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The cultural dynamics of energy: The impact of lived experience, preference and demographics on future energy policy in the United States

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ABSTRACT

Cultural diversity is increasing in the US, which is likely to have an impact on preferences toward future energy policy.

This research investigates people's lived experience and preferences through a nationally representative survey (n = 3000) regarding the energy system, and how these relate to cultural group and other demographics.

Our study highlights the influence of cultural background in the US, alongside educational achievement and income level on perceptions toward the energy system and energy policy.

Through rigorous multivariate statistical evaluation of cultural groupings, income and education on energy system preferences and lived experience, we identified cultural groups that experience energy affordability differently, irrespective of income or educational achievement.

For energy policy issue and factor importance, we identify a positive link with educational achievement and income, varying across cultural grouping.

Overall, Native Hawaiian or other Pacific Islanders and American Indian and Native Alaskans had a muted response to energy policy issues and energy system factors compared to their peers.

Our findings identified a need to enhance overall educational outcomes to engender more positive attitudes toward improving the environment, and the need for policy makers to be aware of cultural group preferences to enable development of energy policies which improve recognition justice outcomes.

1. Introduction

As nations diversify in terms of their cultural makeup, the development of energy policy which is conducive to achieving carbon reduction goals will also need to adapt, in order to engage the citizenry in meeting these goals [1]. Ideally, energy policy making will take account of cultural preferences and behaviors, in order to become more inclusive. At the global level, the Paris Agreement guides the approach and targets employed for achieving a low carbon energy future [2]. Developing nations generally have more ambitious goals, aligned with their potential for meeting them. Along with the advent of the Biden Administration in 2021, the United States of America (US) have rejoined this agreement, and now seek to achieve a 100% clean energy economy, and to achieve net zero emissions by 2050 [3].

At the same time that the US re-enters the Paris Agreement, it is also going through significant cultural reshaping, driven by immigration. Around 2050, it is expected that the White or Caucasian ethnic group will no longer be a majority, and the growth of other ethnic groups will influence electorates and ultimately, politics [4]. As the population diversifies, it follows that so will the makeup of elected representatives, potentially shifting policy outcomes to be more cognizant of cultural groups.

Building on these demographic shifts, the manner in which people report their experiences and express their opinions has implications for energy policy and planning, and toward achieving socially acceptable energy outcomes. In line with the sustainable development goal (SDG) of reduced inequalities (SDG 10) and cognizant of the need to rectify a number of environmental issues, among them affordable and clean

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energy (SDG 7) and climate change (SDG 13; [5]), this research brings together the aspects of stakeholder engagement [6,7] (through an online national survey), and recognition aspects of energy justice to inform robust, culturally appropriate energy policies for the future.

To further our understanding of the recognition aspects of energy justice, an analysis of self-reported lived experience provides a compelling evidence base for uncovering energy system related disparities. These disparities present themselves in terms of demographics, i.e. ethnic background, income, educational achievement, or in terms of self-reported outcomes including energy affordability and opinions toward the importance of energy policy and energy system issues.

The aim of this research is to uncover the relationship between culture, specifically the prevalent cultural groups in the US and personal income, educational achievement and energy system experiences and preferences. By utilizing a national, representative survey, we seek to identify and analyze how responses to various energy issues and self-reporting of experiences differ in these groups. This research is particularly concerned with the recognition aspects of energy justice, to a level of detail unique among existing research, providing key insights for the demographically diverse US, leading to policy implications which will retain their relevance in a demographically shifting population.

The present study is structured as follows: Section 2 outlines the background of the paper's focus on the recognition issues of energy justice and a literature review of relevant recent scholarship. Section 3 outlines the methodology in two parts, first for the stakeholder engagement, undertaken via survey, and second for the survey analysis methods both bivariate and multivariate. Section 4 describes the results of our analyses, and Section 5 discusses important findings and limitations. Section 6 provides the conclusions.

2. Background and literature review

This research is concerned with the issue of energy affordability and stakeholder preferences toward the energy system, cognizant of cultural background. These issues are strongly related to the concept of energy justice, which, following on from environmental justice, provides a basis for perceiving disparities related to the energy system [8]. Within the concept of energy justice there are three core tenets, namely distributional justice, procedural justice and recognition justice [9]. Distributional justice is concerned with the distribution of the costs and benefits of energy system outcomes, procedural justice idealizes the open and equitable access to energy system decision making and recognition justice focuses on recognizing social, cultural, ethnic and other impacts on the divergence of stakeholder perspectives [10]. The present study focuses on quantifying the recognition issues within energy system preferences and outcomes, and as such, the literature review investigates previous research which incorporates the issue of recognition justice within the energy justice framework in order to distinguish the novel qualities of this study.

In terms of general level assessments of cultural differences with regard to energy issues, several studies have attempted to capture these nuances. For example, Sovacool [11] investigates cultural differences between public perceptions of energy security, equity and access (among other factors) across a number of nations. They found that nations did not respond in the way that we might expect, except for the case of Asian respondents, who rated energy self-sufficiency higher than American or European respondents. They also found that their hypothesis that low population density nations prioritized energy access and affordability was supported by the results of their survey. In investigating 'energy cultures' in the European Union, Rosicki [12] uncovers six clusters of nations based on economic energy intensity, energy consumption and greenhouse gas (GHG) emissions per capita and fuel type usage levels. Of note was the Scandinavian energy culture, due to its high level of environmental consciousness and renewable energy sources, resulting in low GHG emissions, and the Benelux energy culture, with high energy consumption and subsequently high GHG per capita emissions. In investigating energy affordability and life satisfaction across 37 nations, Chapman et al. [13] identified a divergence, not only between affordability, life satisfaction, health and perceived economic equality, but also in the way certain national cultures respond to survey questions. Among respondent nations, Myanmar stood out as a nation which avoided the use of extreme response terms (i.e. completely satisfied or unsatisfied), leading to a 'muted' response among nations.

With regard to energy justice and the issue of cultural group and demographics, a variety of previous research has assessed energy issues within individual nations. In the case of Sweden, an assessment of distributional justice of wind power was undertaken by Liljenfeldt and Petterson [14]. They identified that wind turbine deployment applications were more likely to be approved in areas of high unemployment and less likely to be approved in areas with a higher education level or more private sector employees. Although they do not identify unjustness, they suggest that further research is required to identify any marginalizing effects, and to consider Indigenous peoples. Also relevant to energy justice and wind power, Velasco-Herrejon and Thomas [15] investigated community acceptance in Mexico. They identified that the three core tenets of energy justice are somewhat embedded, and with regard to the acceptance of energy technologies, issues such as equal access to employment, higher education, new forms of income and recognition of local Indigenous lifestyles and identity were influential. In an Australian study on the energy justice issues surrounding coal seam gas production, recognition justice-based findings identified the prioritization of scientific knowledge over Indigenous perspectives, often sidelining this group from decision making processes [16]. Further in a Canadian investigation of the energy justice issues specific to a pipeline expansion, it was found that although 'theoretically' issues of procedural and distribution justice had been addressed for Indigenous peoples, recognition justice had not eventuated [17]. Interestingly, in the Canadian case, recognition issues were not only tied to Indigenous sovereignty, but also to cultural differences, such as the prioritization of aspects other than economic outcomes. A study of gender-based energy poverty in Bangladesh identified the need to study individuals (i.e. men and women in this case) rather than the household as the analysis unit, in order to disentangle energy recognition issues of how energy poverty can affect members of a household individually [18]. In the case of Bangladesh, the evaluation, which incorporated energy justice recognition issues identified that women's perspectives were overlooked and devalued. Considering householder's location and income level, a study in Indonesia identified disparities in energy poverty, particularly between high income urban households and rural, lower income households, demonstrating a recognition oversight of 'energy-poor susceptible groups' [19].

Previous energy justice investigations have predominantly included studies at the national or local level, focusing on individual policy or technology issues. These studies have incorporated both homogeneous and heterogeneous cultures, however no single study has considered the cultural demographic variety within a nation and its impact on energy affordability, and energy policy and system issue preferences. This study is novel in that it uncovers for the first time the link between cultural group, demographics, energy affordability and energy policy and system issues in a quantitative manner. We use the US as our case study nation, apt due to its diverse energy system, cultural groups and shifting demographic dynamics, posing challenges for the design of a desirable future energy system, i.e., one which can meet stakeholder's energy, and energy justice needs.

The identification of the policy issues and energy system factors to be explored is based on a body of research which has explored culturally homogenous and heterogenous nations, as well as multiple nations in terms of the policy and energy system issues which are considered important to householders, and vary according to demographics (cultural group, location, age, gender etc,). Pertinent examples of important energy system factors include energy access and affordability [13], environmental friendliness and sustainability [20–22], while for energy

policy issues; environmental protection and climate change mitigation, resource management, economic growth and social equity (i.e. social security issues) policy have taken precedent [23–25].

3. Methodology

The methodology is described in two parts, first, to outline the design, scale and key questions utilized in the national survey. Second, the survey analysis methods including bivariate and multivariate analysis and specific analysis models are detailed.

3.1. Survey design

This study utilizes a national, representative survey of the US, undertaken in August 2020, with 3000 respondents across all 50 states. Special care was taken to incorporate the opinions of adults from all age groups, educational levels and cultural groups with respect to the national census. The survey was conducted via a national online survey company with participants recruited from registered panelists to ensure a representative sample, consistent with national census gender, educational attainment, age and cultural group ratios. Appendix A outlines the demographics of the survey respondents and their alignment with the national census.

The survey was developed as part of a wider research to address a number of energy issues in the US, consisting of 17 questions across four categories of demographics, policy and technology knowledge, opinions and experience regarding the energy system, and choices toward energy system design. The survey was developed utilizing questions which had been identified in precedential literature and previous studies [22,26] as suitable for gauging householder opinions and preferences toward the energy system. The suite of questions was then tested with energy professionals and graduate students to ensure language consistency and ease of understanding, prior to deployment. Care was taken to ensure ease of response, with respondents predominantly asked to use 5-point Likert scales to indicate knowledge level or agreement, or to select a response based on provided keywords. In this study we focus on 6 specific questions related to cultural background (Q3), and personal outcomes, i.e. educational achievement (Q5) and income (Q6), and their impact on energy affordability (Q11), and self-reported importance of energy policy issues (Q12) and energy system factors (Q13). The questions utilized in the present study are detailed in Table 1.

Questions regarding the importance of energy policy issues are adapted from precedential literature, relying specifically on [22] among this body of work, and included descriptors for each policy issue as detailed in Table 1.

3.2. Survey analysis

Analysis of survey results is firstly undertaken using bivariate analysis to determine the difference in responses and trends among cultural groups in general. Further, multivariate analysis approaches are employed to determine the relationships between cultural background, income, educational achievement and stated importance of issues and factors to further investigate these impacts and variation between demographic groups. The employed multivariate analysis utilizes an Ordinal Logistic Regression Model, building on analytical precedent for modelling of the ordinal dependent variable.

The main purpose of ordered logit models is to calculate the accumulative probability of the dependent variable being greater than the j^{th} category [27–31]. This model is referred to by McCullagh [32] as the proportional odds model (POM), assuming that the effect of the predictor variable is same for all categories of the response variable. This assumption is also referred to in the literature as the proportional odds assumption or parallel lines assumption. The theory underpinning the POM is summarized in Appendix C.

In the present study a natural ordering exists for the response

Table 1
Survey Questions Analyzed in this Study.

Question	Response Options
Q3. Which race/ethnicity best describes you?	1. American Indian or Alaskan Native 2. Asian or Asian American 3. Native Hawaiian or other Pacific Islander 4. Black or African American 5. Hispanic or Latino 6. White/Caucasian 7. Multiple ethnicity/Other (please specify)
Q5. What is the highest level of school that you have completed or the highest degree you have received?	1. Less than high school degree 2. High school degree or equivalent (e.g., GED) 3. Some college but no degree 4. Associate degree 5. Bachelor degree 6. Graduate degree
Q6. What was your individual pre-tax income last year?	1. Less than $20,000 2. Between $20,000 and $34,999 3. Between $35,000 and $49,999 4. Between $50,000 and $74,999 5. Between $75,000 and $99,999 6. Between $100,000 and $149,999 7. $150,000 or more
Q11. Thinking about your monthly energy bills, how affordable are they? • **Electricity** • **Gas**	1. Cheap 2. About Right 3. Expensive 4. Very Expensive (unable to pay) 5. I do not use this type of energy at home
Q12. Please rate the following energy policy issues according to their importance to you: • **Environmental Protection** (i.e., clean water, clean air, reduced waste, etc.) • **Dealing with climate change** (i.e., reducing greenhouse gases, restricting temperature rises, etc.) • **Preserving limited resources** (i.e., water, fossil fuels, rare and critical materials and land) • **A healthy economy** (i.e., strong employment, GDP growth, increased income and social welfare) • **A convenient lifestyle** (i.e., energy & communication infrastructure, transport (public and private), a comfortable living environment, etc.) • **Social Equity** (i.e., reducing the gap between rich and poor, equal opportunity for learning and employment, freedom of speech and shared environmental cost and burden allocation)	1. Not at all important 2. Slightly important 3. Moderately important 4. Very important 5. Extremely important
Q13. Focusing on the energy that you use in your daily life, please indicate your agreement or disagreement with the following statements: • Energy should be available for reliable use whenever required (**Availability**) • Energy should be inexpensive (**Affordability**) • Energy should not pollute the environment (**Environmentally Friendly**) • Out energy use should not restrict future generations' ability to use energy (**Sustainability**) • Energy production should be safe, risk should be minimized (**Safety**) • I do not want energy generation plants near my home (**Location**)	1. Strongly Disagree 2. Disagree 3. Neither Agree nor Disagree 4. Agree 5. Strongly Agree

variables. For example, the stated opinions regarding monthly energy bills include the terms cheap, about right, expensive, and very expensive. For opinions regarding the importance of energy policy issues responses include not at all important, slightly important, moderately important, very important and extremely important. For these responses we code 1 for "not at all important", 2 for "slightly important", 3 for "moderately important", 4 for "very important" and 5 for "extremely important". The difference between Category 2 and 3 does not need to be the same as the difference between Category 4 and Category 5. The values are not quantitative here, but there is a natural order between the values. Generally, ordinal logistic regression is used for the estimation of an ordinal type response variable [33,34]. There is a precedent for using ordinal logistic models to assess perceptions and attitudes toward renewable energy [35], and other social innovations [36].

Finally, the implications of the above analyses are considered with regard to future energy system design, cognizant of national demographic shifts in the cultural makeup of the US over time.

4. Results

Results are detailed and discussed below for both bivariate and multivariate analysis considering demographics, the issue of energy affordability, and self-reported importance levels for energy policy issues and system factors for stakeholders in the US.

4.1. Bivariate analysis

Demographic variation between cultural groups is immediately apparent with regard to overall personal income levels and educational attainment, as shown in Fig. 1.

Educational attainment and personal income level appear to be correlated within cultural groups with Asian or Asian American and White or Caucasian adult respondents reporting higher average personal income and educational attainment levels. Indigenous cultural groups including Native Hawaiians, Pacific Islanders and American Indian or Alaskan Natives reported the lowest levels of educational attainment, while Hispanic or Latino adults reported the lowest average personal income level overall.

Factors tested regarding experience and opinions related to the energy system included energy affordability for electricity and gas (on a scale of 1: cheap to 4: very expensive, i.e. unable to pay), and the importance of energy policy issues and important energy system factors (measured on a Likert-type importance scale from 1: not at all important to 5: extremely important). Results for average response by cultural group are shown in Fig. 2.

We observe that energy is reported to be least affordable for Native Hawaiian or Pacific Islanders for both electricity and gas with only mild variation among other cultural groups on average. Gas is consistently reported to be less affordable than electricity, perhaps reflective of average pricing regimes in the US, where the variation in electricity prices between states compared to the national average is lower than that for natural gas [37,38].

In terms of energy policy issues, environmental protection and a healthy economy are consistently rated as important among issues for each cultural group. Overall scores for individual factors are noticeably lower for the Native Hawaiian and Pacific Islander cultural group.

For energy system factors, safety, environmental friendliness and affordability are rated as the most important. White or Caucasian adults reported levels of importance notably higher than other cultural groups, while those of Indigenous cultural groups were noticeably lower.

Considering the results of our bivariate analysis, we can begin to observe nuances with regard to each cultural group's energy

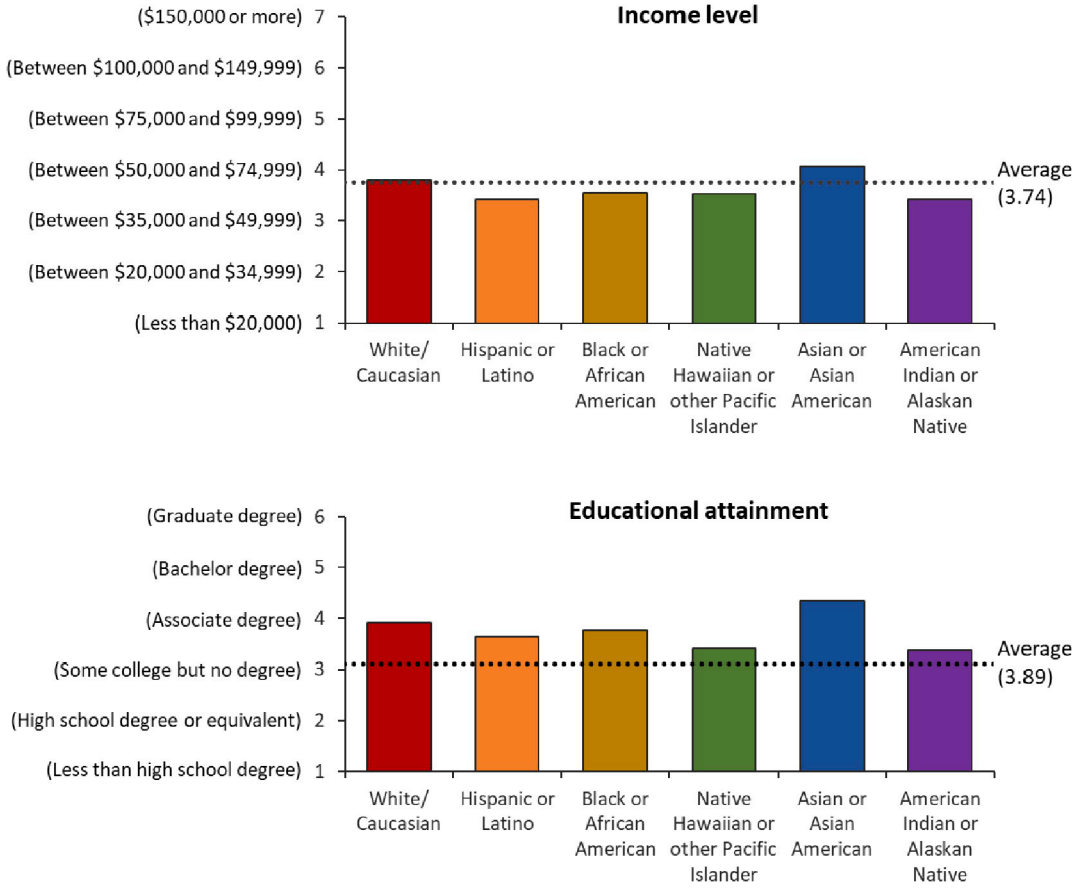

Fig. 1. Average Personal Income and Educational Attainment by Cultural Group (n = 3000).

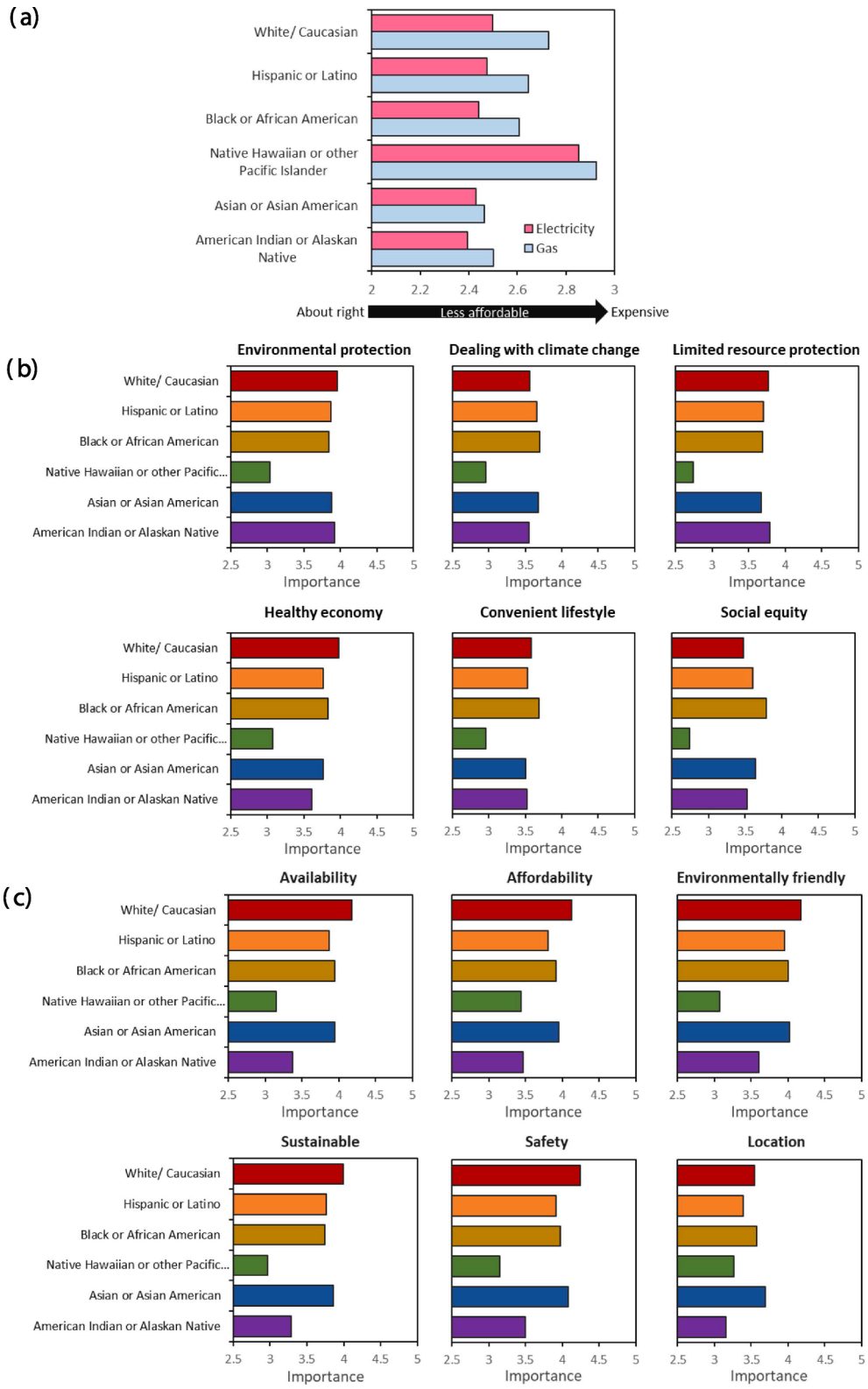

Fig. 2. (a) Experience of Energy Affordability for Electricity (n = 2952) and Gas (n = 2505), (b) Importance of Energy Policy Issues (n = 3000) and, (c) Importance of Energy System Factors (n = 3000) by Cultural Group.

preferences, as well as a difference in response ranges. Average income and educational attainment levels for cultural groups do not appear to be strongly correlated with energy policy issue or energy system factor preferences, however some correlation appears to exist for energy affordability (in terms of income level), particularly for Native Hawaiian or other Pacific Islanders.

One interesting finding was the tendency for Indigenous cultural groups to apportion lower levels of importance to energy policy issues and system factors. These nuances may be related to cultural factors, or to where these groups tend to live, and the condition of the local

environment and energy system infrastructure. In order to uncover deeper relationships between cultural group, income and education, and energy system experiences and preferences we undertake multivariate analysis as outlined below.

4.2. Multivariate analysis

Bivariate analysis identified a potential correlation between personal income level and educational achievement among cultural groups (see Fig. 1). In order to test the nature of this relationship, multivariate analysis was undertaken to establish the significance and size of this correlation, and variance for each cultural group regarding energy affordability and the importance of energy policy issues and system factors. Results are described using the largest cultural group as the reference (i.e White or Caucasian adults) and comparing other ethnicities' experiences and preferences, expressed as an odds ratio (OR). The OR reflects the comparative experience of preference of respondents compared to the reference group, which has a value of 1. In addition, the impact of the level of personal income and educational achievement is also measured. Table 2 details the results for energy affordability for the energy sources of electricity and gas. Full statistics for each of the multivariate analyses are provided in Appendix C.

Asian or Asian American adults found electricity to be more affordable than for the reference group or White or Caucasian adults, as might be expected due to their higher average income (here, affordability is associated with a lower OR due to the response scale used). Only Native Hawaiian or other Pacific Islanders and multiple ethnicity respondents identified electricity as less affordable than the reference group. Interestingly, Black or African Americans found electricity to be more affordable than the reference group, at a significance level of 10%. This was despite a lower level of income than both the reference group and the national average.

For gas, Hawaiian or other Pacific Islander respondents identified this fuel source as significantly less affordable than all other groups. This result is reflective of their lower-than-average income, however it is somewhat unexpected, as American Indian and Alaskan Native respondents had the lowest personal income level among respondents, yet found gas comparatively more affordable than this group. Geographic or cultural factors may be playing a role here.

As might be expected, energy affordability tends to improve as personal income increases, however this was not found to be significantly associated with educational achievement.

The impact of cultural group, income and education on self-reported importance of energy policy issues is detailed in Table 3.

Significant differences among cultural groups included the lower importance attached to limited resource preservation and a healthy economy for Asian or Asian American adults. Among black or African American adults, similar to Asian or Asian Americans, a healthy economy was considered less important than the reference group, however, a convenient lifestyle and social equity in particular were considered much more important than was the case for the reference group. The most interesting result was observed for the Native Hawaiian or other Pacific Islander cultural group, who considered every energy policy issue far less important than the reference group, at a high level of significance. This result may be due to a genuine lack of interest in these issues, educational attainment, or, may be related to a cultural peculiarity with regard to the way certain cultural groups respond to survey questions.

With regard to income level and energy policy issue importance, some significant relationships between increased income and a lower level of importance was observed at various income levels for the issues of environmental protection, limited resource preservation, a healthy economy and a convenient lifestyle. Perhaps unsurprisingly, the two highest income levels expressed a statistically significant, lower level of importance toward the issue of social equity.

An increased level of education was generally associated with a higher level of importance expressed toward all energy policy issues. This association was found to be significant for the issues of environmental improvement, limited resource preservation, a healthy economy and a convenient lifestyle.

The multivariate analysis results for energy system factor importance are detailed in Table 4.

As was the case for energy policy issue importance, the Native Hawaiian or other Pacific Islander cultural group reported the lowest level of importance for all energy system factors, found to be statistically significant for all except for the location of power plants. Although all cultural groups generally expressed a lower level of importance for most energy system factors when compared to the reference group, The American Indian or Alaskan Native group apportioned the second lowest level of importance toward tested issues. The only issue which was considered more important than for the reference group and was statistically significant was power plant location for Asian or Asian American adults.

Although not consistently statistically significant, generally speaking, all energy system factors were considered less important as income increased, except for the issue of power plant location, which became more important as personal income increased.

In terms of education, a statistically significant increase in importance expressed toward the issues of energy availability, affordability, environmentally friendliness, sustainability and safety was observed. This was not the case for the location of energy generation plants. This finding is strongly suggestive of the link between knowledge of issues and their perceived importance to stakeholders, extolling the importance of education toward energy system issue awareness.

Table 2
Odds ratio for electricity and gas affordability levels based on the ordinal logistic regression model.

Predictors	Odds Ratio (OR)	
	Electricity	Gas
Race/ethnicity[1]		
White/Caucasian (ref)	1.00	1.00
Asian or Asian American	0.81	1.10
Native Hawaiian or other Pacific Islander	1.64	2.44**
Black or African American	0.82*	1.19
American Indian or Alaskan Native	0.73	1.47
Multiple ethnicity/Other	1.11	0.79
Personal Income		
Less than $20,000 (ref)	1.00	1.00
$20,000–$34,999	0.99	0.98
$35,000–$49,999	0.81	1.02
$50,000–$74,999	0.85	0.98
$75,000–$99,999	0.94	0.82
$100,000–$149,999	0.92	0.72**
$150,000 or more	0.74*	0.64**
Educational Achievement		
Less than high school degree (ref)	1.00	1.00
High school degree or equiv.	1.01	1.02
Some college or associate degree	1.11	1.06
Bachelor or graduate degree	0.86	0.96

Significant at (* 10% ** 5%, *** 1%) level

[1] The ethnic group of Hispanic and Latino adults is excluded due to overlap with other cultural groups.

5. Discussion

Our investigation of US stakeholders' energy affordability experience, and preferences toward energy policies and issues uncovered a number of interesting findings which have implications for the future energy system. Firstly, in terms of energy affordability, Black or African American adults found electricity more affordable than the reference group despite a lower-than-average income level, while Hawaiian or other Pacific Islander adults found gas to be significantly less affordable

Table 3
Odds ratio for energy policy issue importance.

Predictors	Odds Ratio (OR)					
	Environ. Protection	Dealing with climate change	Limited Resource Preservation	Healthy Economy	Convenient Lifestyle	Social Equity
Race/ethnicity						
White/Caucasian (ref)	1.00	1.00	1.00	1.00	1.00	1.00
Asian or Asian American	0.83	1.08	0.80*	0.66***	0.90	1.20
Native Hawaiian or other Pacific Islander	0.23***	0.46**	0.18***	0.21***	0.31***	0.33***
Black or African American	0.83*	1.17	0.90	0.83*	1.31***	1.60***
American Indian or Alaskan Native	1.02	0.96	1.07	0.59*	1.01	1.07
Multiple ethnicity/Other	1.37	0.67	0.90	1.16	1.46	0.78
Income						
Less than $20,000 (ref)	1.00	1.00	1.00	1.00	1.00	1.00
$20,000–$34,999	0.78*	0.89	0.84	1.06	0.83	0.83
$35,000–$49,999	0.76**	0.89	0.82	0.96	0.78**	0.82
$50,000–$74,999	0.89	1.02	1.03	1.07	0.94	0.91
$75,000–$99,999	0.78*	0.82	0.79*	1.29*	0.92	0.82
$100,000–$149,999	0.73**	0.91	0.82	1.05	0.93	0.76**
$150,000 or more	0.95	0.86	0.90	1.15	1.03	0.71**
Education						
Less than high school degree (ref)	1.00	1.00	1.00	1.00	1.00	1.00
High school degree or equiv.	1.52*	1.15	1.26	1.76**	2.63***	1.23
Some college or associate degree	1.53*	1.12	1.43	2.05***	2.45***	1.22
Bachelor or graduate degree	1.66**	1.39	1.70**	2.12***	2.59***	1.46

Significant at (* 10% ** 5%, *** 1%) level.

Table 4
Odds ratio for energy system factor importance.

Predictors	Odds Ratio (OR)					
	Availability	Affordability	Environ. Friendly	Sustainability	Safety	Location
Race/ethnicity						
White/Caucasian (ref)	1.00	1.00	1.00	1.00	1.00	1.00
Asian or Asian American	0.60***	0.72**	0.68***	0.71***	0.74**	1.26*
Native Hawaiian or other Pacific Islander	0.15***	0.31***	0.13***	0.14***	0.12***	0.61
Black or African American	0.65***	0.72***	0.77**	0.66***	0.65***	1.09
American Indian or Alaskan Native	0.24***	0.34***	0.46**	0.34***	0.28***	0.52**
Multiple ethnicity/Other	0.92	1.07	0.88	0.95	0.84	0.87
Income						
Less than $20,000 (ref)	1.00	1.00	1.00	1.00	1.00	1.00
$20,000–$34,999	0.98	1.06	0.90	1.00	1.04	1.12
$35,000–$49,999	0.81*	0.79*	0.74**	0.83	0.79*	0.90
$50,000–$74,999	0.98	0.87	0.92	0.96	0.93	1.16
$75,000–$99,999	0.95	0.78*	0.78*	0.91	1.02	1.07
$100,000–$149,999	0.86	0.66***	0.75**	0.83	0.91	1.12
$150,000 or more	0.96	0.67**	0.85	0.97	0.90	1.46**
Education						
Less than high school degree (ref)	1.00	1.00	1.00	1.00	1.00	1.00
High school degree or equiv.	2.73***	1.88**	3.15***	1.90***	2.11***	1.25
Some college or associate degree	3.26***	2.17***	3.20***	2.40***	2.64***	1.16
Bachelor or graduate degree	3.62***	2.18***	3.82***	2.92***	3.03***	1.24

Significant at (* 10% ** 5%, *** 1%) level.

than others. Overall, affordability was linked with income (i.e., as income increased, affordability also improved), while not strongly linked with educational attainment.

For energy policy issue importance, education was strongly linked with increasing levels of importance attributed to environmental protection, limited resource preservation, a healthy economy and a convenient lifestyle. Among cultural group differences, Hawaiian or other Pacific Islanders had a muted response to all issues compared to their peers, while Black or African Americans prioritized a convenient lifestyle, and social equity in particular. This may be reflective of the disproportionate exposure to pollution and health issues experienced by this cultural group [39].

For energy system factor importance, again, education was highly correlated to a higher level of importance of all factors, except for the location of power plants, which was considered more important only by higher income respondents (i.e., those earning over $150,000 per year). This concern for the location of power stations relative to one's own home for higher income earners may be linked to economic wherewithal, and the ability to choose the location of one's home, compared to lower income earners. There is some precedent for the existence of a link between economic means and behavior in the energy system, particularly toward deploying rooftop solar, batteries and participation in economically beneficial programs, such as demand response, where the cheapest option is not always the most popular [40].

Unsurprisingly, energy affordability became less important as income increased. Compared to the reference cultural group, all ethnicities generally considered energy system factors to be less important, except for Asian or Asian Americans who gave some priority to the

location of power stations. Again, Hawaiian or other Pacific Islanders had a muted response to all energy system factors compared to their peers, along with American Indian or Alaskan Native respondents. This may be linked to lower-than-average educational attainment, or may be reflective of geographic, or specific cultural response norms. There is some precedent for certain cultural groups having a muted response to survey questions, often using the response scale relatively conservatively with no extremely positive or negative responses [13].

The results demonstrate a strong link between education and the importance of energy policy and system factors. In order to engender a positive attitude toward improved environmental outcomes in the future, boosting educational attainment across all, and especially underserved cultural groups may be an effective approach. In line with the findings of this study, the effect of education on environmental awareness and a propensity toward sustainable behaviors has also been identified internationally [41,42]. Policy which enhances educational attainment for underserved cultural groups may ameliorate the lack of interest in, or importance placed on energy policy issues.

While linkages between education and income level, energy policy and system factor importance were identified, it is important also to recognize the potential for other factors to influence people's preferences. One salient example is geography and the nature of energy generation infrastructure proximate to respondents, along with the comparative price levels of energy sources.

It is expected that cultural diversity in the US will continue to increase, supported by Census Bureau data which suggests that, in advance of the 2020 census, nearly 4 in 10 Americans identify with an ethnic group other than white, and that between 2010 and 2020, for the first time, that the white population will decline [43]. It is important therefore that energy policy makers are aware of the cultural underpinnings of policy and energy issue importance, as well as the lived experiences of cultural groups with regard to energy affordability.

This research presents important evidence of diversity of experience and preference among US cultural groups, with ramifications for future energy policy design which is culturally aware and that can meet the challenge of addressing the SDGs. Identifying the reasons for these cultural group-based variations and for the identified response range differences could help shed light on the needs and preferences of often-overlooked cultural groups and for the improvement of recognition aspects of energy justice, i.e. who is being affected by energy decision making, and who is responsible. This may occur through targeted policy making, and via policy making which includes adversely affected stakeholders in the policy making process. There is also an opportunity for additional analysis in which not only self-reported preferences and lived experience are investigated but are also considered alongside consumption patterns and the way in which energy is used by different cultural groups. Considering consumption and energy use patterns may highlight opportunities to understand the reasons for, and to close the gap experienced in the level of energy affordability reported by each cultural group.

6. Conclusions, limitations and future work

This study's findings bring to the fore the importance of stakeholder engagement in assessing not only the important energy and energy policy issues faced by householders, but also the importance of considering these issues from a cultural standpoint. Developed nations such as the US are undergoing rapid demographic shifts, and as a result are realigning their collective views on energy policy importance, impacts on householders, and ultimately on energy justice issues – particularly those of recognition.

The issues of shifting demographics and energy system challenges are not unique to the US, and this study stands as an example for other developed nations who are grappling with these issues. The findings of this novel study, which uncovers the previously unseen links between cultural group and energy issues in a quantitative manner, stands as an evidence base for the necessity to incorporate recognition aspects of energy justice into the energy policy debate. By doing so, it is our firm hope that collective national energy policy making and recognition aspects of energy justice can be better addressed.

There are some limitations with regard to this study, which present opportunities for future research initiatives. These include an investigation of regional disparities cognizant of energy policies in place, energy pricing regimes and the varying distribution of cultural groups across states and towns. In terms of the muted response to certain issues for some cultural groups, additional stakeholder engagement is required in terms of culturally appropriate measures for eliciting responses, perhaps in the form of workshops or interviews. Also, it is important to note that in achieving a representative sample of the US population, some cultural groups sample sizes were relatively small (for example Native Hawaiian or other Pacific Islanders n = 27, American Indian or Alaskan Native n = 39 compared to n = 2082 for the largest group, White/Caucasian Americans). Further, in line with a shifting demographic in terms of the cultural makeup of the US, the population is also rapidly aging, meaning that the majority opinion on energy policy and system factor issues will be held by older Americans. There is some evidence from surveys in Japan that older individuals place more importance on environmental issues than younger people, who tend to favor convenience [22]. The combination of a cultural group and population age shift is worthy of further investigation in developing fit for purpose energy policies which best serve the national interest.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Survey demographics, cultural group statistics and representativeness (n = 3000).

Category	Survey	US Census [44,45]
Sex		
Male	48.4%	49.2%
Female	51.5%	50.8%
Other	0.2%	0%
Age Group		
18-20	5.7%	5.0 %
21-29	14.6%	16.0%
30-39	22.6%	17.3%
40-49	18.7%	15.8%
50-59	16.4%	16.6%
Over 60	22%	29.2%

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Category	Survey	US Census [44,45]
Primary Cultural Group (Race)		
American Indian or Alaskan Native	1.3%	1.3%
Asian or Asian American	6.8%	5.9%
Native Hawaiian or other Pacific Islander	0.9%	0.2%
Black or African American	12.0%	13.4%
Hispanic or Latino	8.5%*	18.5%*
White/Caucasian	69.4%*	60.1%*
Multiple ethnicity/Other (please specify)	1.3%	2.8%
Educational Attainment		
Less than high school degree	2.6%	10.6%
High school degree of equivalent	20.4%	28.3%
Some college but no degree	22.3%	18.0%
Associate degree	11.4%	9.8%
Bachelor degree	26.6%	21.3%
Graduate degree	16.6%	12.0%

*These categories are expressed as white alone, white alone, not Hispanic or Latino and Hispanic or Latino in the Census QuickFacts, with the sum of these categories approximately equal to the survey percentage.

Appendix B. Multivariate Analysis Probability Odds Model (POM) Theoretical Underpinnings

For a dependent variable Y with K categories and a set of independent variables X having the effect parameters γ the probability of the dependent variable being less than or equal to category *j* can be expressed by the logistic distribution as defined in Eqs. (1) and (2):

$$\beta_j = Pr\left(Y \leqslant y_j | X\right) \tag{1}$$

$$Pr\left(Y \leqslant y_j | X\right) = \frac{exp\left[\alpha_j - \left(\gamma_1 X_{i1} + \gamma_2 X_{i2} + ... + \gamma_p X_{ip}\right)\right]}{1 + exp\left[\alpha_j - \left(\gamma_1 X_{i1} + \gamma_2 X_{i2} + ... + \gamma_p X_{ip}\right)\right]} \tag{2}$$

where $j = 1,2,3,\ldots,K-1$

The above model provides the cumulative probability β_j of category *j* and we find the K−1 cumulative probabilities for the dependent variable having categories K as the cumulative probability is always equal to one for the final category. The above proportional odds model can also be expressed as shown in Eq. (3).

$$Pr\left(Y \leqslant y_j | X\right) = \frac{1}{1 + exp\left[-\alpha_j + \left(\gamma_1 X_{i1} + \gamma_2 X_{i2} + ... + \gamma_p X_{ip}\right)\right]} \tag{3}$$

The odds of the dependent variable being less than or equal to category *j* to a category greater than *j* can be expressed as detailed in Eq. (4).

$$\frac{Pr\left(Y \leqslant y_j | X\right)}{Pr\left(Y > y_j | X\right)} = exp\left[\alpha_j - \left(\gamma_1 X_{i1} + \gamma_2 X_{i2} + ... + \gamma_p X_{ip}\right)\right] \tag{4}$$

The logit model can be expressed as the natural log of the odds ratio and is the linear function of *p* predictors as shown in Eq. (5).

$$Log\left[\frac{Pr\left(Y \leqslant y_j | X\right)}{Pr\left(Y > y_j | X\right)}\right] = \alpha_j - \left(\gamma_1 X_{i1} + \gamma_2 X_{i2} + ... + \gamma_p X_{ip}\right) \tag{5}$$

α_j are the intercepts and are different for each ordinal category, and the relation between α_j is $\alpha_1 < \alpha_2 < ..... < \alpha_{k-1}$ to ensure that $\beta_1 < \beta_2 < ..... < \beta_{k-1}$. The coefficient of independent variables $\gamma_1, \gamma_2, ..., \gamma_p$ are the same across all of the response categories of response variables. For continuous independent variables the slope coefficients change in log odds for each unit change in predictor and for categorical independent variables the slope coefficient represents the effect of each category as compared to the reference category.

Appendix C. Full Statistics for ordinary logistic regression models

Table C1. Ordinary logistic regression of electricity and gas affordability

Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Electricity					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.2158	0.1425	−1.5747	0.81	0.129
Native Hawaiian or other Pacific Islander	0.4943	0.4061	1.2360	1.64	0.223
Black or African American	−0.1988	0.1131	−1.7831	0.82	0.078
American Indian or Alaskan Native	−0.3165	0.3292	−0.9629	0.73	0.336
Multiple ethnicity/Other	0.1045	0.3281	0.3191	1.11	0.749
Income					

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Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.0042	0.1373	−0.0308	0.99	0.975
Between $35,000 and $49,999	−0.2053	0.1362	−1.5064	0.81	0.131
Between 50,000 and $74,999	−0.1651	0.1340	−1.2318	0.85	0.217
Between $75,000 and $99,999	−0.0626	0.1419	−0.4413	0.94	0.658
Between $100,000 and $149,999	−0.0822	0.1475	−0.5572	0.92	0.577
$150,000 or more	−0.3061	0.1617	−1.8922	0.74	0.058
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.0114	0.2662	0.0430	1.01	0.965
Some college or associate degree	0.1007	0.2621	0.3843	1.11	0.700
Bachelor or graduate degree	−0.1456	0.2652	−0.5489	0.86	0.583
Gas					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	0.0911	0.1491	0.6109	1.10	0.541
Native Hawaiian or other Pacific Islander	0.8933	0.4551	1.9628	2.44	0.049
Black or African American	0.1768	0.1211	1.4592	1.19	0.144
American Indian or Alaskan Native	0.3860	0.3428	1.1257	1.47	0.260
Multiple ethnicity/Other	−0.2417	0.3661	−0.6602	0.79	0.509
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.0154	0.1571	−0.0981	0.98	0.921
Between $35,000 and $49,999	0.0286	0.1531	0.1869	1.02	0.851
Between 50,000 and $74,999	−0.0234	0.1508	−0.1552	0.98	0.876
Between $75,000 and $99,999	−0.1962	0.1605	−1.2226	0.82	0.221
Between $100,000 and $149,999	−0.3313	0.1657	−1.9991	0.72	0.045
$150,000 or more	−0.4465	0.1798	−2.4826	0.64	0.013
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.0192	0.2819	0.0683	1.02	0.945
Some college or associate degree	0.0556	0.2767	0.2012	1.06	0.840
Bachelor or graduate degree	−0.0308	0.2803	−0.1101	0.96	0.912

Table C2. Ordinary logistic regression of importance of energy policy issues.

Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Environmental Protection					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.1852	0.1319	−1.4042	0.83	0.160
Native Hawaiian or other Pacific Islander	−1.4553	0.3615	−4.0257	0.23	0.000
Black or African American	−0.1824	0.1047	−1.7421	0.83	0.081
American Indian or Alaskan Native	0.0172	0.2969	0.0581	1.02	0.953
Multiple ethnicity/Other	0.3136	0.3251	0.9647	1.37	0.334
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.2458	0.1287	−1.9099	0.78	0.056
Between $35,000 and $49,999	−0.2724	0.1268	−2.1481	0.76	0.031
Between 50,000 and $74,999	−0.1167	0.1263	−0.9241	0.89	0.355
Between $75,000 and $99,999	−0.2443	0.1320	−1.8501	0.78	0.064
Between $100,000 and $149,999	−0.3098	0.1378	−2.2476	0.73	0.024
$150,000 or more	−0.0535	0.1522	−0.3515	0.95	0.725
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.4191	0.2430	1.7246	1.52	0.084
Some college or associate degree	0.4232	0.2395	1.7667	1.53	0.077
Bachelor or graduate degree	0.5058	0.2429	2.0824	1.66	0.037
Dealing with Climate Change					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	0.0750	0.1269	0.5405	1.07	0.554
Native Hawaiian or other Pacific Islander	−0.7858	0.3282	−2.4071	0.45	0.016
Black or African American	0.1597	0.1012	1.6037	1.18	0.114
American Indian or Alaskan Native	−0.0386	0.2870	−0.1801	0.95	0.892
Multiple ethnicity/Other	−0.4017	0.3031	−1.3152	0.67	0.185
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.1189	0.1239	−0.9599	0.98	0.337
Between $35,000 and $49,999	−0.1185	0.1226	−0.9667	1.02	0.333
Between 50,000 and $74,999	0.0169	0.1226	0.1379	0.98	0.890
Between $75,000 and $99,999	−0.2010	0.1306	−1.5392	0.82	0.123
Between $100,000 and $149,999	−0.0910	0.1364	−0.6673	0.72	0.504
$150,000 or more	−0.1487	0.1489	−0.9990	0.64	0.317

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Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.1428	0.2331	0.6127	1.11	0.540
Some college or associate degree	0.1172	0.2298	0.5100	1.08	0.610
Bachelor or graduate degree	0.3286	0.2337	1.4059	1.29	0.159
Limited Resource Preservation					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.2258	0.1309	−1.7246	1.08	0.084
Native Hawaiian or other Pacific Islander	−1.6946	0.3505	−4.8347	0.46	0.000
Black or African American	−0.1102	0.1042	−1.0575	1.17	0.290
American Indian or Alaskan Native	0.0653	0.2914	0.2244	0.96	0.822
Multiple ethnicity/Other	−0.1030	0.2996	−0.3439	0.67	0.730
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.1772	0.1273	−1.3917	0.89	0.164
Between $35,000 and $49,999	−0.1996	0.1250	−1.5969	0.89	0.110
Between 50,000 and $74,999	0.0274	0.1240	0.2210	1.02	0.825
Between $75,000 and $99,999	−0.2345	0.1307	−1.7942	0.82	0.072
Between $100,000 and $149,999	−0.1937	0.1367	−1.4169	0.91	0.156
$150,000 or more	−0.1060	0.1511	−0.7012	0.86	0.483
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.2320	0.2410	0.9626	1.15	0.335
Some college or associate degree	0.3587	0.2375	1.5101	1.12	0.131
Bachelor or graduate degree	0.5288	0.2410	2.1942	1.39	0.028
Healthy Economy					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.4177	0.1340	−3.1164	0.66	0.001
Native Hawaiian or other Pacific Islander	−1.5665	0.3938	−3.9775	0.21	0.000
Black or African American	−0.1861	0.1073	−1.7351	0.83	0.082
American Indian or Alaskan Native	−0.5252	0.3059	−1.7170	0.59	0.085
Multiple ethnicity/Other	0.1480	0.3088	0.4794	1.16	0.631
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	0.0596	0.1273	0.4684	1.06	0.639
Between $35,000 and $49,999	−0.0405	0.1250	−0.3242	0.96	0.745
Between 50,000 and $74,999	0.0680	0.1243	0.5469	1.07	0.584
Between $75,000 and $99,999	0.2544	0.1322	1.9239	1.29	0.054
Between $100,000 and $149,999	0.0532	0.1372	0.3881	1.05	0.697
$150,000 or more	0.1369	0.1505	0.9095	1.15	0.363
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.5627	0.2435	2.3103	1.76	0.020
Some college or associate degree	0.7175	0.2398	2.9919	2.05	0.003
Bachelor or graduate degree	0.7501	0.2428	3.0884	2.12	0.002
Convenient Lifestyle					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.1101	0.1362	−0.8086	0.90	0.418
Native Hawaiian or other Pacific Islander	−1.1643	0.3822	−3.0464	0.31	0.002
Black or African American	0.2727	0.1061	2.5691	1.31	0.010
American Indian or Alaskan Native	0.0093	0.2865	0.0327	1.01	0.973
Multiple ethnicity/Other	0.3755	0.3124	1.2016	1.46	0.229
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.1888	0.1269	−1.4871	0.83	0.136
Between $35,000 and $49,999	−0.2469	0.1259	−1.9604	0.78	0.049
Between 50,000 and $74,999	−0.0618	0.1253	−0.4934	0.94	0.621
Between $75,000 and $99,999	−0.0774	0.1322	−0.5853	0.92	0.558
Between $100,000 and $149,999	−0.0727	0.1377	−0.5283	0.93	0.597
$150,000 or more	−0.0300	0.1500	0.2000	1.03	0.841
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.9668	0.2504	3.8598	2.63	0.000
Some college or associate degree	0.8952	0.2465	3.6314	2.45	0.000
Bachelor or graduate degree	0.9498	0.2499	3.8003	2.59	0.000
Social Equity					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	0.1871	0.1303	1.4358	1.20	0.151
Native Hawaiian or other Pacific Islander	−1.1080	0.3546	−3.1244	0.33	0.002

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Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Black or African American	0.4688	0.1038	4.5156	1.60	0.000
American Indian or Alaskan Native	0.0662	0.2862	0.2313	1.07	0.817
Multiple ethnicity/Other	−0.2548	0.3098	−0.8224	0.78	0.410
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.1881	0.1243	−1.5129	0.83	0.130
Between $35,000 and $49,999	−0.2000	0.1237	−1.6174	0.82	0.105
Between 50,000 and $74,999	−0.0929	0.1226	−0.7577	0.91	0.448
Between $75,000 and $99,999	−0.2013	0.1305	−1.5428	0.82	0.122
Between $100,000 and $149,999	−0.2687	0.1350	−1.9895	0.76	0.046
$150,000 or more	−0.3400	0.1515	−2.2443	0.71	0.024
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.2063	0.2357	0.8753	1.23	0.381
Some college or associate degree	0.1979	0.2322	0.8521	1.22	0.394
Bachelor or graduate degree	0.3773	0.2359	1.5991	1.46	0.109

Table C3. Ordinary logistic regression of importance of daily life energy uses.

Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Availability					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.5125	0.1400	−3.6602	0.60	0.000
Native Hawaiian or other Pacific Islander	−1.8783	0.4159	−4.5161	0.15	0.000
Black or African American	−0.4325	0.1112	−3.8875	0.65	0.000
American Indian or Alaskan Native	−1.4229	0.3351	−4.2457	0.24	0.000
Multiple ethnicity/Other	−0.0812	0.2976	−0.2728	0.92	0.784
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.0152	0.1313	−0.1158	0.98	0.907
Between $35,000 and $49,999	−0.2150	0.1304	−1.6487	0.81	0.099
Between 50,000 and $74,999	−0.0204	0.1281	−0.1597	0.98	0.873
Between $75,000 and $99,999	−0.0509	0.1363	−0.3734	0.95	0.708
Between $100,000 and $149,999	−0.1509	0.1416	−1.0659	0.86	0.286
$150,000 or more	−0.0416	0.1555	−0.2677	0.96	0.788
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	1.0056	0.2495	4.0295	2.73	0.000
Some college or associate degree	1.1828	0.2451	4.8244	3.26	0.000
Bachelor or graduate degree	1.2865	0.2487	5.1718	3.62	0.000
Affordability					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.3341	0.1393	−2.3973	0.72	0.016
Native Hawaiian or other Pacific Islander	−1.1839	0.3868	−3.0605	0.31	0.002
Black or African American	−0.3349	0.1094	−3.0609	0.72	0.002
American Indian or Alaskan Native	−1.0875	0.3258	−3.3373	0.34	0.000
Multiple ethnicity/Other	0.0724	0.3070	0.2358	1.07	0.813
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	0.0585	0.1321	0.4430	1.06	0.657
Between $35,000 and $49,999	−0.2401	0.1308	−1.8357	0.79	0.066
Between 50,000 and $74,999	−0.1442	0.1287	−1.1199	0.87	0.262
Between $75,000 and $99,999	−0.2525	0.1367	−1.8470	0.78	0.064
Between $100,000 and $149,999	−0.4172	0.1408	−2.9619	0.66	0.003
$150,000 or more	−0.3940	0.1536	−2.5638	0.67	0.010
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.6307	0.2529	2.4932	1.88	0.012
Some college or associate degree	0.7743	0.2490	3.1092	2.17	0.002
Bachelor or graduate degree	0.7788	0.2521	3.0884	2.18	0.002
Environmentally Friendly					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.3786	0.1336	−2.8336	0.68	0.004
Native Hawaiian or other Pacific Islander	−2.0233	0.3758	−5.3830	0.13	0.000
Black or African American	−0.2623	0.1078	−2.4330	0.77	0.014
American Indian or Alaskan Native	−0.7678	0.3230	−2.3769	0.46	0.017
Multiple ethnicity/Other	−0.1244	0.3175	−0.3918	0.88	0.695
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	−0.1016	0.1296	−0.7839	0.90	0.433
Between $35,000 and $49,999	−0.3003	0.1283	−2.3393	0.74	0.019
Between 50,000 and $74,999	−0.0801	0.1287	−0.6225	0.92	0.533

(*continued on next page*)

(*continued*)

Predictors	Estimates	Std. error of Estimates	t-value	OR	p-value
Between $75,000 and $99,999	−0.2497	0.1352	−1.8461	0.78	0.064
Between $100,000 and $149,999	−0.2843	0.1407	−2.0199	0.75	0.043
$150,000 or more	−0.1590	0.1553	−1.0239	0.85	0.305
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	1.1483	0.2457	4.6734	3.15	0.000
Some college or associate degree	1.1629	0.2414	4.8165	3.20	0.000
Bachelor or graduate degree	1.3394	0.2455	5.4553	3.82	0.000
Sustainability					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.3492	0.1346	−2.5931	0.71	0.009
Native Hawaiian or other Pacific Islander	−1.9567	0.3854	−5.0767	0.14	0.000
Black or African American	−0.4137	0.1079	−3.8343	0.66	0.000
American Indian or Alaskan Native	−1.0838	0.3422	−3.1665	0.34	0.001
Multiple ethnicity/Other	−0.0536	0.3131	−0.1714	0.95	0.863
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	0.0045	0.1283	0.0351	1.00	0.971
Between $35,000 and $49,999	−0.1855	0.1272	−1.4584	0.83	0.144
Between 50,000 and $74,999	−0.0393	0.1265	−0.3108	0.96	0.755
Between $75,000 and $99,999	−0.0901	0.1337	−0.6736	0.91	0.500
Between $100,000 and $149,999	−0.1833	0.1388	−1.3206	0.83	0.186
$150,000 or more	−0.0319	0.1525	−0.2096	0.97	0.833
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.6413	0.2427	2.6424	1.90	0.008
Some college or associate degree	0.8769	0.2393	3.6641	2.40	0.000
Bachelor or graduate degree	1.0708	0.2430	4.4065	2.92	0.000
Safety					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	−0.3022	0.1404	−2.1518	0.74	0.031
Native Hawaiian or other Pacific Islander	−2.0907	0.3607	−5.7960	0.12	0.000
Black or African American	−0.4370	0.1100	−3.9714	0.65	0.000
American Indian or Alaskan Native	−1.2637	0.3344	−3.7783	0.28	0.000
Multiple ethnicity/Other	−0.1752	0.3061	−0.5723	0.84	0.567
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	0.0407	0.1303	0.3125	1.04	0.754
Between $35,000 and $49,999	−0.2394	0.1301	−1.8398	0.79	0.065
Between 50,000 and $74,999	−0.0752	0.1283	−0.5864	0.93	0.557
Between $75,000 and $99,999	−0.0232	0.1363	0.1703	1.02	0.864
Between $100,000 and $149,999	−0.0988	0.1426	−0.6933	0.91	0.488
$150,000 or more	−0.1067	0.1549	−0.6887	0.90	0.490
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.7488	0.2470	3.0312	2.11	0.002
Some college or associate degree	0.9694	0.2430	3.9887	2.64	0.000
Bachelor or graduate degree	1.1089	0.2471	4.4871	3.03	0.000
Location					
Race/ethnicity					
White/Caucasian (ref)	0.0000	–	–	1.00	–
Asian or Asian American	0.2332	0.1319	1.7682	1.26	0.077
Native Hawaiian or other Pacific Islander	−0.4879	0.3668	−1.3302	0.61	0.183
Black or African American	0.0898	0.1061	0.8464	1.09	0.397
American Indian or Alaskan Native	−0.6516	0.3200	−2.0360	0.52	0.041
Multiple ethnicity/Other	−0.1359	0.3098	−0.4387	0.87	0.660
Income					
Less than $20,000	0.0000	–	–	1.00	–
Between $20,000 and $34,999	0.1123	0.1256	0.8946	1.12	0.370
Between $35,000 and $49,999	−0.1027	0.1264	−0.8122	0.90	0.416
Between 50,000 and $74,999	0.1480	0.1240	1.1933	1.16	0.232
Between $75,000 and $99,999	0.0691	0.1321	0.5233	1.07	0.600
Between $100,000 and $149,999	0.1169	0.1365	0.8567	1.12	0.391
$150,000 or more	0.3751	0.1500	2.5004	1.46	0.012
Education					
Less than high school degree (ref)	0.0000	–	–	1.00	–
High school degree of equivalent	0.2221	0.2418	0.9187	1.25	0.358
Some college or associate degree	0.1460	0.2386	0.6118	1.16	0.540
Bachelor or graduate degree	0.2144	0.2421	0.8856	1.24	0.375

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