ENCOURAGING CLIMATE-FRIENDLY BEHAVIORS THROUGH A COMMUNITY ENERGY CHALLENGE: THE EFFECTS OF INFORMATION, FEEDBACK, AND SHARED STORIES

by

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This research is about how the actions of many individuals can add up to make a big difference; I have been fortunate to know this truth firsthand. This dissertation would not have been possible without the support and generosity of many people.

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Abstract

Research suggests that changes in household behavior can play a significant role in mitigating climate change. While surveys indicate that many Americans care about climate change and believe something should be done to reduce it, a number of real and perceived barriers prevent them from acting on that concern.

This research investigated two strategies to promote engagement in climate-friendly behaviors: (1) providing feedback about the positive impact of participants' energy-saving efforts on their carbon footprint; and (2) sharing stories about other participants' conservation successes. A random sample of residents in a Midwest college town were invited to participate in a month-long community Energy Challenge that asked households to try to reduce their carbon footprint by 2 percent. Participants were randomly assigned to one of three treatment groups: monthly feedback, weekly feedback, and weekly feedback + stories. All participants received a booklet that gave procedural guidance and estimated carbon savings for 34 behaviors related to personal transportation, household energy use, and dietary choices. In addition, all participants were asked to track their efforts in an online log. For participants in the weekly feedback conditions, these logs estimated their total carbon savings for each week of the challenge. Weekly e-mails were sent to all groups to encourage completion of the logs. For participants in the weekly feedback + stories condition, these reminders included anecdotes about other participants' conservation experiences.

Overall, the results suggest that the basic format of the Energy Challenge provided a supportive setting for developing new climate-friendly behaviors and increasing existing ones. The majority of participants (78 percent), regardless of treatment condition, achieved the Energy Challenge goal, with a median carbon savings of 6 percent. For some participants, weekly feedback helped reduce perceived barriers related to driving less and the perception that conserving requires sacrifice. Participants who had less prior conservation experience as

well as those who received weekly feedback were more likely to engage in a broader set of climate-friendly behaviors. Finally, results from a follow-up survey suggest that most participants maintained the behaviors they adopted one month after the Energy Challenge ended.

Chapter 1

Introduction

Human activities are substantially disrupting the earth's climate. By the end of this century, the average global temperature is predicted to increase by 3 to 7 degrees Fahrenheit (IPCC, 2007b), bringing the possibility of severe weather events, sea-level rise, and numerous changes in ecosystem functioning that will affect human well-being. To avoid catastrophic climate change, scientists advocate reducing greenhouse gas emissions by 80% of 2000 levels by 2050 (IPCC, 2007a). Achieving this task will require dramatically changing the way our society uses energy. To date most proposed solutions to climate change involve using economic instruments to promote technological innovation. Far less attention has been paid to the role of individual consumers and the impacts of their everyday behaviors.

Individuals contribute to climate change through many ordinary, routine activities. From taking a hot shower in the morning and brewing the first pot of coffee, to driving home from work and cooking dinner, most daily activities burn fossil fuels and produce greenhouse gases. Behaviors such as these, where energy is directly consumed in one's home or for personal transportation, are estimated to produce 30-40% of U.S. carbon dioxide (CO_2) emissions (Bin & Dowlatabadi, 2005; Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Vandenbergh, Barkenbus, & Gilligan, 2008). Several analyses have demonstrated that changes in household behavior could achieve significant near-term reductions in greenhouse gas emissions (Dietz, et al., 2009; Laitner, Ehrhardt-Martinez, & McKinney, 2009; Vandenbergh, et al., 2008). For example, if households were encouraged to use more energy efficient technologies and to adopt several high-impact, energy-wise habits, Dietz, et al. (2009) estimate that national greenhouse gas emissions could be reduced by over 7% in ten years time. The potential for individuals to help reduce climate change may be even greater if their purchasing decisions are considered. Though difficult to estimate, consumers can also decrease CO_2

emissions by choosing products that require less energy in their production and transport. Food in particular is a significant source of emissions, accounting for up to 15% of an individual's climate impact (Weber & Matthews, 2008).

Tapping these potential emissions reductions will require effective public programs and interventions. Current evidence suggests that most Americans already care about climate change and want to be part of the solution – but a number of barriers may prevent them from getting involved (e.g., Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007; O'Connor, Bord, & Fisher, 1999; Semenza et al., 2008). Some of these constraints are financial or structural in nature, but others are psychological. People may be uncertain about which actions to take and how to implement them, or they may be reluctant to make changes if they perceive that climate-friendly behavior will reduce their quality of life. Furthermore, even individuals with the best of intentions may have trouble shifting to a low-carbon lifestyle if it requires changing entrenched habits. Unfortunately, few outreach efforts or interventions take these barriers into account.

This dissertation explores how interventions might be structured to create a more supportive setting for climate-friendly behavior. Specifically, this study looks at how a combination of procedural information, feedback, and stories may help people overcome some of their perceived barriers and encourage them to adopt more climate-friendly actions.

The remainder of this chapter provides a rationale for the research. It begins by examining public attitudes about climate change and the barriers that prevent people from engaging in climate-friendly behavior. The following section looks at prevalent approaches to promoting climate-friendly behavior and explores why these strategies may exacerbate rather than reduce perceived barriers. The third section offers an alternative approach to promoting climate-friendly behavior that may be more compatible with how humans process information. The final sections describe the objectives of the study and provide an overview of the dissertation chapters.

Public attitudes and perceived barriers to climate action

Public awareness and concern about climate change have increased dramatically in the last two decades. Though strong partisan divides remain (see McCright & Dunlap, 2011; Pew

Research Center, 2010), the majority of Americans believe that anthropogenic climate change is real, that it has already begun, and that it is a serious or very serious problem that requires human intervention (Carroll, 2007; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010a; Pew Research Center, 2010). Toward this end, Americans are generally supportive of government action to reduce greenhouse gas emissions, including policies to regulate carbon dioxide, increase fuel economy standards, and subsidize renewable energy development (Carroll, 2007; Krosnick, Holbrook, & Visser, 2000; Leiserowitz, 2003, 2007; Leiserowitz, et al., 2010a). There is also growing recognition of the role individuals can play in mitigating climate change. A poll by Ecoalign (2008) found that nearly half of Americans (46%) believe that individuals have primary responsibility to reduce emissions. Other surveys show that the vast majority of Americans believe home energy conservation is important (Leiserowitz, et al., 2010a), and that households should do more to increase the efficiency of their homes and their use of public transportation (Carroll, 2007).

Despite these supportive attitudes, surveys indicate that only a minority of people have taken significant steps to reduce their climate impact. A recent survey found, for example, that while the majority of Americans believe that activities like taking public transportation and adjusting the thermostat are important, far fewer report actually engaging in these behaviors (Leiserowitz, et al., 2010a). Such an attitude-behavior gap is not uncommon in the realm of environmental behavior (e.g., Blake, 1999; Kollmuss & Agyeman, 2002). Any number of barriers may prevent people from acting on their pro-environmental beliefs, including financial constraints, limited access to resources such as public transportation, as well as perceived barriers related to the inconvenience or difficulty of carrying out a behavior. In the case of climate change, these psychological barriers are likely exacerbated by the nature of the problem.

The time lag between the causes and effects of climate change, the remoteness of its current impacts (e.g. melting glaciers and sea level rise affecting distant islands), and the invisibility of greenhouse gases make climate change difficult for people to experience (Dilling & Moser, 2007; Williams, 2002). As a result, people's understanding of the problem depends largely on the information they have been exposed to through various mass media channels as well as acquaintances and friends (Stamm, Clark, & Eblacas, 2000). Not surprisingly, many

people admit that they are not confident in their knowledge of climate change, its causes, or how they can respond (Lorenzoni, et al., 2007; Semenza, et al., 2008). As people tend to avoid situations in which they feel confused or incompetent (S. Kaplan, 1991) this uncertainty may lead some people to disengage from the issue and tune out additional information (Norgaard, 2006).

Insufficient knowledge can lead to another barrier: People may think they have done enough to address climate change when in fact their efforts have only a nominal effect on the problem. Several studies have found that when people are asked what they can do or have done to reduce climate change, many suggest recycling and reducing chlorofluorocarbons (CFCs) (Bostrom, Morgan, Fischhoff, & Read, 1994; Lorenzoni, et al., 2007; Read, Bostrom, Morgan, Fischhoff, & Smuts, 1994; Semenza, et al., 2008; Whitmarsh, 2009a). While these behaviors have some impact on climate change, they are far less effective than reducing direct energy consumption. Even among people who recognize the importance of reducing fossil fuel use, there are misconceptions about the energy savings associated with different activities. Research has shown that people tend to overestimate the energy savings of behaviors with small impacts (e.g., turning lights off, watching less television) and underestimate the savings of activities with large impacts (e.g., turning down the heat in winter, washing laundry in cold water, installing efficient appliances; Attari, DeKay, Davidson, & Bruine de Bruin, 2010; Kempton, Harris, Keith, & Weihl, 1985). This phenomenon may be related to the invisibility of energy. Without visual cues to indicate how much energy different activities consume, people may choose behaviors based on their perceptual salience or how frequently they are performed (Kempton, et al., 1985; Kempton & Montgomery, 1982).

Even highly knowledgeable individuals may not act on their concern about climate change if they perceive it will reduce their quality of life. The changes necessary to reduce one's climate impact often require giving up or cutting back certain behaviors. As many fossil fuel-burning activities are associated with comfort and convenience, using less may be seen as an unwelcome sacrifice. Similarly, people may forgo certain climate-friendly activities if they are perceived to conflict with other values and goals. For instance, individuals may be unwilling to lower their thermostat in winter because they believe cooler temperatures are unhealthy

(Becker, Seligman, Fazio, & Darley, 1981; Samuelson & Biek, 1991). Likewise, safety concerns may prevent individuals from riding a bicycle to nearby destinations.

People may also be reluctant to make significant lifestyle changes if no one else seems to be doing the same. Research has demonstrated that people are heavily influenced by others' behavior and what they perceive to be socially acceptable (e.g., Clayton & Brook, 2005; Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). Without strong social cues to suggest that living a climate-friendly lifestyle is "normal," even concerned individuals may be dissuaded from taking action for fear of standing out from their peers. The perception that others are not acting can also increase feelings of sacrifice. Individuals may question why they should be the ones to conserve and "go without" when others are not doing the same (Lorenzoni, et al., 2007; Norgaard, 2006).

Without evidence that others are doing their part, people may also lose hope that climate change can be prevented. A recent poll found that while 73% of Americans believe that humans have the capacity to reduce global warming, only 5% believe we actually will (Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010b). This diminished sense of collective efficacy may make individual action seem pointless.

Finally, even people with the best of intentions may find it challenging to shift to a low-carbon lifestyle if it involves changing ingrained habits. Most energy-consuming behaviors are performed routinely and require little thought or attention to carry out. Few people, for example, deliberate their shower routine, how they will get to work each day, or the settings they use on a washing machine. Instead these decisions, having evolved over a considerable time period, are now automatically cued by the setting (Ouellette & Wood, 1998; Verplanken & Wood, 2006). For this reason, overriding these established patterns of behavior can be challenging. One must devote far greater attention to the task at hand, and even then, change, if unaided, may only happen slowly. If one is not very skilled in performing the new behavior, or if it is perceived to be less enjoyable than the current way of doing things, motivation to continue may quickly decline (Wood & Quinn, 2004).

Common approaches to promoting climate-friendly behavior

Current approaches to promoting climate-friendly behavior may do more to perpetuate these perceived barriers than to help people overcome them. Most interventions fall into two broad categories: 1) climate change communications, and 2) energy conservation programs. Climate change communications tend to focus on the global nature of the problem and assume that once people know about and understand climate change, they will be motivated to act. However, decades of research have demonstrated that this approach is misguided. While information is likely to increase knowledge of an issue and perhaps create favorable attitudes toward action, it rarely leads to behavior change (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Costanzo, Archer, Aronson, & Pettigrew, 1986). The second category of interventions includes programs that promote energy conservation and efficiency but often without explaining how these actions relate to global warming. While these programs may lead to reduced energy consumption in the short-term, they often fail to produce durable change (Abrahamse, et al., 2005). Furthermore, by ignoring the larger issue of climate change, energy conservation programs may do little to help individuals feel that they are doing their part.

The following discussion looks more closely at how these two approaches to promoting climate-friendly behavior may ultimately fail to produce long-term engagement in the issue.

Climate change communications

Gloom and doom.

One of the most prevalent communication strategies involves framing climate change as an impending crisis (Hulme, 2008; Nisbet, 2009). These communications are often accompanied by dramatic imagery of potential climate impacts, such as polar bears stranded on melting ice floes, drought-stricken farms, and flood-ravaged cities. This approach assumes that by emphasizing how threatening and potentially disastrous climate change will be, people will take action in order to protect themselves or the things they value (Ereaut & Segnit, 2006, 2007; Moser & Dilling, 2007). Such emotional appeals may work for some audiences – particularly those with deep environmental values – but for others these communications are likely to exacerbate feelings of helplessness (Ereaut & Segnit, 2006; Lorenzoni, et al., 2007; Macnaghten, 2003; Moser, 2007; Moser & Dilling, 2004). When faced with an uncontrollable threat, people

tend to engage in defensive coping strategies in order to reduce the feelings of fear (Hastings, Stead, & Webb, 2004; Roser & Thompson, 1995; Ruiter, Verplanken, De Cremer, & Kok, 2004). This might mean avoiding information about the problem, justifying their current behaviors, or deflecting blame to others (Norgaard, 2006; Stoll-Kleemann, O'Riordan, & Jaeger, 2001). By sensationalizing the potential impacts of climate change, fear appeals can also increase skepticism about the reality of the problem and the viability of solutions (Lorenzoni, et al., 2007; Nisbet, 2009), or lead to resentment that others are trying to manipulate one's behavior (Moser & Dilling, 2004; Williams, 2002).

Carbon footprint calculators.

Another popular approach used by utilities and environmental organizations is to have individuals calculate their carbon footprint. This intervention, a derivative of the Ecological Footprint Questionnaire (Wackernagel & Rees, 1996), asks users about their homes, appliances, transportation choices, and consumption of various goods. The calculator then provides an estimate of the user's environmental impact. For the ecological footprint, users are told how many Earths would be needed if the world's population lived as they did. Carbon footprints tell users how much CO_2 their lifestyles produce annually and how their footprint compares to that of the average American's. The presumption with either type of footprint analysis is that when people understand the direct impact of their choices on the environment, they will be inspired to adopt a less resource-intensive lifestyle (Sutcliffe, Hooper, & Howell, 2008).

However, as Brook (2011, p. 114) notes, this intervention may actually increase feelings of helplessness:

> "[P]eople may also react… in a variety of unproductive ways, including feeling overwhelmed, feeling that sustainability is impossible, giving up, justifying their unsustainable behavior, blaming other people for environmental problems, trivializing the impact of their own behavior, deciding that environmental problems are not important, or discounting the accuracy of the footprint feedback itself."

These reactions may arise, in part, because footprint calculators tend to provide very negative feedback that is too general and difficult for people to act upon (Aubert, 2006). The average carbon footprint for an American is 20 tons or 40,000 lbs. of CO_2. The enormity of these numbers is not only discouraging, but challenging to interpret. Few people fully grasp how

invisible air has weight (McCaffrey & Buhr, 2008) or what their footprint means relative to atmospheric concentrations of CO_2. Furthermore, these calculators rarely explain how different behaviors contribute to one's footprint; individuals are left to guess how they might reduce their impact.

Providing information on climate-friendly behaviors may not be enough to help individuals overcome the shock of learning their footprint. In an experimental study, Truelove (2009) tested the effects of combining ecological footprint analysis with (1) a list of energy-saving action strategies and (2) feedback designed to enhance participants' sense of self-efficacy. Neither addition proved to be worthwhile. In all treatment conditions, ecological footprint analysis reduced participants' sense of self-efficacy, which in turn predicted lower intentions to engage in climate-friendly behavior. Other evidence suggests that footprint feedback may only be useful for people strongly committed to the environment. Brook (2011) found that footprint feedback promoted environmental behavior among individuals who base their self-worth on their environmentalism. But for those less committed to the environment, receiving the same feedback discouraged action.

Lists of "simple and easy" actions.

Finally, many communications try to make climate-friendly behavior more inviting by emphasizing its simplicity. Lists of 10, 50, or 100 "things you can do to fight global warming" are commonplace in environmental nonprofit communications and popular press articles. Focusing on what individuals can do to help address climate change seems a step in the right direction, but the way information is presented in these lists may have drawbacks. As Ereaut and Segnit (2006, 2007) have pointed out, the juxtaposition of "simple and easy" discourse with alarmist language, e.g., "10 *easy* things you can do to fight the climate *crisis*," may actually increase skepticism that individuals can affect the problem, as few crises seem to be resolved with simple fixes. Gardner and Stern (2008) have further criticized these "laundry lists" because they rarely give any indication of the impact different behaviors have. Confronted with a long list of options, people are likely to choose the behavior that is easiest or most memorable – which often coincides with the behaviors that have the smallest impact, such as turning off lights when leaving a room (Gardner & Stern, 2008). Another concern is that presenting lists of ten or more recommended actions might intimidate those less environmentally inclined, especially when any

one behavior may require major changes to one's lifestyle. The recommendation to "drive less," for example, does not provide any imagery about alternative strategies for getting around, the planning that this behavior might require, or even a goal for how much to reduce one's driving. In other words, people may not know where to begin. Even those who try the behavior may quickly abandon it if it proves to be too challenging; rarely do these communications acknowledge or provide advice for overcoming the hurdles one might face.

Energy Conservation Programs

In contrast to the above communication strategies, other programs focus exclusively on promoting energy conservation and efficiency. Mention of climate change is typically avoided altogether, presumably because it is seen as a politically divisive issue. Though many types of energy conservation interventions have been studied (for a review see Abrahamse, et al., 2005), in practice most programs rely on a combination of information and financial incentives. For example, the U.S. Department of Energy as well as many utilities offer informational materials with taglines such as "Save energy – save money!" These brochures and websites describe energy-saving actions along with the money they might save or the rebates that are available for upgrading to efficient appliances.

This indirect approach to addressing climate change has both benefits and risks. On one hand, by focusing on financial motives, these energy conservation programs may have broader appeal, particularly among audiences that remain skeptical of climate change (e.g., Kaufman, 2010). On the other hand, this approach may be a disservice to individuals who are already concerned about the problem. As alluded to earlier, research suggests that people do not necessarily see energy conservation and climate change as related issues. A study by Whitmarsh (2005, 2009a) found, for example, that among individuals concerned about climate change, many did not recognize that their existing efforts to conserve energy also helped reduce global warming. This finding suggests that unless the connection between energy conservation and climate change is made explicit, programs may miss an opportunity to reduce feelings of helplessness and further engage people in the issue.

Programs that rely solely on economic motives may have other disadvantages. First, the monetary savings that can be achieved through energy conservation may be too

inconsequential to compel change (Becker, et al., 1981; Black, Stern, & Elworth, 1985). When activities are projected to save only a few dollars each month, individuals may decide that the convenience and comfort associated with their current way of doing things is worth the added expense. People may be willing, for example, to pay a bit more each month to keep their air conditioning at a cooler temperature.

Second, using an economic framing may undermine other intrinsic motivations for conserving. Research has shown that in the face of strong extrinsic motives such as money, an individual's intrinsic reasons for engaging in a behavior may become less available (R. Katzev & A. Pardini, 1987; Lepper, Greene, & Nisbett, 1973). This could mean that people only consider energy-saving activities with a large financial payoff. In contrast, if programs also highlighted how conservation activities benefit climate change, people might be willing to adopt a broader array of behaviors, including those with a low economic payoff.

This relates to a third concern: Behavior change may be less durable when it is economically motivated (De Young, 1993). When the economy improves or an individual's income increases, concerns about saving money may fade. If individuals have overjustified their behavior to this motive, they may stop conserving – even if they once had other reasons to engage in climate-friendly behaviors (R. D. Katzev & A. U. Pardini, 1987; Thøgersen, 1996).

Finally, a fourth criticism is that when individuals conserve energy to save money, concerns about energy consumption are less likely to guide their decision-making in other contexts. For instance, an individual may install an energy efficient furnace to reduce heating costs, then think nothing of spending the money saved to fly somewhere for vacation. The result is a net increase in greenhouse gas emissions. A recent marketing campaign by the U.S. Department of Energy's Energy Savers program seems to encourage this mentality with their slogan: "When you throw away money on wasted electricity, you're throwing away everything you could have bought with it" (U.S. Department of Energy, 2011). As Crompton (2008, p. 21) has argued, it is questionable whether appealing to these types of individualistic, short-term interests will lead to a "public appetite for radical changes in how we live – and a commensurate popular acceptance of, or demand for, far-reaching policy change."

Creating a supportive setting for change

This discussion suggests a different approach is needed to engage the public in climate-friendly behaviors, one that is sensitive to how people perceive climate change, their desire to help mitigate it, and the barriers they face in changing their behavior. Based on the review of literature above, it appears there is a need for interventions that will:

- Translate the immense, abstract problem of climate change into terms that are meaningful and concrete at a personal level;
- Help people identify effective strategies for reducing their climate impacts;
- Demonstrate how individual actions add up to make a difference;
- Highlight the climate-friendly actions others are taking; and
- Help individuals consider how to integrate new energy-saving habits into their lifestyles.

The following outlines several approaches that may be used to achieve these objectives.

Procedural information

One solution is to provide more detailed information about potential climate-friendly behaviors. As previously discussed, people need more than a "to do" list of action strategies. They may need imagery about specific behaviors, how to perform them (e.g., the steps of backyard composting) and where to find relevant information (e.g., bus schedules and routes) (De Young, 1996). They may also need, as Maccoby and Alexander (1980) have suggested, both a rationale for why specific behaviors should be done and a description of the benefits to be expected. Knowing, for example, how reducing meat consumption helps reduce CO_2 emissions may go a lot further toward motivating that behavior than simply being told to "eat less meat."

Feedback

People may be more likely to adopt and maintain climate-friendly behaviors if they can see how their actions make a difference. Instead of emphasizing the detrimental consequences of individuals' existing behaviors (as carbon footprint calculators do), interventions could provide feedback about the positive impact of their climate-friendly choices. For example, people could be told how much energy or CO_2 they avoided every time they opted for public

transportation instead of driving or chose a vegetarian meal instead of a meat entrée. If they were also provided a cumulative summary of their efforts, individuals might begin to see how seemingly small actions add up to have a substantial impact over time.

Feedback has already proven to be an effective intervention for decreasing home energy consumption (for a review see Abrahamse, et al., 2005), but studies have only begun to explore its usefulness for promoting other climate-friendly behaviors such as reduced personal vehicle use or eating a lower-carbon diet (e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2007; Graham, Koo, & Wilson, 2011). Research suggests there are several ways this technique may facilitate climate-friendly behavior. First, when feedback is given frequently, it can enhance learning and improve self-efficacy (Grønhøj & Thøgersen, 2011; Hutton, Mauser, Filiatrault, & Ahtola, 1986). Compared to a carbon footprint which gives annual feedback or even a monthly energy bill, feedback that is provided often (e.g., instantly, daily, weekly) can help individuals discern the impacts of their specific actions. Thus, individuals may gain a better understanding of how different consumption patterns contribute to or reduce climate change. Second, regular feedback may also prompt people to think about and reflect on their behaviors more often (Kluger & DeNisi, 1996). In this way, feedback may make energy more "visible" and encourage people to be more conscientious about their energy consumption. Third, feedback may motivate individuals to continue climate-friendly behaviors longer than they might otherwise. Seeing the positive impact of one's actions may instill a sense of satisfaction that compels people to persist at them (Seligman, Becker, & Darley, 1981). This effect can be enhanced by combining feedback with a specific goal (Becker, 1978; McCalley & Midden, 2002). When one has a standard for comparison, feedback can help people know whether they need to increase their efforts. Thus, feedback may encourage individuals to engage in climate-friendly behaviors more often and further reduce their climate impact.

Social influence through stories

Another strategy for promoting climate-friendly behavior is to demonstrate that others are taking action to reduce their climate impact. This can be done through a number of techniques. Recently there has been considerable interest in normative messaging, where individuals are persuaded to engage in a certain behavior by telling them, for example, the

(large) percentage of people already doing that activity (Cialdini, 2003; Nolan, et al., 2008). Behavior change can also be encouraged through modeling. Aronson and O'Leary (1982-83) found that students were far more likely to comply with a request to conserve water while showering if they saw their peers also doing the behavior. Modeling has also been successfully employed indirectly through television programs (Winett et al., 1982; Winett, Leckliter, Chinn, Stahl, & Love, 1985) and public service announcements (Cialdini, 2003).

While each of these techniques is promising, many organizations may not have the financial or staff resources to orchestrate this kind of programming. For instance, gathering information about the types of climate-friendly behaviors a community is already engaged in may be too time consuming and cost prohibitive. Likewise, there may not be a feasible means of modeling desired behaviors. A less expensive alternative is to use stories. Monroe and Kaplan (1988) demonstrated that stories can be just as effective, if not more so, than direct experience for teaching environmental problem-solving skills. By providing imagery of what behaviors involve and the challenges one my face, stories can help individuals familiarize themselves with behaviors before trying them out (Bardwell, 1991; De Young & Monroe, 1996; Kearney, 1994). This prefamiliarization may encourage people to consider behaviors that they would not have otherwise (S. Kaplan & Kaplan, 1983, p. 162). Similarly, seeing that others have successfully done a behavior can enhance perceptions of self-efficacy (Bandura, 1986).

Stories may be particularly effective if they are drawn from members of a program's target audience. Research on social diffusion suggests that people are more receptive to information when it is vivid and comes from interpersonal sources such as friends and community members (Costanzo, et al., 1986; Stamm, et al., 2000; Yates & Aronson, 1983). For example, hearing a neighbor describe how much she has enjoyed carpooling to work may be far more compelling than reading about that same behavior in a fictional piece or in an informational brochure from a transportation organization. Interventions that incorporate these types of personal stories may help individuals recognize that taking action to reduce climate change is something that people like them do.

Small experiments

Finally, people may benefit from interventions that help them through the process of changing habits. One way to achieve this is to encourage people to approach the adoption of climate-friendly behaviors as a series of "small experiments" (De Young & Kaplan, 1988; Irvine & Kaplan, 2001; R. Kaplan, 1996; S. Kaplan, 1990). As the name implies, a small experiment involves trying something out on a modest scale and tracking the results along the way. The intent of this approach is to make the process of change more manageable. Rather than asking individuals to dramatically reduce their carbon impacts all at once (as many climate communications suggest), a small experiment approach favors breaking the process into incremental steps. Individuals might be encouraged to try out just a behavior or two over a limited period of time. The goal of a small experiment is not to achieve a perfect outcome, but rather to tentatively explore a possible solution to a problem, see what happens, and learn from the process. In this way, small experiments enable individuals to explore new territory without straying too far from what is familiar, and as a result, keep competence high and the cost of failure low.

Besides helping people through the process of change, the small experiment approach has other benefits. Participating in this type of activity can also be personally rewarding. The satisfaction of becoming more competent at a behavior as well as participating in a meaningful activity can be profound and thus, motivate individuals to continue behaviors after an intervention ends (De Young, 1993, 1996, 2000). The "small win" of successfully adopting one climate-friendly behavior may also motivate individuals to experiment with others (Weick, 1984).

Study objectives

Using the small experiment approach as a guiding framework, this dissertation examines the extent to which procedural information, feedback, and shared stories might help reduce perceived barriers to conserving energy and encourage greater engagement in climate-friendly behaviors. Working in partnership with a local government agency, a field experiment was designed in which households were engaged in a month-long community energy challenge.

Rather than focusing on the urgency of climate change or emphasizing the negative impact that households have, the Energy Challenge was framed as an opportunity for participants to make a positive difference and help their community reduce global warming. In addition, the challenge tasked participants with a modest goal: reduce household greenhouse gas emissions by 2% for one month.

Participants were divided into three treatment groups. All three were provided an informational booklet to help them meet the Energy Challenge goal. This booklet described 34 climate-friendly actions related to personal transportation, home energy use, and food-related behaviors and provided estimates of their respective carbon dioxide (CO_2) savings. In addition, participants received either monthly or weekly feedback about the cumulative savings of their actions. Based on the literature described above, it was hypothesized that households receiving *weekly feedback* would:

1a) experience a greater decline in perceived barriers to conserving, and
1b) engage in more climate-friendly behaviors relative to participants who received monthly feedback.

Some of the participants who received weekly feedback were also provided with stories that shared what other community members were doing to conserve. These *shared stories* were expected to augment the effects of weekly feedback. Specifically, it was hypothesized that participants who received weekly feedback *and* stories would:

2a) experience even greater reductions in perceived barriers, and
2b) be more likely to engage in climate-friendly behaviors than participants who received weekly feedback alone.

The study also explored whether the effects of the program components were moderated by participants' prior experience with energy conservation.

Outline of the dissertation

The next chapter explains the methodology used to explore these hypotheses, including the details of the Energy Challenge, the survey instruments, and a brief overview of analytic procedures. Chapter 3 describes participants who initially signed up for the Energy Challenge, including their demographic background, their motivations for and perceived barriers to conserving, and their prior engagement in climate-friendly behaviors. Chapter 4 presents results for participants who completed the Energy Challenge and examines whether the informational booklet, weekly feedback, and stories helped enhance feelings of efficacy and reduce perceived barriers to conserving. Chapter 5 then investigates how the Energy Challenge influenced individual behaviors as well as the total number and variety of behaviors that were adopted. The final chapter summarizes the research findings and discusses their theoretical implications as well as recommendations for practitioners.

Chapter 2

Methods

This chapter explains the methods that were used to conduct the present research. The sections describe the research setting and the process for recruiting participants, the study design, the procedure and materials used to deliver the behavior change intervention, and the survey instruments. The final section provides an overview of how the data were analyzed.

Setting and Participants

Research Setting

The City of Ann Arbor, Michigan, is a large university town with a long history of supporting progressive environmental initiatives. Since the energy crisis of the late 1970s, the City government has taken a proactive role in moving the community toward more efficient and sustainable energy use. A mayor-appointed Energy Commission meets monthly to discuss energy goals for the community, and a small Energy Office oversees the implementation of energy efficiency projects. These include, for example, installing solar panels on the roofs of the farmers market and the main fire station, replacing conventional street lamps with LED lighting, and transitioning City vehicles to run on alternative fuels. The current mayor is also one of the original signers of the U.S. Mayor's Climate Protection Agreement, which commits cities to comply with the emission reduction targets set by the Kyoto Protocol.

The present study was designed to complement an existing initiative of the City. In 2005, the mayor issued the *Green Energy Challenge*, calling on the community of Ann Arbor to:

- Achieve a 20% reduction in greenhouse gas emissions from 2000 levels by the year 2015, and

- Adopt 20% renewable energy by 2015 (exclusive of municipal operations, which must achieve 30% by 2010).

At the time of this study in 2009, the City had made some progress toward its municipal goals for renewable energy. However, because of budget and staff constraints, the Energy Office had done little to raise awareness of the *Green Energy Challenge* or to engage residents in the emissions reduction goals set for the community. Outreach was limited to flyers at public events and to a little known City web page that provided a brief list of energy-saving actions. In light of the Energy Office's constraints, this research sought to inform the development of a relatively low-cost program that would engage households in the emissions reduction goal set for the City and that could be easily replicated in the future.

Participant recruitment

Figure 2.1 provides a schematic of how participants were recruited. In September 2009, a random sample of 3,000 households in Ann Arbor received a letter from the City's Energy Office, inviting them to participate in a month-long Energy Challenge (see Appendix A). The letter was written to convey a sense of community, stating "Dear Neighbor, The City of Ann Arbor needs your help to reduce our community's impact on global warming1." The letter further explained that scientists believe we can avoid major climate change if we reduce global greenhouse gas emissions every year by 2%. The Energy Challenge was offered as an opportunity for residents to do their part. Recipients were asked if they would be willing to try reducing their household's monthly carbon footprint by 2% during October, or 68 lbs. of carbon dioxide (CO2) for the average Ann Arbor household. This number was based on an annual carbon footprint of 40,700 lbs. of CO2 for the average two-person Ann Arbor household (A. Brix, Ann Arbor Energy Office, personal communication, May 2008). This estimate was a conservative calculation based on personal automobile use, household energy consumption, and waste disposal; it did not account for diet choices, air travel, or consumption of goods. To help recipients understand what 2% might look like in the context of their everyday behaviors, the

[1] Though climate change is the generally preferred term among scientists, research suggests that global warming resonates more with the public (Whitmarsh, 2009b).

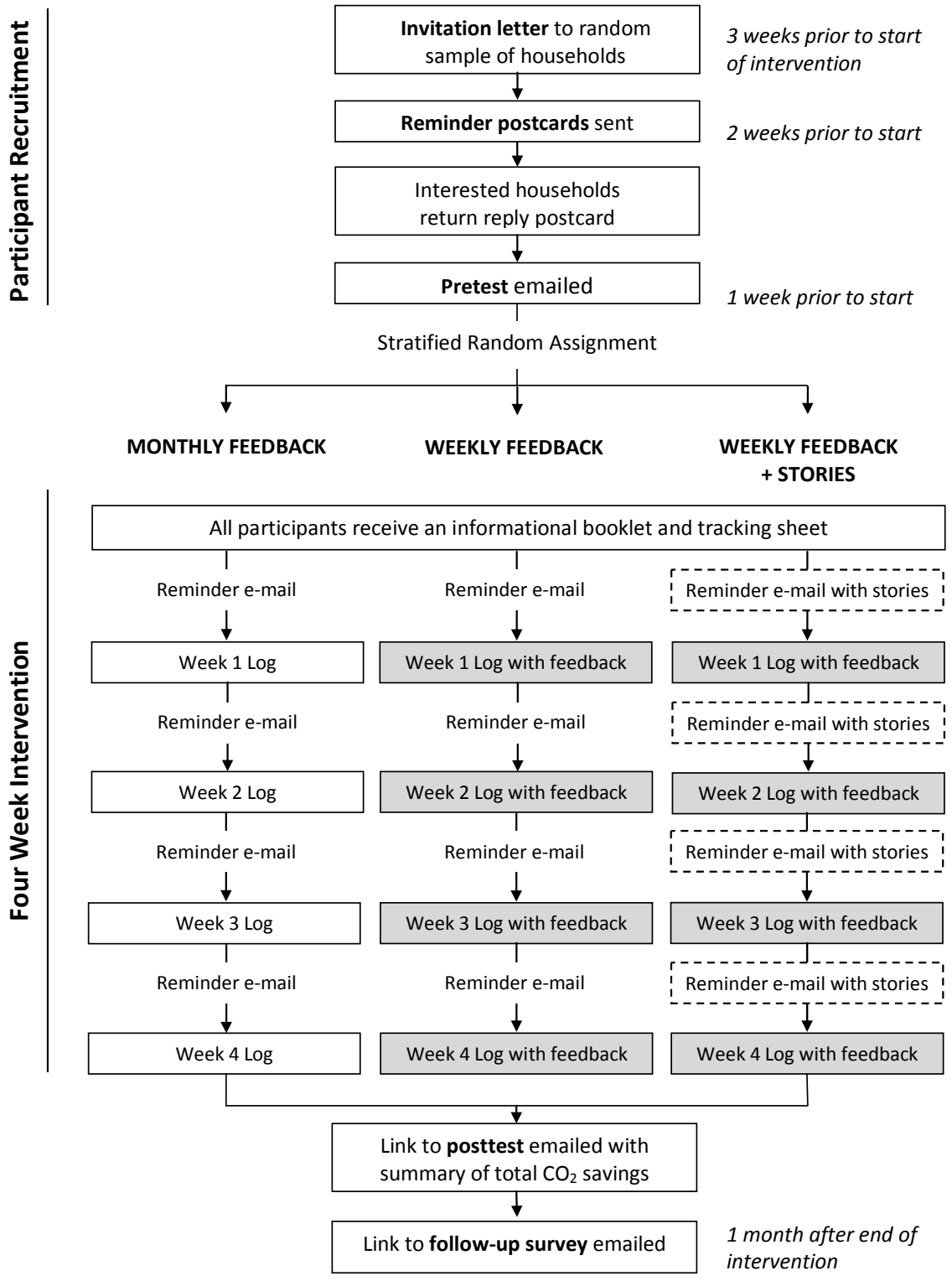


Figure 2.1. Study design. Gray shading is used to contrast weekly feedback from monthly feedback. Boxes with dashed borders indicate where shared stories were incorporated into the intervention.

letter provided two examples of the types of actions that could meet this goal. For instance, one of these examples explained that a person could avoid 70 lbs. of CO_2 by cutting five miles of driving each week, using the energy saving setting on their dishwasher, and inflating their car tires once during the month. No financial incentives were offered for participation; however, households that signed up were promised an Energy Challenge kit that would provide information to help them meet the 2% goal.

The sample included single-detached homes as well as multi-unit housing. Parcels predominantly occupied by college students were excluded since this population tends to be more transient and has less control over its household energy consumption. All Ann Arbor residents were eligible to participate, provided that they would not be away for an extended period during the Energy Challenge, had regular access to Internet, and were willing to share their e-mail address. Participants were also asked to complete one survey before and after the Energy Challenge, four online weekly logs, and a follow-up survey one month after the program ended. Although this study was found to be exempt from IRB oversight, the letter explained that participation was completely voluntary and that all personal information would be kept confidential.

Households signed up for the Energy Challenge by returning a business reply postcard that was included with the invitation letter. In addition to collecting contact information, the response card reiterated the expectations of participating and included a commitment pledge for participants to sign (see Appendix B). A reminder postcard with a detachable response card was sent one week later in an effort to increase the response rate and give residents a second opportunity to participate (Appendix C).

One hundred and sixteen households responded to the initial letter, 88 replied to the reminder postcard, and an additional five households signed up by phone or e-mail (it was unclear to which invitation these individuals responded). Another seven individuals wrote notes to applaud the City's program and to explain that they would not be participating because they were already doing a lot to conserve energy. Of the 209 households that signed up for the Energy Challenge, 11 were ineligible to participate because they did not have Internet access; another individual was excluded because he represented an entire condominium association.

The total response rate (including ineligible participants) was 7.4% out of the 2,825 invitations that were delivered.

All eligible participants were sent an e-mail (Appendix D) with a URL to a Qualtrics.com website that contained the pretest survey. This URL was unique to each participant and enabled confidential tracking of survey responses while also allowing participants to leave and return to the survey at a later time. Up to three reminder messages were sent to encourage participants to fill out the survey. Of the 197 participants who signed up and were eligible to participate, 152 (77%) completed the pretest survey.

Stratified random sampling was used to ensure that participants with similar household constraints and energy conservation experience were evenly distributed among the three treatment groups. Based on pretest survey data, participants were categorized into subsamples based on (1) whether they owned or rented their home, (2) the type of dwelling they lived in, and (3) the extent to which they already engaged in energy conservation behaviors. This last measure was determined by averaging how frequently each participant engaged in 21 behaviors on the pretest survey and then dividing the sample into three groups according to whether they had low, average, or high energy conservation experience. Individuals in each subsample were then randomly assigned to one of three treatment conditions – monthly feedback (N = 51), weekly feedback (N = 49), or weekly feedback + stories (N = 52). These group sizes were uneven because several individuals changed their mind about participating before the Energy Challenge started and were replaced by other individuals who signed up after them. At the start of the Energy Challenge, there were 47 participants in the monthly feedback group, 47 in the weekly feedback group, and 48 in the weekly feedback + stories group. At the posttest, the number of participants in each treatment with complete data were as follows: 23 in the monthly feedback group, 24 in weekly feedback, and 22 in weekly feedback + stories.

Study Design

A pretest – posttest design was used to assess the relative impact of each treatment condition on participants' sense of efficacy, perceived barriers to conserving, and their self-reported behavior. As shown in Figure 2.1, the three experimental conditions differed

according to (1) the amount and frequency of feedback provided to participants about the impact of their actions, and (2) whether participants were exposed to stories of other community members' efforts to conserve energy.

As the name implies, participants in the monthly feedback condition learned how much they had reduced their carbon footprint at the end of the Energy Challenge month. Households in this group received an informational booklet about how to reduce their household emissions and a paper tally sheet to help track their efforts. Participants were also asked to report what climate-friendly actions they took each week in an online log. Data from the logs were used to calculate participants' total CO_2 savings for the month, and this information was e-mailed to participants at the end of the Energy Challenge.

Participants in the weekly feedback group also received an informational booklet and tally sheet and were asked to record their efforts in an online log. The logs for this group, however, provided automatic feedback about how many pounds of CO_2 the participant had saved that week. The last page of the log also calculated the household's cumulative CO_2 savings during the Energy Challenge.

The final treatment condition, weekly feedback + stories, was the same as the other weekly feedback condition but had an added component. The logs, in addition to providing feedback, asked participants to share a story about what they had done to save energy. Several of these stories were then featured in future reminder e-mails that were sent to this group.

Procedure and Materials

Informational booklet

After completing the pretest survey, all participants were mailed a packet containing a 12-page, 8.5" x 11" full-color booklet designed by the author that described 34 energy-saving behaviors and their potential CO_2 savings (Appendix E). The packet also contained a tally sheet (Appendix F) printed on cardstock to help participants track their actions during the Energy Challenge. The booklets were identical for all three treatments with the exception of the page that reiterated the instructions for participating in the Energy Challenge.

The booklet primarily focused on curtailment behaviors, which were selected based on their appropriateness for October (e.g., air conditioning behaviors were excluded) and the ability of the author to provide reasonable estimates of CO_2 savings. Several low-cost efficiency behaviors were also included such as installing compact fluorescent light bulbs (CFLs), low-flow showerheads, and water heater blankets. Efficiency upgrades that would require a larger investment, such as insulating the attic or replacing appliances, were excluded in light of the recent economic downturn as well as the expectation that most participants would not take on such activities given the short time frame of the Energy Challenge.

Behaviors were organized in the booklet according to whether they concerned personal transportation use (8 behaviors), household energy consumption (19 behaviors), or food-related actions (7 behaviors). Each behavior was described in a two to five sentence paragraph. In addition, an attempt was made to address some of the concerns or questions that readers may have had about the recommended actions. Various *Tips* outlined the initial steps for taking an action or advised readers how to determine if an action was appropriate for their household. For example, the recommendation to turn the water heater temperature down to 120° F was accompanied by the following:

> TIP: If your water heater thermostat doesn't have numbers, turn the dial to warm or medium. To test the temperature, turn on the hot water at your sink, let it run for 3-5 minutes, then measure the temperature with a meat or candy thermometer. If you need to adjust the temperature further, wait a day before re-measuring it.

More involved actions such as composting food scraps or taking the bus had *Web resources* that directed readers to websites where they could learn more about the recommended behavior. The booklet also presented several *Myth-busting* facts to address misconceptions about energy consumption. For instance, the recommendation to setback the heat 8° F when away or sleeping was accompanied by the following:

> MYTH-BUSTING: It's a common misconception that a furnace will have to work harder after the temperature has been turned down for a long period. In truth, it takes far less energy to reheat your home after a setback period than it does to maintain a constant, high temperature throughout the day. Just try to keep your thermostat at a constant temperature for periods of 4 hours or more.

In addition to describing each behavior, the booklet included six sidebars that illustrated some of the non-energy benefits of the recommended actions. The purpose of these sidebars was to relate energy-saving actions to other goals or concerns that participants may have had – and, thus, potentially increase their motivation for trying a behavior. Examples of sidebar topics included the health benefits of walking or biking to work, the potential to sleep better at cooler temperatures in the winter, the increased durability of clothes washed in cold water and air dried, and the pleasant, social atmosphere of buying local food at the farmers market.

Finally, at the end of each section in the booklet (i.e., personal transportation, household energy, food), a table was provided that summarized the CO_2 savings for each behavior in that section. Where possible, the table showed the pounds of CO_2 that would be saved every time the action was performed (e.g., each day the thermostat was set back 8° F for eight hours) as well as the potential monthly savings if that behavior were maintained throughout the month-long Energy Challenge.

Online logs and feedback

Each week of the Energy Challenge, participants were asked to record in an online log what actions they had taken that week. There were four logs in total. The basic structure of the log was the same across treatment conditions and was designed to take as little time as possible to complete. The first page of the log asked participants to check off the general types of behaviors they did that week, such as "Drove car less," "Used less hot water," or "Changed diet." These categories matched how behaviors were organized in the informational booklet. The log then asked more specific questions about the behaviors that participants checked off. For example, if a participant checked "Changed diet," the log skipped to a page that inquired how many meat-based meals had been replaced with vegetarian entrées, how many were made with 50% organic ingredients, and so forth. By enabling participants to skip over irrelevant questions, the logs typically took 5 to 10 minutes to complete (as indicated by the online log software). Participants also had the option of leaving and returning to their saved responses at a later time.

The logs differed by treatment condition according to the feedback they provided. Participants in the weekly feedback and weekly feedback + stories conditions had interactive

logs that enabled participants to learn how many pounds of CO_2 each action saved, their savings for the week, and their cumulative savings over the course of the Energy Challenge (Appendices G and H). As participants filled out, for example, the "Use less hot water" portion of the log and indicated how many times they took a shorter shower or tried to conserve water while washing dishes, a box at the bottom of the page tallied their impact for reducing hot water usage. The final page of the log summed the impact of all of their actions for the week as well as their cumulative savings over the course of the Energy Challenge. The log also calculated how much each household could potentially reduce its annual carbon footprint if household members continued the week's activities throughout the year. In contrast, participants in the monthly feedback group received no indication in the logs of how many pounds of CO_2 they had saved as a result of their actions (see Appendix I). Instead, these participants were told their cumulative CO_2 savings at the end of the month, just prior to completing the posttest survey.

Finally, the logs for the weekly feedback + stories condition had two additional pages that asked participants to share a brief story about something they had done to meet the Energy Challenge (see Appendix H). The log asked participants to list the energy-saving activity they did and to respond to four questions. The first question, "This activity was rewarding because" was followed by six checkbox options such as "It felt consistent with what I value," and "It was fun." Participants were also given space to write in their own reasons. The second question asked "This activity was challenging because" and provided four options: "It was inconvenient," "Others in my household disapproved," "I had difficulty remembering to do it," and "It caused additional stress." Again, participants could write in their own explanations. The last two questions asked participants what advice they would give to others considering the same activity and, additionally, if they had any other energy-saving tips they wanted to share. Several of these stories were then used in the weekly reminder e-mails described below.

Weekly e-mail reminders and community stories

Every Thursday of the Energy Challenge, a brief e-mail was sent to participants with a link to their online log and a reminder to complete it. These reminder e-mails were virtually identical for the monthly and weekly feedback treatment conditions (see Appendices J and K). The only difference was that the monthly feedback participants were encouraged to complete

the log so that their carbon savings could be calculated at the end of the month; in contrast, participants in the weekly feedback condition were told they could learn of their progress thus far in the Energy Challenge. The body of the e-mail for the weekly feedback + stories condition was the same as the weekly feedback group. However, it also included a sidebar with three to four stories (taken from previous logs) of what other participants were doing to meet the Energy Challenge (see Appendix L). The stories were typically brief in nature, capturing what the participant did as well as their reflection on the experience. For example, one participant wrote, "I turned off the heated dry setting on my dishwasher. It was a really easy thing to do and had no negative impacts on the cleanliness of the dishes or my schedule."

At the end of the Energy Challenge, an e-mail (Appendix M) was sent to participants to thank them for their participation in the program and to invite them to complete a posttest survey about their experience. Participants received one of two versions of the e-mail depending on whether they had completed any of the online logs. For participants who completed at least one log, the e-mail summarized their total CO_2 savings during the Energy Challenge and the percentage by which their household would reduce its annual carbon footprint if they continued their energy-saving actions year-round. This was the first time participants in the monthly feedback group received information about the impact of their actions. The other e-mail, sent to participants who did not fill out any of the online logs, excluded information about CO_2 savings since that information was not available. Both e-mail messages tried to entice participants to complete the posttest survey by asking, "How much do you think the average household in Ann Arbor saved during the Energy Challenge?" and promising to reveal the results at the end of the survey. Up to three reminders were sent to complete the survey. Of the 88 participants who filled out at least one online log, 71 took the posttest survey. Among the 57 participants who did not complete any of the logs, only 17 took the posttest survey. The data from this latter group of participants were excluded from analysis since they represented a small portion of the overall sample, did not receive any feedback during the Energy Challenge, and had different levels of exposure to community stories in the weekly e-mails.

Finally, one month after the Energy Challenge ended, an e-mail was sent with a URL to the follow-up survey. Fifty-two of the participants with completed data from pretest to posttest

responded to this survey. Appendix N summarizes the sample sizes for each treatment condition at different stages of the study.

Measures

Pretest Survey

The pretest survey instrument (Appendix O) was primarily composed of 5-point, Likert-scale items intended to measure participants' current level of climate-friendly behavior as well as a number of covariates expected to influence behavior. These constructs are briefly described in the following subsections and are discussed in greater depth in Chapter 3. The survey also requested demographic information as well as some background information about participants' homes and transportation choices. Skip logic was embedded in the survey to reduce the demands on participants' time and attention. This feature of online surveys enables a participant to automatically bypass irrelevant questions based on his or her responses to previous questions (e.g., renters who indicated that they did not have control of their thermostats were not asked about whether they owned or used a programmable thermostat). The survey was pre-tested with a convenience sample of 11 acquaintances of the author.

Climate friendly behavior.

Participants were asked to rate how often they did each of 21 climate-friendly actions on a scale from *never* to *almost always*, with an option to mark *not applicable*. Multiple items were used to measure several classes of conservation behavior related to electricity use, hot water consumption, personal car habits, dietary choices, and thermostat settings.

Covariates.

Attention to global warming. The extent to which individuals engage in climate-friendly behavior may be influenced by how much they pay attention to the issue. Three items on the survey instrument were used to gauge this construct. Respondents were asked to rate from none to a great deal how much they paid attention to "information about global warming," as well as how much they had "actively looked for information about global warming" and

conserving energy in the past 30 days (adapted from Maibach, Roser-Renouf, & Leiserowitz, 2009).

Motivations to conserve. Eight items measured participants' motivations for engaging in energy conservation. Respondents were asked to indicate "How important are the following factors to you in deciding to conserve energy?" Four items were included to assess moral obligation (e.g., "It feels like the right thing to do") and two items measured perceived social norms (e.g., "People I care about are doing it"). In addition, participants were asked to rate the importance of "It saves me money" and "It's good for my health." The response scale ranged from *not at all* to *extremely important*.

Energy involvement, perceived barriers, and efficacy. The survey instrument also included 24 items designed to measure how salient energy conservation was to participants, their perceived barriers to conserving, and the degree to which they felt people are capable of addressing global warming. More specifically, items assessed whether participants actively sought out opportunities to conserve (e.g., "I look for ways to use less electricity," "I encourage others to conserve energy") and the degree to which global warming was a salient and priority issue (e.g., "I'm committed to reducing my impact on global warming," "I often think about my impact on global warming"). Perceived barriers to conserving were measured with general statements such as, "I would like to use less energy, but it's hard to change my habits" as well as statements specific to a particular behavior (e.g., "I'm too busy to use other forms of transportation besides my car"). Additional items concerned perceptions of collective efficacy, such as "If everyone does their part to conserve energy, we can reduce global warming," and "Our community is making a difference in reducing global warming."

Intrinsic satisfaction. The survey instrument included 16 items (adapted from De Young, 1996; 2000) designed to measure satisfaction gained from being frugal and avoiding wastefulness, from participating in activities that matter, and from doing things that enhance one's competence. Participants were asked to rate from *not at all* to *a great deal* how much satisfaction or enjoyment they got from a list of activities. Items intended to measure satisfaction from frugality included "Making do with what I have rather than buying new things," "Conserving energy," and "Avoiding wastefulness." Satisfaction from participation was

measured with statements such as "Taking action on issues I care about," "Working with others to solve a problem," and "Being a responsible citizen." Finally, satisfaction from competence was assessed with items like "Discovering new ways to lessen my environmental impact," "Taking on challenging tasks," and "Learning how to solve problems I face."

Posttest Survey

The purpose of the posttest survey (Appendix P) was to evaluate: (1) participant satisfaction with the program; (2) whether the Energy Challenge influenced participants sense of efficacy with regard to climate change and their perceived barriers to conserving; and (3) the degree to which the Energy Challenge encouraged climate-friendly behavior.

Climate friendly behavior.

The posttest survey measured behavior change by asking participants, "Compared to BEFORE the Energy Challenge, how often did you do the following during the last month?" Items included the same behaviors that were measured at pretest.[2] The response options included *N/A*, *less than before* (coded as -1) and a 5-point scale from *about the same* to *much more* (0-4). This question was used instead of the original pretest question, "How often do you do the following?" out of concern that the response scale *never* to *almost always* might not capture change. For example, people who reported *sometimes* taking the bus or carpooling at pretest might give the same response at the posttest even though they made an effort to increase this activity during the Energy Challenge.

Covariates.

Energy involvement, *perceived barriers to conserving*, *efficacy*, and *intrinsic satisfaction* were measured using the same items and response scales that were on the pretest survey. *Motivations for conserving* were not re-assessed as these were not expected to change during the relatively short course of the Energy Challenge. The items that measured *attention to global*

[2] Whereas the pretest separately assessed how often participants air dried laundry in warm weather and cold weather, the posttest had only one measure of this behavior.

warming were also excluded since participation in the Energy Challenge would obviously influence participants' exposure to information about global warming and energy conservation.

Evaluation of the Energy Challenge program.

Participant satisfaction with the program was measured in several ways. To gauge participants' perceived effort during the Energy Challenge, a single question at the beginning of the posttest survey asked participants to rate "To what extent did you try to conserve energy during the Energy Challenge?" with a response scale from *not at all* to *a great deal*.

The informational booklet was evaluated using four Likert scale items: "usefulness of information presented," "variety of energy-saving actions described," "how interesting it was to read," and "visual appeal," with a 5-point response scale from *poor* to *excellent.* A separate bank of items assessed participants overall satisfaction with the program. Participants were asked to rate how true the following statements were of their experiences with the Energy Challenge (*not at all true* to *very true*): "I had a clear understanding of what I was expected to do during the Energy Challenge," "Conserving energy was more difficult than I expected," "I learned new ways to reduce my impact on global warming," "I intend to continue some of the actions I tried during the Challenge," "I would be willing to try other energy conservation behaviors," "If I had it to do over, I would participate in this program," and "I feel good about my participation in the Energy Challenge."

Follow-up Survey

The follow-up survey assessed whether participants maintained the behaviors they had adopted during the Energy Challenge. Skip logic was used so that participants only had to answer questions about the behaviors they had adopted during the intervention. For example, the first question on the survey asked participants to check off the types of transportation-related behaviors that they had adopted (e.g., reduced driving, drove slower, checked tired pressure). This list was consistent with how behaviors were presented in the weekly logs and therefore included more behaviors than were measured on the pretest and posttest surveys. Based on participants' checked responses, the survey then presented a series of retrospective questions (see Appendix Q). For each climate-friendly behavior, participants were asked how

often they did the behavior before the challenge, during the challenge, and in the month since the challenge ended. To give participants more flexibility in answering, the response scale was a slider bar, which participants could drag between *never* and *almost always*. In contrast to a Likert scale, the slider bars enabled participants to more precisely show how much they felt they had changed from pretest, to posttest, to the follow-up. In addition to asking about transportation behaviors, the survey also presented checklists of behaviors concerning home energy use and food-related behaviors.

Data analysis

Data were analyzed with PASW (formerly SPSS) 18.0 unless otherwise noted. The analysis proceeded in several stages. In the first stage, principal axis factoring was conducted on pretest data to identify underlying constructs among the covariate items. Multiple regression was then used to explore the relationship between these covariates and participants' behavior at pretest. In the second stage of analysis, moderated multiple regression was used to determine the relative impact of *weekly feedback* and *shared stories* on participants' sense of efficacy and their perceived barriers to climate-friendly behavior. In the next stage of analysis, moderated multiple regression was again used to evaluate the impact of the treatment conditions on the adoption rates of individual behaviors during the Energy Challenge. Two-step cluster analysis and logistic regression were used to evaluate how the treatments influenced participants' overall patterns of behavior adoption, including the number and variety of behaviors that were adopted. The final analysis of the follow-up survey examined the rates at which each behavior was maintained or decreased one-month after the Energy Challenge ended. An alpha level of $p < .05$ was used for all statistics tests unless otherwise indicated. More detailed explanations of each analysis are provided in the following chapters.

Chapter 3

Correlates of Climate-Friendly Behaviors Prior to the Energy Challenge

The purpose of this chapter is to contribute to research on potential predictors of climate-friendly behavior. It examines the characteristics of individuals who initially signed up for the Energy Challenge and their motivations, attitudes, and behavior prior to the start of the program. The first two sections describe variables expected to influence behavior: demographics, participants' motivations for conserving, their sense of issue involvement, their perceived barriers to conserving, and their sense of efficacy in addressing climate change. The third section details participants' prior engagement in climate-friendly behaviors, and the final section looks at the relationships among these variables.

Characteristics of participants

Table 3.1 summarizes the demographic background of the 152 participants who completed the pretest survey. Three-quarters of the respondents were female, and the majority of participants owned their homes. The sample had a normal age distribution, with several household characteristics varying by age. Younger participants (age 18 – 29) were predominantly renters (68%) in multi-unit housing (75%) and tended to live alone (36%) or with one other adult (44%). In contrast, the vast majority (82%) of participants in the 30 – 49 age bracket lived in single-detached dwellings, and most (65%) had families with children at home. Participants aged 50 – 69 also lived primarily in single-detached homes (85%) and tended to be couples (45%) or families (34%). The eldest participants (70+) lived alone (45%) or with a significant other (45%) in single-detached homes (64%) or multi-unit housing with five units or more (18%). The square footage of participants' homes tended to increase with age, with the

Table 3.1
Participant demographics

	N	*%*
Age		
18 – 29	25	17
30 – 49	61	41
50 – 69	53	35
70 +	11	7
Gender		
Female	115	76
Male	37	24
Household structure		
Single	37	24
Couple	47	31
Family	60	40
Unrelated individuals	7	5
Have kids at home		
Yes	56	37
No	96	63
Home ownership		
Own	116	81
Rent	28	19
Approximate sq. footage of home		
< 1,000	29	20
1,001 – 1,500	43	30
1,501 – 2,000	41	29
2,001+	31	22

Note: Percentages may not add to 100 because of rounding error.

exception of participants 70 or older, most of whom (60%) lived in homes that were less than 1,500 square feet.

Attitudes toward and motivations for energy conservation

A number of variables were expected to correlate with participants' engagement in climate-friendly behaviors. These included the pretest items intended to measure *attention to global warming, motivations to conserve, energy involvement, perceived barriers* to conserving, and *intrinsic satisfaction*. Rather than assume that these items accurately captured the intended constructs, principal axis factoring with listwise deletion and varimax rotation was

performed to explore the structure of these data. All 51 covariate items included in the pretest survey were factor analyzed together rather than analyzing each bank of items separately. This was done out of concern that items across different banks were correlated. Analyzing all of the covariate items together enables related items to form one factor rather than several correlated factors. This was desirable as variables based on the factors were later used in multiple regression (Tabachnick & Fidell, 2007).

All factor analyses conducted for this study followed the same procedure. Bartlett's test of sphericity was run to ensure that the correlations among items were sufficiently large for factor analysis, and Kaiser-Meyer-Olkin (KMO) measures were examined to ensure sampling adequacy. Only items with KMO values > .6 were factor analyzed (Tabachnick & Fidell, 2007). If in the initial analysis, multiple items had a KMO value < .6, the item with the lowest value was dropped and the analysis was rerun. KMO values were reassessed, and the process was repeated until no items were below the .6 threshold.

The size of the final factor solution was determined, in part, by looking for convergence between the number of factors suggested by the scree plot and by Kaiser's criterion (i.e., factors with eigenvalues > 1). Each solution was also evaluated in terms of the meaningfulness and reliability of the factors produced. Items were considered to belong to a factor if they loaded at an absolute value of .45 or above; however, items with high loadings on multiple factors were dropped from the solution to minimize the relationship between factors. For each factor, Cronbach's alpha was computed to assess its reliability, and factors with an alpha greater than .60 were retained for future analyses.[3] Finally, a new variable was created for each factor by calculating the mean of the items it comprised; if necessary, items were first reverse-coded so that all measures were in the same direction. As a result, factor scores loosely correspond to the original 5-point Likert scale. Since the items included in the factor analysis had slightly different response scales (e.g., *not at all* to *a great deal* versus *not at all true* to *extremely true*), factor scores should be interpreted on a scale from 1 = *no endorsement* to 5 = *strong endorsement.*

[3] While .70 is generally the standard cutoff in the social sciences, .60 is considered acceptable for exploratory studies (Garson, 2010; Hair, Anderson, Tatham, & Black, 1998; Nunnally & Bernstein, 1994).

Based on these criteria, the factor analysis of attitudes and motivations yielded nine factors (Table 3.2). Eight of these factors seem to fall into three broad constructs: *issue involvement*, *motivations to conserve*, and *barriers to conserving*. The following subsections describe these constructs and their respective factors in greater detail. The ninth factor included most of the items that were intended to measure three types of intrinsic satisfaction (see Appendix R). Based on De Young's (1996, 2000) extensive testing of these intrinsic satisfaction items, it was expected that they would form three distinct factors related to satisfaction from *competence, participation,* and *frugality.* However, exploratory analyses revealed that most of the 16 items had virtually identical distributions and means. Although this factor had high internal consistency (Cronbach's $\alpha = .93$), it was excluded from future analyses because of its high correlation to one of the *issue involvement* factors ($r = .62$, $p < .001$).

Finally, six items were removed from the factor analysis due to low KMO values, and another seven items were dropped because they either failed to load on any factor or had loadings above .45 on multiple factors. Several of these single items were retained for future analyses because they represented important constructs not captured in the factors. Two items measured the degree to which participants' energy conservation was motivated by money and health, and three items concerned self- and collective-efficacy. These items are discussed in the following subsections, and their means and standard deviations can be found in Tables 3.2 and 3.3, respectively.

Issue involvement

Two factors emerged related to participants' involvement in the issue of climate change. The first factor, Seek information*,* included two items that measured whether participants actively sought information on energy conservation and global warming in the past 30 days. The third item in this factor measured how much participants paid attention, in general, to information on global warming. The mean of 2.94 (on a 5-point scale) suggests that participants made a moderate effort to seek information on these topics.

A second factor, Energy involvement*,* included statements that reflect active engagement in energy conservation. The top loading items concerned whether participants

Table 3.2

Factor analysis on pretest attitudes, motivations, and perceived barriers

	Rotated factor loadings					
	Issue involvement		*Motivations to conserve*			
	Seek information	Energy involvement	Social norms	Save money	Benefits health	Do the right thing
In the past 30 days how much have you actively looked for						
…information about conserving energy	.91					
…information about global warming	.68					
How much attention do you pay to information about global warming?	.62					
I look for ways to use less energy		.62				
[Satisfaction from] conserving energy		.52				
I rarely think about conserving energy†		-.47				
I encourage others to conserve energy		.47				
I would feel comfortable explaining to others how they can conserve energy		.46				
People I care about are doing it			.70			
Others in my household encourage me to			.64			
It saves me money				—		
It benefits my health					—	
It feels like the right thing to do						.87
It makes me feel good about myself						.60
It's the moral thing to do						.58
It helps reduce global warming						.55
Cronbach's alpha	.81	.76	.66	—	—	.80
Mean rating	2.94[a]	3.77[a]	2.88	3.80	4.07[b]	4.22[b]
SD	.93	.67	1.11	1.05	.98	.67

Note: †The mean of this item was reversed to be in line with the other items in this factor.

[a] Issue involvement means are significantly different at $p < .05$.

[b] Motivations that share a superscript are not significantly different at $p < .0083$. (Bonferroni correction = .05/6)

Table 3.2 continued

Factor analysis on pretest attitudes, motivations, and perceived barriers

	Rotated factor loadings			
	Perceived barriers			
	Inconvenience	Diet change barriers	Transportation barriers	Discomfort
Conserving energy around my home is inconvenient	-.58			
I would like to use less energy, but it's hard to change my habits	-.49			
Changing my diet to reduce global warming would be a sacrifice		-.54		
I rarely think about the impact of my food choices on global warming		-.45		
I'm too busy to use other forms of transportation besides my car			.64	
It's not practical for me to use my car less			.62	
I rarely think about how much I drive			.47	
I can use less energy in my home without sacrificing comfort†				.71
Using less heat or air conditioning in my home would be uncomfortable				-.57
Cronbach's alpha	.64	.61	.67	.65
Mean rating	2.13[c,d]	2.20[e]	2.37[d]	2.49[c,e]
SD	.76	.92	.91	.91

Note: †The mean of this item was reversed to be in line with the other item in this factor.

[c,d,e,] Barrier means that share a superscript are significantly different at $p < .0083$. (Bonferroni correction = .05/6)

Table 3.3

Means and standard deviations of efficacy items

	M (SD)
Self efficacy	
I'm not sure what I can do to help reduce global warming (*mean reversed*)	3.70[a] (.97)
Collective efficacy	
If everyone does their part to conserve energy, we can reduce global warming	4.20[a] (.93)
Our community is making a difference in reducing global warming	3.14[a] (.95)

Note: [a] Means are significantly different at $p < .017$ (Bonferroni correction = .05/3)

looked for opportunities to reduce their energy consumption and the degree of satisfaction they got from conserving. This factor also included two measures about whether participants actively encouraged others to conserve. This combination of items suggests that people who scored high on this factor not only thought energy conservation was important, but also derived satisfaction from acting on that concern. The moderately high mean of 3.77 indicates that this was true for many of the participants in the study, which is not surprising given the self-selected nature of the sample.

Motivations for conserving

Factor analysis yielded two factors about what participants' believed motivated them to conserve energy. The first factor, Do the right thing, included four items that suggest participants felt a sense of moral obligation to do their part. The second factor, Social norms, included the items "People I care about are doing it" and "Others in my household encourage me to." Two additional motivation items that failed to factor, "It saves me money," and "It's good for my health," were retained for further analysis given that their focus was inadequately represented in the survey question. The former had an inadequate KMO value to be included in the analysis while the latter did not load on any factor.

Of the four motivation types, only Social norms had a normal distribution. The other three motivations were negatively skewed at $p < .01$, indicating that a large portion of participants highly endorsed them. To compare endorsements of the four motivations, paired t-tests[4] were conducted with a Bonferroni correction applied (.05/6), which set the significance level to .0083 (see Table 3.2). These tests showed that participants were most motivated to conserve energy because it's the right thing to do and because it benefits their health. The relative endorsements of these two motivations were statistically equivalent. Save money was also highly endorsed but less so than Do the right thing and Benefits health. Finally, respondents reported being substantially less motivated by Social norms than Do the right thing, Benefits health, and Saves money.

[4] Although the distributions were highly skewed, paired t-tests between the motivations yielded the same results as the equivalent nonparametric test; for ease of interpretation, the paired t-tests are reported.

Barriers to conserving

The remaining four factors concerned barriers to conserving. Each of these factors had relatively low means (between 2.1 and 2.5), indicating low perceived barriers. The factor with the highest mean involved the perception that conserving energy in one's home can lead to Discomfort. Participants were equally discouraged by Transportation barriers, which included items related to the impracticality of using one's car less. The two items comprising the next factor, Diet change barriers, captured the degree to which participants felt changing their diet would be a sacrifice. It also reflected how aware they were of the connection between dietary choices and climate change. Finally, participants rated Inconvenience as the least discouraging aspect of conserving energy. This factor included two items about the difficulty of changing habits and the inconvenience of conserving energy in one's home. It should be noted that while the internal consistency of each of these factors is moderate at best, the low alphas are likely a function of each construct being underrepresented on the survey. Hence, only a few items were available to load on each factor.

The low overall means for each of the barrier factors suggests that the sample as a whole did not perceive many impediments to reducing energy consumption. Paired t-tests were conducted with a Bonferroni correction applied (i.e., p was set to $< .0083$) to explore differences in means. The results indicate that there were slight differences in participants' perceptions of the four barriers, with Discomfort and Transportation barriers having the highest means and Inconvenience the lowest mean (see Table 3.2). However, where significant differences were found, the effect sizes were small, ranging from $d = .27$ to .41 (adjusted for correlation between factors; Cohen, 1988; Dunlap, Cortina, Vaslow, & Burke, 1996), suggesting that participants' ratings of perceived barriers were not substantively different.

Self - and collective efficacy

Three items intended to measure perceptions of self and collective efficacy were retained for future analyses based on their face validity. The first item, "I'm not sure what I can do to help reduce global warming," had a relatively low mean (2.30, SD =.97), suggesting that most participants felt fairly knowledgeable about strategies to reduce their impact on global

warming. Another item, "If everyone does their part to conserve energy, we can reduce global warming," had a mean of 4.20 (*SD* = .93), suggesting that participants strongly believe that individual actions have the capacity to influence climate change. Finally, the third measure, "Our community is making a difference in reducing global warming," which measured collective efficacy, had a mean of 3.14 (*SD* = .95).

To compare endorsement of the three efficacy variables, the mean for "Not sure what I can do" was reversed and paired t-tests were conducted. All means were significantly different (see Table 3.3), and the differences in means had medium to large effect sizes. Results suggest that while participants felt strongly that individuals can make a difference in combating climate change, they were less confident in their knowledge of action strategies, and even less certain of the impact their community was having. Even among individuals who perceived few barriers to conserving, there may still be a need to enhance knowledge of action strategies and to highlight the positive impact that others in their community are having. Other research has found that lack of knowledge and the perception that no one else is taking action can limit individuals engagement in climate-friendly behaviors (Lorenzoni, et al., 2007; Norgaard, 2006; Semenza, et al., 2008).

Climate-friendly behaviors

The pretest survey revealed that most participants had already adopted several energy-saving actions prior to the start of the Energy Challenge. Table 3.4 lists the 21 behaviors that were measured along with their means and standard deviations across the entire sample. A mean composite score across all 21 behaviors was calculated as a measure of participants' overall level of climate-friendly behavior. This measure was normally distributed with a range from 2.14 to 4.71 and had a mean of 3.48 on a 5-point scale (*SD* = .52), indicating that on average, participants engaged in climate-friendly actions *sometimes* to *quite often*.

The frequency with which participants performed various climate-friendly behaviors appears to fall along a rough continuum from high to low perceived costs in terms of effort, inconvenience, and time. The behaviors that were engaged in least often might be

Table 3.4
Frequency of conservation behaviors at pretest

	N	*Mean*	*SD*
Plan errands to minimize number of car trips	149	4.28	.87
Wear more clothes in winter instead of turning up the heat	151	4.25	.90
[Do not] Leave the car running while waiting for someone	147	4.20	.93
Keep the heat turned down to 62°F or below when no one is home	149	3.89	1.44
Turn off computer(s) when not in use	151	3.87	1.16
Use compact fluorescent light bulbs	151	3.81	1.14
Wash laundry in cold water	152	3.77	1.13
Keep the heat turned down to 62°F or below when sleeping	149	3.73	1.51
Eat meatless meals	151	3.71	.92
Consider whether I really need to drive somewhere	148	3.67	1.07
Buy locally produced food	151	3.64	.78
Take showers of 6 minutes or less	149	3.61	1.08
Cook with a microwave or toaster oven instead of oven	148	3.50	1.07
Eat organic food	151	3.42	.90
[Do not] Use the heated dry setting on the dishwasher	111	3.21	1.59
[Do not] Leave electrical chargers (e.g., for cell phone) plugged in	148	3.12	1.60
Walk or bike instead of driving	151	2.96	1.14
Turn electronic devices completely off by unplugging them or controlling them with a power strip	151	2.92	1.26
Take the bus or carpool instead of driving	147	2.71	1.29
Air dry laundry during warm weather months	150	2.49	1.47
Air dry laundry during winter months	150	2.07	1.37

Note: Responses measured on a 5-point Likert scale from 1 (*never*) to 5 (*almost always*), based on the stem question, "How often do you do the following?"

characterized as the most burdensome. These include actions such as air drying laundry and using alternative forms of transportation to personal vehicles. Carrying out these activities involves a certain level of commitment and patience as well as giving up more convenient alternatives (e.g., using a dryer or one's car). These behaviors also require supportive infrastructure: One needs a place to hang wet laundry and access to useful bus routes or pedestrian- and bike-friendly paths.

Behaviors that were engaged in somewhat more frequently, such as eating a low-carbon diet or reducing standby energy use, have similar but less demanding constraints. The degree to

which one buys organic and local food may be constrained by income or availability at one's local grocery store. Likewise, regularly unplugging electronic devices to reduce standby power can be difficult to remember. This behavior can also pose an inconvenience if outlets are not readily accessible or devices need to be reprogrammed when they are plugged back in.

The behaviors with greatest adoption have fewer impediments. These include a number of common energy-saving actions such as using compact fluorescent light bulbs (CFLs), washing laundry in cold water, and turning down the heat. Also included here are behaviors such as planning one's errands, layering clothing to avoid adjusting the heat, and turning off the car while waiting for someone. While these behaviors arguably have their own drawbacks, the minor inconvenience or discomfort that is caused occurs on a shorter time scale that may be less objectionable. The one exception to this may be behaviors related to keeping the heat turned down. It is possible that participants suffered recall bias when rating these behaviors, as the survey was administered at the beginning of autumn, when most households had not used heat in over four months. It is also possible that the economic benefit of this action makes it seem worthwhile. Perceived benefits could also explain the appeal of some of the other frequently done actions. Compact fluorescent light bulbs (CFLs), for example, save money and reduce the nuisance of replacing hard to reach light bulbs. Likewise, combining errands can lower gasoline costs and save time.

As the above discussion implies, different types of climate-friendly behaviors are likely influenced by different variables. In recognition of this, behaviors were divided into meaningful categories before examining their relationship to specific demographics and attitudes (Abrahamse & Steg, 2009; Black, et al., 1985; Poortinga, Steg, & Vlek, 2004; Poortinga, Steg, Vlek, & Wiersma, 2003). Toward this end, the 21 behaviors were factor analyzed using the procedure previously described. Because many participants rated one or more behaviors as *not applicable* to them, pairwise deletion was used to preserve as much data as possible.

Five factors emerged from the analysis, four of which had alpha coefficients greater than .60 (see Table 3.5). One of the most frequently done behaviors, Plan driving (M = 3.99, SD = .85), included two items that reflect being conscientious about the number of car trips one makes. Keep heat low (M = 3.95, SD = 1.11) was also done *quite often* and included items

Table 3.5
Factor analysis of conservation behaviors

Behaviors	Rotated factor loadings			
	Air dry laundry	Eat low carbon diet	Keep heat low	Plan driving
Air dry laundry during warm weather months	.91			
Air dry laundry during winter months	.85			
Eat organic meals		.71		
Buy locally produced food		.65		
Eat meatless meals		.56		
Keep the heat turned down to 62°F or below when sleeping			.90	
Keep the heat turned down to 62°F or below when away			.80	
Wear more clothes in winter instead of turning up the heat			.50	
Consider whether I really need to drive somewhere				.70
Plan errands to minimize number of car trips				.69
Cronbach's alpha	.93	.69	.80	.68
Mean rating	2.28	3.59	3.95[a]	3.99[a]
SD	.68	1.38	1.11	.85

[a] Behaviors that share a superscript are not significantly different at $p < .0083$. (Bonferroni correction = .05/6)

Table 3.6
Pearson correlations between categories of behaviors, with sample size indicated in parentheses

	1	2	3	4	5
1. Composite score	—				
2. Air dry laundry	.67*** (150)	—			
3. Eat low carbon diet	.54*** (152)	.19* (150)	—		
4. Keep heat low	.67*** (152)	.30*** (150)	.27*** (152)	—	
5. Plan driving	.58*** (150)	.37*** (148)	.30*** (150)	.20* (150)	—

Note: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$
The sample size differs across correlations as some behaviors were not applicable to all participants (e.g., participants without a car had no data for Plan driving).

related to keeping the thermostat at 62° F when away or sleeping as well as wearing more clothing instead of turning up the heat. The third category, Eat low carbon diet, was done somewhat less frequently (*M* = 3.59, *SD* = 1.38) and comprised the three items that pertained to eating local, organic, or meatless meals. The fourth factor, Air dry laundry, was the least endorsed (*M* = 2.28, *SD* = .68) and reflected, on average, how frequently participants air dried laundry year round. The fifth factor concerned use of alternative transportation (i.e., walking or biking, taking the bus or carpooling) but had low reliability, Cronbach's $\alpha = .57$.

Table 3.6 shows the correlations between behaviors. Each behavior factor is moderately to strongly correlated with overall behavior (i.e., the composite score). However, correlations between specific types of behaviors are only small to moderate, suggesting that engaging in one type of energy-saving behavior does not necessarily carry over to other forms of energy conservation (Harland, Staats, & Wilke, 1999; Tracy & Oskamp, 1983-84).

Relationships among covariates and behaviors

To investigate the relationship between each set of covariates and climate-friendly behaviors, a series of multiple regression analyses was conducted. The following four categories of behaviors were examined: participants' composite score across all 21 behaviors as well as Keep heat low, Eat low carbon diet, and Plan driving. The correlations between covariates are shown in Table 3.7 and the product-moment correlations between each covariate and behavior are shown in Table 3.8. Air dry laundry was not analyzed as this behavior is rather uncommon and less representative of the types of actions that Americans might take to conserve energy. The other three behaviors, in contrast, exemplify the three categories of behavior the Energy Challenge sought to influence: household energy use, food choices, and transportation.

For each behavior of interest, the analysis proceeded as follows. Initially, the behavior was regressed independently on each set of covariate variables. That is, a separate model was built for the variables that comprise issue involvement, another for the variables related to barriers, motivations, and efficacy. The intent of these analyses was to identify, for example, which aspects of issue involvement or what types of motivations had the strongest relationship to each behavior, independent of other variables. A final model was then developed by

Table 3.7

Pearson correlations between covariates

	Issue Involvement		Motivations				Barriers				Efficacy		
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Seek information	—												
2. Energy involvement	.46***	—											
3. Social norms	.17*	.19*	—										
4. Save money	-.11	.05	.19*	—									
5. Good for health	.15	.38***	.33***	.33***	—								
6. Do the right thing	.27***	.41***	.34***	.05	.32***	—							
7. Inconvenience	-.35***	-.43***	-.16*	.06	-.23**	-.22**	—						
8. Diet change barriers	-.35***	-.36***	-.16*	.23**	-.17*	-.43***	.34***	—					
9. Transportation barriers	-.29***	-.38***	-.15	.15	-.05	-.12	.44***	.38***	—				
10. Discomfort	-.10	-.24**	-.19*	.07	-.16	-.14	.25**	.14	.25**	—			
11. Not sure what I can do	-.18*	-.31***	.07	.19*	.02	-.10	.23**	.23**	.23**	.07	—		
12. If everyone does their part	.10	.18*	.05	.00	.31***	.25**	-.09	-.10	-.14	-.11	-.16	—	
13. Our community is making a difference	.25**	.20*	.17*	.00	.23**	.16	-.20*	-.11	-.08	.06	-.06	.25**	—

*$p < .05$, **$p < .01$, ***$p < .001$

Table 3.8
Pearson correlations between covariates and categories of behaviors

Variable	Composite behavior	Keep heat low	Eat low carbon diet	Plan driving
1. Seek information	.42***	.16*	.29***	.35***
2. Energy involvement	.52***	.27***	.29***	.37***
3. Social norms	.16*	.08	.16*	.22**
4. Save money	-.02	.01	-.13	-.05
5. Good for health	.21**	.12	.11	.23**
6. Do the right thing	.29***	.17*	.29***	.17*
7. Inconvenience	-.46***	-.29***	-.25**	-.33***
8. Diet change barriers	-.48***	-.26***	-.56***	-.34***
9. Transportation barriers	-.50***	-.20*	-.32***	-.51***
10. Discomfort	-.24**	-.24**	-.14	-.11
11. Not sure what I can do	-.32***	-.05	-.31***	-.13
12. If everyone does their part	.06	.07	.00	.02
13. Our community is making a difference	.12	-.03	.14	.05

*$p < .05$, **$p < .01$, ***$p < .001$

combining the significant predictors from previous models and using backward elimination to arrive at the most parsimonious model. For the final regression model, assumptions regarding the normality, linearity, and homoscedasticity of residuals were checked.

Relationship of demographics to climate-friendly behavior

Table 3.9 shows the results of the regression analyses with participant demographic data. Only two variables, age and home size (measured in square footage), were significant predictors of participants' overall engagement in energy conservation, as measured by the composite score. The results indicate that older participants, in general, tended to be more engaged in climate-friendly behavior. In contrast, home size was negatively related, suggesting that people who are conscientious of their energy use may seek to live in smaller homes. Age was also positively correlated with planning car trips, suggesting that older participants drive less. Gender, homeownership, and household size were not found to predict any of the behaviors.

Table 3.9

Regression results using demographics to predict behaviors

	Composite behavior			Keep heat low			Eat low carbon diet			Plan driving		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Age	**.10**	**.03**	**.28****	.13	.08	.17	.06	.05	.12	**.18**	**.06**	**.31*****
Square footage	**-.13**	**.04**	**-.33*****	-.13	.09	-.15	.01	.05	.01	-.11	.07	-.16
Household size	.03	.04	.07	.08	.08	.10	-.03	.05	-.07	.01	.06	.02
Rent	-.02	.13	-.02	-.44	.31	-.16	-.02	.18	-.01	.25	.22	.11
Male	-.00	.10	-.00	.11	.23	.04	-.09	.14	-.06	-.15	.17	-.07
F	3.74**			1.72			.62			2.80*		
R^2	.13			.07			.02			.09		
Adjusted R^2	.09			.03			-.01			.06		

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 3.10

Regression results using issue involvement to predict behaviors

	Composite behavior			Keep heat low			Eat low carbon diet			Plan driving		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Seek information	**.14**	**.05**	**.25****	-.01	.11	-.01	**.15**	**.07**	**.21***	**.25**	**.08**	**.27****
Energy involvement	**.32**	**.07**	**.40*****	**.45**	**.16**	**.28***	.18	.10	.18	**.31**	**.12**	**.24****
F	31.08***			4.96**			8.48***			16.09***		
R^2	.32			.07			.11			.20		
Adjusted R^2	.31			.06			.10			.18		

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Relationship of issue involvement to climate-friendly behavior

Both factors related to issue involvement significantly predicted participants' overall engagement in climate-friendly actions (Table 3.10). Taken together, these two variables accounted for nearly a third of the variance in participants' composite behavior scores, confirming that issue involvement is closely related to climate-friendly behavior. The beta coefficients indicate that this relationship was strongest for Energy involvement. The weaker relationship with Seek information may reflect that participants who were highly engaged in climate-friendly were already well-informed about the issue.

Among the specific behavior measures, Energy involvement was positively related to keeping the heat turned down and planning car trips. As participants reported doing these two behaviors most often, the positive relationship with Energy Involvement may suggest that participants develop a stronger sense of involvement the more they engage in energy-saving activities. The results also showed that participants who recently sought information about global warming and energy conservation were more likely to eat less carbon-intensive meals and to minimize their car travels. This finding suggests that information about these behaviors and how they relate to climate change may be useful for encouraging their adoption.

Relationship of motivations to climate-friendly behavior

The analyses revealed an apparent discrepancy between what participants said motivated them to conserve and the motivations that significantly predicted their behavior. Of the four motivations, only Do the right thing was significantly related to overall behavior, despite the fact that participants also highly endorsed Benefits health and Saves money (Table 3.11). The regression models for dietary and thermostat behaviors had the same results. These findings are in line with previous studies that suggest environmental concern may be sufficient to change easy, low-cost behaviors (Gatersleben, Steg, & Vlek, 2002; Lindenberg & Steg, 2007; Whitmarsh, 2009a). In contrast, Plan driving was predicted by Benefits health, which accounted for 20% of the variance in this behavior. Past research has similarly found that self-interested motives (such as health) have a greater influence on transportation behaviors than motives to do the right thing (Bamberg & Schmidt, 2003). This may be because driving is associated with

Table 3.11

Regression results using motivations to predict behaviors

	Composite behavior			Keep heat low			Eat low carbon diet			Plan driving		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Do the right thing	**.17**	**.07**	**.22***	**.34**	**.16**	**.21***	**.23**	**.09**	**.24***	.07	.12	.06
Benefits health	.07	.05	.14	-.03	.09	-.03	.03	.06	.05	**.16**	**.08**	**.19***
Saves money	-.03	.05	-.05	.01	.10	.01	-.10	.06	-.16	-.11	.07	-.14
Social norms	.03	.04	.06	-.06	.11	.06	.08	.05	.13	.12	.07	.16
F	3.58**			1.69			4.30**			3.25*		
R^2	.10			.05			.12			.09		
Adjusted R^2	.07			.02			.09			.06		

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Table 3.12

Regression results using barriers to predict behaviors

	Composite behavior			Keep heat low			Eat low carbon diet			Plan driving		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Inconvenience	**-.15**	**.06**	**-.22****	-.25	.14	-.18	-.01	.08	-.01	-.16	.10	-.14
Diet change barriers	**-.15**	**.04**	**-.28*****	-.20	.11	-.17	**-.35**	**.06**	**-.48*****	-.10	.08	-.11
Transportation barriers	**-.16**	**.05**	**-.28*****	-.07	.11	-.06	-.09	.06	-.12	**-.42**	**.08**	**-.44*****
Discomfort	-.05	.04	-.09	**-.25**	**.10**	**-.21***	-.04	.06	-.06	.05	.07	.05
F	21.91***			6.59***			15.04***			14.85***		
R^2	.40			.18			.32			.31		
Adjusted R^2	.38			.15			.29			.29		

$^{**}p < .01$, $^{***}p < .001$

many personal benefits, from convenience to pleasure and fun. Lindenberg and Steg (2007) suggest that people may be more willing to change such behaviors if they believe there will be positive consequences to themselves.

Relationship of barriers to climate-friendly behavior

The regression analyses confirmed that perceived barriers have a strong relationship with behavior. In the case of the composite score, perceived barriers explained 40% of the variance (Table 3.12). Engagement in climate-friendly behaviors, in general, was negatively related to perceptions that conservation is inconvenient as well as to barriers concerning dietary choices and using one's car less. No relationship was found between composite behavior and Discomfort. Keep heat low, Eat low carbon diet, and Plan driving were each negatively related to the barrier that most closely aligned with the behavior – Discomfort, Diet change barriers, and Transportation barriers, respectively.

Relationship of efficacy to climate-friendly behavior

Only one of the efficacy measures was significantly related to behavior: "I'm not sure what I can do to help reduce global warming." This variable alone accounted for 13% of the variance in overall behavior and 11% of diet-related behaviors. The more participants lacked self-efficacy, the lower their composite score and the less likely they were to eat a low carbon diet. These findings may reflect that participants were not aware of some energy-saving behaviors before the Energy Challenge. For example, several participants remarked on the pretest survey that they did not understand how eating differently was related to climate change. Likewise, comments on the weekly logs and posttest surveys suggest that participants were unfamiliar with the concept of standby power. The significant relationship between the composite behavior score and self-efficacy may be explained by the fact that the composite measure included many items related to both dietary choices and standby power. Interestingly, self-efficacy was not related to thermostat or driving behaviors. This finding may imply that most participants were already very familiar with these types of actions, and thus, lack of knowledge was not a barrier for engaging in them.

Table 3.13

Regression results using efficacy to predict behaviors

	Composite behavior			Keep heat low			Eat low carbon diet			Plan driving		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Not sure what I can do	**-.18**	**.04**	**-.34*****	-.11	.10	-.10	**-.21**	**.06**	**-.31*****	-.10	.08	-.11
If everyone does their part	-.00	.05	-.00	.17	.11	.15	-.04	.06	-.05	-.00	.08	-.00
Our community is making a difference	.04	.05	.08	-.15	.11	-.13	.07	.06	.11	.03	.08	.03
F	6.52***			1.71			5.24**			.63		
R^2	.13			.04			.11			.01		
Adjusted R^2	.11			.02			.09			-.01		

** $p < .01$, *** $p < .001$

Table 3.14
Final regression models for each behavior

	Composite behavior				Keep heat low				Eat low carbon diet				Plan driving			
	b	*SE*	β	sr^2	*b*	*SE*	β	sr^2	*b*	*SE*	β	sr^2	*b*	*SE*	β	sr^2
Age	.07	.02	.19**	.03									.09	.04	.15*	.02
Square footage	-.06	.03	-.16*	.02												
Seek information	—	—	—						—	—	—		.17	.07	.18***	.03
Energy involvement	.23	.06	.29***	.06	.37	.14	.23**	.05					—	—	—	
Do the right thing	—	—	—		—	—	—		—	—	—					
Benefits health													.15	.06	.18*	.03
Inconvenience	—	—	—													
Diet change barriers	-.10	.04	-.19*	.03					-.36	.05	-.50***	.23				
Transportation barriers	-.14	.04	-.25***	.05									-.43	.07	-.46***	.18
Discomfort					-.29	.10	-.24**	.06								
Not sure what I can do	-.08	.04	-.16*	.02					-.13	.05	-.19*	.03				
F	20.91***				9.29***				32.53***				20.16***			
R^2	.49				.13				.33				.38			
Adjusted R^2	.47				.12				.32				.36			

Note: * $p < .05$, ** $p < .01$, *** $p < .001$
Dashes indicate the predictor became nonsignificant when combined with other variables and was therefore removed from the final model.

Combining significant predictors

A final model was developed for each behavior category by combining the significant predictors from each of the previous regression models. Variables that became nonsignificant were removed one-by-one starting with the variable that had the highest *p* value until all predictors had $p < .05$. The final models for each behavior are shown in Table 3.14 along with the semi-partial correlations (sr^2) for each predictor. Semi-partial correlations represent the unique variance that each predictor explains beyond variance that is shared with other predictors. As such, semi-partial correlations are useful for gauging the relative importance of each predictor, particularly when predictors are mildly correlated; sr^2 reflects the amount by which R^2 would decrease if the predictor were removed from the model (Tabachnick & Fidell, 2007).

Composite behavior

The final model for composite behavior accounted for 49% of the variance in this measure. Energy involvement was the strongest predictor of overall behavior followed by transportation barriers. Age, home size, diet change barriers and the self-efficacy measure, "Not sure what I can do" also remained significant predictors. Three variables – Seek information, Inconvenience, and Do the right thing – became nonsignificant in the combined model, suggesting that their effects on behavior were mediated by other predictors (Tabachnick & Fidell, 2007). In other words, the variance that these variables initially accounted for was captured by one or more of the remaining significant predictors. Energy involvement is a likely candidate as each of the aforementioned variables was moderately correlated with it at .40 or greater (see Table 3.4). This factor comprised items that reflect satisfaction from conserving energy as well as whether individuals seek opportunities to conserve. As these items are more closely related to behavior it seems logical that Energy Involvement might be an intermediate variable between a general desire to Do the right thing and actual engagement in behavior.

Keep heat low

Three variables were significant predictors of Keep heat low in the previous analyses: Energy involvement, Do the right thing, and Discomfort. In the combined model, Do the right thing was no longer significant, suggesting again that its effect on behavior was mediated by the

other predictors. Energy involvement and Discomfort were relatively equal in their predictive strength and together accounted for 13% of the variance in this behavior.

Eat low carbon diet

Of the four variables that separately predicted whether participants ate a low carbon diet, two remained significant in the combined model: Diet change barriers and Not sure what I can do. Together, these two variables accounted for 33% of the variance in this behavior, 23% of which was uniquely attributed to diet change barriers. Similar to the model for composite behavior, Seek information and Do the right thing became nonsignificant when combined with other variables. Taken together, these findings indicate that while people may care about doing the right thing and are attentive to the issue of climate change, the extent to which they eat a low-carbon diet ultimately depends on the barriers they associate with it and whether they understand how their dietary choices affect climate change.

Plan driving

The final model for Plan driving explained 38% of the variance in this behavior. Participants were more likely to plan car trips the older they were, the more they had recently looked for information about climate change, and the more they were motivated by health. Transportation barriers had a significant negative relationship with behavior, which uniquely accounted for 18% of the variance. Energy involvement became nonsignificant and was removed from the final model.

Summary

Taken together, the regression analyses support that climate-friendly behavior, in general, relates to motivations, issue involvement, perceived barriers to conserving, and self-efficacy. Interestingly, for each behavioral category, perceived barriers had the strongest relationship to behavior. The motive to Do the right thing, which was initially a strong predictor of the composite score and behaviors related to thermostat settings and diet, became nonsignificant in the final models. This common finding suggests that while people may be motivated to Do the right thing, their engagement in climate-friendly behaviors is ultimately driven by specific attitudes about those behaviors (such as the perceived barriers about the inconvenience of an activity) .

Discussion

This chapter examined the characteristics of individuals who signed up for the Energy Challenge and explored the relationships among their energy-related attitudes and behaviors prior to the start of the program. Survey data suggest that the Energy Challenge appealed to a broad age demographic as well as to different household types (i.e., individuals, couples, and families). It appears, though, that females were more likely to sign up for the program than males.

As might be expected, the Energy Challenge also attracted individuals who were already attuned to the issues of climate change and energy conservation. Most participants were engaged in a number of energy-saving actions prior to the start of the program, particularly behaviors that pose minimal inconvenience and are commonly advocated as a means to reduce energy consumption. These include actions such as using CFLs, washing laundry in cold water, planning errands, and keeping the heat turned down. A number of high impact behaviors were done less frequently, namely eating a lower carbon diet and using alternative transportation. Other studies have found similar patterns of results, with people preferring energy-saving actions that have low monetary and personal costs over behaviors that pose a major inconvenience or require greater commitment (Abrahamse, et al., 2007; Poortinga, et al., 2003).

Survey responses also indicate that the sample was highly motivated and perceived few barriers to conserving. Participants reported that they conserved energy out of a sense of moral obligation as well as a desire to save money and benefit their health. In contrast to other studies (Lorenzoni, et al., 2007; Norgaard, 2006; Stoll-Kleemann, et al., 2001), participants did not find the inconvenience of conserving to be a major deterrent, and they seemed hopeful about the potential of individuals to make a difference in mitigating climate change. Similar to past research, however, participants felt only moderately confident in their knowledge of strategies to address climate change and in the positive impact their community was having (Lorenzoni, et al., 2007; Semenza, et al., 2008). Multiple regression analyses of four specific categories of behaviors – the composite score, thermostat settings, dietary choices, and personal car use – revealed several interesting patterns in terms of how these covariates were related to each other and to climate-friendly behavior.

One important finding concerns the relationship of motivations to behavior. The results suggest that curtailment behaviors such as lowering the thermostat and eating a low carbon diet are ultimately rooted in a desire to do the right thing. This motive closely aligns with Schwartz's (1977) concept of *personal norms*, which he defines as feelings of moral obligation that individuals hold for themselves. Past research suggests that personal norms and environmental attitudes are most likely to lead to behavior change when individuals perceive few personal costs to taking action (Diekmann & Preisendörfer, 2003; Gatersleben, et al., 2002; Heberlein & Warriner, 1983; Lindenberg & Steg, 2007). As previously discussed, thermostat behaviors and dietary choices are likely to fall in this category. The inconveniences imposed by either behavior are short-lived and within the individual's control to alleviate. If the ambient temperature becomes too cold, for example, one can easily make adjustments.

The same cannot be said for transportation-related behaviors. In the present study, Plan driving was motivated by health. Research has shown that behaviors with greater constraints – like using one's car less – tend to be influenced more by self-interested motives such as the desire to save money or to gain social approval (Bamberg & Schmidt, 2003; Black, et al., 1985; Lindenberg & Steg, 2007; Whitmarsh, 2009a). In other words, individuals are more likely to take on a burdensome behavior if they perceive that it will result in personal gain. The regression analysis for Plan driving suggests that when participants choose to drive less, they may turn to other forms of transportation that involve exercise. There is some evidence to support this interpretation as the survey item, "walk or bike instead of driving" was moderately correlated with Plan driving at $r = .43$, $p < .001$. Others studies have found that health is a primary motivation for using these modes of transportation (Hunter, Carmichael, & Pangbourne, 2006; Whitmarsh, 2009a).

But what about the motive to save money, which was moderately endorsed on the survey? Why did it fail to predict any of the behaviors? One possibility is that people tend to misattribute the causes of their behavior. Using Heider's (1958) theory of naïve psychology, Nolan, et al. (2008) demonstrated that what motivates people to conserve energy is often different from the reasons they state. While participants in their study rated saving money as a "very important" reason to conserve energy, no correlation was found between the belief that conserving energy saves money and their actual energy consumption. In fact, the authors

demonstrated that behavior was influenced most by social norms – though participants reported being least motivated by this factor. Nolan, et al. (2008) suggest that when people are asked to explain what influences their behavior, they are likely to rely on cultural theories of what *should* motivate their behavior. It is conceivable that participants in the present study were influenced by the abundance of campaigns that emphasize "save energy – save money," and thus overestimated the role of this motive in their behavior.

Another explanation is that the perceived monetary savings associated with the behaviors on the survey were too small to motivate change. Past research has shown this to be true for thermostat behaviors. Becker, Seligman, Fazio, and Darley (1981) found no relationship between actual energy consumption and the belief that lowering the thermostat can save money. As the authors hypothesized, the relatively small amount of money saved each month by turning down the heat may not be worth the perceived sacrifice in thermal comfort. Research by Black, et al. (1985) further supports that thermostat behaviors are predominantly driven by personal norms, not financial motives. They found, instead, that concerns about energy costs were associated with installing efficient appliances and taking steps to weatherize one's home and seal air leaks – actions that presumably have a bigger benefit to one's wallet (Black, et al., 1985).

The results of this study also confirm the importance of accounting for the psychological barriers that may prevent people from engaging in climate-friendly behavior. Although, on average, the sample did not perceive major barriers to conserving energy, the final regression models demonstrate that barriers had the strongest relationship to each of the behavior measures, above and beyond the other covariates. These results support the notion that measures that are specific to a behavior – like the barriers measured here – are better predictors of behavior than motivations or feelings of environmental concern (Ajzen & Fishbein, 1977, 1980; Fishbein & Ajzen, 1975; Heberlein & Warriner, 1983; Stern, 1992).

Further evidence of this can be seen by comparing the regression models for the different sets of covariates (Tables 3.9 through 3.13). As indicated by the adjusted R^2 values, the barrier models explained the highest proportion of variance in each of the behaviors. This may be because the barrier measures were the only items on the survey that were specific to

particular behaviors. The issue involvement models explained the next largest portion of variance, which may be due to the energy involvement variable. Although this measure was not about a particular energy-saving behavior, it reflects an attitude about taking action. As such, energy involvement is more specific to behavior than say the motivation measures, which capture more general feelings about why one should conserve. Several researchers have suggested that behavior-specific attitudes may mediate the relationship between general motivations and behavior (Poortinga, et al., 2004; Stern, 1992). There is partial evidence for this as Do the right thing became nonsignificant when combined with the barriers for overall behavior, thermostat settings, and dietary choices.

The modest amount of variance explained in each of the final regression models suggests that other important variables were missing from the survey. Based on the above discussion, future research might consider including more variables that are specific to the behaviors being measured. For example, participants could be asked how knowledgeable and capable they feel to undertake certain behaviors, what their motivations are for doing them, and the perceived ease or difficulty of engaging in them.

Practical implications

The results have several implications for the design of programs aimed at promoting climate-friendly behavior. The first concerns the types of behaviors that are advocated when program participants are self-selected. As participants may already be engaging is a number of energy-saving actions, programs may be wise to focus on high-impact behaviors that are less commonly advocated or are more difficult to change. Data from the present study indicate that dietary behaviors and alternative transportation are two areas worthy of further intervention. Although participants already ate local, organic, or meatless meals moderately often, the regression results suggest that participants were not fully aware of how these choices relate to climate change. Helping people make this connection may encourage them to take these actions more often. Participants also used alternative transportation infrequently. Though this behavior was not examined in-depth, the moderate endorsement of transportation barriers suggests that people may need help overcoming the challenges of using their car less.

The results also draw into question how energy-saving actions should be framed. Many programs and informational campaigns emphasize the monetary savings associated with different activities. Relying on such frames seems logical, especially when people report that they are highly motivated to save money. However, the regression analyses in this chapter indicate that saving money is not a significant driver of repetitive curtailment behaviors. Drawing attention to dollar savings may do little to change perceived barriers to such behaviors. As other studies have shown, financial incentives may be more important when trying to persuade households to invest in one-time efficiency upgrades, such as installing an energy-efficient furnace, insulating the walls and attic, or weatherizing one's home (Black, et al., 1985).

Instead, the results indicate that among participants already somewhat engaged in energy conservation, household energy-saving behaviors are driven by a sense of moral obligation. This finding is promising given that there may be multiple reasons why reducing one's climate impact feels like the right thing to do. These could relate to concerns about social justice or U.S. energy security, feelings of patriotism, or a desire to live in accordance with one's religious values. People may also feel obligated to look out for the welfare of their children and grandchildren. The results of this chapter suggest that framing climate-friendly actions in terms of these values may be more motivating than programs framed in terms of economic self-interest. Practitioners must be careful, however, to avoid imposing values on target audiences. As suggested in Chapter 1, many current climate change communications already carry the implicit message that acting on global warming is the right thing to do. Yet, these messages are rarely successful in changing behavior. Practitioners may have greater success if, instead of making claims that climate change is the right thing to do for health or one's country, they demonstrated how climate-friendly actions can fulfill those motives.

Reframing the way climate change and climate-friendly behaviors are communicated is unlikely to be sufficient on its own. As the results of this chapter suggest, even when people are highly motivated to do the right thing, they may be unaware of opportunities to reduce their impact (Cook & Berrenberg, 1981). In the present study, for example, participants seemed to be less familiar with how changing their diet or reducing standby power could save energy. Past research also suggests that individuals concerned about climate change may choose inappropriate or ineffective strategies to address the problem, such as recycling or avoiding

products with chlorofluorocarbons (CFCs) (Bostrom, et al., 1994; Stamm, et al., 2000; Whitmarsh, 2009a). Others have found that there is a tendency for environmentally concerned individuals to favor highly symbolic behaviors – such as turning off the lights – over behaviors that would be more beneficial (Poortinga, et al., 2003). People may choose these behaviors because they do not have a clear understanding of the relative impacts of their actions (Attari, et al., 2010; Gardner & Stern, 2008; Gatersleben, et al., 2002).

Increasing knowledge of appropriate actions and their relative impacts is likely an important but insufficient step toward changing behavior (Lorenzoni, et al., 2007). The results of this study also highlight the need to address individuals' concerns about how energy-saving actions might be adapted to their lifestyles. In particular, the regressions analyses suggest that perceived barriers may mediate the relationship between the motive to do the right and engagement in climate-friendly behaviors.

Unfortunately, few interventions aimed at promoting climate-friendly behaviors take these barriers into account. In recent years, information campaigns have been dominated by laundry lists of "things you can do to fight global warming." Descriptions of potential actions strategies in these lists are minimal, with little guidance about how to implement a behavior or overcome some of the challenges it may pose. The results presented here suggest there is a need for more supportive interventions, ones that help answer participants' questions, provide positive reinforcement for trying new behaviors, and help engender a greater sense of self- and collective efficacy. The next chapter explores the extent to which the Energy Challenge was able accomplish some of these outcomes.

Chapter 4

Changes in Perceived Barriers and Efficacy

One purpose of this study was to explore the effect of the Energy Challenge on participants' perceptions of energy conservation and their ability to help reduce climate change. As discussed in Chapter 1, prior research suggests that there are a number of reasons people concerned about climate change fail to adopt energy-saving behaviors. These include a lack of knowledge about appropriate action strategies, feeling that one's actions will not make a difference in the grand scheme of the problem, and a number of barriers concerning the perceived inconvenience and discomfort of conserving energy (Lorenzoni, et al., 2007; Norgaard, 2006; Semenza, et al., 2008; Stoll-Kleemann, et al., 2001). The present chapter examines to what extent the Energy Challenge was able to help participants overcome these obstacles. In particular, this chapter seeks to understand the relative impact of the three treatment conditions: monthly feedback, weekly feedback, and weekly feedback + stories. Does receiving weekly feedback, for example, help individuals feel more efficacious in their actions or reduce perceived barriers? Does reading stories of other community members' efforts make behaviors seem less difficult?

To answer these questions, this chapter first examines participants' perceptions of the Energy Challenge overall. The degree to which each treatment manipulation influenced attitudes and barriers may be a function of how involved participants were in the Energy Challenge and their satisfaction with the program. Subsequent sections examine how perceived barriers and efficacy changed during the course of the program.

Involvement in and satisfaction with the Energy Challenge

Participants

As might be expected in a longitudinal study, a considerable number of households dropped out during the course of the month-long Energy Challenge or failed to complete one or more of the instruments. Of the 152 participants who completed the pretest survey, 47% (n = 72) failed to comply with one or more components of the Energy Challenge and 10 individuals (7%) officially withdrew from the study. Compliance was defined as completing both the pretest and posttest surveys as well as at least one of the online logs. Among non-compliers, 63 failed to complete any logs or the posttest survey, 18 completed at least one log but not the posttest, and another 17 completed the posttest survey but no logs. Among the handful of individuals who contacted the researcher to officially withdraw from the study, most commented that they felt they were already doing everything that the Energy Challenge recommended.

To determine whether any differences existed between compliers and non-compliers, paired t-tests and chi-square analyses were conducted. No differences were found between the two groups in terms of participant demographics, motivations, issue involvement, or behavior. Ratings of perceived barriers and efficacy variables were also equivalent – with two exceptions. Participants who complied with the Energy Challenge had a slightly lower mean rating of the efficacy variable, "If everyone does their part to conserve energy, we can help reduce global warming," (M = 4.03, SD = .95 versus M = 4.34, SD = .89, $t(149) = 2.08$, p = .04, d = -.38). Compliers also perceived greater diet change barriers at pretest (M = 2.42, SD = .96) than non-compliers (M = 2.01, SD = .84, $t(150) = 2.76$, p = .007, d = .45). These results suggest that participants who stayed in the program may have seen an opportunity in the Energy Challenge to further reduce their impact through diet-related behaviors. Interestingly, though, there were no differences between compliers and non-compliers on this behavior at pretest, M = 3.50, SD = .69 vs. M = 3.67, SD = .67, $t(150) = 1.54$, $p < .127$.

In total 70 individuals complied with the basic requirements of the Energy Challenge. This sample was distributed fairly equally among the three treatment groups (monthly feedback, n = 23; weekly feedback, n = 24; weekly feedback + stories, n = 22), and no relationship was found between treatment condition and the rate of attrition, χ^2 (2, N = 152) = .80, p = .67. One

participant in the weekly feedback group was excluded from analysis as her responses on the posttest survey suggested that she had misread several of the survey questions. Data from the remaining 69 participants are the basis of the analyses that follow.

Involvement in the Energy Challenge

Completion of the study instruments does not necessarily imply that participants were fully engaged in meeting the goal of the Energy Challenge. Several measures were used to assess participants' involvement in the program. The first was the number of logs completed. On average, participants filled out three of the four weekly logs (M = 3.20, SD =1.05), with no differences found between treatment groups, F (2, 66) = 1.98, p = .15. This completion rate may have been higher had there not be a technical error in weeks two and three of the challenge that prevented some participants from easily accessing their logs. The second measure of involvement was a self-report item on the posttest, "To what extent did you try to conserve energy during the Energy Challenge?" with a 5-point scale from *not at all* to *a great deal*. Participants reported that they made a moderate effort to conserve energy during the Energy Challenge (M = 3.41, SD = .67). Again, no differences were found between treatments, F (2, 66) = .42, p = .66. Descriptive statistics of these measures for each treatment group can be found in Appendix S.

For participants in the weekly feedback + stories condition, it is also possible to assess how engaging participants found it to share and read stories about their experiences during the Energy Challenge. As Chapter 2 explained, the logs for this treatment group provided space for participants to describe something they did to meet the Energy Challenge and to offer advice to others considering the same behavior. The logs also included two checklists for participants to complete: One gave reasons why the activity might have been rewarding, and the other described why it might have been challenging. Participants also had the option of uploading photos. Of the 22 individuals in this treatment group who complied with the Energy Challenge, 11 provided commentary on at least one behavior they did. While several participants gave thoughtful, paragraph-length accounts of actions they had taken, most of the comments were quite brief. Of the remaining 11 individuals who did not contribute stories, six at least checked

off why the activity was rewarding or challenging. Appendix L shows how these stories were later incorporated into the weekly e-mail reminders sent to this group.

To test whether participants in the weekly feedback + stories condition took note of the stories in the weekly e-mails, the following manipulation check was included on the posttest survey: "The weekly email reminders were interesting to read," with a scale from 1 (*not at all*) to 5 (*a great deal).* The weekly feedback + stories group was expected to have the highest mean on this item, as the e-mails sent to the other treatment groups simply reminded participants to fill out their logs. However, no differences were found between treatment conditions, $F(2,61) = .07$, $p = .936$, suggesting that the personal stories were not a noticeable feature in the e-mail reminders. In retrospect, though, interestingness may not have been the most appropriate manipulation check. It is possible that participants read the stories without necessarily finding them interesting.

Satisfaction with the Energy Challenge

As described in Chapter 2, a number of measures were included on the posttest survey to assess participants' satisfaction with the Energy Challenge. Factor analysis of these items yielded two categories: one concerned satisfaction with the informational booklet and the other captured overall satisfaction with the program (see Table 4.1). No differences were found between treatment groups on either of these measures (overall satisfaction, $F(2, 66) = 2.07$, $p = .13$; booklet satisfaction, $F(2, 66) = .89$, $p = .42$). On average, participants reported being highly satisfied with the Energy Challenge overall, and they rated the quality of the informational booklet as good to very good (see Table 4.1). These two measures were moderately correlated, $r = .45$, $p < .001$. Appendix S shows the means and standard deviations for each measure by treatment condition. Overall satisfaction was also correlated with the number of logs that were completed, $r = .55$, $p < .001$. Neither satisfaction measure was significantly correlated with participants' perceived effort during the Energy Challenge.

Table 4.1
Rotated factors of participant satisfaction (N=69)

		Rotated factor loadings	
	Mean (*SD*)	Booklet satisfaction	Overall satisfaction
How interesting [booklet] was to read	3.45 (.87)	.89	
Usefulness of information presented [in booklet]	3.52 (.96)	.84	
Visual appeal [of booklet]	3.58 (.78)	.75	
Variety of energy-saving actions described [in booklet]	3.51 (.92)	.67	
I feel good about my participation in the Energy Challenge	4.22 (1.03)		.76
I had a clear understanding of what I was expected to do during the Energy Challenge.	4.47 (.70)		.64
If I had it to do over, I would participate in this program.	4.39 (1.04)		.46
Cronbach's alpha		.89	.66
Mean rating		3.51	4.35
SD		.77	.75

The posttest survey also provided space for participants to comment about the booklet, provide suggestions for improving the program, or give general feedback. Fifty-three participants provided one or more comments, most of which were positive. Eighteen participants remarked that the Energy Challenge was a "good" or "great idea" and expressed gratitude for the program. One participant commented, "Overall, this was a great experience and I'm pleased that my family participated. I wish that every household would do it." However, a number of individuals (*n* = 12) commented that they found it difficult to further reduce their carbon footprint because they were already doing so many of the recommended actions. Most of these individuals (*n* = 9) had above average scores on the composite behavior measure at pretest. Still, several participants (*n* = 8) indicated that the Energy Challenge caused them to be more conscientious about their energy use. This was true even for several experienced conservers. As one participant wrote, "We already did several of the items mentioned, however, I am trying to be more diligent with the items that we lack consistency." As might be expected, the Energy Challenge appeared to be most beneficial to participants who had below average composite behavior scores at pretest. Among this group of individuals, several made general comments about the usefulness of the program materials and the

potential for a program like the Energy Challenge to make a difference. For example, one participant remarked, "[The booklet] was very helpful and provided ideas that I had not come up with. Every household should be able to find an area in which they can improve from the booklet." Another wrote, "Doing this challenge seems like it might make a real difference in the amount of energy consumed in AA [Ann Arbor]… That's fantastic – I'm glad you took on this project and to have participated."

In sum, participants who complied with the Energy Challenge were fairly engaged in the program and seemed pleased to have participated. It is unclear, though, to what extent the stories manipulation was successfully operationalized. Survey comments also suggest that while most felt the concept of the Energy Challenge was good, a number of participants – particularly those who were already doing a lot to conserve – wanted more ideas of how to save energy.

Changes in perceived barriers and efficacy

The Energy Challenge appears to have been a positive experience for most of the participants who completed the program. But to what extent did it enhance their feelings of efficacy or reduce barriers associated with particular behaviors? And importantly, did the treatments have different effects on these outcomes? Results from the previous chapter suggest that while participants, on average, perceived few barriers to conserving and felt moderately efficacious in their actions, these variables still limited their overall engagement in climate-friendly behaviors. The following describes how the Energy Challenge was expected to influence efficacy and perceived barriers.

There were three single-item measures of efficacy on the surveys: "I'm not sure what I can do to reduce global warming;" "If everyone does their part to conserve energy, we can reduce global warming;" and "Our community is making a difference in reducing global warming." Several components of the Energy Challenge were predicted to affect these variables. For one, the informational booklet provided explanations and procedural guidance for over 34 energy-saving activities; it also estimated how many pounds of carbon dioxide (CO_2) each action saved every time it was performed. Thus, the booklet may have helped participants learn not only new action strategies but also their relative effectiveness. For these reasons, all

treatments were expected to improve on the measure "I'm not sure what I can do to reduce global warming."

Providing weekly feedback was predicted to enhance this effect. Households received not only an estimate of their progress during each week of the Energy Challenge, but also a breakdown of how many pounds of CO_2 they had avoided from different categories of actions (e.g., using less hot water, driving less, reducing standby power). In this way, the weekly feedback may have helped participants learn more quickly the relative impact of their actions, and hence, how to more effectively reduce their respective households' carbon footprints. While participants in the monthly feedback group could have estimated their total CO_2 savings using the booklet, the level of calculation involved likely deterred most from doing so. The weekly feedback logs also estimated the potential annual CO_2 savings that a household could achieve if it continued the recorded actions year-round. By showing how small actions add up, the weekly feedback logs may have improved participants' perceptions that individual actions can make a difference (as measured by the item, "If everyone does their part"). In the context of a community-wide Energy Challenge, this information could have also improved the perception that their community was making a difference.

The stories that were shared in the weekly feedback + stories condition were predicted to further enhance feelings of collective efficacy (i.e., Our community is making a difference). One of the common barriers to engaging in climate-friendly behavior is the perception that others are not making an effort to reduce their impact (Lorenzoni, et al., 2007; Norgaard, 2006). Most energy-saving actions are done in the privacy of one's home or are simply not apparent to others. By sharing anecdotes of what others were doing to meet the Energy Challenge, the weekly feedback + stories condition sought to alter this perception.

The Energy Challenge was also predicted to reduce some of the perceived barriers associated with conserving energy. The informational booklet, for instance, offered advice on how to make activities easier or more convenient to carry out. In addition, the estimated CO_2 savings that were provided may have caused participants to re-evaluate the merits of certain activities. Behaviors that had previously seemed too inconvenient to do may have been more appealing in light of their potential CO_2 savings. Weekly feedback was expected to enhance this

effect. Seeing the cumulative impact of one's actions each week may have led to a feeling of accomplishment that helped decrease negative attitudes about the behaviors they tried. Finally, the stories component of the weekly feedback + stories condition was predicted to make behaviors seem more appealing. Often, the psychological barriers that people associate with a behavior are based on preconceived notions of what that activity will involve and not actual experience. The stories that were used in the intervention often reflected surprise at how easy it was to do a particular behavior as well as genuine satisfaction for having tried it. Consequently, exposing participants to these stories may have created more favorable perceptions of the behaviors described.

To determine the extent to which the Energy Challenge achieved these outcomes, analyses were conducted with the three efficacy measures previously described as well as the four perceived barriers concerning *inconvenience*, *diet changes*, *transportation*, and the *discomfort* of using less energy. Based on the rationales provided above, two general hypotheses were investigated:

1. Receiving *weekly feedback* will enhance efficacy and decrease perceived barriers more than receiving monthly feedback.
2. Reading *stories* of others' efforts during the Energy Challenge will enhance efficacy and decrease barriers beyond the effect of weekly feedback alone.

It was also predicted that greater involvement and satisfaction in the program would be associated with improvements in these outcome variables and, thus, need to be controlled for. However, preliminary analyses found no evidence to support these predictions. Consequently, the analyses reported here focus only on the effects of weekly feedback and shared community stories.

Analytic procedure

For each efficacy or barrier variable of interest, paired t-tests were used to assess whether there was a significant difference from pretest to posttest within each treatment group and for the sample overall. Hierarchical regression analysis was then conducted to compare the size of change between treatment conditions. The change score from pretest to posttest was

used as the dependent variable. The corresponding pretest variable was entered in the first step of the model to control for participants' past level of efficacy or perceived barriers. Although the three treatment groups had statistically equivalent pretest means for each of the seven measures, controlling for the pretest score increases statistical power, thereby improving the likelihood of detecting a difference between treatments.

The second step of the model used Helmert contrast codes to compare the effects of the treatment conditions. As opposed to dummy coding, which compares each treatment to a reference group (e.g., weekly feedback vs. monthly feedback and weekly feedback + stories vs. monthly feedback), Helmert coding directly tests the two hypotheses of interest. The first contrast tests the hypothesis that the weekly feedback groups, on average, improved more on the outcome than the monthly feedback group (see Figure 4.1). The second contrast tests whether the addition of shared community stories had a positive effect beyond that of the weekly feedback alone. For both contrasts, the beta coefficient (*b*) represents the mean difference between the two groups being compared, after controlling for the pretest variable.

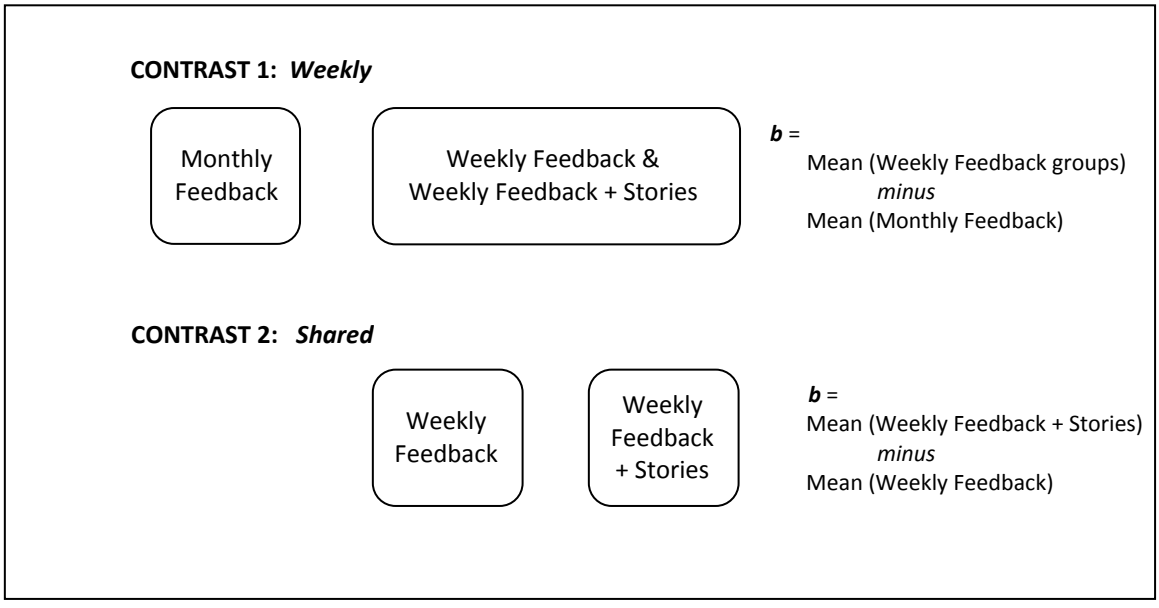


Figure 4.1 Contrasts tested using Helmert coding, with an explanation of how to interpret beta (*b*).

The final step of the model tested whether the effect of *weekly feedback* or *shared stories* was moderated by participants' prior sense of efficacy or perceived barriers. It was expected, for example, that among participants with high perceived barriers at pretest, the two weekly feedback conditions would be more effective at reducing barriers than the monthly feedback treatment. Such differences were not expected among participants with low perceived barriers. Interaction terms were created by multiplying each Helmert contrast code by the pretest variable (e.g. Weekly feedback contrast X Pretest transportation barrier, Shared stories contrast X Pretest Transportation barrier). A moderation effect was assumed if the addition of the two interaction terms together significantly increased the fit of the model (ΔR^2) at $p < .1$. This more lenient significance level was used because of the difficulty of detecting significant interactions with low power, especially when sample sizes are small (Aguinis, 2004; Aguinis & Gottfredson, 2010; Pedhazur & Schmelkin, 1991). Individual interaction terms were assessed for significance at $p < .05$.

Changes in efficacy

The analyses of the three efficacy items provide inconclusive evidence about the effects of weekly feedback and shared stories. Table 4.2 shows the pretest and posttest means for each efficacy variable according to treatment condition. Both of the weekly feedback groups experienced significant decreases on the item "I'm not sure what I can do to help reduce global warming." The change for the monthly feedback group was in the right direction, but not significant. These results appear to support the hypothesis that receiving weekly feedback about the impact of one's actions boosts self-efficacy, but the hierarchical regression analysis failed to find a difference between monthly feedback and the two weekly feedback groups combined, $b = -.32$, $t(63) = -1.42$, $p = .16$. To further clarify these results, another item on the posttest survey that assessed perceived knowledge was evaluated. This item asked participants whether they felt they had learned new ways to reduce their impact on global warming as a result of the Energy Challenge. The mean for this item was moderately high ($M = 3.53$, $SD = 1.32$), but no differences were found between treatments, $F(2,64) = .56$, $p = .57$, suggesting that all treatment conditions improved somewhat on self-efficacy.

Table 4.2
Paired t-tests of efficacy variables

		Pretest		Posttest			
	n	*M*	*SD*	*M*	*SD*	*t*	*d*
I'm not sure what I can do							
All participants	67	2.30	.94	1.75	.93	-4.37***	.59
Monthly feedback	23	2.09	.85	1.87	.92	-1.31	
Weekly feedback	22	2.32	1.00	1.68	.95	-2.54*	.66
Weekly feedback + stories	22	2.50	.96	1.68	.95	-3.65**	.86
If everyone does their part							
All participants	68	4.03	.96	4.09	1.00	.59	
Monthly feedback	23	4.04	1.11	4.04	.88	.00	
Weekly feedback	23	4.13	.92	4.17	.78	.25	
Weekly feedback + stories	22	4.05	1.13	3.91	1.11	.83	
Our community is making a difference							
All participants	64	2.98	.92	3.23	.92	2.12*	.28
Monthly feedback	20	2.85	1.04	3.15	.99	1.14	
Weekly feedback	22	3.14	.77	3.55	.91	2.41*	.52
Weekly feedback + stories	22	2.95	.95	3.00	.82	.25	

Note: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$
Responses were measured on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*) based on the stem question "To what extent are the following true of you?"
d = Effect size of significant difference, adjusted for correlation between pre- and posttest measures (see Dunlap, et al., 1996)

The variable, "If everyone does their part to conserve energy, we can reduce global warming" remained stable, and there was no evidence of a moderation effect, $\Delta R^2 = .03$, $F_{change}(2,62) = 1.07$, $p = .35$. As the mean rating for this variable was already quite high ($M = 4.01$, $SD = .96$) at pretest, there was not much room for participants to improve on this item.

Paired t-tests suggest that the weekly feedback group improved on the other measure of collective efficacy, "Our community is making a difference in reducing global warming" (see Table 4.2). Hierarchical regression analysis found no differences between the weekly feedback conditions and monthly feedback, $b = .03$, $t = .15$, $p = .879$. Interestingly, the contrast between weekly feedback and weekly feedback + stories was marginally significant, but in the opposite direction than hypothesized, $b = -.46$, $t = -1.89$, $p = .063$. This suggests that while weekly feedback alone improved participants' sense of collective efficacy, the addition of community stories may have negated this effect. Because this result could have influenced the weekly

feedback contrast, post-hoc pairwise comparisons were done between the three treatments. The results confirm that the average change in collective efficacy (after controlling for pretest scores) was not statistically different between the weekly feedback and monthly feedback groups (b = .27, $t(60)$ = 1.05, p = .297). The difference between monthly feedback and weekly feedback + stories was also nonsignificant (b = -.20, $t(60)$ = -.79, p = .43).

In summary, neither *weekly feedback* nor *shared stories* appeared to have strong effects on participants' self- and collective efficacy. There is some evidence to suggest that participating in the Energy Challenge – regardless of treatment – enhanced participants' perceived knowledge of action strategies. But, without a true control group, it is unclear how much maturation would have happened naturally over the course of the Energy Challenge month. The effect of the Energy Challenge on collective efficacy was also unclear, with some indication that the *shared stories* actually decreased this type of efficacy relative to the weekly feedback condition. Some of these results may be an artifact of the small sample sizes and using single item measures that may be less reliable from pretest to posttest. The results may have been more robust had multiple measures been used to assess each construct.

Changes in perceived barriers

Inconvenience.

On average, perceived inconvenience remained stable from pretest to posttest (Table 4.3), and no differences were found between treatment conditions after adjusting for the pretest measure, ΔR^2 = .003, $F_{change}(2,65)$ = 0.14, p = .87. The interactions between pretest inconvenience and treatment were also nonsignificant, ΔR = .03, $F_{change}(2,63)$ = 1.31, p = .28. While these results imply that the Energy Challenge was ineffective at reducing perceived inconvenience, there may have been a floor effect. Only 11 individuals gave this barrier a rating of three or higher at pretest. Consequently there was not much room for the sample as a whole to further reduce this barrier.

Table 4.3
Paired t-tests of inconvenience

		Pretest		Posttest		
	n	*M*	*SD*	*M*	*SD*	*t*
All participants	69	2.16	.76	2.08	.74	-.97
Monthly feedback	22	2.15	.82	2.13	.81	-.14
Weekly feedback	24	2.20	.79	2.08	.67	-.80
Weekly feedback + stories	22	2.11	.71	2.02	.76	-.78

Note: No significant differences were found from pretest to posttest.
Responses were measured on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*) based on the stem question "To what extent are the following true of you?" Lower means reflect a weaker barrier.

Diet change barriers.

Although participants had relatively low perceived barriers to changing their diet at pretest, all three treatment groups experienced a significant decrease in this barrier at the end of the Energy Challenge (Table 4.4). After controlling for participants' pretest scores on this variable, no differences were found between treatments in terms of the size of this change, F_{change} (2,65) = .30, p = .74. Furthermore, there was no evidence to indicate that the effect of weekly feedback or shared stories was moderated by prior perceptions of diet change barriers, ΔR^2 = .02, F_{change} (2,63) = .74 , p = .48.

Table 4.4
Paired t-tests of diet change barriers

		Pretest		Posttest			
	n	*M*	*SD*	*M*	*SD*	*t*	*d*
All participants	69	2.42	.95	2.04	.84	-4.23***	.42
Monthly feedback	23	2.57	1.01	2.20	1.06	-2.07*	.35
Weekly feedback	24	2.33	1.14	1.92	.76	-2.59*	.39
Weekly feedback + stories	22	2.36	.64	2.02	.66	-2.83**	.51

Note: $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$
Responses were measured on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*) based on the stem question "To what extent are the following true of you?" Lower means reflect a weaker barrier.
d = Effect size of significant difference, adjusted for correlation between pre- and posttest measures (see Dunlap, et al., 1996)

The decline in this barrier may reflect a change in awareness about the impact of diet choices on climate change. Several participants commented on the pretest survey that they did not understand the relationship between food and global warming. As the informational booklet contained an entire section dedicated to the climate impacts of food, it is plausible that this information changed participants' awareness and knowledge of this issue, and thus their perceptions of the barriers associated with eating a low-carbon diet. It should be noted that satisfaction with the booklet did not predict this change in barriers; this may be because the satisfaction measures evaluated the booklet as a whole rather than specific sections.

Transportation barriers.

Table 4.5 shows the pre- and posttest means of transportation barriers for each treatment condition. According to paired t-tests, the mean rating of transportation barriers significantly increased (i.e., worsened) for participants in the monthly feedback condition, whereas the means remained stable for both of the weekly feedback conditions. Hierarchical regression analysis further revealed a significant interaction between pretest transportation barriers and the weekly feedback contrast, $b = -.37$, $t(62) = -2.18$, $p = .033$. This interaction indicates that the effect of weekly feedback on transportation barriers depended on (i.e., was moderated by) participants' pretest level of this barrier. To interpret this significant interaction, simple slope analysis was used (see Aiken & West, 1991; Hayes & Matthes, 2009; West, Aiken, & Krull, 1996). This procedure looks for significant differences between treatments at three levels of the moderator: one standard deviation below the mean (= weak barrier), the mean (= moderate barrier), and one standard deviation above the mean (= strong barrier).

As shown in Figure 4.2, weekly feedback was most beneficial to participants who perceived high transportation barriers at pretest; their posttest transportation barrier was, on average, 0.68 Likert scale points below that of participants in the monthly feedback group, $b = -.68$, $t(62) = -2.89$, $p = .005$. There was also a marginally significant effect for participants with moderate transportation barriers, $b = -.32$, $t(62) = -1.98$, $p = .053$. These results provide partial support for the hypothesis that weekly feedback reduces perceived transportation barriers more than monthly feedback. There was no evidence to support the hypothesis that shared stories would further reduce this barrier.

Table 4.5
Paired t-tests of transportation barriers

		Pretest		Posttest			
	n	*M*	*SD*	*M*	*SD*	*t*	*d*
All participants	68	2.46	.97	2.45	.99	-.09	
Monthly feedback	22	2.41	.96	2.62	1.11	2.08*	.20
Weekly feedback	24	2.47	1.08	2.30	1.03	-1.04	
Weekly feedback + stories	22	2.48	.90	2.44	.83	-.33	

Note: $^{*}p = .05$
Responses were measured on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*) based on the stem question "To what extent are the following true of you?" Lower means reflect a weaker barrier.
d = Effect size of significant difference, adjusted for correlation between pre- and posttest measures (see Dunlap, et al., 1996)

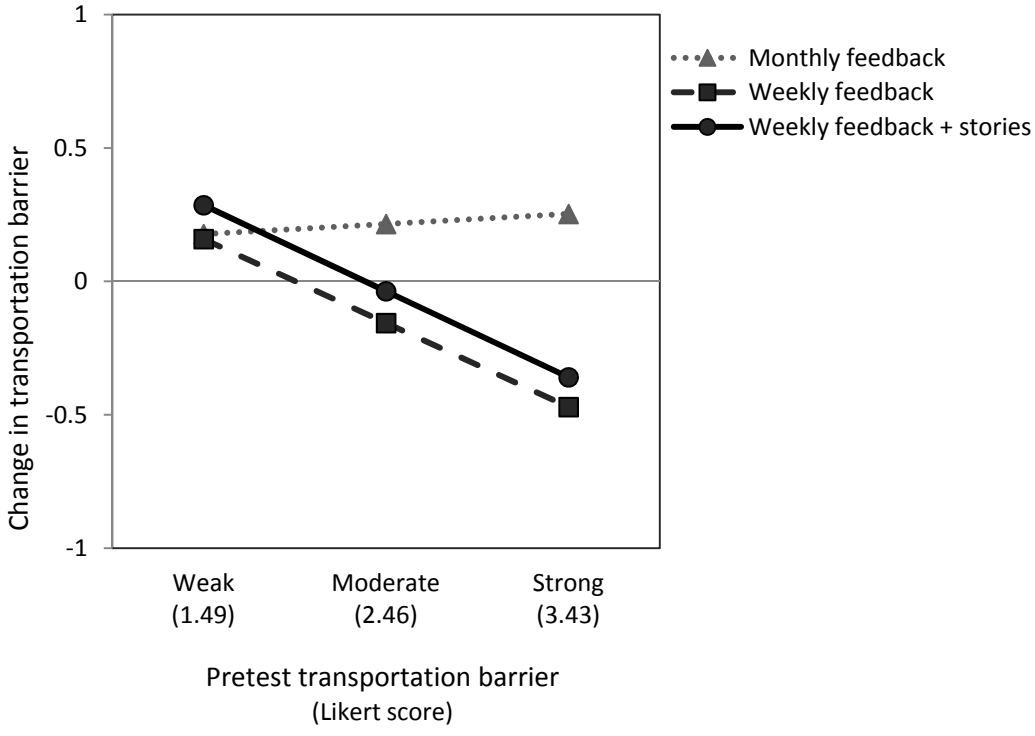


Figure 4.2 Interaction between pretest transportation barriers and treatment condition on change in transportation barriers. A negative change indicates the barrier decreased.

Perceived discomfort

The degree to which participants felt energy conservation involved sacrificing comfort did not, on average, change from pretest to posttest (see Table 4.6). However, there was a significant interaction between pretest discomfort and the weekly feedback contrast, b = -.55, $t(63)$ = -2.23, p = .03. As Figure 4.3 illustrates, among participants with high perceived discomfort at pretest, receiving weekly feedback was advantageous. Simple slope analysis revealed that posttest discomfort for the weekly feedback groups was on average 0.69 points less than the monthly feedback group, b = -0.69, $t(64)$ = -2.24, p = .029. No differences were found between treatments among participants with weak or moderate perceived discomfort at pretest. Again, there was no evidence to support the hypothesis that shared community stories further reduced this barrier.

Table 4.6
Paired t-tests of discomfort barrier

		Pretest		Posttest		
	n	*M*	*SD*	*M*	*SD*	*t*
All participants	68	2.38	.92	2.51	.95	1.13
Monthly feedback	22	2.43	.90	2.67	1.03	1.50
Weekly feedback	24	2.38	1.04	2.50	.96	.52
Weekly feedback + stories	22	2.32	.84	2.36	.86	.20

Note: No significant differences were found from pretest to posttest.
Responses were measured on a 5-point Likert scale from 1 (*not at all true*) to 5 (*extremely true*) based on the stem question "To what extent are the following true of you?" Lower means reflect a weaker barrier.

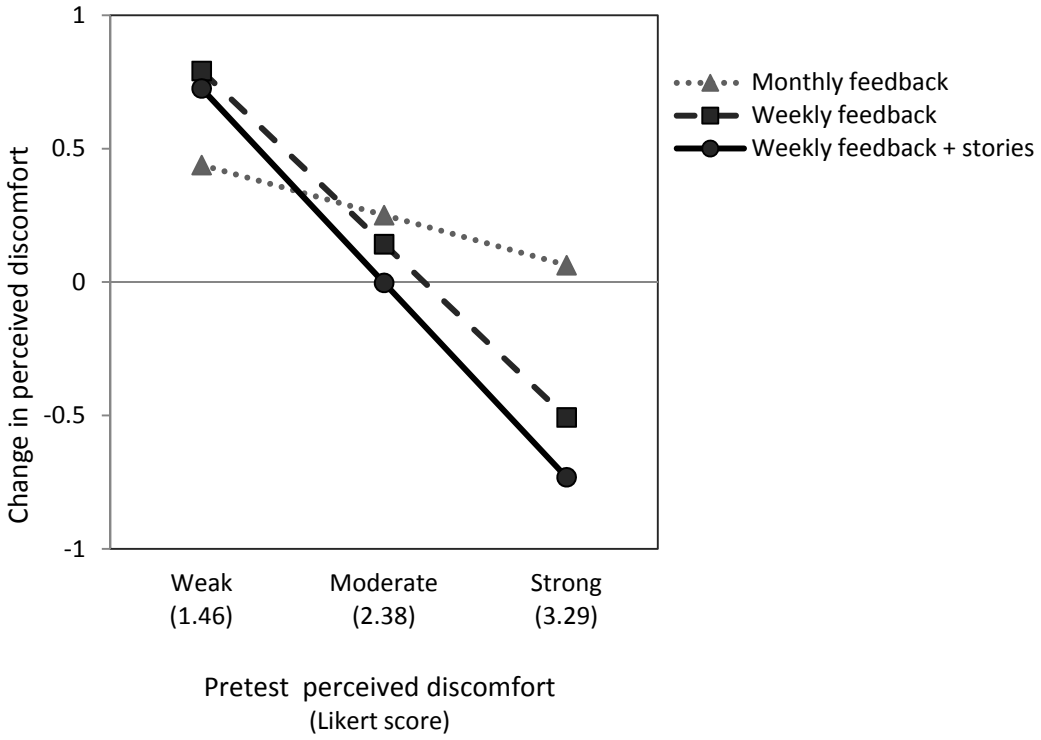


Figure 4.3. Interaction between pretest discomfort and treatment condition on change in perceived discomfort. A negative change indicates the barrier decreased.

Summary and discussion

This chapter explored the effect of the Energy Challenge on participants' sense of self- and collective efficacy as well as their perceived barriers to conserving. None of these outcomes appeared to be influenced by participants' satisfaction with their Energy Challenge experience or their overall satisfaction with the informational booklet. While there was some evidence to support the hypothesis that *weekly feedback* has advantages to monthly feedback, none of the results support the hypothesis that *shared stories* augments this affect.

Within-subject analyses suggest that weekly feedback may have significantly improved participants' perceived knowledge of action strategies from pretest to posttest, whereas the

difference was not significant for the monthly feedback group. These results are in line with other studies that suggest frequent feedback helps individuals learn the outcomes of their actions (Darby, 2000, 2006; Fischer, 2008; van Houwelingen & van Raaij, 1989), which enhances feelings of self-efficacy. Though all participants had the benefit of the informational booklet (which outlined potential CO_2 savings for each behavior), weekly feedback may have helped participants more quickly discern which actions had the largest CO_2 savings. This knowledge, in turn, may have led to greater confidence in their ability to help reduce global warming. The monthly feedback group, in comparison, would have had to manually calculate their savings, and the Energy Challenge materials provided no guidance for doing this. Since the between-subject regression analysis did not find a difference between monthly and weekly feedback, additional research with larger sample sizes is needed to confirm the effect of feedback on self-efficacy.

There was also no evidence to suggest that *weekly feedback* had a consistent advantage over monthly feedback in terms of reducing perceived barriers to conserving. However, frequent feedback did appear to help some participants – particularly those with above-average transportation barriers and those who felt strongly that using less energy involves sacrificing comfort. Among participants who had high ratings on either of these two barriers at pretest, those who received *weekly feedback* experienced a significant decline in these barriers. These findings are promising given the self-selected nature of the sample and the fact that participants had relatively low barriers to begin with. Even the participants who were classified as having "strong" transportation or discomfort barriers relative to the sample mean had only moderate ratings of these barriers (3.43 and 3.29, respectively, on a 5 point scale). This suggests that in more representative populations where individuals might have higher perceived barriers, *weekly feedback* could be especially valuable.

Finally, contrary to expectations, the *shared stories* manipulation did not have any effect on perceived barriers and may have even been detrimental to participants' feelings of collective efficacy. There are several potential explanations for these results. As discussed previously, participants in the weekly feedback + stories group did not find the weekly e-mail reminders (which contained the stories) to be more interesting than participants who received reminders without stories. This failed manipulation check could indicate that participants did not notice

the stories or that they may not have opened all of the messages sent during the Energy Challenge. Another explanation is that the behaviors described in the stories did not match the barrier measures on the survey. For example, one participant wrote about encouraging her teenage daughters to take shorter showers, another talked about installing a low-flow showerhead, and another reported using a rake instead of a leaf blower. If these stories altered participants' perceptions of these activities, the barrier measures included on the survey would not have captured such changes. It is also possible that the stories were simply not compelling or memorable. While the anecdotes that were shared often conveyed a sense of satisfaction for having done a behavior, they rarely described what the behavior involved or why a participant chose that particular activity. Without those details, the stories may not have been engaging enough to hold readers' attention or provided sufficient imagery to familiarize readers with the behavior (Bardwell, 1991; De Young & Monroe, 1996; Monroe & Kaplan, 1988). The limited content and variety of stories may also explain why the weekly feedback + stories group did not increase on the measure of collective efficacy, "Our community is making a difference," whereas the weekly feedback group did. As only a few stories were shared in each weekly e-mail and some of the behaviors had relatively small CO_2 savings, participants may have felt that the few actions described in the e-mails did not collectively add up to make a large difference.

Chapter 5

The Effect of the Energy Challenge on Behavior

How did participants' behavior change during the Energy Challenge? Unlike other interventions that target one specific behavior or a small set of related behaviors, the Energy Challenge allowed participants to choose from 34 energy-saving actions in domains related to home energy use, personal transportation, and dietary choices. Consequently, the effect of the Energy Challenge can be evaluated not only in terms of whether or not individual behaviors changed, but also by the number and variety of behaviors that were adopted.

This chapter explores how the three treatment conditions influenced these outcomes as well as their impact on carbon dioxide (CO_2) savings. The first section examines the degree to which participants were able to reduce their carbon footprint during the intervention and the next section looks at how individual behaviors changed. The third section examines the overall pattern and diversity of behaviors that were adopted, and the last section looks at the durability of those behaviors one month after the Energy Challenge ended.

CO_2 savings and completion of the Energy Challenge goal

The Energy Challenge asked households to try to reduce their monthly carbon footprint by 2%. The default goal for all participants was 68 lbs. of CO_2 , based on the average carbon footprint for an Ann Arbor household. If desired, participants could alternatively choose a more difficult goal or calculate 2% of their actual carbon footprint using a website described in the booklet; only 10 of the 69 participants chose one of these options. Based on self-reported data in the logs, most (78%) participants exceeded their goal for the Energy Challenge, with total

savings ranging from 10.3 lbs. to 2555 lbs. of CO_2.[5] After excluding three extreme cases with savings of over 1,500 lbs., the average total savings for the entire sample was 302 lbs. of CO_2 (*SD* = 295), with a median of 199 lbs. Before comparing the savings across treatments, a square-root transformation was applied to reduce the extreme positive skew of this variable. After adjusting for the number of logs completed and household size, ANCOVA with planned Helmert contrasts found no differences in savings based on whether participants received monthly vs. weekly feedback, $t(64) = -.01$, $p = .995$, or weekly feedback vs. weekly feedback + stories , $t(64) = -.20$, $p = .84$. Appendix T provides a breakdown of CO_2 savings by treatment condition. These results suggest that without controlling for other factors, the three treatment conditions were equally effective in helping participants reduce their carbon footprint. Without a true control group, however, it is unknown how much of these savings can be attributed to the Energy Challenge alone and not other outside influences.

Types of behaviors adopted

What types of behaviors did the Energy Challenge encourage participants to adopt? Table 5.1 provides the pre- and posttest means for each of the 20 behaviors[6] measured on the surveys. As explained in Chapter 2, the pretest survey asked participants how often they engaged in each behavior (from 1 = *never* to 5 =*almost always*), while the posttest survey sought to assess participants' perceived change during the Energy Challenge (from -1 = *less than before* and 0 = *about the same* to 4 = *much more*). At first glance, the mean posttest scores appear low (ranging from 0.42 to 1.53), suggesting that the Energy Challenge had little influence on behaviors. It is important to keep in mind, though, that participants could choose from a large variety of behaviors. Consequently, for any given behavior, there are a substantial number of participants who did not attempt to increase that particular activity during the challenge,

[5] Because some participants had difficulty accessing the logs during weeks two and three of the Energy Challenge, this result may be conservative.

[6] The pretest survey had 21 behavior measures, including two items that assessed whether participants air dried laundry in the summer and winter. The mean of these two items was used for all analyses reported in this chapter.

Table 5.1

Popularity, pretest frequency, posttest change, and potential CO_2 impact of behaviors

Percentage of participants who adopted behavior†	Behaviors	*n*	Pretest frequency *Mean*	*SD*	Posttest change *Mean*	*SD*	Potential impact per person‡ (lbs. CO_2) *per instance*	*per month*
	Home energy							
52.2	1. Turn off computer(s) when not in use	69	3.80	(1.21)	1.42	(1.48)	0.4-1.3	10 - 36
50.7	2. Wear more clothes instead of turning up the heat	69	4.28	(.86)	1.45	(1.27)	2.0	60
47.1	3. Take showers of 6 minutes or less	66	3.52	(1.04)	1.39	(1.47)	0.8	22.5
44.3	4. Wash laundry in cold water	69	3.81	(1.09)	1.29	(1.53)	3.0	18 - 96
41.9	5. Unplug electrical chargers (e.g., for cell phone)*	61	3.02	(1.55)	1.31	(1.52)	-	-
39.1	6. Keep the heat turned down to 62°F or below when sleeping	64	3.81	(1.48)	1.33	(1.67)	5.5	165
38.2	7. Turn electronic devices completely off by unplugging them or controlling them with a power strip	67	2.87	(1.17)	1.10	(1.30)	1.1	32
37.5	8. Turn off the heated dry setting on the dishwasher*	46	3.15	(1.78)	1.30	(1.71)	0.5	7.5
35.9	9. Keep the heat turned down to 62°F or below when no one is home	63	3.86	(1.45)	1.30	(1.60)	5.5	165
31.7	10. Cook with a microwave or toaster oven instead of oven	59	3.56	(1.01)	.92	(1.24)	1.0-2.0	4 - 8
29.5	11. Air dry laundry	59	2.73	(1.36)	.78	(1.04)	5.0	30
15.3	12. Use compact fluorescent light bulbs	59	4.08	(.99)	.42	(1.03)	0.4	12
	Personal transportation						*per 5 miles avoided*	
49.2	13. Consider whether I really need to drive somewhere	65	3.71	(1.06)	1.52	(1.29)	5.0	20
47.0	14. Plan errands to minimize number of car trips	66	4.38	(.80)	1.38	(1.37)	5.0	20
30.2	15. Walk or bike instead of driving	62	3.00	(1.09)	.87	(1.11)	5.0	20
28.3	16. Turn off the car while waiting for someone*	60	4.10	(.99)	.93	(1.30)	0.9	24
14.3	17. Take the bus or carpool instead of driving	56	2.77	(1.28)	.46	(.83)	1.3-3.8	5-15
	Dietary choices						*per meal*	
38.6	18. Eat meatless meals	69	3.60	(.92)	1.03	(1.23)	6.0-22.0	24-88
34.8	19. Buy locally produced food	68	3.60	(.81)	1.03	(1.29)	0.5	2
22.4	20. Eat organic food	67	3.28	(.92)	.64	(1.18)	0.5	2

Note: This table applies to all respondents, regardless of treatment condition. Pretest items were measured from *never* to *always* (1-5). Posttest items were measured from *less than before* (-1), and *about the same* to *much more* (0-4). The sample size, *n*, indicates the number of participants for whom the behavior was applicable.

† Percentage of participants who indicated doing behavior at least *somewhat more* (2 to 4 on Likert scale) during the challenge.

* Items with asterisk were negatively worded on the pretest. Means were reverse-coded in the table to reflect the frequency with which desired behaviors were done.

‡ Assumptions for these estimates can be found in Appendix U. A value is not provided for #5. "Unplug electrical chargers" as the savings from this behavior are accounted for in item #7, "Turn electronic devices completely off by unplugging them or controlling them with a power strip."

thereby lowering the sample mean. To better assess the adoption of different behaviors, Table 5.1 also provides the percentage of participants who reported increasing each activity at least *somewhat* (a rating of 2 or higher on the 6 pt. Likert scale) during the program. Based on these data, the most popular activities during the Energy Challenge were reducing electricity consumption by turning off computers and unplugging electrical chargers; layering clothing to use less heat; and using less hot water when showering and doing laundry. The behaviors that changed the least concerned using alternative transportation, buying organic food, and installing compact fluorescent light bulbs (CFLs).

To understand the impact of the Energy Challenge on each behavior, it is useful to compare how much each behavior changed relative to how frequently participants reported engaging in it at the pretest. Figure 1 plots each behavior based on its sample mean at pretest and how much it changed at posttest. This diagram reveals that behaviors with similar patterns of adoption from pretest to posttest tend to have other shared characteristics, such as their domain of energy use (i.e., home energy, transportation, or dietary choices) and similar constraints that likely influence their adoption. Identifying these common characteristics may help illuminate why these behaviors were more or less affected by the Energy Challenge. The following briefly describes each group of behaviors:

Group 1: Low pretest frequency, low change: Behaviors in the lower-left quadrant were done rarely to somewhat often at pretest and changed little as a result of the program. These include using alternative transportation, air drying laundry, and buying organic food. Participants may have been reluctant to change these behaviors because they were perceived as costly, whether in terms of the time involved, inconvenience, or monetary expense. Relative to other behaviors, these activities may also be more dependent on situational factors that the Energy Challenge was unlikely to influence, such as one's commuting distance, access to bus stops, space for drying wet clothing, or income.

Group 2: Low pretest frequency, high change: The group of behaviors in the upper left quadrant comprise actions that reduce unnecessary electricity consumption, particularly standby power. As suggested in Chapter 3, participants may have been unaware prior to the Energy Challenge that these devices could save energy. These behaviors — which

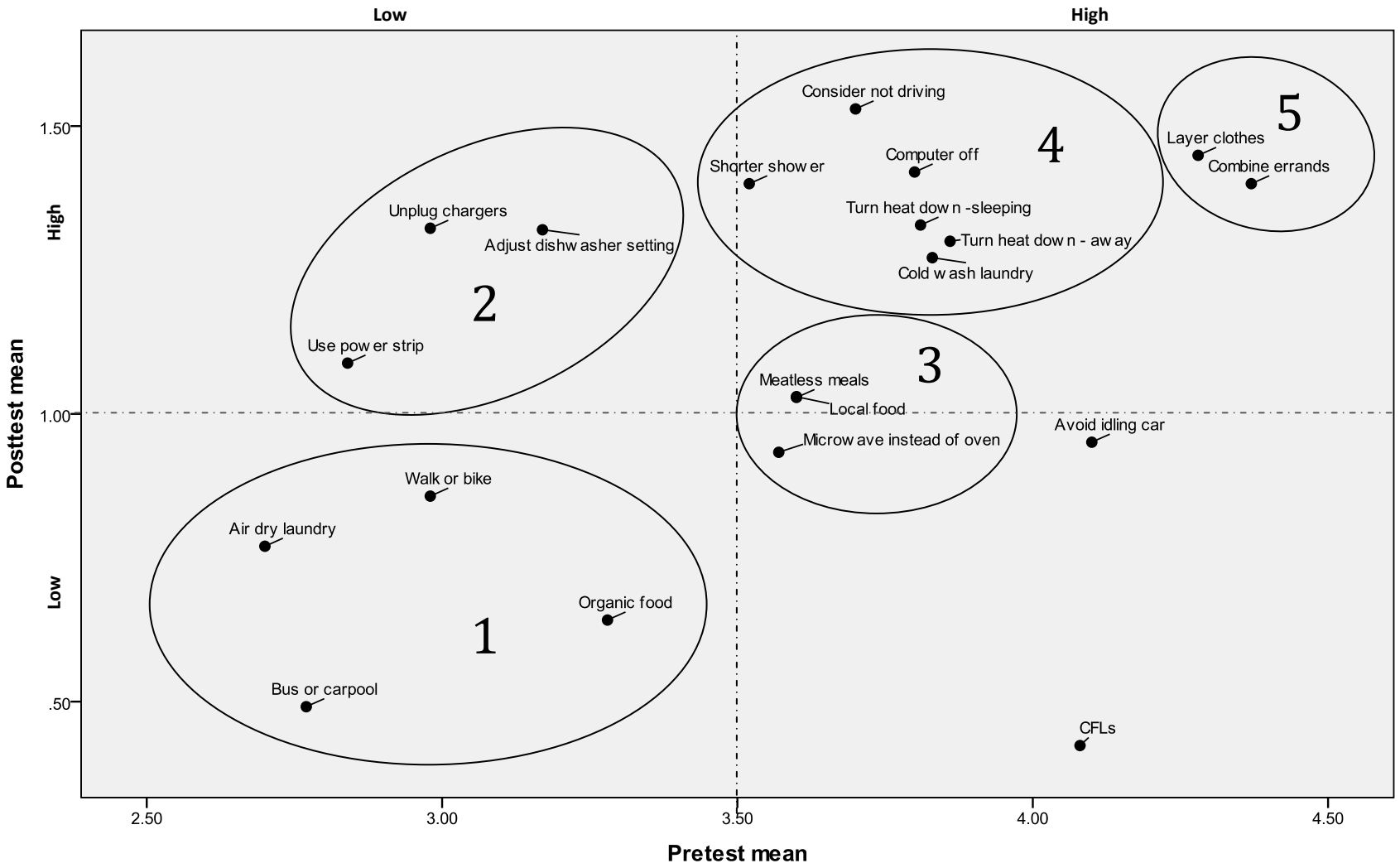


Figure 5.1 Scatter plot of perceived changes in behavior (posttest means) relative to pretest means.

included unplugging electrical chargers, using power strips, and using the energy-saving settings on the dishwasher — may have been more amenable to change because they were relatively easy to do.

Group 3: Moderate pretest frequency, moderate change: Toward the center of the figure are several behaviors concerning dietary and cooking choices (buying more local food, eating less meat, cooking more efficiently). These behaviors were done somewhat to quite often at pretest and increased moderately during the Energy Challenge. Because participants' perceived barriers to changing their diets decreased as a result of the Energy Challenge (see Chapter 4), it may seem curious that participants did not report doing these activities more often. One explanation for the modest change may be that the booklet recommended changing one meal per week rather than dramatically changing one's entire diet.

Group 4: Moderate-to-high pretest frequency, high change: The behaviors in the top right quadrant were the most popular activities during the Energy Challenge. They include actions that are commonly advocated in energy conservation campaigns, such as adjusting thermostat settings or washing laundry in cold water. The fact that these behaviors were already done quite often at pretest but increased even more suggests that the Energy Challenge reinforced behaviors with which participants were already familiar. Participants may have also gravitated toward these behaviors because they seemed easier to do. As described in Chapters 3, participants perceived that conserving energy around their home was less inconvenient than changing their diet or driving their car less.

Group 5: High pretest frequency, high change: At the extreme upper right corner are two behaviors, "wear more clothes instead of turning up the heat," and "plan errands to minimize number of car trips." These activities were done quite often to almost always at pretest, yet participants reported increasing them more than any of the other behaviors. The fact that both of these activities increased suggests that the Energy Challenge may have made participants aware that there was room for improvement. However, this apparent incongruity may also be a result of perceptual bias. At the time

the pretest was administered (late September), participants had probably not used heat in at least four months, making them prone to recall bias. Self assessments of how often one plans errands may have also been skewed. Without having a reference of what constitutes a desirable number of combined trips, participants may have overestimated the virtuousness of their driving habits.

Finally, it is worthwhile noting the low popularity of "use compact fluorescent light bulbs." This behavior was the only survey item that measured a one-time or infrequent action. As participants reported using CFLs quite often at pretest, they may have had few incandescent light bulbs left to replace.

In summary, the Energy Challenge as a whole seemed to encourage participants to increase behaviors with which they were already familiar, particularly common conservation techniques done in the home. The intervention also appeared to draw attention to behaviors related to reducing standby power and the impact of one's dietary choices, but had little effect on using alternative transportation. Interestingly, there was no obvious pattern to suggest that participants chose behaviors based their potential CO_2 savings (see Table 5.1). Had climate impact been a significant influence, we might have expected greater increases in eating meatless meals or air drying laundry and less interest in activities related to reducing standby power.

Effects of weekly feedback, stories, and the informational booklet

To determine whether the treatment conditions encouraged participants to engage in some behaviors more than others, a separate regression model was tested for each behavior, using the posttest change as the dependent variable. After controlling for participants' pretest behavior, the model tested the effect of the informational booklet (as measured by the factor, *Booklet satisfaction*, described in Chapter 4) as well as Helmert contrast-coded treatment conditions (as done in Chapter 4). To test whether participants' past behavior moderated the effect of the experimental manipulations, interaction terms were added in a second step of the model; however, none were found to be significant. This indicates that the effects of receiving either weekly feedback or weekly feedback + stories did not depend on participants' prior conservation experience.

With a few exceptions, the popularity of each behavior was consistent across treatments, regardless of whether participants received monthly or weekly feedback, or whether *shared stories* were provided. Significant differences were found for only four of the 20 behaviors (see Table 5.2). Notably, providing *weekly feedback* (vs. monthly) seemed to encourage reducing hot water usage: Participants who received more frequent feedback were more likely to take shorter showers and wash laundry in cold water. These regression models, however, were only marginally significant (p = .053 and p = .066, respectively), suggesting that other important variables were not accounted for.

Though participants, in general, did not appear to pick behaviors based on their climate impact, participants in the weekly feedback conditions may have noticed how quickly these hot water related behaviors accrued CO_2 savings over time (see Table 5.1), particularly in large households. Furthermore, these behaviors may have seemed less inconvenient than other potentially frequent, high impact behaviors such as lowering the thermostat, which has a prolonged effect on thermal comfort.

Table 5.2
Regression results using pretest behavior, booklet satisfaction, and treatment to predict changes in behavior

	Hot water usage						Standby power					
	Take short showers			Wash laundry in cold water			Unplug chargers			Unplug devices/ Use power strip		
	b	*SE*	β	*b*	*SE*	β	*b*	*SE*	β	*b*	*SE*	β
Pretest behavior	.17	.17	.12	.07	.17	.05	-.21	.13	-.22	**.29**	**.13**	**.26***
Contrast: Weekly feedback	**.92**	**.36**	**.30***	**.80**	**.38**	**.25***	**-.79**	**.39**	**-.25***	.23	.31	.09
Contrast: Stories	.33	.44	.09	.26	.44	.07	.64	.47	.17	**.86**	**.37**	**.27***
Satisfaction with booklet	.34	.23	.18	**.51**	**.24**	**.26***	.43	.25	.22†	**.52**	**.20**	**.31****
F	2.48†			2.33†			2.60*			3.85**		
R^2	.14			.13			.16			.20		
Adjusted R^2	.08			.07			.10			.15		

Note: Only behaviors with significant contrasts are shown.
$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$
† $p < .10$

Treatment condition also influenced whether participants took action to reduce standby power. Participants who were also provided *stories* were more likely than those who received weekly feedback alone to "turn electronic devices completely off by unplugging them or controlling them with a power strip." Though none of the participants shared stories about this behavior, the first e-mail reminder sent to this group mentioned that 38% of participants had taken steps to reduce standby power (see Appendix L). Whether participants "unplug[ged] electrical chargers" also varied by treatment. The contrast that compared the monthly feedback groups to the weekly feedback groups combined suggested that participants in the monthly feedback did this behavior more often than those who received weekly feedback. However, post-hoc pairwise comparisons revealed that this difference was only significant between monthly feedback and weekly feedback (estimated marginal mean = .72 versus 1.83 for monthly feedback, $p = .017$). No difference was found between monthly feedback and weekly feedback + stories (estimated marginal mean = 1.83 versus 1.36, $p = .306$). Taken together, these results suggest that when provided with frequent feedback, individuals may be less inclined to take actions with very small impacts, unless they perceive that others are also doing those behaviors.

The regression models also revealed that the informational booklet only positively influenced two out of the 20 behaviors measured. Significant main effects were found for (1) washing laundry in cold water, and (2) unplugging devices or using power strips. Interestingly, both of these behaviors had special sidebars in the booklet that described their non-energy benefits (see Appendix E). These sidebars may have not only drawn attention to these behaviors, but also made them more memorable. The laundry sidebar, for example, explained how washing laundry in cold water can help clothing last longer by minimizing fabric shrinkage and color fading. Another sidebar suggested that the inconvenience of reconnecting power cords may indirectly benefit well-being by nudging people to spend a little less time in front of televisions and computers. It was explained that both of these behaviors have been linked to decreased physical activity and less time spent with family. In addition to these two behaviors, the booklet had marginal effects ($p < .10$) for unplugging electrical chargers, eating organic food, wearing more clothes instead of turning up the heat, and planning errands.

Patterns of behavior adoption

Beyond looking at which behaviors were most popular, it is also worthwhile to examine whether the Energy Challenge encouraged participants to try multiple behaviors as well as behaviors in different domains of energy use (i.e., home energy, personal transportation, dietary choices). For example, did households focus on just a few behaviors in one domain for the entire month or did they experiment with a variety of actions? And how did *weekly feedback* and *shared stories* influence these choices?

Cluster analysis was used to identify different patterns of behavior adoption. This multivariate method is conceptually similar to factor analysis, but instead of categorizing variables, it classifies participants based on the similarity of their responses across several variables. For the present analysis, participants were clustered based on the number of behaviors they engaged in at different frequencies. For each participant, a tally was calculated for the number of behaviors that did not change or decreased during the Energy Challenge (recorded as -1, 0 or *not applicable*[7]); the number of behaviors that changed *moderately* (rated 1 or 2); and those that changed *much more* (rated 3 or 4). Variables based on these three tallies were then analyzed with PASW's Two-step cluster analysis (Norušis, 2010).

Two clusters emerged from this process. The first cluster (43.5% of participants), was labeled *low exploration* and comprised individuals who, on average, tried a handful of behaviors during the Energy Challenge. These participants reported changing a few behaviors moderately and one behavior quite a bit more (see Table 5.3). In contrast, participants in the *high exploration* group (56.5% of participants) tried a large variety of behaviors, increasing nearly eight behaviors a moderate amount and four behaviors quite a bit more.

[7] More participants used the *not applicable* response at posttest than at pretest. A comparison of the two surveys suggested that participants marked this option at posttest because they were already doing the behavior *almost always* at pretest and had no room to increase the behavior. Consequently, the *not applicable* response was considered equivalent to having done the behavior *about the same* as before.

Table 5.3
Comparison of low exploration and high exploration groups according to the number of behaviors done at different frequencies before and during the Energy Challenge

	Number of behaviors adopted/changed	
	Low exploration	High exploration
Frequency	*Mean* (*SD*)	*Mean* (*SD*)
Before Energy Challenge		
Did moderately often	6.23 (2.99)	8.23 (3.42)
Did quite often	11.40 (3.52)	9.54 (3.74)
Total No. behaviors	17.63[a] (1.69)	17.77[a] (1.71)
During Energy Challenge		
Increased moderately	3.23 (1.63)	7.69 (2.62)
Increased quite a bit	1.37 (1.50)	4.33 (3.45)
Total No. behaviors	4.60 (2.03)	12.03 (2.75)

[a] Means sharing a superscript are **not** significantly different at $p < .05$.

Interestingly, these two patterns of adoption is not a function of how many behaviors participants engaged in prior to the Energy Challenge. As shown in Table 5.3, both groups were engaged in approximately 17 climate-friendly behaviors at pretest. The only notable difference was that participants in the *low exploration* group on average did two behaviors at a higher frequency (i.e., *quite often*) than the *high exploration* group.

To further delineate the two clusters, *t*-tests were used to compare their means for the 20 behaviors measured on the pretest and posttest surveys (see Appendix V). As suggested by Table 5.3, participants in the *low exploration* group engaged in several behaviors more often at pretest than the *high exploration* group. These included activities related to keeping the heat turned down as well as turning off the heated dry setting on their dishwasher. Marginal differences were also found for cooking more efficiently and air drying laundry. In general, the *low exploration* group had slightly higher means across the 20 behaviors at pretest, but most of these were not significantly different from the *high exploration* group.

At posttest, the pattern was reversed: Participants in the *high exploration* group had significantly higher means on 15 of the 20 behaviors. As a result, participants in the *high exploration* group also achieved significantly greater total CO_2 savings during the Energy Challenge (M = 367, SD = 334; versus M = 219, SD = 213, t (61.7), p = .032). Figure 5.2

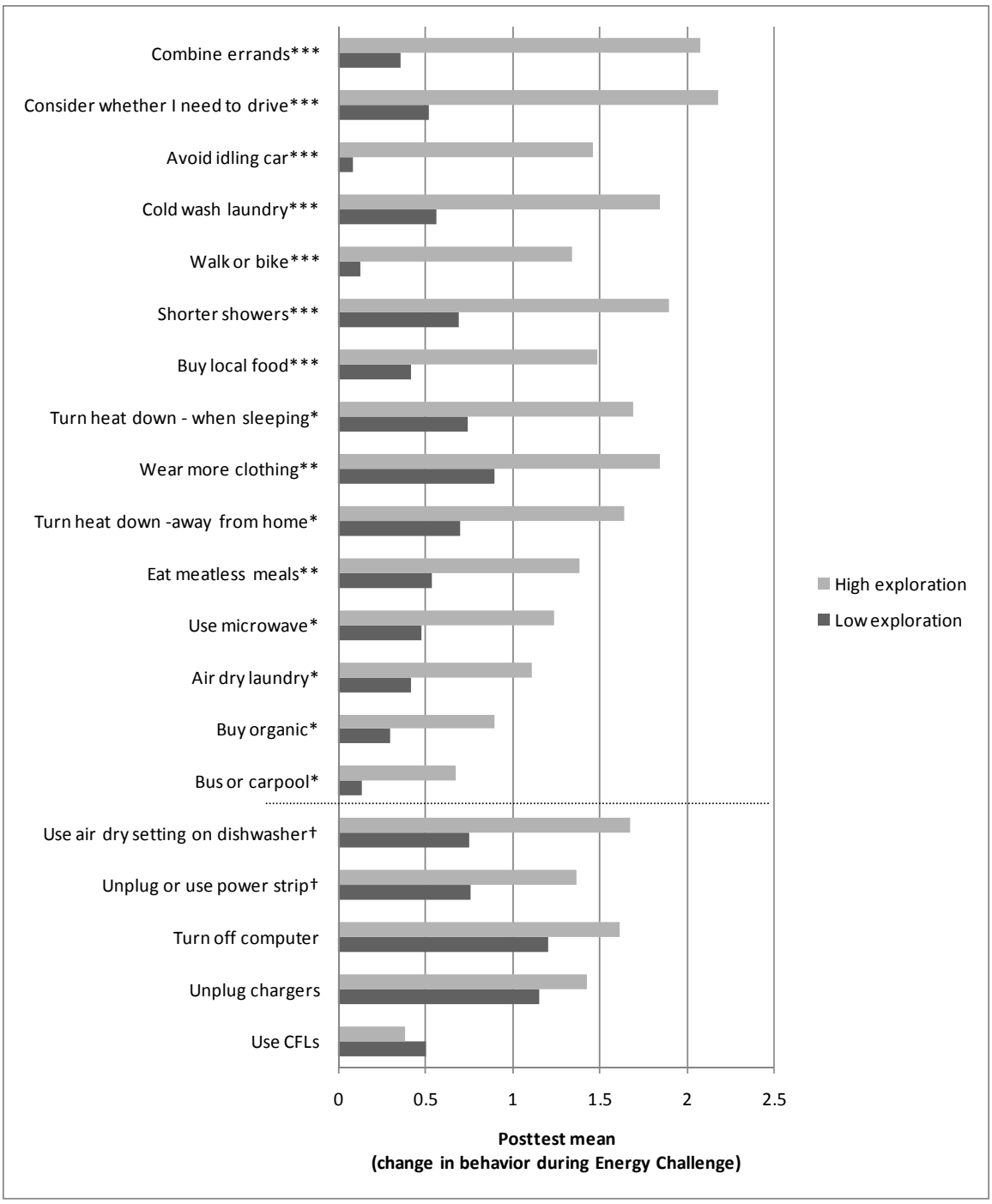


Figure 5.2 Comparison of *low* and *high exploration* clusters on posttest behavior change. Behaviors above the dashed line are organized in order of greatest to smallest mean difference between clusters. Behaviors below the line were not significantly different at $p < .05$

* $p < .05$, ** $p < .01$, *** $p < .001$, † marginal difference at $p < .10$

illustrates the differences between groups across the 20 behaviors. Participants in the *high exploration* group engaged in a wide range of behaviors, with the greatest increases observed for planning car trips, using less hot water, keeping the heat turned down, and reducing standby power. With the exception of standby power, participants in this group engaged in these behaviors significantly more often than those in the *low exploration* group. This latter group focused more narrowly on a smaller set of behaviors, namely reducing standby power and adjusting the thermostat. The fact that both groups reported reducing unnecessary standby power by the same amount may reflect that these behaviors were done infrequently at pretest by all participants. As suggested in Chapter 3, participants may have been unaware of this type of energy-saving behavior prior to the Energy Challenge.

To determine whether the treatment conditions influenced participants' patterns of behavior adoption, a logistic regression model was developed with cluster membership as the dependent variable (0 = *low exploration*, 1 = *high exploration*). As in previous analyses, Helmert contrast codes were used to compare the effect of receiving monthly feedback to *weekly feedback* (contrast 1), and the effect of adding *shared stories* to weekly feedback (contrast 2). Since participants with more conservation experience may have been limited in terms of how many behaviors they could increase or adopt, the model also controlled for participants' pretest composite score (i.e., their average engagement in all 20 behaviors at pretest; see Chapter 3). The results of this model are presented in Table 5.4.

Table 5.4
Logistic regression predicting high exploration from past behavior and treatment manipulation

	b	*SE*	*Wald*	Odds ratio	*95% CI*
Pretest composite score	-1.14	.51	5.03*	.32	[.12 , .87]
Contrast 1: Monthly feedback (vs. weekly feedback)	-1.14	.58	4.20*	.32	[.10 , .95]
Contrast 2: Weekly feedback (vs. stories)	.97	.72	0.84	2.65	[.51, 6.55]
Model $\chi^2(3, N = 69)$	10.50*				
Nagelkerke R^2	.19				

Note: Contrast 1 compares monthly feedback (1) to weekly feedback (0). Contrast 2 compares weekly feedback (1) to stories (0). An odds ratio greater than 1 indicates an increase in the odds for a unit change in the predictor variable, while a value less than 1 indicates a decrease in the odds for a unit change.
* $p < .05$

Table 5.5
Cluster membership by treatment condition

	Low exploration	High exploration	
	n (%)	n (%)	Total *n*
Monthly feedback	14 (61%)	9 (39%)	23
Weekly feedback	7 (29%)	17 (71%)	24
Weekly feedback + stories	9 (41%)	13 (51%)	22

Together, past behavior and treatment conditions explained 19% of the variance in cluster membership. A significant main effect was found for *weekly feedback*, with participants in the monthly feedback group three times more likely to be in the *low exploration* group. Participants with higher pretest composite scores were also significantly more likely to be in the *low exploration* group. No difference was found between weekly feedback and weekly feedback + stories. In sum, these results suggest that participants were more likely to try a greater diversity of behaviors if they received *weekly feedback* and reported having less experience with energy conservation. Table 5.5 shows the proportion of each treatment condition that was in the *low* and *high exploration* groups, respectively.

To explore whether other covariates influenced participants' level of exploration, the initial logistic model was expanded. Potential covariates were first screened by entering blocks of related variables (i.e., motivations, barriers, efficacy measures, and program satisfaction measures) into separate logistic models. Variables that had a stronger relationship ($p < .25$) with cluster membership were carried forward into a combined model (Hosmer & Lemeshow, 2000). A backwards elimination approach was then used to reduce the set of covariates to variables that predicted cluster membership at $p < .10$. The pretest composite score and treatment conditions were then added back into the model in the last step. Table 5.6 shows the final model from this process.

The new model accounted for 59% of the variance and correctly predicted cluster membership for 84% of participants. Again, being in the *high exploration* group was strongly associated with receiving *weekly feedback* and having less conservation experience prior to the

Table 5.6

Logistic regression predicting *high exploration* from past behavior, treatment manipulation, and covariates

	b	*SE*	*Wald*	Odds ratio	*95% CI*
Pretest composite score	-3.43	1.19	8.33***	.03	[.003 , .33]
Contrast 1: Monthly feedback (vs. *weekly feedback*)	-1.82	.81	5.09*	.16	[.03 , .79]
Contrast 2: Weekly feedback (vs. *stories*)	.96	.91	1.12	2.61	[.44, 15.54]
Attention to global warming	1.36	.53	6.28*	3.73	[1.33, 10.44]
Inconvenience	1.61	.69	5.46*	5.00	[1.30, 19.28]
Transportation barriers	-1.76	.61	8.37**	.17	[.05, .57]
If everyone did their part	.70	.39	3.21†	2.01	[.94, 4.29]
Motivated by social norms	.58	.35	2.76†	1.79	[.90, 3.55]
Model $\chi^2(8, N = 67‡)$	39.00***				
Nagelkerke R^2	.59				

Note: Contrast 1 compares monthly feedback (1) to weekly feedback (0). Contrast 2 compares weekly feedback (1) to stories (0). An odds ratio greater than 1 indicates an increase in the odds for a unit change in the predictor variable, while a value less than 1 indicates a decrease in the odds for a unit change.

* $p < .05$, ** $p < .01$, *** $p < .001$, † $p < .10$

‡This model excludes two participants who did not own cars and therefore had no data for transportation barriers.

Energy Challenge. Participants were also more likely to be in the *high exploration* group the more they felt conserving energy was inconvenient (at pretest); the greater their sense of collective efficacy; the more motivated they were by social norms; and the more they had recently looked for information about global warming and energy conservation. Finally, the odds of being in the *high exploration* group were significantly lower for participants the more they perceived high transportation barriers at pretest.

Taken together, these results suggest that the Energy Challenge was particularly helpful to individuals who might be classified as being in the contemplation or preparation stages of Prochaska and DiClemente's (1982) transtheoretical model of behavior change. This model describes an individual's readiness to make specific behavior changes. Participants who ended up in the *high exploration* group may have already recognized the role of individuals in addressing climate change and were actively searching for information on how to reduce their impact. Still, the perceived inconvenience of conserving may have prevented them from following through on their beliefs. The opportunity to participate in a community Energy

Challenge may have been just the nudge they needed to take action. As one participant wrote on the pretest survey:

> "We welcome the opportunity to participate in this project. We are a busy professional couple with two college-aged kids; we are very concerned about the environment but have done less than we should and could. Thank you."

These participants may have explored more behaviors during the Energy Challenge, in part, because they simply had not done as much before to conserve. But it is also conceivable that the satisfaction associated with signing up for the Energy Challenge and acting in accordance with their values may have made these participants more open and willing to try new behaviors. Receiving weekly feedback and seeing how one's actions add up to make a difference may have enhanced this positive experience.

Durability of behaviors at follow-up

Finally, data from the one-month follow-up survey were analyzed to determine whether the Energy Challenge led to (short-term) durable behavior change. Fifty-two of the 69 participants who complied with the Energy Challenge completed this survey. Chi-square analysis suggested that the differences in attrition rate among treatment conditions from posttest to follow-up was marginally significant, $\chi^2(69) = 5.15$, $p = .076$, with fewer participants in the weekly feedback + stories group completing the survey.

As described in Chapter 2, this survey used skip logic so that participants only answered questions about the behaviors they had adopted during the Energy Challenge. The survey also included measures for behaviors that were not assessed on the pretest and posttest surveys but had been included in the informational booklet and weekly logs, such as whether participants checked their tire pressure, tried to drive at slower speeds, or used the energy-saving settings on their computers. For each behavior, participants were asked to retrospectively assess how frequently they had engaged in that activity before the Energy Challenge, during the Energy Challenge, and in the month since the program ended. Table 5.7 shows the percentage of participants across the entire sample who decreased, maintained, or increased each behavior since the Energy Challenge ended.

Table 5.7
Maintenance of behaviors at one-month follow-up

Behavior	Total *n*	Returned to baseline *n* (%)	Decreased but stay above baseline *n* (%)	Maintained *n* (%)	Increased *n* (%)
Home energy					
Kept thermostat down	28	—	4 (14%)	21 (75%)	3 (11%)
Reduced hot water use	34	—	7 (21%)	26 (77%)	1 (3%)
Used energy-saving settings on dishwasher	10	—	1 (10%)	9 (90%)	—
Reduced oven use	14	1 (7%)	1 (7%)	11 (79%)	1 (7%)
Air dried laundry	11	4 (36%)[1]	2 (18%)	3 (27%)	2 (18%)
Used CFLs	16	—	1 (6%)	15 (93%)	—
Turned off computers	22	1 (5%)	2 (9%)	16 (73%)	3 (14%)
Put computers on standby	22	1 (5%)	4 (18%)	16 (73%)	1 (5%)
Personal transportation					
Reduced driving	21	5 (22%)	2 (9%)	14 (61%)	2 (9%)
Drove more slowly	18	—	4 (22%)	13 (72%)	1 (6%)
Reduced idling	20	—	6 (30%)	12 (60%)	2 (10%)
Checked tire pressure	17	3 (18%)		14 (82%)	—
Dietary choices					
Purchased local food	18	2 (11%)	1 (5%)	13 (72%)	2 (11%)
Purchased organic food	14	1 (7%)	—	9 (64%)	4 (29%)
Ate meatless meals	21	3 (14%)	2 (10%)	13 (62%)	3 (14%)

Note: Percentages may not add to 100 because of rounding error.
[1]Includes 3 participants who reported decreasing air drying below their baseline level

For most of the behaviors measured, at least 60% of participants reported that they had maintained or increased the activity since the Energy Challenge ended. The only exceptions to this were air drying laundry and composting food, which participants explained on the survey were harder to do in cold weather. While many participants admitted that they had not engaged in some behaviors as frequently as they did during the Energy Challenge, no participant reverted to baseline on all behaviors. The number of participants who reported decreasing each behavior was too small to enable comparisons between treatment groups. However, the participants who reported some decreases in behavior were spread across all three groups.

Overall, these results suggest that participation in the Energy Challenge – regardless of treatment condition – led to persistent changes in habits.

Summary and Discussion

This chapter examined how participants' behavior changed during the Energy Challenge. Overall, the results indicate that the program successfully encouraged participants to increase or adopt new climate-friendly behaviors. Across all three treatments, most participants who completed the Energy Challenge met – if not far exceeded – the proposed goal of reducing their monthly carbon footprint by 2%. The follow-up survey suggested that most of these behaviors were maintained one-month after the program ended.

Participants primarily met the Energy Challenge goal by conserving energy in their homes. Somewhat less popular were behaviors related to eating a less carbon-intensive diet, and actions that involve using alternative transportation remained largely unchanged. These results are consistent with previous studies that suggest people prefer actions that are easy to adopt and impose little inconvenience (Abrahamse, et al., 2007; Poortinga, et al., 2003; Whitmarsh, 2009a). Many of the household behaviors measured in this study involved merely remembering to change a setting on a device, for example, setting back the thermostat, changing the temperature on the washing machine, or turning the heated dry setting off on the dishwasher. Once the setting is adjusted, the behavior is done. In contrast, behaviors related to eating a low-carbon diet and using alternative transportation may have been less appealing because they involved more planning and inconvenience. Preparing a meatless meal might require shopping for special ingredients or looking up new recipes. Likewise, taking the bus to work might necessitate waking up earlier and deciphering bus schedules. Household energy-saving actions may also have seemed easier because participants were already familiar with them (as indicated by the higher pretest scores). Hence, participants could simply increase activities they were already doing rather than adopt entirely new behaviors.

With few exceptions, the informational booklet and the two treatment manipulations, *weekly feedback* and *shared stories*, appeared to have little effect on the rate at which individual climate-friendly behaviors were adopted. However, by looking at participants' *overall* patterns of behavior change, it was revealed that weekly versus monthly feedback encouraged participants not only to explore a wider variety of behaviors during the Energy Challenge, but to engage in them more often.

There are several explanations as to why *weekly feedback* led to greater exploration and engagement in climate-friendly behaviors. One is that feedback reinforced behavior. By showing individuals that they had made progress toward their goal, frequent feedback may have motivated participants to continue behaviors from one week to the next (Seligman, et al., 1981). Similarly, seeing the impact of one's actions in the logs might have provoked self-competition and a desire to improve one's performance relative to previous weeks. This in turn, could have led participants to engage in behaviors more often or to continue trying new behaviors each week. Another explanation is that *weekly feedback* helped individuals not only to learn the consequences of their actions in terms of CO_2 savings, but also to recognize which behaviors were ineffective for the time and effort they involved. For example, an individual might decide that the small amount of CO_2 avoided from unplugging electronics for a week was not worth the inconvenience this behavior caused. This realization might lead individuals to try other behaviors with a bigger payoff, such as taking shorter showers. In this way, *weekly feedback* may have encouraged participants to explore multiple behaviors. Finally, weekly feedback may have prompted participants to be more reflective about their efforts during the Energy Challenge and their energy consumption in general. This, in turn, may have increased general consciousness about energy consumption and helped participants recognize additional opportunities to conserve.

The results reported in this chapter have implications for the types of audiences that an intervention like the Energy Challenge might target, as well as the behaviors it promotes. Results from the logistic regression model suggest that the Energy Challenge positively influenced participants who were less familiar with energy conservation and perceived greater inconvenience barriers prior to the program. These participants tended to explore more behaviors during the program, many of which had moderately high CO_2 savings. For these participants, receiving weekly feedback was particularly helpful. By contrast, participants in the low exploration group may have been limited in what they could do during the Energy Challenge, as they tended to already be engaged in a number of climate-friendly behaviors prior to the program. The relative popularity of behaviors adopted by this group suggest that reducing standby power may have been the only "new" conservation strategy for these participants. This finding suggests that the scope of the Energy Challenge may have to be expanded to meet the needs of this type of audience. One possibility is to add

recommendations and advice about how to improve the energy efficiency of one's home. Another option would be to take advantage of these participants' past experience by asking them to recruit and encourage other community members. This might take the form of a block leader program or simply asking these participants to give detailed testimonials about behaviors they have done (as the *stories* manipulation was intended to provide). As discussed in the following chapter, there are a number of ways social influence might be better incorporated into an intervention like the Energy Challenge.

Chapter 6

Conclusions and Recommendations

Changes in individual behavior—including the adoption of energy-wise habits and increased use of efficient technologies—are a necessary and often undervalued component of combating climate change. This study used the small experiment approach (Irvine & Kaplan, 2001; R. Kaplan, 1996) to examine the role of *procedural information, feedback,* and *shared stories* in the context of a community program aimed at engaging residents in climate-friendly behaviors. The Energy Challenge was designed to support participants in achieving the goal of a 2% reduction in their household greenhouse gas emissions for one month. To help them achieve this goal, all participants received an informational booklet that outlined climate-friendly behaviors related to home energy conservation, personal transportation, and dietary choices. In addition, participants were divided into three treatment groups: one group received monthly feedback, the second received weekly feedback, and the third received a combination of weekly feedback and shared stories about the conservation activities of other participants.

This chapter provides an overview of the findings, explores their theoretical implications, and details recommendations for practitioners seeking to promote engagement in climate-friendly behaviors. Suggestions for future research are also offered.

Overview of results

Predictors of behavior prior to the Energy Challenge

Chapter 3 examined the characteristics of individuals who initially signed up for the Energy Challenge. Though the majority of participants were female and homeowners, the program appealed to a broad demographic in terms of age and household structure. As might be expected, the Energy Challenge also attracted a number of people who had already taken

steps to conserve energy. In particular, participants reported that they often engaged in activities commonly advocated to reduce home energy use, such as using compact fluorescent light bulbs, adjusting the thermostat, and washing laundry in cold water. Participants also reported frequently planning their car trips to minimize driving. Behaviors related to eating a low-carbon diet were done somewhat often, and few individuals reported that they regularly tried to reduce standby power in their homes, use alternative transportation, or air dry laundry.

Factor analysis identified several covariates expected to influence engagement in climate-friendly behaviors. These included factors related to *issue involvement*, *motivations* for conserving, and *perceived barriers* to conserving. In addition, three single-item measures were included to evaluate *self-* and *collective efficacy.* As a whole, descriptive analyses of these measures suggest that the sample was already moderately involved in the issue of energy conservation, with participants indicating that they often looked for ways to use less energy. When asked to rate their reasons for conserving, participants reported that they were highly motivated to "do the right thing" and to benefit their health. Saving money was also a moderately strong motivation; few people, however, felt they conserved because others wanted them to. Four barriers were measured related to *food*, *transportation,* and the perceived *inconvenience* and *discomfort* of using less energy. In contrast to previous research (e.g., Lorenzoni, et al., 2007; Stoll-Kleemann, et al., 2001), participants did not, on average, perceive significant barriers to engaging in energy-saving activities; this finding may reflect that participants were already engaged in a number of conservation behaviors before the Energy Challenge. Of the four barriers, the perceived impracticality of using one's car less and the discomfort associated with conserving energy were the strongest (with middling means), followed by diet change barriers and the general inconvenience of conserving. In terms of efficacy, participants strongly believed that individual actions could help reduce climate change, but they were less confident in their knowledge of action strategies and whether their community was making a difference in reducing global warming.

A series of linear regression models were used to examine how each set of potential covariates — *demographics*, *motivations, issue involvement, sense of efficacy,* and *perceived barriers* to conserving — was related to participants' prior engagement in three categories of behaviors: thermostat settings, dietary choices, and whether participants tried to minimize car

trips. Models were also developed for a composite behavior measure that averaged all 21 behavior items on the pretest survey. Across the separate models, perceived barriers explained the greatest amount of variance in each behavior measure, followed by sense of issue involvement, and motivations to conserve. This finding is striking as it suggests that even among highly motivated individuals, perceived barriers may be the limiting factor that prevents engagement in climate-friendly activities. The regression models also revealed a discrepancy between participants' reported motivations for conserving and those that predicted their behavior. Of note, the motive to save money, which was moderately to highly endorsed on the survey, did not predict any of the behavior measures. Instead, the motive to do the right thing was the only motivation to significantly predict the composite score, whether participants kept their thermostat turned down, and the degree to which they ate a low-carbon diet. The extent to which participants planned their car trips was predicted by the health motive. Together, these findings challenge the common assumption that people will only conserve energy if it saves them money.

To examine the relative importance of the covariates, significant predictors of each behavior measure were combined into a final model. Across the four models, perceived barriers remained the strongest predictor of each behavior measure, uniquely explaining between 6% and 23% of the variance in each model. Participants' sense of issue involvement also remained a significant predictor of thermostat and driving behaviors as well as the composite measure. Interestingly, the motive to do the right thing became nonsignificant in all models, suggesting that the effect of this motive may be mediated by the other variables. This result is in line with previous research that suggests measures that are specific to a behavior – such as the barriers measured here – are better predictors of behavior than more generalized motivations or feelings of environmental concern (Bamberg, 2003; Heberlein & Black, 1976; Poortinga, et al., 2004). The moderate amount of variance explained by these regression models (13% - 49%) further suggests that other important predictors of behavior were missing.

Changes in efficacy and perceived barriers

Chapter 4 examined the relative effect of the three treatment conditions – monthly feedback, weekly feedback, and weekly feedback + stories – on feelings of efficacy and

perceived barriers to conserving. For all analyses, the effect of receiving *weekly feedback* was assessed by comparing the monthly feedback group to the other two treatments combined. Weekly feedback and weekly feedback + stories were then compared to determine the impact of *shared stories*. None of the results supported the hypothesis that *shared stories* had an added benefit beyond weekly feedback alone. The analyses also examined whether satisfaction with the informational booklet was associated with changes in efficacy and perceived barriers, but no significant relationships were found.

The hypothesis that receiving *weekly feedback* would enhance feelings of efficacy and reduce perceived barriers more than monthly feedback was only partially supported. Within-group analyses indicated that self-efficacy increased from pretest to posttest for both of the *weekly feedback* groups but not the monthly feedback group. The between-group comparison, however, was unable to confirm that *weekly feedback* was advantageous. Within-group comparisons also suggested that weekly feedback alone (without stories) increased participants' perception that their community was making a difference in reducing climate change; again, the between-group comparisons provided contradictory results. These incongruent findings may be a consequence of the small sample sizes or the fact that the efficacy variables were single-item measures and less reliable.

There was also no evidence to suggest that *weekly feedback* consistently reduced barriers more than monthly feedback. However, a moderation effect was observed for *transportation* barriers and the barrier related to *discomfort.* Specifically, receiving weekly feedback helped reduce barriers among individuals who perceived average to high transportation barriers at pretest as well as those with high discomfort barriers. These findings suggest that frequent feedback has the potential to alter perceptions of a behavior, and thus may be a particularly useful intervention among audiences with even greater perceived barriers to conserving than the present sample.

Lastly, the results indicate that all study participants, regardless of treatment group, experienced a significant decline in the perception that eating a low carbon diet would be a sacrifice – even though this barrier was initially low at pretest. As several participants commented on the pretest survey that they did not understand the relationship of food to

global warming, this change may be a result of learning about these behaviors in the informational booklet, an entire section of which was dedicated to food-related behaviors. In addition, participants may have changed their views on eating a low carbon diet after seeing the associated CO_2 savings. In particular, participants expressed surprise on the posttest and follow-up surveys at how much CO_2 could be avoided by having an occasional meatless meal.

Interestingly, participants' satisfaction with the booklet did not predict the decrease in diet change barriers. This finding may be a result of how booklet satisfaction was measured. This scale comprised four items that assessed the booklet in terms of how interesting it was to read, visual appeal, variety of actions described, and usefulness. It is possible that participants' ratings of the booklet overall may have differed from how they would have rated specific sections of the booklet. For example, participants who were already quite familiar with household energy-saving strategies (which comprised the bulk of the booklet), may have thought that the booklet as a whole was only mildly useful but that the section devoted to food-related behaviors was more interesting and helpful. This nuance was not captured by the measures on the posttest survey.

Changes in behavior

Chapter 5 examined how behaviors changed during the Energy Challenge and whether participants maintained those activities one-month after the program ended. Across treatment conditions, the vast majority of participants met or far exceeded the goal of reducing their monthly carbon footprint by 2%. Relative to the default goal of 68 lbs. of CO_2, the median for the sample was 199 lbs., suggesting that the Energy Challenge goal was relatively easy to obtain for these participants.

In general, the Energy Challenge seemed to reinforce behaviors with which participants were already familiar. The behaviors with the highest adoption rates concerned planning car trips, keeping the heat turned down, and using less hot water — activities which participants reported engaging in *sometimes* to *quite often* before the Energy Challenge. However, the program also successfully encouraged behaviors with which participants had less experience. Participants reported moderately increasing their efforts to eat less meat and to buy more locally produced food. In addition, more than a third of participants reported increasing

activities that reduce standby power and electricity waste, behaviors that were relatively uncommon before the Energy Challenge. Finally, participants were least likely to meet the Energy Challenge by using alternative transportation, buying organic food, and air drying laundry. These activities may have been more difficult for individuals as they are dependent on situational factors such as access to bus routes and having additional income to purchase organic foods.

Regression analyses suggest that satisfaction with the informational booklet enhanced overall engagement in climate-friendly behaviors (as measured by the posttest composite behavior score), as well as whether participants washed laundry in cold water and unplugged electronic devices to reduce standby power. Both of these latter behaviors received extra attention in the booklet in the form of special sidebars that discussed the non-energy benefits of these activities. These benefits included, for example, how clothing might last longer when washed in cold water and how unplugging electronics might encourage people to spend less time in front of computers and televisions. These sidebars may have been more memorable and thus influenced participants' ratings of the booklet as a whole as well as their engagement in these activities. It is interesting to note that several other sidebars were included in the booklet about behaviors such as biking to work, turning down the heat at night, and buying local food at the farmers market. Yet no relationship was found between participants' satisfaction with the booklet and their engagement in these activities. A possible explanation is that these behaviors were perceived as more involved or inconvenient relative to washing laundry in cold water and unplugging electronic devices.

Overall, the degree to which participants engaged in specific behaviors was not significantly related to whether they received *weekly feedback* or *shared stories.* That is, participants' preferences for different types of behaviors were consistent regardless of treatment condition; only a few behaviors were affected by the frequency with which feedback was given (monthly vs. weekly). *Weekly feedback* appeared to encourage reducing hot water usage when doing laundry and showering; by contrast participants in the monthly feedback group were more likely to unplug devices to reduce standby power. These results may be a function of seeing how much CO_2 each of these behaviors avoided over time. Washing laundry in cold water and taking shorter showers save a moderate amount of CO_2 each time they are

performed, but when done frequently, they have the potential to avoid a considerable amount of emissions over the course of a month, particularly in large households. In contrast, reducing standby power avoids a relatively small amount of CO_2. Though the informational booklet provided estimated monthly CO_2 savings for each activity, the weekly feedback logs may have made clearer the relative multiplier effects of these behaviors, motivating participants who received weekly feedback to reduce hot water use rather than reduce standby power.

Besides examining how individual behaviors changed during the Energy Challenge, Chapter 5 also explored differences in the diversity and number of behaviors that participants adopted. Cluster analysis was used to group participants who had similar patterns of change, based on how many behaviors they changed a little versus a lot. Two groups emerged. The first, called *low exploration*, comprised individuals who adopted a handful of behaviors during the Energy Challenge, most of which were increased only a little compared to how often participants did those behaviors before. In contrast, participants in the *high exploration* group tried a larger variety of behaviors, several of which they reported increasing a lot compared to before the Energy Challenge. Logistic regression analysis found that participants were more likely to be in the *high exploration* group the less prior experience they had with energy conservation, the more they felt conserving energy was inconvenient (at pretest), and the more they had looked for information on global warming and conserving energy prior to the program. In addition, participants were more likely to be in the *high exploration* group if they were in one of the *weekly feedback* conditions. Together, these findings suggest that the Energy Challenge program, regardless of treatment condition, was particularly useful to individuals who had contemplated doing more to conserve energy but had not yet taken action. *Weekly feedback* appeared to augment these effects by motivating individuals to explore even more behaviors.

Finally, the one-month follow-up survey data suggest that the Energy Challenge led to durable behavior change, at least in the short-term. For all but one of the behaviors measured, at least 70% of participants reported that they had continued the activity at the same level of intensity as they had during the Energy Challenge. The exception was air drying laundry, an activity that participants commented was harder to maintain in the colder weather. Among individuals who did not maintain activities at the same intensity, most reported that they were still engaging in the behavior more often than they had before the Energy Challenge.

Study limitations

As with any study, there are a number of limitations that should be taken into consideration when interpreting the results. First, the data are from a self-selected group of participants. While some households may have declined to participate in the Energy Challenge because they were not willing to complete all of the surveys and logs that were required, others may not have been interested in energy conservation or climate change. Consequently, participants' level of issue involvement as well as their perceived barriers to and motivations for conserving may not reflect the general population's. The Energy Challenge might not have worked as well with households less interested in climate change or conserving energy.

Self-selection also occurred as participants dropped out of the study over the course of the Energy Challenge. While some participants may have felt that the survey instruments and logs demanded too much time and effort, others may have discontinued the program because they did not find the Energy Challenge engaging. A comparison of participants who completed the follow-up survey with those who did not suggested that the former group was slightly more satisfied with their Energy Challenge experience. However, even participants who did not complete the follow-up survey were still highly satisfied with the program.

Second, as the study lacked a true comparison group, some of the results cannot be attributed to the Energy Challenge alone. It is possible that participants would have changed some of their behaviors anyway, especially as the Energy Challenge occurred during a change in seasons when participants may have been more inclined, for example, to re-evaluate their thermostat settings. While this may be true for some of the behaviors measured, it seems improbable that such a large number of people would have decided, for example, to suddenly eat less meat or begin taking shorter showers. To the best of the author's knowledge, there were no other major initiatives at the time of the study that would account for these changes.

Third, changes in behavior were based on self-reported data rather than objective measures of energy consumption. This was done largely out of necessity. For one, behaviors related to transportation and dietary choices are not easily measured directly. Furthermore, the self-reported data were the basis of the weekly feedback conditions. Had meter readings been collected to assess household energy consumption, this aggregated information would not have

shown participants the impacts of their individual actions (as was provided in the weekly feedback logs). In addition, even if utility data had been collected to supplement some of the self-reported information, it is questionable whether genuine differences in energy consumption would have been detected. There is a considerable amount of noise in energy billing that makes detecting significant, small differences in energy use difficult, particularly when sample sizes are small (Becker, 1978; Messenger, 2010).

As a result of the self-reported data, the findings of this study may overestimate the impact of the Energy Challenge program and the three treatment conditions. However, there are several indications that participants tried to give honest reports of their behavior. At pretest, for example, participants reported that they did not frequently use alternative transportation or take actions that reduce standby power. Had social desirability biased participants' responses, means for these behaviors might be higher. Similarly, at posttest, most individuals indicated that there were a number of behaviors they did not attempt to change during the Energy Challenge and that the extent to which they did increase climate-friendly behaviors was often moderate at best. Finally, on the follow-up survey, most (63%) participants admitted that they had failed to maintain at least one of the behaviors they adopted during the Energy Challenge at the same intensity as before.

A fourth concern relates to the small sample sizes in this study. Because of low statistical power, effects of small magnitude were unlikely to be detected, and the effects that were significant were imprecisely estimated. However, because the study was exploratory, the intent was not to determine the precise effects of the treatment conditions, but rather to ascertain whether strategies such as feedback and stories were useful.

Theoretical contributions

Despite these potential limitations, the results of this study demonstrate that the Energy Challenge concept is a worthwhile alternative to typical approaches to engaging the public in climate-friendly behaviors. Such efforts often involve: (1) describing climate change as a crisis and providing information about what individuals can do; or (2) avoiding the issue of climate change altogether and instead trying to persuade people to conserve energy because it will save

money. As discussed in the introductory chapter, these approaches may have unintended consequences, such as increasing feelings of helplessness about global warming or creating confusion as to how individuals' actions relate to the problem. The Energy Challenge was designed to investigate an alternative approach in which individuals were not only directly engaged in the issue of climate change, but also provided a supportive environment to explore climate-friendly behaviors. This approach proved successful, as participants reduced their monthly carbon footprints by 6% on average, nearly three times the suggested goal. Moreover, most participants maintained the climate-friendly behaviors they adopted one month after the Energy Challenge ended. While more research is needed to investigate exactly how the Energy Challenge facilitated behavior change, several plausible mechanisms stand out. The following sections examine key aspects of the Energy Challenge program and explore how they contributed to the process of behavior change.

Participants committed to achieve a manageable goal within a set timeframe

The Energy Challenge recruitment materials asked individuals to sign a pledge card indicating their intent to meet the 2% reduction goal over the course of one month. Two features of this recruitment — the request for written commitment and the setting of a modest goal — have potential ramifications for how participants engaged in the program.

First, past research indicates that commitment can be a powerful intervention (Bryce, Day, & Olney, 1997; R. Katzev & A. Pardini, 1987; Katzev & Wang, 1994; Werner et al., 1995), particularly when it is in the form of a written pledge (Pardini & Katzev, 1983-84). Several studies have demonstrated, for example, that compared to receiving incentives (R. Katzev & A. Pardini, 1987; Wang & Katzev, 1990) or information alone (Burn & Oskamp, 1986; R. Katzev & A. Pardini, 1987), participants who commit to a task tend to engage in it more often during an intervention as well as continue the behavior longer after the intervention ends. These findings are typically explained in terms of the minimal justification principle (Lepper, et al., 1973). Katzev and Pardini (1987) argued that when individuals voluntarily commit to a task, they are likely to attribute that decision to their own beliefs and attitudes, and thus will be more motivated to engage in the task as well as continue it after the intervention ends. This rationale

may help explain why in the present study, the three treatments not only achieved equivalent CO_2 savings, but also similar maintenance rates at the one-month follow-up.

Second, the Energy Challenge presented participants with a concrete goal that was within their capabilities to accomplish. According to goal setting theory, simply having a goal can stimulate planning and problem-solving (Locke, 1996; Locke & Latham, 2002). By contrast, typical approaches to promoting climate-friendly behavior tend to focus on the abstract, global nature of the problem, without giving individuals a sense of what they should be striving to achieve. There are two problems with this approach. Research has demonstrated that vague goals such as "do your best" are likely to lead to lower performance than when individuals have a specific goal in mind (Locke, 1996; Locke & Latham, 2002). Another concern raised by Weick (1984, p. 40) is that efforts to describe the gravity of large social problems can "disable the very resources of thought and action necessary to change them." Instead, he proposed that programs focus on workable sub-goals. These involve recasting large problems into smaller, tangible tasks that have visible outcomes. The Energy Challenge tried to take this approach by reframing the problem of climate change into one that was meaningful and manageable at a personal level. Rather than focusing on the abstract goal of reducing global climate change or emphasizing the urgency of the problem, the Energy Challenge emphasized how personal actions could make a difference. The invitation letter challenged participants with the modest goal of reducing their carbon footprint by 2% for one month and provided concrete examples of how one might achieve that goal. The letter then related this modest goal to global climate change by explaining that if global emissions were reduced by 2% each year, catastrophic climate change could be avoided.

Participants were encouraged to experiment with behaviors

As described in Chapter 1, the Energy Challenge was designed with the "small experiment" framework in mind (Irvine & Kaplan, 2001; R. Kaplan, 1996; S. Kaplan, 1990). This approach involves trying things out on a modest scale, tracking one's efforts along the way, and making modifications as appropriate. To encourage this type of mindset, both the invitation letter and the informational booklet framed the Energy Challenge as an opportunity for participants to explore new behaviors and to identify a few climate-friendly actions that would

be appropriate for their families. Importantly, rather than expecting participants to adopt a specific behavior, the Energy Challenge gave participants the flexibility to choose from a large menu of options provided in the informational booklet. Letting participants choose how to meet the Energy Challenge goal likely engaged them in the problem-solving process of reducing their carbon footprint, which in turn may have led to a greater sense of ownership over the behaviors they adopted. As a result, participants may have been more intrinsically motivated to continue their climate-friendly efforts after the program ended.

The informational booklet was designed to support the small experiment process in several ways. For one, the booklet went beyond simply listing action strategies, and instead tried to give participants a rationale for each behavior as well as imagery about what might be involved. An effort was also made to address common questions and correct misconceptions about behaviors that might deter people from trying them. Lastly, the booklet tried to demonstrate the relative impact of different behaviors, a feature that is uncommon in most climate change communications (Gardner & Stern, 2008). The booklet provided not only an estimate of how much CO_2 would be saved each time a behavior was performed, but also its potential savings over the course of a month. The intent of these cumulative estimates was to give participants an idea of how small efforts had the potential to make a large difference over time.

The Energy Challenge also encouraged participants to track their behaviors by tallying them each week and reporting them to an online log. This self-monitoring – regardless of whether participants received feedback – may have caused participants to think about their behaviors more often and to consider how they might continue to meet the Energy Challenge goal. The weekly email reminders may have aided this process, as one participant commented:

> "Reminders (such as this e-mail) help keep the issue of energy in the forefront of my mind, and as a result I focus on reducing my energy consumption."
>
> [Weekly feedback participant]

Finally, the duration of the Energy Challenge – 4 weeks – may have been sufficiently long for participants to begin to develop new habits. This time frame would have enabled participants not only to explore multiple behaviors, but also to experiment with different ways

of achieving the same task. For example, one participant reported trying several different strategies for reducing the carbon footprint of his commute. Were the Energy Challenge shorter, he might have tried one approach (e.g., riding the bus to work), decided it was not for him, and then given up. Instead, the duration of the Energy Challenge gave participants the opportunity to tinker and make modifications as needed, so that participants were able to adapt climate-friendly behaviors to suit their needs. In addition, the duration of the program may have encouraged participants to repeat certain activities and begin to develop new routines. Such repetition might explain why most behaviors persisted at least one month beyond the end of the Energy Challenge.

The Energy Challenge disrupted participants' energy consumption routines

The weekly email reminders and logs may have also served as a disruption to participants' usual family routines. This aspect of the Energy Challenge likely contributed to participants' increased awareness of their energy use as well as changes in their behavior. Past research suggests that habits are easiest to alter during periods of transition when normal patterns of behavior are disrupted or not yet formed (Verplanken & Wood, 2006). The disruptive aspect of the Energy Challenge may have been amplified by the fact that it coincided with a change in seasons when individuals might naturally shift their energy-use patterns. As participants may not have yet re-established their habits related to home heating, winter cooking, etc., they may have been more receptive to the suggestions in the Energy Challenge booklet.

Feedback increased openness to change

Providing weekly feedback enhanced the effects of the basic Energy Challenge program in two notable ways. First, among participants who initially perceived moderate to high barriers to reducing the use of their cars and among those who felt strongly that using less energy would involve sacrificing comfort, the weekly feedback reduced the perception of these barriers. Second, participants who received weekly feedback were more likely to explore a greater number of climate-friendly behaviors during the challenge, which was in turn associated with higher CO_2 savings and a significant decrease in the perceived inconvenience of conserving

energy. Taken together, these results suggest that feedback has benefits beyond those of self-monitoring alone.

Acharya and colleagues (2011) found similar results in a study that compared paper record-keeping with automated feedback. In their study, participants were asked to record their dietary intake in either a hardcopy workbook or a personal digital assistant (PDA). Much like the weekly electronic logs in the present study, the PDA provided automatic feedback about participants' caloric intake relative to their dietary goals, whereas participants using the paper record would have to calculate this information on their own. While no differences were found between the two treatments in terms of weight-loss or fat consumed, participants in the PDA group engaged in a wider range of healthy dietary behaviors, such as eating more fruits and vegetables. The authors suggest that the automated feedback increased awareness of eating behaviors. Kluger and DeNisi (1996) have similarly proposed that feedback draws attention to one's behavior and may encourage individuals to evaluate their actions in relation to their goals. This rationale may explain why in the present study, participants assigned to the weekly feedback groups were more likely to engage in a greater number of climate-friendly behaviors. Furthermore, it may also explain why feedback helped reduce high perceived transportation and discomfort barriers. By thinking about their actions more often, participants may have reconsidered their objections to climate-friendly behaviors or realized that some of their concerns about a behavior were exaggerated.

Another explanation for the present findings is that feedback enhances motivation, since people may derive satisfaction from making progress toward their goals (Fischer, 2008; Kluger & DeNisi, 1996; Seligman, et al., 1981). This satisfaction may have increased willingness to explore other climate-friendly behaviors as well as offset the inconvenience or perceived discomfort associated with different behaviors. As one participant in the weekly feedback + stories group remarked:

> "Although there wasn't a lot of pain in the changes I made, there are inconveniences (my shower isn't quite as enjoyable with a low-flow shower head, it's a pain to wash containers for recycling, and the light from the new light bulbs really isn't as good) but being reminded of the impact I was making was very encouraging."

Interestingly, feedback was not found to have an effect on learning. *Weekly feedback* did not predict whether participants felt they had learned new ways to reduce global warming, and it had only a weak effect on their feelings of self-efficacy. These results are in contrast to previous research that suggests feedback enhances learning by helping individuals learn the consequences of their actions (Abrahamse, et al., 2007; Darby, 2006; Fischer, 2008; Kluger & DeNisi, 1996). One explanation for the present results is that the informational booklet provided estimated CO_2 savings for each behavior. Thus, even participants in the monthly feedback group were able to determine the relative impact of various climate-friendly behaviors. An interesting avenue for future research might be to vary the amount of up-front information provided across treatment groups.

Summary: Toward a process-based model of behavior change

The success of the Energy Challenge in reducing participants' carbon footprints and encouraging at least short-term durability — regardless of treatment condition — suggests that the basic structure of the program provided a supportive setting for changing behavior. The Energy Challenge directly engaged individuals in the issue of climate change, drew commitments from participants to achieve a reasonable goal, and then provided participants with tools such as the informational booklet, online logs, and weekly feedback to help them experiment with and adopt new behaviors.

More research—involving random assignment of these different components of the program—is needed to assess the contribution of each. Still, the overall success of the Energy Challenge points to a framework for designing behavior change interventions that takes advantage of individuals' innate inclinations and motivations. Securing a commitment from participants may lead them to attribute their behaviors to their own beliefs and attitudes rather than the intervention itself. Setting a reasonable goal and allowing participants to choose how they wish to meet that goal taps into people's inherent problem solving ability. Similarly, providing participants with an opportunity to explore new behaviors at their own pace is likely to leverage an innate desire to achieve competence. In tapping these innate inclinations, the Energy Challenge proved to be a positive experience for most participants, one in which they felt proud and grateful to have participated in.

Methodological contributions

This study raises an important methodological consideration when evaluating behavior change interventions that target multiple behaviors. Typically, such programs are assessed in terms of how the treatment conditions affect (1) changes in individual behaviors, and (2) the absolute amount of energy or carbon emissions saved. However, because of small sample sizes and large within-group variances, studies often fail to find significant differences between treatments (e.g., Abrahamse, et al., 2007; Brandon & Lewis, 1999). Findings from the present research suggest it may be valuable to examine participants' overall pattern of behavior adoption using techniques such as cluster analysis. Had the present study only used conventional analyses, many of the important findings of this research, such as the value of feedback in encouraging the exploration of multiple behaviors, would not have been discovered.

Implications for practitioners

As discussed above, there are key features of the Energy Challenge that practitioners may want to incorporate in their programs – providing participants with a goal, giving them procedural information and guidance, encouraging them to monitor their behavior, and providing them with automated feedback. The remainder of this section explores some additional implications for organizations interested in engaging the public in climate-friendly behaviors.

Appeal to deeper values

The results of this dissertation challenge the common assumption that individuals will only engage in climate-friendly behaviors if those activities are framed in terms of economic self-interest. Chapter 3 revealed that the motive to save money, while moderately endorsed by participants, was not significantly correlated with their prior engagement in climate-friendly behaviors. Instead, participants' past behavior was predicted primarily by the motive to do the right thing and in the case of reduced personal vehicle use, the desire to benefit their health. Moreover, the motive to save money did not seem to influence participants' behavior during the Energy Challenge. Participants adopted a wider variety of behaviors than the handful for which the informational booklet provided estimated dollar savings. In addition, the motive to save

money was not a significant predictor of whether participants were in the low or high exploration groups.

Taken together, these results suggest that programs may be more successful at engaging individuals in climate-friendly behaviors if they are framed in terms of a deeper set of values. In particular, it may be especially worthwhile to tap the motive to do the right thing. It is noteworthy that this motive, as measured in this study, is not necessarily about taking action for the sake of the environment. Rather, this factor primarily consisted of items that reflect a general sense of satisfaction from acting in accordance with one's values or what De Young (1996, 2000) has characterized as intrinsic satisfaction from participating in activities that one finds meaningful. The top-loading items in this factor included "It feels like the right thing to do," "It makes me feel good about myself," and "It's the moral thing to do."

Fortunately, there are many reasons why acting on climate change may feel like the right thing to do, in addition to benefitting the environment. Some of these relate to other broad-scale social issues such as promoting human health or protecting disenfranchised populations that live in areas vulnerable to climate change impacts. But taking action on climate change can also relate to more personal values, such as a sense of patriotism (to reduce dependence on foreign oil) or the desire to protect "God's creation." Depending on the target audience, practitioners may be wise to frame climate-friendly actions in terms of these motives (Nisbet, 2009). To be clear, the suggestion here is not to tell people that acting on climate change is the right thing to do. Many climate change communications already carry this implicit message – and are met with reactance if people feel that values are being imposed upon them. Rather the recommendation is to demonstrate to audiences how engaging in climate-friendly behaviors can align with values they already have. This approach has already been successfully employed by several religious groups, where action on climate change has been reframed as "creation care" and an opportunity "to know the Lord more fully" (Abbasi, 2006; Evangelical Environmental Network, 2011).

Tailor the program to account for different levels of experience

Given the self-selection that occurs with a program like the Energy Challenge, program managers can expect that some participants will already be engaged in a number of climate-

friendly behaviors. In the present research, this caused some individuals to drop out of the Energy Challenge while others felt very limited in what they could do to further reduce their impact. The following participant comment reflects some of the frustration that these experienced individuals felt:

> "I thought the Energy Challenge Program was a good idea, but I don't think everybody started on an even playing field. I had to really think long and hard about what I could do to reduce my global impact from how I live already, since our household already has a lot of energy saving practices. The next round for the program might want to take into account what household[s] are already doing and factor that into how much energy reduction a household should shoot for. Maybe provide energy saving suggestions o[n] an easy, moderate, and difficult level. I think our household was already implementing the easy, moderate, and several difficult energy saving methods. I was running out of ideas of what else I could do to save energy on top of what we were already doing. I would have really appreciated some insight as to how to save energy in unconventional methods that I hadn't thought of. I felt like I [was] failing the challenge, since I felt like I wasn't meeting my energy reduction goals, since I started at such a low level. "

One solution, as this participant suggested, is to expand the range of behaviors that are promoted in the program. This might include identifying other curtailment behaviors but could also mean expanding the program to include energy efficiency improvements such as upgrading appliances or weatherizing one's home.

An alternative approach is to engage these experienced conservers as ambassadors for climate-friendly behavior. Rather than be asked to find additional ways to conserve energy, these participants might be invited instead to promote the program to their friends and neighbors. A similar approach involving "block leaders" has been used successfully to promote recycling (Burn, 1991; Hopper & Nielsen, 1991). A block leader approach might work particularly well in the context of promoting climate-friendly behaviors, as past research suggests that people are more likely to trust and act upon energy related information that comes from friends and community members (Costanzo, et al., 1986; Stamm, et al., 2000; Stern, 1992).

Future directions

Findings from this research raise several questions that are worthy of future investigation. These pertain to the measures used in the study, the design of informational materials, the delivery of feedback, how to better incorporate social influence in the program, and external validity.

Measures

The measures used to assess *motivations*, *efficacy*, *perceived barriers*, and sense of *issue involvement* did not prove as robust as would have been desirable (e.g., the barrier factors had moderate Cronbach alphas), suggesting that additional measures would be worthy of exploration. In addition, future research could investigate whether self-efficacy items that are specific to the behaviors being studied would have more predictive power than the more general measures studied here. Participants could be asked, for example, to assess their confidence in adopting specific behaviors. This information could help researchers and practitioners identify behaviors for which participants need additional procedural guidance.

Design and evaluation of informational materials

Participants' satisfaction with the booklet was found to predict their average change in climate-friendly behaviors (as measured by the posttest composite behavior score), but it was not significantly related to changes in perceived barriers or, with few exceptions, whether participants engaged in specific climate-friendly activities. This finding is striking given that the booklet appeared to be at least partially responsible for changes participants made in their diets as well as increased efforts to reduce standby power. As discussed above, information in the booklet may have also influenced perceived barriers to eating a low-carbon diet.

Future research might incorporate more specific measures of booklet satisfaction. For example, it would have been helpful to know what participants thought about the tone and understandability of the behavior descriptions and the associated CO_2 savings charts; the usefulness of features such as *tips*, *myth-busting* facts, and related *web resources*; and how engaging participants found the sidebars that described the non-energy benefits of conserving.

These questions might be best evaluated early on in the intervention when participants are first becoming acquainted with the booklet. It would also have been informative to know at the end of the Energy Challenge to what extent participants read the booklet or referred back to it.

These questions reflect a general need for more research on how people respond to informational materials. In the thirty years since Ester and Winett (1981-82, p. 203) critiqued antecedent interventions (such as informational brochures) as being "rather uncreative" and failing to incorporate "basic tenets of communications research," little research has empirically tested the effectiveness of different communication designs (Abrahamse, et al., 2005).

Providing feedback

While the results of this study suggest that providing regular feedback can be beneficial, there are challenges to implementing this intervention. For one, climate-friendly behaviors involve a suite of actions, many of which have impacts that cannot be measured objectively with an energy meter. This means that to receive feedback on the impacts of one's dietary choices or transportation behaviors, individuals must necessarily record the actions they take. This burden may be a factor that inhibits wider participation in initiatives such as the Energy Challenge or that leads to people to drop out of programs.

Future research could investigate less burdensome ways for participants to record their actions and receive feedback. One possibility is to take advantage of technology such as mobile phone applications. For example, Froehlich et al. (2009) have developed an application that automatically senses whether a person is using public transit or a personal automobile. The phone then provides positive feedback for their "green" commutes in the form of a visualization – a tree growing more blossoms or a polar bear whose ice floe expands. Such an application could be expanded so that individuals could input information about other climate-friendly behaviors. As an increasing number of people carry their phones with them everywhere, having such an application readily accessible could make it easier for individuals to record their efforts and to receive feedback closer in time to when a behavior was performed. Where applicable, these applications could also provide feedback in other units, such as the calories burned from walking to work or the gas money saved by properly inflating tires and driving the speed limit. Other research has found that providing multiple types of feedback may be more motivating

than one type alone (Graham, et al., 2011). Research could evaluate the effectiveness of such applications not only in terms of whether they help reduce carbon emissions, but also the extent to which they engage users and encourage continued recording of behaviors.

How to incorporate social influence

The intention of the *shared stories* manipulation was to help individuals establish more realistic expectations of what different climate-friendly behaviors involve and to demonstrate that others in the community were doing their part to reduce climate change. It was also hoped that this intervention might provide practitioners with a low-cost method for gathering and sharing information between participants. Given the low number of stories submitted and their tendency to be brief in nature, it appears that this method of soliciting stories was not appealing to most participants. Furthermore, there was no evidence to suggest that the *shared stories* had an appreciable effect on participants' perceived barriers, their sense of efficacy, or their engagement in climate-friendly behaviors.

Several explanations may be offered as to why the *shared stories* manipulation did not have the hypothesized effects. The manipulation check, which assessed how interesting the weekly reminder e-mails were, found no differences between treatment groups, suggesting either that participants did not notice the stories in the e-mails or that their content was not engaging. In most cases, the anecdotes that participants shared fell short of what might be considered a "good story." Typically, participants stated what climate-friendly behavior they did and offered an observation that it was not as difficult as they thought it would be. While these anecdotes often conveyed a sense of accomplishment, they lacked other qualities that may have made the stories more memorable and captivating. De Young and Monroe (1996) have suggested that to be engaging, a story should demonstrate how a problem or dilemma was resolved and provide imagery of how individuals came to that solution. Few of the *shared stories* conveyed the thought process that led to the behaviors described or how participants overcame challenges they faced in adopting them. Thus, the stories may not have been descriptive enough to help others build a mental model of what the behavior involved. As stories and modeling have been successfully employed in other settings (Monroe & Kaplan, 1988; Winett, et al., 1982; Winett, et al., 1985), the present results say more about how stories

were (poorly) operationalized than how this type of intervention can influence behavior. The participant comments below suggest that this type of intervention, if well executed, would be appreciated.

> "It would be great to have ideas that other participants have devised for reducing the carbon footprint shared with all members of the survey. The more ideas we have on HOW to save, the more we CAN save."
>
> [Weekly feedback participant]

> "I would have liked to hear more from other participants -- new ideas, things I hadn't thought of, tricks for adapting to changes in lifestyle, etc."
>
> [Weekly feedback + stories participant]

Future research could examine whether this method can be improved upon – for example, by including better prompting questions in the logs. Alternatively, it may be worthwhile to investigate other ways of incorporating social influence into an Energy Challenge. One option would be to integrate the online log with a website on which participants could ask questions to each other and share advice. For example, an "Ask the experts" forum could enable users to pose questions to more experienced participants about particular climate-friendly activities. The interactive nature of such a website – particularly the possibility that participants could observe their stories inspiring others – may make sharing advice about one's experiences more compelling. Such a website could also be a venue for participants to post short videos and photos of actions they have taken. Other research has shown that modeling behaviors in this way can be an effective way to change behavior (Winett, et al., 1982; Winett, et al., 1985). Finally, offering a website where users can browse what others have done to meet the Energy Challenge may encourage participants to explore climate-friendly strategies that they would not have otherwise considered.

Replication in other communities

Finally, the Energy Challenge program should be replicated in other communities. Ann Arbor, Michigan, is a progressive college town in which many residents are already

environmentally inclined. Conducting an Energy Challenge in a more nationally representative community may reveal different patterns in terms of how motivations and barriers relate to climate-friendly behavior. In addition, the benefits of an Energy Challenge may be even more pronounced, as residents in such a community may have less experience with climate-friendly behaviors than the present sample. Replication of the study would also be an opportunity to test different ways of framing climate-friendly actions in terms of local residents' motivations for doing the right thing.

Conclusion

Research suggests there is a potentially significant role for individuals and households to play in mitigating climate change through their everyday behaviors. While surveys suggest that many Americans care about climate change and believe something should be done to reduce it, a number of real and perceived barriers prevent them from acting on that concern. Unfortunately, current efforts to engage people in climate-friendly behaviors tend to reinforce these barriers, either by stressing the overall urgency and magnitude of the climate problem or by failing to help individuals see how their actions contribute to solving the problem.

This study provides a more hopeful perspective on how to engage people in climate-friendly behaviors. In contrast to typical interventions that target a single behavior or select group of behaviors, the Energy Challenge gave participants the option to choose among 34 behaviors in domains related to transportation, household energy, and dietary choices. By reframing the problem of climate change as a manageable goal, providing procedural guidance, and encouraging participants to monitor their behavior, the Energy Challenge helped participants successfully reduce their carbon footprints and adopt new behaviors that they continued beyond the duration of the program. This study also demonstrated that providing frequent, automated feedback can help decrease perceived barriers to change and motivate people to explore a wider range of behaviors. Although questions remain about the precise mechanisms by which the Energy Challenge facilitated these changes, the results overall suggest that this approach is a promising way to help people shift to a low-carbon lifestyle.

Appendices

APPENDIX A: Invitation Letter

CITY OF ANN ARBOR, MICHIGAN

Energy Office P.O. Box 8647, Ann Arbor, Michigan 48107
Phone (734) 794-6430 ext. 43711 Fax: (734) 994-1744
abrix@a2gov.org

ENERGY – ANN ARBOR
PUTTING IT TOGETHER

Dear Neighbor,

September 4, 2009

The City of Ann Arbor **needs your help** to reduce our community's impact on global warming. Scientists estimate that reducing global greenhouse gas emissions by just 2% a year could help avoid major climate change. Would you be willing to help meet this goal with some small changes to your routine? We hope so—that's why we're inviting you to participate in the Ann Arbor **Energy Challenge.**

The **Energy Challenge** asks you to try to reduce your household's greenhouse gas emissions by 2% for the month of October. Although addressing global warming is our primary goal, the Energy Challenge is also an opportunity to make changes that benefit you personally. If you sign up, we will provide information about ways to conserve energy that can also save you money, improve your health, and contribute to your personal well-being.

If you're wondering whether the Energy Challenge is right for you, consider these examples of how you might reduce your greenhouse gas emissions by 2%.

What does 2% look like?

For the typical Ann Arbor household, that amounts to about 68 lbs. of carbon dioxide (CO_2) per month. Here are a few examples of how you might meet this goal:

Example 1	Monthly Savings (lbs. CO_2)	Example 2	Monthly Savings (lbs. CO_2)
Air dry one load of laundry per week	20	Reduce driving by 5 miles each week	20
Reduce shower time from 8 minutes to 6	22.5	Use energy saving setting on dishwasher	21
Eat one less meat-based meal per week	28	Inflate car tires once a month	29
Total monthly savings:	**70.5 lbs.**	**Total monthly savings:**	**70 lbs.**

These are just a few of the many changes that can reduce greenhouse gas emissions. Here in Ann Arbor, the average household produces approximately 40,700 lbs of CO_2 emissions a year. Simple choices—the settings on our thermostats, the way we use electronic devices and appliances, the food we eat, and how and when we travel—all affect our greenhouse gas emissions. The Energy Challenge is an opportunity to explore those choices and reduce our carbon footprint. If you decide to participate in the Energy Challenge, you will receive an **Energy Challenge Kit** with additional information to help you meet the 2% goal.

Who's eligible to take the Energy Challenge?

Any Ann Arbor household is eligible to participate, provided that you:

- Will not be out of town for an extended period of time during the month of October.
- Have regular access to Internet (either at home or work).
- Are willing to provide your e-mail address to us so that we can send you surveys and weekly logs online. Using e-mail will help us evaluate the effectiveness of the program more quickly, while also saving paper, energy, and expenses. Your e-mail address will not be shared with others.

What's involved? What will I be asked to do?

If you decide to participate in this initial program, ***you'll be asked to:***

1. Reduce your household's carbon footprint by 2% during the month of October.
2. Record your efforts each week in a short, online log *(To make it easier to remember, we'll send reminder e-mails; 10 - 15 minutes each week).*
3. Fill out three brief surveys (one before the Challenge begins, one at the end of the Challenge month, and one follow-up survey; *15 minutes each*).

All participants will receive a kit with strategies and resources to help them meet the Energy Challenge. The logs you fill out will also give you feedback about your progress. Kim Wolske, a doctoral student at the University of Michigan, will use the information from surveys and logs to help us understand what works best for Ann Arbor citizens when it comes to conserving energy, as well as how we can improve the Energy Challenge program. Your participation is completely voluntary, and any information you provide through surveys or weekly logs will be kept confidential. Your name and contact information will not be shared with anyone outside of this project, and no one will be able to identify you from your responses.

How do I sign up?

If you are interested in participating, please fill out and return the enclosed postcard by **September 18, 2009**. We will then e-mail you a link to the first survey and send (via postal mail) an Energy Challenge Kit containing additional information and guidance for meeting the challenge.

Ann Arbor's Energy Challenge Commitment

The City is working hard to do its part. The Green Energy Challenge passed by City Council in 2006 sets goals for increasing our use of renewable energy sources, including a 20% reduction in community-wide greenhouse gas emissions by 2015. With new energy-efficient, LED streetlights downtown, use of biodiesel in city vehicles, our landfill gas to energy system, and hydroelectric dams, the City is leading the way to a sustainable energy future. **But we need your help to meet our community-wide greenhouse gas emissions goal!**

Have questions?

If you have any questions about this program, please contact Kim Wolske at **734-330-3263** or **EnergyChallenge@umich.edu**. You may also contact Andrew Brix at abrix@a2gov.org.

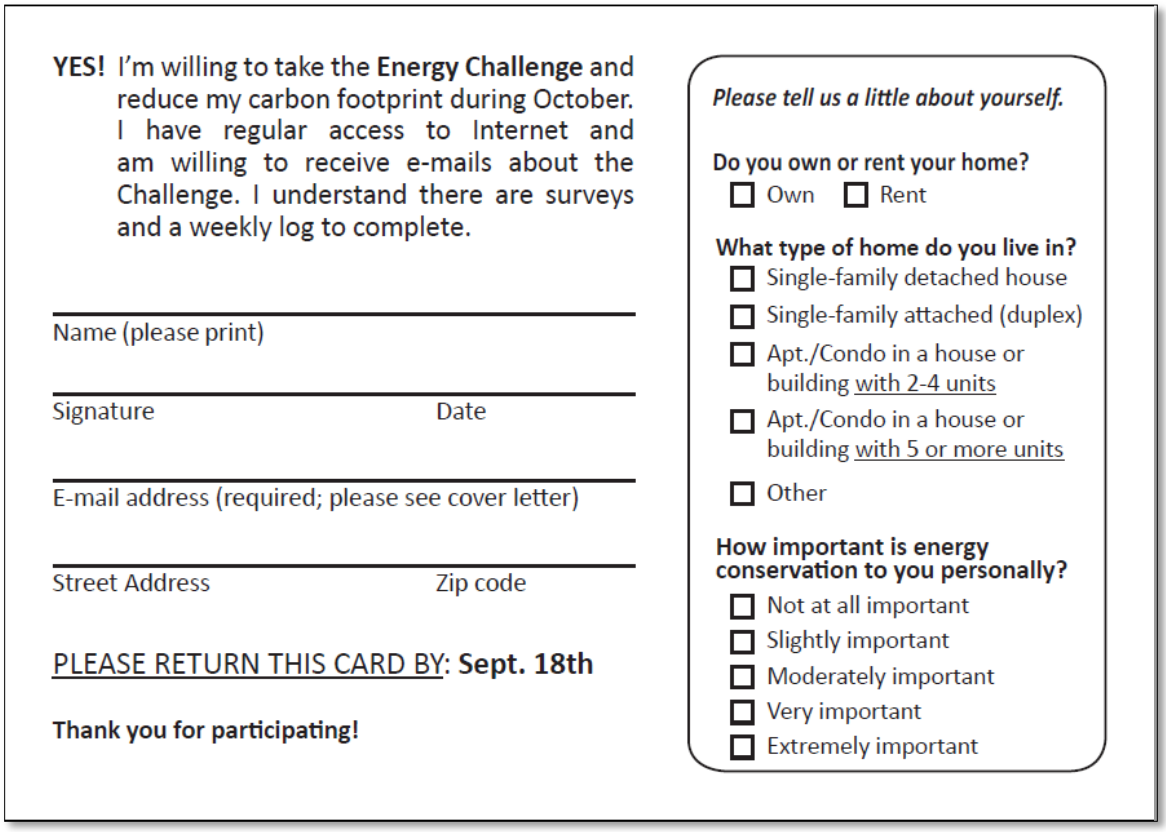
We hope you will join in this effort. Thank you for your help!

Sincerely,

Andrew Brix
Energy Programs Manager
City of Ann Arbor

Kim Wolske
Doctoral Candidate
School of Natural Resources & Environment, UM

APPENDIX B: Business Reply Postcard



YES! I'm willing to take the **Energy Challenge** and reduce my carbon footprint during October. I have regular access to Internet and am willing to receive e-mails about the Challenge. I understand there are surveys and a weekly log to complete.

Name (please print)

Signature Date

E-mail address (required; please see cover letter)

Street Address Zip code

PLEASE RETURN THIS CARD BY: **Sept. 18th**

Thank you for participating!

Please tell us a little about yourself.

Do you own or rent your home?

☐ Own ☐ Rent

What type of home do you live in?

☐ Single-family detached house
☐ Single-family attached (duplex)
☐ Apt./Condo in a house or building with 2-4 units
☐ Apt./Condo in a house or building with 5 or more units
☐ Other

How important is energy conservation to you personally?

☐ Not at all important
☐ Slightly important
☐ Moderately important
☐ Very important
☐ Extremely important

APPENDIX C: Reminder Postcard

Dear Neighbor,

About a week ago, we sent you an invitation to participate in the Ann Arbor **Energy Challenge** – a new program that encourages residents to reduce their household greenhouse gas emissions by 2% during the month of October.

If you have already responded to participate in the challenge, thank you! The first survey to complete will be e-mailed to you soon, and the Energy Challenge Kit should arrive by the end of September.

If you still want to participate but haven't yet responded, **a new response card is attached**. To sign up, please return it by **September 18, 2009**. Once you sign up, you will receive a kit with suggestions to help you meet the 2% goal. Also, to help us evaluate the effectiveness of this new program, you will be asked to fill out three brief surveys and to track your efforts to conserve energy in a brief weekly log. Links to these surveys and logs will be sent to you via e-mail.

If you have any questions or need another copy of the invitation, please contact Kim Wolske at **(734) 330-3263** or **EnergyChallenge@umich.edu**.

We hope you will join in this effort. Thank you for your help!

Andrew Brix
Energy Programs Manager, City of Ann Arbor

Kim Wolske
Doctoral Student, University of Michigan

YES! I'm willing to take the **Energy Challenge** and reduce my carbon footprint during October. I have regular access to Internet and am willing to receive e-mails about the Challenge. I understand there are surveys and a weekly log to complete.

Name (please print)

Signature Date

E-mail address (required; please see cover letter)

Street Address Zip code

PLEASE RETURN THIS CARD BY: **Sept. 18th**

Thank you for participating!

Please tell us a little about yourself.

Do you own or rent your home?
☐ Own ☐ Rent

What type of home do you live in?
☐ Single-family detached house
☐ Single-family attached (duplex)
☐ Apt./Condo in a house or building with 2-4 units
☐ Apt./Condo in a house or building with 5 or more units
☐ Other

How important is energy conservation to you personally?
☐ Not at all important
☐ Slightly important
☐ Moderately important
☐ Very important
☐ Extremely important

APPENDIX D: E-mail with URL to Pretest

From**: Ann Arbor Energy Challenge <noreply@qualtrics.com>**
Subject: Energy Challenge Survey

Thank you for signing up for the Energy Challenge!

By participating, you're helping to reduce our community's impact on global warming.
The first step in the Energy Challenge is to fill out the survey at the link below.

Take the Survey

Or copy and paste the url below into your internet browser:
http://umichpsych.qualtrics.com/WRQualtricsSurveyEngine?Q_SS=4ZsNLC0c1YKWhaA_0GuKDpcMBsZ0hQU&SVID=Prod

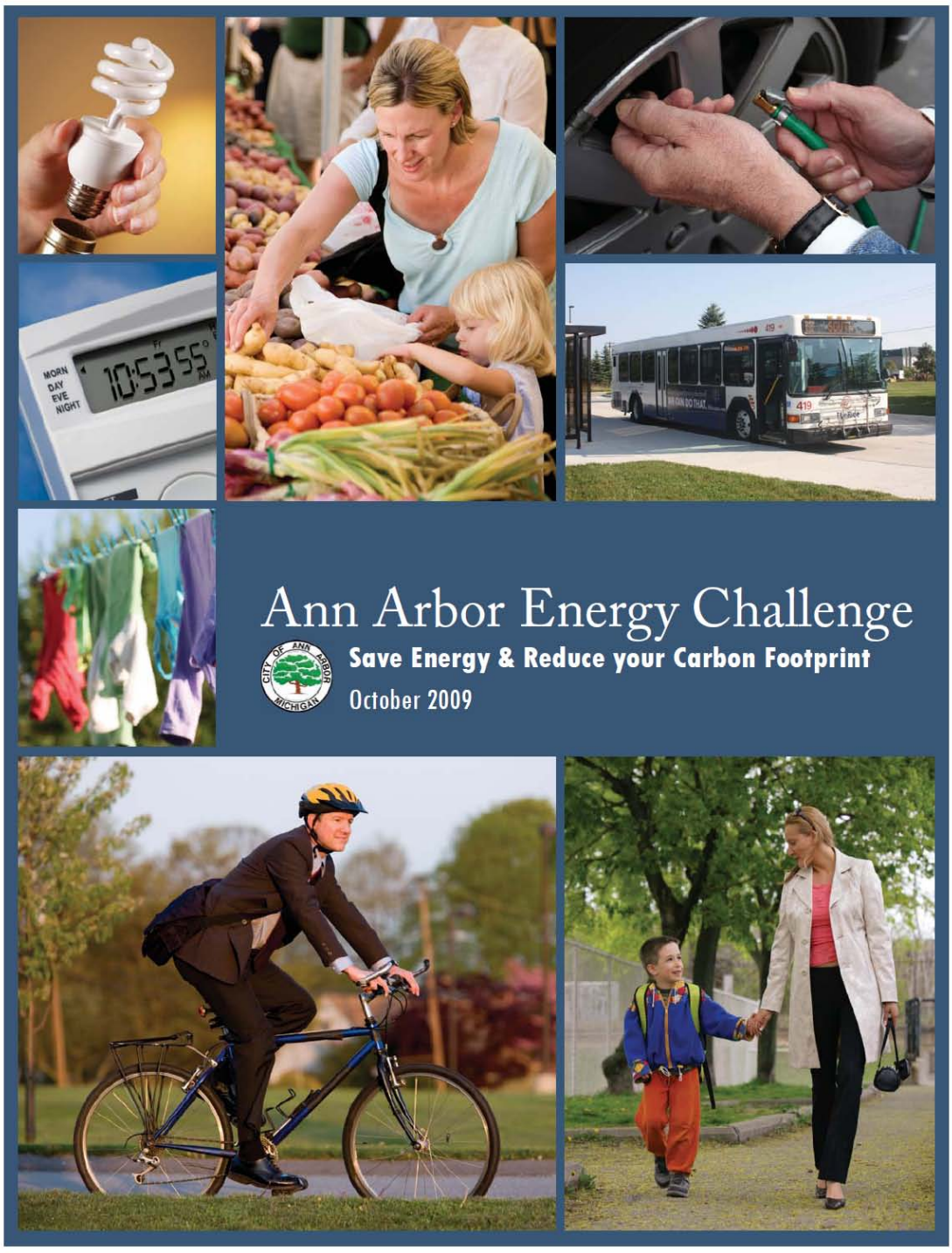
The survey will take approximately 15 minutes to complete. Your responses will help us better understand how Ann Arbor residents feel about energy conservation and the steps they're already taking to conserve. Please try to complete the survey in the next few days.

Your Energy Challenge Kit should arrive next week and provides suggestions and tips to meet the challenge goal. We'll send another e-mail next week with instructions for recording your efforts online. If you have questions, please feel free to contact us at energychallenge@umich.edu or 734-330-3263. Thank you again for participating!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment, University of Michigan

Follow the link to opt out of future emails:
http://umichpsych.qualtrics.com/CP/Register.php?OptOut=true&RID=MLRP_cuSR4goTDrGtuDy&ServerID=Prod

APPENDIX E: Informational Booklet



Thank you for taking the Ann Arbor Energy Challenge!

Whether it's flipping a light switch, doing a load of laundry, or driving to the grocery store, our actions have consequences in terms of the energy they use. In many small ways, we all contribute to the problem of global warming — just as we all have the potential to help reduce it. The Energy Challenge asks you to do your part by reducing your monthly carbon footprint by 2% during October.

Why 2%? It's the amount we need to decrease greenhouse gas emissions each year in order to stabilize the climate by 2050 and prevent dramatic global warming. For the average Ann Arbor household, 2% is about 68 lbs. of carbon dioxide (CO_2) per month.

Although cutting your household's greenhouse gas emissions by this amount alone won't solve global warming, your efforts this month and beyond *are* part of the solution. We hope you'll use the Energy Challenge as a stepping stone for longer-term change — a chance to identify a few energy-conserving behaviors that you could maintain even after the challenge ends.

If every household in Ann Arbor reduced its annual greenhouse gas emissions by 2%, we'd avoid 38.5 million pounds of CO_2, equivalent to taking 3,200 cars off the road for a year. By continuing to reduce emissions an additional 2% each year, we could offset the annual emissions of nearly 48,000 cars in five year's time.

Positive Change for the Planet – And You!

Reducing greenhouse gas emissions isn't the only reason to use less energy. Whether you're concerned about improving your health, providing a better environment for your family, or increasing your financial security, the strategies in this booklet can help. **We encourage you to consider the Energy Challenge an opportunity not only to reduce your household's global warming impact, but also to satisfy other goals you may have.**

In the end, the path to low-carbon living is about finding what works for you. We hope the Energy Challenge proves to be a rewarding experience and thank you again for taking part in this community effort.

A refresher on global warming...

The coal that produces our electricity, the natural gas that heats our homes, and the gasoline that fuels our cars all release greenhouse gases like carbon dioxide when burned. These gases act as a blanket, trapping heat in the earth's atmosphere. While this warming effect is necessary to keep our planet livable, our global greenhouse gas emissions have far exceeded acceptable levels.

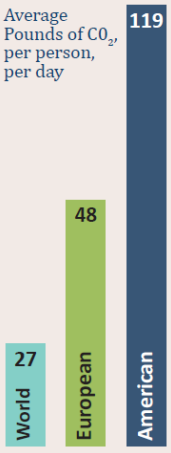
In Michigan, we've already seen signs of global warming: higher average annual temperatures, more frequent, severe rainstorms, and decreased ice cover on the Great Lakes. Over time, these changes are expected to alter the growing seasons of crops, encourage the spread of disease-carrying insects, change wildlife habitat and migration patterns, and even decrease our winter tourism.

We can help reduce these potential impacts by increasing the energy efficiency of our homes and vehicles, switching to renewable energy sources, and conserving energy where possible.

What is a carbon footprint?

Your carbon footprint is a measure of the amount of greenhouse gases your daily activities produce in a year. It's typically measured in pounds or tons of carbon dioxide (CO_2), the most prevalent greenhouse gas. The chart shows how the typical American's footprint compares to a European's and to the world average.

To help stabilize the climate and avoid dangerous global warming, we each need to reduce our carbon footprint by 2% per year.



Transportation

One third of the average American's carbon footprint comes from travel. *Every mile of driving adds almost 1lb. of CO_2 to the atmosphere.* Fortunately, there are many options for reducing the impact of your travels. Nearly half of the trips we make in our cars are less than 3 miles long – a distance that can easily be accomplished with more climate-friendly options such as carpooling, walking, biking, or taking a bus. Even when those options may not be feasible, we can reduce our impact by changing the way we drive and maximizing our cars' potential gas mileage. The less gasoline we burn, the less global warming pollution we produce.

Curb Your Car

Try leaving your car at home at least one day each week. Eliminating 10 miles of driving each week can save you $65 in gas over the year and reduce global warming pollution by 485 lbs.

Here's How:

- **Take the AATA Bus.** Over 90% of Ann Arbor households live within a quarter mile of an AATA bus stop. Taking the bus can save you money and produces one-third less CO_2 than driving your own car.

  WEB: You can find routes and schedules at **www.theride.org** and track the current location of your bus at **http://mobile.theride.org.** If your employer participates in the AATA's go!pass program or if you have a current University of Michigan ID, you can ride the bus for free!

- **Carpool.** Over 37,000 Ann Arbor residents drive alone to work. Sharing a ride with another person cuts your fuel costs and greenhouse gas emissions by at least half. Fewer cars on the road also means less smog and fewer air pollutants.

  WEB: Michigan RideShare, **www.mirideshare.org,** provides free carpool and vanpool matching services for commuters within Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne Counties. Applicants are matched with others who share common neighborhoods, destinations and hours. MI Rideshare also offers a guaranteed ride home in the event of an emergency, up to six times per year.

- **Walk or bike.** Consider walking or biking for short-distance trips. In congested areas, riding a bike can actually be faster than taking a car. Even at a casual pace, a one mile trip can take only 5 minutes on a bike or 20 minutes on foot. Each mile you power by foot – instead of your car – prevents nearly 1lb. of CO_2 from being released into the atmosphere.

  TIP: Make it a family affair. Walking or biking to nearby destinations can be a great way to fit in extra time with a spouse or child. Studies show that walking in nearby nature can help reduce stress and improve focus. In addition, regular physical activity helps kids control weight, build self-esteem, and even perform better in school.

  WEB: When you're used to driving, places can seem farther away than they are. Enter your address at **www.walkscore.com** to see which stores, restaurants, and other amenities are within a mile of your home. Click the "Expand all" link (just below your walk score) to see a complete listing.

- **Telecommute**. Avoid the commute altogether! If you have the type of work that can be done from home, talk to your employer about working from home one day a week.

  WEB: See **http://getdowntown.org/telecommute** for resources to help you set up this type of work arrangement.

Get More Out of Your Commute!

Colder weather and the holidays are approaching – and for many of us, that means putting on a few pounds. Beat winter weight gain by replacing some of your car trips with **walking or biking**. Besides burning calories, both types of exercise improve your cardiovascular health and help reduce your risk for health problems such as diabetes, high blood pressure, osteoporosis, and stroke.

The Centers for Disease Control and Prevention (CDC) recommend getting 150 minutes of modest physical activity each week, in as little as 10 minute increments. A one mile walk takes about 20 minutes and burns 100 calories. One mile on a bike takes about 5-7 minutes and burns 25 calories.

If your daily commute is 2 miles one way, you can burn 2000 calories per week by walking — enough to lose 2.5 pounds in one month.

When You Do Drive – Drive Smart!

Simple changes in the way you drive can improve your gas mileage and reduce your greenhouse gas emissions.

Here's How:

- **Plan and combine errands.** Think ahead about the errands you need to run and combine trips when possible. Doing so can reduce the total number of miles you drive as well as make your car more fuel efficient. Running separate errands from a cold engine uses up to twice as much gasoline as one multi-purpose trip of the same distance.

- **Don't idle.** If you'll be parked for more than 10 seconds, turn off the car. Restarting uses less fuel than letting the car idle – and contrary to popular belief – will not damage modern engines. Even in cold weather, modern cars need no more than 30 seconds to warm up. You'll actually heat the engine twice as fast by driving rather than idling in place. For every 5 minutes your car idles, nearly 1 lb. of CO_2 is released.

  TIP: It may not always be practical to turn the car off, but try to avoid idling when:
  - You first get in. Don't start the engine until everyone is buckled up and ready to go.
  - You're dropping off or picking someone up.
  - You're talking on the phone while parked.
  - You're going to a bank or fast food restaurant. Park the car instead of using the drive-thru.

- **Reduce your highway driving by 5 mph.** Most cars get their best gas mileage at or near 60mph. For every 5mph you drive faster, your fuel efficiency declines by about 7% –equivalent to paying approximately $0.24 more per gallon of gas. For the average American, driving over the speed limit releases an extra 348 lbs. of CO_2 into the atmosphere each year.

- **Inflate your tires once a month.** Looks can be deceiving – half of the vehicles in the U.S. have at least one tire that is underinflated. Under normal driving conditions, your tires naturally lose 1-2 psi per month. Since underinflated tires have more contact with the road, they require more energy – and gasoline – to move and maintain speed. By inflating your tires to the recommended level each month, you can save up to 18 gallons of gas each year. The proper tire pressure for your vehicle can be found on a sticker in the driver's side door jamb or in your owner's manual.

Take back your time

Time spent behind the wheel can make the day seem longer, especially if you have to contend with traffic or find parking. Many of the alternatives suggested here allow you to avoid this hassle – and gain a little time to yourself. **Carpooling** can give you an opportunity to rest and socialize with others. Likewise, time spent waiting for and **riding the bus** can easily be used to make an important phone call, catch up on a few pages of reading, or simply relax. **Telecommuting** has an obvious advantage: you can use your normal commuting time to sleep in, spend time with your family, or get more done.

Efficient driving is safer

It probably comes as no surprise that speeding triples your risk of being in a crash. Besides **driving the speed limit**, you can make your drive safer by keeping your **tires properly inflated**. Underinflated tires wear out faster, reduce car handling, and increase the chance of a blowout.

Potential CO_2 Savings (lbs.)

Curb Your Car	Pounds CO_2 Saved Per 5 miles	5 mi./week Per month
Take the bus	1.25	5
Carpool		
with 1 other	2.5	10
with 2 others	3.3	13
with 3 others	3.75	15
Walk/Bike	5	20
Telecommute	5	20

Drive Efficiently	Pounds CO_2 Saved Per week	Per month
Combine errands to eliminate 5 miles of driving	5	20
Turn off car instead of idling 5 min./day	6	24
Reduce highway speed by 5 mph	7	28
Inflate tires once per month	—	29

Household Energy

Household energy use accounts for 20% of the average American's carbon footprint. From the furnace burning natural gas to the computer that draws coal-fired electricity, numerous household actions result in the release of carbon dioxide. At the same time, every switch, dial, and power cord presents an opportunity to conserve. By using what you need and eliminating waste, it's easy to save dozens, even hundreds of pounds of CO_2 every month without sacrificing comfort or convenience.

Keep the Thermostat in Check

About two-thirds of a household's energy bill goes toward heating and cooling. The following actions can cut a significant portion of your carbon footprint and your DTE bill.

Here's How:

- **Dial the thermostat down a few degrees & resist the urge to adjust it.** When you're at home, try keeping the thermostat a degree or two cooler than you did last year. For every degree you lower your heat, you can save up to 3% on your heating bill and prevent over 300 lbs. of CO_2 from entering the atmosphere each winter. On particularly chilly days, look for other ways to stay comfortable before adjusting the thermostat. Consider putting on another layer of clothing or wrapping up in a blanket, and be sure to close blinds and drapes at night to help keep heat in.
- **Lower your heat 8°F or more when sleeping or away from home.** The Department of Energy recommends setting your thermostat no higher than 68° F when at home and 60° F or less when you're sleeping or away from the house. For each 8-hour block of time that you regularly set your thermostat back 8° F, you'll avoid emitting 154 lbs. of CO_2 each month and potentially save $67 over the course of winter. If you don't already have a programmable thermostat, consider installing one to automatically adjust the temperature at different points in the day.

MYTH-BUSTING: It's a common misconception that a furnace will have to work harder after the temperature has been turned down for a long period. In truth, it takes far less energy to reheat your home after a setback period than it does to maintain a constant, high temperature throughout the day. Just try to keep your thermostat at a constant temperature for periods of 4 hours or more.

Sleep better...

Not only because of the money you'll save!

While **setting your thermostat back** is one of the most effective ways to trim your carbon footprint and your heating bill, it's also a great way to improve your sleep. Studies have shown that the optimal temperature for sleep is between 60 - 66° F. A cool room helps lower your body's internal thermostat, which in turn leads to sleepiness.

Use Less Hot Water

You probably don't think about energy when you turn on the faucet or take a shower, but hot water heating accounts for 25% of a household's energy bill. It's possible to conserve water without sacrificing comfort.

Here's How:

- **Turn your water heater down and insulate it.** Most water heaters are preset to 140° F. However, 120° F is plenty hot to produce a warm shower and kill bacteria when cleaning. By turning the temperature down, you'll not only save 6-10% on your water heating costs, but reduce the risk for scalding (water at 125° F can burn children in only 2 to 3 seconds). Lowering the temperature also reduces corrosion and buildup in your water heater and pipes. If your water heater is more than ten years old, consider wrapping it in a water heater blanket. These special blankets sell for about $15 and help reduce heat loss from the tank, saving an additional 10% in water-heating energy costs. Newer tanks come with insulation built-in.

TIP: If your water heater thermostat doesn't have numbers, turn the dial to warm or medium. To test the temperature, turn on the hot water at your sink, let it run for 3-5 minutes, then measure the temperature with a meat or candy thermometer. If you need to adjust the temperature further, wait a day before re-measuring it.

- **Take shorter showers.** Showers account for about a third of a household's hot water usage. For every 2 minutes you shorten your daily shower, you save, on average, 120 gallons of water and 22.5 lbs. of CO_2 per month. Keep an old digital watch or kitchen timer in the bathroom to help you keep track of time. You can also reduce hot water usage by shutting off the shower while you soap up or shave.
- **Install a low-flow showerhead.** If your showerhead is more than 17 years old, consider upgrading to a new low-flow model. Showerheads made prior to 1992 can use 4 to 6 gallons of water per minute. By law all new showerheads have a maximum flow of 2.5 gallons per minute, and many models can be found that use only 1 to 1.5 gallons per minute – without a drop in water pressure. Make the switch and you'll save about 8,000 gallons of water per person each year.

  TIP: Don't know your shower's flow rate? Cut the top off of an old gallon jug and time how long it takes the showerhead to fill it. If it fills in less than 20 seconds, you have a model worthy of upgrading.

- **Don't let water run continuously while hand-washing dishes.** If you have a tendency to let the faucet run while dishwashing, you could use more than 17 gallons of water in 8 minutes – nearly triple the amount used by a modern automatic dishwasher. Cap how much water you use by putting your drain plug to use and avoiding unnecessary rinsing.

  TIP: If you have a double sink, fill one basin with warm soapy water, the other with cold rinse water, and avoid turning on the faucet as you wash. If you only have one basin, plug it and start with a minimum amount of warm soapy water. As you rinse dishes, the basin will collect rinse water and help soak other dirty dishes. Challenge yourself to keep the water level as low as possible. With these tricks you can use half the amount of hot water.

Use Appliances Wisely

Small changes in the way you use your appliances can add up to big savings in household energy use.

Here's How:

- **Use the energy-saver settings on your dishwasher.** Dishwashers use the same amount of energy and water for every load, regardless of load size. Avoid partial loads and opt for the "energy-saver" or "light wash" setting, which uses less water and cuts the rinse cycle short. Also turn off the "heated dry" option to let your dishes dry naturally. By using both of these settings, you can save 1 lb. of CO_2 per load.
- **Choose the best cooking method.** Microwaves, toaster ovens, and crock pots are more efficient for cooking small meals than your electric or gas oven. Each saves between 1–2lbs. of CO_2 per use. If you do use the oven, consider making a double batch of food or baking several items at the same time. You can always freeze leftovers to save for later. For every hour of oven time you avoid, you save 2.5 lbs. of CO_2.
- **Wash laundry in cold water instead of hot.** Most of the energy used to wash your clothes goes toward heating the water. Opt for cold water washes unless the load is heavily soiled and always use a cold rinse cycle. If you have a lot of heavily soiled laundry, consider buying a special cold water detergent to get your clothes clean. Washing in cold water instead of hot or warm saves nearly 3 lbs. of CO_2 per load –an annual savings of 900 lbs. and $75 for the typical family.

Make your favorite clothes last longer

Washing machines and automatic dryers make laundry tasks easier, but the heat and tumbling action can take a toll on fabrics. Just think about dryer lint – all of that fuzz came from your clothing!

Cold-water washes and air drying can help maximize the life of your wardrobe.

By washing in cold water:

- Colors are less likely to fade or bleed
- Elastic retains its shape and stretch
- Fabrics won't shrink

Benefits of air drying:

- If you missed a stain, you can retreat it; dryer heat sets stains
- Fabrics last longer. Dryer heat makes cotton brittle and susceptible to forming holes. Heat also causes synthetic materials like elastic, microfiber, and lycra to wear out faster
- Clothes are less likely to shrink or pill
- No more static cling!

Drying laundry outdoors in the sun also helps break down stains, makes whites brighter, and leaves your clothes smelling fresh.

- **Dry full loads of laundry – or skip the dryer altogether**. Reduce drying time by running full loads of similar weight items (e.g., avoid mixing towels and sheets) and drying loads consecutively; doing so takes advantage of built up heat. Better yet, air dry your clothes. Each time you skip the dryer, you prevent 5 lbs. of CO_2 emissions. To make the most of autumn weather, hang laundry early in the day.

  TIP: To reduce wrinkles when air drying clothes, hang them as soon as the wash cycle ends. Give each item a brisk snap before hanging, then smooth out pockets and cuffs. Hang shirts upside down to avoid misshapen shoulders, or dry them directly on hangers.

  TIP: Can't hang a line? Even without a clothesline, you can air dry laundry using a folding drying rack in a well ventilated area (outdoors if possible). Large items like sheets can be folded into quarters and hung on a hanger. Turn them over to ensure that both sides get dry. If you're drying indoors, expect items to take a day or two to completely dry.

Look for Hidden Energy Wasters

There are many ways that small amounts of energy get wasted every day. Finding energy wasters can add up to significant energy savings over time.

Here's How:

- **Replace your incandescent light bulbs with compact fluorescent light bulbs (CFLs).** CFLs use about one-fourth the amount of energy as regular light bulbs and last 10 times as long. If you've been avoiding CFLs because of the cost or quality of light, the technology and price of these bulbs have improved dramatically. With the exception of some specialty bulbs, most CFLs pay for themselves within a year. Each bulb lowers your annual energy bill by $5-10 and reduces your global warming emissions by 115 - 140 lbs. of CO_2 each year.

  WEB: Need help finding the right CFL? Visit www.energystar.gov/lighting and click "Light bulbs (CFLs)" to access the Energy Star Buyer's Guide.

- **Turn off your computer at night and use standby/sleep settings.** Most American homes have one or more computers, and many are left on all the time. Turning off your computer (and monitor) is the best way to save energy, but if you don't want to wait for the system to reboot, set your computer to go to sleep or standby after 15 minutes of inactivity (Note: Screensavers are not the same thing as standby and do not save any energy). In standby/sleep mode, your computer uses 95% less energy than leaving it on and idle! By turning off your computer or setting it to sleep at night, you'll save 35 lbs. of CO_2 each month on a desktop or 10 lbs. on a laptop.

  TIP: Not sure how to change your computer's power settings?
  Windows XP & Vista: Go to Start > Control Panel > Power Options
  Mac: Choose Apple > System Preferences > Energy Saver

Potential CO_2 Savings (lbs.)

Lower Thermostat	Pounds CO_2 Saved Per day	Per month
One degree for entire day	2	56
8 degrees for 8 hours	5.5	154

Use Appliances Wisely	Pounds CO_2 Saved Per load	Per month*
Use energy-saving & air-dry settings on dishwasher	1	18
Wash laundry in cold water	3	18 - 96
Air dry laundry	5	30-160

* Varies depending on household use.

Use Appliances Wisely	Pounds CO_2 Saved Per use	Per month
Eliminate an hour of baking in the oven by using a:		
Toaster oven	1	*varies by use*
Crockpot	1.5	*varies by use*
Microwave	2	*varies by use*
Or cooking multiple items in the oven at the same time	2.5	*varies by use*

MYTH BUSTING: Computer technology has advanced considerably in the last two decades. Contrary to popular belief, turning your computer on and off several times a day will not make it wear out faster. Nor does it take more energy to restart your computer than to keep it running.

- **Pull the plug or use a power strip.** Many electronic devices are energy vampires, sucking a small amount of power even when they're "off." The typical home has around 40 of these devices. Common culprits include computers, microwaves, programmable coffee makers, televisions, VCRs, DVD players, stereos, video game systems, printers, and cell phone chargers. Unplug the electronics you don't use regularly, and plug the rest into an easily accessible power strip that can be turned off. By making a concerted effort to reduce vampire power (also called standby or phantom power), you can trim up to 32 lbs. of CO_2 per month and a couple of dollars off your electric bill.

  TIP: To determine whether something is an energy vampire, look to see if it has a charger, remote control, LED lights, digital display, clock, or memory system.

  TIP: It may be impractical to unplug televisions, DVRs, etc., if you use them regularly, as you'll have to reprogram the clock and stations each time you restore power. But consider unplugging equipment that you don't use as frequently – perhaps a VCR that you use once or twice a year or an extra T.V. in a guest bedroom. Likewise, evaluate whether you really use the clock on your microwave or coffee maker. These devices often use more energy to power the clock than they do for their primary purpose.

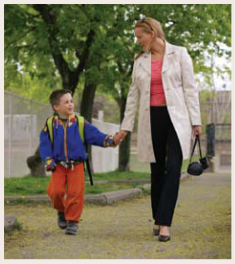
  WEB: To learn more about vampire energy and the types of devices that use it, see http://standby.lbl.gov/standby.html.

Unplug and Unwind

Remembering to **turn things off and unplug them** can seem inconvenient, especially given the number of gadgets in our lives. But by taking that small action — and making it a little more difficult to turn something back on — we may actually be doing ourselves a favor.

Americans are spending an increasing amount of time watching television, surfing the Internet, and visiting online social networking sites. This trend has been linked to a decline in time spent with family and is particularly concerning for children, who may choose to be "plugged in" over being physically active outdoors.

The small hassle of reconnecting power cords or waiting for the computer to boot up maybe just the nudge we need to encourage some time away from the screen.



Use Less Hot Water	Pounds CO_2 Saved Per day	Per month
Lower hot water heater 10° F	—	9.5
Lower hot water heater 20° F	—	19
Insulate water heater	—	32
	Per shower	Per month
Shorten shower by 2 minutes	0.75	21
Install low-flow showerhead	3.75	105
	Per load	Per month*
Hand wash dishes efficiently	1.5	45

Hidden Energy Wasters	Pounds CO_2 Saved Per week	Per month*
Replace one frequently used incandescent bulb with CFL	2.5	10
Turn off computer each night (or set to standby)	9	36
Turn off laptop each night (or set to standby)	2.5	10
Unplug electronics or use power strips to reduce vampire energy	8	32

Food

Next to personal transportation, your dietary choices are one of the most significant ways to impact your carbon footprint. It's not just the energy that it takes to cook a meal, but also the resources used to grow, harvest, and transport the ingredients. There are a number of ways to reduce your carbon "foodprint," including buying locally grown food, avoiding waste, and reducing consumption of resource-intensive food such as meat.

The delights of the Farmers Market... More than just food

Since the days when street cars circled downtown, the Ann Arbor Farmers Market has been a place where people break from the grind and savor the bounty of local farms. Michigan is the second-leading state in agricultural diversity, which means you can choose from scores of fruit and vegetables, many of which you won't find in grocery stores.

All of the produce is fresh, often picked from the vine or dug from the soil that very morning. Because of this 24-hr turn around, farmers select crop varieties for their flavor, as opposed to their transportability. In contrast, much of what you'll find in the supermarket arrives from California or even another continent and, consequently, may have lost some of its nutritional quality and flavor.

But the farmers market isn't just for produce – you'll find eggs, cheeses, meat, herbs, grains, jams, and breads to satisfy many of your culinary needs. It's never been easier to **incorporate local food into your meals.**

For many people, the freshness and the flavor alone make the farmers market worth the trip, but there's a deeper pleasure to be found in the experience. You're likely to bump into people you know, and you can converse directly with local growers about life on the farm, gardening tips, or mouth-watering ways to serve up what's in season. With every dollar you spend, you're contributing to a vibrant local economy that supports farming families and the land they till and protect. When it comes to food, going local is truly a return to our roots.

What You Eat Matters

By making different food choices, most people can significantly reduce their impact on global warming.

Here's How:

- **Buy locally grown food.** The average meal travels between 1,200 to 1,500 miles from the producer to your plate. Aside from arriving short on flavor, high mileage foods also take a serious toll on the climate. After harvest or processing, they're loaded into an assortment of energy-guzzling transports – freight trains and ships, semi-trucks, and even airplanes. Buying food from local farmers saves transportation-related emissions and puts money in your local economy. If local offerings are sparse, try to pick in-season food that traveled the shortest distance. Many produce labels will indicate the state or country of origin.

  TIP: You can find the greatest selection of local food at the Ann Arbor Farmer's Market
  Location: 315 Detroit St. in Kerrytown.
  Hours: May – Dec., Wednesday & Saturday, 7 AM to 3 PM
  Jan. – Apr., Saturday Only, 8 AM to 3 PM

  TIP: What's local in October?
  Apples, Beans, Beets, Broccoli, Brussel Sprouts, Cabbage, Eggs, Eggplant, Greens, Honey, Herbs, Jams and Preserves, Leeks, Maple Syrup, Pears, Plums, Potatoes, Pumpkins, Radishes, Spinach, Squash, Sweet Potatoes, Tomatoes (from hothouses), Watermelon

  WEB: For recipes to help you make the most out of seasonal foods, visit **www.harvesteating.com.** Not sure what's in season? See **http://www.fieldtoplate.com/downloads/MichiganProduceAvailability.pdf** for a listing of local foods in Michigan by month.

- **Buy organic.** The chemical fertilizers and pesticides used to produce conventional, non-organic foods are produced with considerable amounts of fossil fuels. Organically produced foods avoid this extra carbon price tag. In addition, organic farming practices increase the biodiversity of the soil, reduce erosion, and even absorb CO_2 from the atmosphere. You can also feel good knowing that your food is free of artificial chemicals and preservatives.

  TIP: If you're uncertain whether something is organic, check the label. Product stickers that start with a 9 indicate organic; conventional produce usually starts with a 4. If you're buying boxed or prepared foods, look for the green and white USDA organic label.

- **Have a regular meatless meal.** You don't have to become a vegetarian! Even eliminating one meat-based entree per week can have a significant impact. Raising livestock requires an enormous amount of resources. For example, producing one pound of beef requires seven pounds of grain, which in turn requires 2,500 gallons of water for irrigation plus fertilizers and pesticides. Grazing animals such as cows, sheep, and pigs also release methane. One pound of this greenhouse gas has the same impact as 25 lbs. of carbon dioxide. For each meat-based meal you eliminate, you cut on average, 6 lbs. of CO_2 from your footprint. If you specifically eliminate beef, the savings are even greater. Each pound of beef your forgo saves 22 lbs. of CO_2 from entering the atmosphere.

Avoid Waste Before & After Dinner

Shopping for and disposing of food also impacts global warming. However, carefully planning ahead can further reduce your "foodprint."

Here's How:

- **BYOB – Bring Your Own Bag.** The global warming impact of using a single disposable bag is small. But each year Americans use over 100 billion plastic bags and 10 billion paper bags. The typical shopper uses 9 bags per week, at a cost of 6 lbs. of CO_2 per month. The next time a cashier gives you the choice of paper or plastic, take pride in providing your own reusable bag instead. Reusable bags hold up better and can even earn you some cash. Many grocery stores provide a cash rebate – up to 10 cents per bag, every time you check out.
- **Compost Your Food Scraps.** When you toss banana peels, coffee grounds, and other organic matter into the trash, they end up in landfill where it produces methane, a greenhouse gas 25 times more harmful than CO_2. Instead, consider returning your food scraps to the earth. You'll save up to 7 lbs of CO_2 each week, halve the number of times you have to take out the trash, and generate a nutrient-rich medium for gardening. A number of commercial compost bins are available or you can start a pile in a corner of the backyard.

WEB: For practical advice on starting and managing a compost pile, visit www.compost-guide.com or www.howtocompost.org.

Potential CO_2 Savings (lbs.)

What you Eat	Pounds CO_2 Saved Per meal	One meal Per week Per month
Eat a meal with 50% local ingredients	0.5	2
Eat a meal with 50% organic ingredients	0.5	2
Replace a chicken, fish, or egg-based entree with a vegetarian one	6	24
Replace a beef entree with chicken, fish, or eggs	16	64
Replace a beef entree with a vegetarian one	22	88

Avoid Waste	Pounds CO_2 Saved Per week	Per month
Bring your own bag	1.5	6
Compost kitchen scraps	7	28

How will you meet the Challenge?

We look forward to finding out! Thank you again for taking part in this community effort.

If you have any questions, please do not hesitate to contact us at energychallenge@umich.edu.

APPENDIX F: Tracking Sheet

How will YOU meet the Energy Challenge?

This worksheet is provided for your convenience, to help you plan and keep track of your efforts during the Energy Challenge. You may find it handy to have when filling out the weekly logs, which calculate your CO_2 savings based on how frequently you do each activity.

Important: You probably did things to conserve energy before the Energy Challenge. Since the challenge asks you to *further* reduce your household emissions by 2%, **only count new activities you've done since starting the challenge.** This can include efforts to increase what you were already doing. For example, if you were already biking to work twice a week and now bike four days, you can count the extra two days toward meeting your challenge goal.

Examples of how you might use these charts

Your Plan		What You Accomplished
Energy-saving Activity	How often do you plan to do this?	Use this space to track your efforts (e.g., miles of driving avoided, # loads done efficiently, # days this week)
Walk kids to school instead of driving	3x this week	1 mile roundtrip walked Monday, Wednesday
Wash more laundry in cold water	2 loads	loads done III
Keep the heat 1 degree cooler than usual	everyday	days this week IIII

Your Goal for the Energy Challenge:

Reduce our household carbon footprint by _____ lbs. of CO_2 during October (See p. 3 of Booklet).

Week One (Thursday, Oct. 1 – Saturday, Oct. 10)

Your Plan		What You Accomplished
Energy-saving Activity	How often do you plan to do this?	Use this space to track your efforts (e.g., miles of driving avoided, # loads done efficiently, # days this week)

Week Two (Sunday, Oct. 11 – Saturday, Oct. 17)

Your Plan		What You Accomplished
Energy-saving Activity	How often do you plan to do this?	Use this space to track your efforts (e.g., miles of driving avoided, # loads done efficiently, # days this week)

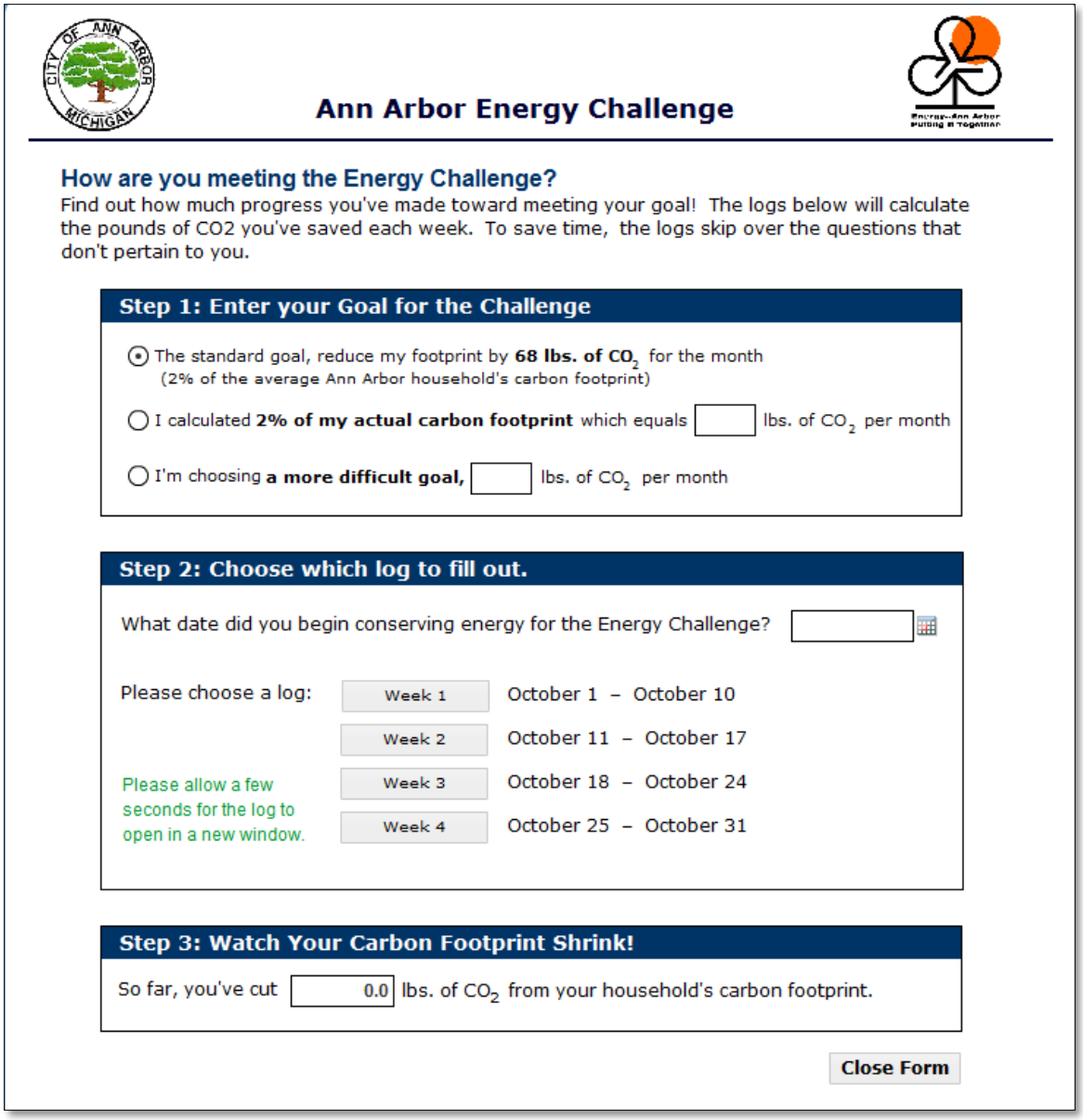
Week Three (Sunday, Oct. 18 – Saturday, Oct. 24)

Your Plan		What You Accomplished
Energy-saving Activity	How often do you plan to do this?	Use this space to track your efforts (e.g., miles of driving avoided, # loads done efficiently, # days this week)

Week Four (Sunday, Oct. 24 – Saturday, Oct. 31)

Your Plan		What You Accomplished
Energy-saving Activity	How often do you plan to do this?	Use this space to track your efforts (e.g., miles of driving avoided, # loads done efficiently, # days this week)

APPENDIX G: Weekly Feedback Log



Ann Arbor Energy Challenge

How are you meeting the Energy Challenge?

Find out how much progress you've made toward meeting your goal! The logs below will calculate the pounds of CO2 you've saved each week. To save time, the logs skip over the questions that don't pertain to you.

Step 1: Enter your Goal for the Challenge

- (•) The standard goal, reduce my footprint by **68 lbs. of CO_2** for the month (2% of the average Ann Arbor household's carbon footprint)
- ( ) I calculated **2% of my actual carbon footprint** which equals [ ] lbs. of CO_2 per month
- ( ) I'm choosing **a more difficult goal,** [ ] lbs. of CO_2 per month

Step 2: Choose which log to fill out.

What date did you begin conserving energy for the Energy Challenge? [ ]

Please choose a log:

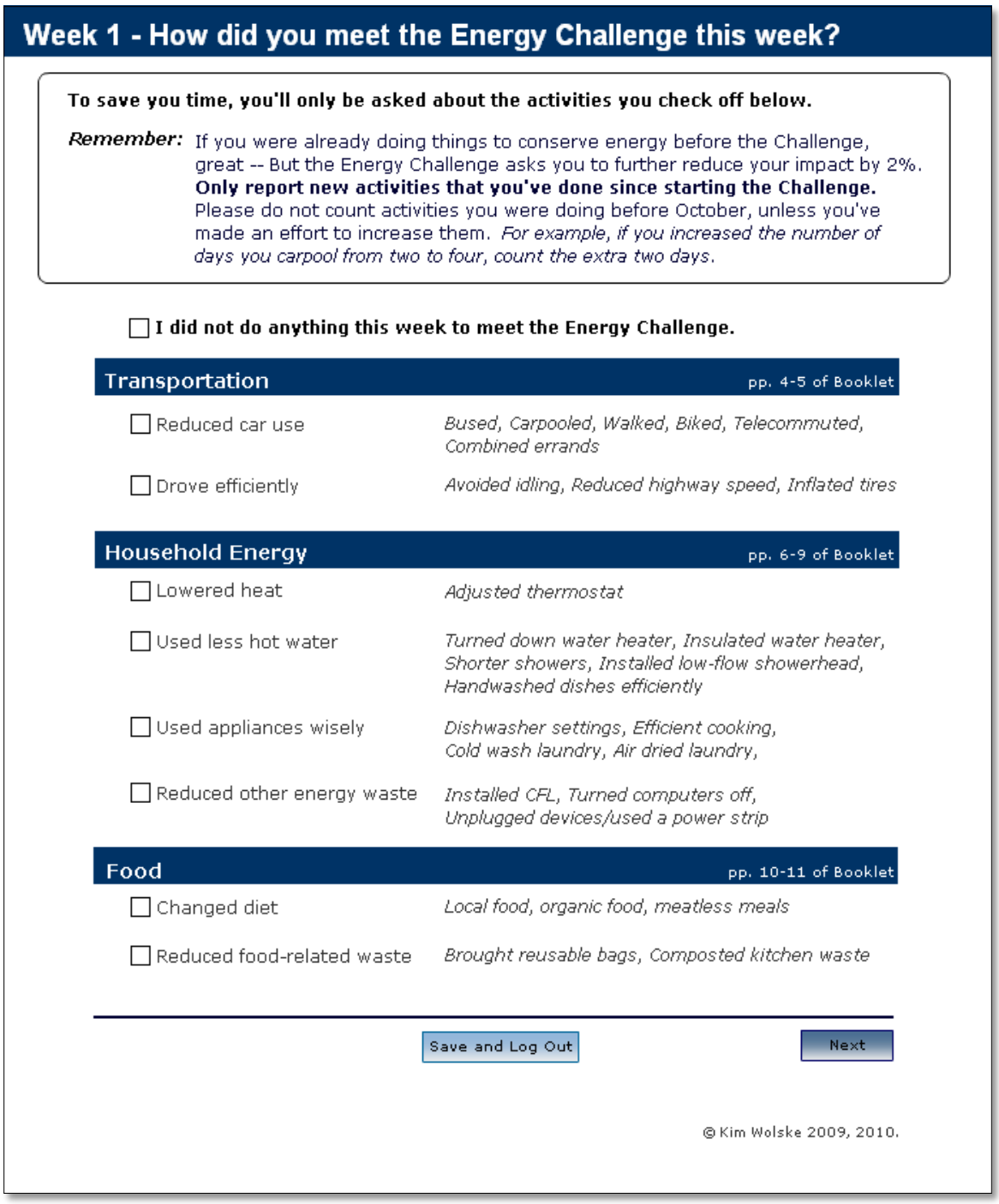
Week 1	October 1 – October 10
Week 2	October 11 – October 17
Week 3	October 18 – October 24
Week 4	October 25 – October 31

Please allow a few seconds for the log to open in a new window.

Step 3: Watch Your Carbon Footprint Shrink!

So far, you've cut [0.0] lbs. of CO_2 from your household's carbon footprint.

Close Form



Week 1 - How did you meet the Energy Challenge this week?

To save you time, you'll only be asked about the activities you check off below.

Remember: If you were already doing things to conserve energy before the Challenge, great -- But the Energy Challenge asks you to further reduce your impact by 2%. **Only report new activities that you've done since starting the Challenge.** Please do not count activities you were doing before October, unless you've made an effort to increase them. *For example, if you increased the number of days you carpool from two to four, count the extra two days.*

☐ **I did not do anything this week to meet the Energy Challenge.**

Transportation — pp. 4-5 of Booklet

☐ Reduced car use	*Bused, Carpooled, Walked, Biked, Telecommuted, Combined errands*
☐ Drove efficiently	*Avoided idling, Reduced highway speed, Inflated tires*

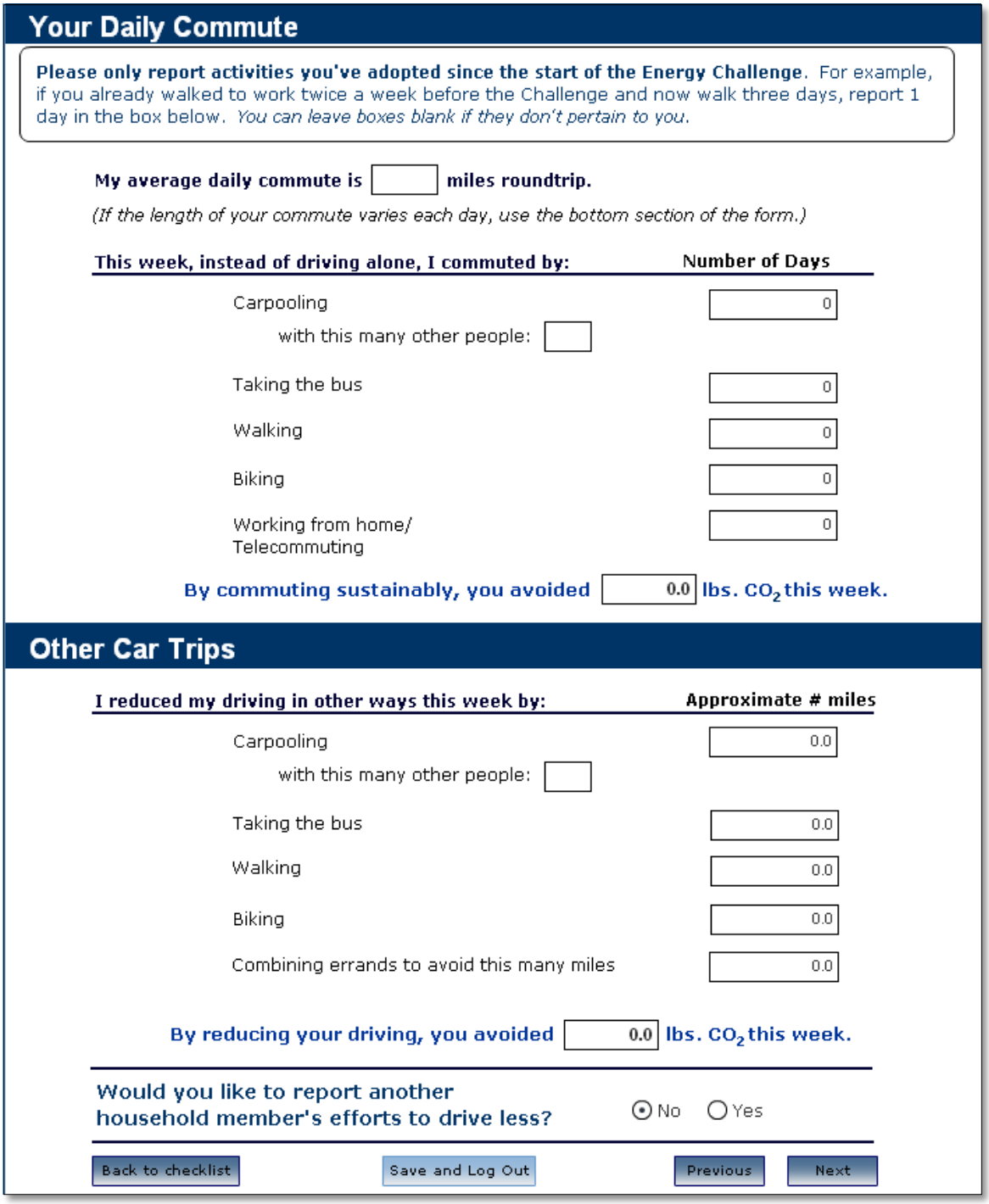
Household Energy — pp. 6-9 of Booklet

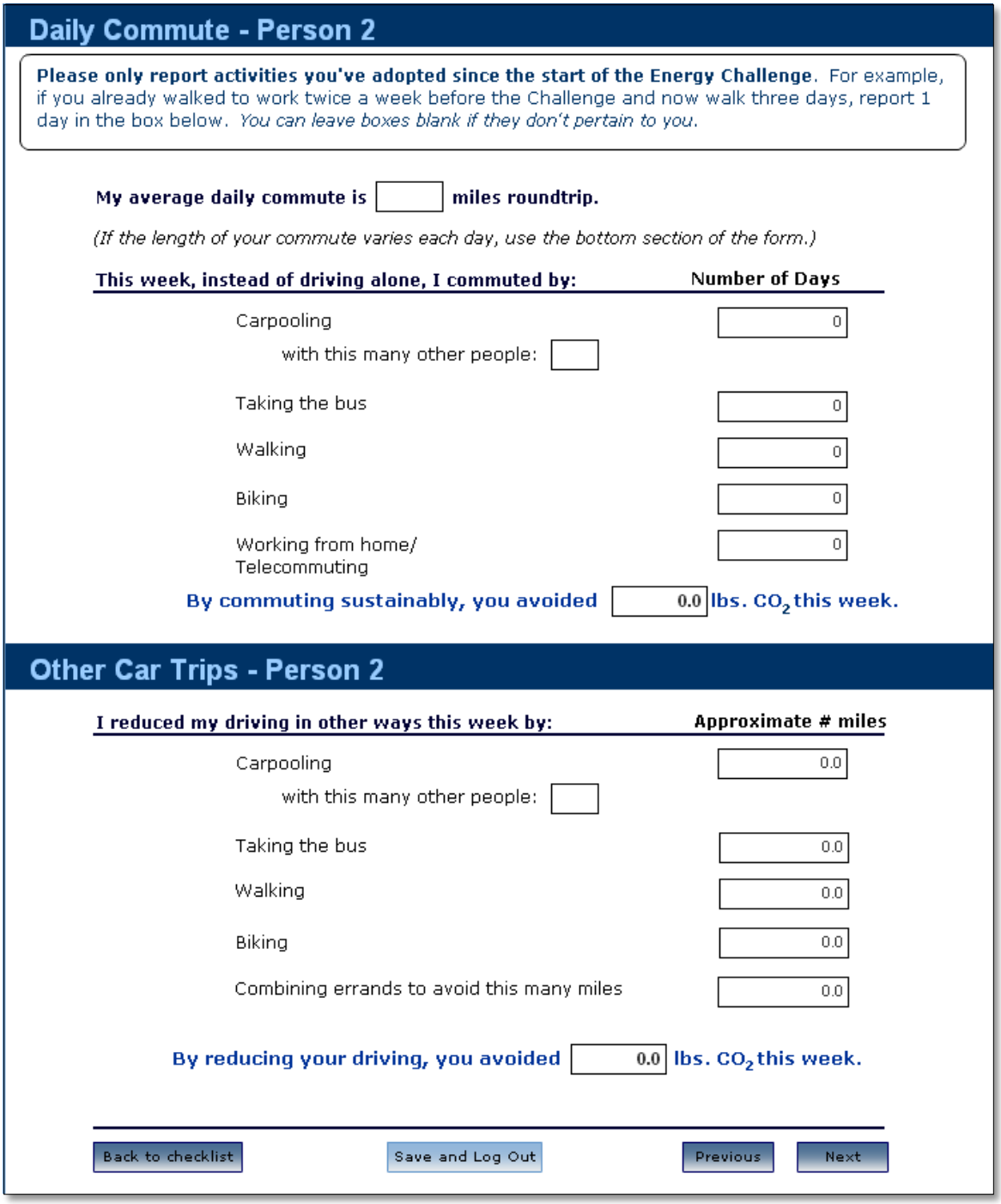
☐ Lowered heat	*Adjusted thermostat*
☐ Used less hot water	*Turned down water heater, Insulated water heater, Shorter showers, Installed low-flow showerhead, Handwashed dishes efficiently*
☐ Used appliances wisely	*Dishwasher settings, Efficient cooking, Cold wash laundry, Air dried laundry,*
☐ Reduced other energy waste	*Installed CFL, Turned computers off, Unplugged devices/used a power strip*

Food — pp. 10-11 of Booklet

☐ Changed diet	*Local food, organic food, meatless meals*
☐ Reduced food-related waste	*Brought reusable bags, Composted kitchen waste*

Save and Log Out Next


Your Daily Commute
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already walked to work twice a week before the Challenge and now walk three days, report 1 day in the box below. You can leave boxes blank if they don't pertain to you.
My average daily commute is miles roundtrip.
(If the length of your commute varies each day, use the bottom section of the form.)
This week, instead of driving alone, I commuted by:
Number of Days
Carpooling
with this many other people:
Taking the bus
Walking
Biking
Working from home/ Telecommuting
0
By commuting sustainably, you avoided 0.0 lbs. CO2 this week.
Other Car Trips
I reduced my driving in other ways this week by:
Approximate # miles
Carpooling
with this many other people:
Taking the bus
Walking
Biking
Combining errands to avoid this many miles
0.0
By reducing your driving, you avoided 0.0 lbs. CO2 this week.
Would you like to report another household member's efforts to drive less?
No
Yes
Back to checklist
Save and Log Out
Previous
Next



Daily Commute - Person 2

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already walked to work twice a week before the Challenge and now walk three days, report 1 day in the box below. *You can leave boxes blank if they don't pertain to you.*

My average daily commute is [ ] **miles roundtrip.**

(If the length of your commute varies each day, use the bottom section of the form.)

This week, instead of driving alone, I commuted by:	**Number of Days**
Carpooling	0
with this many other people: [ ]	
Taking the bus	0
Walking	0
Biking	0
Working from home/ Telecommuting	0

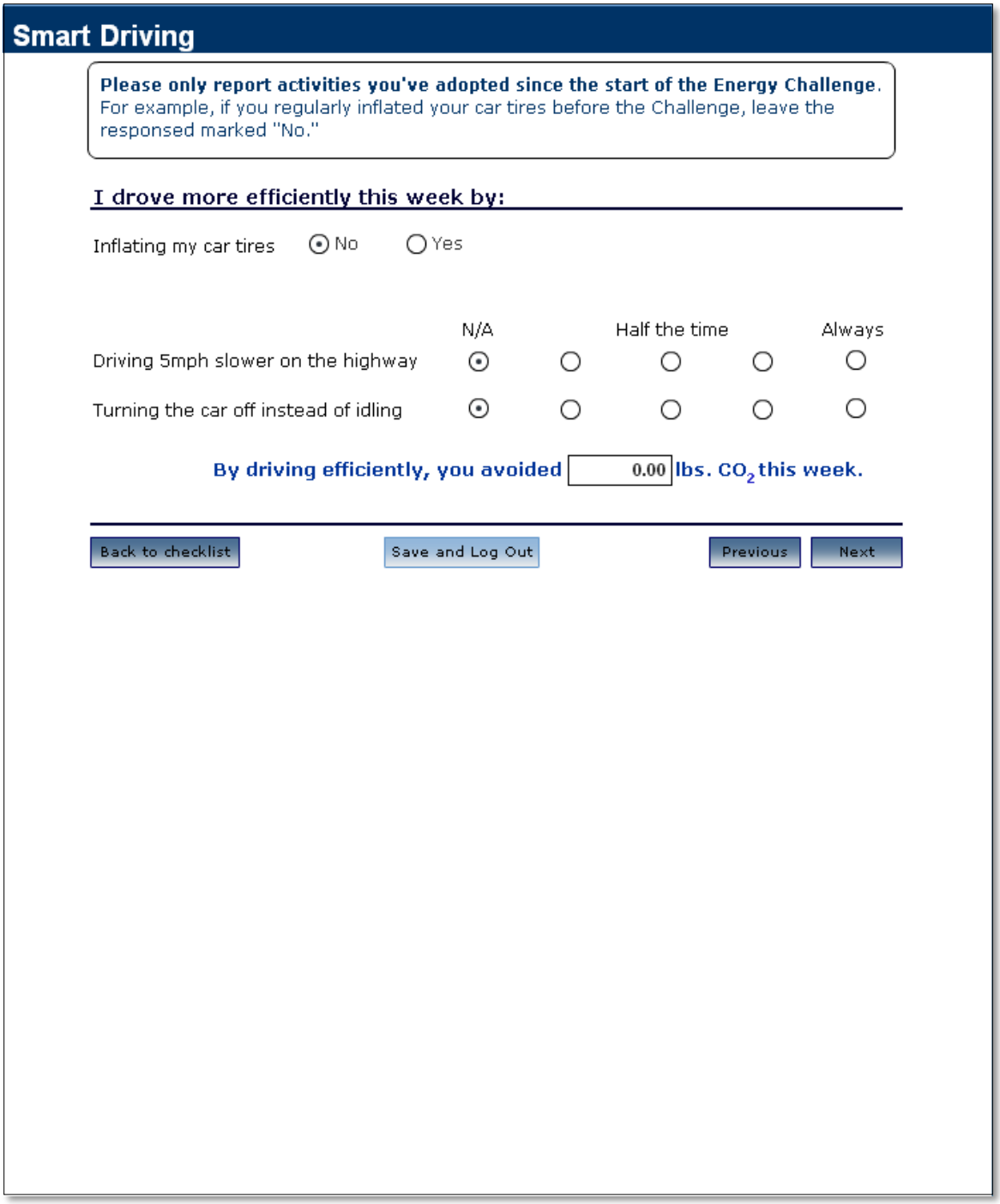
By commuting sustainably, you avoided 0.0 **lbs. CO_2 this week.**

Other Car Trips - Person 2

I reduced my driving in other ways this week by:	**Approximate # miles**
Carpooling	0.0
with this many other people: [ ]	
Taking the bus	0.0
Walking	0.0
Biking	0.0
Combining errands to avoid this many miles	0.0

By reducing your driving, you avoided 0.0 **lbs. CO_2 this week.**

Back to checklist | Save and Log Out | Previous | Next


Smart Driving
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you regularly inflated your car tires before the Challenge, leave the responsed marked "No."
I drove more efficiently this week by:
Inflating my car tires
No
Yes
N/A
Half the time
Always
Driving 5mph slower on the highway
Turning the car off instead of idling
By driving efficiently, you avoided 0.00 lbs. CO_2 this week.
Back to checklist
Save and Log Out
Previous
Next

Household Heating

Enter how many degrees you turned the thermostat down compared to the setting you would have used *before* the Energy Challenge For example, if last year you would have set the temperature to 68° F when away from home and have turned it down to 62° F for the challenge, please enter 6 in the first box below.
You can leave boxes blank if they don't pertain to you.

Thermostat settings

How many degrees did you turn the thermostat down?

When away from home
I turned the thermostat down [ ] ° F for [ ] hours, for [ ] days this week

When sleeping
I turned the thermostat down [ ] ° F for [ ] hours, for [ ] days this week

While at home (not sleeping)
I turned the thermostat down [ ] ° F for [ ] hours, for [ ] days this week

By turning your heat down, you avoided [0.0] **lbs. CO_2 this week.**

Back to checklist | Save and Log Out | Previous | Next

Used Less Hot Water

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already insulated your water heater before the Challenge, leave the response marked "No." *You can leave boxes blank if they don't pertain to you.*

Hot Water Heater

Lowered temperature approximately 10° F	(•) No	( ) Yes
Lowered temperature approximately 20° F	(•) No	( ) Yes
Insulated water heater	(•) No	( ) Yes

Showers

Installed low-flow showerhead(s)	(•) No	( ) Yes

If yes, how many people typically use this/these shower(s)? [ ]

Shortened shower time	**How many minutes less? (on average)**	**Number of times this week**
Person 1	0.0	0.0
Person 2	0.0	0.0
Person 3	0.0	0.0
Person 4	0.0	0.0
Person 5	0.0	0.0

Hand-washed Dishes Efficiently

	Number of loads
Used the drain plug & minimized faucet use	[ ]

By using less hot water, you avoided 0.00 **lbs. CO_2 this week.**

Back to checklist | Save and Log Out | Previous | Next

Used Appliances Wisely

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already washed some laundry in cold water before the Challenge, only count loads that you would have previously washed in hot or warm. *You can leave boxes blank if they don't pertain to you.*

Changed DISHWASHER settings:	Number of Loads
Used the Energy-Saving Setting	
Turned off "Heated Dry"	

Used OVEN less by:	Number of times
Cooking with a microwave	
with a toaster oven	
with a crock pot	
Cooking multiple items in the oven at the same time	

Saved energy while doing LAUNDRY by:	Number of Loads
Washing laundry in cold water instead of hot or warm	
Air drying clothes	

By using your appliances wisely, you avoided 0.0 **lbs. CO_2 this week.**

Back to checklist | Save and Log Out | Previous | Next

Energy Wasters

Please only report activities you've adopted since the start of the Energy Challenge. This can include efforts to increase activities you did before. For example, if you already had some CFLs, only count new bulbs you've installed in October. *You can leave boxes blank if they don't pertain to you.*

Lighting

	Number of bulbs
I replaced incandescent light bulbs with compact fluorescent lights (CFLs).	

Powered Down Computers

	N/A		Half the time		Always
I turned off my **desktop** computer(s) at night (or used sleep/standby settings).	◉	○	○	○	○

How many desktops does this apply to? 1

	N/A		Half the time		Always
I turned off my **laptop** computer at night (or used sleep/standby settings).	◉	○	○	○	○

How many laptops does this apply to? 1

Standby/Vampire energy

	N/A		Half the time		Always
I turned electronics completely off by unplugging them or controlling them with a power strip.	◉	○	○	○	○

By reducing hidden energy wasters, you avoided 0.00 **lbs. CO_2 this week.**

Back to checklist | Save and Log Out | Previous | Next

Diet Choices

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already ate mostly organic food before the Challenge, leave that box empty. *You can leave boxes blank if they don't pertain to you.*

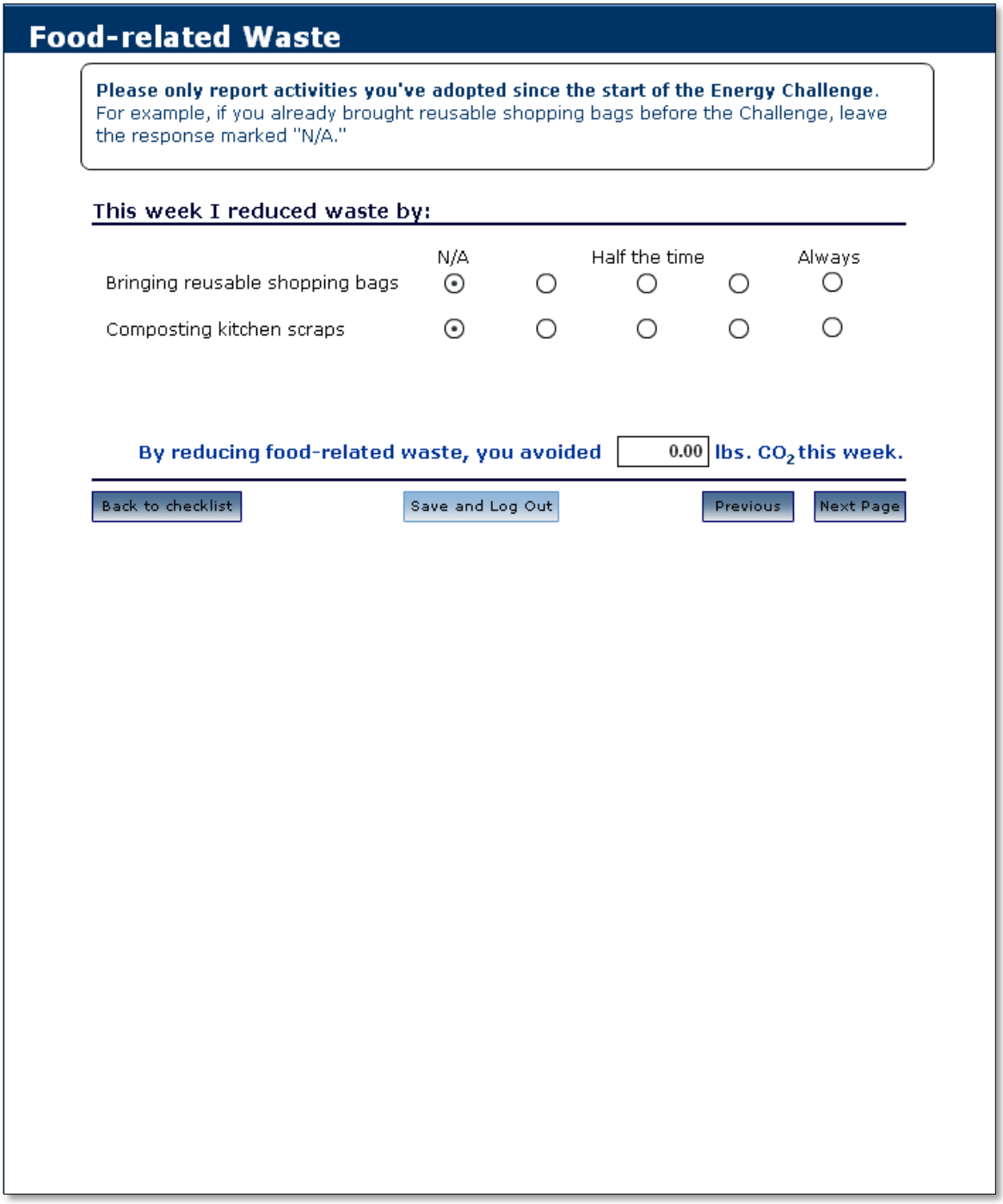
This calculator assumes that 1 meal = an entree for one person. If multiple household members changed their diet, change the first entry below.

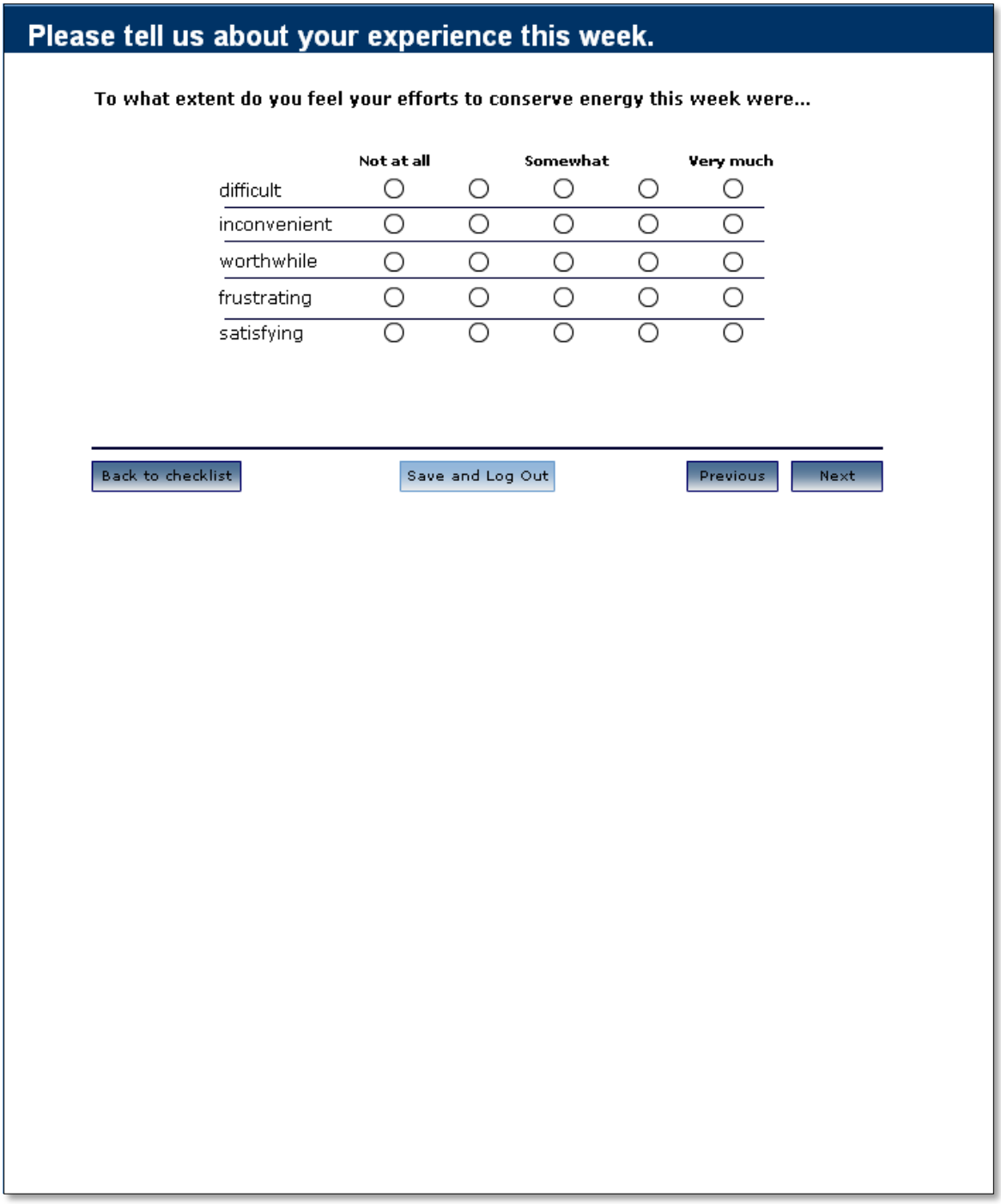
How many people changed their diet for the challenge?	1.0

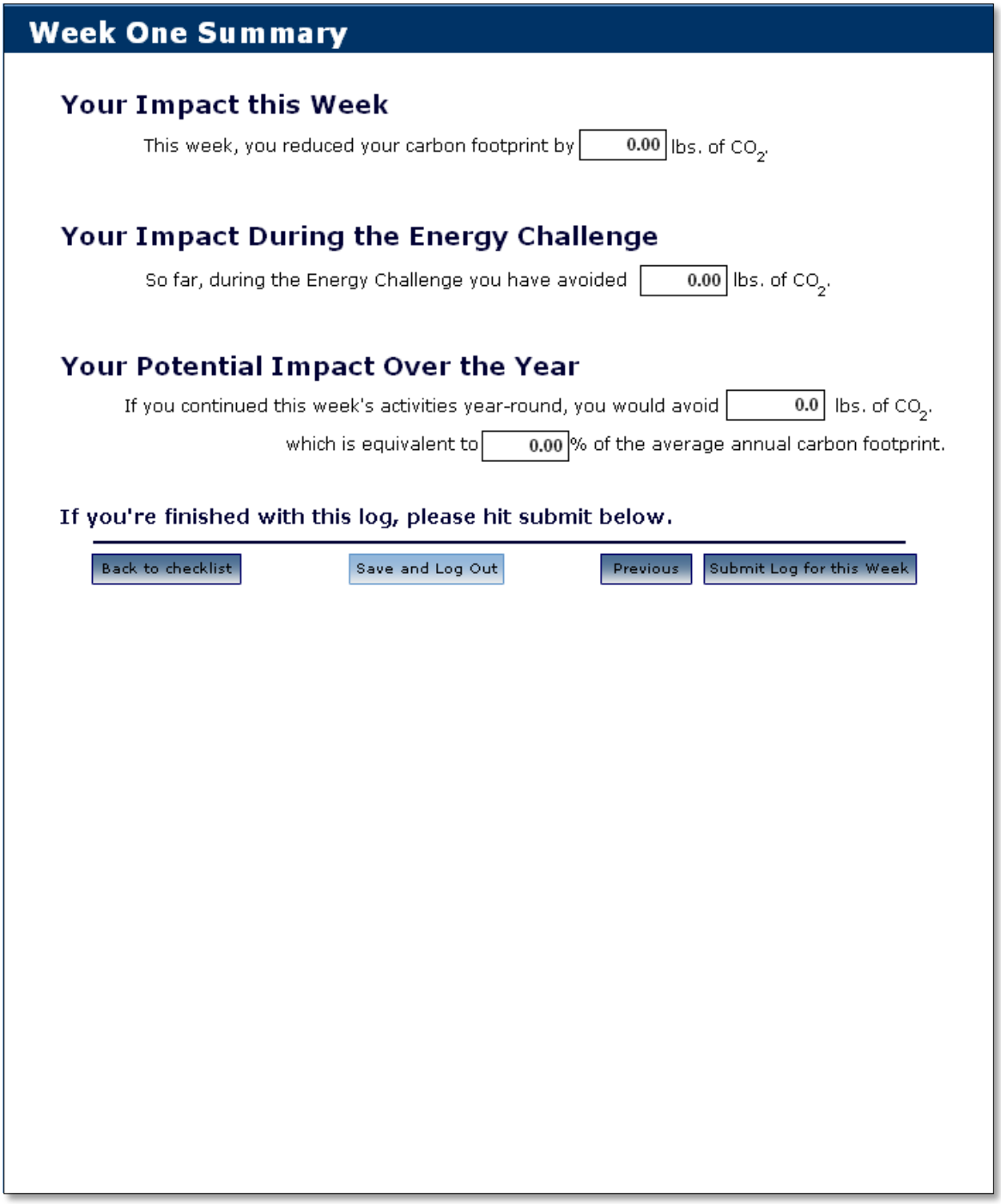
Changed my/our diet by:	Number of Meals
Eating meals with at least 50% locally produced ingredients	
Eating meals with at least 50% organic ingredients	
Replacing chicken, fish, or eggs with a vegetarian entree	
Replacing a regular beef entree with chicken, fish or eggs	
Replacing a regular beef entree with a vegetarian one	

By changing your diet, you avoided 0.00 **lbs. CO_2 this week.**

Back to Checklist | Save and Log Out | Previous | Next

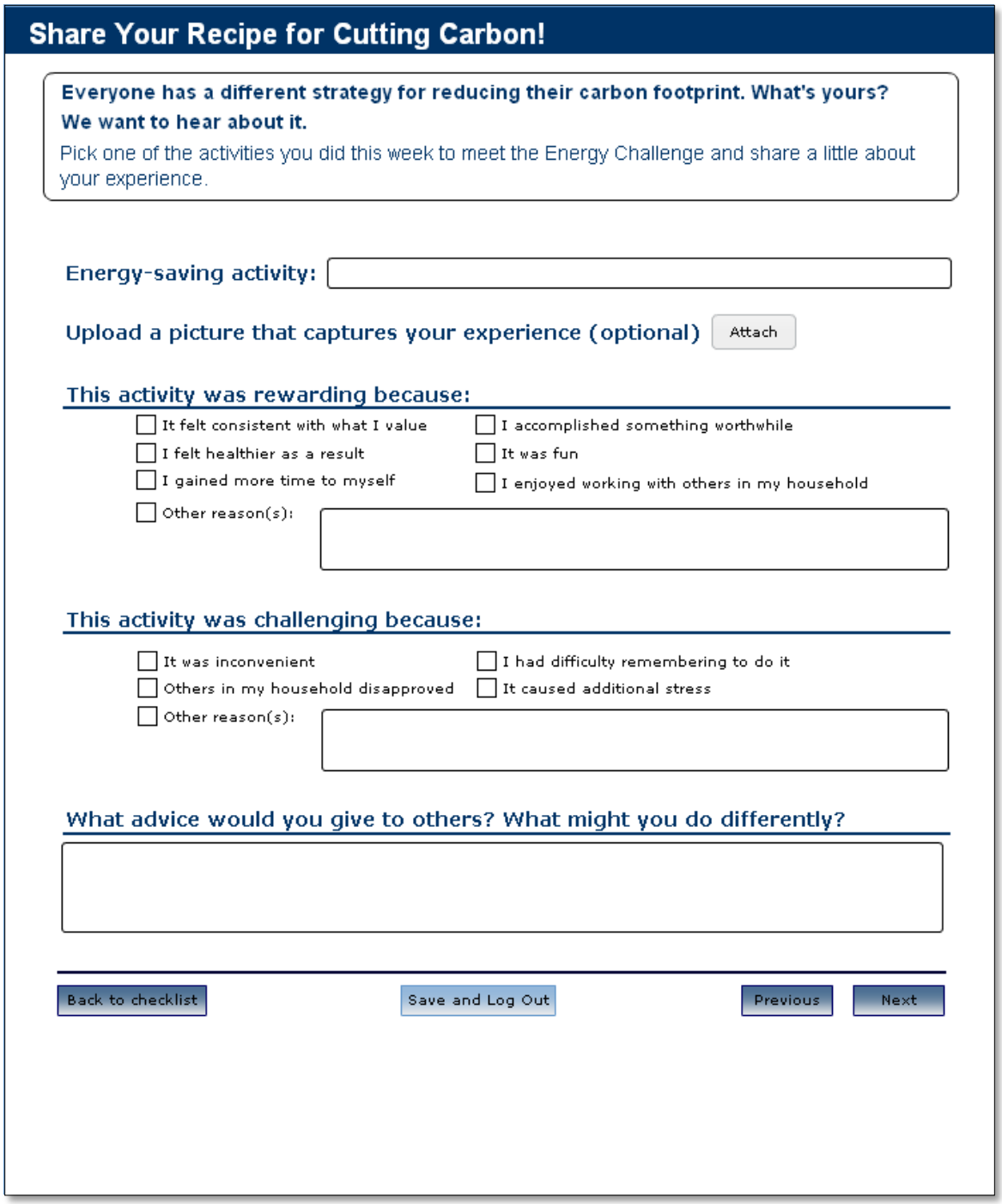

Food-related Waste
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already brought reusable shopping bags before the Challenge, leave the response marked "N/A."
This week I reduced waste by:
N/A
Half the time
Always
Bringing reusable shopping bags
Composting kitchen scraps
By reducing food-related waste, you avoided 0.00 lbs. CO_2 this week.
Back to checklist
Save and Log Out
Previous
Next Page


Please tell us about your experience this week.
To what extent do you feel your efforts to conserve energy this week were...
Not at all
Somewhat
Very much
difficult
inconvenient
worthwhile
frustrating
satisfying
Back to checklist
Save and Log Out
Previous
Next

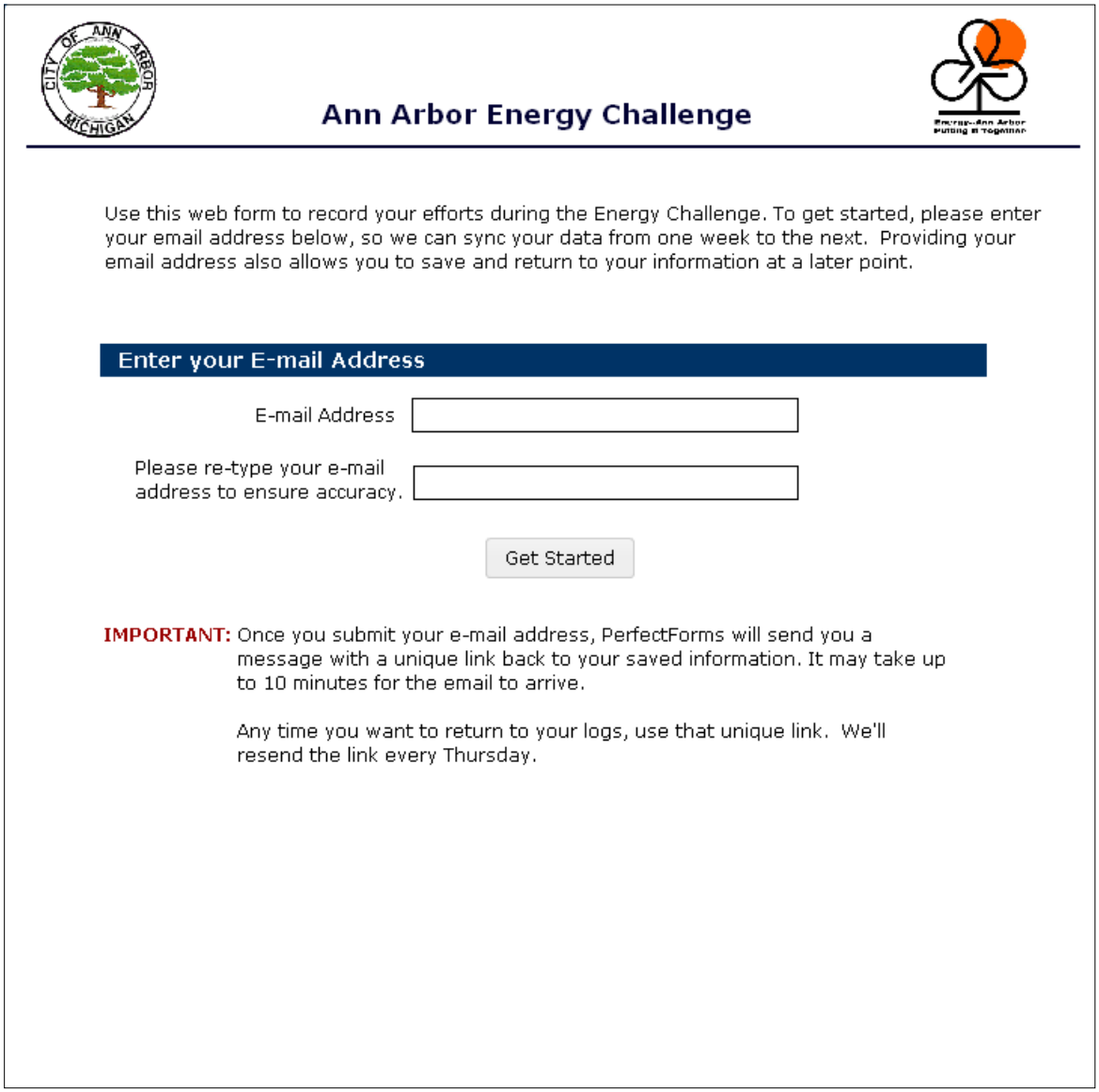

Week One Summary
Your Impact this Week
This week, you reduced your carbon footprint by 0.00 lbs. of CO_2.
Your Impact During the Energy Challenge
So far, during the Energy Challenge you have avoided 0.00 lbs. of CO_2.
Your Potential Impact Over the Year
If you continued this week's activities year-round, you would avoid 0.0 lbs. of CO_2.
which is equivalent to 0.00 % of the average annual carbon footprint.
If you're finished with this log, please hit submit below.
Back to checklist
Save and Log Out
Previous
Submit Log for this Week

APPENDIX H: Weekly Feedback + Shared Stories Log

The weekly feedback + stories log included all of the pages from the previous log as well as the following, which were presented before the summary page.



APPENDIX I: Monthly Feedback Log



Ann Arbor Energy Challenge

Use this web form to record your efforts during the Energy Challenge. To get started, please enter your email address below, so we can sync your data from one week to the next. Providing your email address also allows you to save and return to your information at a later point.

Enter your E-mail Address

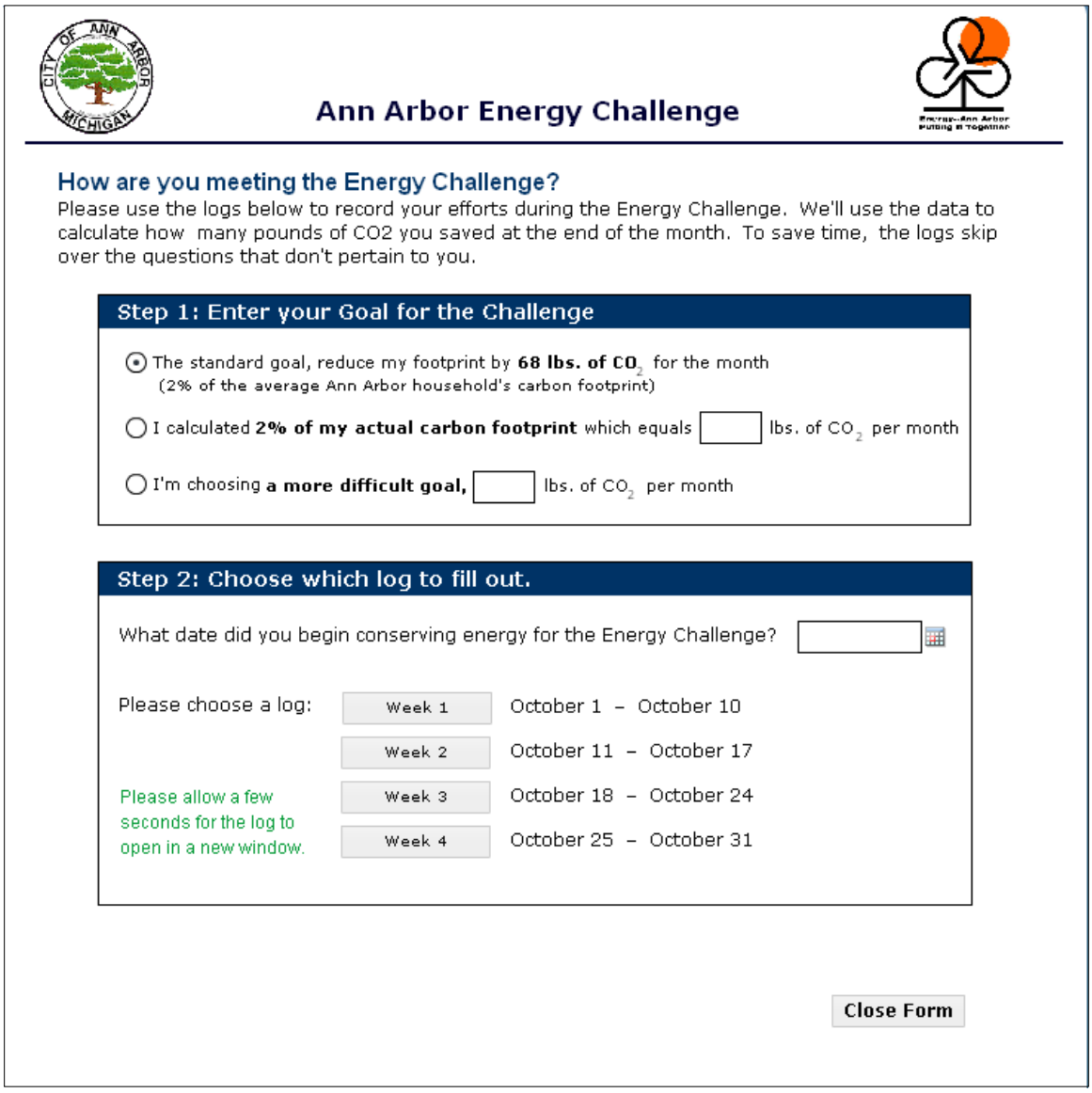
E-mail Address

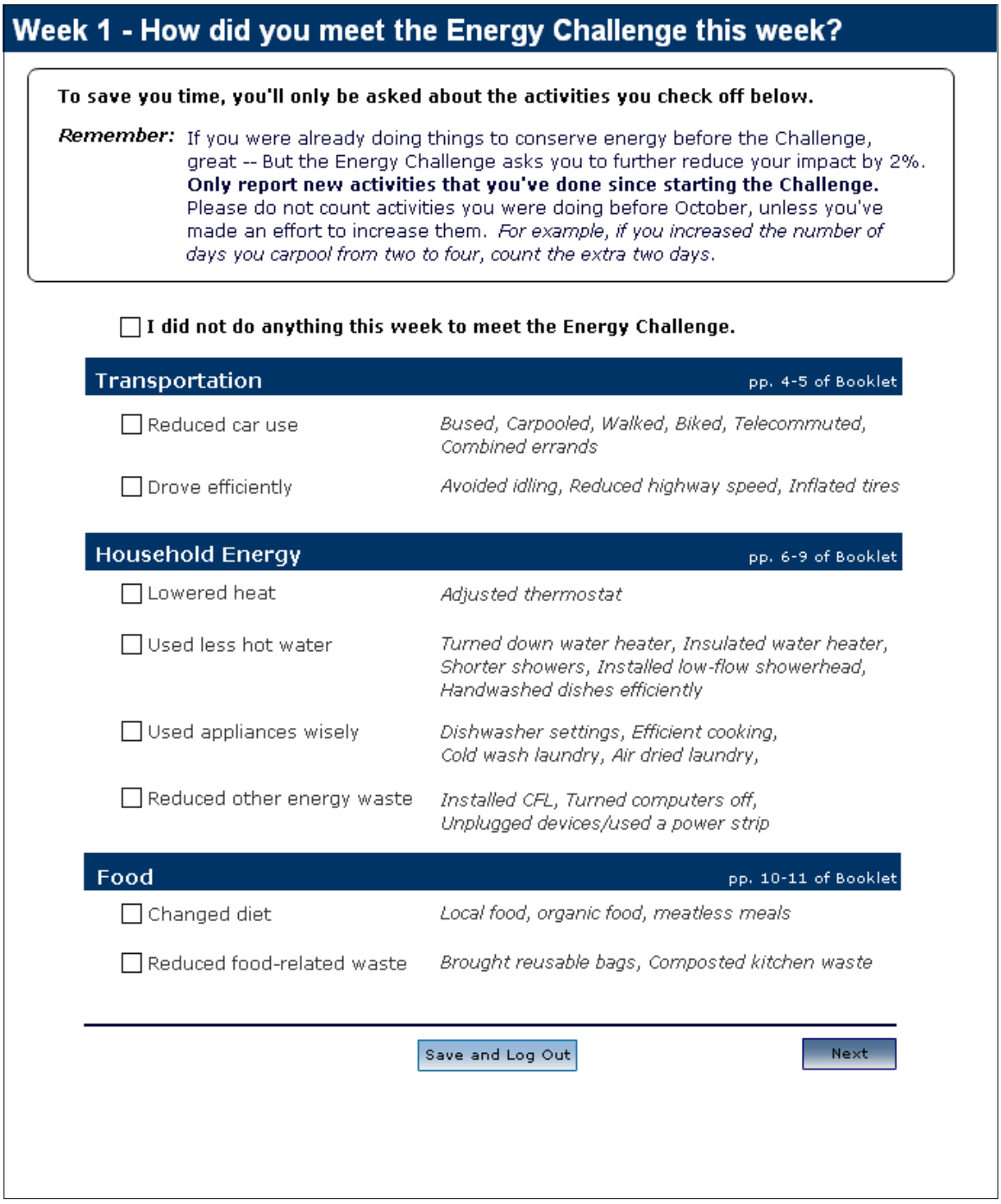
Please re-type your e-mail address to ensure accuracy.

Get Started

IMPORTANT: Once you submit your e-mail address, PerfectForms will send you a message with a unique link back to your saved information. It may take up to 10 minutes for the email to arrive.

Any time you want to return to your logs, use that unique link. We'll resend the link every Thursday.


Ann Arbor Energy Challenge
How are you meeting the Energy Challenge?
Please use the logs below to record your efforts during the Energy Challenge. We'll use the data to calculate how many pounds of CO2 you saved at the end of the month. To save time, the logs skip over the questions that don't pertain to you.
Step 1: Enter your Goal for the Challenge
The standard goal, reduce my footprint by 68 lbs. of CO2 for the month
(2% of the average Ann Arbor household's carbon footprint)
I calculated 2% of my actual carbon footprint which equals lbs. of CO2 per month
I'm choosing a more difficult goal, lbs. of CO2 per month
Step 2: Choose which log to fill out.
What date did you begin conserving energy for the Energy Challenge?
Please choose a log:
Week 1
October 1 – October 10
Week 2
October 11 – October 17
Week 3
October 18 – October 24
Week 4
October 25 – October 31
Please allow a few seconds for the log to open in a new window.
Close Form


Week 1 - How did you meet the Energy Challenge this week?
To save you time, you'll only be asked about the activities you check off below.
Remember: If you were already doing things to conserve energy before the Challenge, great -- But the Energy Challenge asks you to further reduce your impact by 2%. Only report new activities that you've done since starting the Challenge. Please do not count activities you were doing before October, unless you've made an effort to increase them. For example, if you increased the number of days you carpool from two to four, count the extra two days.
I did not do anything this week to meet the Energy Challenge.
Transportation
pp. 4-5 of Booklet
Reduced car use
Bused, Carpooled, Walked, Biked, Telecommuted, Combined errands
Drove efficiently
Avoided idling, Reduced highway speed, Inflated tires
Household Energy
pp. 6-9 of Booklet
Lowered heat
Adjusted thermostat
Used less hot water
Turned down water heater, Insulated water heater, Shorter showers, Installed low-flow showerhead, Handwashed dishes efficiently
Used appliances wisely
Dishwasher settings, Efficient cooking, Cold wash laundry, Air dried laundry,
Reduced other energy waste
Installed CFL, Turned computers off, Unplugged devices/used a power strip
Food
pp. 10-11 of Booklet
Changed diet
Local food, organic food, meatless meals
Reduced food-related waste
Brought reusable bags, Composted kitchen waste
Save and Log Out
Next

Your Daily Commute

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already walked to work twice a week before the Challenge and now walk three days, report 1 day in the box below. *You can leave boxes blank if they don't pertain to you.*

My average daily commute is [ ] **miles roundtrip.**

(If the length of your commute varies each day, use the bottom section of the form.)

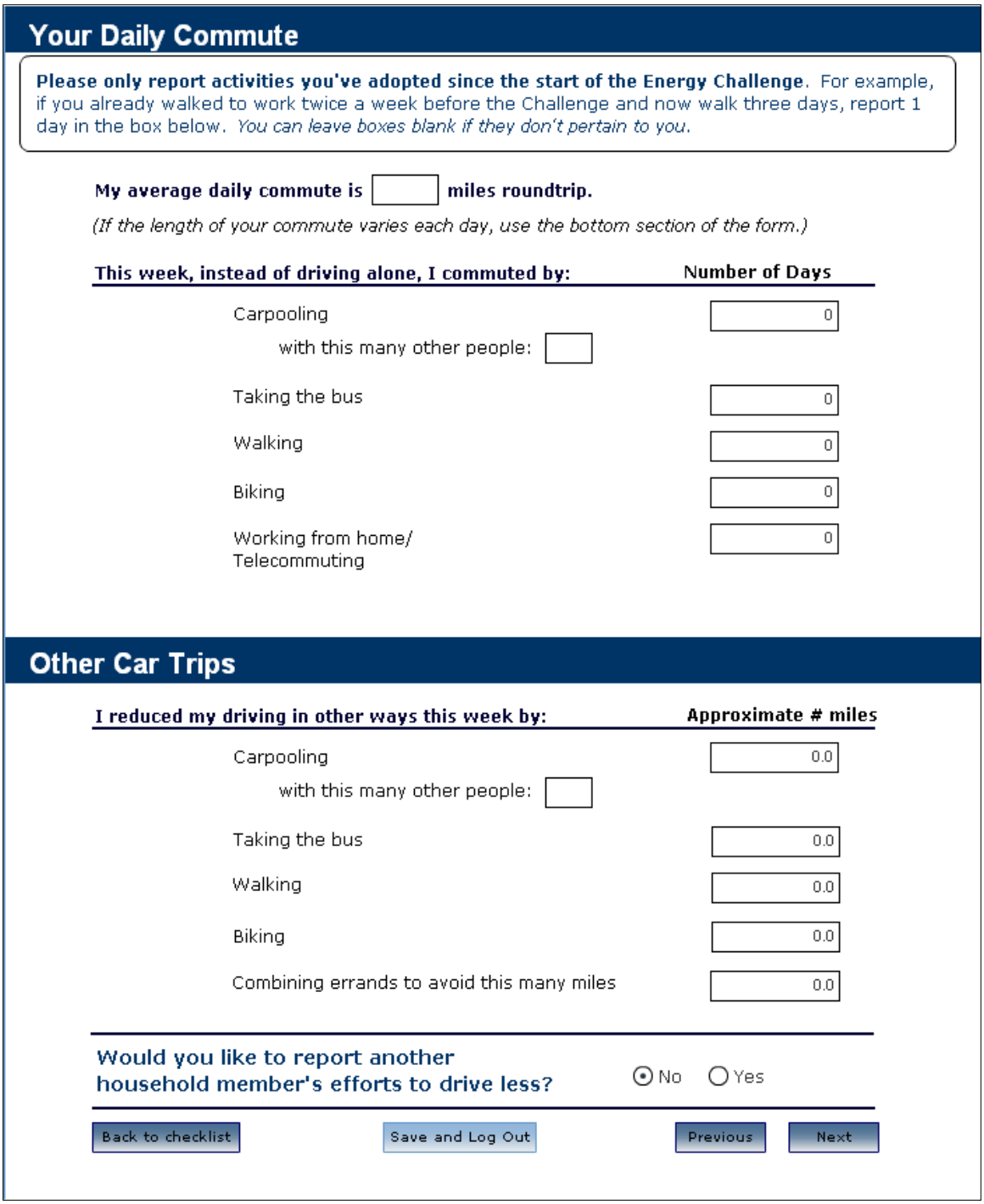
This week, instead of driving alone, I commuted by:	**Number of Days**
Carpooling	0
with this many other people: [ ]	
Taking the bus	0
Walking	0
Biking	0
Working from home/ Telecommuting	0

Other Car Trips

I reduced my driving in other ways this week by:	**Approximate # miles**
Carpooling	0.0
with this many other people: [ ]	
Taking the bus	0.0
Walking	0.0
Biking	0.0
Combining errands to avoid this many miles	0.0

Would you like to report another household member's efforts to drive less? (•) No ( ) Yes

Back to checklist | Save and Log Out | Previous | Next



Your Daily Commute

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already walked to work twice a week before the Challenge and now walk three days, report 1 day in the box below. *You can leave boxes blank if they don't pertain to you.*

My average daily commute is [ ] **miles roundtrip.**

(If the length of your commute varies each day, use the bottom section of the form.)

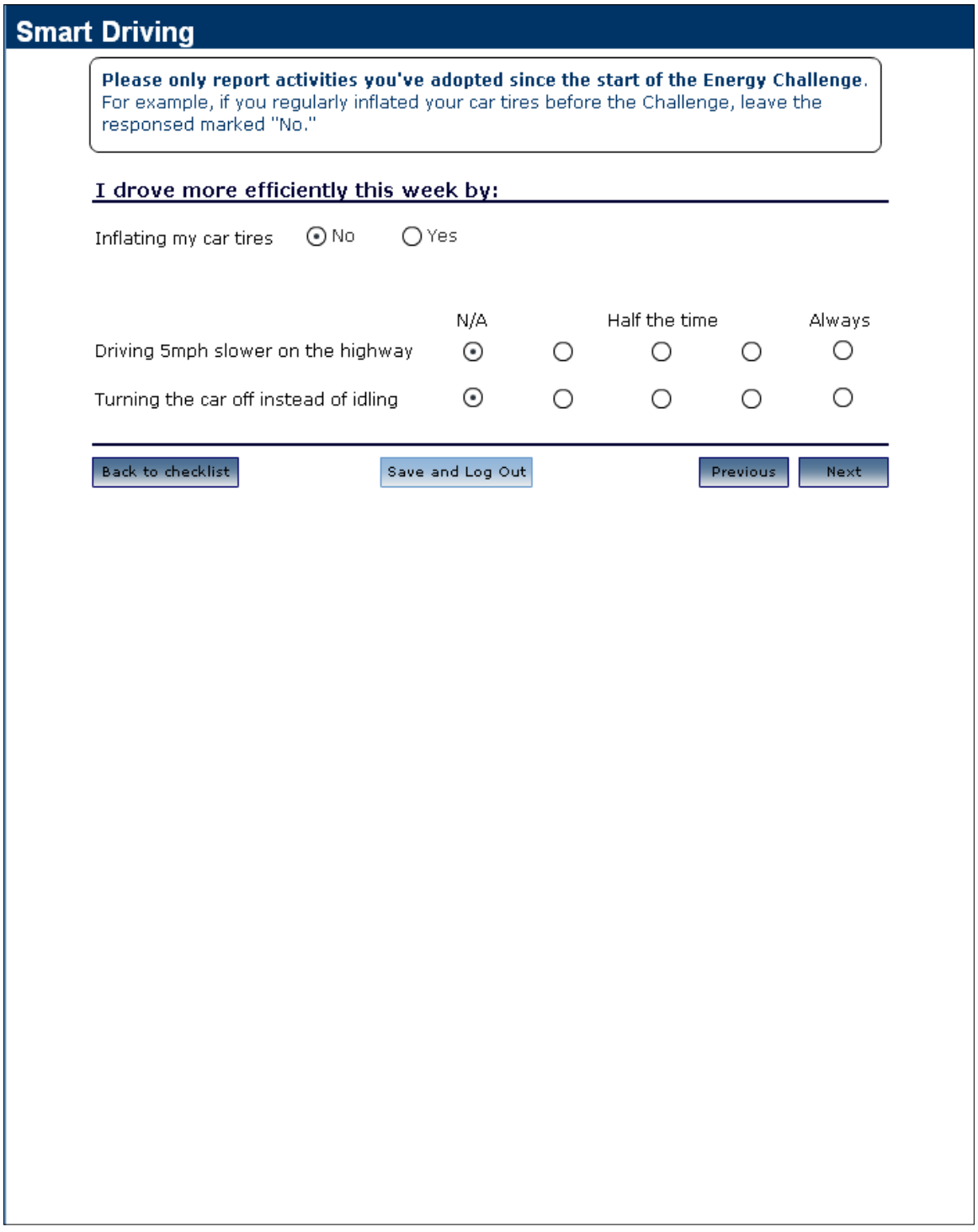
This week, instead of driving alone, I commuted by:	**Number of Days**
Carpooling	0
with this many other people: [ ]	
Taking the bus	0
Walking	0
Biking	0
Working from home/ Telecommuting	0

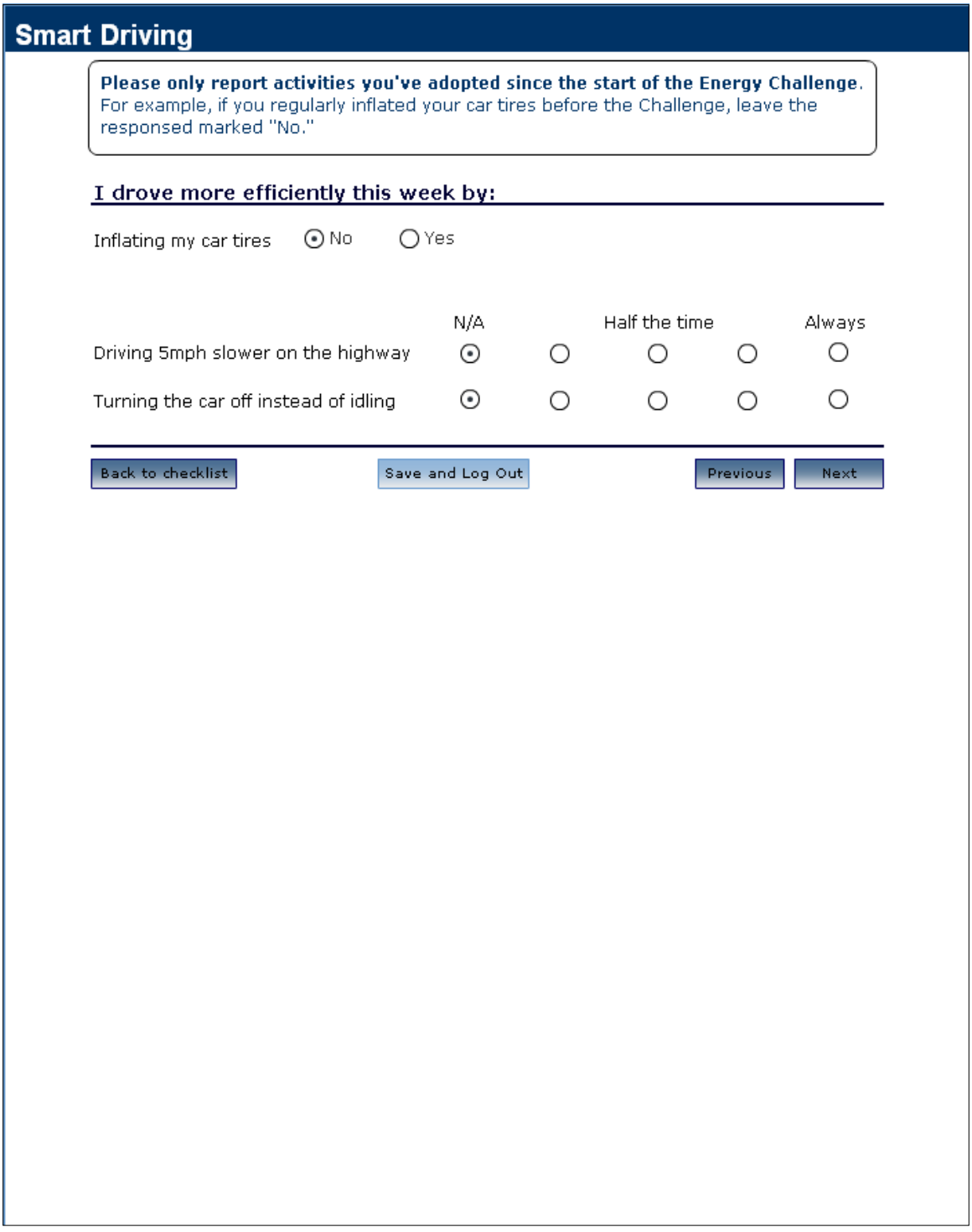
Other Car Trips

I reduced my driving in other ways this week by:	**Approximate # miles**
Carpooling	0.0
with this many other people: [ ]	
Taking the bus	0.0
Walking	0.0
Biking	0.0
Combining errands to avoid this many miles	0.0

Would you like to report another household member's efforts to drive less? (•) No ( ) Yes

Back to checklist | Save and Log Out | Previous | Next


Smart Driving
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you regularly inflated your car tires before the Challenge, leave the responsed marked "No."
I drove more efficiently this week by:
Inflating my car tires
No
Yes
N/A
Half the time
Always
Driving 5mph slower on the highway
Turning the car off instead of idling
Back to checklist
Save and Log Out
Previous
Next


Smart Driving
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you regularly inflated your car tires before the Challenge, leave the responsed marked "No."
I drove more efficiently this week by:
Inflating my car tires
No
Yes
N/A
Half the time
Always
Driving 5mph slower on the highway
Turning the car off instead of idling
Back to checklist
Save and Log Out
Previous
Next

Used Less Hot Water

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already insulated your water heater before the Challenge, leave the response marked "No." *You can leave boxes blank if they don't pertain to you.*

Hot Water Heater

Lowered temperature approximately 10° F	◉ No	○ Yes
Lowered temperature approximately 20° F	◉ No	○ Yes
Insulated water heater	◉ No	○ Yes

Showers

Installed low-flow showerhead(s)	◉ No	○ Yes

If yes, how many people typically use this/these shower(s)? [ ]

Shortened shower time	**How many minutes less? (on average)**	**Number of times this week**
Person 1	0.0	0.0
Person 2	0.0	0.0
Person 3	0.0	0.0
Person 4	0.0	0.0
Person 5	0.0	0.0

Hand-washed Dishes Efficiently

	Number of loads
Used the drain plug & minimized faucet use	[ ]

Back to checklist | Save and Log Out | Previous | Next

Used Appliances Wisely

Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already washed some laundry in cold water before the Challenge, only count loads that you would have previously washed in hot or warm. *You can leave boxes blank if they don't pertain to you.*

Changed DISHWASHER settings:	Number of Loads
Used the Energy-Saving Setting	
Turned off "Heated Dry"	

Used OVEN less by:	Number of times
Cooking with a microwave	
with a toaster oven	
with a crock pot	
Cooking multiple items in the oven at the same time	

Saved energy while doing LAUNDRY by:	Number of Loads
Washing laundry in cold water instead of hot or warm	
Air drying clothes	

Back to checklist | Save and Log Out | Previous | Next

Energy Wasters

Please only report activities you've adopted since the start of the Energy Challenge. This can include efforts to increase activities you did before. For example, if you already had some CFLs, only count new bulbs you've installed in October. *You can leave boxes blank if they don't pertain to you.*

Lighting

	Number of bulbs
I replaced incandescent light bulbs with compact fluorescent lights (CFLs).	

Powered Down Computers

	N/A		Half the time		Always
I turned off my **desktop** computer(s) at night (or used sleep/standby settings).	◉	○	○	○	○

How many desktops does this apply to? 1

	N/A		Half the time		Always
I turned off my **laptop** computer at night (or used sleep/standby settings).	◉	○	○	○	○

How many laptops does this apply to? 1

Standby/Vampire energy

	N/A		Half the time		Always
I turned electronics completely off by unplugging them or controlling them with a power strip.	◉	○	○	○	○

Back to checklist | Save and Log Out | Previous | Next

Diet Choices

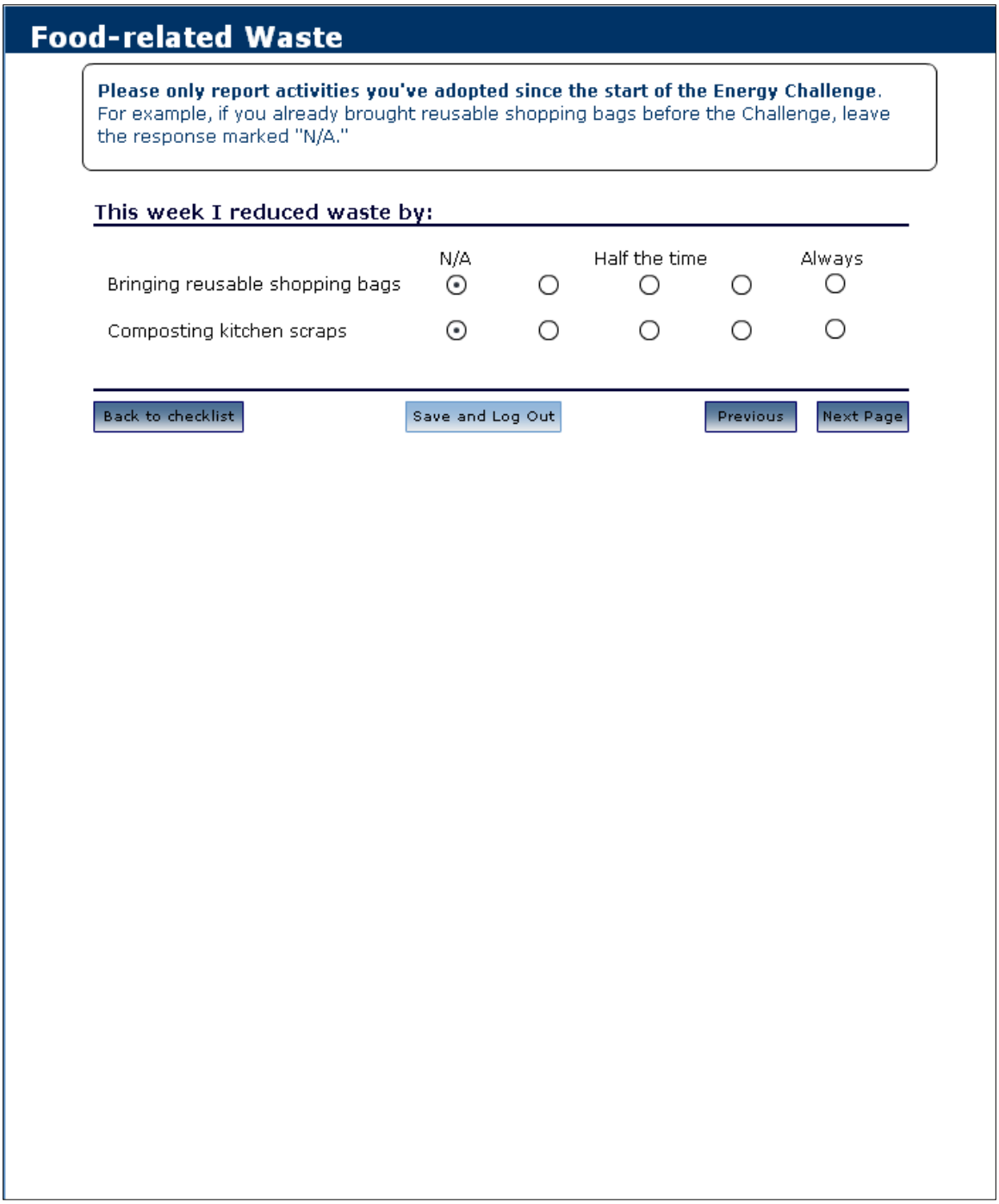
Please only report activities you've adopted since the start of the Energy Challenge. For example, if you already ate mostly organic food before the Challenge, leave that box empty. *You can leave boxes blank if they don't pertain to you.*

This worksheet assumes that 1 meal = an entree for one person. If multiple household members changed their diet, change the first entry below.

How many people changed their diet for the challenge?	1.0

Changed my/our diet by:	Number of Meals
Eating meals with at least 50% locally produced ingredients	
Eating meals with at least 50% organic ingredients	
Replacing chicken, fish, or eggs with a vegetarian entree	
Replacing a regular beef entree with chicken, fish or eggs	
Replacing a regular beef entree with a vegetarian one	

Back to Checklist | Save and Log Out | Previous | Next


Food-related Waste
Please only report activities you've adopted since the start of the Energy Challenge.
For example, if you already brought reusable shopping bags before the Challenge, leave the response marked "N/A."
This week I reduced waste by:
N/A
Half the time
Always
Bringing reusable shopping bags
Composting kitchen scraps
Back to checklist
Save and Log Out
Previous
Next Page

Please tell us about your experience this week.

To what extent do you feel your efforts to conserve energy this week were...

	Not at all		Somewhat		Very much
difficult	○	○	○	○	○
inconvenient	○	○	○	○	○
worthwhile	○	○	○	○	○
frustrating	○	○	○	○	○
satisfying	○	○	○	○	○

Back to checklist | Save and Log Out | Previous | Next

Week One

Thank you for recording your efforts this week.

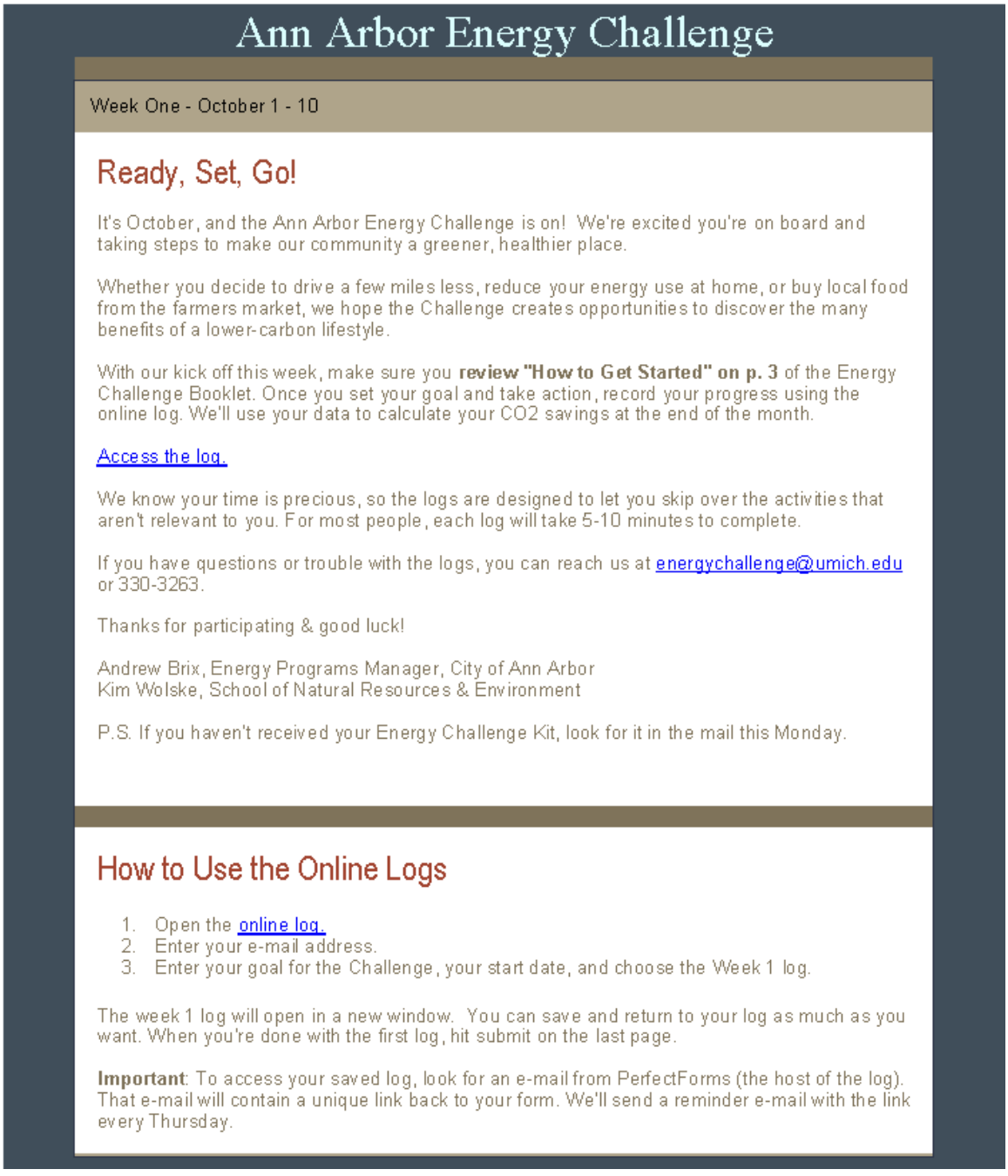
We'll use these data to calculate how many pounds of CO_2 you saved at the end of the month.

If you're finished with this week's log, please hit submit below.

Back to checklist | Save and Log Out | Previous | Submit Log for this Week

APPENDIX J: Reminder E-mails – Monthly Feedback

Initial E-mail



Ann Arbor Energy Challenge

Week One - October 1 - 10

Ready, Set, Go!

It's October, and the Ann Arbor Energy Challenge is on! We're excited you're on board and taking steps to make our community a greener, healthier place.

Whether you decide to drive a few miles less, reduce your energy use at home, or buy local food from the farmers market, we hope the Challenge creates opportunities to discover the many benefits of a lower-carbon lifestyle.

With our kick off this week, make sure you **review "How to Get Started" on p. 3** of the Energy Challenge Booklet. Once you set your goal and take action, record your progress using the online log. We'll use your data to calculate your CO2 savings at the end of the month.

Access the log.

We know your time is precious, so the logs are designed to let you skip over the activities that aren't relevant to you. For most people, each log will take 5-10 minutes to complete.

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Thanks for participating & good luck!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment

P.S. If you haven't received your Energy Challenge Kit, look for it in the mail this Monday.

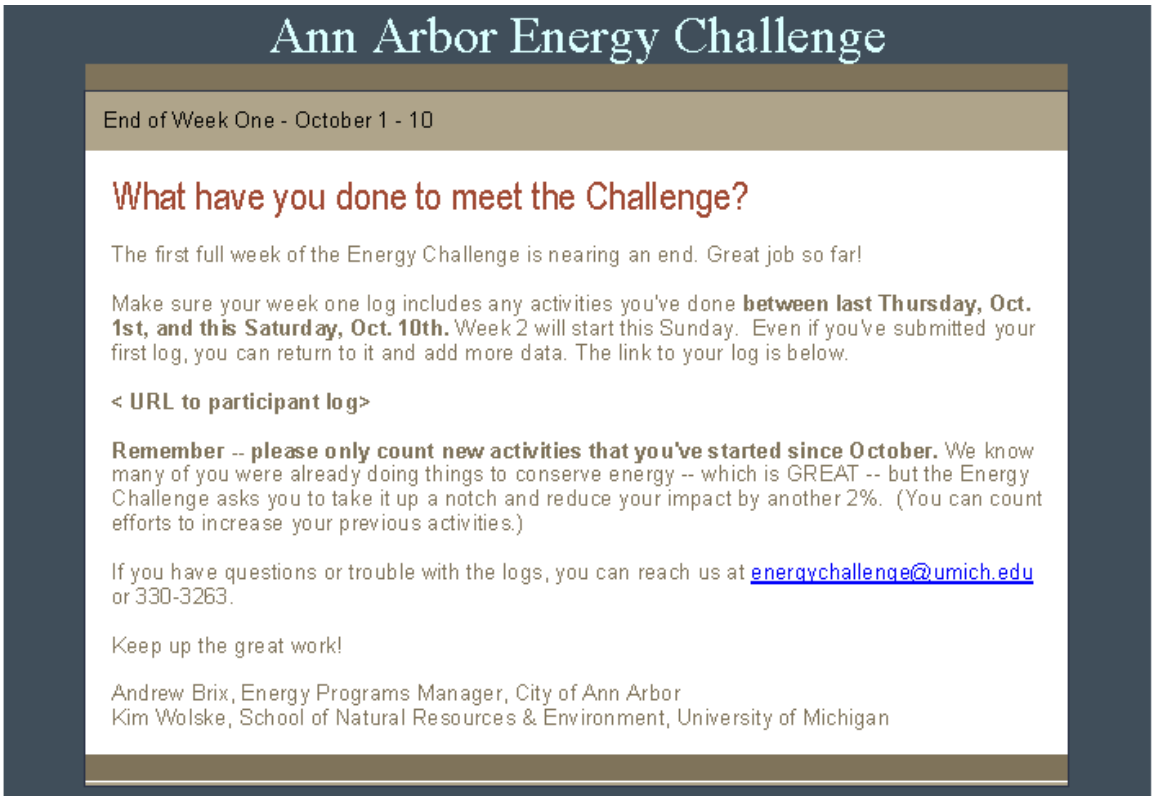
How to Use the Online Logs

1. Open the online log.
2. Enter your e-mail address.
3. Enter your goal for the Challenge, your start date, and choose the Week 1 log.

The week 1 log will open in a new window. You can save and return to your log as much as you want. When you're done with the first log, hit submit on the last page.

Important: To access your saved log, look for an e-mail from PerfectForms (the host of the log). That e-mail will contain a unique link back to your form. We'll send a reminder e-mail with the link every Thursday.

Week 1



Ann Arbor Energy Challenge

End of Week One - October 1 - 10

What have you done to meet the Challenge?

The first full week of the Energy Challenge is nearing an end. Great job so far!

Make sure your week one log includes any activities you've done **between last Thursday, Oct. 1st, and this Saturday, Oct. 10th.** Week 2 will start this Sunday. Even if you've submitted your first log, you can return to it and add more data. The link to your log is below.

< URL to participant log>

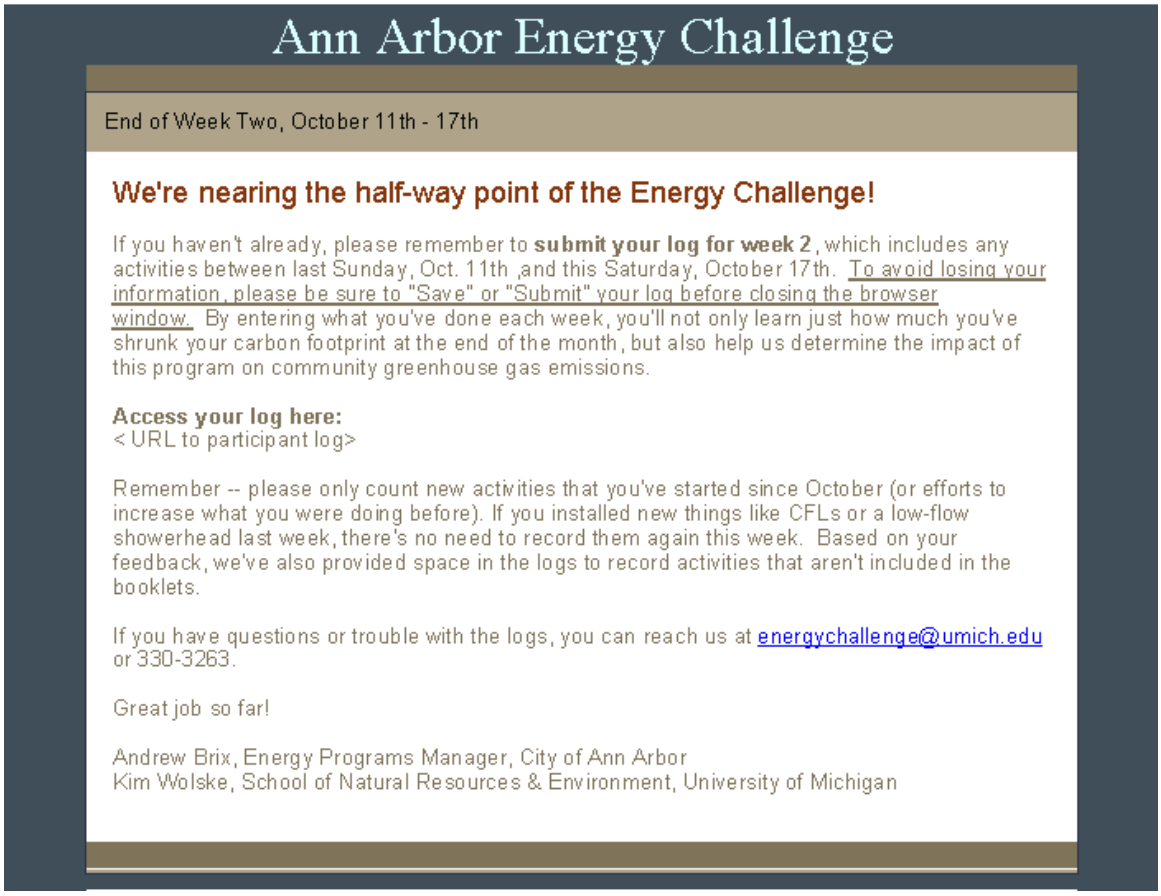
Remember -- please only count new activities that you've started since October. We know many of you were already doing things to conserve energy -- which is GREAT -- but the Energy Challenge asks you to take it up a notch and reduce your impact by another 2%. (You can count efforts to increase your previous activities.)

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Keep up the great work!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment, University of Michigan

Week 2



Ann Arbor Energy Challenge

End of Week Two, October 11th - 17th

We're nearing the half-way point of the Energy Challenge!

If you haven't already, please remember to **submit your log for week 2**, which includes any activities between last Sunday, Oct. 11th ,and this Saturday, October 17th. To avoid losing your information, please be sure to "Save" or "Submit" your log before closing the browser window. By entering what you've done each week, you'll not only learn just how much you've shrunk your carbon footprint at the end of the month, but also help us determine the impact of this program on community greenhouse gas emissions.

Access your log here:
< URL to participant log>

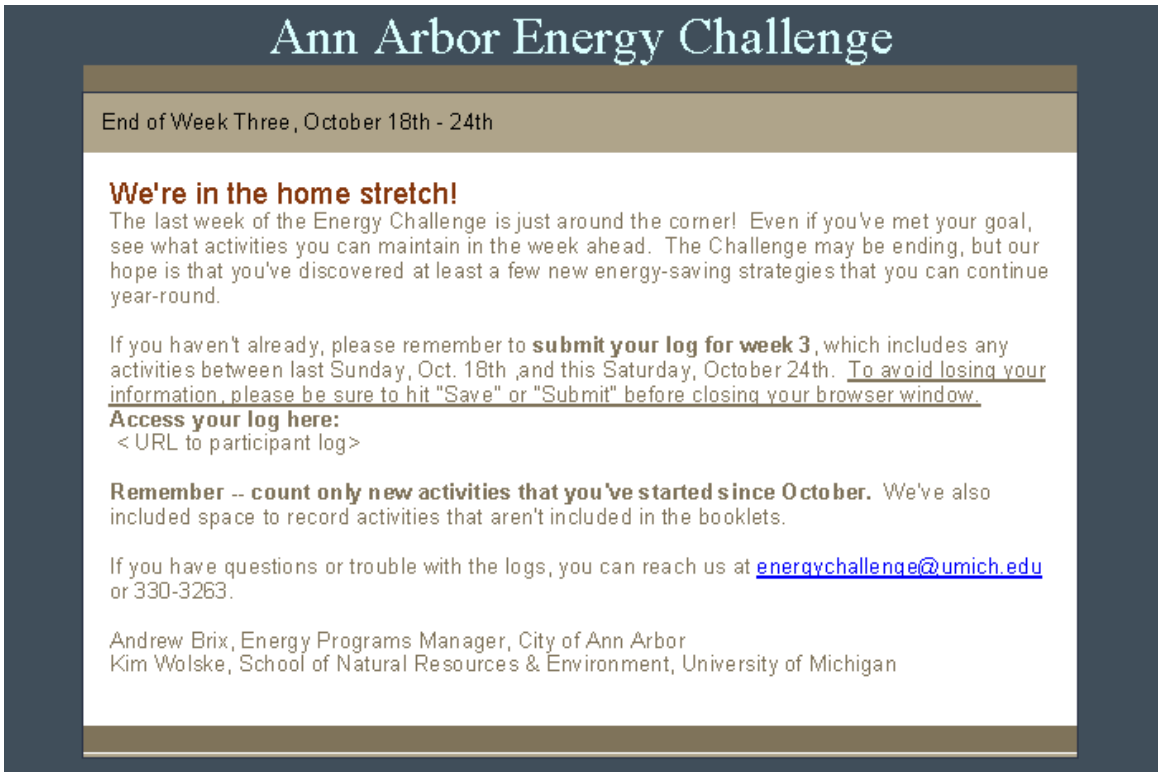
Remember -- please only count new activities that you've started since October (or efforts to increase what you were doing before). If you installed new things like CFLs or a low-flow showerhead last week, there's no need to record them again this week. Based on your feedback, we've also provided space in the logs to record activities that aren't included in the booklets.

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Great job so far!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment, University of Michigan

Week 3



Ann Arbor Energy Challenge

End of Week Three, October 18th - 24th

We're in the home stretch!

The last week of the Energy Challenge is just around the corner! Even if you've met your goal, see what activities you can maintain in the week ahead. The Challenge may be ending, but our hope is that you've discovered at least a few new energy-saving strategies that you can continue year-round.

If you haven't already, please remember to **submit your log for week 3**, which includes any activities between last Sunday, Oct. 18th ,and this Saturday, October 24th. To avoid losing your information, please be sure to hit "Save" or "Submit" before closing your browser window.

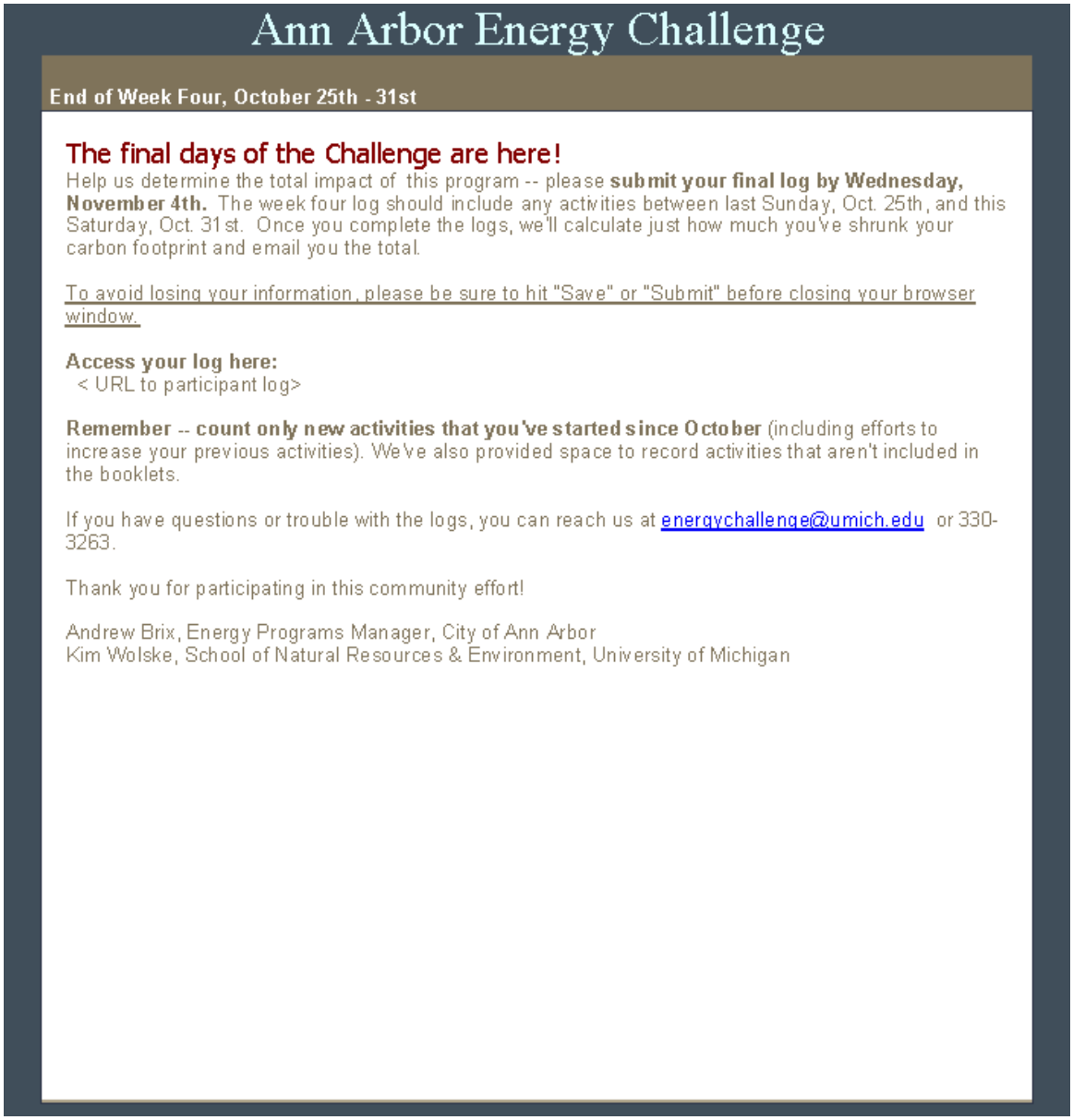
Access your log here:
< URL to participant log>

Remember -- count only new activities that you've started since October. We've also included space to record activities that aren't included in the booklets.

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment, University of Michigan

Week 4



Ann Arbor Energy Challenge

End of Week Four, October 25th - 31st

The final days of the Challenge are here!

Help us determine the total impact of this program -- please **submit your final log by Wednesday, November 4th.** The week four log should include any activities between last Sunday, Oct. 25th, and this Saturday, Oct. 31st. Once you complete the logs, we'll calculate just how much you've shrunk your carbon footprint and email you the total.

To avoid losing your information, please be sure to hit "Save" or "Submit" before closing your browser window.

Access your log here:
< URL to participant log>

Remember -- count only new activities that you've started since October (including efforts to increase your previous activities). We've also provided space to record activities that aren't included in the booklets.

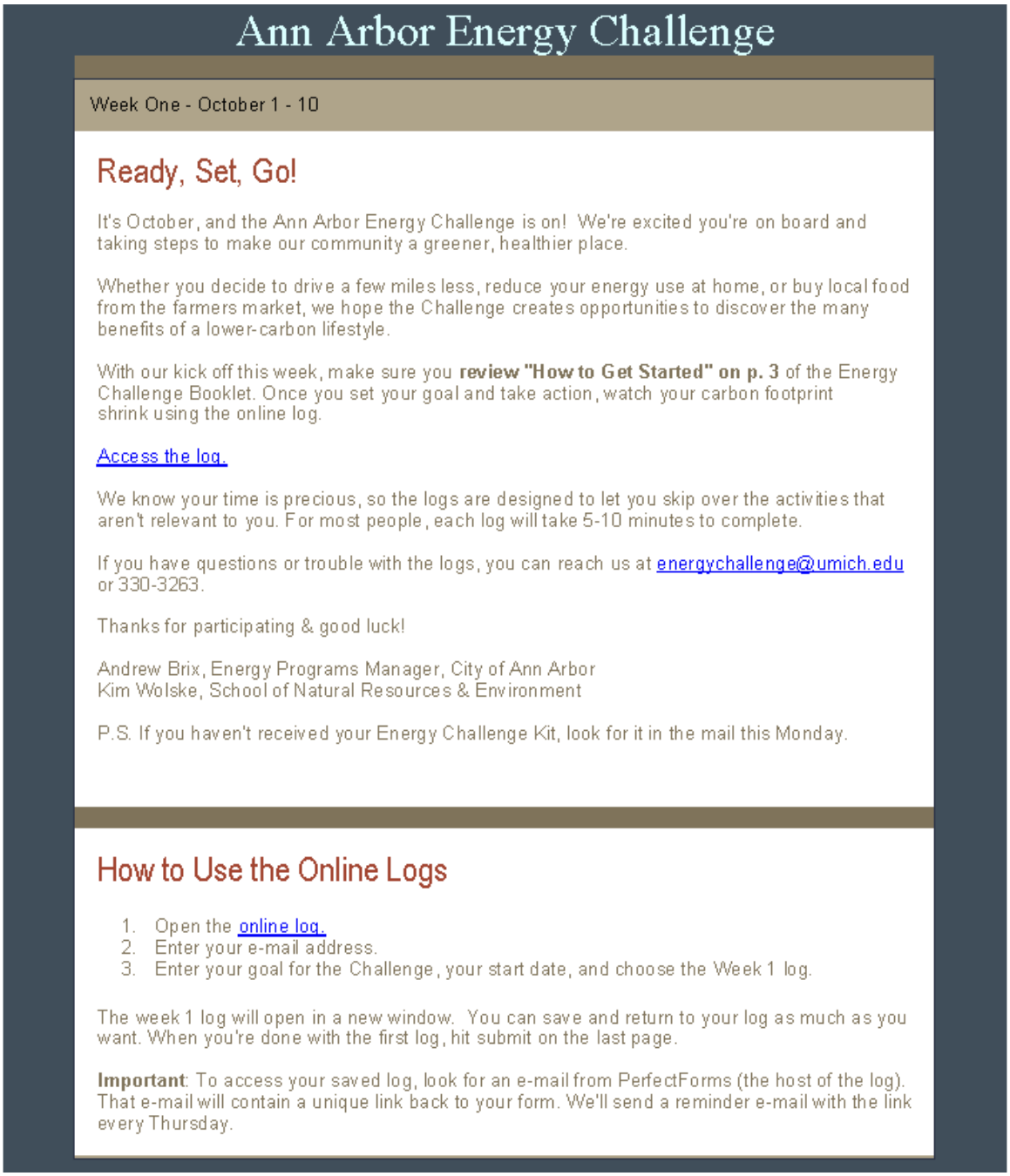
If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Thank you for participating in this community effort!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment, University of Michigan

APPENDIX K: Reminder E-mails – Weekly Feedback

Initial E-mail



Ann Arbor Energy Challenge

Week One - October 1 - 10

Ready, Set, Go!

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Whether you decide to drive a few miles less, reduce your energy use at home, or buy local food from the farmers market, we hope the Challenge creates opportunities to discover the many benefits of a lower-carbon lifestyle.

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Access the log.

We know your time is precious, so the logs are designed to let you skip over the activities that aren't relevant to you. For most people, each log will take 5-10 minutes to complete.

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Thanks for participating & good luck!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
Kim Wolske, School of Natural Resources & Environment

P.S. If you haven't received your Energy Challenge Kit, look for it in the mail this Monday.

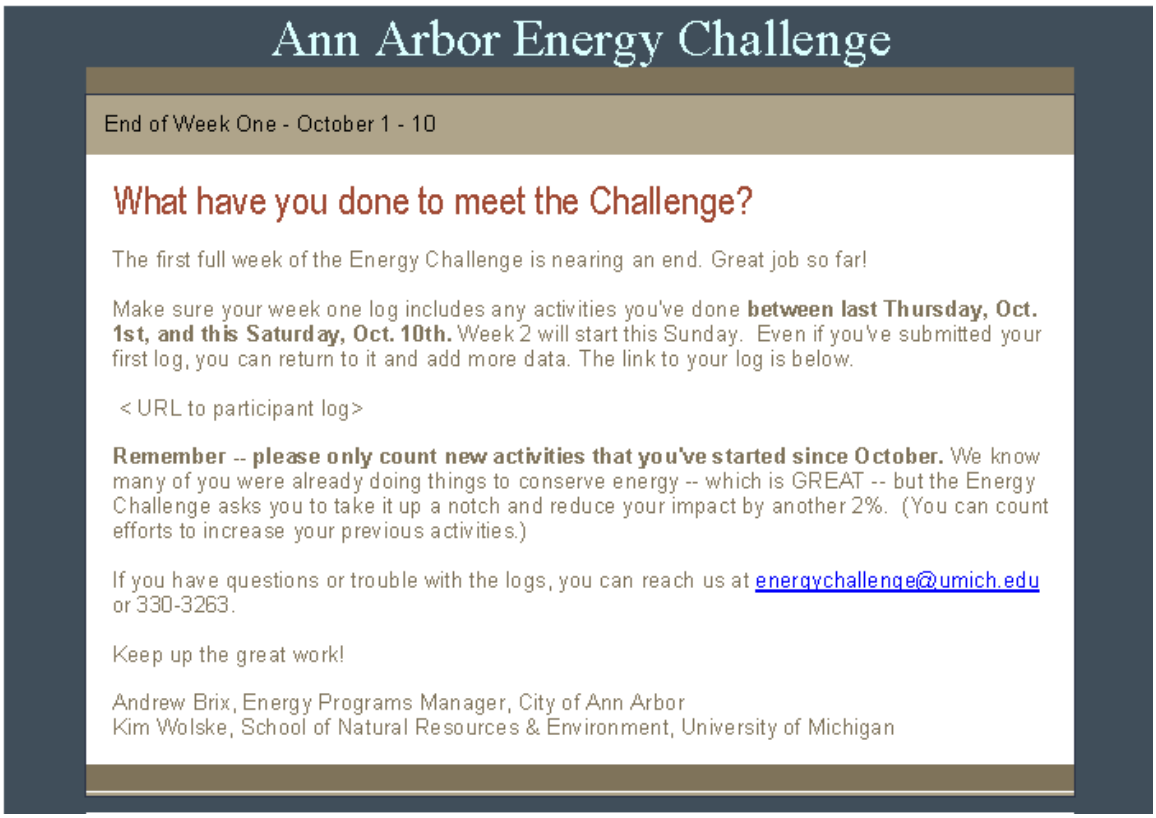
How to Use the Online Logs

1. Open the online log.
2. Enter your e-mail address.
3. Enter your goal for the Challenge, your start date, and choose the Week 1 log.

The week 1 log will open in a new window. You can save and return to your log as much as you want. When you're done with the first log, hit submit on the last page.

Important: To access your saved log, look for an e-mail from PerfectForms (the host of the log). That e-mail will contain a unique link back to your form. We'll send a reminder e-mail with the link every Thursday.

Week 1



Ann Arbor Energy Challenge

End of Week One - October 1 - 10

What have you done to meet the Challenge?

The first full week of the Energy Challenge is nearing an end. Great job so far!

Make sure your week one log includes any activities you've done **between last Thursday, Oct. 1st, and this Saturday, Oct. 10th.** Week 2 will start this Sunday. Even if you've submitted your first log, you can return to it and add more data. The link to your log is below.

< URL to participant log>

Remember -- please only count new activities that you've started since October. We know many of you were already doing things to conserve energy -- which is GREAT -- but the Energy Challenge asks you to take it up a notch and reduce your impact by another 2%. (You can count efforts to increase your previous activities.)

If you have questions or trouble with the logs, you can reach us at energychallenge@umich.edu or 330-3263.

Keep up the great work!

Andrew Brix, Energy Programs Manager, City of Ann Arbor
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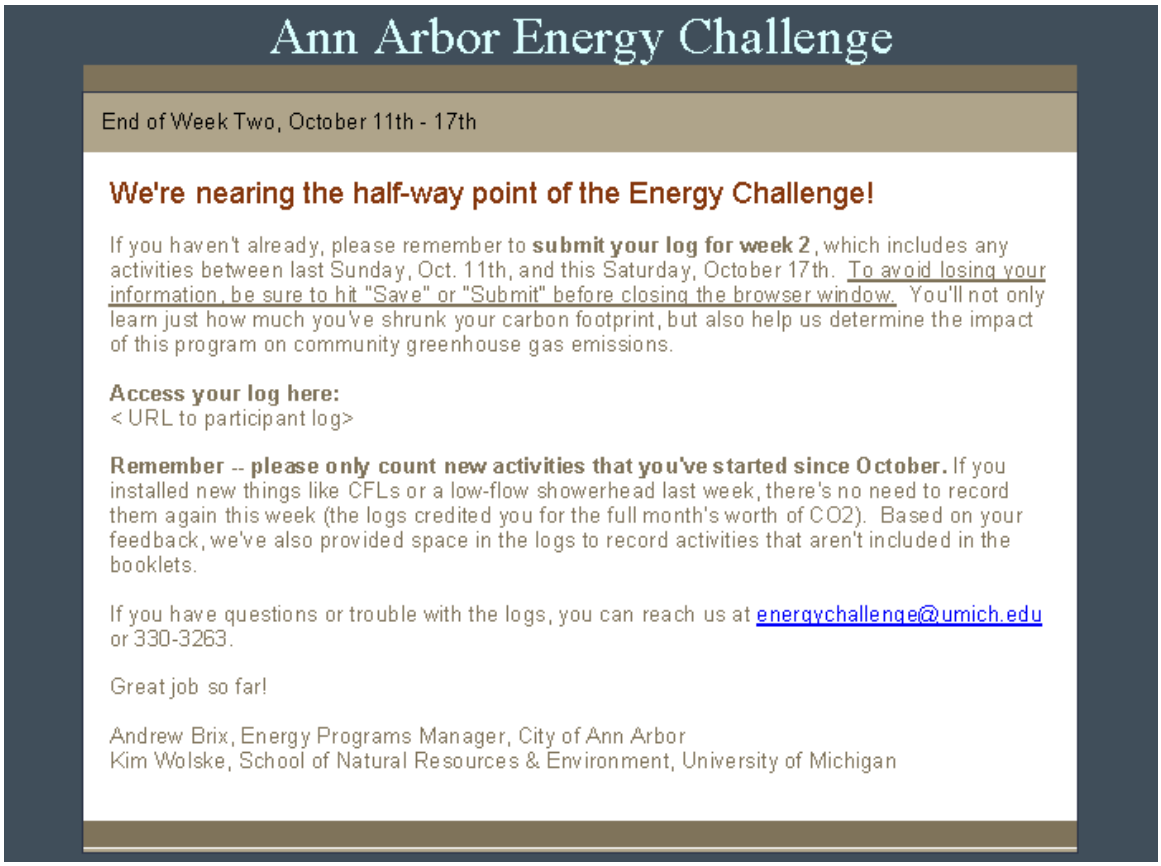
Week 2



Ann Arbor Energy Challenge

End of Week Two, October 11th - 17th

We're nearing the half-way point of the Energy Challenge!

If you haven't already, please remember to **submit your log for week 2**, which includes any activities between last Sunday, Oct. 11th, and this Saturday, October 17th. To avoid losing your information, be sure to hit "Save" or "Submit" before closing the browser window. You'll not only learn just how much you've shrunk your carbon footprint, but also help us determine the impact of this program on community greenhouse gas emissions.

Access your log here:
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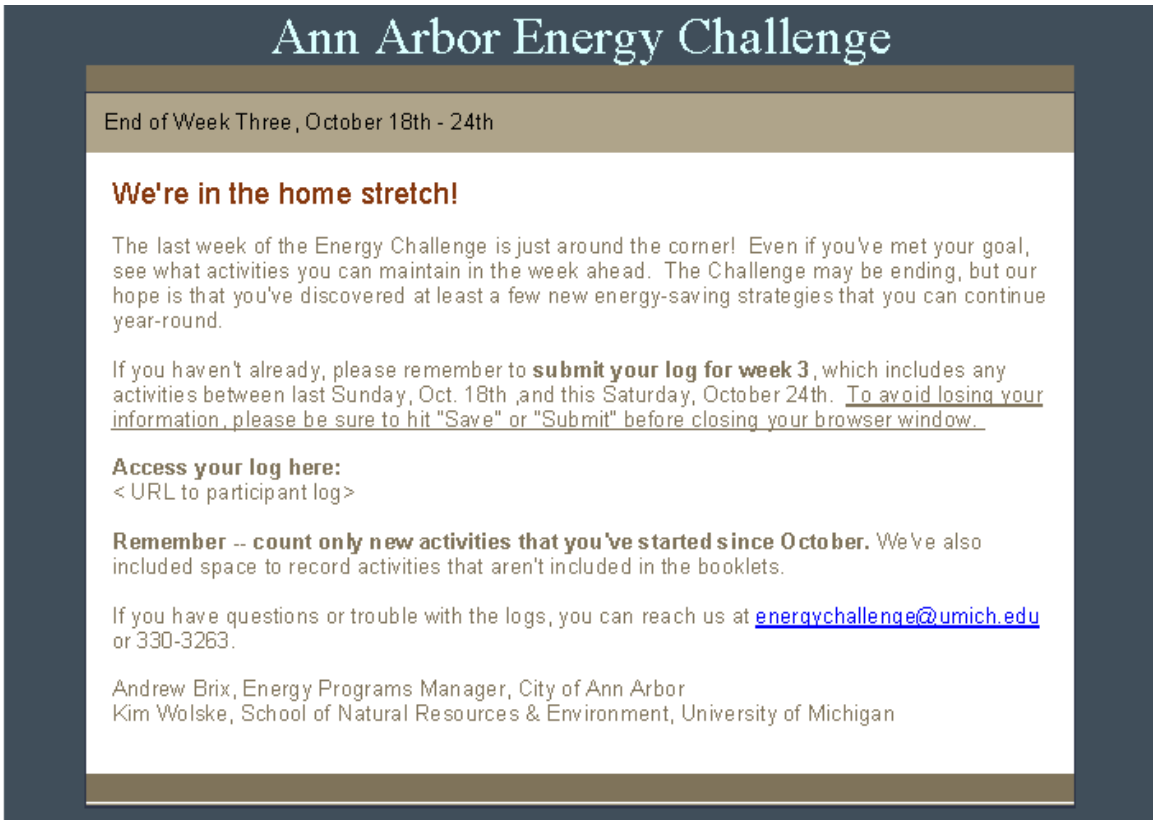
Week 3



Ann Arbor Energy Challenge

End of Week Three, October 18th - 24th

We're in the home stretch!

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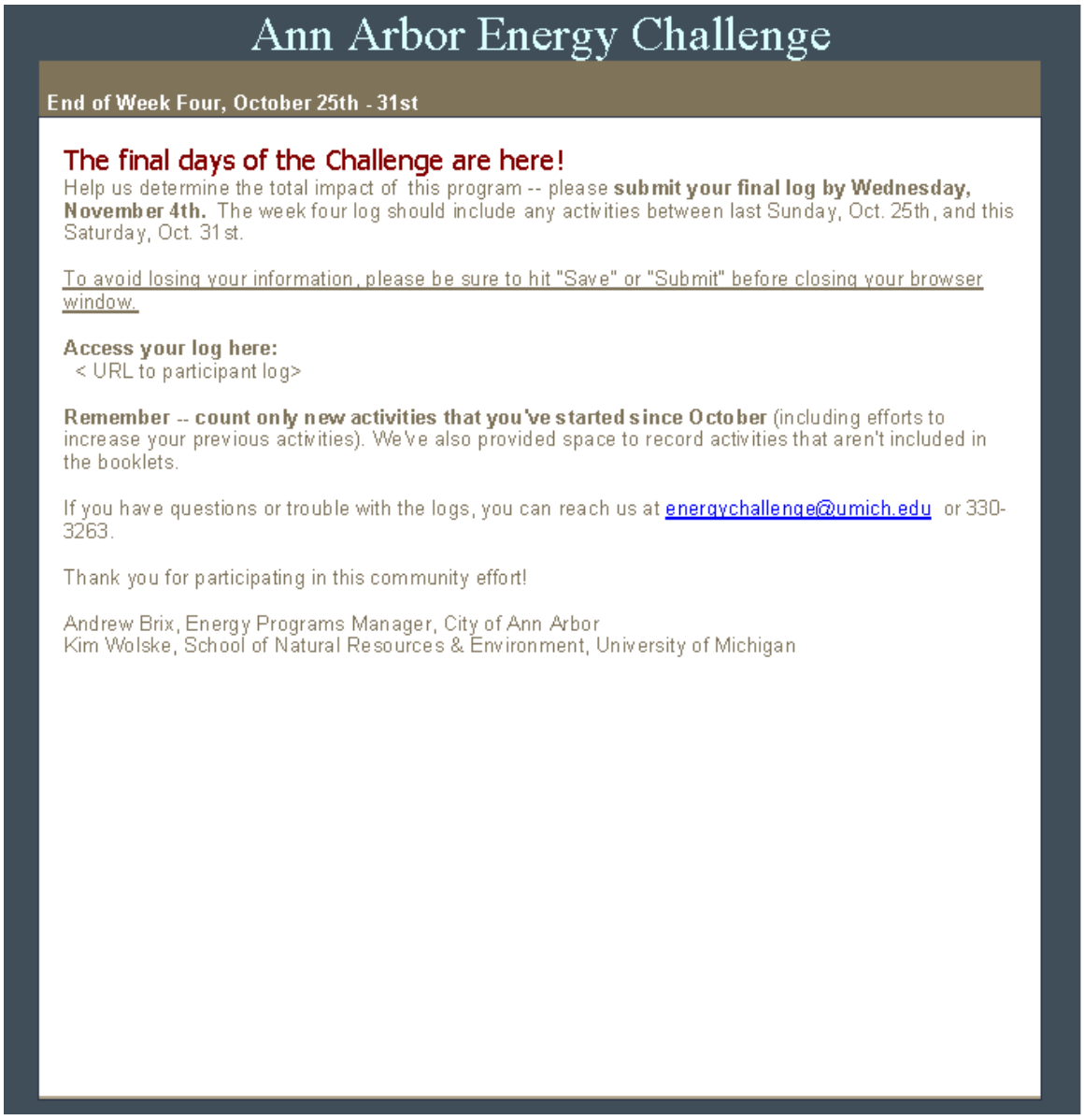
Week 4



Ann Arbor Energy Challenge

End of Week Four, October 25th - 31st

The final days of the Challenge are here!

Help us determine the total impact of this program -- please **submit your final log by Wednesday, November 4th.** The week four log should include any activities between last Sunday, Oct. 25th, and this Saturday, Oct. 31st.

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APPENDIX L: Reminder E-mails – Weekly Feedback + Stories

Initial E-mail

Ann Arbor Energy Challenge

Week One - October 1 - 10

Ready, Set, Go!

It's October, and the Ann Arbor Energy Challenge is on! We're excited you're on board and taking steps to make our community a greener, healthier place.

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We Want Your Stories & Advice!

Sometimes it helps to hear what others are doing. Do you have tips for making energy conservation easier? Have a story about your Energy Challenge experience?

You can share your stories & advice in the weekly log. We'll be highlighting them in future e-mails. You can even upload a photo that captures something you've done to meet the challenge.

Week 1

Ann Arbor Energy Challenge

End of Week One - October 1 - 10

What have you done to meet the Challenge?

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Keep up the great work!

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Kim Wolske, School of Natural Resources & Environment, University of Michigan

What are others doing?

Popular Choices:

- Turn down the heat (46% of participants)
- Reduce vampire energy (38%)
- Shorten shower time (35%)
- Washed laundry in cold water (35%)

Other creative ideas:
"I taught my high school son how/where to catch the AATA from Community High School."

Share your stories & advice!

Have a good vegetarian recipe or one that uses seasonal ingredients?

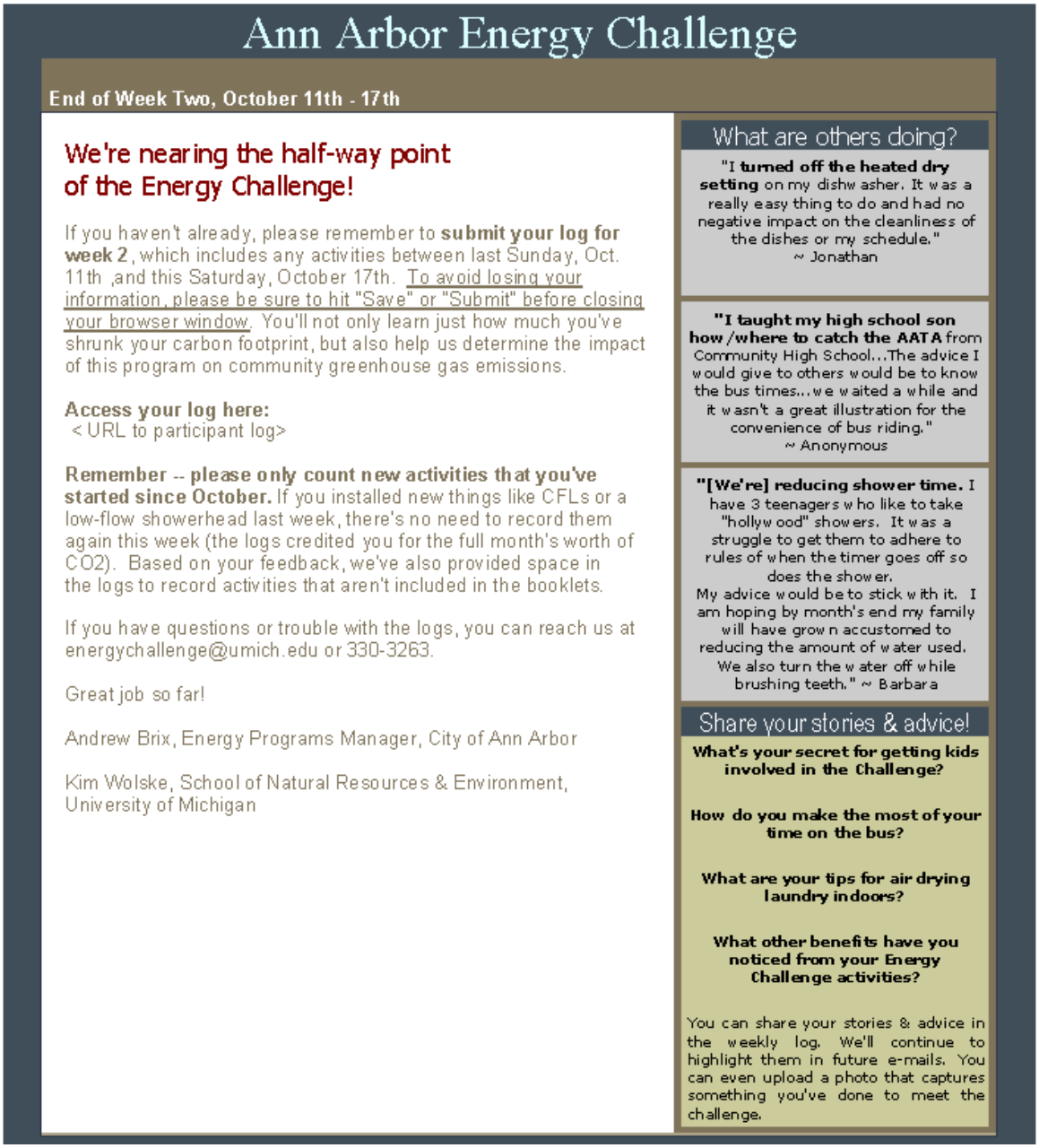
Know good places to inflate your car tires?

Have tips for commuting by bike or on foot?

What other ideas do you have for meeting the Challenge?

You can share your stories & advice in the weekly log. We'll be highlighting them in future e-mails. You can even upload a photo that captures something you've done to meet the challenge.

Week 2



Ann Arbor Energy Challenge

End of Week Two, October 11th - 17th

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What are others doing?

"I **turned off the heated dry setting** on my dishwasher. It was a really easy thing to do and had no negative impact on the cleanliness of the dishes or my schedule."
~ Jonathan

"I taught my high school son how /where to catch the AATA from Community High School...The advice I would give to others would be to know the bus times...we waited a while and it wasn't a great illustration for the convenience of bus riding."
~ Anonymous

"[We're] reducing shower time. I have 3 teenagers who like to take "hollywood" showers. It was a struggle to get them to adhere to rules of when the timer goes off so does the shower.
My advice would be to stick with it. I am hoping by month's end my family will have grown accustomed to reducing the amount of water used. We also turn the water off while brushing teeth." ~ Barbara

Share your stories & advice!

What's your secret for getting kids involved in the Challenge?

How do you make the most of your time on the bus?

What are your tips for air drying laundry indoors?

What other benefits have you noticed from your Energy Challenge activities?

You can share your stories & advice in the weekly log. We'll continue to highlight them in future e-mails. You can even upload a photo that captures something you've done to meet the challenge.

Week 3

Ann Arbor Energy Challenge

End of Week Three, October 18th - 24th

We're in the home stretch!

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What ideas or advice do you have to share?

- How have you overcome some of the challenges of using less energy?
- What tips can you share with others interested in doing the same activities?

You can share your stories & advice in the weekly log. We'll continue to highlight them in future e-mails. You can even upload a photo that captures something you've done to meet the challenge.

Creative Ideas for Saving Energy:

"Instead of ordering a book through Amazon, I cycled downtown and bought it in a local shop. It's so tempting to order things online because it takes very little time, and in a day or two the cardboard box magically appears on one's doorstep. But CO2-producing planes and trucks are involved in the delivery. I live close enough to downtown AA that I really don't have the excuse not to cycle (or bus) in to town and look in local shops first. I'm going to try to do that more often." ~ Fiona

"[We] decided to have a 'candle evening' once per week. We only use minimal electric light (one in kitchen) and otherwise enjoy the ambience of candlelight." ~ Anonymous

How Ann Arborites are reducing their heating bills

- Installed new door threshholds and weatherstripping
- Insulated outlets and electrical switches
- Caulked exterior of windows
- Installed a programmable thermostat
- Had a blower test done (as part of an energy audit) to identify drafts and leaks

How others are saving water

- Reduced number of showers per week
- Collected water from heating up the shower to water plants
- Installed a rain garden

Week 4

Ann Arbor Energy Challenge

End of Week Four, October 25th - 31st

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How are other households meeting the Challenge?

"**[We] had a completely meatless day!** Although initially my family was against a "meatless" day, they did agree afterwards that it was not as bad as they thought and they could do it again. I'm trying for 2 days next week!" ~ Barbara

"**I put in an energy saving handheld shower**. I am normally not a fix it type gal. This was very rewarding not only to myself for doing it, but to know that it is going to save so much on water usage." ~ Sherri

"**I raked leaves instead of using the blower.** It only took an extra 30 minutes."
~ Anonymous

How Ann Arborites are saving energy on laundry

- Wore clothes another time before washing them
- Put up lines in the basement to air dry clothes

How others are saving energy by reducing waste

- Gathered plastic bags, used oil, batteries, cardboard, styrofoam popcorn, etc. from three families and took to the recycle center on Ellsworth Road.
- Read latest issue of WasteWatcher for more ideas on things that can be recycled.
- Took old drapes and rods to A2PTO and the ReUse Center on S. Industrial

What ideas or advice do you have to share?

- How have you overcome some of the challenges of using less energy?
- What tips can you share with others interested in doing the same activities?

Share your stories & advice in the weekly log! You can even upload a photo that captures something you've done to meet the challenge.

APPENDIX M: E-mail to Posttest Survey

From: **Ann Arbor Energy Challenge** <noreply@qualtrics.com>
Subject: Please take this brief survey about the Energy Challenge

We need your help! The Energy Challenge is a new program, and we need your input to evaluate its effectiveness. Let us know what you thought by taking the survey below -- it only takes 15 minutes (or less) to complete.

Take the Survey

Or copy and paste the url below into your internet browser:
http://umichpsych.qualtrics.com/WRQualtricsSurveyEngine?Q_SS=bmExWRABCSl2YC0_3P2zkOqGYxVAh8w&SVID=Prod

Your CO_2 Savings During the Energy Challenge
Based on the logs you submitted, your household reduced its carbon footprint by:
122 lbs. of CO_2 during October.

If you maintained your Energy Challenge activities over the year, you would reduce your carbon footprint by approximately **3.6**%.* Scientists estimate that reducing global greenhouse gas emissions by just 2% each year could help avoid major climate change.

How much do you think the average household in Ann Arbor saved during the Energy Challenge?
Find out by taking the survey above. The results will display on the last page.

Thank you again for taking part in this community effort! If you have questions or comments, please contact us at energychallenge@umich.edu or (734) 330-3263.

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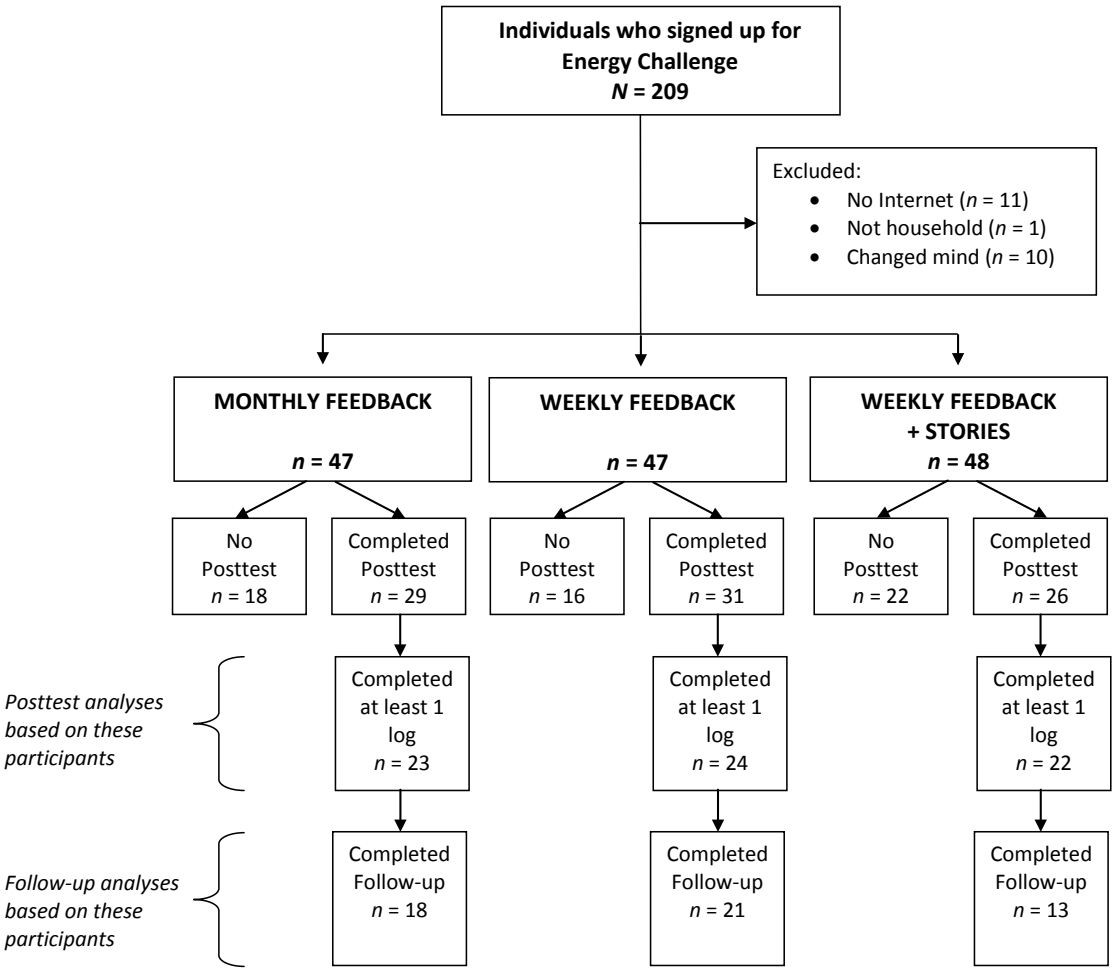
* This is based on the average Ann Arbor household's carbon footprint of 40,700 lbs. of CO_2 per year, a conservative estimate that includes home energy use, automobile transportation, and waste. It does not include dietary choices.

Follow the link to opt out of future emails:
http://umichpsych.qualtrics.com/CP/Register.php?OptOut=true&RID=MLRP_0Hgi9TYR4OVbqbq&ServerID=Prod

APPENDIX N: Flow of Participants



APPENDIX O: Pretest Survey

Thank you for taking the time to fill out this survey. Your responses will help us better understand how Ann Arbor residents feel about energy conservation and the steps they're already taking to conserve. The survey will take about 15-20 minutes to complete. If you have any questions, please contact Kim Wolske at energychallenge@umich.edu or 330-3263.

How often do you do the following?

	Never	Rarely	Sometimes	Quite Often	Almost Always	N/A
Use compact fluorescent light bulbs	❍	❍	❍	❍	❍	❍
Turn off computer(s) when not in use	❍	❍	❍	❍	❍	❍
Turn electronic devices completely off by unplugging them or controlling them with a power strip	❍	❍	❍	❍	❍	❍
Leave electrical chargers (e.g., for cell phone) plugged in	❍	❍	❍	❍	❍	❍
Cook with a microwave or toaster oven instead of oven	❍	❍	❍	❍	❍	❍
Take showers of 6 minutes or less	❍	❍	❍	❍	❍	❍
Wash laundry in cold water	❍	❍	❍	❍	❍	❍
Use the heated dry setting on the dishwasher	❍	❍	❍	❍	❍	❍
Air dry laundry during warm weather months	❍	❍	❍	❍	❍	❍
Air dry laundry during winter months	❍	❍	❍	❍	❍	❍

How often do you do the following?

	Never	Rarely	Sometimes	Quite Often	Almost Always	N/A
Walk or bike instead of driving	❍	❍	❍	❍	❍	❍
Take the bus or carpool instead of driving	❍	❍	❍	❍	❍	❍
Leave the car running while waiting for someone	❍	❍	❍	❍	❍	❍
Consider whether I really need to drive somewhere	❍	❍	❍	❍	❍	❍
Plan errands to minimize number of car trips	❍	❍	❍	❍	❍	❍
Buy locally produced food	❍	❍	❍	❍	❍	❍
Eat meatless meals	❍	❍	❍	❍	❍	❍
Eat organic food	❍	❍	❍	❍	❍	❍
Wear more clothes in winter instead of turning up the heat	❍	❍	❍	❍	❍	❍
Keep the heat turned down to 62°F or below when sleeping	❍	❍	❍	❍	❍	❍
Keep the heat turned down to 62°F or below when no one is home	❍	❍	❍	❍	❍	❍

Please describe other actions you take to conserve energy or reduce your impact on global warming.

Please answer the following:

	None	A little	Some	Quite a bit	A great deal
How much attention do you pay to information about global warming?	❍	❍	❍	❍	❍
In the past 30 days, how much have you actively looked for information about global warming?	❍	❍	❍	❍	❍
In the past 30 days, how much have you actively looked for information about conserving energy?	❍	❍	❍	❍	❍

To what extent are the following true of you?

	Not at all true		Moderately true		Extremely true
I'm not sure what I can do to help reduce global warming	❍	❍	❍	❍	❍
I rarely think about conserving energy	❍	❍	❍	❍	❍
Using less heat or air conditioning in my home would be uncomfortable	❍	❍	❍	❍	❍
I rarely think about how much I drive	❍	❍	❍	❍	❍
I would like to use less energy, but it's hard to change my habits	❍	❍	❍	❍	❍
I'm too busy to use other forms of transportation besides my car	❍	❍	❍	❍	❍
I would feel comfortable explaining to others how they can conserve energy	❍	❍	❍	❍	❍
I rarely think about the impact of my food choices on global warming	❍	❍	❍	❍	❍
I can use less energy in my home without sacrificing comfort	❍	❍	❍	❍	❍
I think of myself as environmentally responsible	❍	❍	❍	❍	❍
My friends/relatives don't see the urgency of trying to reduce global warming	❍	❍	❍	❍	❍
I often think about my impact on global warming	❍	❍	❍	❍	❍

To what extent are the following true of you?

	Not at all true		Moderately true		Extremely true
If everyone does their part to conserve energy, we can reduce global warming	❍	❍	❍	❍	❍
I look for ways to use less electricity	❍	❍	❍	❍	❍
Changing my diet to reduce global warming would be a sacrifice	❍	❍	❍	❍	❍
I live too far from where I work and shop to walk or bike	❍	❍	❍	❍	❍
Public transportation is limited in my area	❍	❍	❍	❍	❍
It's inconvenient to buy locally produced food	❍	❍	❍	❍	❍
Conserving energy around my home is inconvenient	❍	❍	❍	❍	❍
Global warming is a pressing concern for me	❍	❍	❍	❍	❍
I encourage others to conserve energy	❍	❍	❍	❍	❍
It's not practical for me to use my car less	❍	❍	❍	❍	❍
Our community is making a difference in reducing global warming	❍	❍	❍	❍	❍
I'm committed to reducing my impact on global warming	❍	❍	❍	❍	❍

How important are the following factors to you in deciding whether to conserve energy?

	Not at all		Somewhat important		Extremely important
It saves me money	❍	❍	❍	❍	❍
It's good for my health	❍	❍	❍	❍	❍
It's the moral thing to do	❍	❍	❍	❍	❍
Others in my household encourage me to	❍	❍	❍	❍	❍
It helps reduce global warming	❍	❍	❍	❍	❍
It feels like the right thing to do	❍	❍	❍	❍	❍
It makes me feel good about myself	❍	❍	❍	❍	❍
People I care about are doing it	❍	❍	❍	❍	❍

Please indicate how much satisfaction or enjoyment you get from the following activities.

	Not at all	A little	Some	Quite a bit	A great deal
Taking action on issues I care about	❍	❍	❍	❍	❍
Doing things that matter in the long run	❍	❍	❍	❍	❍
Being a responsible citizen	❍	❍	❍	❍	❍
Working with others to solve a problem	❍	❍	❍	❍	❍
Avoiding wastefulness	❍	❍	❍	❍	❍
Taking on challenging tasks	❍	❍	❍	❍	❍
Conserving energy	❍	❍	❍	❍	❍
Taking action on something my community thinks is important	❍	❍	❍	❍	❍
Learning how to solve problems I face	❍	❍	❍	❍	❍
Making do with what I have rather than buying new things	❍	❍	❍	❍	❍
Sharing my ideas with others	❍	❍	❍	❍	❍
Discovering new things I'm good at doing	❍	❍	❍	❍	❍
Determining how to achieve goals	❍	❍	❍	❍	❍
Discovering new ways to lessen my environmental impact	❍	❍	❍	❍	❍
Following through on my plans	❍	❍	❍	❍	❍
Learning how to take action on environmental problems	❍	❍	❍	❍	❍

What is the distance of your average daily round-trip commute in miles?

How do you typically commute to work (or school)? (Check all that apply)

- ❑ Walk
- ❑ Bike
- ❑ Car
- ❑ Carpool/vanpool
- ❑ Bus
- ❑ Other
- ❑ Don't commute

Do you own a hybrid vehicle?

- ❍ Yes
- ❍ No
- ❍ I don't know

Do you own or rent the home you live in now?

- ❍ Own
- ❍ Rent

What is the approximate square footage of indoor living space in your home (including finished basements)?

- ❍ Less than 500 square ft.
- ❍ 501 – 1,000 square ft.
- ❍ 1,001 – 1,500 square ft.
- ❍ 1,501 – 2,000 square ft.
- ❍ 2,001 – 2,500 square ft.
- ❍ 2,501 – 3,000 square ft.
- ❍ More than 3,000 square ft.
- ❍ Don’t know

What type of home do you live in?

- ❍ Single-family detached house
- ❍ Single-family attached house (e.g. duplex, townhouse)
- ❍ Apartment/Condo in a house or a building with 2-4 units
- ❍ Apartment/Condo in a building with 5 or more units
- ❍ Mobile home
- ❍ Other

Answer if Renter

Who is responsible for paying your energy bill?

	Household members	Landlord / Management Company	Other
Electricity	❍	❍	❍
Natural Gas	❍	❍	❍

Do you have control of the thermostat in your home?

❍ Yes
❍ No

If **No** is selected, then skip to "What is your age?"

Answer if Homeowner or Renter with control of thermostat

Do you have a programmable thermostat?

❍ Yes
❍ No
❍ Not sure

If **No** or **Not sure** is selected, then skip to "What is your age?"

Is your thermostat programmed to...

	Yes	No	Don't Know	N/A
Turn the heat down when sleeping?	❍	❍	❍	❍
Turn the heat down when you are gone for the day?	❍	❍	❍	❍
Adjust the air conditioning when you are gone for the day?	❍	❍	❍	❍

What is your age?

- ❍ Under 20
- ❍ 20-29
- ❍ 30-39
- ❍ 40-49
- ❍ 50-59
- ❍ 60-69
- ❍ 70-79
- ❍ 80 or older

What is your gender?

- ❍ Male
- ❍ Female

Including yourself, how many people live in your home on a full-time basis?

- ☐ Adults
- ☐ Children (18 and under)

What best describes the people who share this household? (Check all that apply)

- ❑ Single person
- ❑ Couple
- ❑ Family
- ❑ Unrelated people

Do you have any comments you would like to share with us?

APPENDIX P: Posttest Survey

To what extent did you try to conserve energy during the Energy Challenge?

- ❍ Not at all
- ❍ A little
- ❍ Somewhat
- ❍ Quite a bit
- ❍ A great deal

How many people in your household participated in the Energy Challenge?

Compared to BEFORE the Energy Challenge, how often did you do the following during the last month?

	N/A	Less than before	About the same		Somewhat more		Much more
Used compact fluorescent light bulbs	❍	❍	❍	❍	❍	❍	❍
Turned off computer(s) when not in use	❍	❍	❍	❍	❍	❍	❍
Turned electronic devices completely off by unplugging them or controlling them with a power strip	❍	❍	❍	❍	❍	❍	❍
Unplugged electrical chargers (e.g., for cell phone)	❍	❍	❍	❍	❍	❍	❍
Cooked with a microwave or toaster oven instead of oven	❍	❍	❍	❍	❍	❍	❍
Took showers of 6 minutes or less	❍	❍	❍	❍	❍	❍	❍
Washed laundry in cold water	❍	❍	❍	❍	❍	❍	❍
Turned off the heated dry setting on the dishwasher	❍	❍	❍	❍	❍	❍	❍
Air dried laundry	❍	❍	❍	❍	❍	❍	❍

Compared to BEFORE the Energy Challenge, how often did you do the following during the last month?

	N/A	Less than before	About the same		Somewhat more		Much more
Walked or biked instead of driving	❍	❍	❍	❍	❍	❍	❍
Took the bus or carpooled instead of driving	❍	❍	❍	❍	❍	❍	❍
Turned off the car while waiting for someone	❍	❍	❍	❍	❍	❍	❍
Considered whether I really need to drive somewhere	❍	❍	❍	❍	❍	❍	❍
Planned errands to minimize number of car trips	❍	❍	❍	❍	❍	❍	❍
Bought locally produced food	❍	❍	❍	❍	❍	❍	❍
Ate meatless meals	❍	❍	❍	❍	❍	❍	❍
Ate organic food	❍	❍	❍	❍	❍	❍	❍
Wore more clothes instead of turning up the heat	❍	❍	❍	❍	❍	❍	❍
Kept the heat turned down to 62°F or below when sleeping	❍	❍	❍	❍	❍	❍	❍
Kept the heat turned down to 62°F or below when no one was home	❍	❍	❍	❍	❍	❍	❍

Please describe additional actions you took to conserve energy or reduce your impact on global warming.

How would you rate the Energy Challenge booklet in terms of ...

	Poor	Fair	Good	Very Good	Excellent
Usefulness of information presented	❍	❍	❍	❍	❍
Variety of energy-saving actions described	❍	❍	❍	❍	❍
How interesting it was to read	❍	❍	❍	❍	❍
Visual appeal	❍	❍	❍	❍	❍

Do you have other feedback about the Energy Challenge booklets?

To what extent are the following true of you?

	Not at all true		Moderately true		Extremely true
I'm not sure what I can do to help reduce global warming	❍	❍	❍	❍	❍
I rarely think about conserving energy	❍	❍	❍	❍	❍
Using less heat or air conditioning in my home would be uncomfortable	❍	❍	❍	❍	❍
I rarely think about how much I drive	❍	❍	❍	❍	❍
I would like to use less energy, but it's hard to change my habits	❍	❍	❍	❍	❍
I'm too busy to use other forms of transportation besides my car	❍	❍	❍	❍	❍
I would feel comfortable explaining to others how they can conserve energy	❍	❍	❍	❍	❍
I rarely think about the impact of my food choices on global warming	❍	❍	❍	❍	❍
I can use less energy in my home without sacrificing comfort	❍	❍	❍	❍	❍
I think of myself as environmentally responsible	❍	❍	❍	❍	❍
My friends/relatives don't see the urgency of trying to reduce global warming	❍	❍	❍	❍	❍
I often think about my impact on global warming	❍	❍	❍	❍	❍

To what extent are the following true of you?

	Not at all true		Moderately true		Extremely true
If everyone does their part to conserve energy, we can reduce global warming	❍	❍	❍	❍	❍
I look for ways to use less electricity	❍	❍	❍	❍	❍
Changing my diet to reduce global warming would be a sacrifice	❍	❍	❍	❍	❍
I live too far from where I work and shop to walk or bike	❍	❍	❍	❍	❍
Public transportation is limited in my area	❍	❍	❍	❍	❍
It's inconvenient to buy locally produced food	❍	❍	❍	❍	❍
Conserving energy around my home is inconvenient	❍	❍	❍	❍	❍
Global warming is a pressing concern for me	❍	❍	❍	❍	❍
I encourage others to conserve energy	❍	❍	❍	❍	❍
It's not practical for me to use my car less	❍	❍	❍	❍	❍
Our community is making a difference in reducing global warming	❍	❍	❍	❍	❍
I'm committed to reducing my impact on global warming	❍	❍	❍	❍	❍

Please indicate how much satisfaction or enjoyment you get from the following activities.

	Not at all	A little	Some	Quite a bit	A great deal
Taking action on issues I care about	❍	❍	❍	❍	❍
Doing things that matter in the long run	❍	❍	❍	❍	❍
Being a responsible citizen	❍	❍	❍	❍	❍
Working with others to solve a problem	❍	❍	❍	❍	❍
Avoiding wastefulness	❍	❍	❍	❍	❍
Taking on challenging tasks	❍	❍	❍	❍	❍
Conserving energy	❍	❍	❍	❍	❍
Taking action on something my community thinks is important	❍	❍	❍	❍	❍
Learning how to solve problems I face	❍	❍	❍	❍	❍
Making do with what I have rather than buying new things	❍	❍	❍	❍	❍
Sharing my ideas with others	❍	❍	❍	❍	❍
Discovering new things I'm good at doing	❍	❍	❍	❍	❍
Determining how to achieve goals	❍	❍	❍	❍	❍
Discovering new ways to lessen my environmental impact	❍	❍	❍	❍	❍
Following through on my plans	❍	❍	❍	❍	❍
Learning how to take action on environmental problems	❍	❍	❍	❍	❍

To what extent are the following statements true of your experience with the Energy Challenge?

	Not at all true		Somewhat true		Very true	Don't Know
I had a clear understanding of what I was expected to do during the Energy Challenge.	❍	❍	❍	❍	❍	❍
Conserving energy was more difficult than I expected.	❍	❍	❍	❍	❍	❍
I learned new ways to reduce my impact on global warming.	❍	❍	❍	❍	❍	❍
I intend to continue some of the actions I tried during the Challenge.	❍	❍	❍	❍	❍	❍
I would be willing to try other energy conserving behaviors.	❍	❍	❍	❍	❍	❍
I had difficulty accessing the online logs.	❍	❍	❍	❍	❍	❍
The weekly email reminders were interesting to read.	❍	❍	❍	❍	❍	❍
If I had it to do over, I would participate in this program.	❍	❍	❍	❍	❍	❍
I feel good about my participation in the Energy Challenge.	❍	❍	❍	❍	❍	❍

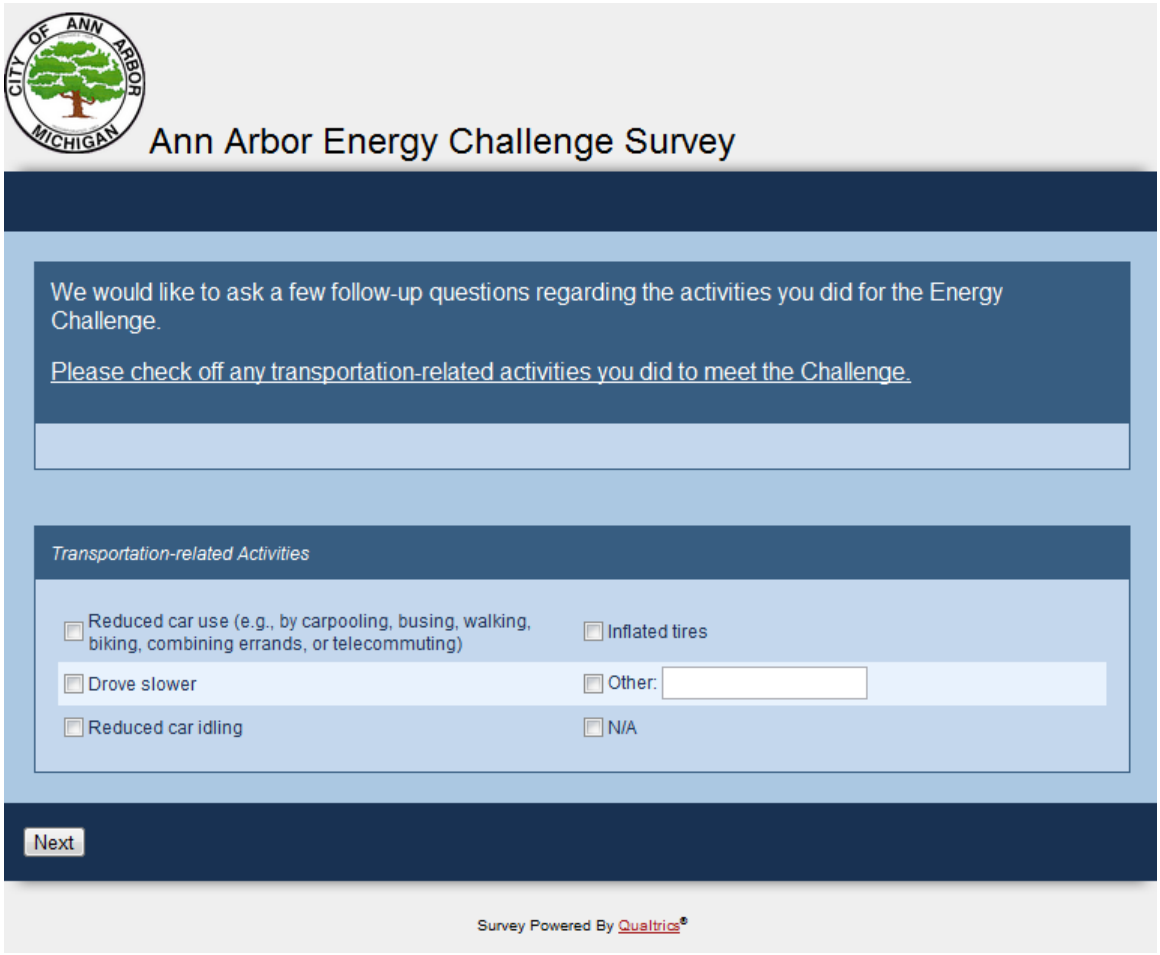
How could the Energy Challenge Program be improved to better meet your needs?

Would you like to receive periodic emails about energy initiatives in Ann Arbor?

❍ No, thanks.
❍ Yes, please send updates to my email address below: _____

Do you have any other comments you would like to share with us?

APPENDIX Q: Follow-Up Survey



Ann Arbor Energy Challenge Survey

We would like to ask a few follow-up questions regarding the activities you did for the Energy Challenge.

Please check off any transportation-related activities you did to meet the Challenge.

Transportation-related Activities

- Reduced car use (e.g., by carpooling, busing, walking, biking, combining errands, or telecommuting)
- Drove slower
- Reduced car idling
- Inflated tires
- Other:
- N/A

Next

Survey Powered By Qualtrics®

Answer If Transportation-related Activities: Reduced car use (e.g., by carpooling, busing, walking, biking, combining errands, or telecommuting) is selected

How often did you try to reduce car use...

Answer If Transportation-related Activities: Drove slower is selected

How often did you try to drive slower ...

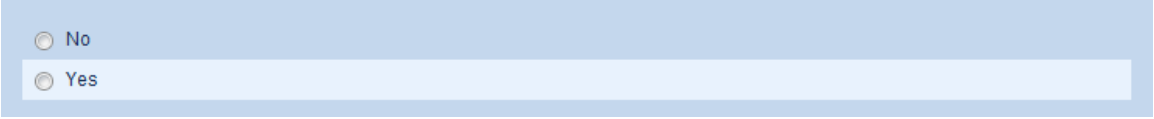
Answer If Transportation-related Activities: Reduced car idling is selected

How often did you try to reduce car idling...

Answer If Transportation-related Activities: Inflated tires is selected

To what extent did you regularly check your tire pressure...

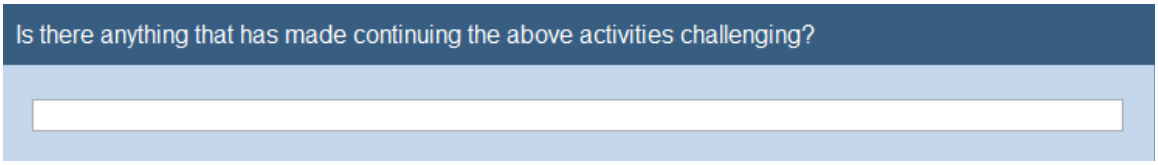
Have you checked your tire pressure in the past month, since the Challenge ended?



Answer If Transportation-related Activities Other: Is Not Empty

You indicated that you [Other behavior]. How often did you do this...

Answer If Transportation-related Reduced car use (e.g., by carpooling, busing, walking, biking, combining errands, or telecommuting) Is Selected Or Transportation-related Drove slower Is Selected Or Transportation-related Reduced car idling Is Selected Or Transportation-related Inflated tires Is Selected Or Transportation-related Other: Is Not Empty



HOUSEHOLD ENERGY USE

Please check off which activities you did around your home to meet the Challenge.

Household Energy Use

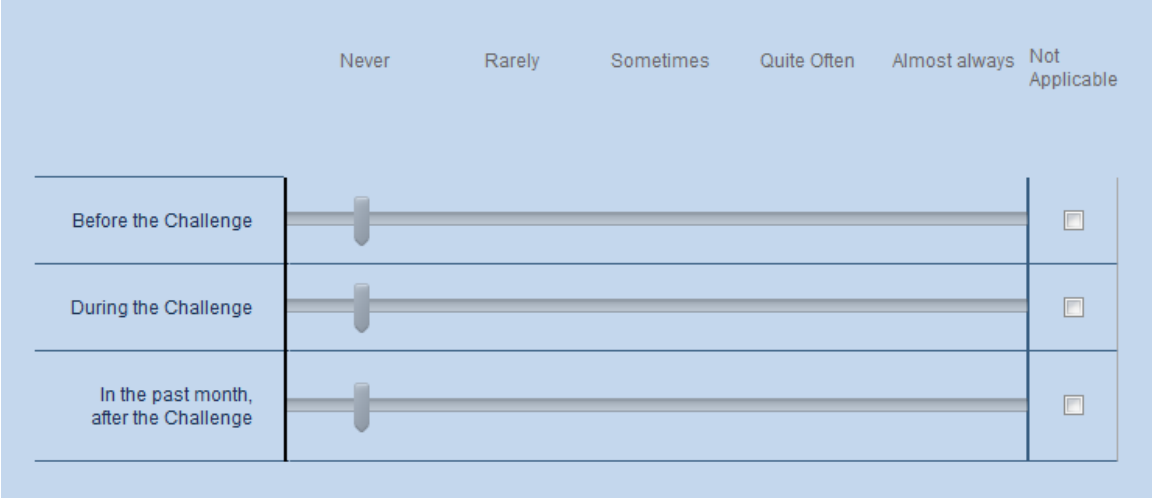
☐ Kept the heat at a lower temperature than last year	☐ Used the energy-saving settings on dishwasher	☐ Turned off computers/Used sleep or standby setting
☐ Turned the water heater temperature down	☐ Reduced oven use by cooking with a microwave, toaster oven or slow cooker	☐ Unplugged electronics/Controlled them with a power strip
☐ Insulated water heater	☐ Air dried laundry	☐ Other:
☐ Installed low-flow showerhead	☐ Used lamps with compact fluorescent light bulbs (CFLs)	☐ N/A
☐ Used less hot water (e.g., washed laundry in cold water; shorter showers; hand washed dishes efficiently)		

Answer If Household Energy Use: Kept the heat at a lower temperature than last year is selected

How often did you try to keep the thermostat turned down...

Answer If Household Energy Use: Used less hot water (e.g., wash laundry in cold water; shorter showers; hand wash dishes efficiently) is selected

How often did you try to reduce hot water use...



Answer If Household Energy Use: Used the energy-saving settings on dishwasher is selected

How often did you use the energy-saving settings on the dishwasher...

Answer If Household Energy Use: Reduced oven use by cooking with a microwave, toaster oven or slow cooker is selected

How often did you try to reduce oven use by cooking with a microwave, toaster oven, and/or slow cooker...

Answer If Household Energy Use: Air dried laundry is selected

How often did you air dry laundry...

Answer If Household Energy Use: Used lamps with compact fluorescent light bulbs (CFLs) is selected

How often did you use lamps with compact fluorescent light bulbs (CFLs)...

Answer If Household Energy Use: Turned off computers/Used sleep or standby setting is selected

How often did you turn off computers when not in use or use their sleep/standby setting...

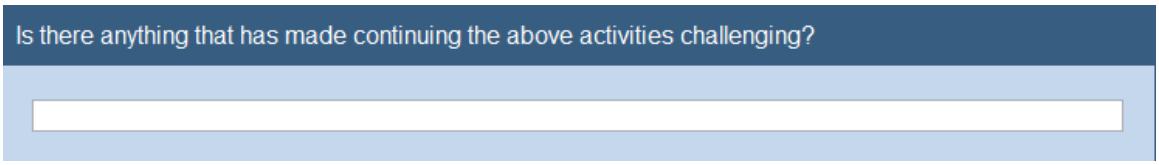
Answer If Household Energy Use: Unplugged electronics/Controlled them with a power strip is selected

How often did you try to reduce "vampire energy" by unplugging electronics or controlling them with a power strip...

Answer If Household Energy Use, Other: Is Not Empty

You indicated that you [other activity]. How often did you do this...

Answer If Household Energy Use: Kept the heat at a lower temperature than last year Is Selected Or Household Energy Use Used less hot water (e.g., wash laundry in cold water; shorter showers; hand wash dishes efficiently) Is Selected Or Household Energy Use Used the energy-saving settings on dishwasher Is Selected Or Household Energy Use Reduced oven use by cooking with a microwave, toaster oven or slow cooker Is Selected Or Household Energy Use Air dried laundry Is Selected Or Household Energy Use Used lamps with compact fluourescent light bulbs (CFLs) Is Selected Or Household Energy Use Turned off computers/Used sleep or standby setting Is Selected Or Household Energy Use Unplugged electronics/Controlled them with a power strip Is Selected Or Household Energy Use Other: Is Not Empty



DIETARTY CHOICES AND FOOD WASTE

Answer If Dietary Choices and Food Waste: Ate more local food is selected

How often did you try to eat local food...

Answer If Dietary Choices and Food Waste: Ate more organic food is selected

How often did you try to eat organic food...

Answer If Dietary Choices and Food Waste: Ate less meat is selected

How often did you try to eat less meat...

Answer If Dietary Choices and Food Waste: Brought reusable shopping bags is selected

How often did you try to bring reusable shopping bags...

Answer If Dietary Choices and Food Waste: Composted food scraps is selected

How often did you compost food scraps...

Answer If Dietary Choices and Food Waste, Other: Is Not Empty

You indicated that you [other activity]. How often did you do this...

Answer If Dietary Choices and Food Waste: Ate more local food Is Selected Or Dietary Choices Food Waste Ate more organic food Is Selected Or Dietary Choices Food Waste Ate less meat Is Selected Or Dietary Choices Food Waste Brought reusable shopping bags Is Selected Or Dietary Choices Food Waste Composted food scraps Is Selected Or Dietary Choices Food Waste Other: Is Not Empty

Is there anything that has made continuing the above activities challenging?

Since the Energy Challenge ended, have you done anything new to conserve energy or reduce your carbon footprint?

How interested are you in learning more about the following?

	Not at all		Somewhat interested		Very interested
Additional low-cost conservation behaviors	○	○	○	○	○
How to shop for energy efficient appliances	○	○	○	○	○
Having an energy audit done of my home	○	○	○	○	○
Reducing drafts in my home	○	○	○	○	○
Improving my home's insulation	○	○	○	○	○
Renewable energy options for my home (e.g., solar panels, geothermal, wind)	○	○	○	○	○
Purchasing renewable energy	○	○	○	○	○
Carbon offsets	○	○	○	○	○

What other resources or information would you like the Energy Office to provide?

We would like to conduct brief interviews (~ 15 to 20 minutes) with some of the Energy Challenge participants. Would you be interested in sharing your experience with us?

- ○ No, thanks.
- ○ Yes

Answer If We would like to interview some of the Energy Challenge p... Yes Is Selected

Please provide the following information so that we may contact you about being interviewed.

Name	
Phone	
E-mail Address	

Thank you for completing this survey. Do you have any other comments you would like to share?

APPENDIX R: Intrinsic Satisfaction Factor

Rotated factor loadings for intrinsic satisfaction	
Determining how to achieve goals	.85
Following through on my plans	.79
Discovering new things I'm good at doing	.75
Learning how to solve problems I face	.69
Learning how to take action on environmental problems	.65
Working with others to solve a problem	.63
Taking action on issues I care about	.62
Taking on challenging tasks	.62
Sharing my ideas with others	.62
Being a responsible citizen	.58
Discovering new ways to lessen my environmental impact	.57
Doing things that matter in the long run	.56
Taking action on something my community thinks is important	.53
Avoiding wastefulness	.47
Cronbach's alpha	.93
Mean rating	3.91
SD	.63

APPENDIX S: Involvement in and Satisfaction with the Energy Challenge by Treatment

Comparison of involvement and satisfaction measures across treatments

	Monthly feedback *M* (*SD*)	Weekly feedback *M* (*SD*)	Weekly feedback + stories *M* (*SD*)	*F*	*p*
Number of logs completed	3.04 (1.15)	3.54 (.83)	3.00 (1.11)	1.98	.15
Perceived effort	3.39 (.66)	3.50 (.72)	3.32 (.65)	.42	.66
Booklet satisfaction	3.55 (.65)	3.65 (.78)	3.34 (.86)	.89	.42
Overall satisfaction	4.27 (.69)	4.59 (.48)	4.17 (.98)	2.07	.13

APPENDIX T: Comparison of CO_2 Savings by Treatment

CO_2 savings by treatment condition

	Total CO_2 savings (lbs.)			CO_2 savings per person per week (lbs.)		
	M	*SD*	*Median*	*M*	*SD*	*Median*
Monthly feedback	295	327	157	39.6	31.6	30.0
Weekly feedback	338	289	259	46.1	50.1	28.6
Weekly feedback + stories	270	277	152	32.3	44.6	34.2

Note: Values are adjusted after excluding three extreme cases with savings > 1,500 lbs.

APPENDIX U: Assumptions Underlying Monthly CO_2 Savings

Assumptions underlying monthly CO_2 savings for each behavior

Behaviors	Potential impact per person (lbs. CO_2) *per instance*	*per month*	*Assumptions underlying monthly savings*
Home energy			
1. Turn off computer(s) when not in use	0.4 - 1.3	10 - 36	Laptop = 2.5 lbs./week Desktop = 9 lbs./week x 4 weeks
2. Wear more clothes instead of turning up the heat	2.0	60	Avoid turning up thermostat 1 degree for entire day;2 lbs. x 30 days
3. Take showers of 6 minutes or less	0.8	22.5 - 90	.75 lbs per shower x 30 days x up to 4 household members
4. Wash laundry in cold water	3.0	18 - 96	6 to 22 loads/month depending on household size
5. Unplug electrical chargers[a]	-	-	-
6. Keep the heat turned down to 62°F or below when sleeping	5.5	165	5.5 lbs. saved every 8 hours that thermostat is lowed 8 degrees x 30 days
7. Turn electronic devices completely off by unplugging them or controlling them with a power strip	1.1	32	1.1 lbs x 30 days
8. Turn off the heated dry setting on the dishwasher	0.5	7.5 - 15	Assumes dishwasher is run every day or every other day
9. Keep the heat turned down to 62°F or below when no one is home	5.5	165	5.5 lbs. saved for every 8 hours that thermostat is lowed 8 degrees x 30 days
10. Cook with a microwave or toaster oven instead of oven	1.0 - 2.0	4 - 8	Toaster oven saves 1 lb.; Microwave saves 2 lbs. x 1 meal per week not cooked in oven
11. Air dry laundry	5.0	30	Assumes 6 loads of laundry/month
12. Use compact fluorescent light bulbs	0.4	12	Assumes 1 bulb replaced
Personal transportation	*per 5 miles avoided*		
13. Consider whether I really need to drive somewhere	5.0	20	Assumes one 5-mile trip is avoided per week x 4 weeks
14. Plan errands to minimize number of car trips	5.0	20	same as above
15. Walk or bike instead of driving	5.0	20	same as above
16. Turn off the car while waiting for someone	0.9	24	Avoid 5 minutes of idling each day (.85 lbs) x 30 days

Table continued

17. Take the bus or carpool instead of driving	1.3 - 3.8	5 - 15	1.25 lbs. avoided on bus; Up to 3.75 lbs. avoided if carpooling with 3 others Assumes replacing one solo car trip of 5 miles per week x 4 weeks
Dietary choices	*per meal*		
18. Eat meatless meals	6.0-22.0	24 - 88	Replace chicken with vegetarian (6lbs.) or Beef with vegetarian (22 lbs) for 1 meal per week x 4 weeks
19. Buy locally produced food	0.5	2	Assumes having one local-based meal per week x 4 weeks
20. Eat organic food	0.5	2	Assumes having one organic-based meal per week x 4 weeks

Note: This table is organized to match Table 5.1 in Chapter 5.
Numbers may vary slightly from the information in the booklet. The Energy Challenge took place over 4 weeks, so estimates in the booklet were based off of 28 days or 4 weeks.
[a]Estimates are not provided for #5, "Unplug electrical chargers" as the savings from this behavior are accounted for in item #7, "Turn electronic devices completely off by unplugging them or controlling them with a power strip."

APPENDIX V: Comparison of Low and High Exploration Clusters

	Pretest means						Posttest means					
	Low Exploration		High Exploration				Low Exploration		High Exploration			
Behaviors	*N*	*Mean*	*SD*	*Mean*	*SD*	*p*	*N*	*Mean*	*SD*	*Mean*	*SD*	*p*
Home energy												
1. Turn off computer(s) when not in use	68	4.03	(1.09)	3.69	(1.22)		68	2.21	(1.52)	2.62	(1.44)	
2. Wear more clothes instead of turning up the heat	69	**4.60**	**(.68)**	**4.03**	**(.90)**	< .01	68	**1.90**	**(1.24)**	**2.85**	**(1.16)**	< .01
3. Take showers of 6 minutes or less	67	3.59	(.98)	3.47	(1.08)		67	**1.69**	**(1.39)**	**2.89**	**(1.31)**	< .001
4. Wash laundry in cold water	69	3.90	(1.03)	3.74	(1.14)		69	**1.57**	**(1.14)**	**2.85**	**(1.57)**	< .001
5. Unplug electrical chargers (e.g., for cell phone)*	68	3.41	(1.62)	2.95	(1.56)		61	2.15	(1.69)	2.43	(1.40)	
6. Keep the heat turned down to 62°F or below when sleeping	68	**4.28**	**(1.28)**	**3.28**	**(1.52)**	< .01	63	**1.74**	**(1.40)**	**2.69**	**(1.72)**	<.05
7. Turn electronic devices completely off by unplugging them or controlling them with a power strip	69	2.97	(1.33)	2.74	(1.02)		67	**1.76**	**(1.15)**	**2.37**	**(1.36)**	<.1
8. Turn off the heated dry setting on the dishwasher*	51	**4.00**	**(1.49)**	**2.69**	**(1.71)**	< .01	47	1.75	(1.61)	2.68	(1.74)	<.1
9. Keep the heat turned down to 62°F or below when no one is home	68	4.17	(1.47)	3.54	(1.47)		63	**1.70**	**(1.35)**	**2.64**	**(1.61)**	<.05
10. Cook with a microwave or toaster oven instead of oven	57	3.69	(.89)	3.24	(1.20)	<.1	59	**1.48**	**(1.01)**	**2.24**	**(1.30)**	<.05
11. Air dry laundry	68	**2.85**	**(1.62)**	**2.25**	**(1.13)**	<.1	60	**1.42**	**(.88)**	**2.11**	**(1.17)**	<.05
12. Use compact fluorescent light bulbs	69	3.87	(1.14)	3.90	(1.17)		58	1.50	(1.22)	1.38	(.92)	
Personal transportation												
13. Consider whether I really need to drive somewhere	67	3.64	(1.28)	3.67	(.96)		68	**1.52**	**(.70)**	**3.18**	**(1.17)**	<.001
14. Plan errands to minimize number of car trips	67	4.36	(.91)	4.36	(.74)		67	**1.36**	**(.68)**	**3.08**	**(1.29)**	<.001
15. Walk or bike instead of driving	68	2.90	(1.30)	3.00	(.96)		62	**1.13**	**(.49)**	**2.34**	**(1.15)**	<.001
16. Turn off the car while waiting for someone*	67	4.25	(.84)	4.03	(1.04)		60	**1.09**	**(.29)**	**2.46**	**(1.41)**	<.001
17. Take the bus or carpool instead of driving	68	2.70	(1.47)	2.71	(1.16)		56	**1.14**	**(.47)**	**1.68**	**(.95)**	<.01
Dietary choices												
18. Eat meatless meals	69	3.63	(1.13)	3.59	(.75)		69	**1.53**	**(1.11)**	**2.38**	**(1.21)**	<.01
19. Buy locally produced food	68	3.69	(.89)	3.51	(.76)		68	**1.41**	**(.73)**	**2.49**	**(1.43)**	<.001
20. Eat organic food	69	3.27	(1.11)	3.23	(.81)		68	**1.30**	**(.91)**	**1.90**	**(1.29)**	<.01

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