

Behavior change and energy use: is a 'nudge' enough?

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“...the evidence that non-price energy nudges can substantially and cost-effectively change consumer conservation behaviors seems compelling.”

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This article assesses recent evidence concerning the effectiveness of energy conservation ‘nudges’. We discuss which individuals and behaviors are most affected. Finally, we discuss the common lessons learned and gaps for future work.

As recognition of the consequences of the rising trends in energy consumption increases among policy-makers and the public, calls to rally international efforts to tackle the issue grow louder. While international organizations work on a global strategy, it remains the case that residential electricity accounts for 40% of global energy-related CO₂ emissions and is expected to grow globally by 58% by 2030 unless new policy measures are introduced [10]. In this article, we ask what can be done to induce changes in households’ energy consumption.

Recently, utilities companies have stepped up information-led campaigns that seek to provide feedback to consumers to positively influence how households think about and use energy. Evidence of the effectiveness of such strategies has been mixed. Fischer found that of the dozen studies she reviewed, none could identify an effect of normative statements on energy use [1]. She suggests this failure stems from the ‘boomerang’ effect,

where descriptive norms can have the unintended consequence of inducing individuals below the norm to up their usage so that they conform to typical peer behavior. In response to this limitation, normative feedback is often combined with messages to buffer against any boomerang behavior. In a field experiment exploring the extent of this counterbalance, it was found that adding an injunctive message – a smiley face emoticon for consuming less than average – had eliminated the boomerang 8.6% increase in consumption of households who only received descriptive norms [2].

While message type is one important feature that can shape households’ response to a conservation nudge, it is not the only one. Several recent studies test the dynamics of alternative features [3–7]. Others have examined the extent to which their effect can be generalized across different populations and economic conditions [8], while some consider the possible mechanisms driving their impact [9].

Three of the first batch of studies examined datasets drawn from a field experiment in which households, across several US states at various stages, were randomly treated to a Home Energy Report (HER). Congruent in methodology, these studies allowed for some considered

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comparisons of the relative impact of a nudge across different samples, states and periods. The report itself contained three types of messages to encourage and sustain pro-conservation behavior: descriptive information compared households' own level of consumption over the preceding 12 months to that of the mean and 20th percentile; injunctive messages (emoticons or green stars) to curtail possible boomerang effects; and instructive energy-saving tips, some of which were targeted at households whose historically high-energy use patterns and demographics suggested would have a greater bearing on behavior.

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Between them, Ayers *et al.* [3] and Allcott [4] measure the impact and dynamics of different design features of the nudge, including different frequencies (quarterly vs monthly reports), durations (over 7 months to a year), and mode of presentation (envelope sizes). The former study noted persistent impacts ranging from a 1.2% reduction in gas and electricity use in Washington, to a 2.1% decrease in electricity use in California, sustained monthly over the course of the two experiments – 7 and 12 months, respectively. They found reductions as result of quarterly versus monthly reports were statistically indistinguishable, suggesting the less costly, but equally effective, quarterly report offers the more efficient approach [3]. This contrasts with Allcott whose Minnesota study did report similarly sized reductions in electricity (1.9–2.0%), but from monthly treatments with a significantly lower 1.5% effect from quarterly reports. Moreover, the response from the latter quarterly HER would wither over the months between letters, but recover upon receipt of the next. This decay was economically significant, amounting to almost half the original impact. Here Allcott presents some evidence to suggest this was partially driven by the bounded and malleable attention of consumers [4].

Both these papers find that envelope size affected treatment response. Specifically, the graphical HER template type inside a business style envelope was significantly more effective at lowering electricity usage than other modes of presentation. Since these resembled the format of energy bills, the authors suggest more individuals may have been inclined to open and read their content [3].

Although these findings are encouraging, these studies leave unanswered the following questions. First, they do not provide conclusive evidence on which types of behavioral change drove the bulk of energy savings – for

example, a switch to more efficient durable appliances or changes in day-to-day behaviors (e.g., switching off appliances nightly). Second, since all treated households receive the same three types of information, the studies could not test which message types (singular or combined) appeared to have a stronger and sustained bite on behavior, nor if any caused an unhelpful response. Third, the studies fail to consider alternative channels through which differential impacts may be driven. Refined further, the underlying mechanisms and motivations that may have moved consumers – some maybe more than others – to alter behavior not because of the nudge *per se*, but because its message interacted with, for example, individual's own ideology or set of beliefs about social identity. These are important areas for future study to provide a more complete understanding of non-price interventions.

To better understand to whom nudges should be targeted at and why, a recent study by Costa and Kahn suggests political ideology as a plausible channel [9]. Their framework takes ideology as given – a household either is or is not liberal – and, given that the HER was voluntary, ideology therefore partly determines uptake and a household's subsequent response.

The study found that while the report had the intended effect of lowering consumption among liberals, usage among some conservatives actually increased. They reported an estimated 3.1% (0.7%) decrease (increase) in electricity consumption for a registered liberal (conservative) who lives in the top 75th (bottom 25th) percentile liberal neighborhood, who pays (does not pay) for renewably sourced electricity and who subscribes (does not subscribe) to environmental causes. They also reported that for high-energy usage consumers, which any nudge would ideally like to target, the size of the effect increased to a 5.5% reduction for liberals, but there was no change among conservative households. Neighborhood characteristics further elicited differential responses: those that lived in communities with a higher fraction of graduates were more likely to consume less, while a 0.1 increase in the fraction of liberals lowered consumption by 1%.

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Intuitively, Costa and Kahn suggest the response among liberals may reflect how social and private effects move together. Therefore, if liberals know their utility company knows their energy consumption, and others' level of consumption, this may work to strengthen their desire to lower consumption. Whereas conservatives, knowing the same, may choose to react in defiance.

However, this leaves open the question of how messages specifically tailored towards households' ideology, rather than a 'one-fits-all' approach, may differentially affect energy consumption.

There is also uncertainty concerning the external validity of behavioral interventions across different populations and economic conditions. Dolan and Metcalfe [7] point out that UK effect sizes were considerably greater than those found in the USA by Ayers *et al.* [3] or Allcott [4]. Of the 14 identical HER experiments spread across the USA, Allcott and Mullainathan reported average effects that varied by as much as 240% – a figure that was both statistically and economically significant [8].

To conclude, the evidence that non-price energy nudges can substantially and cost-effectively change consumer conservation behaviors seems compelling. Allcott and Mullainathan estimated that if scaled nationally, a program like the HER could single-handedly lower US emissions of CO₂ by 12.7 million metric tonnes annually – almost 1% of emissions of the US electricity sector, which itself accounts for more than one-third of total annual US emissions [10,11]. However, uncertainty surrounds the permanence of its impact and its likely

success across different populations and economic conditions. Moreover, the success of a nudge hinges in part on consumers understanding the information given to them and their valuing it sufficiently so that it alters their behavior. More research is required on how messages specifically tailored towards households' values in their various forms, rather than a 'one-fits-all' approach, evoke different reactions to energy conservation. Finally, and perhaps of most importance, more work is needed to examine the extent to which any spillovers into other behaviors might counter or augment gains to energy saving. It is, for example, crucial to understand whether when a household saves £60 due to the nudge, do they invest it in energy-efficient appliances or airline tickets?

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