Under the influence

The role of the Energy Conservation Influence Factors and the use of online social networking in household electricity conservation outcomes in Latin America and the Caribbean

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Abstract

This article describes the behavioural factors that are thought to affect the outcomes of energy efficiency efforts targeted at the household sector and briefly discusses their role and the value of online social networking in the development of effective household energy efficiency programmes, with comments on a Latin American and Caribbean context.

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> “*It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth.*”

William Stanley Jevons, 1865

1. Defining Energy Efficiency

The basic definition of energy efficiency is: using less energy to provide the same level of energy service. The term "energy service" needs elaboration.

An energy service is any service that requires an external provision of energy – cooking food and cooling drink; lighting to allow reading at night; a warm shower on a chilly morning; these are some examples of energy services that are commonly procured on a daily basis, all over the world.

The importance of this term in the definition is critical. It is now the received wisdom that what is required by human beings is not energy in itself, but the service that can be provided by the energy. For example: I live in the Caribbean, so I need year-round refrigeration (which uses electricity) to keep my beer cold. My brother-in law, who lives in upstate New York, can keep his beer cold for a good part of the year simply by putting it outside. For the same result, I must purchase energy, while my brother-in-law needs not. On the other hand, he needs to buy energy to keep warm for much of the year, while I don't have that problem.

That this distinction now seems obvious is largely due to the contribution of Amory Lovins, an American scientist who was one of the earliest advocates of energy efficiency as a solution to the so-called 'energy problem'. The Economist describes how Lovins redefined the energy problem in the 1970s: *The main problem with the approach to energy… was that the issue was defined as a supply shortage. "The question they asked was how to get more energy, at any price, instead of asking: 'How should we use energy, why are we using it so wastefully, and what do people really use energy for?'" he says. That question points to one of his main contributions to the energy debate. He insists that the goal of public policy should be to ensure adequate and affordable supplies not of energy per se but of "energy services"—as he loves to put it, the cold beer and hot showers made possible by energy. By redefining the problem that way, rather than merely subsidising more power plants or oil drilling, public policy can be made technology neutral, and consumer needs can be satisfied by demand-side measures if they prove cheaper than drilling or digging for new supply."*
Thus, the description is complete; energy services can be provided by efficiency – and this elevates energy efficiency to the status of an actual source of supply. Lovins

summed up this insight by introducing the term *NegaWatt* in 1989, to describe a MegaWatt of energy service potential provided by efficiency or conservation[1].

2. Mr. Jevons Returns

More recent contributions to the discussion have reiterated this theme. A 2008 report by the Inter-American Development Bank's Sustainable Energy and Climate Change Initiative notes that "*few people are aware of a clean source of energy that could solve a large part of the problem for a fraction of the cost of building new power plants or drilling new oil wells. That source is energy efficiency and conservation. New research by the Inter-American Development Bank indicates that Latin America and the Caribbean as a whole could reduce energy consumption by 10% over the next decade by investing in widely available technology and equipment.*"

The report concludes that the cost of extending Latin America and the Caribbean's energy supply to 2018, by way of energy efficiency, would be less than one-third the cost of building new generating plant. In short, it is suggested that energy efficiency is the quickest, cheapest and cleanest way to extend the region's energy supplies.

But a complication exists, which is that improvements in the technical energy efficiency of devices (lighting, appliances, automobiles, etc.) often result in little or no decrease in overall energy consumption. In some cases an overall *increase* in consumption may result. For example, households that replace incandescent bulbs with high-efficiency CFL bulbs may leave more lights on longer, thereby reducing the benefit of the increased efficiency inherent in each new bulb.

The first observation and explanation of this problem goes back a century and a half, to the work of British economist William Stanley Jevons. In his book *The Coal Question*, published in 1865, Jevons pointed out how James Watt's steam engine, by improving on the previous design, provided much better fuel efficiency – thereby causing England's consumption of coal to soar. Jevons proposed that "*it is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a*

[1] It is reported that while reading a Colorado Public Utilities Commission report, Lovins came across the serendipitous typographical error – megawatt spelt with an 'n' – and was immediately inspired by the conceptual potential of the mis-spelt word.

diminished consumption. The very contrary is the truth". His observation came to be known as the Jevons Paradox.

The Jevons Paradox is explained by the rebound effect; an economic theory which says that if the cost of a resource is reduced due to increased efficiency, people will consume more of the resource (or the services dependent on the resource) than previously, thereby offsetting (partially or entirely) the effect of the efficiency improvement.

The rebound effect is generally expressed as a ratio of the 'lost' benefit (reduction in consumption) due to an increase in technical energy efficiency, compared to the expected benefit of the increase.

For example, if you buy a new car that is 10% more fuel efficient than your old one, but you only observe a 6% drop in your fuel use – there is a 'lost' 4% and the rebound effect is 4/10 = 40%. According to the theory, the efficiency benefit would have been lost, or taken back, by a change in your driving behaviour – now that you have a shiny, new, fuel-efficient car, you may be driving more often, further or faster than before.

In some cases the rebound effect is greater than 100%, which gives rise to the situation described by the Jevons Paradox – where improved energy efficiency results in increased overall energy use.

Today, there appears to be little controversy in research circles over the existence of the rebound effect, but its size and impact is debated. The UK Energy Research Centre (2007), in a peer-reviewed study that examined over 500 studies and reports from around the world, concludes that the rebound effect is a significant factor in energy consumption outcomes, noting that *"The evidence does not suggest that improvements in energy efficiency routinely lead to economy-wide increases in energy consumption, as some commentators have suggested. At the same time the evidence does not suggest that economy-wide rebound effects are small (e.g. <10%) as many analysts and policy-makers assume. Rebound effects therefore need to be taken seriously in policy appraisal."*

The rebound effect has been hardly studied in the developing world, but one conclusion that has been tentatively drawn is that it is likely to be larger in developing countries, where there tend to be higher energy costs and larger levels of unmet demand for energy services. This likelihood is suggested by the UKERC study and by Herring (2008).

A 2009 study of the situation in the United Kingdom by Barker, Dagoumas and Rubin advises that the rebound effect is problematic for energy, economic and climate change policymakers. Their paper concludes that "*the total rebound effect arising from the IEA WEO 2006 (IEA 2006) energy-efficiency policies for final energy users over the post-2012 period 2013–2030 is around 50% by 2030, averaged across sectors of the economy. Given the large magnitude of our estimated long-term rebound effects, a priority for future research should focus on the effectiveness of complementary policies such as broad-based energy taxes, educational and other behavioural changes that 'lock-in' first-order efficiency gains*."

In other words, half of the benefit of technical energy efficiency increases will be lost by 2030, due to the behaviour of consumers and it is recommended that researchers and policymakers should focus on this aspect of the issue and consider policies that will offset the rebound effect.

The problem here is that: though researchers may have concluded that the rebound effect is of importance to energy efficiency outcomes, policymakers generally have not. The UKERC report concludes that "*In general, rebound effects have been neglected when assessing the potential impact of energy efficiency policies"* and further advises that *"rebound effects are of sufficient importance to merit explicit treatment. Failure to take account of rebound effects could contribute to shortfalls in the achievement of energy and climate policy goals*."

A noteworthy criticism leveled in this regard is that the rebound effect is ignored[2] in the authoritative *Stern Review on the Economics of Climate Change* (2006). This critique has been addressed by Stern et al, but not particularly strongly in this specific case.

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[2] Keyword searches were made by this author in the entire narrative of the Stern Review for the terms "rebound", "jevons", "jevons paradox" and "rebound effect" – and none of these terms was found.

Interestingly, one of the primary skeptics regarding the importance of the rebound effect is Lovins himself, who appears not to have considered it in his early thinking on the energy problem.[3]

3. Behaviour: the Energy Conservation Influence Factors

The literature directly speaks to the importance of consumer behaviour, which drives the rebound effect, on energy efficiency outcomes.

Shippee (1980) advises that "*Little emphasis has been placed on behavioural approaches to energy conservation, yet many researchers, in both the physical and the social sciences, have suggested that neglecting the energy consumer is tantamount to ignoring a potentially enormous source of energy savings*." He goes on to note that "*Ross and Williams (1976) believe that behavioural changes could result in conservation of up to 50 percent of resources consumed in the residential sector*." And he opines that various studies suggest that "*the success of technological innovations designed to enhance energy conservation depends to a great extent on the consumer's behavioural responses*".

The question at hand therefore is: what are the specific behavioural factors that will *encourage* energy conservation outcomes? My review of the literature suggests that there are four basic, inter-related and interacting factors at work, which I collectively refer to as the energy conservation influence factors (ECIFs). They are:

1) The availability of information (**Information**)
2) The provision of feedback (**Feedback**)
3) The ability to set significant goals (**Goal-setting**)
4) The availability of opportunities for peer comparison (**Social Proof**[4])

[3] This has resulted in some pointed, though apparently not widespread, criticism of Lovins' work in recent times.
[4] A terminology used by psychologist Dr Robert B. Cialdini.

Information

Information promotes knowledge and is a basic requirement for effective action of any sort. For example, it is essential for someone attempting to lose weight to know that a reduction in their net daily intake of calories is the key, and that such a reduction is best effected by a combination of eating smaller portions of the right foods and engaging in regular physical activity.

Similarly, householders wishing to slim down their energy bills need to know what amounts of energy they are using at the moment, how they are using it and what actions they can take to use less. And in fact, they do have some basic information in this regard. Monthly electricity bills provide information on consumption and cost;[5] many bills have standard energy saving 'tips' printed somewhere on them and most consumers already have some idea as to how to reduce their consumption – turn off unneeded lights; turn off the TV before going to bed, rather than falling asleep in front of it, and so on.

However, as Darby (2006) puts it: "*Information on its own has a poor track record in achieving energy conservation. While people may appreciate the message, few are likely to be spurred into action*".

Consider again for a moment the question of weight loss mentioned above. The causes of non-pathological weight gain are well known; so is information on the necessary offsetting actions. But, according to the World Health Organization, obesity is a growing problem, of epidemic proportions globally.

In relation specifically to energy consumption, research on household energy conservation by Abrahamse et al (2005) indicates that "*information tends to result in higher knowledge levels, but not necessarily in behavioural changes or energy savings*". This is not good news for the designers of the "education and awareness" programmes that are often referred to in the regional energy policy literature: the conclusion indicated here is that these programmes, on their own, are likely to achieve little or no reduction in energy use.

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[5] To be sure, utility billing information in the Caribbean is not high-quality information for the purpose of providing feedback and influencing customer action. Many utility bills show only the bare minimum of information necessary to define the consumption amount and its cost for the period in question.

Feedback

Darby (2006) has conducted a review of the literature on the effects and effectiveness of feedback on energy consumption, with special focus on metering, billing and electronic monitoring. Her review concludes that *"Overall, the literature demonstrates that clear feedback is a necessary element in learning how to control fuel use more effectively over a long period of time and that instantaneous direct feedback in combination with frequent, accurate billing (a form of indirect feedback) is needed as a basis for sustained demand reduction. Thus feedback is useful on its own, as a self teaching tool. It is also clear that it improves the effectiveness of other information and advice in achieving better understanding and control of energy use."*

Abrahamse (2005) also indicates that "*Feedback has … proven its merits, in particular when given frequently*."

Goal setting

Feedback is shown to be interactively related to the ability of the consumer to set meaningful goals. This interaction was illustrated by Becker who describes an experiment conducted in the USA where feedback was the variable factor in relation to conservation goals that were set by households. Eighty families were asked to set a goal to reduce their residential electricity consumption for several weeks during the summer, half of them by 20% (a difficult goal) and half by 2% (an easy goal). Within each of these groups, half of the families were given feedback about their consumption and the other half was given none. Twenty other families served as a control group. The results showed that the group with the 20% reduction goal that was given feedback conserved the most (13% to 25% of electricity consumption) and was the only one that consumed significantly less electricity than the control group.

Interestingly, the feedback seemed to have no significant effect on the households with an easy-to-achieve (2% reduction) goal. To the householders, it probably hardly seemed worth the while to do anything, since the outcome made no significant difference anyway.

Social Proof

A January 30th, 2009 New York Times article reports on Dr Robert Cialdini, a social psychologist and best-selling author of *Influence: The psychology of persuasion*, who has been studying how to get people to lower energy consumption. His conclusion has been that the most effective method is to get people to compare themselves with their peers. The article reports that *"In a 2004 experiment, [Dr Cialdini] and a colleague left different messages on doorknobs in a middle-class neighborhood north of San Diego. One type urged the residents to conserve energy to save the earth for future generations; another emphasized financial savings. But the only kind of message to have any significant effect, Dr. Cialdini said, was one that said neighbors had already taken steps to curb their energy use. "It is fundamental and primitive," said Dr. Cialdini… "The mere perception of the normal behavior of those around us is very powerful."*

This result has been corroborated by others, including Schultz (2008) who finds that "social norms – an individual's beliefs about the common and accepted behaviour in a specific situation" are a powerful influence on behaviour.

4. Incorporating the ECIFs – Online Social Networking

Empirical research indicates that the above behavioural factors influence the outcomes of energy efficiency and conservation efforts. The question being considered here is: how do we incorporate the ECIFs into a durable, universally applicable system or product that allows households to reduce their long-term electricity consumption?

Various approaches to reducing household energy consumption are already being taken by several players in the space; they all involve monitoring of and interaction with household electricity use in three broad categories:

1. Monitoring and interaction by means of utility-installed smart meters
2. Monitoring and interaction by means of third-party monitoring devices and systems
3. Monitoring and interaction by means of an online service

These three categories overlap significantly. For example, Google entered the home energy monitoring space in February 2009 with their announcement of the Google PowerMeter, a web-based service that displays detailed energy consumption information that is meant to be delivered from a smart meter, thus straddling the three categories in one go.

Microsoft entered the space in June 2009 with their Microsoft Hohm, a web-based service that uses data supplied by users and/or utilities, without the need for a smart meter or monitoring devices. The Microsoft service is based on energy models developed for the Home Energy Saver™ by the US Department of Energy's Lawrence Berkeley National Laboratory; one of the first Internet-based tools for calculating energy use in residential buildings.

Various companies offer a range of in-home electricity monitoring devices. The Wattson, by DIY Kyoto, is an iconic early entrant; less elegant but no less useful devices perform similar functions. The devices and systems range from the simple and inexpensive to the complex and expensive. The Owl wireless electricity monitor for example is a simple device that can show the total electricity demand and consumption (and other indicators) of the entire home, employing a clip-on sensor/transmitter and a receiver/display unit. At the other extreme, there are systems that incorporate plug-in monitors at each appliance socket that wirelessly broadcast the individual appliance consumption data to a central console that displays the aggregated information in close to real time.

All of these devices and systems have the same basic function – to provide **information** and **feedback** to consumers on their electricity consumption. These two factors are necessary, but not sufficient for the purpose of fully reducing rebound effects related to household energy efficiency. A complete system must also allow **goal setting** and provide **social proof**. The mechanism proposed for this amalgamation is the online social network, a relatively new, but rapidly growing medium.

Online social networks are booming. The first generalized[6] online communities, accessible to anyone with an internet-connected computer, were born in the last two decades of the 20th century, with offerings such as The Well (launched in 1985), The

[6] ie: intended for use by the general public for non-specialized purposes

Globe.com, Geocities and Tripod. These were followed in the 2000s by the now-ubiquitous MySpace, Facebook and the micro-blogging social network Twitter, which launched in 2006 and was reported[7] to be growing by over 1,300 percent per annum in February 2009. Today, it is estimated that there are over 200 general social networks in existence with a total of approximately 600 million users worldwide[8].

The value proposition of the online social network is as an aggregator of the ECIFs into one easily-accessible platform, in a format that is becoming increasingly popular. Using a specifically-designed social network, households can receive information and feedback, can compare their usage to that of their peers and can set and monitor their energy reduction goals.

Moreover, via a social network, which is an ever-evolving platform, information and feedback can be presented to users in a variety of engaging and vivid ways; goal-setting can be interactive with other users and social proof can take on a competitive bent that may reinforce its effect.

5. The Caribbean and Latin American Context

Households consume a lot of the electricity used in the Caribbean. In 2005, the amount of electricity consumed by the residential sectors of a dozen (arbitrarily selected) Caribbean countries was 40% of total electricity consumption. In Belize, the proportion was as high as 58%. These numbers indicate that the potential savings from residential sector energy efficiency in the Caribbean are large.

No empirical studies of the rebound effect have been done in the Caribbean and perhaps few have been done in Latin America.

Formal studies of the use and growth of social networks in Latin America indicate very high interest and adoption rates in the larger countries. Information from ComScore, a company that specializes in measuring the digital world, shows that Brazil is the

[7] Year-on-year growth reported by Nielsen, a data collection, measurement and information firm
[8] And uncounted users of other special-interest, or 'vertical' social networks

biggest user of social media in the region, with a percentage reach[9] of 85% in September 2008, closely followed by Chile, Colombia and Argentina, all with over 70% reach. Overall, nearly 9 out of 10 people in Latin America visited a social networking site in September 2008, up 9 percentage points over the previous year.

While the growth of social networking in the Caribbean has not been formally studied, anecdotal evidence suggests that the adoption of social networks in the Caribbean is in its early stages and that significant growth is still to occur, as has been the trend in Latin America.

Further evidence indicates that social networking is no longer the exclusive province of the young. According to a March 2009 Nielsen report[10], users aged 35-49 accounted for the greatest growth on Facebook during December 2007 – December 2008. It further reports that Facebook added almost twice as many 50-64 year old visitors (an additional 13.6 million) than it added visitors under 18 year old (7.3 million) over the same period. "*Consequently, people under 18 years old are making up less of the social network and blogging audience, whereas the 50+ age group are accounting for more of the audience.*" Although these data do not specifically address the trends in the region, limited anecdotal evidence suggests that similar things may be taking place in Latin America and the Caribbean.

This is an important point in connection with potential energy conservation outcomes: if both young and old are able to be reached via social media, the prospects for durable behavioural changes facilitated by social networking tools are improved.

Based on this actual and potential growth, it is considered that a social network specifically focused on energy efficiency has the prospects to deliver significant energy conservation outcomes to households of the region.

[9] Percentage of population age 15 and older who visited a social networking site in September 2008 while accessing the Internet at home or work
[10] Global Faces and Networked Places: A Nielsen report on Social Networking's New Global Footprint

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