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Be Who You *Ought* or Be Who You *Are*? Environmental Framing and Cognitive Dissonance in Going Paperless

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Abstract

This paper explores the potential for environmental information and dissonance-inducing messaging to encourage resourceful behavior. We manipulate message framing to analyze behavioral motivators businesses may consider when encouraging customers—here, those with revealed environmental preferences—from paper to online communications. In a large-scale natural field experiment comprising 38,654 customers of a renewable energy provider, we randomize environmental information and messaging rooted in theories of cognitive dissonance in email communications promoting an active switch to paperless billing. We find that environmental information and imagery is ineffective in inducing behavior change. Interestingly, the dissonance-inducing messaging weakly improves uptake among our main sample but backfires among a subsample of individuals with extensive postgraduate education. Contrary to the majority of the literature on gender and environmental behavior, females in our sample are less likely to switch to paperless billing.

Keywords: Natural field experiment, message framing, cognitive dissonance, environmental information, paperless billing
JEL: D12, D83, L21, Q29

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Introduction

Businesses and governments are increasingly turning to randomized experiments to discover means by which to increase profitability or pursue policy goals. In a number of contexts, social and private objectives coincide, creating opportunity for partnerships between academic researchers and businesses interested in either or both of said objectives.[1] Companies with clear sustainability or corporate social responsibility objectives or whose resource use is both socially and privately costly (e.g., see Gosnell et al., 2016) may be especially motivated to identify cost-efficient means to improve their resourcefulness due to the increased competitiveness and profitability associated with "innovation offsets" (Porter and Van der Linde, 1995).

As a means of increasing the efficiency and resourcefulness of operations, the business world has seen a clear and rapid capitalization upon technological advancements, such as mobile phone applications and text messaging, or automatic bill pay (ABP). However, enrollment in such programs may lead to consumer welfare loss. For instance, Sexton (2015) demonstrates that residential energy consumers enrolled in ABP increased energy consumption by 4.0% on average and 7.3% for small- to medium-sized commercial and municipal customers. Thus, while enrolling customers in alternative bill payment schemes may decrease transaction costs for retailers and improve resourcefulness, the act may come at a cost in terms of customer satisfaction, convenience, financial awareness, and ultimately retention. Instead, companies may offer the option to switch voluntarily, but status quo bias[2] and potential costs (e.g., from increased consumption, as shown above) suggest that many consumers may refrain from opting in.

How can companies maximize customers' voluntary participation in schemes that increase the resourcefulness of communications or information provision? In this study, we investigate means by which to facilitate such cost- and resource-efficient change without imposing the change upon the customer. We

[1] A prominent example of the merging of social and private objectives is the founding of Opower, a thriving for-profit energy information provider founded upon robust research originally intended to help energy suppliers transition their business models to increase customer satisfaction and retention. Using a customer-centric approach involving provision of tailored social norm information to households, Opower's product helps utilities' customers to scale back on inefficient and privately costly energy consumption in the home, while simultaneously reducing environmentally costly greenhouse gas emissions (Allcott, 2011).

[2] In an experimental study on green nudges to deter junk mail, Liebig and Rommel (2014) demonstrate that mandated choice is more effective than active choice in overcoming status quo bias with respect to placement of "No Junk Mail" stickers on mailboxes, though only about a fifth of subjects take up the scheme.

manipulate message framing to analyze behavioral motivators 'green' businesses may consider when encouraging customers—here, those with revealed environmental preferences—to engage in resource-saving behaviors. We explore a role for targeted messaging based on consumer preferences and beliefs through randomization of environmental information and messaging rooted in theories of cognitive dissonance, a phenomenon centered upon a desire for consistency in self-perception. The research design rests on the assumption that the customer base of Good Energy, a 100% renewable energy supplier in the United Kingdom and our partner in this study, is characterized by strong environmental preferences.[3] In light of the social mission of Good Energy and its customers' selection into their customer base, we conceptualize a utility function susceptible to information and cognitive dissonance, designing interventions to manipulate arguments in the utility function related to social preferences and self-perception.

Neoclassical economics holds that information influences behavior through its effects on individuals' internal cost-benefit analyses, which are rooted in preferences characterized by selfishness (DellaVigna, 2009). More recent economic theories posit that such internal cost-benefit analyses incorporate altruistic preferences, so that social objectives may play a role in decision-making (Becker, 1974; Andreoni, 1989, 1990). Theories in social psychology draw similar conclusions regarding the role of information on attitudes and behaviors (e.g., Ajzen and Fishbein, 1980; Stern, 2000; Kollmuss and Agyeman, 2002). However, perhaps counter to intuition, there is ample empirical evidence that calls into question the effectiveness of information in changing human behavior. A first goal of this experiment is to test whether social information—defined more specifically here as information on the (environmental) externalities associated with one's privately beneficial actions—influences the decision making of

[3]The assumption is founded upon the mission of Good Energy "to keep the world a habitable place by offering consumers an active role in addressing climate change." At the time of the study, it was the sole utility that sourced 100% of its electricity from renewable sources (wind, sun, and rain), and it supplies carbon-neutral biogas from organic materials. Additionally, while Good Energy's prices are comparable with the Big Six Standard tariffs (i.e. those paid by approximately 60% of UK residents), Good Energy's customer base is comprised of consumers who are engaged in the energy market and therefore actively switch. While Good Energy's tariffs are in the 75th percentile of available tariffs in its market, its customers pay a premium of approximately 25% compared to the cheapest available tariff, suggesting that their motivation is not strictly monetary. Finally, while Good Energy customers' consumption is quite similar to the average consumption in the UK, they are primarily 'ABC1' (i.e. consumers presumed to be from high social and economic categories with more education and income than those under other classifications. Thus, consumption may be relatively low when house size is taken into consideration.

individuals with revealed environmental preferences. That is, the first intervention aims to promote paperless billing through provision of information on environmental costs associated with paper use.

Demand for social information is apparent in the experiment of Cain and Dana (2012). In their study, a significant proportion (63%) of subjects in the control group chose to reveal the external consequences of their actions when given the opportunity to behave selfishly while remaining ignorant to the consequences; even more surprisingly, 24% actually *paid* to reveal such externalities. Of those who revealed, 44% and 50% (respectively) chose the more altruistic option, whereas all subjects who did not reveal made the selfish choice.[4] Remaining ignorant to the externality, therefore, allows for justification of action upon one's private utility alone, i.e. regard for external costs.

Once social information has been consumed and acted upon, it may be possible to create a virtuous circle by appealing to one's voluntarily established identity with the cause (Akerlof and Kranton, 2000). While several cognitive dissonance theories have been proposed and (to some extent) tested, field experimentalists have arguably understudied the psychological phenomenon, whether as a means to explain behaviors inconsistent with neoclassical economic predictions or as a vehicle for behavior change. The second intervention therefore investigates the role that innate desire for consistency across one's beliefs and behaviors may play in encouraging repeated conservation.

Finally, a sparse literature appears to suggest that imagery can induce behavior change. For instance, a series of lab experiments (Haley and Fessler, 2005; Burnham and Hare, 2007; Rigdon et al., 2009; Mifune et al., 2010) and field experiments on honesty, littering, and donating (Bateson et al., 2006; Ernest-Jones et al., 2011; Ekström, 2012) demonstrate that an image of eyes can cause individuals to comply with cooperative norms in some contexts. Additionally, money priming has been shown to lead people to make less altruistic decisions or to focus their attention on monetary features of products (see Vohs, 2015, for a review). Here, we test whether images of the environmental good under threat (i.e., trees) can serve as a visual reminder of the externality associated with subjects' inaction and therefore increase their probability of acting.

In a large-scale natural field experiment comprising 38,654 Good Energy customers, we randomize environmental information, dissonance-inducing messaging, and environmental imagery in emails promoting an active switch to

[4]The effect of social information may be contextual, losing its bite in the presence of moral licensing (Cain et al., 2005; Tiefenbeck et al., 2013) or strategic ignorance (Cain and Dana, 2012; Golman et al., 2015).

paperless billing (i.e. a one-off low-cost behavior).[5] In addition to household-level data on e-billing sign-up, our data allow for exploration of the roles of both gender and education, two demographic factors that have been shown to increase pro-environmental behavior (Kollmuss and Agyeman, 2002). We find that both imagery and information on environmental costs associated with the status quo are ineffective in increasing uptake of paperless billing beyond that of a control group. On the other hand, dissonance-inducing messaging increases uptake among our main sample.

Interestingly, we find significant heterogeneity of uptake, both broadly speaking and with respect to treatment. Interestingly, dissonance-inducing messaging backfires among our highly educated sample, which we speculatively attribute to a lesser need for reassurance of a moral (e.g., socially-minded) self-concept. This finding aligns with self-affirmation theory and findings (Steele et al., 1993) and perhaps also with some economic theories of cognitive dissonance (e.g., Akerlof and Dickens, 1982). To our knowledge, this is the first study to demonstrate such nuanced heterogeneity among a large and presumably educated sample.[6] Additionally, the data suggest that women are less likely than men to sign up to paperless billing. The research suggests that individuals may be targeted with various forms of messaging to increase environmentally advantageous behaviors at no additional cost, and calls into question the general conclusion in the literature that women are more inclined than men to behave in line with social or environmental objectives (Croson and Gneezy, 2009; Kollmuss and Agyeman, 2002).

The remainder of the paper is structured as follows. Section 2 provides background on the mechanisms investigated in our treatments, namely the role of information in environmental decision making and the infusion of cognitive dissonance into the study of economic decision making. Section 3 outlines the experimental design and details the interventions implemented across Good Energy's customer base. Section 4 reveals the results of the field experiment, and Section 5 concludes.

[5]Environmental framing may also play a role in inducing cognitive dissonance by making the individual aware of the external costs of their current behavior. Therefore, we do not measure a 'pure' effect of cognitive dissonance, but rather an 'additional' effect of making such dissonance particularly salient.

[6]Prior studies have demonstrated that education leads to higher green energy uptake (Jacobsen et al., 2013).

1 Background and motivation

1.1 Information provision: Be who you *ought*

While the rational economic man of neoclassical theory is influenced by two primary motivators—information and incentives—social psychology and behavioral economics reserve a role for evaluative, normative, and identity-driven beliefs and motivations (Ajzen and Fishbein, 1980; Akerlof and Kranton, 2000; Elster, 2000; Stern, 2000; Kollmuss and Agyeman, 2002). According to the norm-activation theory of Schwartz (1973) and the value-belief-norm (VBN) theory of Stern et al. (1999), knowledge of negative consequences associated with one's actions—or particular undesirable conditions for which one is perceived to be responsible—spurs altruistic behavior. Therefore, information regarding particular externalities (or internalities) may change individuals' beliefs and intentions, in turn altering their proclivity to engage in socially or personally beneficial behaviors (Stern, 2000).

Empirically speaking, and despite the overwhelming tendency of social campaigns to communicate information with the goal of changing behavior, the impact of consequence-based information on subsequent behavior has proven negligible in a number of settings. During well-child appointments in a Norwegian experiment, parents were randomly assigned to receive short informational briefings and brochures on smoking and its harmful passive effects on their children, and self-reported smoking behavior did not change (Eriksen et al., 1996). Similarly, several studies demonstrate a non-effect of information—including calories per item and recommended daily caloric intake—on subsequent order choice in fast food restaurants (Harnack et al., 2008; Downs et al., 2009). Likewise, extreme media coverage of the consequences of Enron's accounting scandal on 401(k) holdings did not prompt employees in similar companies to diversify their 401(k) investments (Choi et al., 2005).

The consequences discussed above are primarily 'internalities', or unintended costs of one's actions that accrue to oneself alone. A meta-analysis of interventions intended to reduce household energy consumption demonstrates that information regarding externalities may increase knowledge but does not subsequently alter behavior (Abrahamse et al., 2005). On the other hand, Ferraro and Price (2013) find that information on the extent and consequences of water use among its (environmentally unconscious) customer base increased the implementation of water-saving strategies, especially among high-consumption households. Additionally, using a field experiment in Brazilian favelas, Toledo (2016) finds that environmental persuasion increases take-up of LED (energy-

efficient) light bulbs by 6 percentage points (or 13%).[7] In contrast to our setting, the outcome of interest in these cases is costly, as they require that individuals actively change their habits or spend money to reduce their energy and water consumption.

In addition, the interventions are applied to individuals who do not necessarily exhibit a preference for the healthy or financially advantageous outcomes that constitute the focus of those studies. Yet, there is some evidence suggesting that such preferences may be instrumental in determining outcomes. In a Dutch mass media campaign surrounding the causes of and possible behavioral solutions for climate change, individuals who reported a higher willingness to engage in pro-environmental behaviors were those who had already been behaving in such a manner prior to the campaign (Staats et al., 1996). That is, information campaigns may be more effective in inducing behavior change among individuals already motivated prior to intervention.

We explore a role for information regarding environmental externalities on a targeted audience of individuals exhibiting green preferences, where the information provided is directly and specifically related to the outcome behavior of interest. As environmental issues become more prominent in media and education, this environmentally conscious audience is growing and is arguably the segment of the population most inclined to change their behavior as a result of exposure to information on environmental damage for which they are (partially) responsible (see, e.g., Costa and Kahn, 2013). Such individuals tend to possess a locus of control and, as with the subjects under study here, have likely already acted prosocially in accordance with their environmental knowledge in signing up to this particular utility. Unlike many studies in the literature on the effects of information, our setting controls for any external influences (e.g., economic or social incentives) and targets an extremely low-cost behavior—namely making a one-time switch from paper billing to online billing—so that attitudinal factors (as opposed to transaction costs) likely play a direct role in decision making (Stern, 2000).

1.2 Cognitive dissonance: Be who you *are*

Theories of cognitive dissonance originated in psychology and have since piqued the interest of a number of economists. The theories generally rest upon the assumption that human beings are averse to inconsistencies between past or

[7] While persuasion is found to increase uptake of energy-efficient lighting, it is important to note that subjects were asked to participate voluntarily and therefore the findings may suffer from selection bias.

current beliefs and behaviors (Festinger, 1962).[8] In general, individuals strive for consistency, competence, and morality in their perceptions of themselves, and behaving in a manner that negates these features results in psychological discomfort (Aronson, 1992). Such 'dissonance' is morally costly, and economic agents will incorporate these costs into their utility maximization problems (e.g., Gilad et al., 1987; Konow, 2000). Hence, cognitive dissonance may be able to explain behavior anomalistic to the predictions of traditional neoclassical theory.

According to Gilad et al. (1987), cognitive dissonance can manifest in situations in which "a decision is undertaken freely and with the understanding of possible adverse outcomes" (p. 64). In their theory of selective exposure, behavior remains consistent with traditional utility maximization if exposure to certain types of information can be controlled and dissonance kept at a level below some threshold, an assertion consistent with literature on information avoidance (Cain and Dana, 2012; Golman et al., 2015). Otherwise, the individual must change her beliefs (which is costly), and she will subsequently maximize in accordance with a revised objective function.[9]

A more recent interpretation of cognitive dissonance emphasizes the role of context in determining the extent to which one may rationalize decisions in light of her beliefs. Mazar et al. (2008) put forth a theory of cognitive dissonance in which the propensity to engage in dishonest behavior is dependent on individuals' mindfulness of and attention to their own moral standards. In several laboratory experiments, Mazar et al. find that individuals who have the opportunity to cheat do so, though they are less likely to cheat when reminded of their moral beliefs or after signing an honor code. The authors argue that the internal *salience* of self-concept is, therefore, an important driver of congruence

[8] In a seminal experiment, Festinger and Carlsmith (1959) demonstrated that individuals who completed an hour-long mind-numbing task in the lab rated the task more positively if they were subsequently paid more money to convince new recruits to do the task. That is, those paid $20 to convince new subjects to complete the task rated the task more favorably than those paid $1 to recruit new subjects.

[9] Rabin (1994) proposes a similar structure for the utility function, adding a more nuanced explanation of the contexts in which cognitive dissonance will increase the tension between material benefit and psychological cost. For instance, he conjectures that an individual who receives less material benefit from an immoral activity will further convince himself of the immorality of the activity. Interestingly, he shows that a stronger proclivity toward cognitive dissonance may pressure an individual with high material benefit from said activity into changing her beliefs, thereby augmenting immoral activity.

between belief and behavior.[10]

In a more formal economic theory, Akerlof and Dickens (1982) propose a two-period model in which a rational individual first chooses whether to participate in a safe or hazardous industry; if she chooses the latter, she will convince herself of the safety of the industry so as to justify her past decision. In the second period, a cost-effective safety device becomes available and the individual—who would have purchased the device had it been available prior to her perception change—continues to work without it. According to the authors, their model justifies government intervention requiring hazardous industry workers to wear the equipment in order to return to Pareto optimal conditions.[11]

Finally, Konow (2000) posits a utility function comprising material wealth along with two costly parameters: cognitive dissonance and self-deception. The former characterizes the deviation between one's beliefs and one's actions—in this case, the deviation between a fair allocation and one's actual allocation in a dictator game—while the latter captures the discomfort associated with altering one's initial fairness perspective to increase consistency between the aforementioned allocations. Experimental results from several variants of the dictator game, where subjects perform both active and passive roles, provide strong empirical support for both phenomena.

Do individuals express opinions or take part in costly activities in order to remain consistent with self-perceptions outside of the laboratory? Can cognitive dissonance explain individual sacrifice for the sake of maximizing social welfare in the real world? Indeed, social scientists have cited cognitive dissonance as an explanation for voting behavior (Mullainathan and Washington, 2009), investor inertia (Goetzmann and Peles, 1997; Rennekamp et al., 2014), sexual risk taking (Mannberg, 2012), diminished labor supply in the face of job search discrimination (Goldsmith et al., 2004), endogenous class formation (Oxoby, 2003), and honesty in the face of cheating opportunities (Mazar et al., 2008). Furthermore, the phenomenon has been exploited as a means to ends

[10]The second contextual feature cited in Mazar et al. (2008) refers to the extent to which the given context facilitates flexibility of interpretation with respect to self-perception, or the extent to which the act may plausibly be considered consistent with the self-concept (which may, in turn, depend on the strength and relevance of social norms; see Wichardt, 2012). For instance, Nail et al. (2004) point out that the dissonance-inducing act must be voluntary and otherwise unjustifiable (or difficult to justify), and must involve perception of commitment.

[11]While the model focuses on labor selection, it is also applied to explain the effectiveness of non-informational advertising, the incidence of crime under various degrees of sanctions, and the necessity of Social Security for individuals who are averse to acknowledging the inevitability of old age.

such as water use reduction (Dickerson et al., 1992), sustained weight loss (Axsom and Cooper, 1985), condom use Stone et al. (1994),[12] and reducing hypothetical bias in contingent valuation studies (Alfnes et al., 2010). Perhaps most relevant to the present study, Kantola et al. (1984) implemented a framed field experiment (N=203, out of 429 initially contacted)[13] where individuals who were reminded that they had previously expressed agreement with a statement claiming that individuals have a duty to save electricity reduced their electricity consumption compared to a control group in a follow-up measurement period of four weeks.[14] In a more recent series of field experiments on voting behavior, invoking the self-concept through use of noun identifier ("to be a voter") as opposed to a verb ("to vote") in pre-election surveys significantly increased voter turnout, demonstrating that provision of "positive self-regard" may substitute for recognition from others for largely invisible behaviors (Bryan et al., 2011).

We extend the above strands of literature using a large-scale natural field experiment to identify the influence of information provision and cognitive dissonance in encouraging "green" renewable gas and energy consumers to switch from resource-intensive paper billing to online billing. To investigate a role for social information provision in promoting resourceful behavior, we provide the utility customers with information on the environmental consequences of continuing to receive communications in the post. To test the impact of cognitive dissonance on e-billing take-up, we promote present decision making consistent with implicit beliefs associated with related past decisions by increasing the salience of one's revealed standard for environmental integrity, as in (Mazar et al., 2008). In sum, we implement treatments that both appeal to embedded environmental preferences and that target preferences for a consistent self-perception.

In light of the above theories, we hypothesize that 'green' consumers of a renewable energy utility will respond to the cognitive dissonance intervention

[12]In a follow-up study where individuals made a pro-condom speech and recalled past failures to practice safe sex, they demonstrated a preference for direct rather than self-affirming dissonance reduction by choosing to purchase condoms rather than donate to a homeless shelter Stone et al. (1997).

[13]It is worthwhile to note that subjects were volunteers for the study who could participate only if they a) consented to have their energy use monitored throughout the study period, and b) agree or strongly agree with the statement "It is your personal duty as a responsible citizen to conserve as much electricity as possible." Therefore, selection and Hawthorne effects may bias these results. Additionally, there is no mention of a balance check across treatment arms.

[14]In a survey of UK households, past behavior was correlated with *intentions* to engage in future green behaviors, though no actual behaviors were measured Whitmarsh and O'Neill (2010).

by switching from paper billing to online billing if the cost of such dissonance sufficiently outweighs the benefits (i.e., convenience to the consumer of paper billing and any perceived cost savings associated with its salience). Additionally, in line with VBN theory and theories of identity, we posit that information on environmental damage will trigger motivation to act altruistically, especially if individuals have internalized the norms of eco-consciousness associated with being a Good Energy customer. Finally, in line with the conclusion of Taylor and Thompson (1982) that vividness may be important in the context of everyday informational competition, we conjecture that environmental imagery may serve to enhance the salience of environmental costs, thereby augmenting the perceived benefits of taking action and increasing the probability of doing so.

2 Experimental design

We partnered with Good Energy—the UK's leading renewable energy supplier—to randomize email content in a campaign to encourage customers to switch from their current information channel (i.e., quarterly paper bills received by mail) to online billing (i.e., quarterly bills received via email). The six-week campaign ran in September and October of 2014.

As a business founded upon an environmental mission, Good Energy's objective was to achieve a switch rate as close to 100% as possible. Additionally, online billing constitutes a cost reduction, as it requires fewer physical and human resources than does paper billing. The experiment is primarily designed to test the effectiveness of environmental savings information ('environmental framing') and a reminder of the customers' environmental preferences ('cognitive dissonance'). The design also allows for testing of the importance of relevant imagery on customers' decision making. The subject of each email announces the arrival of the e-billing option, and emails are sent from Good Energy's Chief Operating Officer. The defining features of each email intervention are detailed below.

2.1 Interventions

Control (Groups 1-2). In the control email, the first line unveils the online billing option ('availability line' hereafter, emphasis included): "**It's finally here!** Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post." The subsequent line touts online billing access ('online access line' hereafter): "Even better, you

can access your bills online any time, so they won't fill any valuable space in your drawers or bins." Both of the previous lines appear identically across all interventions.

The key following control statement reads, "**Here at Good Energy, we prioritise customer satisfaction.** The opportunity to switch to e-billing is just one more step we have taken to keep you smiling." Three benefits of switching are subsequently listed: 1) Reduce paper waste; 2) Spend less time sorting through mail; and 3) Access bills 24/7 online. The email includes a link to make the switch, and all emails contain the same closing statement followed by a signature from the Chief Operating Officer (for full email, see Figure A1 in Appendix).

Environmental Framing (Groups 3-4). This treatment provides information on the environmental benefits associated with a universal shift of GE customers to e-billing. Following the availability line stated above, this treatment states (emphasis included), "**If all customers make the switch, we would save 46 trees worth of paper each year!**" This line is followed by the online access line.

In addition to emphasizing GE's attention to customer satisfaction, the next line also points out its commitment to the environment (emphasis included): "**Here at Good Energy, we prioritise customer satisfaction as well as the environment.** The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint." The subsequent benefits no longer appeal to the customer herself, but rather are informative of the extent of paper waste and its environmental costs. The first bullet states, "The average UK family throws away 6 trees worth of paper in their household bin each year." The second pertains to the energy and climate impacts of the paper industry as a whole: "Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively)." Finally, we provide aggregate paper use statistics for the UK: "12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world." The email closes as indicated in the control description (for full email, see Figure A2 in Appendix).

Control and Environmental Framing (Groups 5-6). While the content contained in the above treatment email is roughly the same length and format as the control email, it contains some fundamentally different information. Therefore, we also test whether provision of the environmental information (presented to Groups 3 and 4) in addition to the control information (provided to Groups 1 and 2) is effective, allowing us to control for the otherwise substantial change in content from one email to the next (see Table 1). All information

from both the control and the environmental framing email is aggregated into one email (for full email, see Figure A3 in Appendix).

Cognitive Dissonance (Groups 7-8). Our final treatment quite closely emulates the control email with the exception of a single line, so that length and format are quite similar. Instead of emphasizing customer satisfaction, this email appeals to one's identity as a conscious decision maker: **"As a Good Energy customer, you are an environmental steward.** By switching to e-billing, you take another important step to eliminate the environmental impact of your energy use." The remainder of the email is identical to the control email (for full email, see Figure A4 in Appendix).

Environmental Image (Groups 2, 4, 6, and 8). Finally, we test the effectiveness of imagery—a central and customary component of Good Energy's communications strategy—in capturing customers' attention. For each of the above treatment emails, an additional treatment intervention existed with the same email content with a vibrant image of trees at the outset (see Figure A5 in Appendix). All other content in the emails remains identical.

2.2 Sample

The main sample consists of 36,810 Good Energy customers, which is the entire customer base omitting those for whom a working email address had not been provided or for whom gender could not be identified. This sample is 47% female. The average customer had been with Good Energy for 315 days and consumed 6450 kWh in gas and 3435 kilowatt-hours (kWh) in electricity on an annual basis. Customers who were on a dual fuel account (i.e. who have both gas and electricity accounts with Good Energy) comprise 41% of the sample, while those with gas or electricity only constitute 6% and 53%, respectively. A separate analysis is performed for those identified as either 'Doctor' or 'Professor' and are gender neutral in the data, of which there are 1844 customers (approximately 5% of the sample).[15] Of these customers, the average customer duration was 320 days, average annual gas and electricity consumption were 7592 kWh and 3546 kWh (respectively), and 41%, 7%, and 52% were on dual-fuel, gas, and electricity contracts (respectively) in 2014. The difference in the two samples is significant for annual gas consumption ($p<0.01$) and proportion of gas-only customers ($p<0.10$). We control for all of the above observables in the analysis.

[15]We are powered (β=0.8, α=0.05) to detect treatment effects of approximately 0.02 (approximately 15%) in the main sample, and 0.10 (approximately 25%) in the postgraduate sample.

More generally, the customers of Good Energy are fairly representative of UK households more broadly in terms of energy consumption and costs. In our data, the average estimated annual energy consumption is 3668 kWh, while the average UK household in 2014 consumed 4001 kWh. On the other hand, Good Energy gas customers use slightly more gas (13,827 kWh) than the average British household (12,404 kWh) (Goodright and Wilkes, 2015). Additionally, customers in our data likely pay similar prices per kWh. Due to increased competitiveness of renewable energy in the UK energy market, Good Energy customers pay a competitive price for their energy. On average, while dual fuel customers of the UK's 'Big Six' energy providers (i.e., those providers supplying over 90% of domestic customers) paid approximately £1360 per household in 2013, Good Energy households paid £1313 (see Figure 1). Similarly, compared to Ecotricity, one of Good Energy's primary competitors in the UK renewable energy market, Good Energy dual fuel customers paid £55 less per annum. Therefore, cost of energy does not distinguish Good Energy households from other UK households.

2.3 Randomization

All observable variables in the dataset were used in the stratified randomization.[16] Specifically, customers were sorted according to the fuel type on their account (gas only, electric only, or dual fuel), their estimated annual consumption (partitioned into quartiles), the length of their contract with Good Energy (partitioned into deciles), and the gender of the account holder (male, female, unidentified). First, we sorted customers according to the three fuel types, and within each fuel type we blocked them according to the estimated annual total consumption quartiles, creating twelve blocks. Having sorted the data into these twelve blocks, we then sorted customers in each block according to duration of existing contract with Good Energy, followed by the account holder's gender. If all blocks had contained at least one customer, this would have created $12 \times 10 \times 3 = 360$ blocks in total. However, there are nine blocks (i.e., combinations of the above variables used for stratification) for which no customer in the dataset is representative, so the stratification created 351 blocks in total. Once the data is sorted according to the existing 351 blocks, a number $(1-8)$ is assigned to each account holder to allocate each customer to

[16] We perform the analysis with and without controlling for strata. Standard errors are slightly inflated without strata, and we report these slightly more conservative estimates. Qualitatively, the results remain entirely intact, which is unsurprising given the finding in Bruhn and McKenzie (2009) that all randomization methods will achieve balance as sample sizes become large.

one of the eight treatments described above.

Since Good Energy's email server was limited in terms of the volume of emails that could be sent in one day, the trial was planned for six weeks. We tested for pre-experimental equivalence across all group pairs on the above variables as well as the day of week on which the email would be sent, as shown in the balance tables (see Tables 2a and 2b).[17]

3 Results

3.1 Treatment effects

In total, 13.42% of customers signed up for e-billing. In almost all cases, the email without the image outperformed that with the image; while the difference is not statistically significant when comparing all treatments without images to all treatments with images (chi-square test; p=0.122), the difference is significant when comparing the cognitive dissonance treatments with and without images (chi-square test; p=0.054). Simple chi-square tests do not reveal significant differences across treatments with varying information in the full sample (see Table A1 in Appendix). We do, however, see significant differences between outcomes in the Control and Cognitive Dissonance groups within the main and postgraduate samples, which indicate opposing reactions from these stratified groups. To reduce variation and increase power, we additionally investigate treatment effects using logistical regression analysis controlling for a number of observables in our data.

Our intent-to-treat analysis considers a binary response variable, and we therefore report the results of a logit model (in terms of both odds ratios and average marginal effects[18]). The logistic regression performed is specified as follows:

$$logit_i = \alpha + \beta_i T_{i,j} + \gamma X_i + e_{it}, \qquad e_{it} \sim N[0,1]$$

[17] We additionally test for balance within the subsample of Doctors and Professors in Tables 2c and 2d. We find slight imbalance on energy consumption between the cognitive dissonance groups (with and without images; p<0.10) and imbalance between the control and cognitive dissonance groups in the number of days they have been customers of Good Energy (p<0.05). We provide regression results with controls—including energy consumption—though the number of days a customer has been with Good Energy has no predictive power in the model.

[18] Intuitively, the average marginal effects signify the average change in the dependent variable if we consider a marginal increase in the respective independent variable for each individual in the sample separately, then take the average of this marginal effect for all subjects in the sample.

Receiving the cognitive dissonance message (without image) multiplies the odds that one signs up to e-billing by exp(0.105)=1.107, i.e., increases the odds by 10.7% (or about an average 1.2% increase in uptake[19]) controlling for consumption, tariff type, and gender ($p<0.10$). However, including the image appears to distract from the dissonance-inducing messaging, eliminating the effect altogether (consistent with the the t-tests above). While the odds of sign-up also tend to increase for the treatment groups containing environmental information, we do not have sufficient power to detect such an effect with statistical significance. Contrary to findings in the literature regarding environmental behavior and gender (see Cheng, Woon, and Lynes, 2011, for a review), we find that being female decreases the odds of signing up to paperless billing by 26.5%; as shown in Table A2, this result holds if we run the logit without treatment indicators within the control group alone (26.5% reduction in the odds of sign-up, $p<0.01$).[20]

Additionally, it appears that those with smaller observed environmental footprints are more likely to sign up to e-billing. For instance, relative to those on dual-fuel renewable tariffs, the odds of signing up among customers on either gas- or electricity-only tariffs are approximately 40% and 43% lower ($p<0.01$). Finally, for every increase of 1000 kWh in estimated annual gas and electricity consumption, the odds of sign-up decrease by 0.004% ($p<0.10$) and 0.014% ($p<0.01$), respectively. If we assume that being a dual-fuel consumer is indicative of higher environmental preferences than being a single-fuel consumer, and that lower consumption is associated with higher environmental preferences, these final two results appear to imply that individuals with stronger preferences for the environment are more likely to sign up for paperless billing. [21]

[19]In other words, if we consider the effect of the cognitive dissonance treatment for each individual in the sample separately—holding constant all other characteristics of that individual—and then take the mean of these marginal effects across all individuals in the sample, we see that the average marginal effect is to increase the likelihood of signing up to e-billing by 1.2%.

[20]There are no significant interaction effects between gender and treatment; these results are available upon request.

[21]The data do not include household size, income, or age, so consumption may also act as a proxy for wealth, number of residents, or age (and therefore also potentially computer literacy) as opposed to environmental preference. We are unable to make this distinction using the data provided.

3.2 Treatment effect heterogeneity

Since we do not have gender data for the 1844 individuals identified with the title of either 'Doctor' or 'Professor', we run the logit for the two samples independently. That is, in the absence of an all-inclusive continuous or categorical measure for education, we run the same regression as in Table 3 exclusively for the 'postgraduate education' sample (see Table 4). Contrary to the main sample, the cognitive dissonance intervention quite drastically backfires when we consider Doctors and Professors only, decreasing the odds of sign-up by 43.0%. Again, provision of statistics on associated environmental damage does not significantly affect the odds of paperless take-up. Consumption does not predict behavior among this subsample, while again being a dual-fuel customer improves the probability that the individual will sign up quite substantially ($p<0.01$).

If we instead run a logistic regression on the full sample that includes interaction terms between assigned treatment and a dummy indicating whether the individual is in the postgraduate education sample, we find a similar result (Table A3). On average, having extensive postgraduate education increases the odds of signing up to e-billing by 32% ($p=0.141$). Without controlling for gender, the odds of signing up to e-billing in the cognitive dissonance (without image) treatment increase by 10.7% ($p=0.096$) in the main sample, while the odds decrease by 48.7% ($p=0.023$) for Doctors and Professors. Thus, we find evidence that cognitive dissonance indeed backfires among the highly educated, both in a regression with a stratified sample of interest and in a regression using interaction terms among the full sample, suggesting a potential role for heterogeneous treatment of individuals to maximize e-billing uptake.

4 Discussion

In line with the literature, the results of the experiment indicate that environmental information and imagery do not affect individuals' propensity to opt into receiving paperless communications, even among purportedly green consumers. However, appealing to customers' desire for consistency of self-concept holds promise, though it backfires among the postgraduate education sample. Furthermore, our findings contradict the general conclusion in the literature that females are more likely to engage in environmental behaviors than males. The results indicate that informational campaigns are likely ineffective in promoting environmental behaviors, and that individuals with revealed altruistic preferences toward the environment may be susceptible to messaging invoking

feelings of cognitive dissonance. Imagery does not encourage environmental behavior in this context.

Given that the information provided is both easily available and free to access, the non-effect of environmental information speaks to many existing and emerging strands of literature on information and behavior. For example, the results fall in line with the notion of information avoidance, where individuals actively choose to evade information that might make them engage in altruistic behaviors that they otherwise do not wish to perform (Cain and Dana, 2012; Golman et al., 2015). An alternative explanation stemming from a phenomenon called moral licensing suggests that individuals who 'do good' along one dimension may allow themselves to 'do bad' (or simply not 'do good') along another (see Merritt et al., 2010). Alternatively, perhaps the information is sufficient to change beliefs and intentions (as claimed in Abrahamse et al., 2005), though intentions have only been shown to be poorly correlated with behavior change (Webb and Sheeran, 2006). Another possible explanation is that GE customers are already well aware of such information so that additional information has little effect on their beliefs—in line with a 'diminishing returns' argument (Stern, 2000)—or that the externalities are not sufficiently severe to induce change.

Moreover, the experiment demonstrates that particular individuals may be more or less susceptible to certain behavioral anomalies. In our case, individuals titled 'Doctor' or 'Professor' are far less likely to opt into e-billing if they receive the dissonance-inducing intervention as opposed to the control intervention. One possible explanation is that individuals in the postgraduate sample have higher cognitive skills, and that such cognitive skills determine levels of experienced dissonance in the same way they have been experimentally demonstrated to determine risk preferences and impatience ((Dohmen et al., 2010)). Another possible reason for this contrasting effect may be due to such individuals' altruistic fulfillment in their field of work. Therefore, issues of convenience—as highlighted in the control letter—may override concerns for maintaining an altruistic self-concept. A third explanation rests in line with Akerlof and Dickens's theory in the sense that selection into a green utility provider will solidify conviction of one's own environmental consciousness and will justify receipt of paper billing; when paperless billing is subsequently offered in the second period, the individual has altered her attitude toward the environmental harm of paper billing.

In sum, this research suggests that green businesses should consider abandoning the use of information regarding environmental externalities as a tool to encourage environmentally beneficial decision making, and rather appeal to their customer bases using more subtle tactics rooted in the psychology of

cognitive dissonance, with careful attention to the audience of the messaging. Indeed, there are many additional tactics that could be equally—or possibly more—effective in encouraging particular types of customers to continue to make decisions in line with their past behaviors, and businesses can test various interventions to identify subgroups to receive tailored interventions. This particular tactic may well generalize to other groups of socially responsible consumers, such as donors to particular causes or voters who have historically engaged in altruistic or civic behaviors. Further research should aim to gain a more nuanced understanding of the types of individuals who may or may not be responsive to messaging that appeals to desires for consistency in the self-concept to elucidate the underlying reason for this puzzling heterogeneity in the observed responses in this study.

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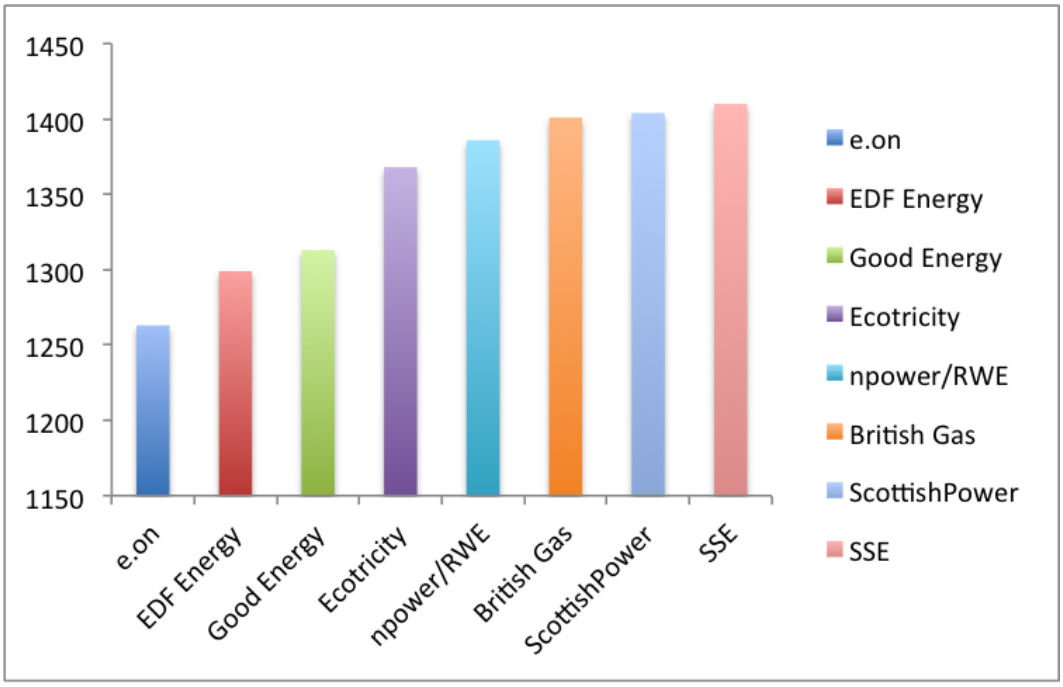
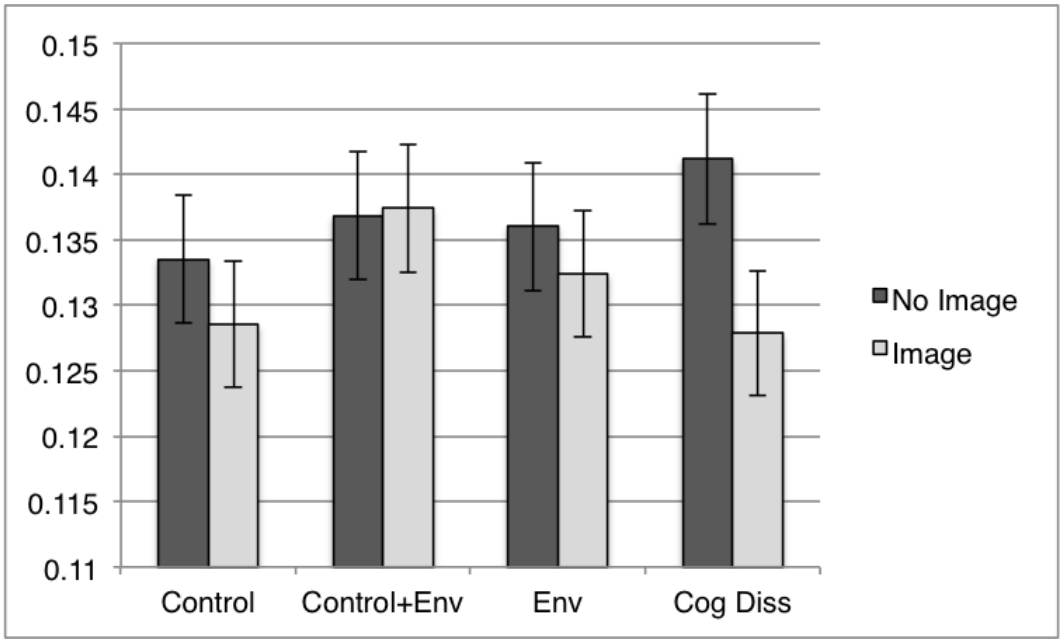
5 Figures and Tables

Figure 1: Average Standard Dual Fuel Bill (£/year, per home)



Notes: The data above were taken from Energy Helpline on 18 November 2013 and is based on 3,300 kWh of electricity and 16,500 kWh of natural gas paid using direct debit on the standard variable rate. The source of this chart is "Green Energy Suppliers in the UK Compared to the Big 6", accessed 30 March 2016 < http://shrinkthatfootprint.com/green-electrical-supply-uk-big-6>.

Figure 2: E-billing Uptake According to Group Assignment



Notes: The above bar graph shows the proportion of each study group that signed up to e-billing, with standard error bars.

Table 1: Treatment Group Design

Content	Text	*Control*	*Environmental Framing*	*Control + Environmental Framing*	*Cognitive Dissonance*
Availability and Online Access	**It's finally here!** Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.	✓	✓	✓	✓
Customer Benefits	**The benefits of switching from paper billing to e-billing:** • Access bills 24/7 online; • Spend less time sorting through mail; • Reduce paper waste;	✓		✓	✓
Environmental Benefits	**If all customers make the switch, we would save 46 trees worth of paper each year!** **Why reduce paper waste?** • The average UK family throws away 6 trees worth of paper in their household bin each year. • Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively) • 12.5 million tonnes of paper and cardboard are used annually in the UK making us the 11th worst paper offender in the world		✓	✓	
Environmental Steward	**As a Good Energy customer, you are an environmental steward.** By switching to e-billing, you take another important step to eliminate the environmental impact of your energy use.				✓

Notes: While the *Control and Environmental Framing* intervention simply adds environmental information to the *Control* email, the email doubles in length with the addition. Therefore, we also include the *Environmental Framing* intervention that is a similar length and format to the *Control* email so that we can 'control' for the added complexity of including a large amount of additional information to the *Control* email. All even-numbered groups receive the treatment with the image.

Table 2a: Balance Check: Groups With vs. Without Images

	Group 1	Group 2	Test of Equality: 1=2	Group 3	Group 4	Test of Equality: 3=4	Group 5	Group 6	Test of Equality: 5=6	Group 7	Group 8	Test of Equality: 7=8
Fuel Type:												
Dual Fuel	0.409	0.411	p=0.824	0.410	0.409	p=0.930	0.408	0.407	p=0.991	0.409	0.409	p=0.975
	(0.492)	(0.492)		(0.492)	(0.492)		(0.491)	(0.491)		(0.492)	(0.492)	
Gas	0.062	0.062	p=0.949	0.063	0.061	p=0.628	0.062	0.062	p=0.967	0.062	0.062	p=0.943
	(0.241)	(0.241)		(0.243)	(0.239)		(0.241)	(0.241)		(0.242)	(0.241)	
Electricity	0.529	0.527	p=0.803	0.527	0.53	p=0.748	0.530	0.531	p=0.975	0.529	0.530	p=0.948
	(0.499)	(0.499)		(0.499)	(0.499)		(0.499)	(0.499)		(0.499)	(0.499)	
Gas	13.949	13.807	p=0.602	13.863	13.605	p=0.324	13.633	13.781	p=0.575	13.886	13.672	p=0.426
Consumption	(9.352)	(9.025)		(9.038)	(8.590)		(8.757)	(9.092)		(9.284)	(8.864)	
Electricity	3.720	3.622	p=0.190	3.753	3.626	p=0.107	3.625	3.672	p=0.531	3.685	3.640	p=0.548
Consumption	(3.845)	(3.231)		(4.162)	(3.283)		(3.419)	(3.671)		(3.419)	(3.615)	
Days as	314.8	313.9	p=0.887	312.1	313.3	p=0.861	317.4	317.2	p=0.977	316.7	318.8	p=0.770
Customer	(333.9)	(321.0)		(327.5)	(333.8)		(338.3)	(344.0)		(342.4)	(346.7)	
Gender	0.469	0.468	p=0.952	0.470	0.471	p=0.907	0.470	0.470	p=0.991	0.469	0.472	p=0.677
	(0.499)	(0.499)		(0.499)	(0.499)		(0.499)	(0.499)		(0.499)	(0.499)	
Postgraduate	0.045	0.046	p=0.860	0.050	0.051	p=0.830	0.048	0.051	p=0.446	0.046	0.045	p=0.677
Education	(0.208)	(0.210)		(0.217)	(0.219)		(0.213)	(0.220)		(0.210)	(0.207)	
Sample Size	4817	4825		4834	4850		4830	4838		4825	4836	

Notes: The table checks for balance across observables for groups with identical intervention content, where one group receives the environmental image and the other does not. The p-values in the table derive from chi-square tests (for comparisons of dummy and categorical variables) and t-tests (for comparisons of continuous variables). Group 1 is the Control group, 2 is Control with image, 3 is the Control and Environmental Framing, 4 is Control and Environmental Framing with image, 5 is Environmental Framing, 6 is Environmental Framing with image, 7 is Cognitive Dissonance, and 8 is Cognitive Dissonance with image. The table pertains to individuals in the entire sample, except for the following: gender balance tests are conducted only for individuals for whom gender is identified, and balance tests on annual gas and electricity consumption are conducted only for individuals who consume gas and energy, respectively. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where "dual fuel" indicates that they receive both gas and electricity. Gas and electricity consumption are estimated annual usage values measured at the unit of 1000 kWh. Female is equal to one if the customer is female, and postgraduate education is equal to 1 if the customer holds a title of 'Doctor' or 'Professor'. Standard deviations are reported below means in parentheses.

Table 2b: Balance Check: Control vs. Treatments

	Test of Equality: 1=3	Test of Equality: 1=4	Test of Equality: 1=5	Test of Equality: 1=6	Test of Equality: 1=7	Test of Equality: 1=8
Fuel Type:						
Dual Fuel	p=0.923	p=0.993	p=0.886	p=0.877	p=0.998	p=0.971
Gas	p=0.762	p=0.856	p=0.934	p=0.968	p=0.947	p=0.972
Electricity	p=0.809	p=0.937	p=0.919	p=0.894	p=0.972	p=0.985
Gas Cons.	p=0.751	p=0.197	p=0.240	p=0.540	p=0.819	p=0.305
Electricity Cons.	p=0.700	p=0.208	p=0.214	p=0.540	p=0.645	p=0.310
Days as Customer	p=0.681	p=0.815	p=0.709	p=0.733	p=0.787	p=0.573
Gender	p=0.937	p=0.845	p=0.897	p=0.906	p=0.949	p=0.792
Postgrad. Educ.	p=0.330	p=0.234	p=0.622	p=0.210	p=0.820	p=0.850
Day of Week	p=0.998	p=0.971	p=0.925	p=0.992	p=0.912	p=0.759

Notes: The table checks for balance on observables between the control group and all treatment groups (see Table 2a for means and sample sizes). The p-values in the table derive from chi-square tests (for comparisons of dummy and categorical variables) and t-tests (for comparisons of continuous variables). Group 1 is the Control group, 2 is Control with image, 3 is the Control and Environmental Framing, 4 is Control and Environmental Framing with image, 5 is Environmental Framing, 6 is Environmental Framing with image, 7 is Cognitive Dissonance, and 8 is Cognitive Dissonance with image. The table pertains to individuals in the entire sample, except for the following: gender balance tests are conducted only for individuals for whom gender is identified, and balance tests on annual gas and electricity consumption are conducted only for individuals who consume Good Energy gas and energy, respectively. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where "dual fuel" indicates that they receive both gas and electricity. Gas and electricity consumption are estimated annual usage values measured at the unit of 1000 kWh. Female is equal to one if the customer is female, and postgraduate education is equal to 1 if the customer holds a title of 'Doctor' or 'Professor'. Day of week is a categorical variable indicating the day of week on which the customer received the treatment email; since means do not provide valuable information for this variable, we simply report the p-value for the chi-square test.

Table 2c: Balance Check (Postgraduate Sample): Groups With vs. Without Images

	Group 1	Group 2	Test of Equality: 1=2	Group 3	Group 4	Test of Equality: 3=4	Group 5	Group 6	Test of Equality: 5=6	Group 7	Group 8	Test of Equality: 7=8
Fuel Type:												
Dual Fuel	0.388	0.422	p=0.475	0.413	0.400	p=0.710	0.391	0.385	p=0.881	0.433	0.449	p=0.735
	(0.488)	(0.495)		(0.493)	(0.490)		(0.489)	(0.487)		(0.497)	(0.499)	
Gas	0.064	0.067	p=0.887	0.083	0.090	p=0.800	0.074	0.077	p=0.901	0.058	0.056	p=0.911
	(0.245)	(0.251)		(0.277)	(0.286)		(0.262)	(0.267)		(0.234)	(0.230)	
Electricity	0.548	0.511	p=0.439	0.504	0.514	p=0.824	0.535	0.538	p=0.936	0.509	0.495	p=0.776
	(0.499)	(0.500)		(0.501)	(0.501)		(0.500)	(0.500)		(0.501)	(0.501)	
Gas	16.736	15.542	p=0.409	15.829	16.178	p=0.806	15.463	15.479	p=0.991	16.257	14.977	p=0.317
Consumption	(9.921)	(10.777)		(10.942)	(10.988)		(9.509)	(9.998)		(9.861)	(9.006)	
Electricity	3.898	3.766	p=0.672	3.827	3.627	p=0.498	3.673	3.840	p=0.567	4.422	3.499	p=0.068
Consumption	(3.134)	(3.208)		(3.434)	(2.748)		(2.965)	(3.138)		(5.937)	(4.169)	
Days as	341.2	354.4	p=0.737	303.3	308.0	p=0.848	311.9	352.2	p=0.265	282.3	302.6	p=0.130
Customer	(427.5)	(396.7)		(241.3)	(289.6)		(321.2)	(451.5)		(81.1)	(182.1)	
Sample Size	219	223		240	245		230	247		224	216	

Notes: The table checks for balance of observables within the postgraduate education sample across groups with identical intervention content, where one group receives the environmental image and the other does not. The p-values in the table derive from chi-square tests (for comparisons of dummy and categorical variables) and t-tests (for comparisons of continuous variables). Group 1 is the Control group, 2 is Control with image, 3 is the Control and Environmental Framing, 4 is Control and Environmental Framing with image, 5 is Environmental Framing, 6 is Environmental Framing with image, 7 is Cognitive Dissonance, and 8 is Cognitive Dissonance with image. Balance tests on annual gas and electricity consumption are conducted only for individuals who consume gas and energy, respectively. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where "dual fuel" indicates that they receive both gas and electricity. Gas and electricity consumption are estimated annual usage values measured at the unit of 1000 kWh. Standard deviations are reported below means in parentheses.

Table 2d: Balance Check (Postgraduate Sample): Control vs. Treatments

	Test of Equality: 1=3	Test of Equality: 1=4	Test of Equality: 1=5	Test of Equality: 1=6	Test of Equality: 1=7	Test of Equality: 1=8
Fuel Type:						
Dual Fuel	p=0.595	p=0.864	p=0.945	p=0.938	p=0.337	p=0.198
Gas	p=0.428	p=0.298	p=0.677	p=0.585	p=0.796	p=0.713
Electricity	p=0.348	p=0.468	p=0.780	p=0.837	p=0.411	p=0.272
Gas Cons.	p=0.526	p=0.697	p=0.348	p=0.359	p=0.728	p=0.182
Electricity Cons.	p=0.825	p=0.342	p=0.452	p=0.849	p=0.262	p=0.275
Days as Customer	p=0.238	p=0.411	p=0.788	p=0.323	p=0.044	p=0.222

Notes: The table checks for balance on observables within the postgraduate education sample between the control group and all treatment groups (see Table 2c for means and sample sizes). The p-values in the table derive from chi-square tests (for comparisons of dummy and categorical variables) and t-tests (for comparisons of continuous variables). Group 1 is the Control group, 2 is Control with image, 3 is the Control and Environmental Framing, 4 is Control and Environmental Framing with image, 5 is Environmental Framing, 6 is Environmental Framing with image, 7 is Cognitive Dissonance, and 8 is Cognitive Dissonance with image. Balance tests on annual gas and electricity consumption are conducted only for individuals who consume Good Energy gas and energy, respectively. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh. The fuel type dummy variables specify the type of fuel the customer receives from Good Energy, where "dual fuel" indicates that they receive both gas and electricity. Gas and electricity consumption are estimated annual usage values measured at the unit of 1000 kWh. Female is equal to one if the customer is female, and postgraduate education is equal to 1 if the customer holds a title of 'Doctor' or 'Professor'. Day of week is a categorical variable indicating the day of week on which the customer received the treatment email; since means do not provide valuable information for this variable, we simply report the p-value for the chi-square test.

Table 3: Logit Regression — Main Sample

	OR	Marginal	OR	Marginal
G2: Control, Image	0.971	-0.003	0.968	-0.004
	(0.060)	(0.007)	(0.060)	(0.007)
G3: Env	1.017	0.002	1.018	0.002
	(0.062)	(0.007)	(0.063)	(0.007)
G4: Env, Image	0.997	-0.000	0.996	-0.000
	(0.061)	(0.007)	(0.062)	(0.007)
G5: Control Env	1.042	0.005	1.042	0.005
	(0.064)	(0.007)	(0.064)	(0.007)
G6: Control Env, Image	1.046	0.005	1.047	0.005
	(0.064)	(0.007)	(0.064)	(0.007)
G7: Cog Diss	1.105*	0.012*	1.107*	0.012*
	(0.067)	(0.007)	(0.067)	(0.007)
G8: Cog Diss, Image	0.964	-0.004	0.965	-0.004
	(0.06)	(0.007)	(0.06)	(0.007)
Gas Consumption			0.996*	-0.001*
			(0.002)	(0.000)
Energy Consumption			0.986***	-0.002***
			(0.005)	(0.001)
Tariff: Gas Only			0.597***	-0.050***
			(0.043)	(0.006)
Tariff: Electric Only			0.569***	-0.065***
			(0.026)	(0.005)
Female			0.735***	-0.035***
			(0.023)	(0.004)
Constant	0.152***		0.257***	
	(0.007)		(0.015)	
Observations	36,810	36,810	36,810	36,810
Controls	No	No	Yes	Yes

Notes: The above logit regression pertains to individuals in the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Table 4: Logit Regression — Postgraduate Education Sample

	OR	Marginal	OR	Marginal
G2: Control, Image	0.946	-0.007	0.929	-0.009
	(0.245)	(0.032)	(0.242)	(0.032)
G3: Env	1.110	0.014	1.10	0.012
	(0.275)	(0.034)	(0.274)	(0.033)
G4: Env, Image	0.992	-0.001	0.986	-0.002
	(0.249)	(0.032)	(0.249)	(0.032)
G5: Control Env	0.943	-0.007	0.936	-0.008
	(0.243)	(0.032)	(0.242)	(0.032)
G6: Control Env, Image	0.867	-0.018	0.869	-0.017
	(0.222)	(0.031)	(0.224)	(0.031)
G7: Cog Diss	0.582*	-0.060**	0.570*	-0.062**
	(0.166)	(0.027)	(0.164)	(0.027)
G8: Cog Diss, Image	0.917	-0.011	0.876	-0.016
	(0.241)	(0.032)	(0.232)	(0.032)
Gas Consumption			1.001	0.000
			(0.009)	(0.001)
Energy Consumption			0.969	-0.004
			(0.024)	(0.003)
Tariff: Gas Only			0.446***	-0.081***
			(0.137)	(0.024)
Tariff: Electric Only			0.655**	-0.054**
			(0.132)	(0.026)
Constant	0.197***		0.285***	
	(0.036)		(0.070)	
Observations	1844	1844	1844	1844
Controls	No	No	Yes	Yes

Notes: The above logit regression pertains to individuals in the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

A Appendix: Additional Tables and Figures

Table A1: Proportion Signed up to E-Billing: Chi-Square Tests Comparing Experimental Conditions

	Control (C)	Environmental Framing (EF)	Test of Equality: C vs. EF	Control and Environmental Framing (CEF)	Test of Equality: C vs. CEF	Test of Equality EF vs. CEF	Cognitive Dissonance (CD)	Test of Equality C vs. CD
Full Sample:								
No Image	0.134	0.136		0.138			0.142	
	(0.340)	(0.343)	p=0.693	(0.345)	p=0.539	p=0.826	(0.349)	p=0.226
	N=4817	N=4830		N=4834			N=4824	
Image	0.130	0.134		0.138			0.129	
	(0.337)	(0.340)	p=0.624	(0.345)	p=0.261	p=0.526	(0.335)	p=0.893
	N=4825	N=4838		N=4850			N=4836	
Pooled	0.132	0.135		0.138			0.136	
	(0.338)	(0.342)	p=0.532	(0.345)	p=0.219	p=0.546	(0.343)	p=0.439
	N=9642	N=9668		N=9684			N=9660	
Main Sample:								
No Image	0.132	0.134		0.137			0.144	
	(0.339)	(0.341)	p=0.781	(0.344)	p=0.498	p=0.690	(0.351)	p=0.098
	N=4598	N=4590		N=4604			N=4600	
Image	0.129	0.132		0.138			0.128	
	(0.335)	(0.338)	p=0.661	(0.344)	p=0.221	p=0.433	(0.334)	p=0.918
	N=4602	N=4593		N=4603			N=4620	
Pooled	0.131	0.133		0.137			0.136	
	(0.337)	(0.340)	p=0.612	(0.344)	p=0.179	p=0.403	(0.343)	p=0.398
	N=9200	N=9183		N=9207			N=9220	
Postgraduate Sample:								
No Image	0.164	0.179		0.157			0.103	
	(0.371)	(0.384)	p=0.675	(0.364)	p=0.820	p=0.512	(0.304)	p=0.056
	N=219	N=240		N=230			N=224	
Image	0.157	0.163		0.146			0.153	
	(0.365)	(0.370)	p=0.852	(0.354)	p=0.735	p=0.591	(0.361)	p=0.904
	N=223	N=245		N=247			N=216	
Pooled	0.161	0.171		0.151			0.127	
	(0.368)	(0.377)	p=0.668	(0.358)	p=0.686	p=0.394	(0.334)	p=0.778
	N=442	N=485		N=477			N=440	

Notes: The table shows the results of tests of equality of proportion of individuals who sign up across experimental conditions for all subjects in the study sample, where groups with and without images (e.g., G1 and G2) are pooled in the final row. Standard deviations are presented below means in parentheses.

Table A2: Effects of Observed Covariates
(Control Group Only)

	OR	Marginal
Electricity Consumption	0.993	-0.001
	(0.007)	(0.001)
Gas Consumption	0.985	-0.002
	(0.014)	(0.002)
Tariff: Gas Only	0.581***	-0.052***
	(0.118)	(0.016)
Tariff: Electricity Only	0.530***	-0.073***
	(0.069)	(0.015)
Female	0.735***	-0.036***
	(0.065)	(0.010)
Constant	0.272***	
	(0.032)	
Observations	4598	4598

Notes: The above logit regression pertains to the individuals in the control group (without image) of the main sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Table A3: Postgraduate Education and Treatment

	OR	Marginal
G2: Control, Image	0.969	-0.004
	(0.060)	(0.007)
G3: Env	1.018	0.003
	(0.063)	(0.007)
G4: Env, Image	0.996	-0.001
	(0.062)	(0.007)
G5: Control Env	1.042	0.004
	(0.064)	(0.007)
G6: Control Env, Image	1.047	0.004
	(0.064)	(0.007)
G7: Cog Diss	1.107*	0.008
	(0.067)	(0.007)
G8: Cog Diss, Image	0.965	-0.005
	(0.060)	(0.007)
G2*Educ	0.956	
	(0.256)	
G3*Educ	0.898	
	(0.238)	
G4*Educ	0.826	
	(0.219)	
G5*Educ	1.074	
	(0.276)	
G6*Educ	0.987	
	(0.256)	
G7*Educ	0.513**	
	(0.150)	
G8*Educ	0.912	
	(0.247)	
Gas Consumption	0.996	-0.000
	(0.002)	(0.000)
Energy Consumption	0.987***	-0.002***
	(0.005)	(0.001)
Tariff: Gas Only	0.605***	-0.050***
	(0.042)	(0.006)
Tariff: Electric Only	0.581***	-0.063***
	(0.026)	(0.005)
Educ	1.319	0.019**
	(0.248)	(0.009)
Constant	0.220***	
	(0.012)	
Observations	38,654	38,654

Notes: The above logit regression includes all individuals in the study sample. Annual estimated energy and gas consumption are measured at the unit of 1000 kWh.

Figure A1: Control Intervention

From: **Good Energy** noreply@goodenergy.co.uk
Subject: Go paperless with Good Energy!
Date: September 4, 2014 at 5:58 AM
To:

GE

Good Energy

Switch for Good

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

Here at Good Energy, we prioritise customer satisfaction. The opportunity to switch to e-billing is just one more step we have taken to keep you smiling.

The benefits of switching from paper billing to e-billing:

- Reduce paper waste
- Spend less time sorting through mail
- Access bills 24/7 online

Go on – it's easy! **Switch to e-billing here**.

Let's work together to better the world of energy.

Best wishes,

Dave Ford
Chief Operating Officer

Good Energy, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Registered Office: Good Energy Limited, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Company Registration No. 3899612, Place of Registration: England and Wales. VAT No. 811 3295 57

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Figure A2: Environmental Framing Intervention

From: **Good Energy** noreply@goodenergy.co.uk
Subject: Go paperless with Good Energy!
Date: September 4, 2014 at 7:55 AM
To:

GE

Good Energy

Switch for Good

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

If all of our customers make the switch, we would save 46 trees worth of paper each year!*

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

Here at Good Energy, we prioritise customer satisfaction as well as the environment. The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint.

Why reduce paper waste?

- The average UK family throws away 6 trees worth of paper in their household bin each year.
- Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively).
- 12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world.

Go on – it's easy! **Switch to e-billing here**.

Let's work together to better the world of energy.

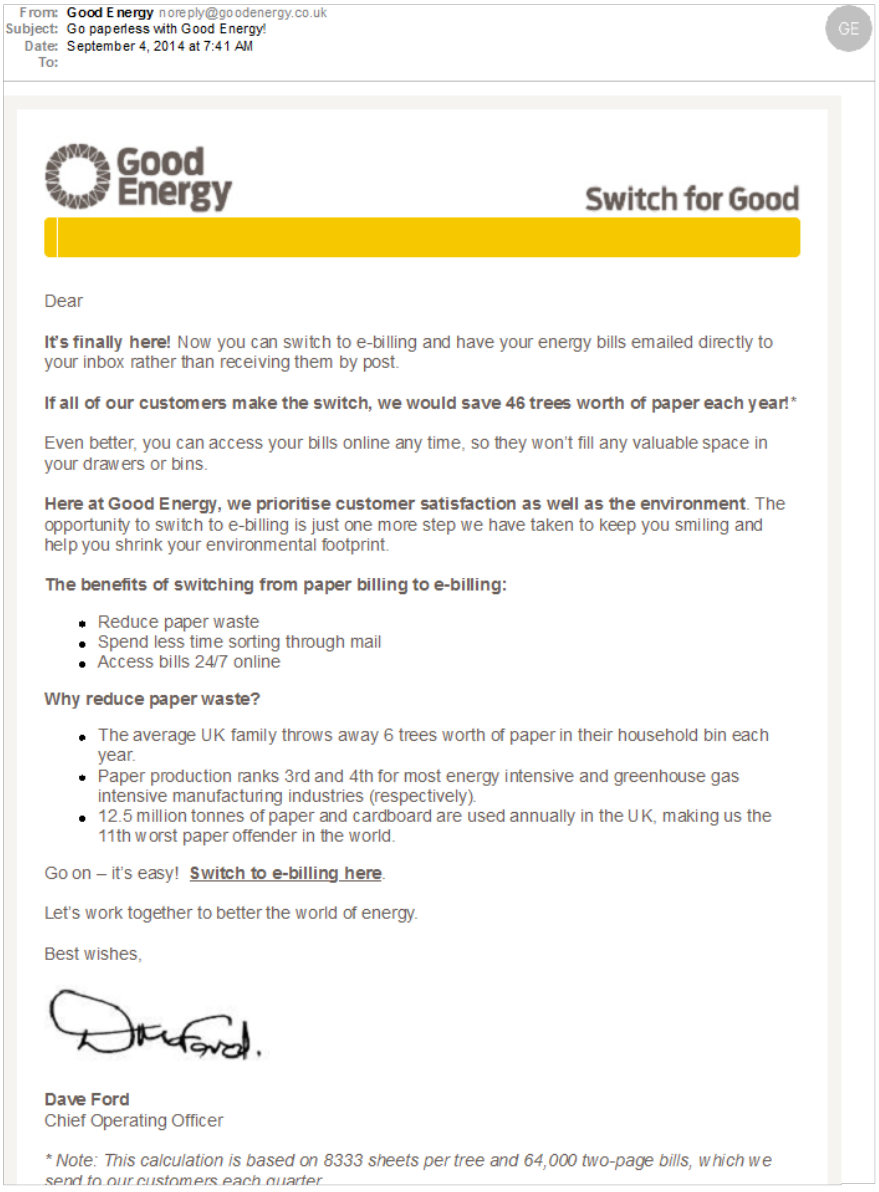
Best wishes,

Dave Ford
Chief Operating Officer

** Note: This calculation is based on 8333 sheets per tree and 64,000 two-page bills, which we send to our customers each quarter.*

Good Energy, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Registered Office: Good Energy Limited, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
Company Registration No. 3899612, Place of Registration: England and Wales. VAT No. 811 3295 57

Figure A3: Control and Environmental Framing Intervention



From: **Good Energy** noreply@goodenergy.co.uk
Subject: Go paperless with Good Energy!
Date: September 4, 2014 at 7:41 AM
To:

GE

Good Energy

Switch for Good

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

If all of our customers make the switch, we would save 46 trees worth of paper each year!*

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

Here at Good Energy, we prioritise customer satisfaction as well as the environment. The opportunity to switch to e-billing is just one more step we have taken to keep you smiling and help you shrink your environmental footprint.

The benefits of switching from paper billing to e-billing:

- Reduce paper waste
- Spend less time sorting through mail
- Access bills 24/7 online

Why reduce paper waste?

- The average UK family throws away 6 trees worth of paper in their household bin each year.
- Paper production ranks 3rd and 4th for most energy intensive and greenhouse gas intensive manufacturing industries (respectively).
- 12.5 million tonnes of paper and cardboard are used annually in the UK, making us the 11th worst paper offender in the world.

Go on – it's easy! **Switch to e-billing here**.

Let's work together to better the world of energy.

Best wishes,

Dave Ford
Chief Operating Officer

** Note: This calculation is based on 8333 sheets per tree and 64,000 two-page bills, which we send to our customers each quarter.*

Figure A4: Cognitive Dissonance Intervention

From: **Good Energy** noreply@goodenergy.co.uk
Subject: Go paperless with Good Energy!
Date: September 4, 2014 at 8:02 AM
To:

GE

Good Energy

Switch for Good

Dear

It's finally here! Now you can switch to e-billing and have your energy bills emailed directly to your inbox rather than receiving them by post.

Even better, you can access your bills online any time, so they won't fill any valuable space in your drawers or bins.

As a Good Energy customer, you are an environmental steward. By switching to e-billing, you take another important step to eliminate the environmental impact of your energy use.

The benefits of switching from paper billing to e-billing:

- Access bills 24/7 online
- Spend less time sorting through mail
- Reduce paper waste

Go on – it's easy! **Switch to e-billing here**.

Let's work together to better the world of energy.

Best wishes,

Dave Ford
Chief Operating Officer

Good Energy, Monkton Reach, Monkton Hill, Chippenham, SN15 1EE
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Figure A5: Email Image