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in Energy Demand and Carbon Abatement

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Keywords

Energy Efficiency, Carbon Mitigation, Carbon Footprint,
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The Psychological Underpinnings of the Consumer Role in Energy Demand and Carbon Abatement

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1. Abstract

While policy targeting carbon mitigation has become a priority, the consumer has been sidelined. Within the EU standards and a carbon price at the industrial level dominate mitigation efforts. There is little room for consumer preferences. Labels on some products do draw a demand for efficient goods, though the messages relayed vary, and the role of embedded emissions often ignored. Once purchased, the energy requirements of various goods and their energy settings are poorly understood by many. In this paper we suggest with appropriately structured policy, providing information and a nudge, that consumers have a willingness and potential to significantly reduce carbon emissions.

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2. Introduction

Spurred by a multitude of concerns – depleting conventional oil stocks, rising energy prices, threats to energy security, and equity issues, and a variety of local environmental concerns – curtailing fossil fuel use is an objective of many governments across the globe. Furthermore, the threats of climate change have become more deeply embedded in the UK and Europe and are drawing ever more attention globally.

There are two mechanisms available to policy makers to reduce our reliance on carbon intensive energy; the innovation of clean energy sources, and the reduction in aggregate energy use. Investment in clean energy generation is part of a long term mitigation strategy. In the nearer term, to meet abatement targets, and to buy more time to establish other energy sources, the primary tool is to reduce energy consumption.

Focusing efforts on reducing consumption is not easy. We are living in consumer driven economies. Political and economic developments are heavily impacted by the structure of consumer demand patterns and the voting behaviour that is closely related to it. Currently the interest is heavily weighted towards energy-dependant activities, from basic activities of transport and cooking and heating, to a range of leisure activities – from watching television to extreme sports – in which consumers have little knowledge of or interest in the energy implications. While western economies have evolved as consumption driven machines, in developing regions, increased access to electricity is causing even faster growth in energy demand. In residential buildings alone, electricity use rose by 350% between 1971 and 2007, and by 498% in commercial buildings (IEA, 2010).

New technologies in energy efficiency offer means of reducing consumption without an accompanying reduction in welfare. However, despite a rapid turnover in seemingly win-win investment opportunities, consumers' preferences have not evolved in line with the developments in technical efficiency.

Regulatory design focused on limiting growth in energy demand has primarily relied on standards, accompanied by labels and information campaigns. While demand continues to push emissions far above what must be achieved if we are to meet abatement schedules, public policy targeting a reduction in consumer energy use has lacked the coherence and sophistication in consumer communication to bring consumers along with the objective. This paper explores why it is important to engage consumers in mitigation efforts, why given the apparent economic benefits of greater efficiency it has been resisted among consumers, what the potential for change might be, and what exactly it is we want consumers to consider while making their purchases. Analysis of this paper suggests consumer engagement is a powerful mechanism to address rising energy demand, and could have a broader impact upon supply chain emissions and clean energy markets.

3. The Energy Efficiency Gap

Estimates using economic and engineering models of the technological potential of efficiency have varied, though are consistently positive. The McKinsey cost curve, perhaps the best known example, describes energy efficiency, if maximised, as having the potential to cut between 6.5 and 8 Gt of CO₂ by 2030, at an average rate of return of 17% (McKinsey and Company, 2008). Specifically, improving building energy efficiency could cut emissions by 3.5GtCO₂ annually, with net cost savings of €32/ tCO₂. Investments in water heating, air conditioning, and lighting are also found to generate a net saving. Similarly improving the efficiency of the entire fleet of road transport could reduce emissions by 1.5GtCO₂ per year, with a net cost saving of €10/tCO₂.

At the consumer level, the Energy Savings Trust (EST) estimate that there is room for a saving of £300 annually and 1.5 tonnes of CO₂ per household, if current potential for energy efficiency in households in the UK were realized (EST 2010). Improvements in lighting should offer a payback between six months and a year, insulation, after two years, draught proofing a house, after eight years, and Combined Heat and Power (CHP) or 'smart building management' will take longer (EST, 2009).

Despite these reports of positive returns, consumer interest in low energy technologies has not been roused. Given the number and nature of variables at play, it is near impossible to calculate the realistic potential for greater efficiency. Technological turnover is rapid. There is an interaction of economic, regulatory and cultural factors. New technologies may be more specialized than their predecessors, and may bear hidden costs – time and effort in researching and applying new technologies. Perhaps most significantly, the impact which psychological factors bear on the market cannot be modelled and explored uniquely.

Classical economics frames the persisting slow up-take of technologies in terms of barriers in the market. Those typically cited include lack of information, split incentives, capital constraints and discount rates. Once these are removed, the premise has been that consumer rationale in favour of lower costs per unit of output should prevail. Interventions in the market, in the form of regulatory measures and fiscal incentives, have been justified by the assertion that if the gains in efficiency outweigh the cost of policy implementation, it is a worthy undertaking.

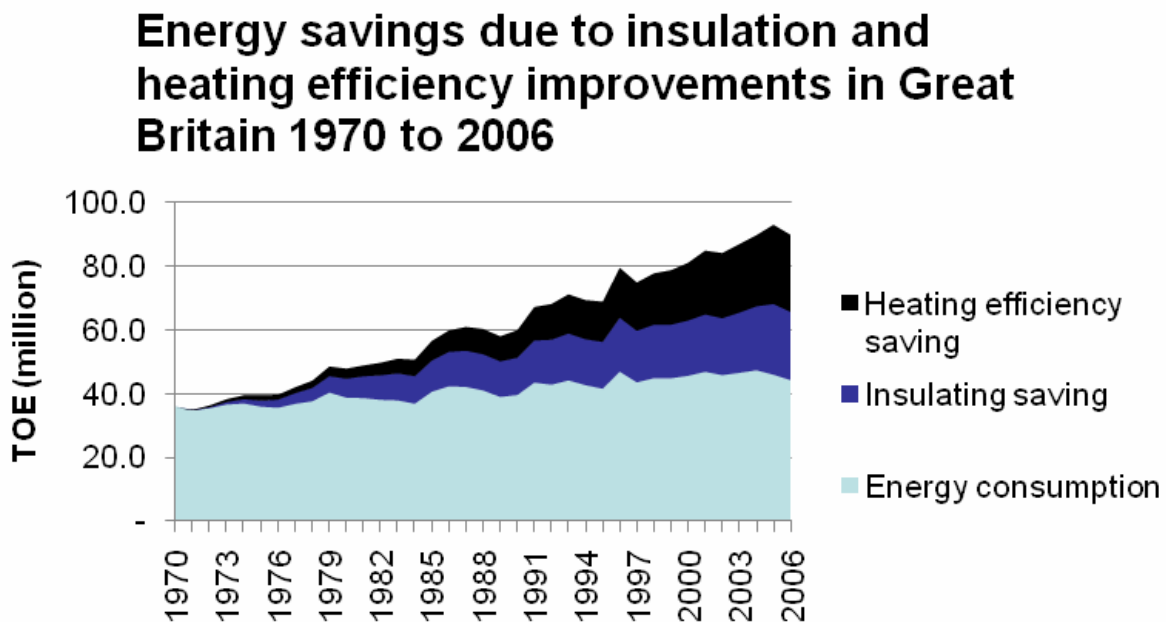
Policy targeting the removal of these barriers has achieved some successes. Labelling programmes have led to increases in the market share of more efficient appliances and electronics, while standards have been effective in increasing the average efficiency of product lines. Fiscal measures (e.g. investment specific subsidies or tax deductions) have provided funds, stimulating investments in energy efficiency and promoting further innovations.

However, despite gaining some ground, policy measures have failed to deliver their intended goal. The enduring discrepancy, between the technological potential and real up-take of efficiency, has been dubbed the ‘energy efficiency gap’ or the ‘energy paradox’.

The example of space heating serves as a useful representation of the great gains that have been made in efficiency, of the greater potential, and of broader implications of demand patterns. Space and water heating makes up the largest proportion of household energy use. Figure I shows, between 1970 and 2006, there was almost a 50% increase in the efficiency of space and water heating in the residential sector in the UK, as measured per

unit area. This can be linked to advances in heating technologies and improved insulation techniques. However, looking at figures across the UK, even by 2006 in fact only 39% of those households suitable had the maximum depth of cavity wall insulation, 50% had double glazed windows across their home, 57% had the maximum depth of loft insulation, and 5% had the maximum depth of insulation on their water tank (DECC, 2009).

Figure I: Household energy savings



Source: DECC (2009) *Energy Consumption in the United Kingdom*

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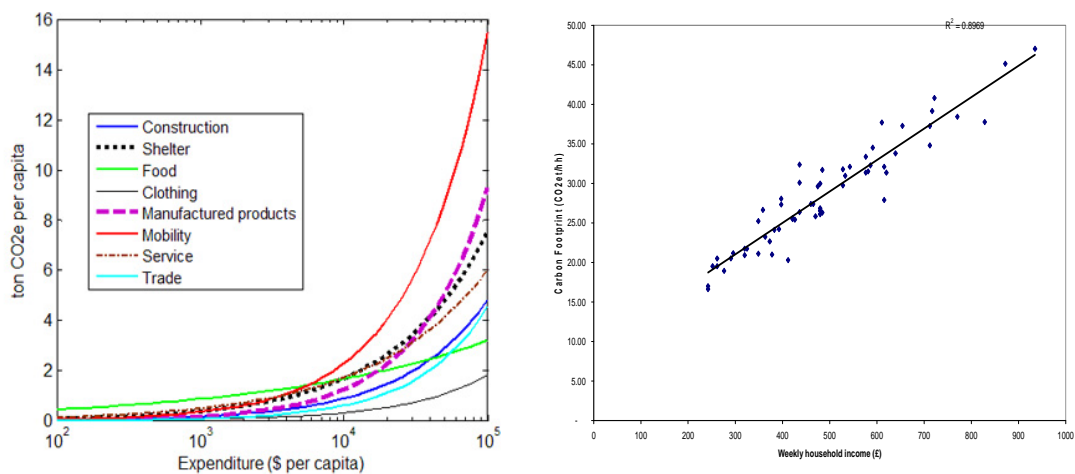
This diagram highlights more than the energy efficiency gap alone. It also brings to our attention that despite the 50% gain realized in efficiency, demand has grown so much during the same period that residential energy use has remained steady. Looking at the trend in energy consumption from a broader perspective we can see that the consumer role in emissions needs to be addressed in more than efficiency terms alone.

It may be argued that there is an upper limit to the growth in energy consumption, however there is no evidence for this. It is human nature that we will always want more, bigger and faster. These desires may be constrained by our economic circumstances and other ethical, religious, or cultural values. However there need never independently exist a point of saturation, only trade-offs.

Today, while innovation is providing us with new attractive technologies (MP3 players, mobile phones, dishwashers, etc.), increased wealth and enhanced efficiency are allowing us to consume more of these, and thus aggregate energy consumption rises.

The rebound effect, a theory that describes increases in energy efficiency as a catalyst for further consumption and greater energy use, has been proposed to underlie some of the rising trend in household energy demand (Hertwich, 2005). Rebound may transpire, for example, as people opt to drive more or faster as their car becomes cheaper to run. While improvements in energy efficiency have taken place in parallel to increases in economic output, total factor productivity, and overall energy consumption in the past, the evidence for a causal relationship is lacking (Sorrell, 2007). Neoclassical production functions suggest that improvements in pure energy efficiency will lead to a direct backfire effect (an even greater use of energy). However, these models may not reflect real behaviour patterns (Sorrell, 2007). While the nature of the contribution of energy to economic growth and the role energy substitutes may play requires greater clarity, the role the rebound effect might play in policy is uncertain. If there is a linear correlation between increased disposable income from energy savings and further overall energy demand, the extent of this, and whether it is infinite, would require further research over longer time scales.

Figure II: Economic Growth and GHG emissions



Source: (Foxon 2010), as adapted from Hertwich and Peters, *Environmental Science and Technology*, 2009.

Future patterns of energy consumption are uncertain, but thus far, as depicted in Figure II, there has been a consistent climb, in line with growth in average incomes. Energy consuming activities have become a dominant feature of consumer demand patterns and, within modern consumption driven economies, curtailing this will be no easy feat.

Politically, pursuing a strategy to address conservation would appear as a restriction on consumption, and meet with massive opposition from market players and consumer bodies. It is for this reason that climate change policy has been made invisible to the consumer – votes could be sacrificed by policies which appear as a constraint on consumption. In Europe carbon has been priced at an industrial level through the ETS, and internationally standards have been applied to consumer goods, wiping out the poorest performing products. Consumer choice is side-lined by these policy strategies, and they are left without agency to reduce emissions. The increasing trend in consumer direct and indirect emissions indicates that it may be necessary to incorporate them into further mitigation efforts.

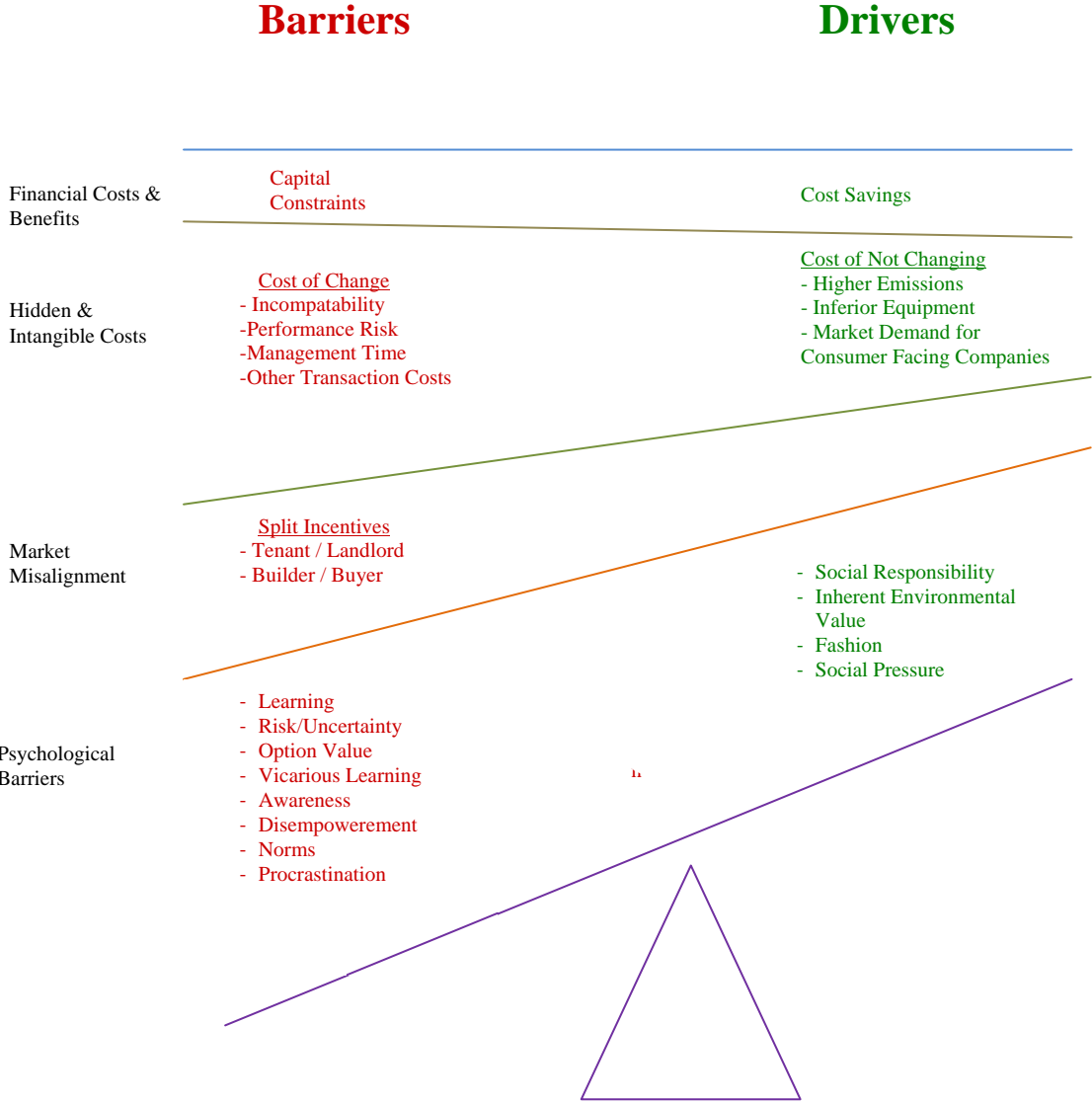
Debate over the potential saturation, versus rebound effects, indicates that we still have a far from complete understanding of cause-effect relationships in the economics of energy consumption. Thus the most strategic means of paving a way for a consumer role in mitigation efforts is unclear. Given the appropriate communication, would consumers internalize the consequences of energy use? Could energy or carbon feature as a constraining or influential factor in consumer optimization processes?

4. The Psychology Underlying the Gap

There may be far more to the stubbornness in the market than the economic barriers policy has been targeting. Figure III shows a range of barriers and drivers of energy efficiency up-take. These are divided into the financial costs and benefits, the hidden and intangible costs, market misalignments, and behavioural barriers. Currently the financial benefits of investing in new technologies outweigh the barriers, over the long run. However with the perseverance of split incentives, the up-front costs of change and the bulk of behavioural factors impeding up-take, the barriers far outweigh the drivers.

It would be a narrow definition of human preferences to assume that purchasing decisions are guided by price alone. There are other psychological and social barriers impeding a change in purchasing behaviours. Consideration of this broader range of factors allows a re-interpretation of consumer choices, as adaptive rather than irrational.

Figure III: Barriers and Drivers to Efficient Technology Up-Take



The vast majority of research and policy effort to date has expended upon the first three categories:

- the basic economics of capital investment vs. the value of energy savings, in a world of limited capital, and the consequent potential impact of policies such as subsidies for energy efficient investment;
- the many dimensions of 'hidden costs', including transaction costs, and ways that policy might reduce these, such as with standards;
- the 'split incentives', most obviously the tenant-landlord split but actually extending much more broadly to equipment where the energy costs of a device may be invisible to the purchaser (and of no concern to the manufacturer), justifying suites of policies around standards, labels, and 'efficiency technology lists'.

This paper instead focuses on the last category – behavioural characteristics, particularly relating to individual consumers. The paper explores how research findings in behavioural economics relate to the challenges of improving energy efficiency. The final tier of the see-saw lists some of these 'psychological barriers', which are multiple, and which we argue may apply the greatest weight to the barrier side of the diagram.

The weight of behavioural barriers hinges on the fact that energy is an abstract commodity. It is invisible and intangible. Typically people would not consider that there is a potential substitution when they are using energy; it is merely an assumed overhead, a means of achieving basic goals – commuting, making tea, showering. It will take time for a change in people's perception of energy, from an automatic cost to one that can be substituted, i.e. more efficient energy stock, or a more efficient application of energy stock. The process of learning will be further delayed by the perceived riskiness inherent in change. Furthermore, communication of the best method to change may be so case-specific that it escapes national policies. People's reliance on cultural norms to inform their behaviours, and their natural tendency to procrastinate or to plan poorly for the future, have locked society into a socially constrained, sub-optimal pattern of energy consumption.

Culturally, the role energy plays will have to evolve, and thus the psychological underpinnings of the energy efficiency gap steered to a more progressive engagement with

energy. The rest of this paper explores what has been learned, both from behavioural economics and practical policies that have sought to engage consumers.

a. Heuristics in Decision Making

Theory in behavioural economics has captured the seemingly irrational pattern of decisions people make due to a variety of biases in judgement. Tversky and Kahneman (1974) introduced to literature what are now known as the 'classic heuristics': availability, anchoring and representativeness.

- Availability describes how people's assessment of the frequency of an event occurring depends upon how easily they can draw upon one similar instance in memory. Thus risk perceptions are often formed based upon the salience of a prior occurrence Gigerenzer (2004) found that while Americans feared a terrorist attack post September 11th, there were in fact more fatalities in road traffic accidents among those attempting avoid the risk of flying.
- Anchoring refers to the tendency to make probability estimates based upon a potentially arbitrary set prior. In Kahneman and Tversky's original study, spinning a wheel to generate a number between 1 and 100, influenced participants' estimations of the percentage of African nations that were members of the UN.
- Representativeness refers to probability estimates stemming from the assumption that a sample, however small, are representative of an entire population. Stereotyping of groups of individuals is most common example of representativeness.

More recent work has developed the role of heuristics further, notably around unstable preferences in the work of Ariely, Loewenstein & Prelec (2003); making accurate use of heuristics in Gigerenzer & Todd (1999); and the role of emotions in assessments of risk and benefits in Finucane, Alhakami, Slovic & Johnson (2000). The significance of emotions present at the time of decisions has been outlined in theory on visceral effects (Loewenstein,

1996). Short term emotions influencing preferences may lead to longer term consequences and be deemed irrational.

What the theory around heuristics and emotions shows us is that there is a wide range of influential factors beyond relative price, which dictate decision-making processes. These need not be considered irrational; one could look at them as experienced-based techniques for fast problem solving, and preference formation. Out of the huge literature in this area, those that reveal most about the energy efficiency gap, which we will explore in greater detail in this section, are those relating to the natural processes of learning and uncertainty.

b. Learning

If we are to change how we perceive and apply energy there will be a learning period, which delays the switch to cheaper practices that comes with technologies and incentives promoting efficiency. This learning period can be understood in the context of utility theory.

Goods and services we consume come with an inherent reward experience; in economics it is calculated in terms of utility. This reward is experienced due to the firing of reward neurons. A feeling of reward causes a direct increase in the behaviour that led to that reward (Schultz, 2005). Eventually we experience reward if we merely think of the activity that caused that sensation in the first place. This is the process of learning.

Money has an inherent reward feature; in that reward neurons fire when people receive money. By assumption then price should be a punishment, the thing that takes our reward experience away. Thus whatever we purchase must bring with it a greater sense of reward than the sense of loss from the money spent. In the case of energy efficiency, price is proving an ineffective punishment, and we are spending more than we need for an equal output. Biologically there may be a very rational cause for this.

Once one consumption-reward relationship is learned it takes time to associate equal reward from new experiences (Schultz, 2005). It takes even longer to dissociate the reward from one object and transfer it to another. First one must unlearn an association they have

already made and used for a period of time, and then learn a new one. In the case of energy efficiency, we must learn that when we shop for a car, it is no longer the up-front cost that we must consider financially, but the miles per gallon of various vehicles. This may transpire as a slow rate of behavioural change. Our preferences do not change instantaneously with the change that comes in circumstances, e.g. the change in relative price; there is a process of learning.

c. Uncertainty

Hyperbolic discounting, a tendency for people to prefer rewards closer in time, even if they are smaller than a reward in the future, is frequently cited as a cause for seemingly irrational economic behaviour. It is true that people show inconsistent valuations of reward across time and at odds with the preferences of their future self (Frederick, Loewenstein & O'Donoghue, 2002). Jaffe and Stavins (1994) attribute the primary causes for high discount rates for investments in energy efficiency technologies to uncertainty, overcoming inertia, and a natural diffusion rate of new technologies.

In the case of energy efficiency it may be that high implicit discount rates are in fact a rational response to risk. With investments in new products, there is an inherent uncertainty about the payback; there is an irreversible nature associated with most of the energy efficiency products (e.g. large expensive appliances), and expectations of future technological advance bring with them benefits of holding out. If people delay now on an investment they may benefit from Option Value, that is they retain the option to invest or not and see how the market develops. They may also learn vicariously – with time one gains practical knowledge of energy saving technologies, and may learn of their value and suitability from observing others' experiences.

There are transaction costs associated with the acquisition and application of information, and because the future is always to some degree uncertain, risk poses a further cost on investments in energy efficiency.

Uncertainty will often enhance the role social norms play in decision making (Schultz, 2007). When people are unsure or confused, in this case brought about by the introduction of new technologies, or by conflicting information, they will look around themselves, to those nearest, for evidence on how to act. If the majority of people are doing this, 'no change' will prevail. Apart from appealing to others for confirmation on the best course of action, people themselves tend to stay with what they know when they are uncertain of a decision. This has been observed most prominently in voting behaviour. It may have links also to the endowment effect; we assume that what we have or the way we do things ourselves is the superior, irrespective of evidence to the contrary.

Uncertainty, brought about by a lack of perfect information may also lead to a greater reliance on heuristics, as problem-solving tools. While people are unaware of the potential savings to be made, they may rely on sub-optimal methods to estimate the cost versus benefit of investing in efficiency. One example is the tendency people have to assume that high cost carbon mitigation strategies represent the cost of any attempt to reduce fossil fuel use. Certainly clean energy generation, or carbon capture, are high-cost mitigation strategies; however, improving efficiency brings with it a saving.

Thus the uncertainty in moving to a new way of doing things, or using new equipment, and the up-front cost associated with it, leads to a multitude of behaviours. They are rational as tools to cope with risk, but irrational from an analytic perspective that assumes perfect (or better) information, and assumes that choices will move one for one with relative price.

Information has been given a lot of attention in terms of policy and private initiatives. However, uncertainty among the public has persisted in terms of the nature of climate change, the scope of its threat, and the extent of their agency in countering its effects. Climate change sceptics have voiced their distrust in the science for years. Though it appears most people accept climate change is a reality, the intricacies of it are unknown, i.e. what is the scale of the threat?, over what time period?, will I be affected?, will people during my lifetime be affected?, how much of it is down to human activity?, if we reduce our emissions will it happen eventually anyway?, what is my exact impact?, what is the best

way of going about my day-to-day activities?, is there a better way to design society?, can we evolve our cultures enough?, if so, do we know what we wish to evolve to?

Communication strategies have not been tailored to fit to the psychological barriers which are currently impeding uptake of energy efficiency. Information content that engages the consumer with energy efficiency and climate change matters, on a level that appeals to them and at a crucial time, is lacking. It is difficult to provide information that will break through the bulk of advertising appeals that the consumer is exposed to on an average day. Attention capture, and then relaying a message that will appeal to the individual in their transactions, is an art explored in marketing.

Other behavioural measures to broaden the scope of the appeal, and complement information, are also absent. Uncertainty is a strong psychological factor, undermining consumer economic rationale in energy consumption, and their ability to engage with climate change. We will now address the width of psychological and social factors dictating consumer decision-making and energy considerations, and the scope to inverse those influences.

5. Potential for Behavioural Change

There is some literature around the potential for mechanisms other than price to initiate behavioural change. The entire marketing industry is based upon the premise that factors other than price affect demand. Though little of the focus has been directly applied to energy consumption, the fundamental lessons may be transferable.

One study, giving a clear demonstration of the impact of psychological cues on preferences was performed between a bank in South Africa, and a group of academic psychologists (Bertrand, Karlan, Mullainathan, Shafir & Zinamn, 2009). They offered various loan packages, sending out pamphlets with the relevant details to potential clients. Along with varying interest rates there was a variety of psychological cues incorporated, (race/gender of the individual pictured on the front of the pamphlet, a deadline to loan availability, suggested loan use, promotional give away). As a control some pamphlets contained no psychological cue. They found that, as would be expected, a lower interest rate resulted in greater up-take of the loan, but also that the presence of a psychological cue was equivalent

to between 1 to 2 percentage points change in the monthly interest rate. If behavioural nudges such as this one have such a prominent impact on purely monetary decisions, could they also bear a similar impact upon decision-making, both economic and with an inherent social goal?

a. Awareness/Information

Information around climate change is, in fact, in abundance. A lack of information is unlikely to be the crux of the problem. Tailoring the information we have about climate change and energy efficiency into something that appeals to people in their day-to-day transactions is the challenge.

To combat the uncertainty at the crux of the energy efficiency gap, generating awareness of energy use and relative costs is imperative. This has been approached through the use of smart metres, labels, certificates for buildings, energy auditing services and information campaigns. Thus far, consumers are unaware of the intricacies of their energy consumption and its environmental impact. People seem to use simple heuristics in associating energy use with their activities, e.g. they think that larger appliances use more energy and grossly underestimate the energy required to heat water (Schuitema & Steg, 2005b). The nature of our consumption is merely dictated by habits. Added to this is a lack of transparency of the cost of running energy-requiring technologies, an uncertainty of future energy costs, and the absence of a reference point – how much energy should I be using to fulfil my requirements? This can lead to sub-optimal decisions, even for rational economic price seekers.

i) Smart Meters

Smart meters are a useful means of providing transparency of energy use across activities. Feedback is intended to facilitate a change from routinized habitual behaviour into a conscious thought-out decision-making process, eventually leading to the development of new habits, e.g. using only light switches that are necessary. Direct feedback on energy use is most effective when it is given frequently, over a long time period, provides an appliance-

specific breakdown, is presented in a clear and appealing manner and uses computerised and interactive tools (Darby, 2006). The benefits in energy savings have been reported to range between 5-15%. The meter should contribute to making people aware of the inherent energy use associated with their activities, and also give them clarity on how their bill is made up.

Indirect feedback, processed information in the form of an energy bill is more effective in promoting consideration of larger effects, e.g. seasonal impacts on bills, changes in space heating, impact of different people occupying a building, investment in large scale efficiency measures (Darby, 2006).

In April 2009 the European Parliament agreed that by 2020 at least 80% of electricity customers should have a smart meter. Smart meter rollout has been announced in Sweden, the Netherlands, Ireland, Norway, Italy, France, Spain, the UK and Finland. In Italy they have already been dispersed.

The advantages of regulated rollouts include a fast dispersion of meters, people share the same technology, they are geographically concentrated, and the changes they facilitate are brought about more quickly. The disadvantage in forcing dispersion is that one single technology prevails and there is no room for further innovation. In the short term this may be ok, but stagnating innovation will slow progress in the future and what we choose today may not be the most suitable for the technologies it applies to tomorrow. Added to this it is very difficult to disaggregate the impacts of meters entirely from other incentives in energy-changing behaviours at any one time, even in small scale studies. The most suitable or adaptive technology, therefore, is very difficult to ascertain.

The greatest merit of applying smart meters in terms of energy conservation may be as a mechanism to bring energy into people's scope of consideration. It will not inform them which are better technologies, or what improvements they could make, but bring about an awareness of energy use and cost and potentially, may eventually facilitate future acceptance of energy-related regulatory measures. Experience with smart meter technology is very young; more understanding of its applicability and utility will come to the fore with greater maturity of this technology.

ii) Labels

Labels may function as a means of informing a consumer of certain criteria at the time of purchase. However, information is most often made available to consumers when it serves a private interest. That is, companies advertise their products on the basis of whatever will generate a market demand. This does not provide the public with the objective and comparable information they require when trying to make an investment. Climate change information is a 'public good' and must be overseen by a credible third party. This not only allows the consumer comparability and awareness of long term costs across products, but also confidence that the information they are reading is the result of standardised measurement procedures and tests that have taken place industry-wide.

Labels may be voluntary or enforced as part of government regulation. Regulators may target increasing efficiency or other environmental causes, or they may pursue a labelling campaign as a precursor to more stringent regulation standards or taxation. Politically imposing labelling requirements is an arduous process. Interest groups acting on behalf of private market players take a hard line against this imposition upon their activities. Though voluntary schemes are easier and thus faster to initiate, they are slow to break through to public awareness, their efficacy in creating comparability suffers as all players do not have to participate, and they may impose a cost on the few who do participate, thus putting them in a less competitive position. Some voluntary schemes have failed for the above reasons, while others have prospered and grown, e.g. the Energy Star (ES) label. ES is a status label, indicating which consumer electronics, home appliances and commercial and residential buildings are in the top 25% of the market on efficiency performance.

Figure IV: Energy Star Logo



Rating labels are more popular in regulatory design. Those imposed upon white goods in the EU grade efficiency from A to G and have been replicated across Brazil, Tunisia, China and Iran. The Australian method of using stars to rank goods has been deemed successful, and taken up in Thailand and Korea (WEC, 2008)

Figure V: EU and Australian efficiency rating labels

Energy		Washing machine
Manufacturer		
Model		
More efficient		
A		B
B		
C		
D		
E		
F		
G		
Less efficient		
Energy consumption kWh/cycle <small>(based on standard test results for 60°C cotton cycle) Actual energy consumption will depend on how the appliance is used</small>		1.75
Washing performance <small>A: higher G: lower</small>	A B C D E F G	
Spin drying performance <small>A: higher G: lower Spin speed (rpm)</small>	A B C D E F G	1400
Capacity (cotton) kg		5.0
Water consumption		5.5
Noise (dB(A) re 1 pW)	Washing	5.2
	Spinning	7.8
<small>Further information contained in product brochure</small>		

Europe



Australia

The European programme led to a rapid increase in the market share of the most efficient appliances; in the decade after 1995 (when labels were first applied to refrigerators), sales of the highest ranking efficiency models sold in the EU rose more than tenfold, from 5% to 61%. Results have followed a similar pattern across other appliances. In many cases, the combined response of consumers and producers (introducing more efficient models) was complemented by accompanying rebate and information programmes, designed to secure an overall ‘market transformation’.

However, there are many question marks remaining over the nature of labels and just how effective they could be with various designs. Labelling different criteria will confuse consumers. Too much variety in label designs across different goods will limit the potential

of any one to penetrate the market and impact upon decision making. Labels are a tremendous tool, in that they could display the relevant information we want consumers to consider at the time of their decision. But what exactly is it that we want consumers to consider? With regard to mandatory labelling schemes, there is a social goal in mind, omitted when left to free-market mechanisms. If it is a reduction in energy use per unit that regulators aim to achieve, then efficiency is the correct criteria to label. If it is the carbon emissions associated with a certain good, it is necessary to consider the emissions equated across the life cycle – those embodied and those from use. This has been the design for the voluntary Carbon Footprint label on goods and services. Accurate calculation of all emissions from a product life cycle may be very complicated in some instances; however this is the most accurate way of addressing the climate impact, or the emissions inherent with the purchase of any goods or services.

Figure VI: Carbon Footprint Indicating Life Cycle Emissions



Labelling efficiency or product life cycle still leaves open how people use these goods. A thermostat installed under a window, which regulates the heating or cooling system, even with efficient heating and ventilation technologies will render it an inefficient system. People must still be clever about how they apply their energy stock. Regulation cannot enforce change here. This requires a change in culture, in which consumers engage with their energy use and incorporate energy conservation into their value systems. Smart

meters may play a role here, creating awareness at the time of use as will information campaigns informing people of the simple changes they can make.

Not only is the design of a label a vital consideration, but also the accompanying media coverage. The example of the Recover and Reinvestment Act and the Consumer Assistance to Recycle and Save (CARS) Act of 2009 (more popularly known as 'Cash for Clunkers') in the US offers a good example of the role of behavioural applications in policy success. CARS, for which \$3 billion was provided to incentivise people to trade in old cars for new fuel-efficient ones was deemed a massive success. This may be accredited to the accompanying marketing campaign funded by the industry and the convenience to the shopper offering them an instant rebate with no paperwork (Dietz, Gardner, Gilligan, Stern, Vandenberg, 2009). The Recover and Reinvestment Act provided \$5 billion for low income home weatherization, \$4.3 billion for tax credits for home energy efficiency improvements and \$300 million for rebates for purchases of Energy Star appliances with some more funds allocated at a local level for energy efficiency undertakings. The performance of this tax incentive did not meet the same success. It was poorly marketed, leaving much of the public unaware, and it was not easy for consumers to partake in. There was paperwork involved and a year's delay in receiving the credits (Dietz, Gardner, Gilligan, Stern, Vandenberg, 2009). The ease and time scale of the incentive and awareness seemed to create the discrepancy between the degrees of penetration of these two policies into the market.

There is a vast marketing literature outlining what it is that draws people's attention to certain goods and what makes them more likely to purchase one item over another. Environmental considerations seem to have broken into fashion somewhat, or, on a broader scale, moral weight attached to goods has gained more consumer attention in recent years. In 2007 in the UK £459 million was spent on Fair Trade goods and £89 million on ethical clothing (Co-Operative Bank, 2008). These are generally more expensive than their substitute products, but to their advantage they carry a moral weight. Green home expenditure in the same year came to £6.7 billion, including investment in efficient appliances, green mortgage payments, small renewables, and green energy purchases (Co-Operative Bank, 2008).

In terms of labels promoting reduction in carbon emissions, a label quoting a carbon number, indicating the embedded emissions in a good or service, has received some criticisms. Such a number does not mean anything to the standard consumer who has no reference point to compare what a low carbon or high carbon content might be, or how much carbon would be standard for them to omit during a day's activities (Quack, 2010). However, if such labels were widespread across goods and services they would offer the greatest potential for coherence in information, they would allow simple comparisons between products based on environmental impact, and over time consumers would learn an understanding of their carbon number, such as they may understand their daily caloric intake.

The current muddle of labels is sure to reduce the efficacy of any single label. One message promoting action on climate change would have greater weight behind it than a multitude of messages, sharing a goal but divided in their path.

Awareness is the first barrier. Valuing energy efficiency for environmental or economic circumstances does not automatically translate into correlated action. We are aware that people do place a high valuation on the environment (Abrahamse, 2007, Schultz & Zelenzy, 1999). However, their actions are not in line with this value structure. As the coverage of climate change has increased so too has total household energy consumption. Once there is awareness social and cultural trends may nevertheless tie people into sub-optimal behaviours.

b. Norms

'Norms' refers to behaviours that we engage in because we perceive others doing so. We are social animals motivated to follow the masses, to be part of the in-group. The individual relies on the majority to inform their behaviours. Until there is a mass movement in a new direction habits and interdependency may anchor people to the current status quo. Norms describe mass movements in fashion, cultural tastes in music and other arts, and habitual behaviours. They have previously been highlighted as the most solid basis for environmentalism (Lindenberg & Steg, 2007).

An interesting demonstration of the impact of norms upon pro-environmental behaviour can be seen in the work of a team of psychologists who paired up with a hotel in Arizona. Goldstein, Cialdini & Griskevicius (2008) crafted three unique appeals to hotel customers to re-use their towels. The first urged that they 'do it for the environment', the second 'partner with the hotel to save the environment', and the third 'join your fellow guests in helping to save the environment'. There was a control group who received no encouragement. Providing the encouraging message increased towel re-use across all three trials; however the final card, appealing to a norm, i.e. do what other people are doing and re-use a towel, increased towel recycling by an extra 34% compared to the first two (Goldstein, Cialdini & Griskevicius (2008).

The power of norms accompanied by enhanced awareness has also been shown using feedback on energy use and social comparison mechanisms. OPOWER, an energy efficiency and smart grid software company partnered with utilities in Northern and Southern California. They provided energy customers with a personalised letter of recommendation detailing how they could reduce their energy bill if they took some key steps. This was followed with a second letter, comparing residents on their efficiency relative to their nearest neighbours. The second letter was accompanied with either a smiley face or a frowning face depending on whether their relative efficiency was good or bad respectively. This second letter comparing households led to an average 2% reduction in household energy use over the course of a year (Schultz, Cialdini, Goldstein, Griskevicius, 2007).

In a follow-on study, the message of praise in the form of a smiley face sent to those who were performing well relatively was eliminated. It appeared that those who were performing above average reduced their efficiency score and moved closer in line with the bulk of their neighbours, termed 'the boomerang effect'. This second, more focused appeal further increased the average energy savings to 4% per household (Schultz, Cialdini, Goldstein, Griskevicius, 2007).

The information from feedback alone, the first letter, was not enough to motivate people to actually make a decision and move on it; however when there was another psychological cue with the motivation to join the majority of others the response rate rose drastically and the initial advice provided proved useful.

Norms serve a further information purpose in providing people with a reference point. An indication of how they could be performing. It takes away some of the uncertainty around the potential to engage with climate change. However, while the majority of consumers are not taking large steps in the way of efficiency, norms are currently influencing people not to invest.

Policy designed to craft norms to promote environmentalism could play a strong hand in reshaping the market. Aside from creating awareness and moulding norms there are yet some other psychological considerations to take account of. Some of the uncertainties may fall out of this range: what do I change first?, would it be better to wait for the next turn-over in technology before investing?, which equipment is most suitable for my circumstances?, when will an investment start paying back?, will that investment be out of date before I accrue any benefits?, if I move or other life circumstances change, will I be able to recoup any of the value of that investment?

c. Turning Intention to Action

While people do report an interest in green behaviour, conservation actually falls quite low in their priorities (Steg, 2008). Status, comfort and effort are other factors dictating energy consumption (Stern, 2000), and the costs of conservation in terms of effort or convenience may be outweighing green aspirations.

People are inherently poor at estimating the time and effort it will require to carry out a task in the future. We procrastinate and assume that things we wish to do will come easier tomorrow, e.g. 'This weekend I am busy but next weekend I will have lots of time and energy to organize house renovations'. We employ various strategies in our day-to-day lives to force self-commitments. In an attempt to force a healthier lifestyle upon themselves, people are very enthusiastic to pay large up-front gym membership fees. Such behaviours have been recognised by marketers and maximised upon. In this case, the gym advertisements

frequently echo messages of lifestyle changes. Offering a yearly membership, the gym earns more than if it were relying on people to maintain consistent enthusiasm to exercise on a pay-as-you-go scheme.

Testing the strength of the role commitment devices may play in economic circumstances, some psychologists joined with a bank in South Africa. They offered those opening a bank account a savings account in conjunction. This second account would have the same interest rate but lock their money in for a period of time. 28% opted for the savings account and on average their savings rate increased by 82% (Ashraf, Karlan, Yin, 2006). In terms of energy efficiency, committing people to action could contribute to the rate of up-take but the design of such a strategy in this context is not obvious. Policy cannot enforce investment decisions but energy efficiency packages could be offered. A package that offers an energy audit and the end service would remove all the hassle from the consumer and have a commitment to carry the plan through from their initial action. However, the profitability of such a service is questionable. As yet the momentum behind demand for energy efficiency services is lagging and the high up-front cost with long term payback for consumers make it a high risk venture as part of a private initiative.

Another method of motivating action where people already value the change is to make it part of a default plan. Our behaviour is frequently driven by defaults specifically where we do not have a clear vision of our favoured course of action. The influence of default has been shown in terms of pension scheme participation, increasing up-take by between 65% to 98% (Madrian and Shea, 2001). It has also been linked with obesity as a poor diet is often linked to the choice of simple and quick meals. In fact successful interventions increasing healthy behaviour have worked by making healthier choices the default option, e.g. in newer vehicles there is an annoying noise if one does not put their belt on (Adler & Stewart, 2009).

Manipulating implementation intentions is another simple method for nudging people into carrying through their green aspirations. During the last US election campaigners who asked people not only which way they might vote but also how they would get to the voting office, if they would do it in the morning or the afternoon, etc. Forcing people to plan out

their actions and rationalize the realities of carrying out this task they found they increased voter turnout by 4.1% (Nickerson & Rogers, 2010). Testing environmental aspirations among a participant group of students it was found that with the addition of a small financial incentive execution of intentions was only 30%, but when the financial incentive was replaced with a cue forcing them to plan where and when to start with their desired action execution raised to 50% (Bamberg, 2002).

These kinds of psychological interventions, nudging behaviours towards a valued goal may be extremely cost-effective. In many reports behavioural interventions have been cited as the most cost effective manner of addressing climate change. Given the uncertain nature of psychological factors, the research that goes into drafting potential strategies and the difficulties with scalability, this may be overstated. However, in the short term, behavioural change is imperative to address rising energy demand and the scarcity of cost-effective clean energy options. In the OPOWER study described above, the cost of intervention turned out to be a mere 3.3 cents per kWh saved. Commitment devices and implementation schemes have a negligible cost. Ascertaining the efficacy of these on a larger scale may require some more trials.

Nevertheless, if it is a psychological cue that is the missing part of the puzzle, addressing the prevailing uncertainty currently influencing consumer preference, it is a worthy pursuit in terms of research time and investment.

6. From Efficiency to Environmentalism

a. Environmental Values

The behavioural mechanisms outlined function to nudge behaviour towards more economical means of consuming energy. However, in reality, gains in energy efficiency are only part of the bridge to a low carbon economy. As shown in Figure I and described by the re-bounce theory, growing consumer wealth is driving up overall energy use. Beyond price, could environmentalism trigger behavioural change?

The underlying message from the bulk of behavioural research seems to be that existence of environmental concern and an interest in engaging with pro-environmental activities is very robust, but in the absence of psychological nudges action will not come about.

That is not to say that consumer choice has not evolved at all in line with environmental concerns. The Carbon Trust recently found in a survey of the British public, that 86% of consumers want their favourite brands to reduce their carbon footprint and 43% actively seek out information about the carbon impact of their purchases. The popularity of voluntary action among commercial players highlights the marketability of environmentalism and thus a demand for related activities; since 2000 there has been a tenfold increase in the number of Energy Star products purchased annually on the US market (energystar.gov, 2010), large consumer facing retailers in the UK, such as Asda, Boots, Tesco and Sainsbury's, have committed to reducing the carbon content of their packaging by 10% by 2012 (Waste and Resource Action Plan, 2010). BT have been purchasing 99% of their electricity from green tariffs in an attempt to cut their emissions (the efficacy of this in cutting emissions has created controversy; however the point stands that there is a value to appearing to going green).

Making room for the consumer going forward would involve harbouring their environmental value and translating it into direct action.

b. Putting Motion Behind Values

Drawing consumer attention typically involves attaching some notion of glamour or status or other emotional appeal to a product. Before an environmental norm in consumption patterns could be hoped for preferences need that first nudge. Consumers don't seem to understand or engage with the merits of efficiency – that they could in fact do more with less and the idea of reducing the carbon embedded in our consumption brings with it notions of conservation. Aside from the political realism of pursuing consumer constraints, it is very unlikely to appeal to many consumers despite reported environmental concerns. It is for

these reasons that policy makers have assumed that a consumer role is not a worthy pursuit in terms of carbon abatement.

Accepting the critical role consumer preferences play in reaching abatement targets, the potential for behavioural nudges where prices alone are not functioning and with a view of the avenues through which consumers are pushing emissions, the first step in getting consumers and thus voters support for an abatement strategy will be their willingness to engage with climate change.

As something from which consumers are detached in time and place and the complexity inherent in the subject, it is very easy to understand that, despite their value structures, they fail to address environmental consequences.

Currently climate change is relayed to the public as a threat. Research into the efficacy of social appeals and negative advertising (advertisements intended to discourage a behaviour) have shown that threatening people encourages rejection of the message. When people are frightened and threatened their defence mechanisms take control and they fail to engage with the threat, assuming that though it is possible it would never happen to them. Shocking people in order to draw their attention and the addition of a recommended strategy on how one might change their behaviour are tools which significantly increase the efficacy of negative advertisements.

Considering the perspective of the consumer alone, climate change is a very uncertain science. We do not know how it might affect people today and more importantly tomorrow. We do not know for certain what the best strategy to combat the potential threat might be. We have an idea that there is a threat knocking on our doorstep, that our activities are feeding this threat, and that we can change things in order to decrease the potential impact.

Framing climate change as a threat and expecting consumers to engage with it, though it is invisible to them and there are no definite simple answers for how they should behave, seems naive.

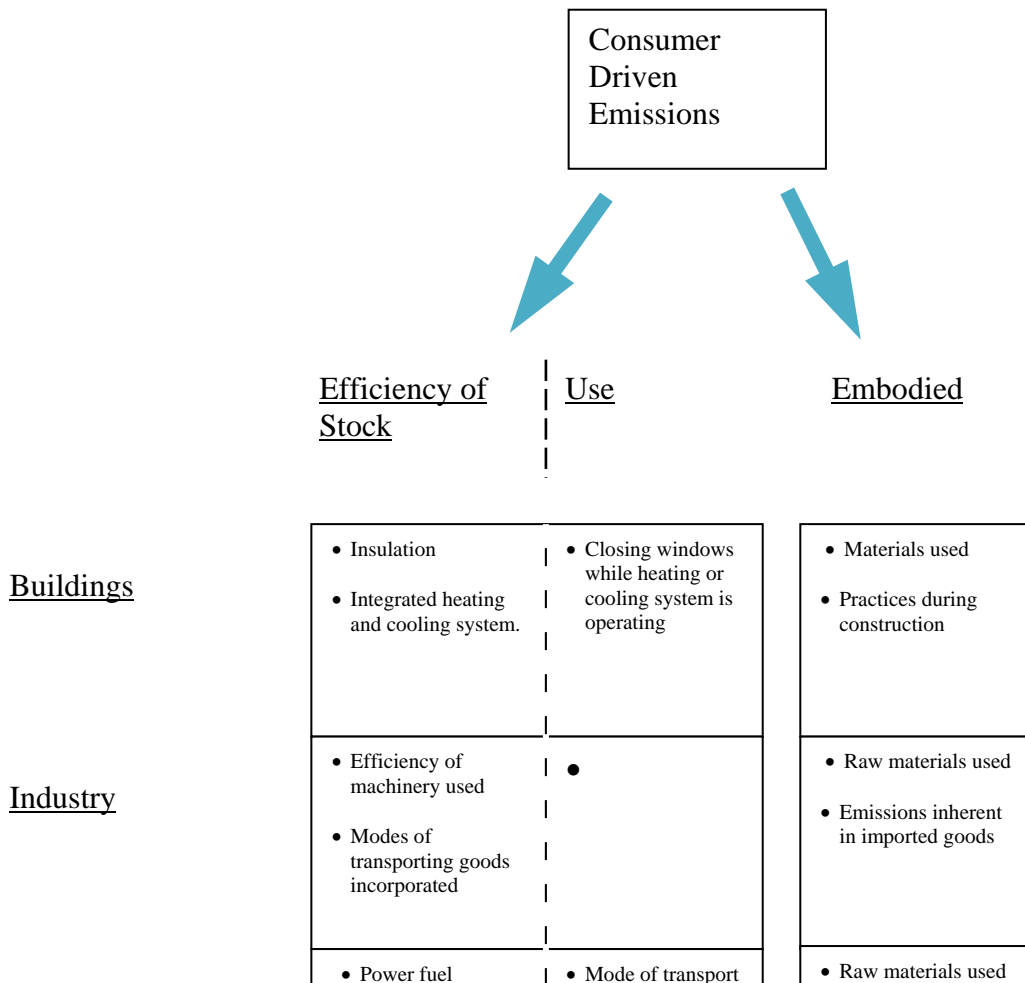
However, before carving out a role for the consumer we must set down what exactly it is that we want from them. How might they most efficiently, effectively and realistically be able to make significant reductions in emissions?

7. What Exactly is it We Want to Change?

Figure VI shows how the consumer role in emissions is spread across three categories of energy consumption; through the efficiency level of the goods and services they consume, their use of such goods and services and the embedded emissions inherent from the production processes.

These three categorisations of the consumers' part are not entirely independent of one another. For example, the emissions from the industrial process make up the embedded emissions of consumer goods and services. However, as a method to understand each agent's impact, this diagram is a means of viewing the link between decision-making processes and emissions.

Figure VI: Consumer Driven Emissions



While efficiency has received most of the regulatory and labelling attention and the use of technologies has received attention from education campaigns, the role of embedded emissions has been almost neglected.

The automotive industry provides a useful example of the significance of considerations of embedded carbon. There are currently about 700 million vehicles in the global fleet, making up between 5 and 6% of the global greenhouse gas emissions. The recent downturn in economies have slowed progression in the automotive industry; however analysts have predicted a turnaround soon and potentially a threefold increase in ownership and miles travelled per annum by 2050. If we are to meet global targets for greenhouse gas reduction, emissions per vehicle sold would have to decline by ~85% by 2035. Average miles per gallon have been increasing in vehicles and a demand for this has been generated with the aid of 'cash for clunker' type policies. However the role of embodied emissions has been ignored. Emissions from the manufacturing process of vehicles make up 20% of the life cycle emissions or 400mtCO₂. As use will become more efficient, especially with the growth of the share of electric cars on the market, the embodied emissions which are in fact greater in electric cars could make up 40% of the life cycle emissions.

Efficiency gains bear with them an economic and environmental incentive. If people were to trust in the technology and in the risk associated with new investments, the economic incentive alone might prevail. However, the embodied emissions bear no economic incentive. Within the EU, the ETS does place a price on carbon released during large industrial processes. This may be viewed as a price incentivising efficiency at the industrial level or a price incentivising lower embedded carbon. Either way, when the price is passed through to the consumer people are unaware that they are paying an extra carbon cost.

Currently all we have to judge and compare the value of products is the price. Take car manufacturing, for example. In the EU, were one car to bear a higher level of embedded carbon the price may be higher due to the role of the ETS. This would be invisible to the consumer, who would likely assume the more expensive car is a better car.

Given the significance of embedded emissions in the overall data, it is vital that they are given equal policy attention. Aside from the current disjoint in local environmental policy, politically it appears to be too arduous and controversial in other regions to impose a Cap and Trade system such as the ETS. Given a high level of imports of goods and materials into the EU (~40% of the carbon embodied in vehicles in traded between regions), it is even unrealistic to rely on the ETS alone to deliver all the abatement requirements to meet current targets.

8. The Footprint

There is no answer for 'how best to live'. Engaging consumers as they make their day-to-day decisions is the only tool realistically available. The footprint label, if popularly adopted, could offer a very clear means of comparing products and services. Information campaigns to market the footprint label would be necessary to enhance its influence while providing an understanding that appeals to individuals in a simple manner and plays upon the power of norms. For example, promoting low carbon goods as a means of addressing climate change and melting polar ice caps is something that few consumers can relate to, and thus it will not be a factor influencing their decisions at the time of purchase. However, promoting low carbon goods as a means of lowering your footprint and joining your community to lower your environmental impact may appeal on a more personal level.

While we cannot remove the uncertainty, we may use it to tip the balance and push normative behaviours towards the most strategic pro-environmental decisions. Uncertainty in the case of climate change and energy consumption is impeding an evolution in demand patterns. However, we are aware that when people are faced with uncertain or unknown threats their willingness to pay for insurance increases. Insurance does not prevent the

threat, but it allows the best possible means of maintaining our lifestyle despite mal-occurrences. Climate change is an uncertainty and an unknown. In order to influence consumers to internalize the damage from emissions we may frame it as just that. In place of using fear, describing it in terms of an uncertain threat for which a low footprint is the best insurance policy we have available could be the invitation to action consumers respond to.

Initiatives to influence how people use their energy stock will rely on a change in habits. The use of psychological cues, such as those cited above – offering tailored information for improvements such as in the OPOWER study, making the efficient means of using technologies the default option, e.g. censored lighting systems, or employing implementation intentions to force people to think through how they carry out tasks – may be pursued to promote change as part of localised action. They are likely to lose their efficacy if pursued at a national level as they would lack the specific considerations of the needs and behaviours of different communities.

We are aware that consumers value environmentalism, that moral judgements do guide some purchasing decisions, and that consumer engagement is an important part of mitigation. The cultural change required to maximise their potential to reduce emissions will require policy initiatives taking the psychological lessons learned in energy studies and across other behavioural research into consideration. Price is not a negligent factor, but coordination with the behavioural realities in policy design may bring consumers back in line with the most economical means of consuming energy and reducing their footprint.

9. Bibliography

1. *Abrahmse, W. (2007). Energy conservation through behavioural change: examining the effectiveness of a tailor-made approach. University of Groningen. PhD.*
2. *Ariely, D., Loewenstein, G, Prelec, D. (2003). "Coherent Arbitrariness": Stable Demand Curves Without Stable Preferences. Quarterly Journal of Economics 118(1): 73-105.*

3. Ashraf, N., D. Karlan, et al. (2006). "Tying Odysseus to the Mast: Evidence from a commitment savings device in the Philippines." *Quarterly Journal of Economics* 121(2): 673-697.
4. Bamberg, S. (2002). "Effects of implementation intentions on the actual performance of new environmentally friendly behaviours - results of two field experiments." *Journal of Environmental Psychology* 27: 265-276.
5. Darby, S. (2006). *The Effectiveness of Feedback on Energy Consumption*. Defra, Oxford University.
6. DECC. (2009). "Energy Consumption in The United Kingdom."
7. Dietz, T., G Gardner, et al. (2009). "Household actions can provide a behavioural wedge to rapidly reduce US carbon emissions." *PNAS* 106: 18452-18456.
8. Finucane, M., Alhakami, A., Slovic, P., & Johnson, S., (2000). The Affect Heuristic in Judgements of Risk and Benefits. *Journal of Behavioural Decision Making* 3(1): 1-7.
9. Foxon, T. (2010). *Complexity Economics*. Complexity Economics for Sustainability, SOAS.
10. Frederick, S., G Loewenstein, et al. (2002). "Time Discounting and Time Preference: A Critical Review." *Journal of Economic Literature* 40: 351-401.
11. Gigerenzer, G (2004). Dread Risk, September 11 and Fatal Traffic Accidents. *Psychological Science* 15(4): 286-287.
12. Gigerenzer, G & Todd, P. (1999). *Simple Heuristics that Make us Smart*. New York: Oxford University Press.
13. Goodall, C. (2007). *How to live a low carbon life*, Earthscan.
14. Hertwich, E. G (2005). "Consumption and the rebound effect: an industrial ecology perspective." *Journal of Industrial Ecology* 9: 85-98.
15. Hertwich, E.G and Peters, G.P. (2009). Carbon Footprint of Nations: A Global Trade Linked Analysis. *Environmental Science and Technology* 43(16): 6414-6420.
16. IEA (2010). CO2 Emissions from Fuel Combustion database, ESDS International, University of Manchester.
17. Jaffe, A. and Stavins, R. (1994). "The energy efficiency gap, what does it mean?" *Energy Policy* 22 (10).
18. Lindenberg, S. and L. Steg (2007). "Normative gain and hedonic goal-frames guiding environmental behaviour." *Journal of Social Issues* 63(1): 117-137.
19. McKinsey and Company (2008). "How Should the World Invest in Energy Efficiency."
20. Quack, D. (2010). *Requirements on Consumer Information about Product Carbon Footprint*. ANEC, Oko Institute.
21. Schuiteman, G and L. Steg (2005b). "Perception of Energy Use of Domestic Appliances." *Developments in Marketing Research. Yearbook 2005* (165-180).
22. Schultz, P., J. Nolan, et al. (2007). "The constructive, destructive and reconstructive power of social norms." *Psych Science* 18: 429-434.

23. Schultz, P. W. and L. Zelezny (1999). "Values as predictors of environmental attitudes: evidence for consistency across 14 countries. ." *Journal of Environmental Psychology* 19(3): 255-265.
24. Schultz, W. (2005). "Behavioural Theories and The Neurophysiology of Reward." *Annual Review of Psychology* 57: 87-115.
25. UK Energy Research Centre (EKERC), (2007). "The Rebound Effect: an assessment of the evidence for economy-wide energy savings from improved energy efficiency." Sorrell, S. Retrieved from <http://www.ukerc.ac.uk/Downloads/PDF/07/0710ReboundEffect/0710ReboundEffectReport.pdf>Steg, L. (2008). "Promoting Household Energy Conservation." *Energy Policy* 36: 4449-4453.
26. Stern, P. C. (2000). "Toward a coherent theory of environmentally significant behaviour." *Journal of Social Issues* 56(3): 407-424.