymakers' objectives with homeowners' retrofit decisions.

Chapter Text:

1. Introduction: Energy Efficiency in the Home.

2010 was an historic year for energy efficiency in the home: it featured in the State of the Union Address alongside the financial crisis, health care reform, and nuclear disarmament. In President Obama's words: "We should … give rebates to Americans who make their homes more energy-efficient".[i] The Home Star Energy Retrofit Act submitted to Congress in April 2010 duly established some $6 billion of tax credits to be disbursed over a 2 year period to homeowners in lump sums of up to $3,000 for appliance and equipment upgrades, and up to $8,000 for whole home retrofits.

Why the interest in energy efficiency in the home? Reducing residential energy use has repeatedly been identified as an important, low or even negative cost component of a climate change mitigation strategy which also contributes towards a host of other policy objectives relating to local employment, energy security, air pollution and health (Metz et al. 2007; Dietz et al. 2009).The residential sector in the US uses 21% of the national energy supply[ii], of which roughly three quarters is electricity and the remainder natural gas and fuels used directly in the home for heating (EIA 2010). This contributes 21% of the US's CO_2 emissions or 18% of total greenhouse gas emissions (EIA 2009).

The energy efficiency of the 1-2 million *new* homes built each year in the US can be ratcheted up through regulation, codes, standards, zoning laws, and other policy levers operating mostly at the state or municipal level. However, around 130 million homes have already been built (JCHS 2009a). Houses are also very long-lived physical assets. So the challenge of improving residential energy efficiency primarily concerns retrofits to existing homes.

Around 44% of energy used in existing US homes is for space conditioning (heating and cooling) and a further 12% for water heating (Gardner & Stern 2008).[iii] Efficiency measures, particularly upgrades to homes' building envelopes and energy systems, offer by far the largest potential reductions in household energy use (Gardner & Stern 1995). 'Weatherization', or sealing and insulating building envelopes, reduces the demand for space conditioning. Efficient energy systems reduce the energy needed to meet that demand. Weatherization measures include: weather-stripping, draft-proofing, cavity insulation, triple glazed low emissivity windows, energy efficient doors. Energy system measures include: high efficiency furnaces / boilers, (programmable) thermostats, hot water tank & pipe insulation. All these technologies are proven, widely available, and cost-effective in so far as their upfront cost is ultimately repaid through energy savings.

The potential energy savings from these types of weatherization and energy system measures throughout the US housing stock is in the ballpark of 30-35% of total energy use (Gardner & Stern 2008). This proportion may be considerably higher in older or less efficient homes. This chapter is concerned with how these energy savings can be achieved. Our central argument is that it is essential to *align* homeowners' interests in improving the feel and function of their home with policymakers' interests in promoting energy efficiency, and the business supply chain's interests in offering an attractive value proposition to homeowners.[iv] At the heart of this alignment challenge lie homeowners' decisions to retrofit their homes.

Sustainable business strategists emphasize the importance of aligning the interests of a wide range of stakeholders (Hoffman 2000). In addition to what Esty & Winston (2006) call the 'consumers' and the 'rulemakers', we emphasize the importance of 'business partners & competitors' as a third category of stakeholder. The premise for our

argument is that the prevailing policy approach to promoting energy efficiency in the home fails to recognize some important characteristics of homeowners' retrofit decisions. This has indirectly reinforced competition and fragmentation rather than partnership between the energy and amenities supply chains. (See Box 1 for a definition of these terms). The result is a misalignment between the interests of homeowners, policymakers, and businesses.

-- insert Box 1 here

In developing our argument, we begin by looking at policymakers' assumptions about how best to promote energy efficiency in the home by influencing homeowners' retrofit decisions. We argue that the prevailing 'inform, incentivize, assure' approach is of limited success because it fails to account for how retrofit decisions are actually made. We present empirical evidence from our own research to support this argument, drawing out important differences between pre-retrofit and post-retrofit decision characteristics, and between amenity and energy retrofit decisions (see Box 1). Based on our analysis, we develop a specific set of proposals for a 'piggybacking' approach which uses the supply chain for amenity retrofits to promote energy efficiency in the home. Drawing on business strategy and supply chain management expertise, we set out a clear business case based on enhancing the value proposition for retrofitting homeowners. Furthermore, we suggest how policymakers can support this value proposition. The result, we argue, is more effective policy for realizing energy savings and the potential to transform the functioning of the residential retrofit market based on an understanding of homeowners' needs and decisions.

The key innovation of this chapter is to treat the improvement of residential energy efficiency not as an energy efficiency challenge but as a retrofit challenge. This simple reframing of the issue allows new business models and service offerings to be explored that align different stakeholders' interests.

2. 'Inform, Incentivize, Assure': The Prevailing Approach for Promoting Energy Efficiency in the Home.

To paraphrase the legal concept and proverb: a home is the homeowner's castle, a private space largely outside the domain of direct regulatory influence. Over 2/3 of US households own their homes (JCHS 2009a). Realizing energy savings across the majority of the US housing stock therefore depends on the weatherization measures and energy system upgrades decided upon by homeowners, both in their own homes and in their rental properties.

Put simply: the key to delivering energy efficiency into the home is homeowners' retrofit decisions.[v] So the starting point for influencing home retrofit decisions towards sustainability is to understand how they are made.

A wealth of behavioral research over the last thirty years has shed light on many aspects of household energy demand and energy efficient technology adoption (for a review, see: Wilson & Dowlatabadi 2007). We know that information that is non-technical, personally-relevant, from a trustworthy source, and delivered through social networks rather than mass media channels, tends to be more effective at influencing behavior (e.g., Kempton et al. 1992; Rogers 2003). We also know that publicly-made commitments and collective or group action further supports behavior change (e.g., Staats et al. 2004). We know that financial incentives that are immediate, simple to administer, and available at the point of sale tend to be more effective (e.g., Stern et al. 1986). We know that households' knowledge and recall of how much energy they use

tends to be fairly simplified and incomplete, as does awareness of how much different behaviors and technologies contribute to overall energy use (e.g., Kempton & Montgomery 1982; Wilson 2008a). We know that generally-held values relating to the environment, health or wealth tend not to explain energy-related behavior (e.g., Gatersleben et al. 2002). We also know that positive attitudes and intentions towards energy efficiency and conservation tend to be constrained by contextual factors such as costs, established norms and regulations (e.g., Stern 2000). We know that energy-related behavior tends to be shaped by domestic routines and habits (e.g., Shove 2003). We also know that decisions tend often to be made using rules of thumb or 'heuristics' over a limited timeframe and based on only partial information (e.g., Kahneman 2003).

Note that these findings are all intentionally expressed as 'tendencies'. There is considerable variability across a population of households in terms of energy demand as well as lifestyles, behavioral routines, and responsiveness to energy price changes. As a result, there is no 'one size fits all' approach to influencing energy-related decisions or behavior. There is, however, a prevailing approach to promoting energy efficient retrofits that is informed by many of these research findings, as well as the limited scope for regulatory intervention within homeowners' castles. This prevailing approach can be characterized as '*inform, incentivize, assure*'.

Information makes homeowners aware of energy efficient investment opportunities, technology options, beneficial outcomes (including financial savings), and supporting policies. Over the longer-term, information can play a role in more broadly educating and sensitizing homeowners about energy efficiency. The information approach includes advertising and awareness campaigns, home energy audit schemes, real-time energy use monitors, and energy performance product labels.

Incentives improve the financial attractiveness of energy efficient investment opportunities (by reducing upfront costs), and can increase the salience of financial savings. The incentive approach includes grants, rebates, and low interest loans.

Assurance improves homeowners' confidence and certainty in the beneficial outcomes of energy efficiency, and in the ability of supply chain actors to deliver those outcomes. Ross (2008) describes assurance as the peace of mind that customers gain from a transaction.[vi] The assurance approach includes knowledge and skills development for retrofit contractors, training programs, and accreditation bodies to maintain and enforce standards.

A prime example of this 'inform, incentivize, assure' approach is provided by the White House Council on Environmental Quality convened by Vice-President Biden in 2009 to recommend how billions of dollars of stimulus money earmarked for energy efficiency should be spent. The task force's October 2009 'Recovery through Retrofit' report[vii] identifies "a series of barriers [which] have prevented a self-sustaining retrofit market from forming" (p1). These barriers are identified as access to information, financing, and skilled workers. So the report recommends action in these three areas. On information, recommendations include developing a standardized home energy performance measure and label. On financing, recommendations include simplified ways for homeowners to fund retrofits through low cost loans rolled up into mortgages or property taxes. On skills or quality assurance, recommendations include developing national standards to qualify energy efficiency and retrofit workers, as well as industry training providers.

These recent stimulus-driven measures are the latest in a long continuum of efforts by governments and utilities targeting energy efficiency in the home as a potential means

of reducing energy demand (Gillingham et al. 2006; Linden et al. 2006). In the US between 1989 and 1999, $23bn was spent by utilities on programs that encouraged energy efficient technology adoption and behavior (Loughran & Kulick 2004). In the residential sector, weatherization and energy system technologies were the most commonly promoted. That weatherization still occupies a headline role in policy efforts indicates the limited success of efforts thus far. Energy efficiency remains important to environmental, energy and social policy objectives; but delivering on these objectives also remains difficult.

3. Assumptions and Misconceptions about Homeowners' Retrofit Decisions.

The prevailing 'inform, incentivize, assure' approach described above tries to encourage homeowners to make energy efficient retrofit decisions. Underpinning the approach is a basic conceptualization of these decisions as being broadly rational. Rationality here implies that homeowners are *motivated* by outcomes, are *informed* about these outcomes and the options for achieving them, and make *optimizing* decisions based on this information (i.e., they select the option which best achieves the outcomes). An additional assumption of the 'inform, incentivize, assure' approach is that homeowners are financially-oriented: hence information on the cost-effectiveness of energy efficient investments is assumed to influence decisions, as are incentives that further improve their financial attractiveness.

Our own work started from the premise that this wasn't the whole picture. Despite considerable expenditure and effort in the US and elsewhere, homeowners remain stubbornly resistant to retrofitted energy upgrades.[viii] We believed that the way in which homeowners actually make decisions about energy retrofits did not fit the rational, financially-oriented decision making implicitly assumed by the prevailing 'inform, incentivize, assure' approach.

To characterize retrofit decisions realistically, we asked over 800 homeowners in British Columbia, Canada, a battery of questions about why and how they made their decisions, and what they were deciding at different stages.[ix] Our survey sample was intentionally biased towards homeowners who were actively deciding about home retrofits, both energy retrofits and amenity retrofits (see Box 1 for definition of these terms).

Retrofit Decisions: Before the Fact vs. After the Fact.

Our research revealed two important findings which supported our suspicion that the prevailing 'inform, incentivize and assure' approach was missing something in its assumptions about homeowners' retrofit decisions.

First, by comparing the responses of homeowners at different stages of the retrofit decision process, we found evidence that decisions are not a discrete event, but an often long drawn out process. This is intuitively obvious; what's important, however, is that key decision characteristics change over this process. In particular, the motivations and decision rules reported by homeowners in the run up to, during, and after their retrofits differ systematically. Figure 1 summarizes some of these differences by contrasting survey responses from homeowners before and after carrying out retrofits.

-- insert Figure 1 here

Our second key finding, drawing on these data, was that the decision characteristics reported by homeowners after completing retrofits correspond well with the model of

rational, financially-oriented decision making assumed by the 'inform, incentivize, assure' policy approach. After the fact, homeowners tend to report being motivated by financial and general comfort-related outcomes (see Figure 1 next to 'stronger post-retrofit'). They also tend to report that they fully considered all the different options ('optimizing' decision rules in Figure 1) or followed expert or other advice to inform their retrofit decisions ('advice & guidance' decision rules). As much of the work done to investigate retrofit decisions asks homeowners after the fact (and this applies to both academic studies and contractors' customer feedback and evaluation studies), it is not surprising that homeowners' motivations and decision rules are thought to be broadly rational.

However, as Figure 1 shows, how homeowners *report* their decisions after the fact does not necessarily mean this is how they actually *make* their decisions before the fact. Decision characteristics reported by homeowners before carrying out retrofits tend to emphasize emotional and aesthetic motivations. Pre-retrofit homeowners also tended to report choosing between options by using gut instincts or an innate sense of what was right ('instinctive' decision rules in Figure 1). Additional work, not shown in Figure 1, found that social norms also play a role in energy retrofit decisions (Wilson 2008b). This is further supported by a growing body of evidence on the influence of social norms on different types of energy-related behavior (Schultz et al. 2007; Nolan et al. 2008). This composite impression of emotional, aesthetic, normative and instinctive retrofit decisions is very different from the broadly rational, financially-oriented model reported by homeowners after the fact. It also helps explain why information, incentives, and quality assurance type inducements offered by policy makers to homeowners are only of limited success. These inducements fail to target the before the fact characteristics of the decision process which they are trying to influence.

Retrofit Decisions: Amenity vs. Energy.

A third finding of our research into the retrofit decision process points to a novel means of tackling this mismatch between policy inducements and energy retrofit decisions. The potential solution lies with amenity retrofits. Figure 2 compares the amounts spent by homeowners in the US on energy-related, amenity-related, and 'other' types of retrofit including structural features (roofing, siding), non-energy systems (plumbing, wiring) and disaster repair.[x] For every $1 spent on energy retrofits, approximately $5 are spent on amenity retrofits.

Retrofits of all types are also very frequent. In 2007, 58% of homeowners reported undertaking at least one retrofit project at some point in the previous two years (JCHS 2009a). Amenity retrofits are reported by homeowners over twice as frequently as energy retrofits, although these may be undertaken concurrently. Amenity retrofits are roughly as common as all other types of retrofit combined.

-- *insert Figure 2 here*

That more is spent on amenity retrofits, and more frequently too, tells us that the before the fact characteristics of amenity retrofit decisions are more motivating for homeowners. And of course, this is without any information, incentives or other inducements from policymakers. So how are these amenity retrofit decisions made?

Our survey sample included a substantial proportion of homeowners undertaking either 'pure' amenity retrofits or mixed amenity / energy retrofits. Compared to 'pure' energy retrofit decisions, these decisions with an amenities component tended to be even more motivated by emotions, looks, and social norms, all bound up in instinctive choices. So

the pre-retrofit and post-retrofit differences in decision making shown in Figure 1 were even more emphatic. Again, this is intuitively obvious. Compared to amenity retrofits, energy retrofits lack any emotional, aesthetic or even visible appeal. Energy retrofits are often born of the necessity to replace poorly functioning equipment or renew worn out parts of the home. In contrast, homeowners' decisions to spend substantial sums of money on a remodeled kitchen or bathroom, a garage or basement conversion, or simply new flooring and decoration, are motivated by aspirations, feelings, desires, looks, and other considerations to do with the home. These considerations are in turn influenced by a morass of personal and social factors relating to status, taste, identity, lifestyle and meaning (Aune 2007). Table 1 generalizes these differences between amenity and energy retrofit decisions.

-- *insert Table 1 here*

The 'inform, incentivize, assure' approach treats building envelope and energy system upgrades as the outcome of a distinct, energy-related retrofit decision. Information and services are aimed at motivating homeowners to decide on energy retrofits that they would not otherwise have done, or to improve the efficiency of energy retrofits to which they are already committed.[xi]

But homeowners are already making decisions to spend substantial sums on amenity retrofits, and, compared to energy retrofits, more frequently to boot. Why not piggyback on this existing pattern of behavior?

Compared to the 'inform, incentivize, assure' approach, this 'piggybacking' approach reduces the incremental effort, inconvenience, time and expense of improving home energy efficiency. These are important characteristics of supply chain actors' value proposition to homeowners. Packaging energy measures into amenity retrofits also ties energy efficiency explicitly to the social signaling role of home amenities.[xii] Interestingly, it also allows the amenities to motivate homeowners to undertake retrofits in the first place, but the energy retrofits to provide financial and comfort benefits as well as a readymade after the fact rationalization for all the effort and money expended.

4. Using the Amenities Supply Chain to Promote Energy Efficiency in the Home.

The comparative attractiveness of 'piggybacking' energy efficiency onto amenity retrofits can be illustrated simply through the thought experiment described in Box 2.

-- *insert Box 2 here*

Of course, both scenarios in this thought experiment are highly stylized. Yet Scenario A is a general formulation of the prevailing 'inform, incentivize, assure' policy approach implemented indirectly through the supply chain for energy retrofits. Scenario B is a general formulation of a 'piggybacking' approach acting directly through the supply chain for amenity retrofits. (See Box 1 for definitions of energy and amenities supply chain). Although the energy efficiency outcome in both scenarios is identical, our research suggests that Scenario B is the more realistic decision process even though – subject to affordability constraints - it involves an additional $5,000 spent on a new kitchen. Interestingly, in the current economic climate, Scenario B also amplifies the stimulus effect of public money targeting energy retrofits.

Relative to Scenario A, Scenario B has five key attractions for homeowners. First, it requires little additional decision effort in terms of time, searching for information, choosing between alternative products, and so on. Second, it requires little specialized

'energy' knowledge about, for example, energy efficiency, available products, energy audits, and available incentives. Third, it involves no additional paperwork or bureaucracy. Fourth, financial incentives are provided upfront not delayed.[xiii] Fifth, it taps into the emotional, aesthetic and normative motivations which lead homeowners to undertake costly retrofits; similar motivations are much weaker for energy efficiency.

All of these points of attractiveness are integral to homeowners' decision making. And from our own research, we have found that homeowners deciding to carry out costly amenity retrofits are indeed open to the inclusion of lower cost energy efficiency measures *once they are committed to undertaking the amenity retrofits* and have ascertained their affordability (Wilson 2008c). As the type of amenity retrofits represented by Scenario B are much more common than the type of energy retrofits represented by Scenario A (see Figure 2), the 'piggybacking' approach can potentially increase the frequency of energy retrofits as well.

So the challenge is to find ways of packaging energy efficiency measures into amenity retrofits. This must involve both policy inducements *and* business supply chains, and is a major departure for both. A goal shift is required away from inducing new and additional energy retrofit decisions towards inducing incremental, energy-related modifications to existing amenity retrofit decisions. This goal shift allows the alignment of homeowners' decisions with both policymakers' objectives and supply chain actors' commercial interests.

The Business Case for Packaging Energy Measures into Amenity Retrofits

The prevailing 'inform, incentivize, assure' approach relies either directly on homeowners, or indirectly on actors in the energy supply chain. Not only does this approach fail to use constructively the differences between energy and amenity retrofits shown in Table 1, it also drives a wedge between the energy supply chain and the amenities supply chain. The contractors, expert advisors, and other service providers who form the energy supply chain are specialized and/or focused on building envelopes or energy systems with little connection to amenities.[xiv] Like policymakers, they treat energy retrofits as the result of a distinct type of retrofit decision.

The 'piggybacking' approach proposed here offers new business opportunities for these energy supply chain actors *as well as* the broader supply chain for amenity retrofits. Crucially, this begins with an understanding of homeowners' decisions, and creative thinking about homeowners' overall experience as a basis for enhancing the value proposition offered by supply chain actors (MacMillan & McGrath 1997). Ross (2008) calls this an emphasis on 'customer intimacy' through which companies seek to enrich their relations with customers by delivering information, service, innovative products, and interactions which add value.

Womack & Jones (2005) summarize what customers really want from their suppliers as being complete solutions, attained and implemented with as little cost, time and effort on the part of the customer as possible, and without the customer having to search for other providers to complete the solution or merge disconnected sources. Bundling the product or service so that this can be achieved with minimal decisions and effort ensures that "ease of sourcing and completeness of the solution and not the product or service that constitutes the key value of the customer" (p21, Ross 2008).

This is central to the value proposition of the 'piggybacking' approach as it centers on "making the search process less complicated, more convenient, less expensive, and more habitual" (p135, MacMillan & McGrath 1997). Similarly important is improving the

convenience and comfort of the decision making process so homeowners can use the sort of 'instinctive' decision rules explained above in the context of Figure 1.

These sources of 'customer intimacy' arise by treating homeowners' decisions as being about retrofits and not about energy efficiency, based on an understanding on the underlying decision process. Offering energy measures as part of an amenity retrofit creates a source of competitive differentiation that arises from making consumers "aware of a need in a way that is unique and subtle" (p134, MacMillan & McGrath 1997). Home retrofits are the need or want for which the supply chain should provide.

Despite, the potential business opportunities of the 'piggybacking' approach, packaging energy measures into amenity retrofits is a major challenge for business. Figure 3 illustrates a simplified supply chain for energy efficient windows, including data on the numbers of firms represented at each stage (Thorne 2003; Will & Baker 2007). The supply chain for retrofits, particularly at the contractor level, is highly fragmented, with *dis*integration not just between amenities and energy contractors, but also between different types of energy contractors (Will & Baker 2007).

-- insert Figure 3 here

Using the amenities supply chain to promote energy efficiency to homeowners would rely on new alliances between accredited energy contractors (doing the work) and amenity contractors (doing the selling). These horizontal alliances are consistent with supply chain management strategies[xv] that seek to leverage "the combined knowledge and capabilities of the individual entities in the supply chain" (p24, Christopher 2004). Knowledge and skills transfer, as well as training and business development programs, would be needed as alternatives to sub-contracting or joint venture arrangements. Mechanisms to manage risks and reputations would be needed, though it is likely that existing government quality assurance schemes could play a central role. More broadly, particularly given concerns over irresponsible 'cowboy' contractors, due attention must be given to ensuring quality and enduring workmanship. This suggests trialing the proposed incentive through established brand name contractors with more internal resources as well as higher reputational risk. Ultimately, the success of the 'piggybacking' approach depends on the expanded, diversified value proposition being attractive to homeowners.

The Policy Case for Packaging Energy Measures into Amenity Retrofits

Policy can and should support businesses in overcoming these challenges. Targeting energy efficiency policy at supply chains rather than individuals or households is well trodden ground. It falls under the rubric of 'market transformation' and includes training and accreditation, new product development, standards, and innovations in the delivery of products and services. Various reports review and evaluate these initiatives by utilities, state agencies and others (e.g., Nadel et al. 2003). Examples of best practice are widely known, as are initiatives for their dissemination (e.g., CEE 2005). And they can be readily extended to the supply chain for amenity retrofits as a means of promoting energy efficiency in the home in the 'piggybacking' approach.

Take financial incentives as an example. Currently, financial incentives are a key mechanism for supporting supply chain activities. Table 2 compares the prevailing type of homeowner-targeted incentive with a proposed amenities supply chain-targeted incentive (also described in Scenario B). The homeowner-targeted incentive takes the form of a rebate for energy efficiency measures purchased or installed as part of an energy retrofit. The amenities supply chain-targeted incentive takes the form of a grant

for energy efficiency measures sold as part of an amenity retrofit. Both incentives have the same objective: inducing the adoption of energy efficiency measures by homeowners. Both incentives work in the same way: reducing the net cost of energy efficiency measures to homeowners. Both incentives could have the same monetary value: e.g., set equal to the social benefit of the energy efficiency measures. However, the incentives differ in terms of their target, their delivery and their administration. The central feature of the amenities supply chain-targeted incentive is that turns energy efficiency from a standalone investment into an incremental add-on.

-- insert Table 2 here

Table 2 reinforces the point that as well as potentially inducing the uptake of more energy efficiency measures, redirecting incentives from homeowners to amenities contractors may have more transformative effects on the supply chain for delivering energy efficiency into people's homes. The existing homeowner-targeted incentive acts through the energy supply chain indirectly by inducing demand for efficiency measures. The proposed amenities supply chain-targeted incentive acts through the amenity and energy supply chains directly by inducing contractors and stores to market an expanded service offering based on new business relationships and skills. Such changes are more likely to persist if and when the incentives are phased out.

5. Conclusion: Criteria for Promoting Energy Efficiency in the Home.

This chapter has argued for both policy and business communities to look to the supply chain for amenity retrofits as a means of promoting energy efficiency in people's homes. This argument rests on two straightforward observations. First, homeowners' decisions to undertake retrofits require time, effort, resources and a cognitive burden which information, incentives, and assurance cannot easily surmount. Business models, supported by policy, can circumvent these characteristics of energy retrofit decisions and so enable strategic differentiation (MacMillan & McGrath 1997). Our proposed approach is to package energy measures into the amenity retrofits already being decided upon and carried out by homeowners.

This 'piggybacking' approach is supported by the second observation. Far more is spent by homeowners on amenity rather than energy retrofits, and more regularly too. Treating energy efficiency as a retrofit challenge rather than an energy efficiency challenge points to the supply chain for amenity retrofits as being well placed to influence this common type of decision of homeowners.

This 'piggybacking' approach can be summarized in three criteria for businesses seeking to promote energy efficiency in the home: circumvent; contact points; cross-sell. These '3Cs' are founded on a realistic characterization of how homeowners report actually making retrofit decisions.

- *Circumvent:* reduce decision effort for homeowner; piggyback on existing decisions rather than trying to induce new ones;
- *Contact points*[xvi]*:* leverage existing points of contact between homeowners and the supply chain rather than trying to create new ones;
- *Cross-sell*: through these contact points, package energy efficiency measures into broader retrofit services and business models.

The 'circumvent' and 'cross-sell' criteria have been referenced frequently above. The 'contact point' criterion is emphasized in the thought experiment described in Box 2, and further elaborated in the context of the supply chain-targeted incentive described in

Table 2. In both cases, the existing 'contact point' between homeowner and supply chain is the finalization of the retrofit contract. But there are many other already existing 'contact points' through which to 'cross-sell' energy efficiency so as to 'circumvent' the need for burdensome decisions. Examples of these 3Cs acting in concert include:

- walk-through energy audit as part of pre-contract home visit;
- in-home servicing of energy system equipment and 'training' on maintenance and system tune-ups as part of amenity retrofits;
- complementary energy products with free installation as part of amenity product sales from home product stores over a certain amount.

In all cases, the same challenges around supply chain fragmentation arise, requiring new business models, alliances, joint ventures, and skills and knowledge transfer between energy and amenity contractors. We do not consider these insurmountable if these changes allow supply chain actors to enhance and differentiate their value proposition to homeowners.

This would mean energy efficiency policies, incentives, marketing and business models could become more effective. Whereas the prevailing 'inform, incentivize, assure' approach targeting homeowners can help sensitize and stimulate demand for energy retrofits, the 'piggybacking' approach targeting the amenities supply chain can ensure this demand is easily and conveniently supplied. This broader approach to transforming the market aligns policymakers and the business supply chain with how homeowners actually make retrofit decisions. The resulting approach to promoting energy efficiency in the home has the hallmarks of a sustainability strategy: comprehensive, integrated, and aligned.

Tables & Figures

BOX 1. DEFINITION OF KEY TERMS.

'*Retrofits*': any activity to replace, upgrade, renew or improve all or part of an existing home. As used here, '*retrofits'* encompasses various other terms including home improvements, renovations, and remodeling. We further distinguish '*energy retrofits'* and '*amenity retrofits'*.

'Energy retrofits': changes to the thermal performance of a home's building envelope (windows, doors, walls, etc.) or to a home's energy systems (heating, cooling, ventilation, hot water, etc.). '*Energy retrofits*' can potentially improve energy efficiency, though this is not always the case. '*Energy retrofits*' are targeted by energy efficiency policies.

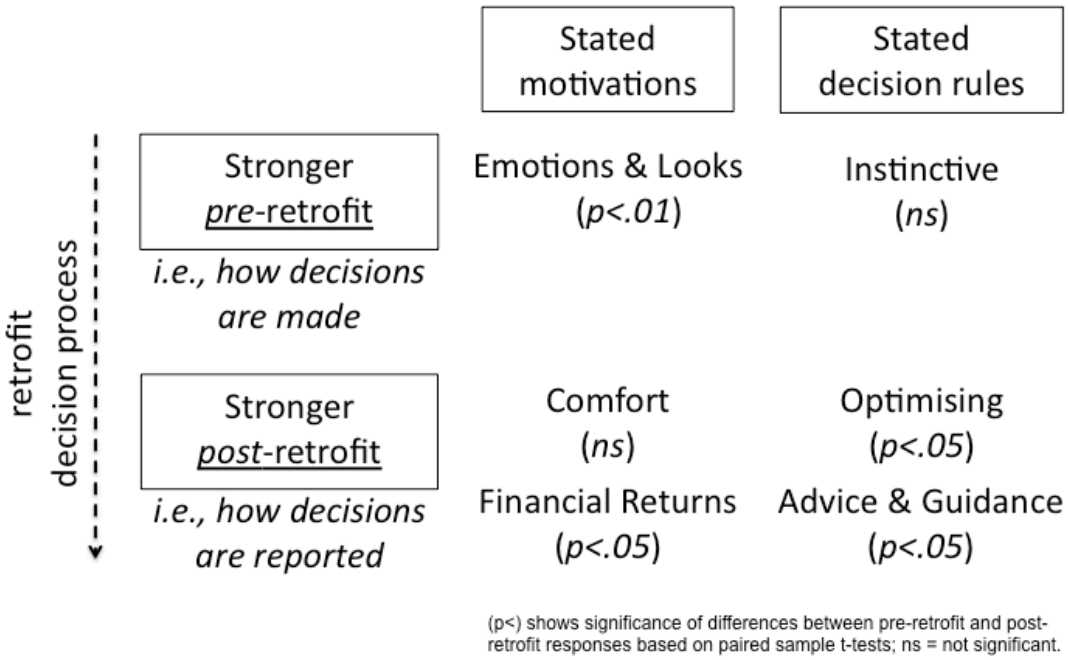
'Amenity retrofits': changes to a home's living and functional spaces (kitchens, bathrooms, living rooms, garage, garden, etc.). '*Amenity Retrofits'* do not generally improve energy efficiency, though this is not always the case. '*Amenity retrofits*' are not targeted by energy efficiency policies.

'*Supply chain*': the network of firms or other entities involved in providing a product or service to a final user. We also use the term '*supply chain actors*' to denote all these firms and entities.

'*Energy supply chain*': the '*supply chain actors'* who enable or carry out '*energy retrofits'*. The '*energy supply chain'* includes product manufacturers, home improvement retailers, home contractors, and also utilities and government agencies.

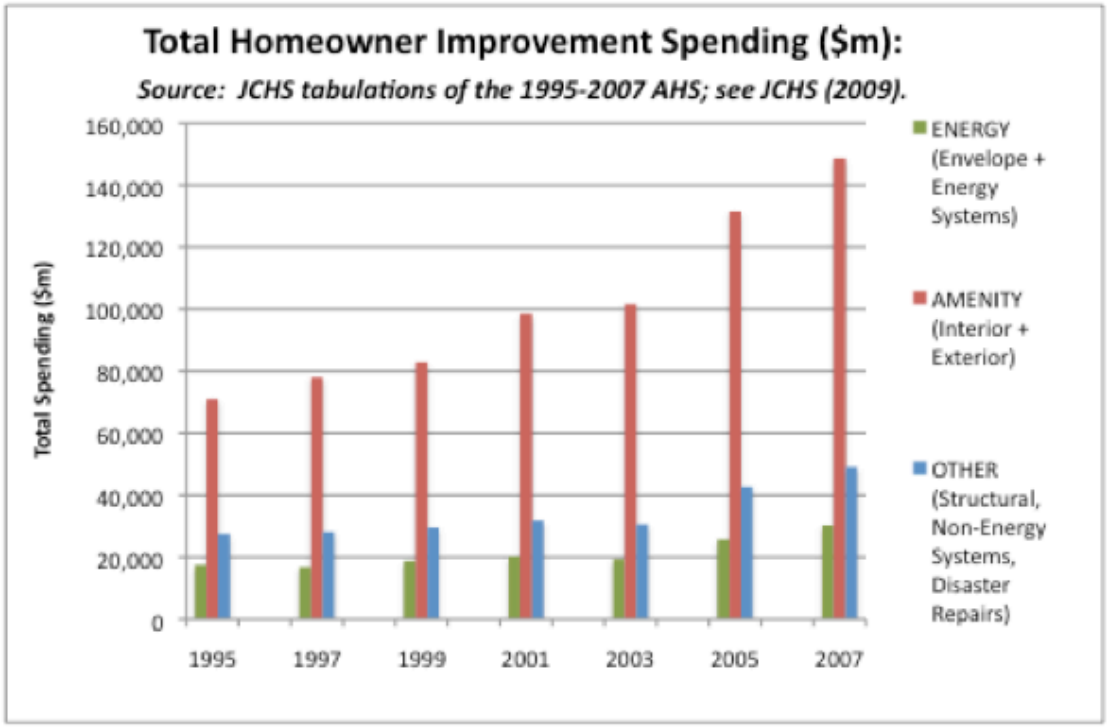
'*Amenities supply chain*': the '*supply chain actors*' who enable or carry out '*amenity retrofits*' (see above).

FIGURE 1. CHARACTERISTICS OF RETROFIT DECISIONS, BEFORE AND AFTER THE FACT.



(p<) shows significance of differences between pre-retrofit and post-retrofit responses based on paired sample t-tests; ns = not significant.

FIGURE 2. HOMEOWNERS' EXPENDITURE ON RETROFITS.

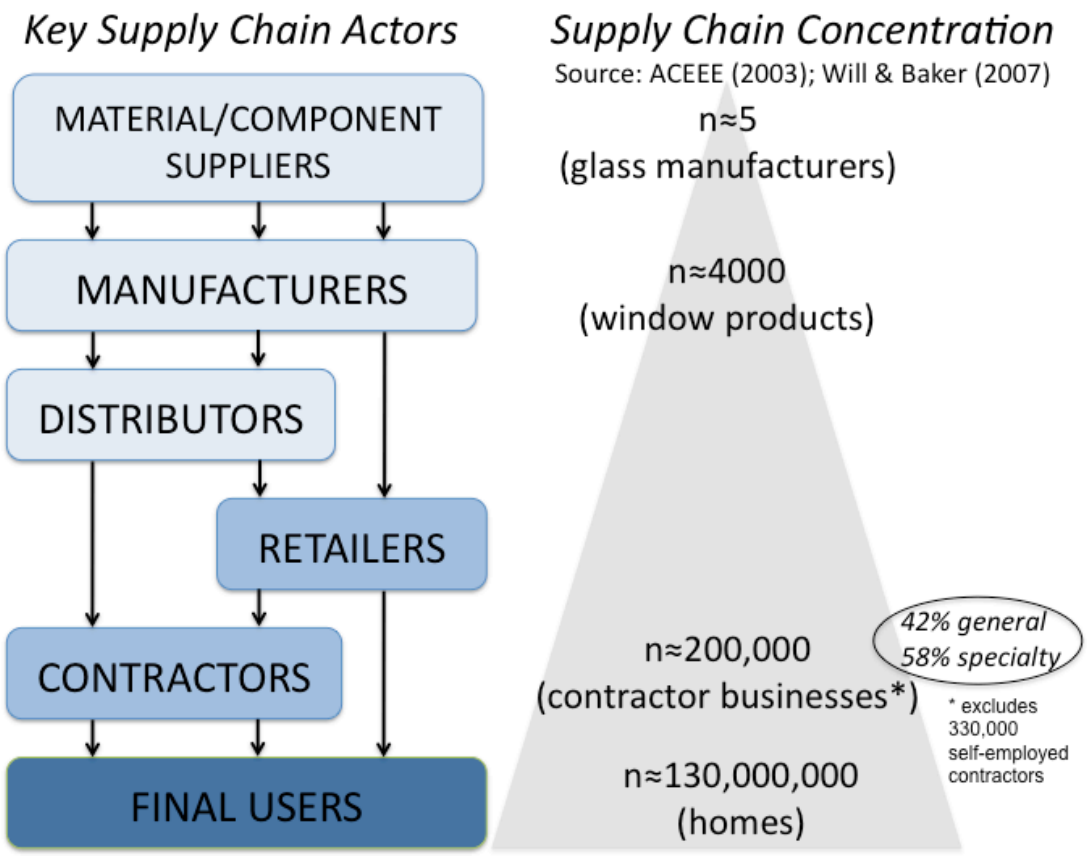


AHS = American Housing Survey
JCHS = Joint Centre for Housing Studies (at Harvard University)

TABLE 1. CONTRASTING CHARACTERISTICS OF AMENITY & ENERGY RETROFIT DECISIONS.

Decision features	Amenity retrofit decisions	Energy retrofit decisions
Prevalence	common	less common
Main parts of the home	kitchens, bathrooms, conversions, outdoor areas	windows, doors, heating & ventilation systems
Motivations	emotions, aesthetics, (social norms)	thermal comfort, financial returns
Strength of motivations (for initiating decisions)	strong	less strong
Decision rules	instinctive	instrumental (optimize outcomes)
Social role	status, identity (symbolic) comfort, modernity (practical)	comfort (practical)

FIGURE 3. THE RETROFIT SUPPLY CHAIN.



BOX 2. A RETROFIT DECISION THOUGHT EXPERIMENT.

<table>
<tr><td colspan="2">Imagine you a homeowner: which of Scenario A and Scenario B seems more likely to you?

* Note that the package of energy efficiency measures referred to in both scenarios is the same. It comprises: cavity wall & roof insulation, hot water system insulation, weather-stripping & draft-proofing, furnace tune-up, programmable thermostat.</td></tr>
<tr><td>Scenario A:
You are motivated to undertake a costly retrofit to improve your home's energy efficiency. You seek information from different sources on energy efficient products and services offered by government, utilities and contractors. You spend $150 on a home energy audit which recommends $1,000 of work on a package of energy efficiency measures* that a computer model of your home predicts will save you 20-25% on your energy bills. You decide to go ahead with this energy retrofit. You research available contractors and ask three to visit your home and give you a quote; you select one based on value for money and trustworthiness. This contractor prepares a detailed contract; you agree and sign. The contractor spends 3 days in your home carrying out the work. The quality of the work is guaranteed through a government quality assurance scheme. Once complete, you submit applications for the available financial incentives from different sources. These add up to a $250 grant on the work done, and a $150 rebate for the cost of the home energy audit. You have spent a net total of $750 on energy efficiency which reduces your energy bills at home by 20%. You are reminded of your retrofit costs and efforts once a month when your energy bill arrives; visitors to your home neither see nor comment on your retrofits.</td><td>Scenario B:
You are motivated to undertake a costly retrofit to improve the look and feel of your home's kitchen. You visit home product stores to see the available options. The remodeled kitchen you like best costs $5,000. You decide to go ahead with this amenity retrofit. You ask three contractors affiliated to the home product stores to visit your home and give you a quote; you select one based on value for money and trustworthiness. This contractor prepares a detailed contract which includes the option to add on a package of energy efficiency measures* for an additional $750. This is reduced from $1000 thanks to various incentives which the contractor can collect on your behalf. The contractor estimates that the measures will save you very roughly 10-30% on your energy bills. The energy efficiency measures will be installed at the same time as the kitchen remodeling. You agree and sign the contract. The contractor spends 3 days in your home carrying out the work. The quality of the energy-related work is guaranteed through a government quality assurance scheme. You have spent a net total of $750 on energy efficiency which reduces your energy bills at home by 20%. You are reminded of your retrofit costs and efforts every day when you walk into your kitchen; visitors to your home always see and comment on your retrofits.</td></tr>
</table>

TABLE 2. REDESIGNING ENERGY EFFICIENCY INCENTIVES.

	Existing: **Homeowner-targeted incentive**	***Proposed:*** **Amenities supply chain-targeted incentive**	**Rationale of Proposed Incentive**
Incentive marketed and paid to	Homeowners.	Amenities contractors (or home product stores) but passed on to energy contractors and/or homeowners.	Reduce bureaucracy and decision burden for homeowners; Leverage influence of supply chain actors on homeowners, and expand service offerings of amenity contractors; Encourage new business alliances and knowledge/skills transfers between energy and amenity contractors.
Type of homeowner benefiting	Homeowners deciding on energy retrofits, e.g., to replace worn out equipment.	Homeowners deciding on amenity retrofits, e.g., to improve look and feel of home.	Target much larger segment of homeowners undertaking amenity retrofits; Use emotional, aesthetic and normative motivations for retrofit.
Benefit to homeowner	Delayed cash flow benefit (post-installation rebate), subject to paperwork.	Immediate cash flow benefit (point-of-sale grant) with no paperwork.	Incentives passed on by supply chain actors to homeowners through lower net cost contract (assuming competitive markets).
Cost of managing incentive program	High: individual applications from, and program marketing to, many dispersed homeowners.	Low: aggregated applications from, and program marketing to, fewer supply chain actors.	Applications for incentives managed and aggregated by supply chain actors; Fewer, more clearly identifiable number of actors for targeted (and so more effective) marketing.

References.

Aune, M. (2007). "Energy comes home." Energy Policy 35(11): 5457-5465.

CEE (2005). Residential Home-Performance Programs: National Summary. Consortium for Energy Efficiency, Boston, MA.

Christopher, M. (2004). Supply Chains: A Marketing Perspective. Understanding Supply Chains: Concepts, Critiques, and Futures. S. New and R. Westbrook. Oxford, UK, Oxford University Press: 23-42.

Dietz, T., G.T. Gardner, J. Gilligan, P.C. Stern and M.P. Vandenbergh (2009). "Household actions can provide a behavioral wedge to rapidly reduce US carbon emissions." Proceedings of the National Academy of Sciences 106(44): 18452-18456.

EIA (2009). Emissions of Greenhouse Gases in the United States 2008. US Energy Information Administration, Washington, DC.

EIA (2010). Annual Energy Outlook. US Energy Information Administration, Washington, DC.

Esty, D.C. and A.S. Winston (2006). Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value, and Build Competitive Advantage. New Haven, CT, Yale University Press.

Gardner, G.T. and P. Stern (1995). Environmental Problems and Human Behavior, Allyn & Bacon.

Gardner, G.T. and P.C. Stern (2008). "The Short List: The Most Effective Actions US Households Can Take To Curb Climate Change." Environment 50(5): 12-24.

Gatersleben, B., L. Steg and C. Vlek (2002). "Measurement and determinants of environmentally significant consumer behavior." Environment and Behavior 34(3): 335-362.

Giannakis, M., S. Croom and N. Slack (2004). Supply Chain Paradigms. Understanding Supply Chains: Concepts, Critiques, and Futures. S. New and R. Westbrook. Oxford, UK, Oxford University Press: 1-22.

Gillingham, K., R. Newell and K. Palmer (2006). "Energy Efficiency Policies: A Retrospective Examination." Annual Review of Environment & Resources 31: 161-192.

Hoffman, A.J. (2000). Competitive Environmental Strategy: A Guide to the Changing Business Landscape. Washington, DC, Island Press.

JCHS (2009a). The Remodeling Market in Transition. Joint Centre for Housing Studies of Harvard University, Cambridge, MA.

JCHS (2009b). The State of the Nation's Housing: 2009. Joint Centre for Housing Studies of Harvard University, Cambridge, MA.

Kahneman, D. (2003). "Maps of bounded rationality: Psychology for behavioral economics." American Economic Review 93(5): 1449-1475.

Kempton, W., J.M. Darley and P.C. Stern (1992). "Psychological Research for the New Energy Problems: Strategies and Opportunities." American Psychologist 47(10): 1213-1223.

Kempton, W. and L. Montgomery (1982). "Folk Quantification of Energy." Energy 7(10): 817-827.

Linden, A.-L., A. Carlsson-Kanyama and B. Eriksson (2006). "Efficient and inefficient aspects of residential energy behaviour: What are the policy instruments for change?" Energy Policy 34(14): 1918-1927.

Loughran, D.S. and J. Kulick (2004). "Demand-Side Management and Energy Efficiency in the United States." The Energy Journal 25(1): 19-43.

MacMillan, I.C. and R.G. McGrath (1997). "Discovering New Points of Differentiation." Harvard Business Review 75(4): 133-145.

Metz, B., O.R. Davidson, P.R. Bosch, R. Dave and L.A. Meyer (2007). Climate Change 2007: Mitigation of Climate Change. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. Cambridge, UK, Cambridge University Press.

Nadel, S., J. Thorne, H. Sachs, B. Prindle and H.S. Elliott (2003). Market Transformation: Substantial Progress from a Decade of Work. American Council for an Energy Efficient Economy (ACEEE), Washington, DC.

Nevin, R. and G. Watson (1998). "Evidence of rational market valuations for home energy efficiency." The Appraisal Journal 66(4): 401.

Nolan, J.M., P.W. Schultz, R.B. Cialdini, V. Griskevicius and N.J. Goldstein (2008). "Normative Social Influence is Underdetected." Personality & Social Psychology Bulletin.

Peters, J.S. (2007). "Lessons Learned After 30 Years of Process Evaluation."

Rogers, E.M. (2003). Diffusion of Innovations. New York, Free Press.

Ross, D.F. (2008). The Intimate Supply Chain. Boca Raton, FL, Taylor & Francis.

Schultz, P.W., J.M. Nolan, R.B. Cialdini, N.J. Goldstein and V. Griskevicius (2007). "The Constructive, Destructive, and Reconstructive Power of Social Norms." Psychological Science 18(5): 429-434.

Shove, E. (2003). Comfort, cleanliness, and convenience: the social organisation of normality. Oxford, UK, Berg.

Staats, H., P. Harland and H. Wilke (2004). "Effecting Durable Change: A Team Approach to Improve Environmental Behavior in the Household." Environment and Behavior 36(3): 341-367.

Stern, P.C. (2000). "Towards a coherent theory of environmentally significant behavior." Journal of Social Issues 56(3): 523-530.

Stern, P.C., E. Aronson, J.M. Darley, D.H. Hill, E. Hirst, W. Kempton and T.J. Wilbanks (1986). "The effectiveness of incentives for residential energy conservation." Evaluation Review 10(2): 147-176.

Thorne, J. (2003). Residential Retrofits: Directions in Market Transformation. American Council for an Energy Efficient Economy, Washington, DC.

Wilk, R. and H. Wilhite (1984). Household energy decision making in Santa Cruz Country, California. Families and Energy: Coping with Uncertainty. B.M. Morrison and W. Kempton. East Lansing, MI, Michigan State University: 449-458.

Will, A. and K. Baker (2007). The Performance of Remodeling Contractors in an Era of Industry Growth and Specialization. Joint Centre for Housing Studies of Harvard University, Cambridge, MA.

Wilson, C. (2008a). Energy Efficient Home Renovations are not Financial Investments. International Association for Energy Economics (IAEE) Conference, Istanbul, Turkey.

Wilson, C. (2008b). "Social norms and policies to promote energy efficiency in the home." Environmental Law Reporter 38: 10882-10888.

Wilson, C. (2008c). Understanding and Influencing Energy Efficient Renovation Decisions. Institute for Resources, Environment & Sustainability. Vancouver, BC, University of British Columbia. PhD.

Wilson, C. and H. Dowlatabadi (2007). "Models of Decision Making and Residential Energy Use." Annual Review of Environment and Resources 32: 169-203.

Womack, J.P. and D.T. Jones (2005). Lean Solutions: How Companies and Customers Can Create Value and Wealth Together. New York, Free Press.

Endnotes.

[i] Quote taken from President Obama's State of the Union Address given on 27 January 2010 to the US Capitol. Downloaded on 7 April 2010 from: www.whitehouse.gov/the-press-office/remarks-president-state-union-address

[ii] These data exclude any energy embodied in the products and services consumed by households, as well as all transportation related emissions.

[iii] According to calculations by Gardner & Stern (2008), energy consumed in US homes in 2005 breaks down in rank order of end use as follows: space heating (33%), water heating (12%), air conditioning (11%), lighting (11%), refrigeration and freezing (8%), small electric inc. heating elements, motors, appliances (7%), clothes washing & drying (4%), TVs (4%), cooking (3%), computers (1%), other (7%).

[iv] We use the term 'value proposition' simply to mean how, where and when value is to be created for specific customers (in this case, homeowners). The value proposition should be defined from the customers' viewpoint in order to provide a strong foundation for competitive advantage (p32, Christopher 2004). Components of a customer-driven value proposition include: convenient solutions, customization, experiential intensity (fostering emotional connections), and excellent quality service (p220, Ross 2008).

[v] Housing owned by the public or not-for-profit sectors does not rely on homeowners' decisions for energy retrofits. But this comprises a small proportion of the US housing stock. In 2008, around 1.1 million households received direct federal housing assistance in 2008 through a public housing program (JCHS 2009b).

[vi] This piece of mind or intrinsic value is distinct from sources of extrinsic value including price, quality, and other physical attributes of the product or service. Ross (2008) also argues that intrinsic value has a second dimension: conformance. This concerns the match between specification and actual (unmonitored) performance in terms of reliability, durability, aesthetics and so on. In contrast, assurance is the confidence or trust a customer has in a supplier in terms of acceptable risk, competence, credibility, courtesy, security, responsiveness and so on.

[vii] 'Recovery through Retrofit' report of the Middle Class Task Force of the White House Council on Environmental Quality convened by the Vice-President of the United States. October 2009. Downloaded on 15 December 2010 from: www.whitehouse.gov/administration/eop/ceq/initiatives/retrofit

[viii] In a curious illustration of the ineffectiveness of the 'inform, incentivize, assure' approach, President Obama used his weekly radio and internet address in early April 2010 to remind homeowners of available tax credits for energy efficient retrofits in advance of the imminent April 15 tax return deadline. His appeal was not for homeowners to improve their homes' energy efficiency, but to claim the tax credits (i.e., free money) if they already had.

[ix] For further details on the research method, see Wilson (2008c); for other findings, see Wilson (2008a, 2008b).

[x] The data refers to 'improvements' by owner-occupied homes and excludes both maintenance expenditure on owner-occupied homes and all expenditure on rental properties. In 2007, these categories accounted for 14% ($46bn) and 16% ($52bn) of a total retrofit expenditure in the US of $326 billion (JCHS 2009a).

[xi] This can be successful. As examples: (i) information and incentives provided by product labels and point-of-purchase rebates can influence in-store decisions (Peters 2007); (ii) training, educating and accrediting actors in the energy supply chain can help make high efficiency the default option for energy retrofits; (iii) product standards and building codes can support economies of scale across the home building and retrofit supply chains; (iv) realtors can play a role in sensitizing the real estate market to the lower running costs and higher thermal comfort of energy efficient homes which could potentially feed through into house prices (Nevin & Watson 1998).

[xii] This echoes a California study which found efficiency measures were actually selected as part of broader retrofits based on their visibility or significance in terms of social norms (Wilk & Wilhite 1984).

[xiii] Note that these attractions are similar to those of the highly popular 'cash-for-clunkers' program through which car owners could trade in their old (inefficient) for a new (efficient) car and receive a financial incentive netted off the price of the new car at the point of purchase (Dietz et al. 2009). All the work done to administer the incentive scheme was done 'behind the scenes' by the car dealers.

[xiv] Large home improvement retailers stock both energy-related and amenity-related products, but the installation complexity of most building envelope and energy system measures mean these are usually delivered through contractors rather than directly to homeowners.

[xv] Supply chain management is broadly understood as the management of the flow of goods and services to end customers to satisfy their requirements (Giannakis et al. 2004).

[xvi] Ross (2008) uses the term 'touchpoint' to describe the interface between supply chain and customer. He goes on to argue that whether touchpoints are in person, over the phone, or online, the customer interface "acts as the vehicle for the dynamic, interactive exchange of experiential communication and value between the supplier's product and the emotional benefits customers anticipate" (p209).