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The C^3 of conservation: The influence of cool, convenience and cash on residential household energy conservation

ABSTRACT

It is important not to underestimate the connectedness of the cool, convenience and cash factors in consumers' choices regarding their energy and water use. A review of the literature suggests that each one of our decisions to save is based on a set of values and virtues that appreciates our time, our hard-earned cash, and our access to technology.

The municipalities and the utilities of the future are planning for tomorrow's customer when allocating resources, managing infrastructure, and projecting master plans to meet growing populations and changing economies. In general, this future customer base is connected to social media and the internet their entire life span, and is a customer that values fitness, information feedback, communication, and reduced impact to the environment. A question often arises regarding what drives consumers to be more energy- and water-efficient or participate in energy saving programs and rebates. This perspective breaks down the answer into the most perceived drivers: the three Cs, or C^3, that is, the cool, the convenience, and the cash.

In our freshman Environmental Systems class at the University of Texas—San Antonio we use Miller and Spoolman's definition of "conservation" from the Merriam-Webster dictionary as "the careful use of natural resources to prevent them from being lost or wasted" (Merriam-Webster, 2014). Energy conservation, therefore, is "a decrease in energy use based primarily on reducing unnecessary waste of energy" (Miller and Spoolman, 2009). This is often accomplished through behavioral modifications, such as changing the set point of the thermostat, turning off lights, and unplugging devices when not in use (Natural Resources Canada, 2014). But what drives these "behavioral modifications?"

1. Cool

Cool – not in the meaning related to temperature but to social status and trend setting – is an important factor when evaluating behavioral incentives that drive participation in energy conservation.

Peer influence, whether from neighbors, family members, friends, or colleagues, remains a mysterious factor that many behavioral research analysts find difficult to measure. However, energy consumption feedback with peer comparison does appear to provide an effective way of reducing energy consumption with low associated program costs (Ayres et al., 2012; Allcott, 2011). The persistence of these benefits following program completion is debatable (see Darby, 2006; Fischer, 2008). Energy savings are most likely to persist when feedback programs support the development of new habits in individual consumers. Thus, longer programs, of three months or more, are more likely to motivate lasting change (Darby, 2006).

Early adopters of energy saving technologies and/or behaviors appear to have a positive impact on the promotion of energy efficiency within their social circles. Denniset al. (1990, p. 1116; see also Faiers et al., 2007, p. 4387) argue "the names and experiences of early adopters should be promoted because consumers often will not try a new technology or behavior until someone they know adopts it." The same can be said about promoting and publishing a list of top users and per se shaming them off that list.

There have been many studies researching the variables of gender, age, and income to this topic. However, studies on the effect of various demographic variables on environmental attitude and conservation have been inconsistent (Straughan and Roberts, 1999). A general belief persists indicating that younger individuals are likely to be more sensitive to environmental issues, having grown up in an age where these issues are more prevalent (Straughan and Roberts, 1999). However, findings here are often equivocal, where non-significant relationships or even higher conservation values are found among older individuals, frequently attributed to Depression-era upbringing (Straughan and Roberts, 1999).

"Energy Engenderment" is another important topic that is yet to be examined. Elnakat (2014) and Elnakat and Gomez (2015) define Energy Engenderment theory as a field of study that "promotes women's participation in energy decisions. It is not about highlighting inequalities but about recognizing the unique set of skills applied by each gender." Elnakat highlights women's role as household managers and their ability to "build on the intrinsic form of energy and water resources conservation through the female head of household's inherent role as mothers, teachers,

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mentors, friends, sibling, daughter, and active members of our GPD" (2014).

"The development of unique sex roles, skills, and attitudes has led most researchers to argue that women are more likely than men to hold attitudes consistent with the green movement. Theoretical justification for this comes from Eagly (1987), who holds that women will, as a result of social development and sex role differences, more carefully consider the impact of their actions on others" (Straughan and Roberts, 1999, p. 560). However, this argument is far from conclusive. Some researchers have found the relationship to be insignificant, or to be the opposite of the predicted pattern (Straughan and Roberts, 1999). "Income is generally thought to be positively related to environmental sensitivity. The most common justification for this belief is that individuals can, at higher income levels, bear the marginal increase in costs associated with supporting green causes and favoring green product offerings" (Straughan and Roberts, 1999, p. 560).

With the difficulty of pinpointing influences on behavior with respect to age, gender, and income, one variable remains easier to agree on. Education is generally expected to be positively correlated with environmental concern. Results from these types of studies are more consistent than studies on other demographic variables. However, the relationship between education and environmental sensitivity can still depend on other variables. For example, Straughan and Roberts (1999),Vlosky et al. (1999), and Pedersen (2000) all concluded that individuals with "higher" education are more likely to exhibit environmentally positive buying behavior. However, later evidence from Peattie (2001), and Laroche et al. (2001) found that consumers of ecologically compatible products tended to be less educated. Thus again, income and age can play a multivariate factor.

With the challenge of isolating multivariate factors affecting behavior measurements, one factor remains. There will always be the promotions, and the mass advertisement that appeals to the energy conscious "early adopters" no matter what their gender, social status, education, and income is. For the early adopters, the "coolness" factor of both the technology and its impact on their lives is a tempting factor that drives their engagement.

2. Convenience

Convenience in adapting to the new technology, retrofit, or behavior associated with conservation is a key factor in how intrinsic and organic the behavior change becomes as part of everyday living. High behavioral costs, in both effort and convenience, are a barrier to individuals implementing energy saving retrofits (Steg, 2008). When it comes to convenience, the word to focus on is "easy." Behavioral change is difficult to achieve if the new behavior is associated with an increased degree of difficulty. However, if the new behavior is made easier (i.e., a learning thermostat that does not need constant reprogramming or a light that turns off automatically via sensor technology), changes in behavior will occur naturally (McKenzie-Mohr and Schultz, 2014).

Convenience benefits obtained from whole-house energy retrofits can include, but are not limited to: automatic thermostat and lighting controls, easier filter changes, faster hot water delivery, and less dusting and vacuuming. With the presence of smart appliances, meters, and apps penetrating the market, managing time and resources has become more accessible to a wide variety of customer backgrounds. Smart and real-time technology is also an added factor for the customer that enjoys evaluating and controlling their usage through their smart devices with a click of an app at their convenience, anytime of the day, without depending on standard business hours and waiting for a customer representative or monthly bill to address their questions.

As in the "cool" factor, quantitative valuation of the benefits of convenience gained from retrofit measures are difficult to achieve because they are less tangible, and more subjective than a monetary cost/benefit analysis. Values ascribed to increased convenience will tend to vary widely from person to person or group to group (Amann, 2006). Fischer (2008, p. 79) argues the most effective feedback programs provide communication that is frequent and given over a long period of time, provide an appliance specific breakdown, are presented in a clear and appealing way, and use computerized and interactive tools. Feedback programs appear to have a differential impact depending upon previous energy consumption practices of the consumer. "Households in the highest decile of pre-treatment consumption decrease usage by 6.3%, while consumption by the lowest decile (households) decreases by only 0.3%" (Allcott, 2011, p. 1082). However, Darby (2006, p. 3) also notes "Historic feedback (comparing with previous recorded periods of consumption) appears to be more effective than comparative or normative (comparing with other households, or with a target figure)."

Implementation of smart metering infrastructure allows for more advanced intervention programs. One study found that direct feedback produced savings between 5 and 20%. Direct feedback mechanisms allow customers to see the real-time impact of their decisions on their energy consumption (European Environment Agency, 2013). These systems may allow homeowners and residents to alter their habits, thus reducing their energy consumption and associated costs (Wiggins et al., 2009).

The "convenience" factor is not for the lazy; it is for the consumer who demands more of the technology in terms of performance, communication, and feedback, and less on their time.

3. Cash

Arguably initial setup/retrofit cost and cash back are the biggest drivers of the conservation challenge. The economics of energy efficiency are critical to the understanding of why homeowners are willing or unwilling to make energy upgrades at their residence. While there are many benefits to energy efficiency upgrades, for the homeowner, the initial cost and the resulting payback period is critical (Abadie et al., 2012). Payback period of an upgrade is dependent on many factors including the initial and final efficiency of the system, cost of energy in the location of the upgrade, regional climate, and available rebates (Department of Energy, 2012a,b). The initial cost to save energy is variable also and dependent on the action a resident is taking and the labor involved in the setup.

Using simulations, research indicates that the probability of homeowners to perform retrofits was dependent on retrofit costs, relative energy prices, and the homeowner's income (Cameron, 1985). Through a survey of over 400 owner-occupiers of homes in Germany, it was found that high-energy costs (65%), necessary renovations (46.1%), and increasing comfort in the home (37.3%) were the drivers for implementing energy retrofits. The most commonly chosen barriers were the lack of need to renovate the heating system (66.4%) and building envelope (61.5%), lack of financial resources (58.6%), and doubt that energy efficiency measures would pay off (60.5%). Leading us to the obvious conclusion that homeowners who have the financial means to perform the retrofit are more likely to do so as are those who are in need of a new system and/or renovation (Achtnicht and Madlener, 2014). In the United States similar factors play a key role (potential cost, savings, and payback) (Abadie et al., 2012). More so, homeowners may be willing to invest in upgrades if the payback