The Evolution of Energy Awareness in Hungary: Examining Consumer Awareness, Attitudes and Individual Responsibility in the Context of the Energy Crisis

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For decades, energy consumption—much like personal finance—was regarded as a low-involvement issue, receiving limited attention from the public. Only recent global disruptions, particularly the energy crisis, have prompted a shift in consumer perceptions. The crisis has underscored the unsustainability of prior consumption habits and exposed the vulnerability of energy systems. In response, an increasing number of consumers are demonstrating interest in energy awareness, sustainable behavior, and the potential of renewable energy sources. Although resistance to renewables remains, this is often rooted in insufficient education and a lack of intergenerational engagement with responsible energy use. In some population segments, energy is still not perceived as a value. This study investigates how the energy crisis has influenced consumer awareness and behavior in Hungary. Specifically, it explores the emergence and levels of energy awareness, the internal (e.g., environmental values, personal responsibility) and external (e.g., financial pressure, informational access) motivators driving behavioral change, and evolving attitudes toward renewable energy. It also examines whether consumers perceive a relationship between energy awareness and the crisis. Furthermore, the study offers recommendations on how artificial intelligence can be utilized to promote energy-conscious behavior through tailored educational interventions and decision-support tools.

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1 Introduction

The promotion of energy-conscious behavior has become a critical imperative in the context of accelerating climate change and increasing energy system vulnerabilities. Although modifying deeply ingrained consumer habits presents considerable challenges, it is essential for achieving long-term sustainability. Effective, accessible communication and education are instrumental in guiding individuals through the complexities of energy use (Hassan et al., 2009). The depletion of fossil fuels, rising greenhouse gas emissions, geopolitical tensions, and volatile energy prices have exposed the fragility of energy infrastructures—conditions that have proven especially acute in Hungary. These developments have rendered previous consumption patterns economically and environmentally unsustainable, particularly for socioeconomically disadvantaged populations. Despite the growing body of literature on sustainable consumption, empirical research remains limited regarding how sudden crises reshape consumer attitudes in Central and Eastern Europe. This study addresses this gap by examining both internal and external motivators of energy-conscious behavior, focusing not only on financial incentives but also on personal responsibility, environmental values, and social influences—and their dynamic interplay. Notably, while this research highlights key drivers of behavior change, it does not extend to the underlying psychological mechanisms, such as emotional responses or cognitive biases, which merit further investigation in future studies.

2 Literature review

Hungarian society is facing pressing challenges shaped by global developments, with climate change, energy production and consumption issues, and energy market instability threatening the sustainability of current economic systems and social behaviors (Kovács et al., 2022). Energy awareness and conservation have become increasingly important not only environmentally but also economically and socially. The adoption of energy-efficient and innovative technologies offers substantial savings for households and businesses, enhances energy security, reduces import dependency, and stabilizes energy prices. Ironically, the recent energy crisis may accelerate the shift towards renewables. Similar to the 1970s oil crisis, the 2021 energy crisis has spurred research into alternative energy, underlining the urgency of

diversification (Gajdzik et al., 2023). The crisis has also shifted consumer attitudes, with more individuals viewing renewables as essential to the future. This study investigates how the crisis has positively influenced energy awareness and consumer behavior (Gârdan et al., 2023). A growing segment of the population has embraced energy-efficient practices, recognizing the need to adjust consumption habits. Fundamental knowledge about energy and renewables is key to fostering an energy-conscious mindset (Meyer et al., 2021). Without reliable information, misinformation may prevail, resulting in apathy or rejection. Energy consciousness is shaped by psychological, sociological, economic, and environmental factors (Mansor et al., 2019) and is mainly achieved by modifying energy-inefficient habits. While sustainability and environmental issues have gained attention, early campaigns had limited influence on personal responsibility. For years, energy was seen merely as a basic necessity. Only after a prolonged process did individuals begin to value energy, adopt responsible consumption, and embrace new behaviors. The energy crisis has further motivated this shift, with socio-economic status, lifestyle, housing conditions, and energy knowledge all affecting how households respond (Slupik et al., 2021; Zhao et al., 2019). Energy awareness fosters conservation, as informed consumers can substantially reduce their usage and influence others (Gadenne et al., 2011). Despite information availability, Hungarian energy awareness remains low, with just 12.5% perceiving the population as energy-conscious. Regional disparities persist, shaped by education, living standards, and socio-economic status (Szakály et al., 2021; Áldorfai et al. 2022). Although some behavior changes have occurred, further willingness to act is crucial for fostering sustainable consumption (Wall et al., 2021).

3 Methodology

This study aimed to examine how the energy crisis has shaped Hungarian consumers' attitudes toward renewable energy, focusing on public perceptions, prior knowledge, levels of awareness, and both internal and external motivations influencing purchasing decisions. Data were collected via an online questionnaire administered through the Surveyplanet platform, structured around four key areas: knowledge of renewable energy, attitudes and preconceptions, user experiences and influencing factors, and demographic background. A stratified random sampling method ensured geographic, age, and gender diversity. The final sample consisted of 400

valid responses, with 54.8% identifying as female and 45.2% as male. Respondents' age distribution was: 18–25 years (6%), 26–35 (18.9%), 36–45 (26.3%), 46–55 (30%), 56–65 (8.3%), and above 65 (4.1%). Most participants (72.8%) were from Budapest or Pest County, while 27.2% represented rural areas across Hungary.

4 Results

The energy crisis and its effects, such as rhapsodically fluctuating prices, have disrupted the daily operations of all energy stakeholders. Therefore, it was deemed essential to examine how participants perceive the impact of the energy crisis as an external event on their interest in and openness towards renewable energy. Moreover, this study aims to determine whether the energy crisis can be considered an influencing factor in the willingness to adopt renewable energy sources, changes in consumer behavior, and the dissemination of an energy-conscious mindset.

- **Consumer openness:** A significant proportion of respondents perceive a growing openness among consumers toward renewable energy solutions. Specifically, 18.7% indicated that the ongoing energy crisis has increased public interest in renewables, whereas only 4.8% believe the crisis has had minimal impact on attitudes. Despite the expanding visibility of environmental movements, the data suggest that environmental protection has not yet achieved widespread behavioral engagement among the general population. Economic factors appear to be a more immediate driver of behavioral change. Approximately 70% of participants reported that rising energy prices prompted them to modify their consumption habits, while 24.4% indicated no notable change in response to these pressures. Furthermore, the dissemination of energy-saving recommendations by utility providers appears to be gaining traction. Respondents demonstrated a heightened receptiveness to such guidance, suggesting a shift from passive awareness toward active information-seeking behavior in relation to energy efficiency.

- **Internal and external consumer motivations:** Beyond the quantitative aspects of energy consumption, consumer behavior has shifted significantly in response to technological change, including the rise of online shopping. These developments have shaped new attitudes, motivations, and risk perceptions.

External factors—such as the Russian-Ukrainian war and the ongoing climate crisis—have intensified public awareness of energy issues, prompting both policy and individual-level reassessment (Rausser et al., 2023). Understanding energy awareness requires examining both internal and external drivers: internal factors include beliefs, habits, and environmental values, while external ones encompass financial pressure and geopolitical instability. This study's findings highlight financial considerations as the primary motivator for adopting renewables—26.8% cited cost reduction, 24.4% rising prices, and 23.2% environmental concerns. Additionally, 13.4% sought energy independence, and 6.1% referred directly to the energy crisis. These results point to a complex interaction between economic reasoning and normative commitments. While cost-efficiency continues to dominate, the growing importance of environmental values suggests the emergence of intrinsic, responsibility-driven motivations. Together, these internal and external factors are fostering a measurable increase in energy-conscious consumer behavior (Smith et al., 2021).

- **Motivational factors behind energy awareness**: The findings of the study reveal a multifaceted set of internal and external factors influencing Hungarian consumers' energy-related decisions and attitudes toward renewable energy adoption. Among the most salient external motivators were financial considerations—reported by 26.8% of respondents—as well as the broader economic impact of rising energy prices. Internally, environmental awareness and normative commitments to sustainability emerged as key drivers. Additionally, motivations such as the pursuit of energy independence and the influence of the ongoing energy crisis were identified as significant contributing factors, reflecting the complexity of behavioral responses under conditions of uncertainty.

- **Financial considerations**: The data indicate a pronounced sensitivity among Hungarian consumers to fluctuations in energy prices, with many expressing a strong preference for financial predictability and security. In the wake of the energy crisis, a distinctly financially conscious consumer segment has emerged—characterized by proactive risk mitigation and long-term planning. For 13.8% of respondents, the adoption of renewable energy technologies is

perceived as a pathway to self-sufficiency and a buffer against future price volatility. However, this group tends to evaluate such investments through a pragmatic lens, emphasizing the importance of a clear and timely return on investment. Their motivation is closely tied to measurable utility savings that can be redirected toward other household expenditures.

- **Rising energy prices**: The energy crisis elicited a range of behavioral responses among consumers, shaped primarily by individual financial circumstances and varying levels of energy awareness (Azizi et al., 2019). This heterogeneity underscores the need to consider socio-economic segmentation when assessing consumer adaptation strategies:

  1. **Price-sensitive consumers**: Many households rapidly implemented energy-saving measures, leading to a significant decrease in overall energy consumption. In certain cases, this entailed substantial adjustments to daily routines and lifestyle patterns (Azizi et al., 2019). When economic conditions allowed, some consumers further responded by investing in renewable energy technologies or energy-efficient systems as a means of long-term adaptation.
  2. **Energy-poor regions**: In response to energy constraints, households in less affluent regions significantly reduced their energy consumption. Where feasible, they supplemented this reduction by increasing their reliance on fossil fuel-based sources to meet essential energy needs (Vágány et al., 2024).
  3. **Information-seekking or educated consumers**: This group actively pursued information on conservation methods, aligning their energy use with financial constraints and implementing diverse strategies to optimize consumption.
  4. **Hedonistic consumers**: Uninfluenced by rising energy costs, this group maintained their usual consumption patterns and comfort levels without making any adjustments to their energy use (Trzęsiok et al., 2019).

- **Environmental awareness and energy crisis**: Even prior to the energy crisis, certain consumers were committed to environmental protection, reducing their ecological footprint, and securing a sustainable future for their children (Jaciow et al., 2022; Radácsi & Szigeti, 2024). Some had already adopted renewable

energy technologies as a proactive measure against climate change, demonstrating both informational engagement and a willingness to invest in green solutions (Ul-Mulk et al., 2018). The crisis further accelerated this shift, enhancing interest in energy independence. According to the data, 12.6% of respondents were directly motivated by the crisis to consider renewables, 18.4% perceived a broader societal shift, and 64.1% held a positive view of public receptiveness. Financial savings often served as a basis for further sustainable investments (Farghali et al., 2023).

- **Responsibility**: Survey findings reveal that respondents view energy-conscious behavior as a collective responsibility, indicating strong public awareness and accountability. While the state is seen as primarily responsible—particularly in advancing renewable energy—energy providers are also expected to support sustainable practices. Individuals with a heightened personal sense of responsibility are more likely to engage in conscious consumption and expect similar efforts from institutional actors, especially in light of the ongoing reliance on fossil fuels (Kollmuss et al., 2002; Imre et al., 2019; Szeberényi et al., 2022).

- **Consumer energy awareness and practices:** While some consumers were already energy-conscious, the energy crisis marked a significant shift, prompting broader recognition of the unsustainability of prevailing consumption habits. Survey data show that 54.6% view the transition to renewables as essential, with respondents rating their energy awareness at an average of 6.65 out of 10. Only 1% reported no engagement in energy-conscious practices. This awareness is evident in behavior: 28.6% use energy-efficient appliances, 32.7% actively track and reduce consumption, and 9.2% utilize renewable energy sources.

- **The role of Artificial Intelligence:** Artificial intelligence (AI) plays an increasingly pivotal role in promoting energy-conscious behavior. Through smart meters, automation, and tailored recommendations, AI enables households to monitor and optimize consumption (Iorgovan, 2024). It also assists in evaluating renewable investments and identifying cost-effective solutions. On a systemic level, AI supports predictive energy management,

enhancing grid efficiency and reducing both costs and environmental impact. By providing data-driven insights, AI fosters deeper energy awareness and sustainable decision-making.

5 Conclusions

The findings of this study confirm that the recent energy crisis has acted as a significant external catalyst in reshaping Hungarian consumer attitudes toward energy use and renewables. Although financial considerations remain the dominant driver of behavioral change, a parallel shift is emerging toward intrinsic motivations such as environmental concern and personal responsibility. This indicates the development of a more complex and layered understanding of energy awareness among consumers. Importantly, the study highlights the role of both internal (e.g., normative values, sustainability awareness) and external (e.g., rising costs, policy signals) motivators, and their interdependence in shaping energy-related behavior. The segmentation of consumer types—ranging from price-sensitive to environmentally committed—underscores the need for differentiated policy and communication strategies. While current energy awareness is largely limited to consumption reduction, it provides a solid foundation for cultivating broader, long-term behavioral change. The findings suggest that enhanced education, tailored information, and digital tools—particularly AI-driven solutions—can play a key role in expanding awareness and fostering active engagement. Although the study offers valuable empirical insights, it does not explore the deeper psychological drivers of energy behavior. Future research should investigate cognitive and affective mechanisms to provide a more comprehensive model of energy-conscious decision-making.

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