

Personality traits and energy conservation behaviour: Implications for energy transition in Ghana

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Abstract

This paper explores the relationship between the “Big Five” personality traits and energy conservation behaviour in Ghana. The energy conservation behaviours analysed are categorised as habit adjustment, energy investments, proactive conservation and brand loyalty. Drawing on a sample of 1,580 households from three regions, our findings revealed that individuals exhibiting agreeableness and conscientiousness tend to demonstrate a predisposition toward habit adjustment, whereas those characterized by openness, agreeableness, and neuroticism show a greater proclivity for engaging in strategic investments in energy-efficient appliances. While the traits of openness, conscientiousness, and agreeableness are positively associated with proactive conservation behaviours, extraversion is negatively associated with taking the initiative to conserve energy within the household. Also, individuals high in agreeableness and openness are more inclined to select trusted brands. These findings underscore the importance of tailoring interventions designed to foster environmental responsibility to specific personality traits to advance a sustainable energy transition.

Article History: Received 20 March 2025

Accepted 8 January 2026

Keywords: Personality traits, energy conservation behaviour, sustainable energy transition

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Introduction

Energy conservation has become an integral part of Ghana's energy and climate change discourse, and this has been shaped by the country's commitment to international frameworks such as the Sustainable Development Goals (SDGs) and the Paris Agreement (Republic of Ghana, Ministry of Energy, 2021). Like many developing nations, Ghana faces the dual challenge of meeting rising energy demand and ensuring equitable access to affordable, reliable, and sustainable energy while pursuing a low-carbon development pathway. The nation's electricity sector is heavily dependent on hydropower, thermal plants powered by fossil fuels, and, to a smaller extent, renewable sources. This energy mix has exposed households and industries to recurrent supply shortages, high costs, and environmental concerns. Consequently, energy conservation is increasingly seen as a policy priority for supporting economic growth, improving living standards, and enhancing energy security.

Unlike many advanced economies, where large-scale energy efficiency interventions have recorded measurable progress, Ghana's context is shaped by distinct socio-economic and infrastructural challenges. Widespread energy poverty, limited penetration of modern energy-efficient technologies, reliance on biomass and inefficient appliances, and urban-rural disparities complicate conservation efforts. For instance, households often depend on old air conditioners, incandescent bulbs, and inefficient cooling systems due to the high upfront costs of modern alternatives. Moreover, the dominance of informal settlements in urban areas limits the feasibility of large-scale conservation policy enforcement.

From the literature, discussions on energy conservation are often shaped by factors such as financial incentives (e.g., taxes), educational interventions (e.g., nudges), external conditions, and the adoption of energy-smart devices (Moriarty & Honnery, 2019; Trotta, 2018; Costa & Kahn, 2013). However, responses to these factors have been far from uniform, prompting research into the sluggish progress of energy conservation initiatives. Studies reveal that even under identical financial conditions, household decisions on energy-saving behaviour exhibit significant heterogeneity (Moriarty & Honnery, 2019; Trotta, 2018; Costa & Kahn, 2013).

The focus of the research explaining variations in energy conservation behaviour has, however, recently shifted to personality traits (Shi et al., 2019; Stern et al., 2016). The "Big Five" personality framework (comprising openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism) has been instrumental in advancing personality research, building on foundational contributions by scholars such as Allport and Odbert, Cattell, Tupes and Christal, Norman, Goldberg, and notably, Costa & McCrae (1992). For example, Brick and Lewis (2014) found that traits such as openness to experience, agreeableness, and conscientiousness are positively associated with pro-environmental behaviours. Openness reflects a general concern for environmental issues, while agreeableness and conscientiousness are linked to specific energy-saving actions.

Milfont and Sibley (2012) and Abdollahi et al. (2017) demonstrated the importance of personality traits in shaping energy conservation and environmental concerns. Despite these insightful developments, questions remain about the precise mechanisms through which personality traits influence energy-saving behaviour (Wang et al., 2021).

While several policies have been revised to foster energy-saving behaviour, research on the role of personality traits in shaping energy conservation practices is still limited in developing country contexts. This study relies on data from Ghana to provide a developing country perspective on the link between personality traits and energy conservation behaviour. Ghana has experienced a marked increase in energy demand over the past two decades, driven largely by demographic factors such as population growth and rapid urbanisation (Energy Commission, 2006). The country's economic transformation, largely propelled by the services sector, has been associated with an increase in electricity and other forms of energy consumption. For example, electricity consumption per capita, which was 364 kWh in 2010, increased steadily to 534 kWh by 2020, representing an approximate growth rate of 3.9% per annum over the decade (Republic of Ghana, Ministry of Energy, 2021). On the supply side, the energy mix for electricity generation remained undiversified for several decades of post-independence. Ghana depended heavily on hydroelectric power to meet its growing energy needs due to low costs and abundant water resources. However, capacity constraints and vulnerability to climate variability led to significant shortfalls as the economy grew, necessitating a diversification of the energy generation mix to include fossil fuels. Between 2010 and 2020, hydroelectric power declined from 54.5% to 29.9% of the energy mix, while thermal sources increased from 45.5% to 69%, with renewable energy accounting for the remaining share (Republic of Ghana, Ministry of Energy, 2021).

To complement these efforts, several behaviour-driven initiatives related to energy conservation have been pursued to promote energy conservation and sustainability, reduce energy consumption and dependence on energy imports as well as avert extreme power crises. A general uncertainty, however, surrounds the effectiveness of these programs and policies in meeting their targets despite the awareness-raising campaigns and sensitisation programs adopted by the government to ensure they are successful. A key limitation of existing intervention frameworks is their failure to account for population heterogeneity – particularly, the individual personality differences in shaping responses to energy conservation efforts. Growing evidence within the extant literature emphasises the important role that personality traits play in understanding the drivers of an individual's motivation and actions towards energy conservation (e.g. Milfont & Sibley, 2012; Abdollahi et al., 2017) and can therefore not be disregarded in the design of effective interventions.

In this paper, we explore the extent to which personality traits influence energy conservation behaviours in Ghana by exploring four energy conservation practices, namely: habit adjustment, efficiency investment, Proactive Conservation and brand loyalty. We again measure personality traits using the “Big Five” (Costa & McCrae,

1992), i.e., openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The data used for the estimations were obtained from a survey that sought to understand household electricity consumption (in)efficiency and poverty among 1,580 household heads from three major administrative regions in Ghana (Greater Accra, Ashanti, and Northern regions).

Theoretical framework and hypotheses

In the broader context, policymakers are puzzled by the low adoption rate of energy-saving solutions among certain households and individuals, despite the availability of comprehensive information on energy conservation and financial incentives designed to facilitate their uptake. Various studies have sought to understand the cause of the observed heterogeneity in individuals' energy savings behaviour. Differences in individual psychological characteristics, i.e., personality traits, have been identified as one of the central factors in explaining heterogeneity in various situations, including employment status and wages (Fletcher, 2013; Buccioli et al., 2015), earnings (Heineck & Anger, 2010), financial asset allocation in households (Brown & Taylor, 2014), gambling (Błaszczynski et al., 1999), housing (Sweaney, Pittman & Montgomery, 1984) as well as energy conservation (Shen et al., 2015).

Personality traits are viewed as a stable set of characteristic behaviours, cognitions and emotional patterns that are shaped by biological and environmental factors (Phares, 1988). These heritable characteristics are noted to be stable over time, particularly in adulthood, and cannot be altered rapidly. These traits explain differences in individuals that are expressed in thought, emotions, and behaviour (Funder, 2001). These traits are considered vital in explaining energy conservation behaviour as they influence people's attitudes, motivations, and behaviours.

The Big Five personality trait theory, or the Five-Factor Model of Personality, is the most widely used framework for personality research. It identifies five primary personality traits (labelled, OCEAN) that either influence energy conservation behaviour directly (Brick & Lewis, 2016) or indirectly by influencing attitudes (Passafaro et al., 2015; Pavalache-Ilie and Cazan, 2018). Costa and McCrae (1992b) developed the original instrument that grouped 240 items into five dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism (OCEAN).

Persons with *openness* are inclined towards new knowledge, novel approaches and are tolerant of diverse thinking and experiences. *Conscientious* individuals have a proclivity for being very organised and committed to their obligations. They demonstrate greater commitment towards completing assigned tasks. *Extraversion* is identified with persons who tend to present a positive attitude to social connection engagement, require stimulation and have the capacity to draw energy from socialising. Persons with the *agreeableness* trait are perceived as kind, sympathetic and cooperative. They show strong qualities of humility and trustworthiness. The quality of interpersonal outlook is

analysed along a spectrum starting from compassion to antagonism. *Neuroticism* refers to the tendency for negative emotion, making the individual emotionally unstable (Gosling et al., 2003).

The literature exploring the link between these traits and energy conservation-related behaviour is growing but limited. For instance, Ramanaiah, Clump, and Sharpe (2000) found that personality differences explained how high or low individuals scored on environmental responsibility. Fraj and Martinez (2006) also find support for the view that various personality traits have different pro-environmental behavioural responses. Studies such as Markowitz et al. (2012), Milfont and Sibley (2012) and Quintelier (2014) highlight the significant influence of personality traits on pro-environmental behaviour.

Nonetheless, empirical evidence on the nature of the relationship between specific traits and pro-environmental behaviour remains inconsistent, perhaps underscoring the importance of context in exploring energy conservation behaviour. For instance, openness generally has a positive association with pro-environmental behaviour (Hirsh & Dolderman, 2007; Soliño & Farizo, 2014; Brick & Lewis, 2014), although some studies find it to be less significant (Hirsh, 2010). Evidence on conscientiousness, neuroticism and agreeableness is mixed. Various facets of conscientiousness have been found to either be positively or negatively correlated with pro-environmental behaviour (Markowitz et al., 2012).

Other studies have shown a positive relationship between conscientiousness and pro-environmental behaviour (Hilbig et al., 2013; Milfont & Sibley, 2012), although in some cases, the relation has been less significant (Brick & Lewis, 2014). Agreeableness is generally found to have a robust positive and significant relation with pro-environmental behaviour (Swami et al., 2011; Milfont & Sibley, 2012; Hirsh, 2010; Meng Shen et al., 2019), although some studies do not establish a significant relationship (Markowitz et al., 2012). Neuroticism has also been found to have a mixed influence on sustainable behaviour in the home, although the link is sometimes weak (Brick & Lewis, 2014; Markowitz et al., 2012; Hirsh, 2010). While extraversion is negatively associated with pro-environmental behaviour (Busic-Sontic & Brick, 2018), other studies have found little to no influence of extraversion on pro-environmental behaviour (Markowitz et al., 2012; Milfont & Sibley, 2012; Hirsh, 2010). Yet extraversion is also found to be associated with pro-environmental behaviour (Fraj & Martinez, 2006; Brick & Lewis, 2014).

Recent studies in developing countries show that, although evidence is limited, personality traits do influence energy conservation behaviours. Research from Pakistan (Nawaz et al., 2022) and Malaysia (Al Mamun et al., 2022) finds that social norms, values, and individual beliefs are significant drivers of energy-saving intentions, often outweighing demographic factors like education and gender. Personal norms, shaped by biospheric and altruistic values, play a central role in motivating conservation behaviour among youth. These findings suggest that integrating behavioural insights and local context into policy and educational programmes is crucial for promoting

sustainable energy use and responding effectively to climate challenges in developing country settings (Nawaz et al., 2022; Al Mamun et al., 2022).

Based on the extant literature discussed, the following hypotheses are advanced:

H1: Openness is positively associated with energy conservation behaviour.

H2: Conscientiousness is positively associated with energy conservation behaviour.

H3: Extraversion is not strongly related or may be negatively associated with energy conservation behaviour due to its limited alignment with extraverted tendencies.

H4: Agreeableness is positively associated with energy conservation behaviour.

H5: Neuroticism may be weakly associated with or show a mixed relationship with energy conservation behaviour, depending on whether risk-consciousness or emotional instability is more salient.

Methods

Sampling frame, instrument development and data collection

The dataset employed in this study was assembled as part of a research project funded by the Environment for Development Initiative (EfD), which focused on the determinants of household electricity consumption efficiency and poverty in Ghana. Data collection followed the sampling frame of the Ghana Statistical Service (GSS), whose established protocols were integral to both survey design and implementation. Fieldwork was conducted across three ecologically distinct regions (Greater Accra, Ashanti, and the Northern Region) representing the Coastal, Forest, and Savannah zones, respectively. This stratification was deliberately chosen to capture heterogeneity in energy consumption patterns, housing characteristics, and socioeconomic conditions across the country.

To ensure high-quality data collection, a team of carefully selected enumerators was recruited and trained extensively by the project team. The training covered both operational and conceptual dimensions, including the theoretical underpinnings of the survey instrument, ethical procedures, and strategies for engaging respondents respectfully and professionally. Emphasis was also placed on mastery of the questionnaire, proficiency in Computer-Assisted Personal Interviewing (CAPI) software, and strict adherence to participant confidentiality and data integrity. By the end of the training, enumerators were well-equipped to manage the demands of large-scale household surveys in varied local contexts.

Building on this preparation, fieldwork was executed using tablets through the CAPI system. This digital approach enhanced efficiency and accuracy by incorporating real-time data validation, reducing entry errors, and facilitating immediate troubleshooting

during interviews. Moreover, the integration of GPS coordinates ensured precise household identification, verification, and geographic coverage in each enumeration area (EA), further strengthening the reliability of the survey process.

In terms of household selection, the study adapted the EA framework from the Ghana Living Standards Survey (GLSS). Rural and urban EAs were proportionally allocated across the three regions based on population distributions and stratification criteria set by the GSS. Within each EA, households were systematically selected using ordered sampling informed by official listings and geospatial identifiers. A total of twenty households were sampled per EA: Greater Accra included 28 urban and 3 rural EAs, Ashanti comprised 19 urban and 12 rural EAs, while the Northern Region consisted of 8 urban and 11 rural EAs. For every household, the person of interest was the household head or an adult with equivalent responsibilities. This careful process, supported by household listings with GPS information, ensured that the sample reflected population diversity and that households could be accurately located.

Equally important, the survey instrument was subjected to rigorous review and pretesting. Feedback was drawn from experts in household survey methodology and aligned closely with national standards. Iterative revisions ensured compatibility with the GLSS and Demographic and Health Survey formats, thereby enabling comparability with national statistical data. The instrument included modules on household energy consumption, dwelling characteristics, socioeconomic indicators, appliance ownership, electricity expenditures, willingness to adopt renewable energy, and assessments of personality traits and risk preferences. Ethical clearance for the study was obtained from the University of Ghana Ethics Committee for Humanities, confirming compliance with research ethics standards and the protection of respondents.

Despite occasional challenges such as inaccessibility of respondents and sporadic refusals, overall response rates remained high. A total of 1,820 household heads initially responded to the survey. After excluding 240 cases with substantial missing information or response inconsistencies, the final analytical sample comprised 1,580 households. Cases with substantial missing information or inconsistencies were excluded to preserve data quality. The sample therefore reflects households as the main unit of analysis, and all references to sample size pertain to the number of individual respondents nested within these households. These cleaning procedures enhanced the robustness of the statistical analyses and reinforced the reliability of the study's findings.

Variables

The main dependent variable for the analysis is energy conservation behaviour, which is captured using a number of questions on actions related to energy conservation. The survey responses were expressed using a Likert scale (1 = strongly agree, 2 = Agree, 3 = neither agree nor disagree, 4 = disagree, and 5 = strongly disagree). These responses were converted into a binary variable with 1=Agree (for 1 & 2 as previously) and 0=otherwise.

We group the conservation-related actions into four categories for our analysis, namely, habit adjustment, efficiency investment, Proactive Conservation and brand loyalty. These groupings were tailored towards the specifics of the data and the research objectives of the project and allow us to identify some of the patterns in energy conservation behaviour, such as whether habitual actions are more prominent than efficiency investments. Additionally, in linking these behaviours/ actions to personality traits, we can more clearly identify which individual differences matter more for the various behaviours. Moreover, this grouping allows us to more easily discover the behaviours/ actions most prominent (or lacking) within the Ghanaian context and therefore flag those requiring the attention of policymakers.

Under Habit Adjustment, respondents are asked whether they unplug unused electronic devices and always turn off lights before leaving a room. In the Efficiency Investment category, items capture the extent to which individuals actively seek energy-efficient appliances, prefer such efficient products, and allow efficiency ratings or labels to influence their purchase decisions more than price considerations. Proactive Conservation contains a single statement about taking action to conserve energy when at home. Finally, the Brand Loyalty category includes one item indicating whether appliance purchases are guided by loyalty to particular brands.

The main independent variables are the Big Five personality traits: extraversion, agreeableness, conscientiousness, neuroticism and openness (building on foundational contributions by Allport and Odbert, Cattell, Tupes and Christal, Norman, Goldberg, and notably, Costa & McCrae, 2008). For each of the questions, the respondents were again asked to indicate the extent to which they agreed with the respective statements on a Likert scale (1=strongly agree to 5=strongly disagree). The principal component analysis approach was used to reduce the various questions into each personality trait. In constructing the measures of personality traits, we relied on the principal component analysis (PCA) to reduce the dimensions of the variables for the different traits. The basic steps involved in the computation of the indexes involve: First computing a Cronbach Alpha to determine the reliability of the variables to be combined. For each of the components, the relevant alpha was >0.7 , which was satisfactory. The second step was the reliance on a measure of sample adequacy (Kaiser-Meyer-Olkin - KMO) and Bartlett's test for sphericity to determine the appropriateness of the factor analysis. The main outcome for this step is a KMO measure being >0.5 and Bartlett's test being significant to show that the variables are appropriately correlated for the factor analysis. In all the cases, these tests were passed. The next step was the computation of the factors. The extraction technique used is the varimax rotation and the latent root criterion that required that the factors selected have eigenvalues greater than one. Consistent with much of the empirical literature (e.g., Russo et al., 2022; Webster, 2021), we treat personality traits as exogenous in our analysis, for two reasons. First, personality traits are generally conceptualised as relatively stable, enduring characteristics of individuals, established early in life and less likely to change significantly in adulthood. Second, prior empirical

studies adopting similar methodological approaches treat them as predetermined rather than outcomes of contemporaneous variables under investigation.

The remaining control variables included in the estimations were primarily introduced to isolate the net impact of personality traits on energy conservation behaviours. They comprise a set of binary indicators for whether the household head is female, resides in an urban locality, and is married, each taking the value one when the condition is satisfied and zero otherwise. The specification further incorporates continuous measures such as the age of the household head (in years), household size (number of resident members), average monthly income, and the number of sleeping rooms in the dwelling. In addition, two ordered categorical variables are employed: the type of dwelling, classified as compound house, separate house, flat/apartment, semi-detached house, or other; and the educational attainment of the household head, coded sequentially from no education, primary, JSS/JHS/Middle, SSS/SHS/Secondary/Vocational/Technical, to tertiary. Collectively, these variables furnish a detailed and coherent characterisation of households' socio-demographic and housing conditions, thereby supporting rigorous quantitative modelling of welfare and housing outcomes.

Estimation method

In pursuit of the main objective of the study, which is to understand the interplay between personality traits and energy conservation behaviours within the context of a developing country, energy conservation behaviour is measured as a binary variable defined as “1” if the respondent agreed to any of the conservation behaviour-related statements, and “0” otherwise. Given the binary nature of the dependent variable, the Probit estimator is employed for the estimation. The Probit model is based on an unobserved latent variable, Y_i , which is assumed to be a linear function of explanatory variables plus a random error term, ε_i , that is independent of the predictors and follows a standard normal distribution. The observed binary outcome y takes the value 1 if the latent variable exceeds zero and 0 otherwise. The model predicts the probability of a particular binary outcome by applying the standard normal cumulative distribution to a linear combination of the predictors and their associated regression coefficients. The probability of outcome k for observation i is modelled as a function of the intercept and the explanatory variables multiplied by their corresponding coefficients. The empirical model is specified as follows:

$$Y_i = \beta_1 \text{Personality_trait}_i + \beta_2 \text{Female_dummy}_i + \beta_3 \text{Age}_i + \beta_4 \text{Size of Household}_i \\ + \beta_5 \text{Locality}_i + \beta_6 \text{Marital Status}_i + \beta_7 \text{Type of Dwelling}_i + \beta_8 \text{Education}_i \\ + \beta_9 \text{Income}_i + \beta_{10} \text{Number of Sleeping rooms}_i + \varepsilon_i$$

In the empirical specification above, the likelihood of an individual adopting any of the energy conservation behaviours (Y_i) is measured to be dependent on personality traits (i.e., the “Big Five”), female dummy, age, the size of a household, locality (urban), marital status (married), type of dwelling and the number of sleeping rooms.

Results

Descriptive statistics

Table 1 presents descriptive statistics of the variables used in the empirical model. Between 32 – 85 percent of the sample agreed having adopted the different energy conservation behaviours. With regards to measures that contribute towards habit adjustment, 84 percent agreed that they unplugged electronic devices that were not in use, and 85 percent agreed to always ‘turning off’ all lights before leaving a room. In the case of efficiency investment, 52 percent agreed they actively searched for products that were more energy-efficient when buying electrical appliances, 61 percent agreed to ‘having a high preference for efficient appliances,’ and 37 percent agreed that ‘efficiency rating/labelling influences their choice of appliances rather than prices.’ In terms of Proactive Conservation, 77 percent agreed to ‘taking action to conserve energy when they were home.’ And, for brand loyalty, 32 percent indicated that their appliances are guided by brand loyalty.

These observations indicate a strong inclination towards habit adjustment among respondents. While there is a notable preference for energy-efficient appliances, the responses on Proactive Conservation show that most respondents take action to conserve energy at home, suggesting a willingness to engage in energy-saving practices. Brand loyalty plays a relatively minor role in appliance choice, with only 32% indicating that it influences their decisions.

Table 1: Descriptive statistics

Variable	Mean (Std. Dev)
Dependent variable	
<i>Habit Adjustment</i>	
I unplug electronic devices that are not being used	0.84 (0.37)
I always turn off all lights before leaving a room	0.85 (0.36)
<i>Efficiency Investment</i>	
I actively search for products that are more energy efficient when buying electrical appliances.	0.52 (0.50)
I have a high preference for efficient appliances	0.61 (0.49)
Efficiency rating/labelling influences my appliances more than the price of the appliances.	0.37 (0.48)
<i>Proactive Conservation</i>	
When home, I take action to conserve energy	0.77 (0.42)
<i>Brand Loyalty</i>	
My appliance purchase is guided by brand loyalty	0.32 (0.47)
Main explanatory variable	
Extraversion	3.08 (0.47)
Agreeableness	2.84 (0.41)
Conscientiousness	2.81 (0.43)
Neuroticism	2.63 (0.55)
Openness	3.25 (0.60)
Control variables	
Female Dummy	0.34 (0.47)
Age	44.70 (13.62)
Size of household	5.16 (4.00)
Locality	0.68 (0.47)
Marital Status	0.59 (0.49)
Type of Dwelling	
Compound House	0.61(0.49)
Separate House	0.15 (0.36)
Flat/Apartment	0.09 (0.29)
Semi-detached Houses	0.08 (0.27)
Others	0.07(0.25)
Education	
No Education	0.20(0.40)
Primary	0.09(0.29)
JSS/JHS/Middle	0.29(0.45)
SSS/SHS/Secondary/Vocational/Technical	0.29(0.45)
Tertiary	0.14(0.34)
Income	1,685 (1,891)
Number of sleeping rooms	3.11 (2.11)
Sample size	1580

Among the control variables, 34 percent of the sampled households used for the estimation were female-headed, the average age of household heads was 45 years, and the average household size was 6 people. In terms of locality, about 68 percent of households

lived in urban areas. About 60 percent of the sampled household heads were married, and 61 percent of households resided in compound houses. The average number of sleeping rooms among the sampled households was four (4).

Estimation results

We present in Table 2 the marginal effects of the probit estimator explaining the extent to which personality traits affect the likelihood of adopting different energy conservation behaviours. In a broader context, we find that four out of the “Big Five” personality traits (i.e., agreeableness, conscientiousness, neuroticism, and openness) are significant predictors of energy conservation behaviour. Agreeableness had the most consistent relation with various aspects of energy conservation behaviour, as individuals who are kind, sympathetic and cooperative responded positively to all seven energy conservation dimensions measured. Neuroticism was the least consistent with various conservation measures, as such persons are noted to be more prone to anxiety and stress. Extraversion, however, was negatively associated with energy conservation behaviour among households within the Ghanaian context, although such individuals are expected to be more assertive, ambitious, energetic, and optimistic.

On the specific energy conservation behaviours and how they relate to the personality traits, we find some interesting results. For instance, agreeableness and conscientiousness have a consistent positive association with habit adjustment. Neuroticism is positively associated with one of the indicators, while extraversion is negatively associated with the other. The findings, in simple terms, suggest that individuals who are inclined towards new knowledge, novel approaches and are tolerant of diverse thinking and experiences, as well as those who have a proclivity for being very organised and committed to their obligations, are more likely to adopt habit adjustment energy conservation measures. While emotionally unstable individuals are also more likely to adopt habit adjustment energy conservation measures, this is not entirely the case for individuals who tend to present a positive attitude to social connection engagement, require stimulation and have the capacity to draw energy from socialising.

Under efficiency investment, we find that agreeableness, neuroticism and openness are positively associated with energy conservation behaviours that represent strategic efficiency investments. Individuals who are perceived as kind, sympathetic and cooperative, are emotionally unstable and are inclined towards new knowledge, novel approaches and are tolerant of diverse thinking and experiences, are more likely to undertake strategic efficiency investments. This includes actively searching for products that are more energy-efficient when buying electrical appliances, having a high preference for efficient appliances, and looking out for efficiency ratings/labelling when purchasing appliances.

Extraversion, agreeableness, conscientiousness and openness are found to be significant for proactive conservation. Individuals who are perceived as kind, sympathetic and cooperative have a proclivity for being very organised and committed to their

obligations and inclined towards new knowledge, novel approaches and are tolerant of diverse thinking and experiences are likely to adopt Proactive Conservation towards energy conservation. However, individuals who tend to present a positive attitude to social connection engagement, require stimulation and have the capacity to draw energy from socialising, are less likely to adopt proactive conservation.

The results show that for brand loyalty, agreeableness and openness are the only significant traits. Thus, individuals who are perceived as kind, sympathetic and cooperative, as well as those who are inclined towards new knowledge, novel approaches and are tolerant of diverse thinking and experiences, are more likely to align with and stick to brands that are committed to energy conservation.

Our analysis of the control variables reveals that age and household size are negatively linked to energy conservation, suggesting that where the household head is elderly and the household is large, one is not likely to find a strong commitment to energy conservation. In contrast, households situated in urban areas show a positive correlation with multiple energy-saving practices. The results further show that the type of dwelling also plays a significant role in explaining energy conservation behaviours. Specifically, households residing in separate houses, flats/apartments, or semi-detached houses are more inclined to adopt energy conservation measures. Regional variations in energy conservation practices were observed.

Table 2: Marginal effects for the adoption of energy conservation behaviours

Variables	Habit adjustment			Efficiency investment			Proactive conservation	Brand loyalty
	(1)	(2)	(3)	(4)	(5)	(6)		
	I unplug electronic devices that are not being used	I always turn off all lights before leaving a room	I actively search for products that are more energy efficient when buying electrical appliances.	I have a high preference for efficient appliances.	Efficiency rating/labelling influences my appliances more than the price of the appliances.	When home, I take action to conserve energy	My appliance purchase is guided by brand loyalty	
Personality traits								
Extraversion	0.016 (0.025)	-0.071*** (0.023)	-0.018 (0.035)	-0.032 (0.034)	-0.031 (0.034)	-0.060** (0.029)	-0.043 (0.029)	
Agreeableness	0.115*** (0.019)	0.088*** (0.020)	0.088*** (0.031)	0.139*** (0.029)	0.053* (0.031)	0.065*** (0.024)	0.089*** (0.029)	
Conscientiousness	0.043** (0.019)	0.060*** (0.020)	0.019 (0.029)	0.027 (0.028)	-0.021 (0.029)	0.093*** (0.022)	-0.013 (0.026)	
Neuroticism	0.038* (0.020)	-0.027 (0.020)	0.043 (0.028)	0.067** (0.028)	0.054** (0.027)	-0.020 (0.023)	0.030 (0.024)	
Openness	-0.025 (0.021)	0.007 (0.021)	0.167*** (0.029)	0.103*** (0.029)	0.168*** (0.028)	0.057** (0.024)	0.118*** (0.026)	
Female Dummy	0.028 (0.021)	0.012 (0.020)	-0.039 (0.028)	-0.048* (0.028)	-0.040 (0.028)	0.023 (0.024)	-0.085*** (0.024)	
Age	-0.000 (0.001)	0.000 (0.001)	-0.002** (0.001)	-0.003*** (0.001)	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	
HH Size	0.003 (0.003)	-0.001 (0.003)	0.002 (0.004)	0.004 (0.004)	0.002 (0.004)	-0.003 (0.003)	-0.008** (0.004)	
Locality (urban)	0.075*** (0.019)	0.066*** (0.019)	0.098*** (0.029)	0.044 (0.029)	0.052* (0.029)	0.123*** (0.023)	-0.014 (0.027)	
Married	-0.001 (0.022)	0.005 (0.020)	0.021 (0.029)	0.027 (0.028)	0.054* (0.028)	0.001 (0.024)	-0.022 (0.024)	
Type of dwelling								
Separate house	-0.064** (0.029)	-0.024 (0.028)	0.094** (0.037)	0.134*** (0.035)	0.131*** (0.036)	0.007 (0.031)	0.007 (0.029)	
Flat/Apartment	0.065** (0.027)	0.074*** (0.028)	0.228*** (0.043)	0.153*** (0.042)	0.194*** (0.046)	0.090** (0.036)	0.057 (0.041)	
Semi-detached	0.057** (0.025)	0.041 (0.027)	0.037 (0.044)	0.078* (0.044)	0.162*** (0.045)	0.031 (0.037)	0.046 (0.038)	
Others	-0.189*** (0.042)	-0.174*** (0.042)	-0.065 (0.048)	-0.085* (0.050)	0.019 (0.048)	-0.151*** (0.042)	-0.043 (0.042)	

	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580	1,580
Education									
No Education	-0.017 (0.035)	0.008 (0.035)	0.056 (0.052)	0.062 (0.053)	0.054 (0.051)	0.041 (0.041)	0.000 (0.044)		
Primary	0.001 (0.028)	0.020 (0.028)	0.035 (0.043)	0.069 (0.043)	0.101** (0.041)	0.013 (0.034)	0.057 (0.037)		
JSS/JHS/Middle	0.018 (0.030)	-0.004 (0.030)	0.046 (0.045)	0.030 (0.045)	0.116*** (0.043)	0.014 (0.035)	0.134*** (0.040)		
SSS/SHS/Secondary/ Vocational/Technical	0.055 (0.033)	0.060* (0.032)	0.186*** (0.051)	0.223*** (0.048)	0.237*** (0.050)	0.102*** (0.039)	0.213*** (0.047)		
Tertiary	-0.017 (0.035)	0.008 (0.035)	0.056 (0.052)	0.062 (0.053)	0.054 (0.051)	0.041 (0.041)	0.000 (0.044)		
Income (in log)	0.029*** (0.007)	0.028*** (0.006)	0.017 (0.012)	0.012 (0.011)	-0.017 (0.011)	0.021** (0.008)	0.024** (0.009)		
Number of rooms	0.010 (0.006)	-0.001 (0.005)	0.006 (0.007)	0.009 (0.007)	0.009 (0.007)	0.010 (0.006)	0.011* (0.006)		
Region									
Ashanti	-0.054** (0.023)	0.098*** (0.022)	0.120*** (0.030)	0.144*** (0.030)	-0.049* (0.030)	0.178*** (0.025)	-0.246*** (0.029)		
Northern	-0.022 (0.029)	0.049 (0.034)	0.032 (0.044)	0.050 (0.045)	-0.045 (0.044)	0.108*** (0.036)	-0.291*** (0.041)		
Observations	1,580	1,580	1,580	1,580	1,580	1,580	1,580		

Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The reference group for the type of dwelling is Compound House, and that for regions in Greater Accra. Results are based on the Authors' estimates.

To check the robustness and consistency of the results, we restricted the samples using three characteristics: individuals' attitudes related to conservation and awareness about the environmental impact of energy consumption; individuals knowledgeable about the social norms of energy efficiency; and the risk profile of individuals. In the survey, there were sub-sections, each of which addressed these characteristics. When the analysis is restricted to individuals with conservation-related attitudes and knowledge of the environmental impact of energy consumption, we observe that the results were the same as before with the full sample, but this new sub-sample had relatively lower probabilities. For instance, while the marginal probability for agreeableness is 0.126 in the full sample for unplugging electronic devices when not in use, for the sub-sample of those with conservation attitudes and sufficient knowledge about the environmental impact of energy consumption, the marginal probability is 0.093. This pattern is consistent for all other significant variables. When we restrict the sample to those with sufficient knowledge about the social norms on energy conservation, we observe results like those of the full sample, but with higher probability values in a few cases. When the analysis is restricted to risk-loving individuals, we observe that most of the results are insignificant. For instance, we find that a person with high agreeableness is more likely to adopt most of the energy conservation behaviours. However, among risk-loving individuals (i.e., all individuals who agreed to take a gamble (presented as an experiment that involved the tossing of a coin), when presented with a game with an uncertain outcome, instead of opting for a more certain outcome), agreeableness is significant and holds partially under habit adjustment only for those willing to unplug electronic devices that are not being used. Again, for risk-taking individuals, persons high in neuroticism are negatively related to a part of habit adjustment in that such persons are unlikely to turn off unneeded light. This result is at variance with the observations from the analysis of the full sample.

An important conclusion we can draw from the findings so far is that personality traits matter for energy conservation behaviour, even when people with environmental attitudes and information, as well as consideration for environmental social norms alone are considered. In other words, the findings for these subsamples broadly reinforce the observed patterns in the full sample analysis. Evidence on the case of risk-loving persons is, however, limited.

Discussion of findings

The results of this paper broadly show that personality traits are significant predictors of various energy conservation behaviours, even in the context of developing countries. More specifically, we focus the discussion of energy conservation on measures that are inclined towards habit adjustment, efficiency investment, proactive conservation, and brand loyalty. In exploring the interplay between the traits and environmental attitudes and knowledge of the environmental impact and environmental social norms, we show that the observed link between energy conservation and personality traits is robust.

We, however, did not find a consistent pattern of relationship when the risk profile of household heads was taken into consideration.

We find support for our hypothesis that openness, conscientiousness, and agreeableness are positively associated with pro-environmental behaviour among households. Individuals with traits like conscientiousness are predisposed towards habit adjustment behaviours towards energy conservation, as they tend to be organised and committed, allowing them to more easily restructure their lives once they see value in energy-saving habits. The curiosity and flexibility of persons high in openness also predispose them towards new habits. They will typically experiment with various conservation routines and adopt them. They can sometimes be the first adopters of new behaviours. The cooperative and empathetic nature of agreeable persons may extend into concerns about collective good and how their actions ultimately impact the environment, serving as an important motivator for energy-saving habits. Emotional instability in persons with neuroticism means they are prone to anxiety. The finding of a positive association between persons with high neuroticism and habit adjustment suggests that they are inclined to energy-saving habits to mitigate perceived risks, such as high electricity bills and financial strain, or even as a coping mechanism for some sense of stability or emotional comfort. The results further show that persons with extraversion are less likely to engage in habit adjustment behaviours. Apart from being forgetful, such persons may find these behaviours mundane.

Persons with agreeableness, neuroticism, and openness are inclined towards strategic investment in energy-efficient equipment, and for different reasons. For instance, cooperative and empathetic traits of agreeable persons may do it out of a sense of social responsibility and environmental sustainability, whilst neurotic individuals may do so to minimise perceived risk and maintain control. Open individuals may be attracted to innovation and cutting-edge solutions that enhance efficiency.

It is, therefore, not out of place to observe in our findings that inclinations towards proactive conservation are positively linked to agreeableness, conscientiousness, and openness, but negatively linked to extraversion. We also observe that brand loyalty in energy conservation is associated with agreeableness and openness, suggesting that empathetic and open-minded individuals are more likely to be loyal to brands known for energy efficiency since these brands minimise the decision-making effort and uncertainty associated with purchases. Although we do not hypothesise about extraversion and neuroticism, we find that the former is associated with a reduced likelihood of habit adjustment and proactive conservation, while the latter increases the likelihood of habit adjustment and strategic investment in energy efficiency.

The results of this paper align with previous research by Markowitz et al. (2012), Milfont and Sibley (2012), and Quintelier (2014), which emphasise the significant role of personality traits in influencing pro-environmental behaviours, such as energy conservation. Specifically, our finding that openness positively predicts the adoption of energy conservation behaviours is supported by studies like Hirsh and Dolderman

(2007), Soliño and Farizo (2014), and Brick and Lewis (2014). Additionally, the positive relationship between conscientiousness and energy conservation is consistent with findings by Hilbig et al. (2013) and Milfont and Sibley (2012). For other personality traits with positive associations, our results are in line with existing literature, including Swami et al. (2011), Milfont and Sibley (2012), and Hirsh (2010) for agreeableness, and Brick and Lewis (2014), Markowitz et al. (2012), and Hirsh (2010) for neuroticism. However, we found that extraversion negatively affects the likelihood of adopting energy conservation behaviours, similar to Busic-Sontic and Brick (2018). Unlike some previous studies, such as Busic-Sontic, Czap, and Fuerst (2017), we found limited evidence that risk preferences consistently moderate the relationship between personality traits and energy conservation behaviours.

Policy implications

The findings have several implications for energy-transition policy in developing-country contexts. By demonstrating the role of personality traits in predicting energy conservation behaviour, the study suggests that targeted interventions can be designed to leverage these traits in promoting sustainable practices. Education and awareness campaigns, incentive programmes, and partnerships or collaborations with strategic brands can be used to nudge individuals towards habitual adjustments and efficiency-enhancing investments, particularly among those scoring high on agreeableness, conscientiousness, and openness, and, to some extent, neuroticism. In addition, initiatives that tap into social norms, such as publicising successful conservation stories, creating community-level energy-saving challenges, and using peer comparison feedback, remain promising policy tools, especially for individuals with higher levels of extraversion, given their responsiveness to external social stimuli.

The results also point to the need for close collaboration among policymakers, educators, community leaders, and respected corporate brands to embed environmental values and norms that support energy conservation. Stakeholders can design targeted programmes that not only promote energy efficiency but also contribute to a broader cultural shift towards sustainability. Practical options include integrating environmental education into school curricula, promoting community-based conservation initiatives, and providing financial and non-financial incentives for households to adopt energy-efficient technologies. By systematically incorporating personality-informed targeting into these interventions, governments and partners can accelerate progress towards a more sustainable and inclusive energy transition.

Conclusion

This paper has investigated the extent to which personality traits (i.e. the “Big Five”) shape energy conservation behaviour in Ghana, drawing on a unique household survey conducted in three regions, Greater Accra, Ashanti, and the Northern Region, which

represent the Coastal, Forest, and Savannah ecological zones, respectively. The findings indicate that personality traits constitute important predictors of energy conservation behaviour. Moreover, because the estimated relationships between personality traits and energy conservation behaviour remain robust after controlling for environmental attitudes, knowledge of the environmental consequences of energy use, and awareness of environmental social norms, greater emphasis should be placed on these dimensions in advocacy and public-education programmes. The heterogeneous effects across traits, particularly for extraversion, further suggest that it is insufficient to assume that merely complementing energy-transition policies with generic education or information provision will automatically generate substantial energy-saving behaviour. Rather, the evidence on extraversion points to the value of more targeted campaigns, implying that educational and awareness initiatives on energy conservation could be strengthened by tailoring their content, framing, and delivery channels to specific personality profiles within the population.

The study underscores the importance of integrating psychological and social dimensions with technological and economic approaches to energy transition. Personality traits, together with environmental attitudes, knowledge, and social norms, provide a valuable lens for understanding variation in household energy conservation behaviour in Ghana. By deliberately tailoring interventions to the personality profiles of different population segments, policymakers can more effectively foster energy-saving actions and support a just and durable energy transition. In doing so, this approach can contribute to addressing climate-change challenges by cultivating a culture of environmental responsibility and encouraging the widespread adoption of conservation practices, even as average incomes and energy demand rise. Ultimately, recognising and harnessing the psychological determinants of energy-saving behaviour enhances the prospects for achieving a sustainable energy system in Ghana and, by extension, in comparable developing-country settings.

Disclosure statement

No potential conflict of interest was reported by the author(s).


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