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# Exploring Everyday Energy Usage Practices in Australian Households: A Qualitative Analysis

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**Abstract:** In recent years, energy conservation research has identified a number of household actions that have the potential to drive significant reductions in carbon emissions in the near-term, without requiring substantial changes to householders' lifestyles or imposing significant financial costs. In this qualitative study, we investigate the potential of some of these actions for behavioral modification by asking householders to reveal the reasons why they perform (or fail to perform) such actions. As part of a telephone survey, a sample of customers ($n$ = 1541) from an Australian energy retailer were asked about their reasons for engaging in specific energy usage practices in one of five household domains: laundry, kitchen, bathroom, space heating/cooling or general appliance usage. Qualitative analyses of participants' open-ended responses revealed that practices in the laundry and kitchen appear to hold the greatest promise for behavioral change, whereas practices in the shower may be more challenging to modify. Integrating our findings with current psychological and sociological knowledge, we present a range of possibilities for future behavior change interventions at the practice-level.

**Keywords:** household energy practices; electricity consumption; practice theory; behavior change

## 1. Introduction

In response to the pressing need to reduce greenhouse gas emissions sooner and more certainly than what might be accomplished via regulatory measures, a growing number of social scientists have broadened the view of energy over-consumption—moving from the "homo-economicus" perspective that seeks to remedy knowledge-deficits and optimize cost-benefit calculations at the individual level, towards a more comprehensive, systems-based assessment of forces that initiate and perpetuate everyday practices that consume energy [1]. For instance, underpinned by theories of social practice, sociological research proposes that it is the expression of several interwoven energy-intensive practices (such as laundering, bathing and cooking) that contributes to resource consumption, and as such, practices should be the unit of analysis rather than the people who are simply the "carriers" of these practices [1–6]. Additionally, the study of habits recognizes the powerful influence of broader situational, environmental and perceptual factors in shaping and perpetuating such routine, automatic practices [7–10]. Both approaches recognize that human behavior is not autonomously shaped by the person per se, but rather, by the field of forces that exist in the natural and social habitat that surrounds the person. This type of systems-based thinking stems from early sociological/psychological theorizing by Kurt Lewin [11]—an approach that has been recently reinvigorated by Oishi and Graham [12,13]. By assessing the "total field" to determine the types and significance of environmental forces (i.e., social, cultural, historical, technological, economic) that underpin everyday energy usage practices, it

is possible to identify a broader range of causal factors and design a wider variety of interventions [6], thereby providing greater potential for achieving nearer-term and longer-lasting system change.

To date, research applying this systems-based view has yielded valuable insights into a range of household energy usage practices, including how and why people cool/heat themselves and their homes [14–19], use lighting [19,20], turn off standby power [21], shower/bathe [19,22–24], wash clothes and dishes [19], freeze food/drinks [25,26], and perform a range of "green" practices [27]. Such research underscores the routine nature of everyday practices that consume energy, and how people engage in these practices to achieve a valued outcome or to satisfy certain needs such as convenience, comfort and cleanliness [28]. In the sociological literature, the concept of an "affordance" [29] has been introduced to refer to the potential utility (as perceived by an individual) that an object or environment is able to offer. For example, the laundry comprising the washing machine and clothes dryer is perceived by people to afford clean, dry clothes in a convenient way. However, note that there may be quite substantial differences in how people practice laundering to achieve these same outcomes, due to such things as the infrastructure or technology available to them (e.g., a clothesline), the person's built knowledge (e.g., practical know-how and skill in cleaning clothes) and their attunement to different affordances (e.g., attuned more to convenience because of a busy lifestyle).

While not common, there are a few examples of how interventions founded on a systems-based approach have contributed to the decay of old practices and/or emergence of alternative practices. For example, introducing a congestion charge scheme along with investment in public transport has been associated with changes in daily mobility practices [23]; providing easier access to recycling services has been associated with higher recycling practices [30]; and providing labels that highlight the environmental affordances associated with certain household practices have been found to reduce water usage during times of restriction [31].

Despite these successes, there remains vast scope to design and test interventions that modify many of the more inconspicuous, mundane in-home practices that influence overall patterns of residential energy consumption and conservation—particularly those practices that are considered high impact in terms of their emissions savings potential. To address this gap in the literature, our study aims to provide greater insight into the specific energy-saving and wasting practices that hold the most promise for securing reductions in energy consumption. By exploring the reasons why householders engage (or do not engage) in everyday high-impact practices, we aim to delve deeper into the meanings or affordances that comprise the practice itself so as to identify opportunities for negotiability, reconfiguration and/or rearrangement of practices in future intervention efforts. Combining our findings with existing literature on social practices, we provide practical suggestions for future intervention-based research that aims to modify everyday practices in ways that lead to significant energy savings and emissions reductions.

Prior research has already sought to identify specific practices that are more or less impactful in terms of their emissions—thereby informing behavior change practitioners and policy-makers about where to invest effort to achieve significant near-term reductions in emissions. These studies have quantitatively documented the potential reduction in energy consumption and carbon emissions that could be derived from immediate changes in many practices in and around the home [32–35]. While different assumptions are made and different household actions are included across studies—for example, Dietz et al. [32] base adoption estimates on the rates known from previous behavioral intervention trials in inducing current non-adopters to take action in the future, whereas the National Resources Defense Council and the Garrison Institute assume that 100% of the population would adopt the action—the conclusions are similar. It appears that small to moderate changes in a select number of household actions have the potential to significantly reduce total national carbon emissions in the range of 7.4% to 22% [32–35].

In applying these findings to real-world behavior change efforts, it can be tempting to focus on those actions that are anticipated to yield the highest return in terms of energy savings or emissions reductions. However, as mentioned by the authors of the aforementioned research, it is recognized

that alternative actions vary considerably in terms of the likelihood that a householder will actually perform the action (or alternatively what proportion of the population will) [32,34,36]. Considerations such as whether the action is easy or difficult to perform, whether it is a one-off versus repeated behavior, or whether it costs money can influence adoption of the action. It is therefore important to consider not only the potential impact of various actions on energy savings and emissions reductions, but also how easy and effortless it is for a householder to perform the action and whether there are any financial barriers to doing so.

In light of this, in the current study we specifically focus on examining the category of low or no-cost household actions that consume electricity, taking the view that these actions may have a relatively high prospect of being effectively managed and modified through the application of inexpensive interventions. As part of a telephone survey, we asked 1541 Australian householders about their energy usage practices in a single household domain—either the laundry (clothes washing and drying), kitchen (second fridge/freezer and dishwashing), bathroom (showering), space heating/cooling (use of air conditioners and heaters) and general appliance usage (turning off appliances and standby). The general research question we sought to answer was:

> *For what reasons do householders perform (or fail to perform) energy-consuming practices, and based on these reasons, how might householders be encouraged to adopt new everyday practices that consume less energy?*

It is considered that many of the reasons put forward by householders will simply refer to the fundamental service or outcome that the particular practice enables or produces. However, other valuable insights may be yielded. For example, because people endeavor to use and modify objects/environments to elicit more personally satisfying affordances, it is possible that our study will reveal what people are doing to achieve better outcomes for themselves and their household.

## 2. Results

Tables 1–5 present the results of the qualitative analysis of householders' responses to the question of why they engage in specific energy usage practices in the laundry, kitchen or bathroom, or in terms of space heating/cooling or use of general appliances.

### 2.1. Laundry Practices

In the laundry (see Table 1), the majority of householders reported that they washed their laundry using cold water, on full loads ($n$ = 257, 83.71%), and hung it out to dry on the clothesline ($n$ = 261, 85.02%). A small percentage claimed the opposite actions—that they washed their laundry in hot water, on partial loads ($n$ = 44, 14.33%), and used the clothes dryer ($n$ = 40, 13.03%).

For washing full loads in cold water, many householders spoke about the energy/water savings ($n$ = 100, 32.57%), and cost savings ($n$ = 37, 12.05%) (e.g., "Cold water doesn't cost as much and the full load is trying to be cost effective again with energy", "Doing a full load makes more sense—a time factor as well as an energy factor", "We don't want to use lots of water and electricity").

Similarly, householders explained that they avoided using the dryer to help save energy ($n$ = 75, 24.42%) or money ($n$ = 71, 23.13%) (e.g., "I don't like using excess energy and the clothes wear out faster by using a dryer", "I don't have a dryer. It is a waste of energy and money", "Because the dryer is essentially a big heater and it uses a lot of energy"). Many householders did not even have a clothes dryer ($n$ = 80, 26.06%; e.g., "I actually don't have a dryer", "I did have a dryer but it put my power bill up too high so I gave it away").

Householders who performed energy-efficient laundry washing and drying practices also explained that it was part of their routine, met their lifestyle needs and/or was convenient for them to do ($n$ = 51, 16.61% for both washing and drying; e.g., "We are lazy and we only wash once a week and we all work", "For me, I don't like doing half loads wasting water and it's a lot more convenient to do one load", "More convenient. I always hang on line"). The dryer was seen as something that would

only be used occasionally, such as in the event of wet or cold weather ($n$ = 39, 12.70%; e.g., "Only a time that would be in winter", "Dryer is only used when it needs to be, it depends on the weather, only used in wet weather", "Except when it's pouring rain").

**Table 1.** Reasons given for engaging in energy-efficient and energy-inefficient practices in the laundry domain ($N$ = 307).

| Laundry Practice | Sample $N$ (%) | Reasons Provided | Description | Sub-Sample $n$ (%) |
|---|---|---|---|---|
| Wash in hot water and/or wash partial loads | 44 (14.33%) | • Partial practice | Does not perform complete practice—hot/warm water but always full loads; or washes frequent partial loads but with cold water | 17 (5.54%) |
| | | • Good results | Hot water results in clean clothes | 16 (5.21%) |
| | | • Lifestyle/routine | Fits lifestyle—washing as required, convenient, routine | 12 (3.91%) |
| Wash in cold water, and/or wash full loads | 257 (83.71%) | • Conserving resources | Concerned about saving energy and/or water; and the environmental benefits | 100 (32.57%) |
| | | • Lifestyle/routine | Fits lifestyle—washing as convenient, routine | 51 (16.61%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity/water bill | 37 (12.05%) |
| | | • Good results | Cold water results in clean clothes and is gentle on clothes | 27 (8.79%) |
| Use clothes dryer | 40 (13.03%) | • Lifestyle/routine | Fits lifestyle—drying clothes as required, convenient, routine | 13 (4.23%) |
| | | • Climate-dependent | Weather is too cold and/or wet | 13 (4.23%) |
| | | • External constraints | No clothesline or it is difficult to use | 11 (3.58%) |
| Hang laundry on clothesline | 261 (85.02%) | • External constraints | No clothes dryer | 80 (26.06%) |
| | | • Conserving resources | Concerned about saving energy and the environmental benefits | 75 (24.43%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 71 (23.13%) |
| | | • Good results/ optimal climate | Climate is optimal, results in fresh, dry clothes | 63 (20.52%) |
| | | • Lifestyle/routine | Fits lifestyle—drying clothes on clothesline is convenient, routine | 51 (16.61%) |
| | | • Partial practice | Does not perform complete practice—occasionally uses clothes dryer | 39 (12.70%) |

Additionally, householders sometimes explained how cold-water washing practices resulted in better results for clothes ($n$ = 27, 8.79%; e.g., "I was always told that cold water will bring out the stains instead of hot water—it shrinks and keeps the stains in", "I've always washed in cold water ... because I find my clothes last a long time in cold water", "Cold washes a lot better than hot water. Seems to get the stains out a lot better"), and that the climate was optimal for achieving fresh and/or dry clothes ($n$ = 63, 20.52%; e.g., "Climate perfect for drying especially in summer", "Things dry better in the breeze", "I like the freshness on the line").

The relatively smaller number of householders who stated that they washed in hot water and/or partial loads sometimes clarified their behavior by explaining that they did not perform that practice all the time, or in quite the same manner as described ($n$ = 17, 5.54%; e.g., "We wash in warm water but have a full load before we turn the washing machine on", "We use warm water but we do mostly wait for a full load"). Yet some specifically explained that hot water was required to meet their needs for clean clothes ($n$ = 16, 5.21%; e.g., "I seriously find the clothes look better. They're so much cleaner with the warm water", "Nothing comes clean in cold water", "I use hot water because the clothes are dirty and will be cleaned quickly. It dissolves better in hot water"). Others explained that they washed

partial loads and/or frequently because it suited their lifestyle (e.g., as a busy, working family) and they had to wash as required when they had the time ($n$ = 12, 3.91%; e.g., "We work in the city so we don't have the time to worry about washing so we just have to wash what we have to when we have to", "The kids nag for me to wash certain items. I have teenagers—three of them", "I would do a load once a day and sometimes it is full load and sometimes not. It is just a routine").

The small number of householders who used the clothes dryer explained that their busy lifestyles required quick access to dry clothes and the dryer was a convenient option to satisfy this need ($n$ = 13, 4.23%; e.g., "I am busy and use the dryer a lot. It is my lifestyle and we put the dryer on when we go to bed", "I don't have time to hang the washing out"). A few householders also cited factors outside their control, such as unfavorable weather or seasonal conditions ($n$ = 13, 4.23%; e.g., "We live in Melbourne and it is always raining and we run out of time", "During winter yes, during summer not much, but most of the time we use the dryer") or the lack of/difficulty in accessing outdoor clothesline space ($n$ = 11, 3.58%; e.g., "I don't have a clothesline, I do but it's not usable. The clothes rack doesn't hold enough", "Because the laundry line outside is not put up yet and I had to take the old one down") as reasons for relying on the clothes dryer.

### 2.2. Kitchen Practices

In the kitchen (see Table 2), more than half of householders reported using only one fridge ($n$ = 184 people, 59.74%), with many stating that this was sufficient for their household needs ($n$ = 122, 39.61%; e.g., "That's more than enough for the house", "We don't need to run another"). Some also mentioned it helps reduce their energy consumption ($n$ = 12, 3.90%; e.g., "We have no need for a second fridge and we wouldn't have one because fridges are the highest users of electricity", "I also wouldn't have a second fridge because of energy consumption and consider it a waste") and associated costs ($n$ = 22, 7.14%; e.g., "Because I am not an idiot to waste money on another fridge—because of the cost of the fridge and the running of it and the cost to the environment", "I can't afford the power to run a second fridge").

The remaining householders ($n$ = 122 people, 39.61%) indicated that they used a second fridge or freezer. Many mentioned that they required more space, perhaps because of a large family and/or many friends ($n$ = 57, 18.51%; e.g., "I have two fridges because I can't get a fridge big enough for a family", "I use the freezer mainly and the fridge is used for extra storage. My freezer in the indoor fridge is not big enough", "We have a large family", "We need more room, I have my daughter living with us at the moment", "It's a space thing. Gives you more room"). There also was specific mention of the need to store/freeze food in the freezer ($n$ = 44, 14.29%; e.g., "I have a big chest freezer to store more frozen products, so I can buy in bulk", "I have a big vegetable garden and freezing is the only way that I can store the produce that I grow", "It's a bait freezer outside for my husband's fishing on holidays"). Some householders also mentioned they ran a second "drinks", "bar" or "beer" fridge ($n$ = 32, 10.39%; e.g., "I like having the bar fridge"), and finally a small number mentioned that they had just acquired two fridges due to circumstance ($n$ = 6, 1.95%; e.g., "When we bought our new fridge, we kept our old one in the garage", "Just because somebody wanted me to rent a house but nobody wanted it, so they gave us the fridge when we helped them take over their lease").

The comparatively more efficient practice of washing up by hand in the sink (versus running the dishwasher all the time, only when partially loaded) appeared to dominate ($n$ = 281, 91.23%). It was apparent that while many of these householders still used their dishwasher, their usage was either infrequent, only when the machine was fully loaded, or involved an efficient dishwasher ($n$ = 125, 40.58%; e.g., "We normally only ever use the dishwasher if we have guests", "We only use the dishwasher when entertaining and it gets full", "We have a dishwasher that is energy efficient and water efficient and it's also got a power cutoff switch"). The small number who conceded that they did routinely use a dishwasher ($n$ = 14, 4.55%) also tended to provide similar comments ($n$ = 10, 3.25%; e.g., "We use the dishwasher all the time but only when it is full", "We put the dishwasher on when it's full, but we don't usually hand wash", "We run the dishwasher continuously but not partly full. We only run it when it's full").

**Table 2.** Reasons given for engaging in energy-efficient and energy-inefficient practices in the kitchen domain ($N$ = 308).

| Kitchen Practice | Sample *N* (%) | Reasons Provided | Description | Sub-Sample *n* (%) |
|---|---|---|---|---|
| Use a second fridge/freezer | 122 (39.61%) | • Lifestyle/household needs | Fits lifestyle—need more space for large family and/or friends | 57 (18.51%) |
| | | • To freeze produce | Need to freeze produce | 44 (14.29%) |
| | | • For drinks | Separate drinks fridge | 32 (10.39%) |
| | | • Circumstance | Ended up with two fridges | 6 (1.95%) |
| Use one fridge | 184 (59.74%) | • Lifestyle/household needs | Fits lifestyle—one fridge provides sufficient space for household's needs | 122 (39.61%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity/water bill | 22 (7.14%) |
| | | • Conserving resources | Concerned about saving energy and the environmental benefits | 12 (3.90%) |
| Use dishwasher all the time and/or partial loads | 14 (4.55%) | • Partial practice | Does not perform complete practice—uses dishwasher all the time, but only when full, or has an economical dishwasher | 10 (3.25%) |
| | | • Lifestyle/routine | Fits lifestyle—using dishwasher is convenient, routine | 5 (1.62%) |
| | | • Questionable resource and cost savings | Dishwasher does not consume much energy; does not cost a lot to run | 4 (1.30%) |
| Usually wash up by hand | 281 (91.23%) | • Partial practice | Does not perform complete practice—uses dishwasher when full, or has an economical dishwasher | 125 (40.58%) |
| | | • External constraints | No dishwasher | 112 (36.36%) |
| | | • Lifestyle/routine | Fits lifestyle—washing up by hand is convenient, routine | 85 (27.60%) |
| | | • Conserving resources | Concerned about saving energy and/or water, and the environmental benefits | 54 (17.53%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 24 (7.79%) |
| | | • Good results | Dishes are cleaner when washed in sink | 11 (3.57%) |

However, many householders did not own a dishwasher at all ($n$ = 112, 36.36%; e.g., "I don't have a dishwasher because I think they're a waste of time. I can use my hands") or simply reported that washing up in the sink was part of their routine, was more convenient/easier and fitted their "small household" lifestyle ($n$ = 85, 27.60%; e.g., "We normally hand wash the dishes because we're a small family, we don't have that many dishes to wash so we just hand wash", "We don't have a dishwasher and I have done washing for 35 years and I'm not going to change").

Some householders spoke of their desire to save water and energy ($n$ = 54, 17.53%; e.g., "I got one but you don't use it because it's not efficient and it's wasting water", "We are pretty conscious of using too much energy", "Obviously we are energy conscious and water wise to a certain point"), while comparatively fewer mentioned cost savings ($n$ = 24, 7.79%; e.g., "I wash by hand because running a dishwasher is too expensive for the electricity bill", "Need to keep costs under control", "It costs too much money, we only run it when it is really full"). A few spoke of the ability to achieve a better outcome when washing in the sink ($n$ = 11, 3.57%; e.g., "Dishwasher is not reliable for cleaning sometimes I can still see dirt on my dishes", "I don't like dishwashers—they do not clean as well as your hands and I am fussy and hygienic").

The householders who agreed they used a dishwasher all the time also occasionally mentioned how the dishwasher may not be using that much energy or may not be costly to run ($n$ = 4, 1.30%; e.g., "I found the dishwasher wasn't really using that much power", "I use the dishwasher all the time as it saves money and water rather than hand washing"). A similar number also mentioned how it was a

convenient way to wash as it helped save time ($n$ = 5, 1.62%; e.g., "I believe the dishwasher is more efficient and less time consuming as well", "Use dishwasher daily. Saves water. Convenience").

### 2.3. Bathroom Practices

Many reasons were put forward to explain bathroom practices (see Table 3), and this was one of the areas in which the proportions of householders claiming energy efficient and inefficient practices were relatively even. A little under half of householders claimed that they had long, hot, daily showers ($n$ = 139, 45.72%) whereas just over half claimed they had short, cooler and less frequent showers ($n$ = 161, 52.96%).

**Table 3.** Reasons given for engaging in energy-efficient and energy-inefficient practices in the bathroom domain ($N$ = 304).

| Bathroom Practice | Sample $N$ (%) | Reasons Provided | Description | Sub-Sample $n$ (%) |
|---|---|---|---|---|
| Has long, hot, daily showers | 139 (45.72%) | • Stress relief and/or pleasure | Practice is enjoyable and relaxing | 36 (11.84%) |
| | | • Cleanliness | Practice makes me clean and/or hygienic | 34 (11.18%) |
| | | • Partial practice | Does not perform complete practice—has daily showers but quick ones; or has less frequent showers | 30 (9.87%) |
| | | • Lifestyle/routine | Fits lifestyle—showering everyday is routine, habitual | 20 (6.58%) |
| | | • Unconcerned about conserving resources | Unconcerned about saving energy and/or water; and the environmental benefits | 16 (5.26%) |
| | | • Access to perceived cheap resource | Has own solar, gas and/or tank water | 16 (5.26%) |
| | | • Unconcerned about cost | Unconcerned about the cost, saving money, reducing electricity/water bill | 7 (2.30%) |
| Has short, cooler, less frequent showers | 161 (52.96%) | • Partial practice | Does not perform complete practice—has hot or daily showers, but quick ones; or less frequent showers | 108 (35.53%) |
| | | • Conserving resources | Concerned about saving energy and/or water; and the environmental benefits | 71 (23.36%) |
| | | • Lifestyle/routine | Fits lifestyle—quick showering is convenient, routine | 26 (8.55%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity/water bill | 20 (6.58%) |
| | | • No need for more | No need to shower daily or for very long | 15 (4.93%) |
| Does not use low-flow shower heads | 119 (39.14%) | • Dissatisfied | Dissatisfied with showering performance of low-flow shower heads | 51 (16.78%) |
| | | • External constraint | Cannot change because renting the dwelling; or has not changed it yet | 23 (7.57%) |
| | | • No need to change | Perceives no need to change | 17 (5.59%) |
| | | • Alternative practice | Reduces the shower length instead of using low-flow shower heads | 13 (4.28%) |
| Uses low-flow shower heads | 168 (55.26%) | • Conserving resources | Concerned about saving energy and/or water; and the environmental benefits | 96 (31.58%) |
| | | • Pre-existing | Accepted water-saving measures provided by Government, or that were pre-existing | 22 (7.24%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 21 (6.91%) |
| | | • Satisfied with performance | Satisfied with showering performance of low-flow shower heads | 10 (3.29%) |

Householders who had long, hot, daily showers tended to cite reasons such as cleanliness ($n$ = 34, 11.18%; e.g., "Hygiene and cleanliness ... I don't like smelly people or being near smelly people", "Shower every day, I just think for cleanliness and young children play and get dirty and sweaty", "Like

to be clean, it's nice") as well as stress relief, relaxation and enjoyment ($n$ = 36, 11.84%; e.g., "It's a luxury, we enjoy showers", "Because it feels good after a long day at work, the luxury", "Stress release").

However, many also clarified that their behavior was not fully consistent with the showering description provided by the interviewer. These householders explained that they had short showers or less frequent showers ($n$ = 30, 9.87%; e.g., "We just have short hot showers", "We try to not be under the shower for too long but we shower every day", "Showering every day but not long hot showers"). Similar clarifying statements were put forward by those who claimed they had shorter, cooler, less frequent showers with many householders explaining that they had reduced the length or frequency of showering ($n$ = 108, 35.53%; e.g., "We do shower but don't tend to have long showers", "I do have two showers a day but I have quick ones", "Showering every second or third day").

A few householders explicitly stated that they had long, hot, daily showers because they were unconcerned with saving energy/water ($n$ = 16, 5.26%; e.g., "I don't think that has a massive bearing on the consumption of electricity in the household", "We have long showers because we like to take our time and we don't feel the need to rush and we're not concerned about water usage"), with some additionally referring to the fact that they could have long, hot, frequent showers because they have solar or gas heated water, or tank water at their disposal ($n$ = 16, 5.26%; e.g., "We have gas hot water", "We have always run our house on rain water and have never had short showers", "Tank water and solar so no restriction or reason to do that"). Again, some householders simply explained that having long, hot daily showers was just a part of their everyday lifestyle/routine and it was their personal choice to shower that way ($n$ = 20, 6.58%; e.g., "Habit—like long hot showers", "Normal lifestyle", "We habitually have hot showers and that is why we continue to have them—habit").

On the other hand, householders who claimed that they had short, cooler, and/or less frequent showers spoke about their desire to save energy/water ($n$ = 71, 23.36%; e.g., "We don't like wasting resources either the gas heater or water we don't like wasting", "I don't like wasting water or gas", "When we had [the] water crisis we started trying to save water and electricity and gas and it became a habit") or money ($n$ = 20, 6.58%; e.g., "The cost. Basically I am aware that the longer the shower the longer my pump works—so I am using more electricity and water", "It costs a lot of money and it is wasting water"). Some also explained that the practice was simply their personal preference, family routine or fitted their time-poor lifestyle ($n$ = 26, 8.55%; e.g., "I can't take very hot showers", "Because that's how we grew up", "Save water, time", "I happen to be busy all the time. It's because I've usually got too much on") and that they had no need for a long, hot or daily shower ($n$ = 15, 4.93%; e.g., "Every second day we shower, don't get sweaty as not doing physical activity", "I don't think it's necessary at the moment as I'm older now and not working", "No need to shower for that long").

More householders claimed that they used a low-flow showerhead ($n$ = 168, 55.26%) than not ($n$ = 119, 39.14%). The main reason put forward for not using a low-flow showerhead was dissatisfaction with its performance ($n$ = 51, 16.78%; e.g., "The water restricted ones aren't as nice, and though I'm mindful of water use, I like a quality product. I would much rather have a high quality short experience than a low quality long experience", "Because I want a quality shower and I like the pressure and I have a very big shower head", "I haven't found a good one that has much pressure"), with a few further justifying their (in)action by saying that they reduced the length or frequency of showering as a compensatory measure ($n$ = 13, 4.28%; e.g., "We don't like them [low-flow showerheads]. We prefer to cut the length of shower down", "We have a very strong running shower, we have a more efficient way of having a shower by cutting the amount of time for having a shower", "We don't use low-flow because you don't get very wet, but we have short showers"). Some stated that they could not modify the type of showerhead they have because they were renting the dwelling ($n$ = 23, 7.57%; e.g., "No, but we're in a rental property", "I just rent the apartment and that's the way it was"). A few comments were made that conveyed a general lack of awareness or a sense of not really needing to make a change ($n$ = 17, 5.59%; e.g., "Never thought about it", "I don't see the need for it", "We just built our house in the last year and don't want to upgrade it", "That's what was there when bought the house and didn't change").

By contrast, those householders who did use a low-flow showerhead tended to mention their concern about saving energy or water ($n$ = 96, 31.58%; e.g., "Saves energy and water", "To save water because we have gas instant heating system, to minimize the electricity usage"). Coming a distant second and third reason to the foregoing were references to prior water-saving programs or pre-existing low-flow shower heads ($n$ = 22, 7.24%; e.g., "When water restrictions were in we changed them over", "Was given for free", "We have the slow flow showerhead. I think it was put in for everyone in the area. Like someone came around and gave us energy globes and the showerheads", "We bought the house and it was already here so we didn't put one in") and cost savings ($n$ = 21, 6.91%; e.g., "We don't want to spend more water, because of the bill", "Because I'm trying to cut down on my water so the bill is not as high"). Finally, some householders also mentioned that the low-flow showerheads were performing well ($n$ = 10, 3.29%; e.g., "To reduce the power I use and to increase the pressure in the water", "We have excellent water pressure so they can stay in there", "I think it is a better shower because it is more concentrated").

### *2.4. Space Heating and Cooling Practices*

Space heating and cooling (see Table 4) was another domain where most householders claimed energy-efficient practices, specifically that they limited use of air conditioning in summer ($n$ = 286, 91.67%), and heating in winter ($n$ = 239, 76.60%). Interestingly, a very similar set of reasons was put forward for both efficient cooling and heating practices. First, many householders sought to clarify that they still used the air conditioner or heater, but that they restricted or limited their usage in some way ($n$ = 179, 57.37% for air conditioning, and $n$ = 89, 28.53% for heating; e.g., "I only put my air conditioning on when it's stinking hot", "We only have the air conditioner on when it's really hot", "If it is really hot when we come home—use air conditioning", "We don't keep it on all the time, only use it when it is really hot", "I normally use a heater in my bedroom and only use if pretty cold", "Only use heater when really cold"). Interestingly, similar clarifications and justifications also were made by those who admitted the energy-inefficient practices of using air conditioning all through summer ($n$ = 23, 7.37%), or heating all through winter ($n$ = 68, 21.79%). Here, a few householders explained how they still tried to cut back their usage of air conditioning ($n$ = 4, 1.28%; e.g., "If the weather cools down we turn it down, but only if it cools down", "We just have the air con or fans on when we are home and switch them off when we are not home") and heating ($n$ = 16, 5.13%; e.g., "We're only in a little townhouse and it doesn't take much to heat it up actually", "We like the warmth but it wouldn't go on till 5.00 or 6.00 till around 10.00. We run it in the morning sometimes if really cold for an hour").

The desire to save money and energy was a consistent justification for household practices limiting both air conditioning and heating ($n$ = 76, 24.36% and $n$ = 53, 16.99% for cost savings in air conditioning and heating, respectively; $n$ = 63, 20.19% and $n$ = 37, 11.86% for energy savings in air conditioning and heating, respectively; e.g., "I try to save energy whenever possible", "Because the air conditioner that I have is pretty expensive to run", "Mainly because my heating and cooling use about a third of the power usage so I try to limit it"). Some people mentioned that they did not have an air conditioner, although this was relatively uncommon ($n$ = 37, 11.85%; e.g., "We don't have air conditioning").

Some householders also stated that they preferred not to cool or heat their homes, feeling quite comfortable managing in hot weather ($n$ = 34, 10.90%; e.g., "I have high tolerance to heat", "I like mild natural air", "I like the heat and can cope with it") or cold weather ($n$ = 9, 2.88%; e.g., "I can cope with the cold and why waste energy when you can put on a jumper", "Not bothered by cold"). Householders also appeared to be quite adept at using alternative means to stay cool ($n$ = 65, 20.83%; e.g., "We generally have the doors open on hot days to let the hot air out of the house", "We open up windows, it saves on the power bills", "We tend to use the air con half an hour before we go to bed. It is costly to have it running all the time and we are not at home either so there is no point", "It is hot but we make the decision not to turn it on, we use fans"). Similarly, they spoke of an array of alternative means for staying warm ($n$ = 42, 13.46%; e.g., "Rather than use a heater, I will wear extra clothes and use an extra blanket or doona to cover myself when watching TV or whatever", "I use

blankets to be environmentally friendly and to save money", "I never use the heater. If I am cold, I'll put on a jumper or go to bed early and put an extra blanket on"). Quite a few householders also explained they used a wood fire instead of an electric heater ($n$ = 28, 8.97%; e.g., "We have a wood fireplace. No electric heating").

**Table 4.** Reasons given for engaging in energy-efficient and energy-inefficient heating and cooling practices ($N$ = 312).

| Space Heating and Cooling Practice | Sample $N$ (%) | Reasons Provided | Description | Sub-Sample $n$ (%) |
|---|---|---|---|---|
| Uses air conditioning in summer | 23 (7.37%) | • Cooling comfort | Practice provides coolth and comfort | 10 (3.21%) |
| | | • Partial practice | Does not perform complete practice—makes an effort to reduce air conditioner use | 4 (1.28%) |
| | | • Family needs | Household members need to be cool and comfortable | 2 (0.06%) |
| Limits use of air conditioning in summer | 286 (91.67%) | • Partial practice | Does not perform complete practice—uses the air conditioner but in a limited way | 179 (57.37%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 76 (24.36%) |
| | | • Alternative practices | Practices other ways to keep cool and comfortable | 65 (20.83%) |
| | | • Conserving resources | Concerned about saving energy; and the environmental benefits | 63 (20.19%) |
| | | • External constraints | No air conditioner | 37 (11.86%) |
| | | • Preference | Personal preference for feeling warm | 34 (10.90%) |
| Uses heating in winter | 68 (21.79%) | • Warmth and comfort | Practice provides warmth and comfort | 28 (8.97%) |
| | | • Family/health needs | Household members need to be cool and comfortable | 18 (5.77%) |
| | | • Partial practice | Does not perform complete practice—uses the heater but in a limited way | 16 (5.13%) |
| Limits use of heating in winter | 239 (76.60%) | • Partial practice | Does not perform complete practice—uses the heater but in a limited way | 89 (28.53%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 53 (16.99%) |
| | | • Alternative practices | Practices other ways to keep warm and comfortable | 42 (13.46%) |
| | | • Conserving resources | Concerned about saving energy and the environmental benefits | 37 (11.86%) |
| | | • Uses wood | Uses wood fire to keep warm and comfortable | 28 (8.97%) |
| | | • Preference | Personal preference for feeling cool | 9 (2.88%) |

The smaller numbers conceding that they did use air conditioning all summer long, and heating all through winter, gave the primary reason of thermal comfort. They just wanted to be cool and comfortable in summer ($n$ = 10, 3.21%; e.g., "Because we'd rather have it on and be comfortable rather than be uncomfortable", "Don't like to be hot", "I use mine all day because I can't handle the heat", "Because the house heats up"). Or likewise, they simply sought warmth in winter ($n$ = 28, 8.97%; e.g., "Because it's cold and we need to warm up", "I just like to feel comfortable", "I think because I hate being cold"). Sometimes, they explained these practices in terms of family reasons or health needs ($n$ = 2, 0.06% and $n$ = 18, 5.77% for air conditioning and heating, respectively; e.g., "Have elderly people in the house and need to keep it on", "I have young children so I want to keep them cool as well", "We use the heater as well because we have babies so it's very crucial for us to use the heater as well", "I don't believe in freezing with all the health issues I have got").

### 2.5. General Appliance Practices

In terms of general appliance use (see Table 5), householders who agreed they left appliances running ($n$ = 55, 17.74%) tended to speak about how their lifestyle revolved around the television and as such, it was simply left on much of the time ($n$ = 27, 8.71%; e.g., "Just move around the house, just go somewhere different in the house and just don't turn it off", "Because you usually just have a short break from watching TV and then go back. We are looking at the TV but we do other things too", "It keeps the kids occupied while I do things around the home"). Similarly, some also spoke about how it was convenient to keep the computer on ($n$ = 6, 1.94%; e.g., "It's mainly computers that are left on", "Our computers tend to stay on when we're not using them. I go back and forth to the computer during the day and that's why I don't turn it off"). Another reason given for keeping appliances running when not in use was a lack of thought, forgetfulness, laziness and/or inconvenience ($n$ = 18, 5.81%; e.g., "Not very efficient with those things. Too lazy", "Just lazy and do not turn things off", "Just the inconvenience of turning things on and off. Mostly lazy").

**Table 5.** Reasons given for energy-efficient and energy-inefficient general appliance usage practices ($N$ = 310).

| General Appliance Practice | Sample N (%) | Reasons Provided | Description | Sub-Sample *n* (%) |
|---|---|---|---|---|
| Leaves appliances running when not in use | 55 (17.74%) | • Lifestyle | Fits lifestyle to leave television on | 27 (8.71%) |
| | | • Laziness/forgetulness | Inconvenient or too lazy/forget to turn off appliances | 18 (5.81%) |
| | | • Computer lifestyle | Fits lifestyle to leave computer on | 6 (1.94%) |
| Turns off appliances when not in use | 252 (81.29%) | • Remembers/routine | Remembers to turn off appliances, it is routine | 129 (41.61%) |
| | | • Conserving resources | Concerned about saving energy and the environmental benefits | 96 (30.97%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 69 (22.26%) |
| | | • Lifestyle | Does not watch television a lot | 26 (8.39%) |
| | | • Partial practice | Does not enact complete practice—others (e.g., children) may leave television on | 7 (2.26%) |
| | | • Safety | Switches off appliances for safety reasons | 4 (1.29%) |
| Leaves appliances on standby | 140 (45.16%) | • Difficult | Difficult or impossible to turn off appliances at powerpoint | 73 (23.55%) |
| | | • Lazy/forgetfulness | Inconvenient or too lazy/forget to turn off at the wall | 41 (13.23%) |
| | | • Negative impact on programming or appliance life | It will negatively affect timers, recording programs and/or the appliance's life | 13 (4.19%) |
| | | • Unavoidable | Some appliances cannot be turned off at the wall | 8 (2.58%) |
| | | • Question energy saving benefits | May not help save energy | 6 (1.94%) |
| Turns appliances off standby | 167 (53.87%) | • Remember/sroutine | Remembers to turn off standby, it is routine | 95 (30.65%) |
| | | • Conserving resources | Concerned about saving energy; and the environmental benefits | 82 (26.45%) |
| | | • Cost savings | Concerned about the cost, saving money, reducing electricity bill | 37 (11.94%) |
| | | • Partial practice | Does not perform complete practice—some appliances cannot be turned off at the wall | 26 (8.39%) |
| | | • Safety | Switches off appliances for safety reasons | 10 (3.23%) |

Many more householders admitted that they left appliances on standby ($n$ = 140, 45.16%). Here, householders tended to talk about the sheer physical difficulty of switching off appliances at the wall

($n$ = 73, 23.55%; e.g., "The power points are hard to get to behind the TV", "Hard to get to appliances because they are behind furniture"). However, some also admitted they were simply too lazy or forgetful, or that they preferred the convenience of having things on standby ($n$ = 41, 13.23%; e.g., "We have things on standby all the time ... for the convenience of flicking a switch and everything being ready", "Being lazy again I guess", "Can't be bothered to turn things off", "Again it's a habit, we're not used to turning everything off").

Whether householders left appliances on standby or not, some explained that it was often unavoidable for certain appliances ($n$ = 8, 2.58% for those who left appliances on standby, and $n$ = 26, 8.39% for those who turned off standby; e.g., "The microwave stays on and the computer stays on—that is the way it is done and don't know why", "TV and DVDs are on at the wall and the digital telephone is always on", "Yes we do that [turn off standby] with most appliances, but not the fridge"). Concerns about programming appliances were also raised by those who left things on standby ($n$ = 13, 4.19%; e.g., "The TV system with the DVD recorder every time you switch if off you need to reprogram it", "It interrupts the memory of particular items, for example, clock radios", "So that we don't lose internet connection"). A few also suggested that switching off standby might not even produce any energy savings ($n$ = 6, 1.94%; e.g., "Don't know that it makes much difference", "I think it takes more energy to turn it off and back on than it does to just leave it running").

For those householders who did turn off appliances or who did not leave them on standby mode, many stated that it was part of their routine, was easy enough, and something they just remember to do ($n$ = 129, 41.61% and $n$ = 95, 30.65% for appliances and standby, respectively; e.g., "I just got in the habit of doing it to save on power", "Just do it, it's the way I've been brought up you just get into the routine of turning things off"). In regard to appliances, many explained that they simply did not watch a lot of television ($n$ = 26, 8.39%; e.g., "Because I rarely watch TV", "We don't watch television all day long", "We actually don't watch very much TV anyway") but that sometimes it was left on by other household members, usually children ($n$ = 7, 2.26%; e.g., "Sometimes the kids leave it on", "My daughter will leave it running").

Energy savings were again mentioned by many householders who either turned off appliances or standby power ($n$ = 96, 30.97% and $n$ = 82, 26.45% for appliances and standby, respectively; e.g., "I don't like wasting energy. If I'm not here and I don't need to use the appliance it is pointless to have it on", "When we leave the room we turn the appliances off because we're very aware of saving energy consumption and trying to save the environment"). Cost savings were also mentioned as a rationale ($n$ = 69, 22.26% and $n$ = 37, 11.94% for appliances and standby, respectively; e.g., "I just expect if it's not on at the wall we're not using it and bills will be cheaper", "To save power and to keep the power bill down and to save energy generally speaking and as a money saving thing for us"). Finally, a few householders explained that they turned off appliances or standby as a safety precaution ($n$ = 4, 1.29% and $n$ = 10, 3.23% for appliances and standby, respectively; e.g., "We switch everything off at the wall. Saves energy and safety in case of power faults", "I turn my appliances off at the wall when not in use, because if I leave something on and it's faulty, there could be a fire and I don't want to die in a fire", "We do it more for fire precaution, a safety purpose").

## 3. Discussion

We now integrate the insights gleaned from our qualitative analysis with prior research, to inform future efforts at cultivating energy-saving practices in different household domains.

### 3.1. Laundry Practices

In the laundry, some of the householders who agreed that they practiced inefficient laundry practices expressed the belief that warm or hot water results in a "better" wash than cold water, as indicated by cleaner clothes. This finding is consistent with prior sociological research that discusses laundering as a practice for achieving clean garments [28]. Some householders also clarified that they did not wash frequently at all (but that they did use warm or hot water), while others stated

that although they washed frequent partial loads, they used cold rather than hot water when doing so. Householders also described the need to wash as frequently as needed, to fit into their lifestyle. A review of a larger number of qualitative comments from householders who used cold water (with a full load of washing) revealed a number of reasons for doing so. Most explained that it would save energy and/or water. However, quite a few householders also reasoned that cold water resulted in better outcomes (cleaner, longer-lasting clothes), and would help reduce their electricity bill. Many also stated that the way they washed clothes was simply a routine practice with the implication being that such practices were habits, performed at a convenient time and often with little conscious thought or effort.

Interestingly, similar reasons were cited by the majority of householders who explained why they refrained from using (or infrequently used) the clothes dryer, and instead relied on the clothesline to dry their clothes. While a good proportion did not even have a clothes dryer, many said that they were satisfied with the results achieved by hanging clothes on the line to dry, especially with a favorable climate. The few householders who stated that they did use the clothes dryer tended to offer a justification—that they only used the machine for short periods of time, for certain items of clothing, when the weather was too wet/cold and/or when they required a "fast dry" to meet their busy lifestyle needs.

Taken together, these qualitative results suggest that there is substantial scope to dispel the myth that hot water is required to clean clothing. For example, to motivate householders to change long-standing laundry practices, it may be fruitful to examine the effectiveness of simple messages to encourage the use of cold rather than hot water. Rather than using messages that focus on saving energy and money—which are presumably of less importance to householders who may be invested in using hot water for cleanliness—we would suggest using the same "cleanliness" message and testing variously-framed messages that explain that washing in cold or cooler water can actually yield favorable outcomes. This message might also require an accompanying explanation that many modern-day detergents have been designed to work most effectively at lower temperature wash cycles [37]. Given that some householders appeared to focus on the quality of the garment's outcome (in terms of cleanliness), it is also possible that an additional argument focused on durability—i.e., that clothes maintain color and are longer lasting when washed in cooler water—could motivate householders to lower the temperature. Similarly, messages that focus on drying quality (drier, fresher and crisper clothes) and avoiding risks such as clothes shrinkage might also prove effective in increasing householders' preferential use of the clothesline over the clothes dryer. Certainly, some householders were already well aware of these types of benefits from line drying, particularly in favorable weather conditions.

All of these suggestions are consistent with the notion of "affordances" as described earlier. Applying these principles to laundering practices, washing in either cold or hot water is simply perceived as affording clean clothing, and clothesline drying is perceived to afford fresh, dry clothes. Householders undertaking laundry tasks might be alerted to the same affordance of better cleaning outcomes (e.g., increased brightness and durability of the clothing fibers) that could be attained by using an efficient detergent at lower temperatures, and similarly, that better drying outcomes (e.g., avoiding shrinkage, increased freshness) can be attained by drying on the clothesline. To complement and reinforce this type of message, washing instructions on clothes and/or the default setting on washing machines (particularly those cycles labeled "normal") could be framed in a way that guides consumers toward lower washing temperatures. To test the impact of these alternative instructions and labels, randomized experiments could be conducted to identify the most optimal way of designing and communicating key messages to consumers. For example, past research has tested the effectiveness of raising a person's attunement to (water and energy) environmental affordances by way of labels [29,38]. This research found that householders were behaviorally receptive to water-attuning labels, but not to energy-attuning labels. The authors explained that recent water shortages might have naturally attuned people to water savings, thus suggesting that greater success might result from leveraging

off the same affordances that people are naturally attuned to when performing certain practices. In the laundry, our results suggest that people may be naturally attuned to longer lasting, fresh, clean, dry clothes.

### *3.2. Kitchen Practices*

Our findings suggest that affordances are also relevant in the kitchen domain. We found that householders who agreed that they ran either a second fridge, a bar fridge or a standalone freezer tended to explain such practices as being due to the storage benefits, as well as the convenience and entertaining aspects—for self and family. Of course, these are the natural functions (or affordances) offered by such a convenience device as the freezer or second fridge [25,26]. Essentially, the freezer/second fridge may be seen as helping to restore flexibility and control in a household's scheduling of meals and purchasing of food, something which may be especially valuable to those who live busy, time-pressured lives, and in households with many people.

In terms of trying to encourage consumers to use only a single fridge/freezer (and thus save on energy consumption and costs, as well as carbon emissions), these key findings suggest that rather than aiming to diminish consumers' desire to "stock up" the refrigerator/freezer with food and drinks, it might be possible to exploit the inertia of habitual behavior by explaining that "stocking up" one's cupboard may be just as effective as relying on a second fridge/freezer when it comes to the ease and convenience of having ample food readily available. Such messages could convey the simple point that many unopened foods and beverages do not require long-term refrigeration and can just as easily be stored in the cupboard. To satisfy consumers' desire for convenience, it could be recommended that householders reorganize their single fridge in a way that allows quick, easy and effortless access to foods and beverages when needed. It may also be beneficial to design fridges that provide slightly more freezer space (to meet the needs of consumers who would otherwise have purchased a separate standalone freezer)—within reason of course, noting that a fridge/freezer with a larger freezer compartment may consume more energy.

It might also be effective to convey the sizeable and ongoing energy and cost-savings that can be gained from simply switching off (and even trading in) the second household fridge or freezer. Certainly, these types of reasons were put forward by many of the householders who reported energy-efficient practices around household fridges and freezers. Additionally, some of these householders also explained that a single fridge was simply sufficient for their needs. An empirical question that remains to be tested is whether or not motivational messages that focus on energy- and cost-savings (or the avoidance of wasting energy and money) or satisfying immediate consumption needs actually succeed in modifying food storage and provision practices of households. However, certainly our suggestions have been carefully considered in light of, and with the intention to redefine, the essential elements of a practice that affords a way to conveniently store and provide food.

The sub-domain of washing up practices was somewhat similar to the practice of using the clothesline to dry clothes rather than the clothes dryer. A good proportion of householders did not have a dishwasher at all. And many of those who did have a dishwasher explained that they used it in an efficient way (only using it when the machine was fully loaded), or alternatively, the machine itself was economical to run. Some of the householders who said that they washed up in the sink rather than running a dishwasher (with partial loads) explained that they only have a small household/family—signaling that the approach to washing dishes may depend on household size. Similar to the reasons provided for only using one fridge, some householders mentioned concerns about cost, energy consumption and environmental impact. In addition, some householders also expressed hygiene or performance concerns with respect to the dishwasher.

### *3.3. Bathroom Practices*

In the domain of the bathroom, we found that householders' responses conveyed the direct affordances yielded through frequent, long hot showers. However, contrary to use of hot water

in the laundry, there were multiple meanings that appeared to satisfy both hedonic and utilitarian (instrumental/functional) consumption goals [39,40]. This finding is consistent with prior research on the multiple, complex forces that support frequent showering—including the desire to improve one's personal appearance, the therapeutic invigoration, refreshing or relaxation of the body, a complementary blending of duty with pleasure, as well as the sheer convenience of private showers [22,28]. In our research, we certainly observed householders who expressed the desire for a "quality" and enjoyable shower, and even a general willingness to shorten the length of their shower in order to maintain the heat, frequency and quality of the showering experience. Thus, some customers felt that their inefficient showering practices (e.g., using a low-flow shower-head and/or having frequent, long hot showers) were acceptable because they curtailed the duration of their shower instead. This rationalization shows some resemblance to the seemingly paradoxical phenomenon of "moral licensing"—the tendency for people to become less pro-social and ethical after they have performed a good deed, presumably because they feel they have then "earned a license" to engage in self-interested behavior [41]. Indeed, this effect has been used to explain the side effects of increased electricity consumption observed during a water conservation campaign among 154 apartment dwellers [42]. This study found that residents who received weekly feedback on their water consumption across a 7-week period, reduced their water consumption by 6%, but at the same time, increased their electricity consumption by 5.6% (relative to control) [42].

It is possible that the apparent trade-off between shower length and quality has been influenced by prior intensive water conservation efforts (i.e., water restrictions, per-person water usage targets, and water-efficiency measures) introduced in response to the severe drought that beset Australia for well over a decade (from 1995 to 2009). Indeed, the sole focus of such efforts at the time was to restrict water usage rather than electricity consumption, so it is possible that householders have become very well practiced in reducing water usage by way of minimizing shower length. However, to also forego what people consider the "quality" aspects of a shower (i.e., the pressure of the flow and heat of the water)—which presumably satisfy a range of complex needs and wants—might indeed be nonnegotiable for some householders. Indeed, many householders expressed dissatisfaction with low-flow shower heads, and some felt no need to change their current shower head. Thus, we suggest that any efforts to intervene in the domain of showering should be thoroughly pre-tested first, as it is possible that unintended or perverse outcomes may result from what people perceive as "interfering" in a practice that serves important, multiple and complex "needs".

### 3.4. Space Heating and Cooling Practices

The domain of space heating and cooling appeared to generate, in addition to the standard rationales about energy and cost-savings, descriptions of other actions undertaken by householders (either in terms of their own behavior or modifications to their home) to feel comfortable when it is cold (e.g., use blankets, jumpers, blinds/curtains) or hot (e.g., use fans, evaporative cooler, pool), which suggests that many people already knew and practiced alternative (and relatively more energy-efficient) ways to keep warm and cool. These results suggest that householders may be willing and able to modify their heating and cooling practices at home, with alternative actions perceived as simply a "better" and more positive way to say warm/cool rather than a personal sacrifice. Yet among these general comments about minimizing air conditioning and heater use—similar to that of the clothes dryer—it was apparent that householders still used these electric cooling/heating appliances, but only under extreme circumstances, in short bursts or in other restrained ways (e.g., by only using it in certain rooms/where people are).

These results are consistent with prior sociological research on space cooling/heating, which reveals that (at least some) householders have the natural preference and necessary "know-how" to perform alternative practices to stay thermally comfortable—although there is considerable variation in these practices across people, climates and cultures [17,18,43]. Research in the area of adaptive comfort also reveals that when people are provided the opportunity to interact with, and modify their

environment in naturally ventilated buildings, they are actually more satisfied with, and tolerant of a wide range of temperatures [44]—certainly a much wider range than the narrow zone of temperatures deemed "acceptable" by internationally-adopted professional comfort standards. Thus, far from heating and cooling being non-negotiable practices, our results suggest that many people possess the ability and might even prefer to perform a wider range of practices to maintain thermal comfort levels, as opposed to simply defaulting to the air conditioner or heater. Importantly, performing alternative ways to keep cool or warm may also naturally appeal to people, because these practices may yield other benefits (e.g., going for a swim to cool down is enjoyable, healthy and a "fun" form of exercise; cuddling up underneath a blanket to keep warm is comforting; hosting summertime barbeques outdoors in the fresh air, rather than indoors, can facilitate socializing) [45]. In the event that air conditioning may be required to meet the needs of vulnerable groups, it may be possible to provide shared cool spaces—which also bring social support and public health benefits to these groups [43]. Implicit in these suggestions is that certain infrastructure and services (e.g., barbeque facilities at local parks, local swimming pools and other cool public spaces), including those that enhance accessibility (e.g., convenient location, low-cost transportation options), may be required to enable the emergence and sustenance of such practices.

Appreciating the fact that people might be naturally receptive to adopting alternative cooling and heating practices, it is important to recognize that the actual performance of these practices requires a minimum level of competency, practical skill or "know-how", not to mention capacity. Since skills are inextricably linked with the actual performance of the practice, they are considered an imperative element of any given practice [4]. In our study, for example, some householders appeared to draw on their practical knowledge and skill in keeping cool/warm without using energy-intensive appliances all the time (e.g., draw the curtains or blinds, get out of the house, only use the air conditioner for a short duration). As such, there appears to be scope for designing behavioral interventions that assist with the transfer of such practical know-how to others. Some examples include directly exposing individuals to new experiences (as in Wallenborn and White's [46] suggestion of a demonstration home), designing cooling or heating infrastructure/architecture that encourages personal control and acquisition of knowledge of how to keep warm or cool [18], and/or communication techniques that visually show people what other people do. In terms of the latter recommendation, there is evidence for the power of social norms in facilitating behavior change in energy consumption [47–49]. Thus, it is possible that making householders more aware of what many other people are doing to keep warm/cool in an energy-efficient manner might encourage them to try the new practices for themselves. As per our recommendations for laundering, when conveying such messages it may be especially important to communicate the valued outcomes (i.e., warmth, coolth, thermal comfort) achieved by performing positive practices, and perhaps also other valued outcomes that are by-products of undertaking alternative actions, as suggested earlier (e.g., health, enjoyment, social benefits).

### *3.5. General Appliance Practices*

In the domain of general appliance usage, we found that many householders engaged in the energy-efficient practice of not leaving appliances running when not in use. Householders explained that by doing so, they could save energy and money. Based on participants' qualitative comments, it appeared that these householders were highly aware of the direct link between appliances being switched on and the consumption of electricity. Similarly, many householders who claimed that they turned off appliances at the wall (i.e., avoiding standby mode) not only mentioned general energy and cost savings as underpinning this practice, but they also sometimes cited the safety benefits and claimed it was something that had simply become a habit. In contrast, when explaining the reasons for leaving appliances on standby, these householders tended to cite the inconvenience of turning off appliances at the wall, particularly if such appliances were out of reach. Forgetfulness, laziness and habit were also quoted as reasons, as well as a perception that because the cost-savings may be insignificant, they do not need to make an effort in this area.

These findings are similar to prior qualitative research on standby consumption, where it was observed that alongside knowledge and motivation to change for personal gains (e.g., to avoid wasting money or energy), the inertia of prior routines might help households modify and sustain new standby practices—and that technology and design characteristics can either severely obstruct or facilitate this process [21]. That is, this research has revealed that householders who successfully modified their standby usage practices typically rearranged their technology set-up so that it would then be easier to perform a new routine. Conversely, householders who did not change their practices typically complained of some technological or design-related barrier, or expressed a lack of motivation to rearrange their set-up. Technologies and related design default-type features should therefore be considered an intrinsic and integral part of how householders perform standby appliance practices [21]. In keeping with this view, various technological innovations are now available to reduce the amount of standby electricity consumed (e.g., designing appliances that only use a single watt or less in standby mode; one-switch standby powerboards; the use of timers; activating power-saving mode on computers), although behavioral solutions are still needed to encourage adoption, as well as appropriate configuration and use of these energy-saving technologies.

## 4. Materials and Methods

### *4.1. Research Context*

The study involved surveying a sample of householders who were customers of a large Australian energy retailer. At the time of surveying, the retailer was seeking to reinvent itself as an energy-efficiency advisor to customers, and as such, improve its understanding of different customer electricity consumption profiles (e.g., by identifying the socio-demographic, psychological and behavioral features of different energy consumer segments). In collaboration with the retailer, the study was designed and delivered in a manner that mirrored how the retailer usually interacted with its customers—which was via a telephone call. The study received ethics approval by the CSIRO Social Science Human Research Ethics Committee (ethical approval code 059/12: Smarter Energy Thinking).

### *4.2. Participants*

Using a sampling frame provided by the energy retailer, a total of 14,500 householders were randomly selected from the energy retailer's customer database. Participant recruitment and survey administration was managed by a third-party research agency. A total of 5938 householders were reached on the telephone, of which 1541 agreed to participate in the study (25.95% response rate). Data from the energy retailer showed that among all of these householders, the average electricity consumption was 2232 kWh for the last quarter (preceding the survey). This level of electricity consumption was equivalent to that of an undisturbed control group (who were sampled for the purposes of the broader research project, but did not complete the survey) who averaged 2343 kWh for the last quarter.

Only 279 householders agreed to answer the final set of socio-demographic questions asked at the conclusion of the survey. This sub-sample was 50.90% male with an average age of 48.38 years (SD = 14.57, ranging from 21 to 89 years). Over two-thirds of participants (68.10%) were formally employed in the workforce and a wide range of occupational types was represented, with professionals being the most common (26.62%). Household income spanned from nil income to very high earners, with the most common income range being around $1750 to $2250 per week (24.31%). In terms of household characteristics, household size typically hovered around two to three people (53.36%), with a couple and child(ren) being the most common arrangement (36%). Most participants lived in a detached home (72.30%) and either owned it outright (26.99%) or with a mortgage (41.44%).

### *4.3. Procedure*

The survey was conducted over the telephone and interviewers followed a standardized script. As an incentive to participate, customers were first advised that they would be eligible to enter a random prize draw to win a $1000 shopping gift card if they agreed to participate. Consenting customers were then randomly assigned to be questioned about their energy practices in one of five different household domains (see Table 6). As the aim of the broader program of research was to experimentally test the impact of differently framed messages on actual household electricity consumption in different domains, householders were randomly assigned to hear one of four different messages about practices in a particular household domain. Each message comprised two sentences that conveyed either (1) "neighborhood" or (2) "state-wide" social normative signals, and framed the practice as (1) energy-inefficient or (2) energy-efficient. For instance, the two sentences: "Many people in your neighborhood in [suburb's name] wash in cold water, and don't put the washing machine on until they've got a full load" and "Many people in your neighborhood in [suburb] hang their laundry on a clothesline or indoor rack to dry, rather than putting everything in the dryer" convey neighborhood norms aboufiguregy-efficient laundry practices. Each message was followed with the questions: (1) "Is this how it is in your household then?" and (2) "Why is this, do you think?" Responses to these questions formed the data set for analysis. Householders' responses to the questions were typed verbatim by the interviewer, into an online survey platform. To conclude the survey, an optional set of questions was asked to collect information about energy efficiency, socio-demographics and attitudes. Following three weeks of data collection, the data were downloaded from the online survey program, and cleaned in preparation for coding and analysis.

In terms of the survey's experimental design, it is acknowledged that the different normative messages that householders were randomly assigned to receive could have influenced how they subsequently responded to the questions about their own household's energy practices. That is, their responses (in terms of agreement with the first question, and reasons given to the second question) might conceivably vary depending on what normative message they were exposed to. Supplementary analyses were undertaken to rule out this possibility. Simple cross-tabulations revealed statistically significant differences of this nature for only two practices: clothes drying and showering. When receiving the energy-inefficient (neighborhood) normative statement that "Many people in your neighborhood in [suburb's name] put everything in the dryer, rather than hanging their laundry on a clothesline or indoor rack to dry", a higher proportion (30%) of participants subsequently agreed that they too used a clothes dryer—as compared to the remaining conditions. In those conditions, the vast majority (~91–95%) of householders claimed that they limited their use of the clothes dryer (and instead used the clothesline). However, the results for showering were more surprising, and perhaps somewhat perverse. Following the energy-efficient normative message (whether referencing their neighborhood or state) that "Many people . . . are having much shorter, cooler showers, and not showering every day", householders were somewhat disinclined to agree that they followed this energy-efficient practice (and inclined to admit to long, hot or frequent showers). In contrast, householders presented with the energy-inefficient version that "Many people . . . are having very long, hot showers, and showering every day" were more inclined to insist that they themselves had shorter, cooler, less frequent showers. For these two specific practices (i.e., clothes drying and showering, only) that were potentially influenced by the manner in which our questions were framed, we further examined the range of reasons provided by householders across conditions. We found that across conditions, the same range of reasons was canvassed by those householders, if not in similar proportions. Since, as noted, any potential bias seemed to be confined to just these two practices in any case, overall we are left with some assurance that our results were not substantially influenced (in total) by the different normative messages embedded in our question framing. To the extent that any response biases were introduced in one direction or another, the overall tendency should be for those to mostly cancel one another out. At the least, we would maintain that they do not tend to undermine the principal conclusions drawn in regard to our current research questions.

**Table 6.** Energy usage practices described in the course of eliciting responses in each household domain.

| Household Domain ($n$ = 1541) | Energy-Inefficient Practices | Energy-Efficient Practices |
|---|---|---|
| | **Many People in Your Neighbourhood in [Suburb's Name]... OR Many People in Your [state]...** | |
| Laundry ($n$ = 307) | • Wash in hot water, and often put the washing machine on when they haven't got a full load.<br>• Put everything in the dryer, rather than hanging their laundry on a clothesline or indoor rack to dry. | • Wash in cold water, and don't put the washing on until they've got a full load.<br>• Hang their laundry on a clothesline or indoor rack to dry, rather than putting everything in the dryer. |
| Kitchen ($n$ = 308) | • Run a second fridge, a bar fridge, or a standalone freezer, in addition to their main fridge.<br>• Run a dishwasher all the time, rather than washing up by hand in the sink, and often put the dishwasher on when it's not really full. | • Use only one fridge, and don't additionally run a second fridge, a bar fridge, or a standalone freezer.<br>• Usually wash up by hand in the sink, rather than running a dishwasher all the time, and put the dishwasher on only when it's really full. |
| Bathroom ($n$ = 304) | • Are having very long, hot showers, and showering every day.<br>• Don't use low-flow showerheads that restrict the amount of water flowing through. | • Are having much shorter, cooler showers, and not showering every day.<br>• Use low-flow showerheads that restrict the amount of water flowing through. |
| Space heating/cooling ($n$ = 312) | • Have air conditioning and fans running all the time throughout the summer and don't usually turn them back when the weather is mild or the day cools down.<br>• Make a lot of use of heating in the winter, and set their heating in such a way that their homes often end up warmer than required. | • Don't have air conditioning and fans running all the time throughout the summer, and instead will usually turn them back when the weather is mild or the day cools down.<br>• Make little use of heating in the winter, and set their heating in such a way that their homes don't end up warmer than required. |
| General appliance use ($n$ = 310) | • Leave their living room and office appliances running all the time, rather than turning them off when they're not in use, for example TVs are still going in the background when no one's in the room.<br>• Leave everything on standby, rather than switching appliances off at the wall. | • Turn their living room and office appliances off when they're not in use, rather than leaving them running all the time, for example TVs are not still going in the background when no-one's in the room.<br>• Switch appliances off at the wall, rather than leaving everything on standby. |

To code the responses provided by householders, a coding scheme was developed by one of the authors. This process was iterative and involved reviewing samples of responses to create distinct codes for agreement or disagreement with the first question of "Is this how it is in your household then?" and for each and every reason presented in response to the second question of "Why is this, do you think?". For the first question, responses were simply coded to reflect agreement (yes) or disagreement (no). For the second question, fine-grained codes were developed to capture small nuances in the reasons provided by householders (e.g., "Too busy/hurried to hang on line/rack" versus "Takes too long to hang on line/rack"). Householders' response (to this second question) often contained multiple reasons for performing or not performing the relevant practice. Ultimately, the final coding scheme contained 20 to 30 codes per energy usage practice. This coding scheme was used by an independent qualitative data-coding agency to code all responses. In the analysis phase, similarly themed codes were grouped together to facilitate interpretation (e.g., "Need second fridge for size of family/household" and "Need second fridge for visitors/guests" were combined into the overarching theme of "Lifestyle/household needs"). Where a householder had mentioned more than one (fine-grained) reason within a particular theme, it was only counted once. This process resulted in dummy-coded variables for each broad category (i.e., 1 = mentioned any fine-grained reason within this category; 0 = did not mention any reason in this category). The majority of householders responded to both the first and second survey question; however, there were a small number of cases where the

phone-line dropped out at that point in the survey, or where the householder responded with a "do not know" to the first question.

## 5. Limitations and Conclusions

Several limitations to this study must be highlighted, as they are important to consider when interpreting the results and drawing conclusions from our findings. While our study surveyed a large number of householders, it should be noted that each householder was only asked about practices in a single domain—either the laundry, kitchen, bathroom, space heating/cooling or general appliance usage—and that the survey questioning within each domain was not standardized. Due to the broader goals of the study (i.e., to examine the impact of normative messages on electricity consumption), each householder was randomly allocated an opening message that differed in terms of (a) whether an energy-efficient or energy-inefficient practice was said to be commonly performed, and (b) who performed these practices—people in their neighborhood or state. Given the persuasiveness of social norms, it is possible that these alternatively framed messages could have affected both agreement and the types of reasons given by householders (though note that one would expect any bias to cancel out across experimental conditions). Examination of the frequencies of agreement revealed that householders claimed they engaged in either energy-efficient or energy-inefficient practices at roughly the same rate for all practices with the exception of just two—clothes drying and showering. Here, it was apparent that householders were more inclined to agree that they used the clothes dryer when told that their neighbors did too (as compared to the remaining messages). In contrast, they appeared to respond in the opposite way to the showering messages: they were less likely to agree with frequent, long, hot showering when told that others (either neighbors or people in their state) washed this way—and instead, were more likely to claim that they had shorter, cooler or less frequent showers (the converse was also true, for the alternative energy-efficient message). While these differences in agreement were observed, it did not appear to significantly affect the reasons that householders gave: the entire range of reasons was mentioned at a reasonable rate by householders, independent of the message they received. Moreover, since the current study was focused more on exploring the qualitative nature (rather than quantitative number) of reasons for certain practices at the aggregate level, we feel confident that our results are a balanced representation of a diverse range of reasons. Future research in this area might prefer to adopt just one approach to questioning householders about their energy usage practices, taking care to frame the question(s) to be as neutral as possible (while still encouraging householders to feel comfortable enough to freely disclose their reasons).

Despite these limitations, a number of interesting insights that can be gleaned from the study—insights that may help inform the direction and design of future behavioral interventions aimed at encouraging greater energy efficiency. Our results suggest that intervening to change many everyday energy-consuming practices should be undertaken carefully. Each practice has its own unique set of elements that may be more or less open to change, and we have provided some ideas and avenues for future behavioral intervention that may help motivate and make it easier for householders to replace inefficient practices with efficient ones. In this final section, we also unpack a few general considerations for future research that aims to re-specify or rearrange household practices.

First, it may be fruitful for practitioners to promulgate, wherever possible, the natural and functional affordances associated with alternative energy-efficient practices. Although reiterating the energy- and money-saving benefits might prove motivating for some householders, these benefits may not be valued or deemed highly important by others. By advocating the functional outcomes, we believe there might be greater potential to influence a broad spectrum of householders. This approach might also help to avoid possible unintended consequences that could otherwise arise from highlighting the energy-saving benefits of alternative practices (e.g., a person may, after performing an energy-saving practice, go on to consume more electricity overall—a phenomenon known as the "rebound effect" [50]). For example, the results from our study suggest that in the case of washing laundry in cold water, the behavior of some householders might be moved by knowing that the same,

if not better, cleanliness outcomes can be achieved by simply switching from hot to cold water. Yet it remains an empirical question as to whether or not energy- or money-saving messages would work any more effectively than a straightforward "cleanliness" message.

Second, it may be useful to design and implement interventions that capitalize on natural openings for change [10], for in these instances an alternative energy-efficient practice may gain traction. For example, it appears that at least some householders already hold a predilection for alternative energy-efficient practices in space heating/cooling, clothes drying and perhaps even food storage/provision. Interventions could then be implemented at times where such practices are most likely to be "called for" (e.g., particularly hot or cold days, very windy days, holidays), providing a fertile "test-bed" for the subsequent emergence of new practices. For example, on particularly hot or cold days, energy retailers could alert householders (in advance by way of a mobile phone text and/or app alert) of the imminent extreme weather, and provide tips on additional ways to keep cool (beyond simply turning on the air conditioner). Changing default settings (e.g., cold wash or short wash as the "normal" setting on washing machines, providing low-flow showerheads as a standard inclusion in new homes) may also help to configure new practices as many people may stick with the status quo and thus not make an effort to change what is already pre-set for them.

In terms of possible interventions for practices that involve repeated actions, capitalizing on social networks and applying persuasive social influence techniques may be effective in encouraging people to perform the energy-efficient version of these practices. However, such strategies might be best reserved for situations where householders already prefer the energy-efficient practice and perceive it as socially desirable, or where there is some basic misconception or "myth" that can be debunked with a straightforward explanation (e.g., washing clothes in cold water; storing unopened drinks in the cupboard rather than a second fridge). In both cases, people may be more receptive to slightly adapting their practices after receiving a proper explanation or demonstration. Social proof and peer influence (e.g., physical demonstrations, verbal testimonials, word-of-mouth) come to the fore here, with previous research showing that simply learning about, or being exposed to what other people do and like (especially those similar to oneself) tends to bring one's own behavior into alignment [51]. That said, we recommend that caution be exercised if social influence strategies are used for practices where householders appear to hold multiple and strong rationales that justify the continuance of poor practices (in our case, hot and high pressure showers). Indeed, prior research has found that people show heightened resistance to influence if they have already formed a rebuttal to a counter claim (see McGuire's theory of inoculation [52,53]); and that the heightened attitude accessibility, involvement and threat that accompanies such resistance might also contribute to spreading the (energy-inefficient practice) message and ultimately confer resistance (to influence or change) to broader social networks [54].

Some social influence strategies that have proved to be effective in motivating energy conservation include comparisons of a household's electricity consumption to that of other similar households, injunctive social norms to reward energy-efficient behavior (e.g., smiley face conveying social approval), providing energy conservation tips [55] and messages that communicate descriptive social norms—for instance, actual energy-saving practices (e.g., using fans instead of air conditioning) being performed by other residents in the community [48]. Given that household electricity consumption involves practices performed in private, one's view of what other people do may be incomplete, limited and therefore potentially biased. To date, many feedback efforts have centered on providing householders with information on energy consumption in kilowatt-hours or monetary terms, via methods such as in-home displays, web portals, or information printed on one's electricity bill. Yet researchers have suggested that this type of information might not be as effective as other communication pathways in helping to change practices [56]. Here it has been recommended that interventions should focus on conveying the meaning that people ascribe to everyday energy usage practices [56]. Thus, future research may wish to continue exploring strategies that focus on communicating descriptive behavioral norms, with particular attention given to conveying additional (beyond the standard

energy-saving reasons) desirable functional outcomes or affordances that people naturally associate with that energy-saving practice.

In conclusion, this study has examined a number of specific household practices that have the potential for influencing household energy usage, extending across the domains of laundry, kitchen, showering, space heating and cooling, and general appliance use. By analyzing the self-professed reasons for performing (or failing to perform) such practices, we have suggested how future behavioral interventions can be designed to shape the emergence of alternative energy-saving practices. In situations where certain practices remain resistant to change due to habits or personal preferences—as might be the case for showering—there still remains scope to develop new technologies, materials and infrastructure that ultimately transform existing practices to new and more efficient ways of performing the same activity or achieving the same outcome. This is consistent with shaping new practices, since the "material" element to the practice, and how that material is perceived, used and manipulated by the person, inevitably gives rise to a whole new practice—even if the affordances, practical skills and know-how associated with the practice remain largely unchanged.

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