Factors associated with the adoption of renewable energy amongst botanical garden members

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Abstract

We examine the factors related to the adoption of renewable energy amongst members of a botanical garden. We surveyed botanical garden members roughly seven months after the garden began incentivizing visitors to switch their household energy supplier to a renewable energy provider, offering a free year of membership to those who switched to renewable energy on site. We examine two related research questions: what factors are related to a) already having one’s household run on renewable energy at the time the incentive was put into place and b) switching to renewable energy on site? We find that politically liberal participants were more likely to already use renewable energy, and that younger participants and those who had a pleasant on-site interaction with the renewable energy supplier were more likely to switch to renewable energy on site. We discuss the implications of our findings for encouraging uptake of renewables.

Choosing to run one’s household on renewable energy, whether through technologies such as solar panels, or purchasing energy from renewable sources through the grid, is one way in which American citizens can take personal action to counter climate change. Because of the importance of the large-scale adoption of renewable energy sources to meaningfully reduce the amount of carbon dioxide released into the atmosphere (Hawken 2017, Intergovernmental Panel on Climate Change (2012)), research is needed to understand the factors associated with public adoption of renewable energy to power their households. We investigated this question by conducting a survey of members of a botanical garden in a mid-sized Northeastern city. We leveraged the botanical garden’s offer of free membership to those who signed up for household renewable energy on site while visiting the garden, at a table hosted by a regional renewable energy supplier. Amongst this already environmentally engaged population, we asked which demographic and attitudinal factors were associated with already having one’s household run on renewable energy, and with switching to renewable energy on site in response to the incentive.

Factors associated with the usage of renewable energy

We conducted a literature review to examine the demographic and attitudinal factors related to the uptake of renewable energy by American households, expanding our review to encompass related behaviors, such as willingness to pay for renewable energy, and non-American households in areas where the literature was slim.

Demographic factors

When energy suppliers offer ‘green power’ options such as renewable energy investments, surveys indicate that residential energy consumers are willing to pay a premium to support technologies that have a lower carbon
footprint. Research understanding factors that contribute to ‘willingness to pay’ and energy efficiency technology adoption among the general public indicates a wide range of demographic factors influence these behaviors (reviewed in Frederiks et al. 2015). On balance, higher income, larger households, and those with more savings are more likely to support renewable energy investments or adopt technologies in their homes (Roe et al. 2001, Clark et al. 2003, Mozumder et al. 2011, Zarnikau 2003, Ameli and Brandt 2015, Aravena et al. 2016; but see Olli et al. 2001). Another study found that parents with children under the age of 18 are more likely to express more negative views about fossil fuels when exposed to a clean energy campaign framed in terms of health impacts to children, as compared to parents whose children were not under the age of 18 (Hanus et al. 2018). Educational attainment is inconsistently associated with higher adoption of renewable energy investments (Olli et al. 2001, Zarnikau 2003). There is also inconsistent support for gender as a predictor of energy-efficiency adoption, though Olli et al. (2001) did find that women exhibited more environmentally-friendly behavior than men. Ameli and Brandt (2015) found differential adoption of energy-efficient technologies by age, suggesting that older survey respondents may prefer well-known energy efficiency measures, while younger respondents may be more open to newer technologies. Politically conservative Americans are less likely to believe in and express concern about climate change (McCright et al. 2016), and are less likely to support investment in energy-efficient technology by individuals, the US government, and US businesses (Gromet, Kunreuther & Larrick, 2013).

Attitudinal factors
There is great complexity in the links among environmental awareness, attitudes, and identities and engagement in pro-environmental behaviors (reviewed in Stern 2014 and Frederiks et al. 2015). Pro-environmental attitudes may encourage sustainable behavior but do not necessarily lead to actual behavior change or action, which is sometimes described as the ‘attitude-action gap’ (Frederiks et al. 2015). Prior research suggests that reducing household energy consumption requires a) knowledge of possible actions, b) motivation to take those actions, and c) the ability to take those actions (Steg 2008).

Some research suggests that engagement in low-carbon behaviors is motivated by frugality and an interest in saving money (Fujii 2006, Whitemarth 2009). In a sample of British adults skewed toward green consumers, Ozaki (2011) found that willingness to adopt green energy was positively related to perceived ease of adoption, familiarity with green energy, and perceived social pressure from people important to them to adopt green energy.

In a study among parents examining the effects of a clean energy campaign, participants with greater acceptance of climate change were more likely to agree to either sign a petition or leave a voice message for their utility, urging them to invest in clean energy and energy efficiency (Hanus et al. 2018). Hagen and Pijawka (2015) found that those who saw addressing climate change as a higher priority for governmental action expressed greater support for renewable energy policies, in general. Individuals with greater perceived consumer effectiveness, who are more likely to believe that the actions of an individual consumer can make a difference in terms of environmental impact, are more likely to purchase environmentally friendly products, recycle, and contribute to pro-environmental groups (Ellen et al. 1991, Antonetti and Maklan 2014, Sachdeva et al. 2015).

Behavioral spillover (Poortinga et al. 2013) suggests that individuals who already engage in pro-environmental behaviors may be more likely to engage in additional pro-environmental behaviors such as adopting renewable energy. However, because of the complex interplay of demographics, identities, and attitudes that influence environmental intention and behavior, there are often inconsistent spillover effects, which can lead to either more or less engagement in pro-environmental behaviors (Truelove et al. 2014). Engagement in pro-environmental behaviors may encourage changes in one’s environmental values or identity, which may further lead to behavioral changes that align with their revised identity (Whitemarth and O’Neill 2010). Conversely, pro-environmental behaviors can lead to negative spillover or ‘moral licensing,’ whereby engagement in one pro-environmental behavior leads to a decrease in other pro-environmental behaviors (Thøgersen and Crompton 2009).

Situational factors associated with switching energy providers on site
We next reviewed literature pertaining to the second part of our research question, which asked which demographic and attitudinal factors were associated with switching to renewable energy on-site at the botanical garden, at a table hosted by a regional renewable energy supplier, and with the incentive of a free one-year membership for switching.

Interpersonal dynamics
Research on the psychology of persuasion suggests that individuals are more likely to say yes to a request when it comes from someone that they like; people are more likely to like those to whom they are similar, and those with whom they are working toward mutual goals (Cialdini, 1984). This suggests that visitors may be more likely to
switch to renewables on site when they perceive the representative of the regional renewable energy supplier as similar to them, or if they feel that they share a goal of addressing climate change with the representative. Similarly, in the service industry, service personnel act as marketers for their product and 'become' the service or company in consumers’ eyes; quality of interactions between service personnel and consumers are important in determining consumer perceptions of service quality and consumer behavior (Parasuraman et al 1985, Zeithaml et al 1996). These results suggest that a customer’s decision to switch to renewable energy may reflect their perception of the representative rather than solely their perception of the renewable energy service itself.

**Effects of the incentive**

Incentives can be powerful influences on human behavior, but have also been shown to backfire in situations where they conflict with or undermine other psychological motivations, such as social norms (Fehr and Falk 2002, Steg and Vlek 2009). Psychological research suggests that providing extrinsic rewards can undermine one’s intrinsic motivation for completing a task (Deci et al 1999). Providing botanical garden visitors, who are likely already intrinsically motivated to take action on climate change, with an extrinsic incentive for switching may reduce their intrinsic motivation to switch, with unclear effects on overall switching rates.

**Hypotheses**

We examine how demographic and attitudinal factors are related to the uptake of renewable energy amongst members of a botanical garden. Our study’s research questions address several key gaps highlighted in our literature review. First, little previous research has focused directly on adoption of renewables, instead examining related dependent measures such as attitudes toward renewable energy, and household energy usage behaviors (Abrahamse et al 2005, Frederiks et al 2015, Nisa et al 2019, Steg and Vlek 2009). Our study builds on this prior work by examining a behavior, renewable energy adoption, that has measurable and consequential impacts on the environment (Hawken 2017, Intergovernmental Panel on Climate Change (2012)). Moreover, our literature review also highlights several inconsistencies in the observed relationships between specific demographic and attitudinal predictors and renewable energy usage and attitudes, which we examine in our analyses. Based on the literature review, we hypothesize that education, income, political liberalism, female gender identity, budgetary usage, pro-environmental attitudes, perceived risk from climate change, and policy support for climate change will be associated with a greater likelihood of usage of renewable energy, and of switching on site to renewable energy. However, the literature does not suggest clear predictions with regards to age, having children, and engagement in other pro-environmental behaviors. Furthermore, we hypothesize that a positive interpersonal on-site interaction will predict greater likelihood of switching on site; the literature does not suggest clear predictions with regards to the effect of the incentive.

**Methods**

We conducted an email survey of botanical garden members approximately seven months after the botanical garden began offering free memberships to visitors who switched to renewable energy on site.

**Incentives to sign up for renewable energy on site**

Starting in January 2017, the botanical garden invited representatives of a regional renewable energy supplier to set up a table inside the botanical garden and solicit visitors to switch their household energy supplier. In the state in which the botanical garden is located, households and businesses can select the energy supplier from which their utility purchases their household or business’ electricity. Individuals and businesses may select energy suppliers based on factors including price and energy type. If a household switches energy supplier, the electric utility responsible for energy distribution and billing will remain the same.

The botanical garden offered visitors an incentive to switch their household energy supplier to this renewable energy supplier: those who switched on site would receive either a free yearlong membership, or, if they were already a member, a free sixth-month extension on their membership to the botanical garden.

Tabling times, recruitment strategies, and representatives of the regional renewable energy supplier varied; the regional renewable energy supplier was more likely to send representatives to the botanical garden on weekends and holidays, which tended to be peak days for the garden.
Participant recruitment

We recruited botanical garden members who had and had not received their membership by switching their household energy supplier on site via emails sent out to the member listserv from the botanical garden. Recruitment details are located in Supplementary Information.

Participants

In total, 21763 households were contacted. Of the total number of households recruited to take the survey, 2957 (14%) had received their membership, or an extension to their existing membership, by signing up for renewable energy on site, and 18806 (86%) current member households’ membership had not come through signing up for renewable energy. Out of the 21763 total initial recruitment emails sent out, 2256 (10%) households started and 1303 (6%) households completed the survey. Of the 1303 households who completed the survey, 19 did not give their informed consent to participate in the research; they were thanked for their time and not allowed to continue to the survey.

Of the final sample of 1284, the overall response rate was 6%, and did not differ across those who had and had not received their memberships by signing up for renewables. This response rate is similar to the observed 8% response rate for a written survey of residential energy-efficient and renewable energy products mailed to Floridian households (Zhao et al 2012).

Of the 1284 participants who gave their informed consent, 75% were female and the mean age was 51.3 (SD = 15.5). 64% indicated that they had children. 3% of participants reported holding at least some high school education or a high school GED; 7% had completed some college; 4% reported holding an associate’s degree; 34% a bachelor’s degree, and 50% a graduate degree. Mean political liberalism was 3.47 (SD = 1) on a 5-point scale where 1 = very conservative and 5 = very liberal; 13% reported considering themselves Republicans, 50% Democrats, and 19% Independents. Reporting demographic data was optional; in our regression analyses, we omit cases with missing data. A comparison of the participant population to the local population and to the population of botanical garden members is located in Supplementary Information.

Survey measures

Renewable energy behavior

The first section of the study concerned households’ renewable energy usage and usage of the membership incentive. Participants were asked a series of questions about their household energy supplier, with response options of Yes, No, and Don’t Know. Participants were first shown a short paragraph about switching their household electricity supplier, adopted from previous research (Hanus et al 2018). Next, participants were asked whether they had been approached by representatives of the regional renewable energy supplier while at the botanical garden, whether they had been asked to switch their energy supplier, and whether they had switched on site (figure 1). Those who indicated having been asked to switch, but had not switched on site, were asked if they switched to renewable energy later. All participants who did not indicate switching to renewable energy on site were asked if they had switched their household energy supplier for any reason since January 2017. All participants were asked whether their household currently ran on renewable energy or not.

Attitudinal and demographic factors

Full details pertaining to our measurement of participants’ perceptions of renewable energy, perceived pleasantness of the interpersonal interaction with the representative of the regional renewable energy supplier, pro-environmental behavioral consistency, perceptions of climate change, support for environmental policy, age, gender, education, budget usage, political liberalism, and ZIP code are located in the Supplementary Information.

Analysis strategy

We examined the factors associated with a) already having one’s household run on renewable energy at the time the incentive was put into place [Column 1 of table 1] and b) switching to renewable energy on site [Column 4 of table 1], given that one’s household was not already run on renewable energy. First, for each of these outcomes, we conducted a logistic regression predicting the likelihood of the target outcome as a function of six demographic factors (gender, age, education, political liberalism, having children, budgetary usage), two attitudinal factors (perceptions of climate change, support for environmental policy), prior behavior
(summarized by the index of pro-environmental behaviors), and, if applicable, one situational factor (pleasantness of the renewable energy representative). We also included two additional models [Columns 2 and 3 of table 1] that further break down the choice to switch on site by examining the likelihood of being approached by a representative of the renewable energy supplier while on site, and the likelihood of being asked to switch by the representative while on site. In the results reported in the text, we group together participants who responded either ‘no’ or ‘not sure’ to the items about whether they were approached on site, asked to switch to renewable energy on site, and switched to renewable energy on site. As a sensitivity analysis, we recalculated our results omitting those who gave ‘not sure’ responses to the items about being approached, asked, and switching on site [table S2 in Supplemental Information]. Results were largely unchanged. Next, we examined demographic and attitudinal differences across those respondents who were already using renewable energy at the time of the incentive, and those who switched to renewable energy on site, asking whether the incentive

Figure 1. Renewable energy behavior.
Table 1. Factors associated with renewable energy usage.

| Factor                        | Usage of renewable energy at the time the incentive was put into place | Approached at the botanical garden | Asked to switch to renewable energy, conditional on being approached | Switched to renewable energy, conditional on being asked |
|-------------------------------|------------------------------------------------------------------------|------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------|
|                               | B                         | 95% CI                             | B                         | 95% CI                             | B                         | 95% CI                             | B                         | 95% CI                             |
| Male                          | 0.074                     | −0.58, 0.73                        | 0.144                     | −0.16, 0.45                        | 0.389                     | −0.12, 0.89                        | 0.131                     | −0.39, 0.65                        |
| Age                           | 0.014                     | −0.01, 0.034                       | −0.016***                 | −0.025, −0.007                     | −0.021**                 | −0.035, −0.006                     | −0.017*                  | −0.03, −0.001                      |
| Education                     | 0.377                     | −0.00, 0.76                        | −0.093                    | −0.22, 0.037                       | 0.074                     | −0.12, 0.27                        | 0.132                     | −0.095, 0.36                       |
| Political liberalism          | 0.493**                   | 0.14, 0.85                         | 0.083                    | −0.073, 0.24                       | −0.035                   | −0.28, 0.21                        | 0.011                    | −0.26, 0.28                       |
| Has children                  | 0.296                     | −0.34, 0.93                        | −0.094                    | −0.38, 0.19                        | −0.049                   | −0.51, 0.41                        | −0.31                    | −0.81, 0.19                        |
| Budget usage                  | −0.11                     | −0.36, 0.14                        | 0.116                    | −0.004, 0.24                       | 0.01                     | −0.19, 0.21                        | −0.11                    | −0.32, 0.1                        |
| Median income in ZIP code     | 0.00                      | −0.00, 0.00                        | 0.00                     | −0.00, 0.00                        | 0.00                     | −0.00, 0.00                        | 0.00                     | −0.00, 0.00                        |
| Perceptions of climate change | −0.048                    | −0.55, 0.45                        | 0.167                    | −0.036, 0.37                       | −0.167                   | −0.5, 0.16                         | 0.15                     | −0.23, 0.53                        |
| Support for environmental policy | −0.019                   | −0.82, 0.78                        | −0.203                   | −0.53, 0.12                        | 0.346                    | −0.17, 0.86                        | −0.122                   | −0.7, 0.46                         |
| Pleasantness of representative | 2.109***                  | 1.6, 2.7                           | 2.109***                 | 1.6, 2.7                           | 2.109***                 | 1.6, 2.7                           | 2.109***                 | 1.6, 2.7                           |
| Pro-environmental behavioral engagement index | 1.43                     | −0.24, 3.1                         | −0.217                   | −0.94, 0.51                        | −0.68                    | −1.8, 0.46                         | 0.354                    | −0.96, 1.7                         |
| Constant                      | −7.123***                 | −11, −3.4                          | 0.610                    | −0.84, 2.1                         | 1.830                    | −0.5, 4.2                          | −10.25***                | −14, −6.6                          |
| N                             | 719                       |                                  | 997                      |                                  | 565                      |                                  | 423                      |                                  |
| Log likelihood                | −182.943                  |                                  | −667.164                 |                                  | −285.393                 |                                  | −223.635                 |                                  |
| McFadden’s pseudo R²          | 0.07                      | 0.02                               | 0.03                     | 0.19                               | 0.19                     |                                  | 0.19                     |                                  |
| AIC                           | 387.886                   | 1,356.33                           | 592.786                  | 471.269                            | 471.269                  |                                  | 471.269                  |                                  |

Note. Logistic regressions. Column 1 reports the likelihood of renewable energy usage, examining only those whose household energy status at the time the incentive was put into place could be determined (N = 911; 67 of which were already using renewables and 842 of which were not; table S1). 192 observations were omitted due to missing demographic data. Column 2 reports the likelihood of reporting being approached by the renewable energy representative while at the botanical garden, examining the full sample of N = 1284 participants, with 287 observations omitted due to missing data. Column 3 reports the likelihood of being approached, conditional on being approached, examining only those who report being approached (N = 718), with 153 observations omitted due to missing data. Column 4 reports the likelihood of switching, conditional on being asked to switch, including those participants who report being asked to switch (N = 566; table 1) but not including those whose household was already run on renewable energy at the time they were asked on site to switch (N = 30; table 1). Of the eligible sample of 536 participants, 113 observations were deleted due to missingness. Maximum Variance Inflation Factor = 1.81 (Column 1), 2.07 (Column 2), 1.90 (Column 3), 1.77 (Column 4). * p < 0.05, ** p < 0.01, *** p < 0.001.
encouraged a similar population to switch to renewable energy as was already using it. We employed t-tests to measure differences across these two groups.

Results

Descriptive results: household energy supplier behavior
Figure 1 provides a visual depiction of participants’ renewable energy behavior. Forty-four percent of participants report being approached and asked to switch their energy suppliers while at the botanical garden. Of these participants, 33% switched on site and 67% did not.

We were able to use participants’ responses to our energy supplier questions to determine whether a participant’s household was already run on renewable energy at the time that the incentive to switch was put into place [table S1 is available online at stacks.iop.org/ERC/2/051005/mmedia]. Roughly 5% of participant households were running on renewables at the time the incentive was put into place. Among the participants who were asked to switch on site but who did not switch or were unsure whether they switched ($N = 377$), about 8% ($N = 30$) were already using renewable energy to power their household. Similarly, amongst those who do not report being approached and asked to switch ($N = 718$), about 5% ($N = 39$) were already using renewable energy.

Factors associated with the usage of renewable energy
Our first set of analyses concerns the factors associated with a participant’s household already being run on renewable energy at the time the incentive for switching was put into place. We determined that 69 households were already run on renewable energy at the time of the incentive. We compared those whose households were and were not powered by renewable energy in January 2017, using only the households for which their energy supplier status could be determined in January 2017 ($N = 911$). Table 1 shows that more politically liberal participants were more likely to report having their household being powered by renewable energy at the time the incentive program started.

Factors associated with switching to renewable energy on site
Next, we examined the factors associated with choosing to switch to renewable energy on site, amongst households not already powered by renewable energy. First, we examined whether those who reported being approached by a representative of the regional energy supplier, and asked to switch, were different from those who were not approached and asked. Any observed differences might indicate biases or strategies on the part of the representatives, differences in member likelihood of visiting the botanical garden, or patterns of participant recall. Table 1 shows that older participants are less likely to report being approached and less likely to report being asked to switch, conditional on being approached. Table 1 also indicates that, conditional on being asked to switch and not having one’s household already run on renewable energy, older participants are less likely to switch. The more pleasant the participant found the representative to be, the more likely they were to switch.

Comparison of households that switched on site and households already using renewable energy
Table 2 compares demographics and attitudes between those whose households were already run on renewable energy at the time of the incentive, and those who signed up for renewable energy on site. After adopting a Holm-Bonferroni correction, there were no statistically significant differences across groups.

Exploratory results: switching to renewables after not choosing to switch on site
We conducted a post hoc exploratory analysis examining whether those who did not report choosing to switch to renewables on site reported switching to renewables afterward. Out of the 347 households in our sample that did not report choosing to switch to renewable energy on site and were not already using renewable energy (figure 1), 43 reported switching to renewable energy later. Thus, roughly 12% of households that did not choose to switch to renewables on site switched to renewables later.

Exploratory results: switching back to non-renewable energy
We conducted a post hoc exploratory analysis examining whether those that reported switching to renewables on site still reported using renewables at the time of the survey. Out of the 189 households in our sample that switched to renewable energy on site, 154 reported their household being run on renewable energy at the time of the survey, indicating that some participants switched back to a non-renewable energy supplier. Twenty-three households reported having switched back to non-renewable energy, while 12 households did not know whether their household was currently powered by renewable energy. While the small sample size prevents us from
conducting more rigorous statistical analysis of the factors associated with switching back, in our sample a lower bound of 12% of households that switched to renewables switched back within seven months or less.

Discussion

We examined the factors associated with the adoption of renewable energy amongst members of a botanical garden. We had two related research questions: what demographic and attitudinal factors predict adoption of renewable energy amongst this group, and what factors predict households choosing to switch their energy supplier to a supplier of renewable energy on site at the botanical garden, in response to an incentive of free membership for switching. We found that households that were already powered by renewable energy at the time the on-site incentive program was put into place were more likely to be politically liberal, while younger households and those who found the on-site representative of the renewable energy supplier to be pleasant were more likely to switch to renewable energy on site. While these results are consistent with the directional predictions of our literature review (Gromet et al 2013, Ameli and Brandt 2015, Cialdini 1984), we did not find evidence for our prediction of greater renewable energy usage amongst more educated, higher income, and female respondents, as well as those respondents with greater pro-environmental attitudes, perceived risk from climate change, and policy support for climate change.

These null findings may stem from our unique sample and its restricted range on these variables. They may also stem from highly correlated predictors, due to our unique sample, which would render our analyses unable to estimate their separate effects. However, estimates of multicollinearity due to highly correlated predictors were well below conventional thresholds (O’Brien 2007, see Variance Inflation Factors reported in table 1), suggesting that our null effects were not due to intercorrelated predictors. A third explanation is that prior literature examining adoption of renewable energy has focused on a variety of largely attitudinal outcomes, including hypothetical willingness to pay for green energy (see Frederiks et al 2015), and support for policies
regarding and investment in renewable energy (e.g. Hagen and Pijawka 2015; Hanus et al 2018, Olli et al 2001, Zarnikau 2003). In contrast, our study focused on predicting renewable energy behavior in the form of switching to household renewable energy, building on the findings of previous research to predict a behavior with measurable and consequential effects on the environment (Hawken 2017, Intergovernmental Panel on Climate Change 2012). The ‘attitude-action gap’ (Frederiks et al 2015) between energy attitudes and energy behaviors suggests that predictors of attitudes of renewables may not predict behaviors regarding renewables. Our findings reinforce the need to extend research on public uptake of renewables to include behavioral measures of renewable energy usage.

Our findings also reinforce the need to examine uptake of renewables amongst more representative populations of Americans. We examined the adoption of renewables in an environmentally engaged population likely to display less variation on key predictor variables, such as pro-environmental attitudes, than the American population as a whole. A limited range on key variables may substantially limit the generalizability of our findings to the general American population. Despite the limitations of our sample, we argue that it represents an important population for study because this population is expected to be more willing to adopt renewables than the general public, thus making it an important target for future interventions.

Further, we asked participants to accurately recall interactions that may have occurred several months prior to the survey; future work studying the effects of on-site incentives could seek to interview participants on site while their memories are still fresh. Our results may have been further influenced by survey non-response: while our overall response rate of 6% did not differ across those who had received their membership via the incentive or not, it only represents a small proportion of members, who may differ in their engagement with environmental and energy issues. Our results may also be influenced by the self-selection of individuals into visiting the botanical garden and becoming a member, as well as self-selecting to take our survey; such self-selection raises the likelihood that surveyed individuals are uniquely motivated to engage with environmental and energy issues. A lack of contact information meant that we were unable to contact non-members who visited the botanical garden and turned down the opportunity to switch to renewable energy, or switched but did not choose to become a member.

Compared to those already using renewable energy to power their households at the time the on-site incentive was put into place, those who switched on site in response to the incentive were demographically and attitudinally similar. These findings suggest the need for future research to identify ways to encourage the uptake of renewables amongst a different segment of consumers than those already predisposed to adopt renewable energy. Future research is also needed to disentangle the effects of the incentive from the effects of simply providing individuals with an opportunity to learn about switching to renewable energy, an option of which participants may have been unaware. Our data suggest that providing such information can impact subsequent behavior. Our results may also be in

Additionally, as we predicted, we found that those who had a pleasant on-site interaction with the representative were more likely to switch on site. Perceptions of pleasantness may stem from individual characteristics of the specific representatives; unfortunately, we were unable to track which representative had spoken with each survey participant. Perceptions of pleasantness may also stem from perceived similarities between the representative and the survey participant, or from a sense of shared goals (Cialdini 1984), and may thus reflect participant characteristics, or the interaction between participant and representative characteristics. Our measure of pleasantness may also be confounded with the outcome in that those who are more predisposed to switch to renewables may also be more predisposed to view the representative positively.

Two unexpected implications arose from our findings. First, an analysis of who in our sample recalled being asked to switch revealed that younger individuals were also more likely to report being approached and being asked to switch to renewables. These differences may reflect differences in recall or botanical garden visitation rates amongst our sample. They may reflect discrimination against older individuals, who may be perceived as less likely to switch their energy supplier. Or, they may reflect age differences between the representatives and the visitors: salespeople feel more comfortable approaching those who are similar to them in terms of age and gender (Dwyer et al 1998), suggesting that the representatives, who tended to be younger than the average garden visitor, may have felt more comfortable approaching younger visitors.

Additionally, our data enabled us to track whether those who had switched to renewable energy on site were still using renewable energy at the time of the survey. Our results suggest that roughly 12% of the 189 households who switched on site switched back to non-renewable energy within seven months or less. This finding suggests the importance of future work estimating long-term outcomes associated with programs such as this one, including the retention of renewable energy (Abrahamse et al 2005, Staats et al 2004, Steg and Vlek 2009), and the potential for negative spillover in terms of a reduction in other pro-environmental behaviors (Truelove et al 2014, Poortinga et al 2013). A recent meta-analysis of non-monetary interventions to encourage household climate change action found only a small effect size for household energy consumption of $d = -0.094$, and little evidence that such interventions have lasting effects (Nisa et al 2019).
Overall, our findings underscore the importance of a) examining behavioral in addition to attitudinal measures related to renewable energy usage, b) assessing incentive programs for equity, c) separating incentives from information provision in evaluating impacts, and d) conducting short- and long-term evaluations.

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