Energy consumers' perspectives on social, environmental and quality of service factors - an analysis of linkages in developed and developing countries

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Abstract

This paper aims to assess the role of social, quality energy services and environmental factors in household energy decision-making. Authors identified links between these dimensions for energy consumers in making decisions and assessed differences between advanced and developing economies. A questionnaire-based survey using the CAPI technique was used. The survey was conducted among respondents from Bulgaria, England, Jordan, Poland, Russia and the United Arab Emirates. The correlation and Principal Component Analyses were used to analyze the data. Results show significant interdependencies between consumers' propensity to government social support, quality of energy services and environmental aspects. Energy consumers who advocate for increased subsidies for the poorest also support banning disconnections due to non-payment. Additionally, the study reveals that consumers highly value pro-quality tools, mainly online energy management tools and artificial AI-driven solutions. The findings contribute valuable insights for policymakers and energy sector practitioners in addressing consumer needs and designing sustainable energy policies.

Keywords: Smart energy management, AI-driven solutions, Energy consumers, Multivariate analysis.

1. Introduction

Energy consumption patterns and consumer perceptions are shaped by multiple factors, including socioeconomic conditions (Stern, 2019; Nagaj, 2022), regulatory frameworks (de la Hoz et al., 2019) and technological advances (Hanah & Dalia, 2024; Liu et al., 2025). With redoubled force, these factors affect vulnerable consumers, who are most often susceptible to energy poverty (for developing economies) or fuel poverty (for developed economies). Vulnerable energy consumers face challenges securing energy services, requiring government interventions such as subsidies and conservation policies. At the same time, service quality and environmental considerations are subject to increasingly stringent regulation. All these factors, social, qualitative and environmental, influence on consumer preferences. The literature (Stern, 2019, Deng et al., 2021), mainly focuses on the economic factors such as income and prices, and economic development, indicating that their impact varies across regions. It is indicated that social or demographic factors may be potential differentiators for this impact (Soto and Martinez-Cobas, 2025; Zou et

al., 2025). The analysis of these areas is a field to be explored.

Attention is also given to environmental issues, due to the increasing role of RES and environmental awareness among young people, including tourists (Nagaj and Žuromskaitė, 2023), the correlation between CO2 emissions and energy consumption (Liu et al., 2022) and the progressive decarbonisation of industry (Gajdzik et al., 2024). However, these studies often isolate single variables, omitting broader social or behavioral contexts.

Similarly, analysis of the influence of other factors such as embedding regulatory framework (de la Hoz et al., 2019), energy digitisation (Hanah and Dalia, 2024), and energy efficiency (Liu et al., 2025) tends to be narrow in scope. They are unidirectional, lacking links to the social situation of consumers or the quality of services offered. Even multivariate analyses such as Zhang, Mu and Hu (2024) often lack insight at the household level and its attitudes to service quality or cross-country comparisons. Of course, the literature notes the importance of the quality of energy services (Gomes, Coelho, Vale, 2023; Mah et al., 2012; Mesarić, Đukec, Krajcar, 2017). The shortcoming, however, is that the literature only pays attention to the technical efficiency of energy companies (Wesseh et al. 2023), or only assesses the quality of service in the energy market in a specific country (Drosos et al. 2020). What is missing, however, are links to economic or social factors, and how this influences consumer decisions.

A review of the current literature on the studied topic indicated a research gap in knowledge regarding the relationships in the three dimensions influencing consumer decisions. In addition, the literature usually analyses only one group of determinants of energy consumption (Mesarić, Đukec, Krajcar, 2017; de la Hoz et al., 2019; Wu et al., 2024). In this manuscript, the authors intend to focus on the three dimensions of energy consumer perception, the social focus on vulnerable consumers, the quality of energy services and the environmental impact, and their importance for energy consumers.

This article aims to assess the role of social, quality of energy services, and environmental factors in household energy decision-making. The authors sought to identify the links between these dimensions and how they are important for energy consumers when making decisions. Five research questions were posed to achieve this aim:

RQ1: Do consumers opt for social support for energy-vulnerable consumers?

RQ2: What role does the quality of energy services play for end-users?

RQ3: Depending on households' perception of the social factor and the quality of energy services, does their perception of the environmental factor change when making energy consumption decisions?

RQ4: Are there any relationships between consumers' propensity to provide social support to poor energy end-users and the importance of the qualitative (quality of services) and environmental factors?

RQ5: Do perceptions of social support, the quality of energy services and the environmental factor depend on the degree of development of economies?

The relevance of analysing these relationships is indicated by the findings presented by Rafindadi, Aliyu and Usman (2022), who point out that not only can economic factors stimulate energy consumption, but there is also a feedback compression. Knowledge of the relationships between the energy consumption factors analysed by the authors can provide practical insights into consumer preferences and be used in the future to analyse how these relationships may determine the development of economies. This study will use a questionnaire-based survey using the Computer-Assisted Personal Interviewing (CAPI) technique. The survey was conducted among respondents from Bulgaria, England, Jordan, Poland, Russia and the United Arab Emirates.

The selection of those particular countries for the survey on energy consumers' perspectives is motivated by their diverse socio-economic, environmental, and energy market characteristics. Developed countries like England and (to less extent) Poland offer insights into advanced energy infrastructure, policy frameworks, and consumer expectations regarding service quality. On the other hand, countries such as Bulgaria and Russia provide valuable data on energy systems in transition economies, with varying levels of development and energy access. Additionally, Jordan and the UAE exemplify regions with distinct environmental and social contexts. Jordan faces significant energy

challenges stemming from its limited natural resources, while the UAE is characterized by a strong emphasis on sustainability and the integration of renewable energy sources. In consequence by including both developed and developing countries, the study captures a wide spectrum of consumer attitudes, allowing for a comprehensive analysis of how social, environmental, and service quality factors influence energy consumers in different contexts. Moreover, the rationale for choosing the countries where the study was carried out is to compare the relationships found among consumers in developed and developing economies because, according to energy poverty theory, the level of development of economies can influence consumer preferences (Canh et al., 2021; Deng et al., 2021). Additionally, the literature shows that energy consumers in highly developed economies tend to pay attention to financial factors, resulting in fuel poverty (Nagaj, 2022). In developing countries, however, more emphasis is placed on the availability of energy services, resulting in greater vulnerability to energy poverty (Li et al., 2014).

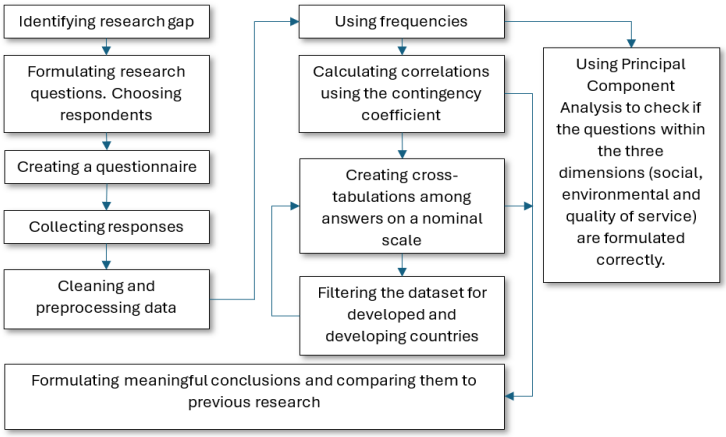

Fig. 1. Research process model.

Source: Own elaboration.

Figure 1 shows the stages of the research process conducted by the authors. The contribution of this paper to the literature is threefold. Firstly, no studies simultaneously analyse the importance of the energy market for consumers in terms of social factors, the quality of energy services offered by companies, and environmental factors. As indicated above, there are studies that assess the impact of each of these factors on the energy market or together with economic factors. However, all these factors are not analysed together. Secondly, this manuscript will explore how consumer opinions are linked in these three aspects indicated. The study aims to provide practical insights for energy policy improvements by identifying these linkages. Thirdly, the authors will assess whether there are differences between developed and developing economies. There is no such research that compares the inclinations of consumers operating in economies with different levels of development. For statistical analysis, including correlation assessments, to ensure that survey items are appropriately grouped into thematic components the Principal Component Analysis (PCA) was used.

The paper's purpose and research questions are thus defined, and it is structured accordingly. After the introduction, a literature review will be presented on the determinants of energy consumption and household perceptions of this sector. This will be continued with a methodological section, research results, and a discussion. The entire work will conclude with a conclusion section.

2. Literature review

Current literature analyses the issue of energy consumption multi-dimensionally. Analyses focus on energy poverty, consumer habits, and energy consumption factors. In summary, the complex nature of consumption processes is revealed. In the context of this manuscript, the factors that determine the level of energy consumption are relevant. Table 1 shows which factors are indicated in the literature.

Table 1. Factors determining the level of consumption and the perception of these factors by consumers in the literature.

Authors and Year	Region/country analysed	Energy consumption factors
Mah et al. (2012)	Hong Kong	smart grid technology
Mesarić, Đukec and Krajcar (2017)	Croatia	smart technologies
de la Hoz et al. (2019)	Spain	regulatory framework
Mrówczyńska et al. (2020)	Zielona Góra (Poland)	income, local policy, location
Voskamp et al. (2020)	World - synthetic review of world literature	social factors, consumer characteristics, resources and the urban landscape
Canh et al. (2021)	115 countries	level of the informal sector
Dokas et al. (2022)	109 countries	economic growth, investment, weather, trade openness, corruption, and innovation.
Liu et al. (2022)	Sichuan Province (China)	population size, economic development and energy consumption structure
Sadiq et al. (2022)	China	economic growth, FDI, inflation and population growth
Dam & Sarkodie (2023)	Turkeye	level of development, environmental factor
Tzeiranaki et al. (2023)	EU	climatic, economic and political factors
Ahsanuzzaman et al. (2024)	Bangladesh	increasing available information and consumer awareness
Koirala and Rahut (2024)	Nepal	household economic stability and well-being
Rasanga, Harrison, & Calabrese (2024)	Great Britain	population size and income
Wu et al. (2024)	Chinese cities	demographic structure, region of residence
Zhang, Mu, & Hu (2024)	Beijing (China)	step of development of the country, technological progress
Nepal et al. (2025)	China	education, income, income inequality, industrial structure of the region, population density
Zou et al. (2025)	Shanghai (China)	age, demographic factors associated with an ageing population and income

Source: own work based on literature review.

The factors identified by the literature can be broadly categorised into six clusters: demographic, technological, economic, social, environmental, and other.

Firstly, demographic factors such as population growth, intensive urbanisation, and ageing processes significantly impact increasing energy demand, especially in regions characterised by dynamic economic development. In developing countries, disparities in energy consumption are often the result of differences in demographic structure and the region where consumers live (Wu et al., 2024).) Population size, economic development, industrial structure, energy intensity, and energy consumption structure are very important factors (Liu et al., 2022). Findings from the work of Zou et al. (2025) show that an ageing population increases energy demand and significantly alters hourly consumption patterns. Rising incomes and progressive economic development compound these changes.

Secondly, technological advances play a twofold role - on the one hand, they enable improvements in energy efficiency and the development of renewable energy sources, and on the other hand, they contribute to an increase in energy consumption by increasing the availability of modern digital devices and automation systems. The literature also includes here the quality of energy services. Contemporary research highlights that consumers place some importance on supply reliability and speed of response to disruptions. Zhang, Mu, and Hu (2024) stated the degree of influence of each factor varies in different periods of development. They also prove that technological progress, especially the introduction of innovative energy-efficient technologies, always plays an important role in reducing energy consumption. Meanwhile Mah et al. (2012) highlighted the role of smart grid technologies, but as Mesarić, Đukec and Krajcar (2017) pointed out, these should not be technologies that energy suppliers are able to use to control consumers.

The literature also emphasizes the importance of economic factors, such as economic growth, foreign direct investment and inflation (Sadiq et al., 2022), the standard of living of the population, location and local policies (Mrówczyńska et al., 2020), which may encourage actions to reduce energy consumption or improve the energy-intensive standard of residential buildings. Meanwhile, the poorer households are likely to pay a premium for energy consumption (Rasanga, Harrison, and Calabrese, 2024), which is characteristic for developing countries (Koirala and Rahut, 2024).

The next group of factors underlined in the literature are political and regulatory factors that help implement energy support strategies (de la Hoz et al., 2019; Tzeiranaki et al., 2023). It can improve the efficiency of energy consumption management. Environmental conditions, such as climate change and raw material availability, determine the seasonality

of energy consumption (e.g. for heating/cooling). All these factors force the energy sector's transformation towards sustainability (Dam and Sarkodie, 2023; Tzeiranaki et al., 2023).

Literature also points out the impact of a combination of several factors. Nepal et al. (2025) note that socio-economic, demographic and geographical factors determine energy consumption and consumer attitudes towards energy consumption. Educated consumers (Voskamp et al., 2020) or well-informed (Ahsanuzzaman et al., 2024) are more environmentally conscious, willing to invest in energy-efficient technologies, and often promoting a rational approach to household energy consumption. Meanwhile, Dokas et al. (2022), emphasize both the role of economic factors (economic growth, investment) and weather, and the level of the informal sector (Canh et al., 2021). A common feature of these studies, however, is the gap, consisting in focusing only on developing countries or are no longer based on data that is no longer up to date .

In summary, the literature on energy consumption highlights the critical role of affordability, income, and sustainability in shaping consumer satisfaction. It also points to growing environmental awareness. Meanwhile, research on energy service quality suggests that digitisation and AI-based solutions enhance consumer experience and efficiency. However, it was found that there is a lack of studies analysing the combined impact of all factors, together with consumer attitudes to service quality. This paper builds on these existing studies, exploring the interrelationships between three dimensions (social, service quality, environmental) using empirical data.

3. Materials and methods

The aim of this article is to assess the role of social factors, the quality of energy services, and environmental factors in household energy decision-making. The authors sought to identify the links between these dimensions relevant to energy consumers' decision-making. A survey was conducted to find out the opinions of consumers in both developed and developing countries about the aim of the study. Thus, respondents in Poland, England, Bulgaria, Russia, Jordan, and the United Arab Emirates were surveyed in October 2024-January 2025, with the first three countries representing developed economies (under the European Green Deal) and the last three developing countries (not under the Green Deal). The rationale for choosing the countries where the study was carried out is to compare the relationships found among consumers in developed and developing economies according to the energy poverty theory. The questionnaire comprises multiple sections assessing consumer views on affordability, service quality, and environmental impact. Key questions include opinions on energy pricing policies, government subsidies, service disruptions, digital solutions, and renewable energy preferences. A total of 261 valid responses were received, of which 58.6% were from developed countries and 41.4% represented developing countries. Respondents also represent different generations, with 9.6% Baby Boomers, 19.2% Generation X, 23.0% Generation Y, 22.2% Generation Z, and 25.7% Generation α. Only people over 18 who pay their energy bills were surveyed. In order to achieve the objective of this work, the following three components were assessed through a survey:

- the relevance of social factors and the protection of vulnerable consumers when using energy,
- the importance of quality energy services,
- the relevance of the environmental factor.

The first was used to assess respondents' attitudes to the role of the social factor and their responses to RQ1. The authors sought to assess attitudes towards differentiating energy bills according to the consumer's income, government energy subsidies to the poorest, providing free energy to the income-poor, and applying a ban on disconnecting the poor from the energy grid. The second question assessed consumer attitudes to the quality of electricity service and the relevance of this factor in choosing an energy supplier. It was used to answer RQ2. In assessing this factor, quality parameters such as time of disruption of the supply of energy carriers during failures, number of energy supply interruptions per year, quality of customer service in the customer service office, ability to handle all energy-related issues online, the possibility of monitoring the consumption of energy carriers, costs of connecting to the energy grid, and access to AI products to reduce

energy expenditures were taken into account. In contrast, the third question was used to answer RQ3. It was assessed how important renewable energy sources (RES) and environmental protection are to energy end-users and whether they would be willing to pay more to consume energy with less negative environmental impact. A 5-point Likert scale was used for all responses.

JASP software is used for statistical analysis, including correlation assessments and Principal Component Analysis (PCA). The PCA ensures that survey items are appropriately grouped into thematic components, confirming the structural integrity of the questionnaire. Principal Component Analysis (PCA) is carried out in 3 steps. Firstly, for the items in Q1. Secondly, for the items in Q2. Thirdly, for the items in Q3. The PCA did not identify groups of thematically connected components. It means that the questions (Q1, Q2, Q3) are asked correctly and are not highly correlated. If all factors-components analyzed in the study through questions Q1, Q2 and Q3) are put in one PCA, all questions are separated thematically as "Component 1" (relevant to social factors), "Component 2" (relevant to the quality of energy services), "Component 3" (relevant to environmental factor). In addition, in implementing the answer to RQ4, an analysis of the relationships and connections between the analysed consumer choice factors was carried out using this method. PCA is used to determine (1) if there is a structure in the items within a question in the questionnaire, (2) if there is a structure in the items within several questions in the questionnaire. If a structure is identified by PCA, the questionnaire may be updated and revised for future surveys. If no structure is identified by the PCA, it means that the questions in the questionnaire are asked thematically correctly. In addition, this analysis was conducted separately for respondents from developed and developing economies. The obtained results, similarities or differences, will allow us to answer RQ5.

Instead of PCA other options are possible: Multiple Correspondence Analysis, Factor Analysis of Mixed Data, Multiple Factor Analysis, Latent Class Analysis. But some of them are not within the functionality of the used software. Further analysis (and research) may be focused on using these methods with the same dataset. The PCA analysis proves that the questions are formulated correctly within the dimensions Q1, Q2 and Q3.

4. Results

As indicated in the methodology, in answering the research questions posed in the paper, the authors transformed the data using JASP software. Data transformation and statistical analyses reveal meaningful correlations between responses.

The first studied research question concerns the relevance of social factors and the protection of vulnerable consumers when using energy (scale of 1-5, where 1 - totally disagree, 5 - totally agree). To validate this research question, the authors examined how respondents rated the relevance of social protection for energy consumers in four areas:

- Q1.1 is "Should energy bills vary according to the consumer's income?",
- Q1.2 is "Should the government pay additional energy subsidies to the poorest?",
- Q1.3 is "Poor people should have energy for free",
- Q1.4 is "There should be a ban on disconnecting the poor from the energy grid".

Table 2 presents interdependent links among affordability-related questions, showing that individuals supporting income-based energy pricing are more likely to favor subsidies and disconnection bans.

The results of the correlation analysis (Table 1) indicate statistically significant correlations between respondents' views on helping the poverty and protecting against grid disconnection. It was found that there is a strong correlation between the willingness of consumers to differentiate energy bills about income, the need for government subsidies for the poorest and the provision of free energy for income-vulnerable consumers. The results also show that the need for government subsidies is accompanied by support for the support of the poor through free energy supply, and a ban on disconnecting the poor from the grid. It indicates some polarization of opinion, with a predominance of those who advocate more excellent protection for vulnerable consumers.

Table 2. Valuable interdependent links in RQ1 (r>0.49).

Question 1	Question 2	Correlation (n=261, p<0.05)	Comment
Q1.1	Q1.2	R=0.523	10% of the people who are neutral on the statement "Energy bills should vary according to the consumer's income" totally agree with the statement Government should pay additional energy subsidies to the poorest". Other cross-table percentages are less than 10%.
Q1.1	Q1.3	R=0.513	14% of the people totally disagree with the statement "Energy bills should vary according to the consumer's income" and the statement "Poor people should have energy for free". Other cross-table percentages are less than 14%.
Q1.2	Q1.3	R=0.507	10% of the respondents totally agree with the statements Government should pay additional energy subsidies to the poorest" and "Poor people should have energy for free". Other cross-table percentages are less than 10%.
Q1.2	Q1.4	R=0.494	10% of the respondents totally agree with the statements Government should pay additional energy subsidies to the poorest" and "There should be a ban on disconnecting the poor from the energy grid". Other cross-table percentages are less than 10%.
Q1.3	Q1.4	R=0.627	Two polars. A group of people (12%) agreeing on both statements "Poor people should have energy for free" and "There should be a ban on disconnecting the poor from the energy grid". Another group of people (12%) disagreeing on both statements.

Source: own contribution.

Next, the authors analysed the importance of the quality of energy services for consumers. As part of the RQ2 revision, respondents were asked to rate the following areas of service quality (rating scale: from 1 - completely unimportant, to 5 - very important):

- Q2.1 - time of disruption of the supply of energy carriers during failures,
- Q2.2 - number of energy supply interruptions per year,
- Q2.3 - quality of customer service in the customer service office,
- Q2.4 - ability to handle all energy-related issues online,
- Q2.5 - possibility of monitoring the consumption of energy carriers,
- Q2.6 - costs of connecting to the energy grid,
- Q2.7 - access to AI products that reduce energy spending.

Table 3 highlights associations between service quality aspects, with a strong preference for digital solutions such as AI-driven energy management.

Table 3. Valuable interdependent links in RQ2 (r>0.5).

Question 1	Question 2	Correlation (n=261, p<0.05)	Comment
Q2.4	Q2.7	R=0.552	17% of people totally agree with the statements "Ability to handle all energy-related issues online" and "It is important for me to have access to AI products that allow me to reduce my energy expenditure". Other percentages are less than 17%.
Q2.5	Q2.7	R=0.610	17% of people totally agree with the statements "Possibility of monitoring the consumption of energy carriers" and "It is important for me to have access to AI products that allow me to reduce my energy expenditure". Other percentages are less than 17%.
Q2.1	Q2.4	R=0.606	17% of people totally agree with the statements "Time of disruption of the supply of energy carriers during failures" and "Ability to handle all energy-related issues online".Other percentages are less than 17%.
Q2.4	Q2.5	R=0.664	25% of people totally agree with the statements "Ability to handle all energy-related issues online" and "Possibility of monitoring the consumption of energy carriers". Other percentages are less than 25%.
Q2.5	Q2.6	R=0.619	20% of people totally agree with the statements "Possibility of monitoring the consumption of energy carriers" and "Costs of connecting to the energy grid". Other percentages are less than 20%.

Source: own contribution.

Table 3 shows significant links showing consistent attitudes toward service quality, digital solutions, and energy monitoring. Online access strongly correlates with AI tools that reduce energy use, and monitoring consumption encourages AI adoption. Similarly, it has been proven that the duration of energy outages motivates consumers to have the ability to deal with the energy company online. In contrast, the strongest correlation is between the ability to monitor energy consumption and the number of connection costs to the grid (R=0.619) and the correlation between the ability to deal with matters online and monitor consumption (R=0.664). Consumers who value the digitalization of energy services (online, AI, monitoring) simultaneously emphasize the importance of reliability and connection costs. It indicates a growing expectation of modern technological solutions. The RQ3 revision examined how households assess the relevance of the environmental factor (scale of 1-5, where 1 - totally disagree, 5 - totally agree). In assessing this factor,

respondents were asked about:

- Q3.1 - Is it important that the energy purchased comes from RES?,
- Q3.2 - How important is it whether an energy company has a negative impact on the environment?,
- Q3.3 - Would they be willing to pay more for energy if it came from RES?,
- Q3.4 - Would they be willing to pay more if the company did not negatively impact the environment?.

Table 4 demonstrates significant correlations between environmental concerns and willingness to pay more for sustainable energy sources. The results showed that consumers have a consistent attitude towards environmental issues. Consumers who would like to consume only energy from RES are also willing to pay more for energy from companies that care about the environment. Similarly, if consumers agree to pay more for energy from RES, they prefer only energy companies that do not negatively affect the environment. In conclusion, those who value RES and the green practices of energy companies are willing to pay more for energy, highlighting a growing environmental awareness.

Table 4. Valuable interdependent links in RQ3 (r>0.5)

Question 1	Question 2	Correlation (n=261, p<0.05)	Comment
Q3.1	Q3.4	R=0.555	10% of people totally agree with the statements "It is important to me that the energy I buy comes from renewable sources (RES)" and "I would be willing to pay more for energy when the company does not have a negative impact on the environment". Another 10% of the people disagree with both statements. Other percentages are less than 10%.
Q3.3	Q3.4	R=0.747	There is a match in the opinions on both statements. People who have agreed with "I would be willing to pay more for energy if the energy came from renewable sources" and "I would be willing to pay more for energy when the company does not have a negative impact on the environment". And also people (16%) who totally disagree on both statements.

Source: own contribution.

To verify responses to RQ4, the PCA method was used. All factors-components (analyzed in the study through questions Q1, Q2 and Q3) were put in one PCA, and all questions are separated thematically as "Component 1" (relevant to social factors), "Component 2" (relevant to the quality of energy services), "Component 3" (relevant to environmental factor). Table 5 shows the results of this analysis.

Table 5. Principal Component Analysis (PCA) for all questions

Component Loadings				
Component	RC1	RC2	RC3	Uniqueness
Q2.4	0.863			0.330
Q.2.1	0.850			0.395
Q2.5	0.814			0.322
Q2.2	0.759			0.500
Q2.6	0.694			0.475
Q2.7	0.503			0.575
Q2.3	0.501			0.660
Q3.4		0.949		0.209
Q3.3		0.915		0.272
Q3.1		0.660		0.322
Q3.2		0.571		0.356
Q1.3			0.889	0.255
Q1.4			0.777	0.405
Q1.2			0.721	0.474
Q1.1			0.682	0.557
Note. Applied rotation method is promax.				

Source: own contribution.

The PCA results confirm the distinctiveness of the studied thematic categories, validating the robustness of the research. It also indicates that social factors, quality of services, and environmental factors are related. This means that for consumers who are willing to provide social support to poor energy end-users, the environmental factor plays a significant role. The results also indicate that pro-environmental preferences are also associated with consumers for whom the quality of energy services is important.

In the final part of our analysis, the authors conducted a comparative analysis for developed and developing countries, thus answering RQ5. Table 6 and Figure 2 show

results of consumer perception of social, qualitative and environmental factors in developed and developing economies.

Table 6. Differences in the dimensions: (1) the social support, (2) the quality of energy services and (3) the environmental factor among two categories: (1) developed countries and (2) developing countries.

Question	Correlation* (n=261)	Comments for developed countries** (n=153)	Comments for developing countries** (n=108)
Q1.3	R=0.243, p<0.05	Providing free energy to poor people is not an important issue.	It is very important to provide free energy to poor people.
Q1.4	R=0.313, p<0.01	The ban on disconnecting the poor from the electricity grid is neither important nor important a social action.	The ban on disconnecting the poor from the electricity grid is very important for consumers from these countries.
Q2.3	R=0.265, p<0.01	Most of the respondents are neutral on the quality of customer service in the customer service office.	Most of the respondents totally agree the quality of customer service in the customer service office is very important.
Q2.6	R=0.25, p<0.01	The cost for connecting the energy grid is neither important nor not important.	The cost for connecting the energy grid is important.
Q3.1	R=0.211, p<0.01	It is important that the energy comes from renewable sources.	It is neither important, nor not important that the energy comes from renewable sources.
Q3.3	R=0.213, p<0.01	The respondents would be willing to pay more for energy if the energy came from renewable sources.	The respondents are neutral on their willingness to pay more for energy if the energy comes from renewable sources.

* Only statistically significant correlations (p<0.05) are marked in Table 6.
** The comments are based on the greatest share of answers on each question for each group (developed countries and developing countries).

Source: own contribution.

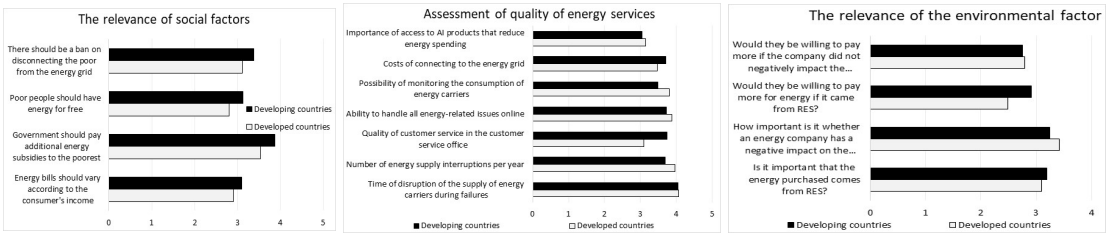

Fig. 2. Importance of social, qualitative and environmental factors
Source: own contribution.

The analysis showed that there are differences in the perception of the importance of the three analyzed factors between consumers from advanced economies and from developing countries. In developing countries, social protection for energy consumers, including providing free energy for the poorest, is of key importance, whereas in developed countries, it is not considered significant. similarly, the ban on disconnecting the poor from the electricity grid is highly important in developing countries but not in developed ones. There are also clear differences in the perception of energy service quality—while opinions on customer service in developed countries are neutral, in developing countries, most respondents consider it important. The costs of connecting to the energy grid are also more significant in developing countries than in developed countries. Regarding environmental factors, the preference for RES and the agreement to pay more for such energy is important in developed countries, and this issue is neutral in developing countries.

To summarize the results, the following key findings relating to the verified 5 research questions can be indicated:

RQ1: Consumers in general do support social assistance for energy-vulnerable users and they are favoring subsidies, social tariffs, and protections against disconnection. However opinions are polarized.

RQ2: Service quality is very important. Consumers tend to prefer also reliability, digitalization, and AI-driven energy management tools. Moreover consumers value efficient online services and real-time communication.

RQ3: Environmentally conscious consumers accept higher prices for green energy.

RQ4: There are strong correlations between social support, service quality and environmental factors, which show that consumers supporting subsidies also find service improvements and sustainability important.

RQ5: Differences exist between developed and developing economies, with the former

focusing on affordability and service quality, while the latter prioritizes energy access and government support. However, both show growing environmental awareness.

5. Discussion

The study confirms that many consumers support social assistance for energy-vulnerable users (RQ1). They are favoring subsidies and protections against disconnection, though opinions remain polarized. This aligns with Rasanga et al. (2024), who show that energy-poor households in Great Britain face a poverty premium, which increases the need for fair pricing policies and targeted financial aid. Our findings also coincide with (Ahsanuzzaman et al., 2024; Koirala and Rahut, 2024) underlining that there are affordability problems in developing countries, where people are willing to pay more for better electricity access but they face significant financial barriers. The findings of this paper show the differences between developed and developing countries. Consumers in wealthier countries see free energy provision and disconnection bans as unimportant, whereas in poorer countries, both are considered crucial social measures.

Service quality, including reliability, digitisation, and AI-driven energy management tools (RQ2), is increasingly valued by consumers. Our findings here are partly in line with the literature. This paper confirms findings of Gomes et al. (2023) that consumers are highly open-minded to smart grids and automation, while it does not confirm findings of Mesaric et al. (2017) who claim that energy consumers would not trust digital solutions if energy suppliers could control consumers. Our findings, on the other hand, are in line with Tzeiranaki et al. (2023) indicating that energy efficiency policies and smart solutions are crucial for the European tertiary sector, reinforcing the role of digitisation in energy management. Our findings, however, differ from the literature, or rather extend it to other parameters of energy service quality, such as customer service quality and customer service. While in developed countries these are considered neutral (consumer service) or unimportant (the cost for connecting the energy grid), in developing countries most respondents consider them important.

The study shows that consumers prioritizing environmental concerns are willing to pay more for green energy (RQ3). This finding is consistent with the findings of Drosos et al. (2020) and Gomes et al. (2023), who report that consumers are open to pay premiums for RES. However, our findings are different from those indicated by Dam et al. (2023) and Schiaroli et al. (2024). Our findings with regard to environmental factors show that consumers in developed countries prefer RES and are willing to pay more for them, while consumers in developing countries are neutral in their opinions. Meanwhile, Dam et al. (2023) notices that RES adoption does not automatically translate into long-term sustainability. Whereas, Schiaroli et al. (2024) highlight that sustainability efforts must address behavioral barriers such as skepticism and accessibility to eco-friendly options.

Our study indicated the existence of the strong correlation between social support, service quality, and environmental factors (RQ4) reflects a holistic consumer perspective. Since the subsidies provided by those supporting entities also place a significant emphasis on enhancing the quality of services while simultaneously promoting long-term sustainability. In consequence they aim to create a balance between immediate improvements and future-focused goals. The findings in our paper are an extension of the findings presented by Voskamp et al. (2020) and Zhang et al. (2024). Voskamp et al. (2020) supports this idea by demonstrating that both time and location play a role in how energy varies, while Zhang et al. (2024) indicates that income and housing types shape energy consumption patterns, requiring tailored policies.

Finally, this article verified the differences between developed and developing economies (RQ5). Our findings highlight distinct energy priorities between consumers from these countries. On a general level the affordability and service quality is the prime concern in wealthier nations, while lower-income regions focus more on access and government support. Additional differences relate to the willingness to pay extra for service quality or renewable energy. Consumers from advanced economies would be willing to do so, while those from developing countries would not. Our findings partly

coincide with those of Zou et al. (2025), who added that demographic shifts, such as aging populations, significantly alter energy consumption, necessitating adaptive energy policies. However, increasing environmental awareness across all economies suggests a converging long-term transition toward sustainable energy solutions. This discussion based on the findings from this study indicated that consumer energy preferences are shaped not only by a combination of financial and technological factors, but also by social, energy service quality and environmental factors. While affordability remains a major concern in both developed and developing economies, smart energy management, digitalization, and policy-driven renewable energy adoption can bridge the gap between cost, efficiency, and sustainability. Future energy strategies should align subsidies, service improvements, and green energy investments to create an inclusive and consumer-responsive energy market.

6. Conclusions

This study identifies significant interdependencies between consumer opinions on energy affordability, service quality, and environmental concerns. The results underscore the importance of comprehensive policy frameworks that address the needs of vulnerable consumers while integrating technological advancements and sustainability goals.

The authors recommend using consumer segmentation in the energy market, i.e., using a personalised approach by companies to different consumer groups. A particular polarisation of respondents‘ opinions exists, indicating the need to seek compromise solutions in the countries’ energy policies. The results indicate that respondent consumers regard access to energy as a fundamental good and are characterised by an apparent attitude of social solidarity. It also identified the need for compromise solutions, i.e., a social tariff and support for the most needy, which will not be an excessive burden for the rest of consumers. Consumers in advanced and developing countries differ. The former see it as unimportant, while it's very important in the latter. There is also a different approach with regard to disconnection from the energy grid. In general, consumers are aware of economic inequalities and see the need for systemic solutions like targeted support. There is an understanding that additional state support may be needed.

Results highlight a growing need for digital transformation in the energy market, as consumers increasingly expect AI-driven, real-time energy management solutions. However, concerns over data privacy and supplier control remain an issue, as also noted in other studies on smart grid adoption. Monitoring is a key tool for informed energy management and cost reduction. Efficient online communication becomes particularly important in outages and supply interruptions. Respondents who value quick response want immediate online contact. There is also a shift in priorities from traditional aspects, such as service in fixed offices, towards digitalisation, self-service and automation. The results also indicated that the global climate policies have implications for consumer expectations. It was found that there is an increasing acceptance of higher prices in exchange for green energy sources, although significantly higher for advanced economies. The analysis found strong links between social support, service quality, and environmental factors; consumers who back subsidies also value service improvements and sustainability. The authors also showed that energy consumers in both developed and developing economies are similar in terms of environmental awareness, with increasing awareness. However, they also differ in other aspects. Consumers in developed economies focus on affordability and service quality, while consumers in developing countries prioritise social factors. These findings provided by the authors undoubtedly add value and contribute to the literature.

This paper also has research limitations. The primary one is the need to conduct the study on a more extensive research group. Also, a more significant number of countries analysed would undoubtedly increase the resonance of the findings obtained in this work. Future research should expand the geographic scope and explore longitudinal trends in consumer attitudes, particularly regarding the interplay between digitalization, demographic shifts, and energy affordability. The findings obtained in this paper indicate that not only economic factors can stimulate energy consumption but also social, quality of service and environmental factors. Knowledge of the relationships studied by the authors

between energy consumption factors can be used in the future to analyse how these relationships may determine the development of economies.

Regionalna Inicjatywa Doskonałości
Minister of Science and Higher Education Republic of Poland
Co-financed by the Minister of Science under the "Regional Excellence Initiative"

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