



Do households misperceive the benefits of energy-saving actions? Evidence from a Japanese household survey



Kazuyuki Iwata^{a,*}, Hajime Katayama^b, Toshi H. Arimura^c

^a Faculty of Regional Policy, Takasaki City University of Economics, Japan

^b Faculty of Commerce, Waseda University, Japan

^c Faculty of Political Science and Economics, Waseda University, Japan

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ABSTRACT

Using a household survey conducted in a suburb of Tokyo, we examine whether individuals properly perceive the benefits of energy-saving actions. A bivariate regression shows that, on average, individuals overestimate the benefits. The tendency to overestimate is robust to controlling for individual and home characteristics. Our results are contrary to those of Attari et al. (2011), who found that individuals in the U.S. tended to underestimate the benefits of energy-saving activities. The difference in our results suggests that the provision of information about the benefits of energy saving may be an effective policy to address global warming issues in one country but not necessarily in all countries. We also find that the magnitude of overestimation is greatest among young single males, whereas the benefits perceived by older married females are the smallest. This result suggests that the provision of tailored information (i.e., highly personalized and specific information) can be an effective intervention even in Japan.

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Introduction

Global warming is one of the most serious problems that our society must address. The average global temperature has increased by approximately 0.8 degrees Celsius since 1880, and with the current level of greenhouse gas (GHG) emissions, each successive decade is expected to be warmer than the previous one (U.S. global change research program, 2014). An increase in global temperature may have negative effects on water supplies, agriculture, power and transportation systems, the natural environment, and our health and safety among other critical systems and resources (EPA, 2014). To avoid such consequences, a reduction of energy consumption is urgently needed.

One promising strategy may be to change household energy-consumption behavior (Truelove and Parks, 2012; Yue et al., 2013). Households are responsible for a large portion of global GHG emissions; specifically, 11% of global emissions are attributable to the household sector (Ecofys, 2013). In addition, the potential for reduction in this sector appears to be large. For example, it is estimated that the energy consumption of U.S. households could be reduced 20–30 percent by changing the selection and use of household and motor vehicle technologies (Dietz et al., 2009; Gardner and Stern, 2008). Similar, though smaller, potentials have been estimated for other countries (Carlsson-Kanyama et al., 2005; Alfredsson, 2004; Benders et al., 2006;

Vringer and Blok, 1995). Furthermore, because there is high variance in household GHG emissions a significant reduction in GHG emissions appears possible by shifting individual to more climate friendly consumption patterns (Griod and de Haan, 2009). For these reasons, households are an important target group for intervention (Arbrahamse et al., 2005, 2007; Steg et al., 2006).

In response to both global warming and the energy crisis of the 1970s, a number of studies have examined intervention strategies aimed at household energy conservation. For an excellent review, see Arbrahamse et al. (2005). One of the most common strategies is to provide information through workshops (Geller, 1981) or mass media campaigns (Hutton and McNeill, 1981; Luyben, 1982; Staats et al., 1996). The information may be general (e.g., information on the causes of global warming) or specific (e.g., information on ways to reduce household energy use). In some interventions, tailored (i.e., highly personalized and specific) information is provided (Gonzales et al., 1988; Hirst and Grady, 1982–1983; Winett et al., 1982–1983; McMakin et al., 2002).

The provision of general information is intended to make individuals aware of and concerned about problems related to household energy consumption, thereby influencing individuals' energy use. This approach is based on evidence that environmental awareness and concern for the environment have significant effects on various energy-saving behaviors (e.g., Barr et al., 2005; Scherbaum et al., 2008; Urban and Scasny, 2012; Whitmarsh and O'Neill, 2010). It seems, however, that there is little room for general information to reduce individuals' energy use because an increasing number of individuals have already become

* Corresponding author at: Kaminamie-cho 1300, Takasaki, Gunma, 370-0801, Japan.
Tel.: +81 27 343 5417.

E-mail address: iwata.kazuyuu@gmail.com (K. Iwata).

concerned about global warming. For example, approximately 90% of individuals are concerned about climate change in a majority of EU countries (Eurobarometer, 2007).

The provision of specific information is based on the assumption that individuals may not be aware of a variety of possible activities, devices and technologies for energy conservation.¹ Perhaps more plausibly, even though they are aware, they may misperceive the potential energy savings. For this reason, the extent of misperception is of particular interest because it provides insight into possible changes in individuals' energy conservation when their perceptions are corrected via information provision.

Baird and Brier (1981) found that individuals tend to think of larger appliances as consuming more energy, even when the opposite is true. Larrick and Soll (2008) provided evidence that individuals tend to underestimate the value of taking the most fuel-inefficient vehicles off the road. More comprehensive evidence was provided by Attari et al. (2011). Using data on individuals in the U.S., they examined public perceptions of energy use and potential energy savings for 15 activities, including turning off lights, driving less, and installing more efficient light bulbs and appliances. Their results show that individuals, on average, underestimate energy use and savings, suggesting that information on the energy use and potential energy savings may have positive influences on household energy conservation.

Using survey data on individuals living in a suburb of Tokyo, this study attempts to provide further evidence on whether and the extent to which individuals misperceive the potential energy savings (monetary benefits) of energy-saving actions. In particular, we examine a wide variety of simple actions recommended by the Energy Conservation Center Japan (ECCJ), most of which are curtailment actions (i.e., actions that involve repetitive efforts to reduce energy use).

A brief summary of the present study follows. A bivariate regression shows that on average, individuals overestimate the benefits of energy-saving actions. The tendency for overestimation is robust to controlling for individual and home characteristics as well as for potential nonlinearity between actual and perceived benefits. These results are in sharp contrast to those of Attari et al. (2011), suggesting the presence of heterogeneity in how individuals from different countries perceive the monetary benefits of energy-saving actions.

Background and data

Background on Japanese energy conservation policies

Several policies have been implemented to promote energy conservation in Japanese households. One major policy initiative aims to promote the diffusion of energy efficient home appliances. To accelerate the diffusion of energy efficient products, the Ministry of Economy, Trade and Industry (METI) mandated under the *Energy Conservation Act* that product labels include energy consumption information. The first labeling system, however, did not allow consumers to easily compare products across different manufacturers. In 2000, METI launched a second program, the voluntary Energy-Saving Labeling program, which informs consumers of the energy consumption of a product relative to the most efficient products in the same class. By the 2008, 16 products were covered under this new labeling program, including air conditioners and electric refrigerators.

These programs provided consumers with information on the energy efficiency of electric appliances. They did not, however, inform consumers of strategies for saving energy when using those appliances or potential cost savings from various energy saving practices.

Other national campaigns, however, specifically promoted energy saving practices. In 2005, the Ministry of the Environment (MOE) launched a national campaign called *Team Minus 6 Percent*. The goal of the campaign was to raise the awareness of the country's GHG emission target, a 6% reduction relative to 1990 emissions, and to contribute to emissions reduction by promoting energy saving practices. The campaign promoted six specific energy saving actions: 1) "Set air conditioners to 28 degrees Celsius (or higher) in summer and 20 degrees Celsius (or lower) in winter," 2) "Turn off the faucet when unnecessary," 3) "Drive car your more efficiently," 4) "Choose eco-friendly products," 5) "Say no to excessive packaging," and 6) "Unplug electric appliances when not in use." By June 2008, more than two million people and 21,975 organizations declared themselves team members.²

To reinforce the *Team Minus 6 Percent* campaign, the MOE launched another campaign, *Cool Biz*, in the summer of 2005. *Cool Biz* promoted casual dress codes, including in formal settings such as the workplace, to help people feel comfortable with the air conditioning set at 28 degrees Celsius.

In Japanese business culture prior to the campaign, every businessman was implicitly required to wear a jacket and tie. Consequently, office temperatures had to be cold enough that businessmen could feel comfortable with a jacket in summer. Once the government endorsed more casual attire in the summer, businessmen began to wear "business casual" or even more relaxed styles, which allowed offices to be kept at warmer temperatures. The MOE hoped that this campaign on the business attire would help people set the temperature to 28 degree Celsius or higher in the summer.

The *Cool Biz* campaign was quite successful and has drastically changed Japanese summer business attire. According to a survey conducted by MOE, more than 90% of the respondents were aware of the *Cool Biz* campaign and 32.7% of offices set their air condition to 28 degrees. The MOE estimated that the campaign contributed to a reduction of 460 thousand tons of CO₂, which is equal to the consumption of one million households.³

Despite the success of the *Cool Biz* campaign, it was unclear whether people understood the cost savings that resulted from the new temperature settings. The campaign did not inform people of the monetary savings associated with energy efficiency practices such as setting air conditioners to a higher temperature.

In another effort, ECCJ promoted energy saving practices in households through their brochure, titled *Dictionary of energy savings in households* (ECCJ, 2010),⁴ and through their webpages. ECCJ listed specific energy saving practices such as "Set air conditioner to 28 degrees Celsius in summer" or "Turn off televisions when unnecessary." ECCJ listed both monetary savings and the amount of electricity saved from each action. ECCJ (2010) resources, however, were not used in the *Cool Biz* or *Team Minus 6 Percent* campaigns, possibly because ECCJ is funded and supported by METI while the *Cool Biz* campaign was run by MOE.

Survey description

To examine the relationship between the actual and perceived benefits of energy-saving activities, we conducted a household survey in Soka City, a suburb of Tokyo (25 km away from Tokyo). The population of the city is approximately 240,000, with a population density of 8.9 thousand persons per square kilometer. Although the population is not large, the density is relatively high in comparison to the average for Japan, which is approximately 0.3 thousand persons per square kilometer.

¹ For example, Yohanis (2012) provided evidence that a majority of households surveyed in Northern Ireland are unaware of the presence of thermostatic controls on hot water tanks, with which they can reduce energy consumption resulting from water heating.

² <http://www.team-6.jp/english/about.html> (accessed on August 9th, 2014).

³ <http://www.env.go.jp/press/press.php?serial=6491> (accessed on August 6th, 2014).

⁴ http://www.eccj.or.jp/dict/pdf/dict_all.pdf (accessed on August 6th, 2014).

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