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## **Understanding consumer shifts to green energy suppliers: A perspective of push-pull-mooring model**

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Master Thesis

presented as partial requirement for obtaining a Master's Degree in Information Management

**NOVA Information Management School**  
**Instituto Superior de Estatística e Gestão de Informação**

Universidade Nova de Lisboa

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Dissertation presented as the partial requirement for obtaining a Master's degree in  
Information Management, specialization in Business Intelligence

**Advisor:** Prof. Dra. Catarina Paisana Costa das Neves

February, 2025

## **STATEMENT OF INTEGRITY**

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism or any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Afonso Viana

[Lisbon, February 2025]

## **DEDICATION**

Aos meus pais, cujo amor, apoio incondicional e ensinamentos foram fundamentais para que eu chegasse até aqui. A sua força e dedicação inspiram-me todos os dias, e sem eles, esta jornada não teria sido possível. À minha família, pelo carinho e incentivo constante, por acreditarem em mim e me motivarem nos momentos mais difíceis. Aos meus amigos, que estiveram ao meu lado, oferecendo apoio, motivação e, acima de tudo, partilhando esta caminhada comigo. A todos, muito obrigado.

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## ABSTRACT

Important for sustainability goals and carbon emissions reduction, the transition to renewable energy sources is a necessity. However, the actual switching behavior among consumers is limited despite the rising interest in green energy, and the main reasons behind consumers' decisions to switch their electricity provider are still unexplored. Thus, this study uses the push-pull-mooring (PPM) framework to examine the key factors that influence consumers' decision to switch their electricity provider, making use of structural equation modeling (SEM) to analyze the data collected from an online survey to determine the relationships between these variables. The findings of the study reveal specific push and pull factors as significant drivers of switching behavior while social influence works as a moderator. Furthermore, a multi-group analysis was conducted to understand the role of age in consumer decision making. These insights are practical and thus recommend policymakers and energy providers on how to design effective strategies to increase consumer engagement, reduce switching barriers, and, therefore, increase the uptake of renewable energy.

## KEYWORDS

Renewable energy; Green energy providers; Consumer switching behavior; push-pull-mooring framework; Structural equation modeling

## SUSTAINABLE DEVELOPMENT GOALS (SDG):



## **RESUMO**

Importante para os objetivos de sustentabilidade e a redução das emissões de carbono, a transição para fontes de energia renovável é uma necessidade. No entanto, o comportamento real de mudança entre os consumidores ainda é limitado, apesar do crescente interesse pela energia verde, os principais motivos que levam os consumidores a trocar de fornecedor de eletricidade ainda não foram totalmente explorados. Assim, este estudo utiliza o modelo Push-Pull-Mooring (PPM) para examinar os principais fatores que influenciam a decisão dos consumidores em mudar de fornecedor de eletricidade, utilizando modelos de equações estruturais (SEM) para analisar os dados recolhidos através de um questionário online. Os resultados do estudo revelam quais os fatores de push e pull são os principais impulsionadores do comportamento de mudança, enquanto a influência social é explorada como fator moderador. Além disso, foi realizada uma análise multigrupo para compreender o papel da idade na tomada de decisão do consumidor. Estas conclusões são relevantes e fornecem recomendações práticas para os responsáveis políticos e fornecedores de energia sobre como desenvolver estratégias eficazes para aumentar o envolvimento dos consumidores, reduzir as barreiras à mudança e, conseqüentemente, aumentar a adoção da energia renovável.

## **PALAVRAS CHAVE**

Energia renovável; Fornecedores de energia verde; Comportamento de mudança do consumidor; Modelo push-pull-mooring; Modelos de equações estruturais

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## 1. Introduction

The transition to renewable energy sources is critical in addressing the global climate crisis and reducing carbon emissions. Therefore, understanding consumer behavior is essential to accelerating and realizing this transformation, as the demand for green and renewable energy increases (Kumar & Nayak, 2024). However, despite growing awareness of environmental issues and the availability of renewable energy options, many consumers remain reluctant to make the actual transition to green energy. This hesitation persists even though consumers recognize the advantages of renewable energy, such as sustainability and long-term cost savings, as well as the technological advancements that facilitate access to green energy solutions. This discrepancy between awareness and action highlights the need to better understand the factors influencing energy-switching behavior.

Previous studies have explored consumer preferences for green energy, yet few have employed predictive models to anticipate real-world switching behavior (Danne et al., 2021; Hussain et al., 2022). Most existing research focuses on isolated factors, such as environmental concern or financial considerations, without integrating a comprehensive framework that captures the interplay between financial, psychological, and behavioral drivers (Kushwah et al., 2024). To close this gap, this study uses the push-pull-mooring (PPM) framework to quantify and evaluate the relationships between several dimensions and the switching behavior. Additionally, it explores the role of social influence in dictating this behavior. A research model is then built making use of the PPM framework and tested using structural equation modelling technique.

This study makes several contributions. First, by focusing on switching intentions and frequency, this study enhances the literature on consumer behavior in renewable energy adoption by applying PPM framework. Unlike prior research that examines factors in isolation, this model integrates push factors (past switching experience, market competition, and perceived ease of change), pull factors (perceived relative price and brand trust), and the mooring factor (social influence) to provide a holistic view of switching behavior. Secondly, we explore the role of social influence, acting as a mooring factor, helping to understand how peer recommendations can either deter or encourage switching behavior (Erdogan et al., 2022). Finally, this study offers practical insights for energy providers and policymakers, highlighting strategies to reduce switching barriers, enhance trust, and leverage social influence to accelerate the transition to renewable energy suppliers (Erdogan et al., 2022).

The work is structured as follows. Section 2 provides a theoretical background and literature review on consumer switching behavior and renewable energy adoption. Section 3 outlines the research methodology, detailing the questionnaire design, data collection process, and the application of structural equation modeling (SEM) to analyze consumer behavior. Section 4 presents the data analysis and results, identifying the key drivers of switching intention and frequency. Section 5 discusses the findings, their implications for energy providers and policymakers, and the moderating role of social influence. Finally, Section 6 concludes the thesis by summarizing the main insights, highlighting limitations, and suggesting future research directions.

## **2. Theoretical background**

### **2.1. Switching to green energy providers**

Our society must prioritize transitioning to renewable energy to combat climate change, as electricity generation accounts for over a quarter of global greenhouse gas emissions (International Energy Agency, 2021). Despite increasing consumer interest in renewable solutions like solar and wind power, actual adoption rates remain relatively low. In 2021, renewable energy comprised only 21.8% of the European Union's total final energy consumption (Eurostat, 2023), revealing a significant gap between interest and usage. Studies indicate that cost is a key barrier to adoption, as financial constraints and the lack of subsidies limit consumer choices (Kumar & Nayak, 2024). Similarly, de Vries, Pieterse, and Jansma (2024) identified financial uncertainty and the hassle factor as significant psychological barriers to renewable energy adoption. These findings highlight the importance of understanding the factors influencing consumer decisions to switch energy providers or remain with their current ones. In fact, a green energy supplier is an energy provider that sources electricity from renewable and environmentally friendly resources, such as wind, solar, hydroelectric, and biomass. Consumers can choose green tariffs to support clean energy, but their electricity still comes from the national grid, which mixes renewable and non-renewable sources. Some suppliers rely on renewable energy certificates rather than directly increasing green energy production. Green energy suppliers play a crucial role in the transition to a sustainable energy system by reducing reliance on fossil fuels, cutting carbon emissions, and encouraging investment in renewable infrastructure. They also drive innovation in the energy sector, making clean energy more accessible and affordable over time. By choosing reputable suppliers that actively invest in renewable projects, consumers can contribute to a cleaner environment and accelerate the shift toward a low-carbon future, without necessarily investing in renewable energy infrastructures (Gallery Climate Coalition, 2025).

Various economic, psychological, and social factors influence consumer switching behavior toward green energy suppliers. Dissatisfaction with current providers often pushes consumers to seek alternative energy options (Erdogan et al., 2022), while environmental and economic benefits serve as strong pull factors, attracting them to green energy suppliers (Kushwah et al., 2024). Beyond these factors, Chaikumbung (2021) highlights the role of institutional influences, arguing that economic freedom and governance structures significantly shape consumer preferences for renewable energy, particularly by affecting willingness to pay and market participation. Ndebele et al. (2019) also stress that non-price attributes—such as service quality, brand reputation, and environmental

commitment—play a fundamental role in switching decisions. Their findings underscore the importance of integrating psychological and social dimensions into models that explain consumer behavior in the energy sector, using frameworks that allow us to better understand complex consumer decisions.

## **2.2. Prior research on switching behavior**

The decision to switch to environmentally friendly energy suppliers is influenced by various factors, with financial considerations and incentives playing a crucial role. Among these, perceived relative price, switching costs, and financial incentives are key determinants. Sangroya and Nayak (2017) found that governmental subsidies and financial incentives significantly encourage consumers to adopt green energy solutions by reducing the perceived financial burden of switching. Similarly, Hussain et al. (2022) emphasized the economic advantages of renewable energy, highlighting that lower energy expenses and long-term cost savings serve as strong motivators for consumers to transition. These findings align with the research of Kushwah et al. (2024), who noted that while financial benefits drive consumer interest, the time and effort required for switching can pose significant challenges. Fontana et al. (2019) further argue that high transaction costs and the perceived complexity of the switching process often act as barriers, discouraging consumers from changing their energy providers despite potential financial savings. Similarly, Vecchiato and Tempesta (2015) found that willingness to pay for renewable energy contracts is significantly influenced by consumer preferences for specific energy sources, indicating that offering tailored renewable energy options can increase market participation. Their findings suggest that when consumers can choose their preferred renewable energy source—such as solar, wind, or biomass—they are more likely to engage in green energy adoption. This highlights the importance of customized energy offerings and consumer-focused marketing strategies in improving adoption rates and bridging the gap between interest and actual usage.

Psychological factors, including environmental concern and perceived behavioral control, also play a significant role. Consumers with higher environmental awareness are more likely to switch, driven by a desire to reduce their carbon footprint and contribute to global sustainability goals (Kumar & Nayak, 2024). Environmental concern has been consistently identified as a key predictor of switching intentions (Lipowska et al., 2024; Dolšak et al., 2020). Furthermore, the theory of planned behavior (TPB) suggests that perceived behavioral control, or the belief in one's ability to complete the switch, significantly influences intentions. This is supported by the findings of Hussain et al. (2022) and Kushwah et al. (2024), who demonstrated that consumers with greater knowledge about switching processes are more likely to change their energy provider.

Social influence is another critical determinant of consumer behavior. The role of peers, family, and broader societal norms in shaping consumer preferences has been well-documented. For instance, Erdogan et al. (2022) found that positive electronic word-of-mouth (PeWOM) significantly enhances consumers' willingness to switch to green energy providers. Similarly, subjective norms play a crucial role, as consumers are more likely to switch when they perceive social approval for green energy adoption (Hussain et al., 2022). When consumers perceive that their social circle values green energy adoption, they are more likely to follow suit, as evidenced by the work of Sangroya and Nayak (2017). In addition to psychological and social factors, service quality and trust in providers are pivotal in driving consumer decisions. Dolšak et al. (2020) highlight that high levels of administrative and physical service quality build trust and reduce perceived risks, which are often barriers to switching. Lipowska et al. (2024) further identify brand trust as a crucial factor, as consumers are more likely to switch when they perceive the provider as credible and capable of delivering on their promises. Ziegler (2020) also emphasizes that transparency initiatives by energy providers can help alleviate consumer concerns and build trust, thereby facilitating a smoother transition to green energy suppliers. Table 1 summarizes the main findings from prior research.

Authors	Theory/Theories	Research Method	Data	Variables
Murside Rabia Erdogan et al. (2022)	Push-Pull-Status Quo (PPS) Model	Factor analysis and ordered logit model	105 large-scale electricity consumers	Risk of Switching, Cost of Switching, Commercial Service Quality, Administrative Service Quality, Communicative Service Quality, Physical Service Quality, Attractiveness of Switching, Market Competition
Shiksha Kushwah et al. (2024)	Push-Pull-Mooring framework	Mixed methods (structural equation modeling and in-depth interviews)	Survey of 231 participants and interviews with 25 participants	Push Factors: Environmental Concern, Perceived Risk; Pull Factors: Economic Benefit, Independence Benefit; Mooring Factors: Switching Cost, Subjective Norms, Habit
Shahid Hussain et al. (2022)	Theory of Planned Behavior (TPB) and Push-Pull Theory (PPT)	Partial least squares structural equation modeling (SEM) with survey data	Survey of 405 retail electricity consumers in Western Australia	Push Factors: Perceived Relative Price, Negative Customer-Based Reputation (CBR), Past Switching Experience; Pull Factors: Positive Electronic Word-of-Mouth (PeWOM), Positive Customer-Based Reputation of Alternative Providers; TPB Variables: Attitude Toward Switching, Subjective Norms, Perceived Behavioral Control
Ilona Lipowska et al. (2024)	TPB, Self-Determination Theory, Self-Efficacy Theory	SEM analysis using AMOS 29	Survey of 1,216 Polish adults in 2020, pre-COVID-19	Resistance to Change, Brand Trust, Perceived Switching Costs, Perceived Ease of Change
Pablo Cabanelas et al. (2024)	Oliver's four-stage loyalty model (cognitive, affective, conative, action phases)	Structural equation modeling with a sample of 231 German electricity consumers	Survey of 231 German electricity consumers with green contracts	Trust, Satisfaction, Perceived Environmental Impact, Perceived Risk, Propensity to Trust
M. Danne et al. (2021)	Generalized multinomial logit (GMNL) model	Discrete choice experiment and survey	371 German private households collected in 2016	Core Service Quality, Service Process Quality, Low and Transparent Pricing, Brand Reputation, Offer of Additional Energy Efficiency Services, Green Energy Offer
Daniel Vecchiato et al. (2015)	Random Utility Theory, Choice Experiments	Choice experiment with random parameter logit model	Survey data from 503 residents of Veneto, Italy	Type of Renewable Energy Source, Size of Power Plants, Distance from Residential Areas, Certification of Biomass Origin, Cost of Electricity Contracts
Ryan Esplin et al. (2024)	Behavioral economics, consumer engagement, switching costs	Linear probability model (LPM) and logistic regression	Survey data from 3,112 respondents in Australia's three largest cities	Income, Employment Status, Educational Attainment, Bill Shock, Billing Frequency, Ownership of Solar PV, Confidence in Decision-Making
Widha Kusumaningdyah et al. (2021)	Agent-based modeling, Simulation-Based Design for EPSS	Simulation-based design framework with agent-based models	Hypothetical market conditions and scenarios simulated	Consumer Type and Preferences, Market Design, Information-Sharing Mechanisms, Renewable Energy Mix, Alternative-Seeker Proportion, Switching Cost
Janez Dolšak et al. (2020)	Latent Class Analysis (LCA), Latent Class Regression (LCR)	LCA and LCR models	Survey data from 984 electricity consumers in Slovenia	Core Service Quality, Service Process Quality, Low and Transparent Pricing, Brand Reputation, Offer of Additional Energy Efficiency Services, Offer of Green Energy
Juan Pablo Loaiza-Ramírez et al. (2021)	Halo Effect, Protected Values Theory	Moderated mediation model, repeated-measures regression	Behavioral experiment data from 323 U.S. residents via Amazon Turk	Renewability of Energy Source, Perceived Comfort, Protected Environmental Values, Expected Cost Premium
Deepak Sangroya et al. (2024)	Theory of Planned Behavior (TPB), multidimensional	Exploratory and confirmatory factor analysis	Survey data from 659 respondents in India	Functional Value, Social Value, Emotional Value, Conditional Value

	perceived value			
Gurdeep Kumar Nayak (2024)	Green Perceived Value, Technology Acceptance Model	Systematic literature review	76 peer-reviewed articles from 2010 to 2020	Demographic Variables, Environmental Psychology-Related Factors, Personal Norms, Perceived Benefits, Perceived Risks, Cost Perception and Government Subsidy

*Table 1 – Summary of Relevant Studies on Consumer Behavior in Renewable Energy Markets*

### 2.3. Push-pull-mooring framework

The study on how consumers decide to switch energy providers has been widely investigated using different theoretical models that highlight different factors affecting decision making. The PPM framework serves as a basis for this study since it addresses the complexities of switching behavior, by incorporating push factors (motivations to switch providers) pull factors (attractions to a new provider), and mooring factors (obstacles or influences that impact the switching process). Therefore, this model provides a complete view of consumer decision-making in the energy sector by considering financial aspects as well as psychological and social dimensions (Hussain et al., 2022 Kushawh et al., 2024).

Several different adoption models have been previously used to study consumer behavior in the energy sector. As stated before, the theory of planned behavior (TPB) has often been applied as a basis for explaining consumer intention, suggesting that change is driven by attitudes toward renewable energy, perceived control over change, and social norms (Danne et al., 2021). This theory indicates that social influence plays a significant role in how consumers shape their actions according to their peers' (Lu & Ahn, 2025). The value-belief-norm (VBN) theory has also been applied to understand environmental behavior and moral decision-making in energy transitions. According to this model, individuals who hold strong environmental values are more likely to switch to renewable energy sources due to their perceived personal responsibility and alignment with broader social expectations. Hojnik et al. (2021) support this argument, noting that moral and ethical considerations play a significant role in consumers' willingness to adopt green energy alternatives (Lagomarsino et al., 2024).

Overall, after considering different approaches to studying energy consumers' behavior patterns, the PPM framework was selected for this study due to its capacity to integrate push, pull, and mooring effects in explaining switching behavior. Using this framework, the inclusion

of financial, psychological, and social factors allows for a nuanced understanding of why consumers switch—or hesitate to switch—to renewable energy providers (Ziegler, 2020).

### 3. Conceptual Model

The conceptual model of this study is based on the PPM framework, which explains consumer switching behaviour through the interaction of three main components: push factors, pull factors, and mooring factors including technology adoption, service industries, and energy markets (Erdogan et al., 2022; Kushwah et al., 2024). To ensure their applicability in comprehending switching behavior in the energy sector, the variables considered for this model were carefully chosen based on insights from the body of existing research. By emphasizing new possibilities or lowering perceived obstacles to switching, push factors—such as prior switching experience, market availability, and variables impacting perceived ease of change—drive customers away from their existing energy suppliers (Erdogan et al., 2022; Kushwah et al., 2024). On the other hand, pull variables, such as price satisfaction and trust in the present supplier, foster a feeling of loyalty that motivates customers to stick with their present supplier (Cabanelas et al., 2024). The mooring factor, in this case, social influence, works as a moderating force that affects the relationships between the push and pull factors and the switching behaviour. Social influence can either strengthen the commitment to the current provider or do the opposite and push consumers to switch, depending on the type of social interactions, peer recommendations, and societal norms (Lu & Ahn, 2025; Kushwah et al., 2024). This model is intended to represent the multifaceted process of deciding on switching intentions and frequency, thereby providing a comprehensive view of the processes that may facilitate or hinder consumer shifts to new energy suppliers. Figure 1 presents the research model.

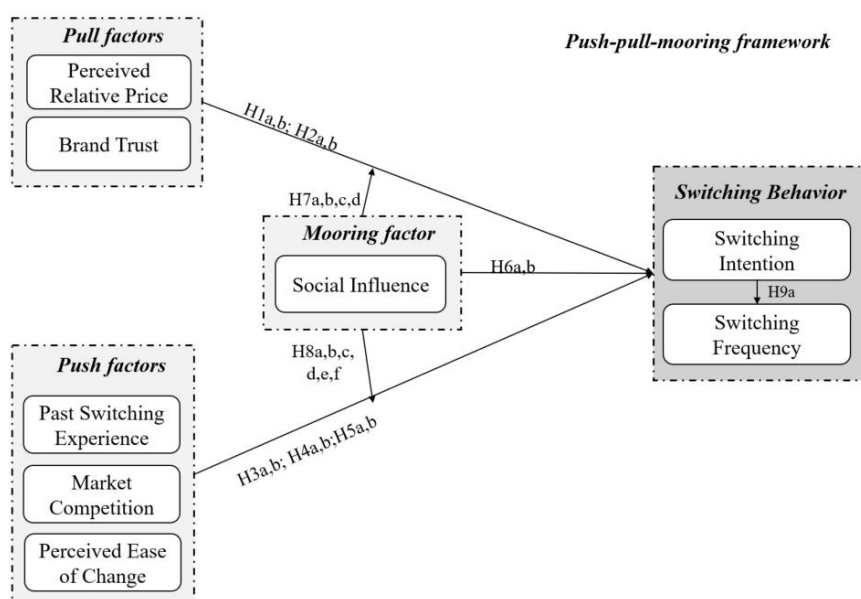


Figure 1 – Research Model

### 3.1 Pull factors

The pull factors context in this study focuses on variables that act as attractive forces, encouraging consumers to remain with their current energy providers. Based on the literature, two key variables are identified: satisfaction with price and trust in the current provider. These factors influence consumer loyalty by reinforcing positive perceptions of the current service, reducing the motivation to seek alternative providers.

Perceived relative price reflects the consumer's perception of the fairness and competitiveness of the current provider's pricing structure. Studies have shown that price satisfaction significantly affects consumer retention, as lower perceived costs or favorable pricing plans decrease the likelihood of switching (Hussain et al., 2022; Danne et al., 2021). Kumar and Nayak (2024) stress that financial perceptions, especially concerning long term costs, are the predominant driver of switching intentions. Similarly, Erdogan et al. (2022) emphasize that customers who have a perceived fair and stable energy price are less likely to switch even when greener alternatives are available. This is in line with Danne et al. (2021) who established that pricing satisfaction was one of the most important factors that cause consumer inertia in energy markets. Moreover, Dolšak et al. (2020) argued that consumers' preferences for energy products are determined by price and cost, which supports the idea of cost perception as a determinant of the switching decision. Based on these insights, we propose that:

**H1a(b):** Perceived relative price will negatively influence switching intention (frequency).

Trust in the current energy provider, often called brand trust, is a key factor influencing whether consumers decide to switch suppliers. It reflects their confidence in the provider's reliability, transparency, and integrity, shaping their willingness to stay or explore other options. According to Erdogan et al. (2022) and Cabanelas et al. (2024), trust is essential in determining customer loyalty since it strengthens the sense of security in the current connection and lowers the perceived risks of switching. Additionally, Lipowska et al. (2024) show that switching intention is considerably reduced by brand trust, especially in energy markets, where decisions often involve long-term commitments. Also, Dolšak et al. (2020) point out that reliable service performance over time frequently builds strong trust connections, which reduces the appeal of other suppliers. According to Kumar and Nayak (2024), trust can be a psychological barrier to change, reducing the impact of outside forces like market competition. Based on these insights, the following hypothesis is proposed:

**H2a(b):** Brand trust will negatively influence switching intention (frequency).

### 3.2 Push factors

The push factors context in this research focuses on variables that drive consumers away from their current energy providers, making them more likely to switch. Based on the literature, three main factors are identified: past switching experience, market availability, and perceived ease of change. These elements contribute to dissatisfaction or reveal opportunities, that make consumers look for other suppliers.

Past switching experience refers to whether a consumer has previously switched to energy suppliers, which can significantly affect their willingness to switch again. According to Erdogan et al. (2022), those customers with positive switching experiences have a greater tendency to be more optimistic and open when it comes to considering new suppliers, as they perceive fewer risks and problems. Hussain et al. (2022) also pointed out that past behavior is a good predictor of future switching intentions. In fact, familiarity with the process reduces uncertainty and increases self-efficacy. Likewise, Lipowska et al. (2024) established that customers who have changed their service providers in the past are less likely to exhibit resistance to change, making them more receptive to new market opportunities. Based on these insights, the following hypothesis is proposed:

**H3a(b):** Past switching experience will positively influence switching intention (frequency).

Market competition is the degree to which customers believe that viable alternatives exist in the energy market. The presence of competitive renewable energy providers with diverse offerings enhances the perceived benefits of switching (Danne et al., 2021; Kumar & Nayak, 2024). According to Erdogan et al. (2022), the higher level of market competition reduces switching barriers because consumers have more choices that fit their needs and preferences, such as price, service quality, or sustainability. Additionally, Cabanelas et al. (2024) argued that more awareness of the accessible green energy solutions by marketing and social pressure increases switching behavior. Based on these insights, the following hypothesis is proposed:

**H4a(b):** Market competition will positively influence switching intention (frequency).

Perceived ease of switching refers to how simple or difficult consumers perceive the process of switching suppliers. This factor is critical in reducing the psychological associated with the

complexity of administrative procedures (Hussain et al., 2022; Kushwah et al., 2024). According to Dolšak et al. (2020), when consumers perceive switching as straightforward, meaning that they don't need much effort or technical knowledge, they are more likely to engage in the behavior. Erdogan et al. (2022) also emphasize that making the switching process easier through clear communication and support services can, in fact, increase consumers' willingness to switch. Based on these insights, the following hypothesis is proposed:

**H5a(b):** Perceived ease of change will positively influence switching intention (frequency).

### **3.3 Mooring factor**

In our conceptual model, the mooring factor is social influence, which plays a crucial role in the relationship between the push and pull factors and consumer switching behaviour. Subjective norms, a way of conceptualizing social influence, refer to the perceived social pressure from family, friends, colleagues, and broader societal expectations that lead individuals to act in certain ways. They define consumer behavior through the normalization of norms, societal expectations, and reference groups' behavior, depending on whether it is a barrier or facilitator to switching decisions. Social influence plays a crucial role in energy market decisions, significantly impacting people stay with their current provider if there is a peer pressure in doing so. Studies have repeatedly established that social influence can affect switching intentions, especially in situations of uncertainty or complex choices, particularly when selecting an energy supplier. Erdogan et al. (2022) and Cabanelas et al. (2024) highlight those recommendations from trusted individuals, positive electronic word of mouth (PeWOM), and societal norms can drastically influence switching behavior. In addition, the study by Lu and Ahn (2025) shows that subjective norms are a strong mooring factor, especially in situations where the decision carries social visibility. Social influence is conceptualized as the peers' recommendation to stay with the current energy provider. Thus, we hypothesize that:

**H6a(b):** Social influence will negatively influence switching intention (frequency).

Social influence is also explored as a moderating factor. For instance, even customers who are highly satisfied with their current provider might still consider switching if they receive strong encouragement from their social circle or if shifting to renewable energy becomes a widespread trend. Likewise, Hussain et al. (2022) and Kushwah et al. (2024) argue that social influence intensifies feelings of dissatisfaction or makes switching seem easier, encouraging consumers to switch or not when they see their peers doing the same or feel pressure from their social circle.

Based on these insights, the following hypotheses are proposed:

**H7a:** Social influence moderates the relationship between perceived relative price and switching intention.

**H7b:** Social influence moderates the relationship between perceived relative price and switching frequency.

**H7c:** Social influence moderates the relationship between brand trust and switching intention.

**H7d:** Social influence moderates the relationship between brand trust and switching frequency.

**H8a:** Social influence moderates the relationship between past switching experience and switching intention.

**H8b:** Social influence moderates the relationship between past switching experience and switching frequency.

**H8c:** Social influence moderates the relationship between market competition and switching intention.

**H8d:** Social influence moderates the relationship between market competition and switching frequency.

**H8e:** Social influence moderates the relationship between perceived ease of change and switching intention.

**H8f:** Social influence moderates the relationship between perceived ease of change and switching frequency.

### **3.4 Switching behavior**

In this study, the focus is on two key target variables: switching intention and switching frequency, which are both crucial for understanding consumer behavior when it comes to switching energy providers. Switching intention is the conscious and deliberate decision of a consumer to switch from one energy provider to another. It is a strong predictor of actual switching behavior as intention captures the motivational factors that lead consumers to decide (Erdogan et al., 2022; Hussain et al., 2022). Previous research has established that switching intention is affected by factors such as price satisfaction with the current provider, trust, past switching experience, market availability, perceived ease of change, and social influence (Kumar & Nayak, 2024; Cabanelas et al., 2024). According to Erdogan et al. (2022), for example, switching intentions can be greatly increased by unhappiness with present price systems, and this impact can be amplified by social influence, which reinforces the idea that switching is a

desirable or socially acceptable option.

On the other hand, switching frequency refers to how often a consumer has changed energy suppliers. It is the real behavior in the past that can help to understand how clients are loyal or how they can react to the changes in the market (Kushwah et al., 2024; Danne et al., 2021). Switching intention is widely recognized as a key predictor of switching frequency, as proposed by behavioral theories such as the theory of planned behavior (TPB) (Ajzen, 1991). Empirical studies in energy markets confirm that consumers who intend to switch providers are more likely to do so repeatedly over time (Hussain et al., 2022; Erdogan et al., 2022). According to Danne et al. (2021), consumers willing to pay premium prices for green electricity are also more likely to switch providers in the future, suggesting a direct link between motivation and action. Furthermore, factors like perceived risk, switching costs, and social influence moderate this relationship, either reinforcing or hindering repeat switching behavior (Neves et al., 2025). These findings support the notion that once switching behavior is initiated, consumers become more comfortable with the process, lowering barriers for future changes. Based on this, we hypothesize that:

**H9a:** Switching intention positively influences switching frequency.

### **3.5 Controls**

Consumer behavior studies often include control variables to account for socio-demographic influences. In this study, age and gender were used as control variables to preserve the effects of the main explanatory factors. Prior research has emphasized the importance of controlling for age and gender, as they can significantly impact energy-related decision-making and switching behavior (Dolšak et al., 2020; Neves et al., 2025).

## **4. Methodology**

### **4.1 Measurement**

In this study, quantitative data was collected through an online survey administered through an online survey method to test the proposed PPM framework. To this end, a survey was developed to measure consumer behavior in respect to switching energy providers and the constructs of the research model were incorporated into the survey. The questionnaire was composed of validated measurement items for each construct, adapted from existing literature on energy consumer behavior and switching intentions (see Appendix A). Most of the questions used a seven-point Likert scale (ranging from 1 – completely disagree to 7 – completely agree) to measure participants' responses with high granularity and consistency. Initially, the questionnaire was developed in English and Portuguese, and its content was reviewed by academic researchers to ensure clarity and alignment with the research objectives. An introductory text explained the objective and concept of green energy providers. The survey was then pre-tested through a pilot study with 50 respondents, which confirmed that the items effectively measured the intended constructs and demonstrated strong validity and reliability. Any ambiguities were revised based on feedback from the pilot phase to ensure clarity before launching the final survey.

### **4.2 Data**

The questionnaire targeted individuals responsible or co-responsible for switching their energy provider and it was conducted in Portugal. A total of 208 complete responses was used to estimate the model. The demographic characteristics of the study's respondents provide valuable insights into energy consumer behavior while also reflecting some differences when compared to Portugal's national statistics. The sample consists of 53.1% female, 46.4% male, and 0.5% identifying as other genders, which is just slightly higher in female representation than Portugal's national gender distribution (51.6% female, 48.4% male) (Pordata, 2025). The average age of respondents is 51 years, indicating an older population segment. Compared to Portugal's national median age of 46.8 years, the sample skews slightly older (Pordata, 2025). This aligns with studies suggesting that older consumers tend to have more established energy consumption habits and may be less inclined to switch providers unless strong incentives are present (Dolšak et al., 2020). Regarding education levels, the sample presents a highly educated

demographic, with 13.7% completing high school, 44.9% holding a bachelor’s degree, 36.6% with a master’s degree, and 4.4% possessing a PhD. Research suggests that higher levels of education are often associated with greater awareness of renewable energy options and an increased willingness to engage in sustainable energy choices (Kusumaningdyah et al., 2021). Employment status within the sample shows 58.5% employed workers, 23.9% self-employed, 13.2% unemployed or retired, and 4.4% students. Prior studies indicate that employment status influences financial flexibility and risk perception in energy provider switching decisions, with employed individuals generally being more receptive to change when economic benefits are present (Cabanelas et al., 2024). The urban-rural divide in the sample is 93.2% urban and 6.8% rural, which is significantly more urbanized than Portugal’s national urban population of 67%. Studies suggest that urban consumers have greater access to energy provider options and are more likely to switch providers, whereas rural consumers often face infrastructural barriers that limit their choices (Erdogan et al., 2022). Table 2 provides the sample descriptive statistics. Additionally, common-method bias was assessed using: (1) Harman one factor test, in which no single indicator explained more than 50% of the variance, and (2) using a theoretically irrelevant market variable, that presented a maximum shared variance of 0.048%. For these reasons, we can conclude that there are no common-method bias issues.

<b>Sample characteristics (n=208)</b>	<b>Descriptive statistics</b>
Average age	51 years old
Gender	
Female	53.1%
Male	46.4%
Other	0.5%
Education Level	
No school degree	0.5%
High school	13.7%
Bachelor’s degree	44.9%
Master’s degree	36.6%
PhD	4.4%
Employment status	
Employed worker	58.5%
Self-employed	23.9%
Unemployed/Retired	13.2%
Student	4.4%
Residence	
Urban	93.2%
Rural	6.8%

*Table 2 – Descriptive statistics of the sample*

## 5. Results

To test the proposed model, this study used partial least squares structural equation modeling (PLS-SEM) as the primary analytical tool. PLS-SEM was chosen for the study because it is appropriate for exploratory research designs especially when testing models that have not been previously validated in the literature. This technique is suitable for use with complex models that contain latent variables, which are appropriate for this study (Ke, Hult, and Roehl 2009; Goo, Babin, and Ferguson 2009). Furthermore, PLS-SEM is not as sensitive to assumptions regarding data normality, thus making it suitable for analyzing survey data (Fornell and Bookstein, 1982). The results section is divided into two parts. First, the measurement model is checked to ensure that the constructs are reliable, have convergent and discriminant validity. After the reliability and validity of the model are established, then the structural model is analyzed to establish the relationships between constructs and the predictability of the model. Also, a multi-group analysis (MGA) is performed to analyze the effect of age on consumer switching behavior. This analysis enables the comparison of different age groups to determine whether the strengths and directions of relationships in the model differ based on demographic differences. SmartPLS 4 was used for the analysis of the data since it is one of the most popular tools for PLS-SEM (Ringle, Wende & Becker, 2015). The findings offer empirical evidence of the determinants of consumer switching behavior in the energy sector and thus contribute to a richer understanding of the processes that lead to switching intention and frequency and how these factors could differ across age groups.

### 5.1 Measurement Model

Several tests were conducted to validate the reliability and accuracy of the measurement model. composite reliability (CR) and average variance extracted (AVE) were used to check the construct reliability. Table 3 shows that all the constructs have a CR above the recommended level of 0.7, which indicates internal consistency (Hair et al., 2011). As for the AVE values, all the constructs were greater than 0.5, which means that each construct captures reasonable variance from its indicators (Fornell & Larcker, 1981). These results show that the constructs employed in this study are reliable enough for the purpose of structural model estimation.

	Mean	STD	CR	BT	MC	PEoC	PRP	PSE	SF	SI	Sin
<b>BT</b>	<b>4.381</b>	<b>1.511</b>	<b>0.901</b>	<b>0.836</b>							
<b>MC</b>	4.013	1.604	0.951	0.336	<b>0.952</b>						
<b>PEoC</b>	4.215	1.700	0.950	0.295	0.415	<b>0.929</b>					
<b>PRP</b>	4.371	1.453	0.931	0.471	0.178	0.338	<b>0.904</b>				
<b>PSE</b>	2.537	1.706	0.940	0.058	0.214	0.419	0.130	<b>0.916</b>			
<b>SF</b>	2.321	1.582	0.952	0.018	0.146	0.258	0.153	0.639	<b>0.932</b>		
<b>SI</b>	2.900	1.684	0.946	0.331	0.052	0.053	0.297	-0.083	-0.030	<b>0.924</b>	
<b>Sin</b>	3.737	1.807	0.977	-0.200	0.146	0.177	-0.141	0.453	0.456	-0.220	<b>0.956</b>

Table 3 – CR, AVE, Mean and standard-deviation table. Fornell-Larcker

Note: BT – Brand Trust; MC – Market Competition; PEoC – Perceived Ease of Change; PRP- Perceived Relative Price; PSE – Past Switching Experience; SF – Switching Frequency; SI – Social Influence; Sin – Switching Intention

To assess discriminant validity, the Fornell-Larcker criterion, cross-loadings, and the Heterotrait-Monotrait Ratio (HTMT) were analyzed. According to the Fornell-Larcker criterion, the square root of the AVE for each construct should be greater than the correlation between that construct and the others. Table 3 shows that this condition is satisfied for all the constructs, thus supporting discriminant validity (Fornell & Larcker, 1981).

Besides, the cross-loadings were inspected and all the indicators loaded more highly on their respective constructs than on any other construct, thus supporting their distinctiveness, as we can see in Appendix B. Also, the HTMT criterion was employed to assess the discriminant validity of the constructs by comparing construct correlations. HTMT values less than 0.9 suggest that constructs are statistically different (Henseler, Ringle, & Sarstedt, 2015). All the HTMT values are shown in Table 4, and all of them are below this threshold, which also supports discriminant validity. Therefore, the reliability and validity assessments suggest that the measurement model is statistically stable, and, therefore, the analysis can proceed to the structural model testing.

	BT	MC	PEoC	PRP	PSE	SF	SI	Sin
<b>BT</b>								
<b>MC</b>	0.376							
<b>PEoC</b>	0.375	0.452						
<b>PRP</b>	0.576	0.200	0.382					
<b>PSE</b>	0.151	0.235	0.458	0.145				
<b>SF</b>	0.099	0.157	0.273	0.173	0.690			
<b>SI</b>	0.379	0.056	0.087	0.327	0.096	0.078		
<b>Sin</b>	0.177	0.155	0.183	0.144	0.484	0.474	0.233	

Table 4 – Heterotrait-Monotrait ratio (HTMT)

Note: BT – Brand Trust; MC – Market Competition; PEoC – Perceived Ease of Change; PRP- Perceived Relative Price; PSE – Past Switching Experience; SF – Switching Frequency; SI – Social Influence; Sin – Switching Intention

## 5.2 Structural Model

After establishing the reliability and validity of the measurement model, the next step is to analyze the structural model in order to test the hypotheses that have been proposed. The structural model describes the relationships between the latent variables, helping to explain the determinants of switching intention and switching frequency. To assess the model's explanatory power, key statistical metrics such as path coefficients and coefficient of determination ( $R^2$ ) were analyzed. Bootstrapping with 5,000 resamples was performed in SmartPLS 4.0 to determine the statistical significance of the path coefficients, ensuring robust hypothesis testing (Hair et al., 2011). The analysis evaluates the direct and moderating effects proposed in the conceptual model, particularly the role of social influence as a mooring factor. Figure 2 presents the structural model results.

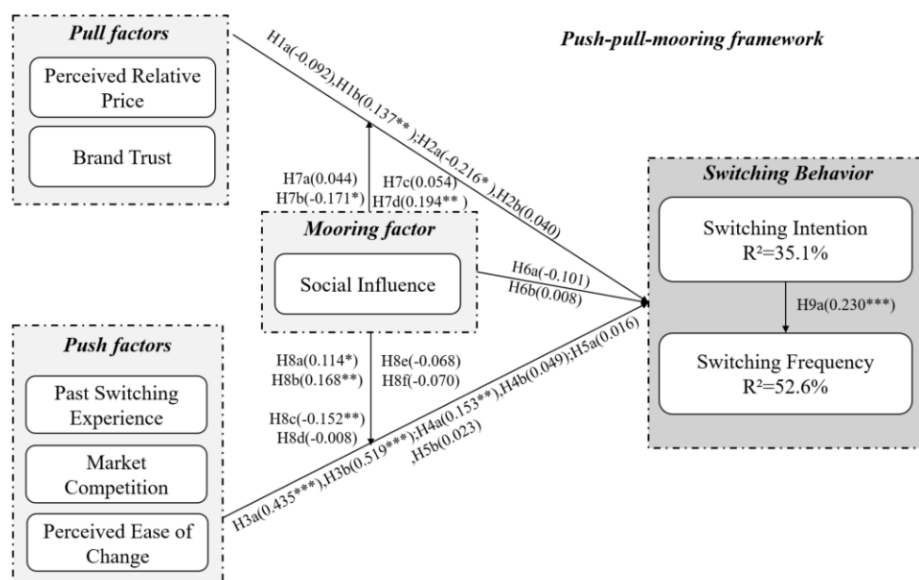


Figure 2 - Structural model based on the Push-Pull-Mooring framework for switching behavior.

( p-value <0.10; \*\* p-value<0.05; \*\*\* p-value<0.01)

The structural model estimates variance in switching intention and switching frequency and has a moderate capacity to predict consumer switching behavior, explaining 35.1% and 52.6%, respectively. The results provide insights into the direct and moderating effects of push, pull, and mooring factors on switching decisions.

Among the pull factors, the perceived relative price was not found to have a significant effect on switching intention (H1a:  $\hat{\beta} = -0.092$ , n.s.), whereas it showed a statistically significant positive effect on switching frequency (H1b:  $\hat{\beta} = 0.137$ ,  $p < 0.01$ ), partially supporting the hypothesis.

Brand trust was found to have a significant effect on switching intention (H2a:  $\beta = 0.216$ ,  $p < 0.05$ ) while not having a significant effect on switching frequency (H2b:  $\beta = 0.040$ , n.s.), thus supporting H2a but not H2b. Regarding push factors, past switching experience had a positive correlation with both switching intention (H3a:  $\beta = 0.435$ ,  $p < 0.001$ ) and switching frequency (H3b:  $\beta = 0.519$ ,  $p < 0.001$ ), confirming the hypothesis that consumers with prior experience in switching suppliers are more likely to switch again. Market competition was also found to be a significant driver of switching intention (H4a:  $\beta = 0.153$ ,  $p < 0.01$ ) but had only a marginal effect on switching frequency (H4b:  $\beta = 0.049$ , n.s.). Perceived ease of change, however, showed no statistically significant effect on either switching intention (H5a:  $\beta = 0.016$ , n.s.) or switching frequency (H5b:  $\beta = 0.023$ , n.s.), leading to the rejection of these hypotheses. The moderating effect of social influence, as a mooring factor, was examined on the relationships between push and pull factors and switching behavior. The moderation effects were mixed: it did not significantly moderate the relationships between satisfaction with price and switching intention (H7a:  $\beta = 0.044$ , n.s.) or trust and switching intention (H7c:  $\beta = 0.054$ , n.s.), but it had a significant effect on satisfaction with price and switching frequency (H7b:  $\beta = -0.171$ ,  $p < 0.05$ ) and trust and switching frequency (H7d:  $\beta = 0.194$ ,  $p < 0.05$ ). Similarly, social influence moderated the effects of past switching experience on switching intention (H8a:  $\beta = 0.114$ ,  $p < 0.05$ ) and switching frequency (H8b:  $\beta = 0.168$ ,  $p < 0.01$ ), but its effect was negative for market competition on switching intention (H8c:  $\beta = -0.152$ ,  $p < 0.01$ ) and non-significant for switching frequency (H8d:  $\beta = -0.008$ , n.s.). Social influence did not significantly moderate the relationships involving perceived ease of change (H8e:  $\beta = -0.068$ , n.s.; H8f:  $\beta = -0.070$ , n.s.), leading to the rejection of these hypotheses. Finally, the direct effect of switching intention on switching frequency was statistically significant (H9a:  $\beta = 0.230$ ,  $p < 0.001$ ), confirming the hypothesis that consumers who intend to switch providers are more likely to do so more frequently.

### 5.3 Multigroup Analysis

Additionally, a multi-group analysis (MGA) was applied to explore if the relationships between variables differ across subgroups within a dataset. In this research, MGA is applied to determine if the relationships in the PPM framework are different based on age. Previous studies have established that age is a key driver of consumer behavior in the energy sector with younger consumers being more likely to accept changes and influenced by social factors than older consumers who are more risk-averse and brand-loyal (Dolšak et al., 2020; Kusumaningdyah et al., 2021). In order to examine these differences, the sample is divided into two age groups ( $\leq 44$  years and  $> 44$  years) and MGA is conducted using SmartPLS 4.0. This analysis enables the

comparison of how age moderates the effects of the push, pull, and mooring factors on switching intention and frequency, providing deeper insights into consumer heterogeneity in energy provider switching behavior. Table 5 presents the MGA results.

	Path coefficient (Age < 44)	Path coefficient (Age >= 44)
<b>Switching intention (R-Squared)</b>	<b>61.8%</b>	<b>27.8%</b>
Brand trust	-0.476***	0.022
Market competition	0.241	0.079
Perceived ease of change	0.076	0.006
Perceived relative price	0.132	-0.194*
Past experience	0.439***	0.437***
Social influence	-0.145	-0.075
Social influence x Past experience	0.309*	0.048
Social influence x Brand trust	0.197	-0.001
Social influence x Perceived ease of change	-0.197	0.002
Social influence x Perceived relative price	-0.069	0.059
Social influence x Market competition	-0.117	-0.165*
<b>Switching frequency (R-Squared)</b>	<b>62.8%</b>	<b>52.4%</b>
Brand trust	0.286	0.064
Market competition	-0.052	-0.051
Perceived ease of change	-0.333**	0.100
Perceived relative price	-0.023	0.110
Past experience	0.555***	0.470***
Social influence	0.011	0.043
Social influence x Past experience	0.497**	0.194***
Social influence x Brand trust	0.029	0.165*
Social influence x Perceived ease of change	0.217	0.196*
Social influence x Perceived relative price	0.076	-0.112
Social influence x Market competition	-0.244	-0.137
Brand trust	-0.032	-0.007

Table 5 - Multigroup analysis by age (before and after 44 years old)

Seven relationships were found to be statistically significant in only one age group, suggesting differences between consumers of different ages. Among the pull factors, brand trust had a negative effect on switching intention for younger consumers ( $\beta = -0.476$ ,  $p < 0.01$ ), but for older consumers, the effect was not significant. Furthermore, perceived ease of change was found to negatively affect switching frequency for younger consumers ( $\beta = -0.333$ ,  $p < 0.05$ ), but it had no effect on older consumers. In the case of push factors, perceived relative price negatively affected switching intention for older consumers ( $\beta = -0.194$ ,  $p < 0.05$ ) but not for younger consumers. As for the mooring effect of social influence, a significant difference was observed in its interaction with past switching experience. Social influence positively moderates the relationship between past switching experience and switching frequency for older consumers ( $\beta = 0.165$ ,  $p < 0.05$ ), but this was not the case for younger consumers.

## 6. Discussion

### 6.1 Theoretical implications

This study contributes to the literature on consumer behavior in the energy market by applying the Push-Pull-Mooring (PPM) framework to analyze switching behavior toward green energy providers. The findings confirm that past switching experience significantly influences switching behavior, supporting prior studies that suggest consumers who have switched before are more open to future changes in providers (Danne et al., 2021). This relationship is visually demonstrated in Figures 3 and 4, where consumers with high past switching experience are more likely to switch again, especially if they are highly influenced by social norms. These findings align with the concept of introjected regulation within the self-determination theory (SDT) framework, which describes motivation driven by internalized social pressure, such as guilt or a need for approval, rather than true personal endorsement. In the context of switching to green energy providers, individuals who feel strong social pressure from friends and family to remain with their current provider experience this form of introjected motivation (Mateus et al., 2023). Since past switchers have already acted against the status quo, they may experience psychological reactance, resisting external influence and becoming even more determined to switch again. This suggests that while social pressure to stay can deter inexperienced consumers, it may actually strengthen switching intentions among those who have previously exercised autonomy in their energy choices. This dynamic highlights the psychological complexity of switching decisions and the interplay between personal agency and social conformity in energy provider selection.

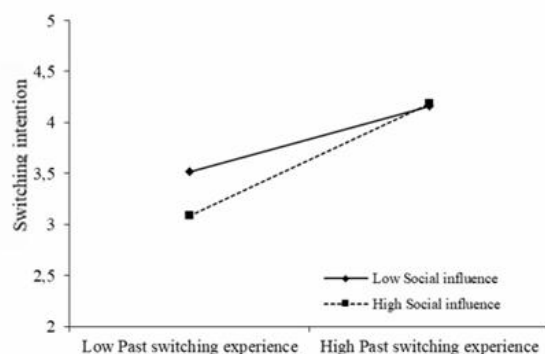
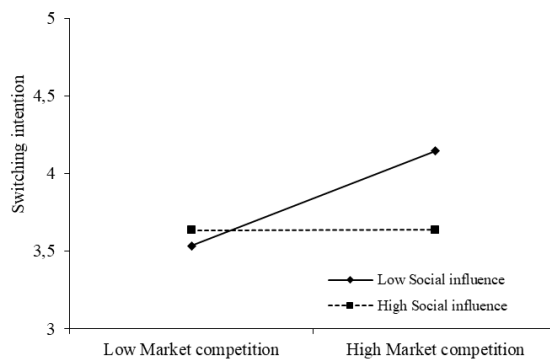


Figure 3 - Moderating effect of Social Influence on the relationship between Past Switching Experience and Switching Frequency



*Figure 4 - Moderating effect of Social Influence on the relationship between Past Switching Experience and Switching Intention*

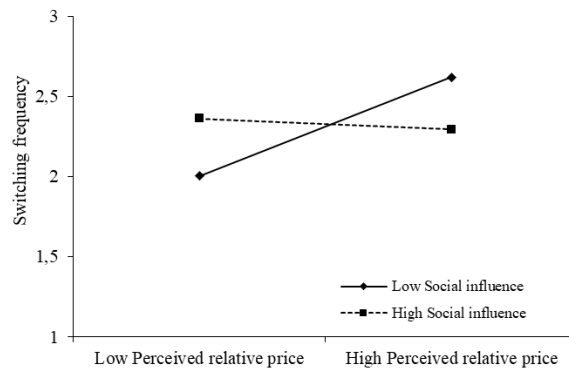
The moderating role of social influence in market competition (Figure 5) suggests that higher competition levels in the energy market only encourage switching behavior among consumers with low social influence. For those who are highly socially influenced, market competition appears to have little effect, likely because their energy choices are shaped more by peer recommendations and perceived group norms rather than by the presence of multiple alternative providers. This aligns with research suggesting that strong social norms can override traditional economic incentives, leading consumers to make choices that align with community values rather than financial rationality (Erdogan et al., 2022).



*Figure 5 - Moderating effect of Social Influence on the relationship between Market Competition and Switching Intention*

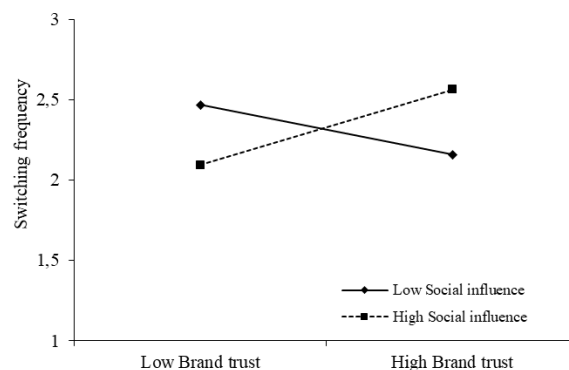
Similarly, Figure 6 demonstrates that perceived relative price impacts switching frequency only for individuals with low social influence. This suggests that price satisfaction can promote switching to green energy, but only for individuals who are not strongly influenced by their social environment. Individuals with low social influence may be more independent in their decision-making and prioritize their personal values, such as environmental concerns. If they are already satisfied with their current provider's price, they may feel financially secure enough to consider switching to a green energy supplier for non-financial reasons (e.g., sustainability, ethical

concerns). On the other hand, those under high social influence are more likely to conform to their social circle's expectations, making price satisfaction less relevant in their decision. This finding suggests that marketing strategies for green energy providers should target consumers with lower social influence, emphasizing individual benefits and personal choice, whereas social norm-based messaging may be more effective for those under strong social pressure.



*Figure 6 - Moderating effect of Social Influence on the relationship between Perceived Relative Price and Switching Frequency*

Figure 7 further demonstrates that brand trust acts as a barrier to switching, but only for individuals with low social influence. When social influence is low, the trust consumers place in the provider becomes the dominant factor in the decision-making, leading them to stick with them rather than exploring other options, and therefore negatively impacting the switching frequency. On the other side, if the social influence is high, it can be seen as overly restrictive or controlling, and in that case the person may choose to defy it and demonstrate that their trust in the current provider still enables them to confidently make decisions based on their own values (i.e., sustainability and environmental responsibility).



*Figure 7 - Moderating effect of Social Influence on the relationship between Brand Trust and Switching Frequency*

This study therefore provides empirical validation of the PPM framework in the context of energy transitions. The findings suggest that switching behavior is not only driven by push and pull forces but is also significantly shaped by external social validation and consumer past experiences. These insights contribute to the ongoing debate on the factors that facilitate or hinder consumer transitions to sustainable energy providers.

## **6.2. Practical Implications**

From a practical standpoint, these findings provide valuable insights for energy providers, policymakers, and regulators aiming to increase consumer adoption of renewable energy. First, since consumers with past switching experience are more open to switching again, energy providers should target past switchers with personalized offers and reminders about the ease of switching to greener options. These consumers are more likely to be motivated by autonomy and psychological resistance against external pressure. Offering tailored incentives that highlight the seamlessness of the switch and its positive environmental impact could be effective in enticing this group. Messaging should focus on empowering these consumers, reinforcing their past experiences, and appealing to their desire for independence and personal choice.

Another key implication is the importance of pricing policies and perceived cost savings in encouraging switching behavior. As demonstrated in Figure 6, perceived relative price influences switching frequency only for consumers with low social influence, suggesting that competitive pricing structures are critical for financially driven consumers. Energy providers should focus on targeted incentives to attract cost-sensitive customers, such as discounted green tariffs, subsidies, and price-matching initiatives. If the energy market is highly competitive, focus on consumers with low social influence who are more likely to respond to price incentives. Provide clear information about cost savings and financial benefits that come with switching to green energy. For consumers with high social influence, price may play a lesser role, so value-driven messaging (e.g., focusing on sustainability, environmental responsibility, and the broader community impact) would be more effective. In these cases, community-focused campaigns that emphasize social norms and the collective benefits of switching can be more impactful than price-based incentives.

The study also highlights the role of market competition in fostering consumer engagement. Figure 5 illustrates that market competition only affects switching behavior for individuals with low social influence, meaning that younger, financially independent consumers are more

responsive to competitive market conditions, whereas older consumers rely more on past switching experiences when making decisions. These insights emphasize the need for age-specific communication strategies, with younger consumers benefiting from dynamic pricing options and easy online switching platforms, while older consumers may require personalized service and trust-building measures.

Moreover, the findings indicate that brand trust can act as a barrier to switching, particularly for consumers with high loyalty to their current provider. Figure 7 confirms that for those with low social influence, brand trust negatively affects switching behavior, meaning that loyal customers are unlikely to switch unless strong incentives are provided. To address this, energy suppliers should focus on building consumer trust through improved service quality, transparency, and corporate social responsibility initiatives.

Additionally, regarding age differences, findings suggest that younger consumers are more driven by trust and ease of change, whereas older consumers prioritize price competitiveness and are less influenced by the perceived complexity of switching. For younger consumers, since brand trust reduces switching behavior, energy providers could focus on reinforcing the current relationship with these consumers. However, to encourage them to switch to greener options, providers could emphasize how green energy solutions align with modern values (e.g., environmental responsibility, sustainability) rather than relying solely on brand trust. Campaigns could also promote flexible, low-risk options for greener energy plans that highlight the ease of transition, appealing to younger consumers' desire for novelty and new experiences. For older consumers, since brand trust has a lesser impact, energy providers should focus on other factors, such as price competitiveness, service quality, and additional benefits (e.g., green certifications or discounts for long-term contracts).

Overall, these practical insights suggest that a combination of financial incentives, market liberalization, and socially driven marketing strategies can significantly enhance consumer engagement in the transition toward renewable energy. Policymakers and industry leaders should tailor their approaches based on demographic and behavioral segmentation to maximize the impact of interventions, ensuring that switching processes are clear, efficient, and aligned with consumer expectations.

## 7. Conclusion

The findings of this study provide significant insights into consumer switching behavior in the renewable energy market using the Push-Pull-Mooring (PPM) framework. The results confirm that perceived relative price, past switching experience, and market competition significantly impact switching intention and frequency. Moreover, the role of social influence as a mooring factor was evident, moderating the effects of price satisfaction, trust, and past switching experience on switching behavior. These findings contribute to the growing body of research on consumer energy choices, offering practical implications for energy providers and policymakers. Specifically, marketing strategies should emphasize not only competitive pricing but also trust-building efforts and social engagement campaigns to encourage a transition toward sustainable energy alternatives. Future policies should consider the influence of peer networks and social norms, as they play a crucial role in shaping consumer decisions. Ultimately, this study provides a holistic understanding of the drivers behind switching behavior, paving the way for more effective strategies in promoting green energy adoption.

## **8. Limitations and recommendations for future work**

Despite this research's important contribution, there are some limitations to be mentioned. Firstly, the research is founded upon a specific set of factors within the PPM framework, which, as comprehensive as they may be, do not include all of the available determinants of switching behavior. Future studies can add more variables, for instance, environmental awareness or policy incentives, to achieve a more whole picture. Further, the survey was conducted in Portugal alone, and this can limit the generalizability of the findings to other countries with different regulatory environments and cultural attitudes toward renewable energy. Subsequent studies might try to conduct cross-country comparisons to establish whether the observed behavior patterns apply to other diverse energy markets. A limitation of the study is the reliance on self-reported survey data, which may introduce social desirability or recall bias. Future studies would be able to fill in survey responses with actual evidence of consumer switching to make the data more precise. Finally, this study provides cross-sectional analysis, which freezes consumer preference in a moment of time. Because consumer switching behavior may shift with time, future studies would benefit from having longitudinal studies to examine how consumer choice is evolving. Overcoming these constraints will improve the understanding of switching behavior and help policymakers and energy suppliers further adapt their strategies to promote renewable energy uptake.

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## Appendix

### Appendix A – Measurement model for reflective constructs

	BT	MC	PEoC	PRP	PSE	SF	SI	Sin
<b>BT1</b>	<b>0.659</b>	0.204	0.346	0.468	0.252	0.171	0.261	-0.016
<b>BT2</b>	<b>0.912</b>	0.268	0.203	0.365	-0.030	-0.038	0.305	-0.225
<b>BT3</b>	<b>0.897</b>	0.349	0.311	0.462	0.111	0.041	0.264	-0.175
<b>BT4</b>	<b>0.851</b>	0.289	0.262	0.417	0.059	0.033	0.311	-0.135
<b>MC1</b>	0.288	<b>0.966</b>	0.409	0.171	0.217	0.155	0.057	0.157
<b>MC2</b>	0.364	<b>0.939</b>	0.379	0.168	0.187	0.117	0.040	0.117
<b>PEoC1</b>	0.277	0.398	<b>0.923</b>	0.283	0.391	0.252	0.031	0.137
<b>PEoC2</b>	0.249	0.398	<b>0.952</b>	0.329	0.401	0.261	0.043	0.207
<b>PEoC3</b>	0.308	0.357	<b>0.913</b>	0.333	0.376	0.200	0.079	0.138
<b>PRP1</b>	0.414	0.132	0.333	<b>0.905</b>	0.115	0.132	0.249	-0.098
<b>PRP2</b>	0.432	0.227	0.386	<b>0.911</b>	0.147	0.177	0.267	-0.070
<b>PRP3</b>	0.428	0.128	0.217	<b>0.896</b>	0.094	0.112	0.285	-0.196
<b>PSE1</b>	0.065	0.212	0.435	0.165	<b>0.921</b>	0.601	-0.104	0.436
<b>PSE2</b>	0.077	0.225	0.392	0.155	<b>0.954</b>	0.590	-0.053	0.398
<b>PSE3</b>	0.017	0.149	0.321	0.032	<b>0.871</b>	0.563	-0.068	0.410
<b>SF1</b>	-0.035	0.123	0.277	0.104	0.687	<b>0.891</b>	-0.066	0.479
<b>SF2</b>	0.034	0.128	0.197	0.155	0.528	<b>0.952</b>	0.006	0.389
<b>SF3</b>	0.060	0.158	0.238	0.175	0.546	<b>0.951</b>	-0.015	0.392
<b>SIn1</b>	0.268	0.012	-0.036	0.213	-0.123	-0.115	<b>0.918</b>	-0.193
<b>SIn2</b>	0.330	0.061	0.052	0.293	-0.095	-0.005	<b>0.956</b>	-0.203
<b>SIn3</b>	0.320	0.072	0.130	0.318	-0.011	0.038	<b>0.897</b>	-0.214
<b>SI1</b>	-0.180	0.193	0.212	-0.107	0.436	0.409	-0.190	<b>0.944</b>
<b>SI2</b>	-0.139	0.141	0.132	-0.125	0.405	0.381	-0.191	<b>0.937</b>
<b>SI3</b>	-0.220	0.112	0.162	-0.152	0.448	0.475	-0.234	<b>0.973</b>
<b>SI4</b>	-0.219	0.117	0.168	-0.151	0.443	0.471	-0.224	<b>0.971</b>

Table 6 – Loadings and cross-loadings

Note: BT – Brand Trust; MC – Market Competition; PEoC – Perceived Ease of Change; PRP- Perceived Relative Price; PSE – Past Switching Experience; SF – Switching Frequency; SI – Social Influence; Sin – Switching Intention

## Appendix B – Survey items

### **Perceived Relative Price** (based on Hussain et al. (2022))

**PRP1.** I feel that my current electricity provider will be reasonably priced compared to the prices that may be charged by other potential green electricity providers. (1 - Completely disagree to 7 - Completely agree).

**PRP2.** I feel that my current electricity service provider will offer more affordable electricity service compared to the prices that may be charged by other potential green electricity providers. (1 - Completely disagree to 7 - Completely agree).

**PRP3.** I feel that my current electricity service provider's service will remain good for the price that I will be paying. (1 - Completely disagree to 7 - Completely agree).

### **Brand Trust** (based on Lipowska et al. (2024))

**BT1.** I know that the offer proposed by the current energy supplier is the best for me. (1 - Completely disagree to 7 - Completely agree).

**BT2.** My current energy provider keeps me safe. (1 - Completely disagree to 7 - Completely agree).

**BT3.** I know that the offer proposed by the current energy supplier takes into account my needs. (1 - Completely disagree to 7 - Completely agree).

**BT4.** I know that I can always count on my current energy supplier's help and advice on matters related to electricity. (1 - Completely disagree to 7 - Completely agree).

### **Perceived Ease of Change** (based on Lipowska et al. (2024))

**PEoC1.** I know the procedure for changing energy suppliers. (1 - Completely disagree to 7 - Completely agree).

**PEoC2.** The procedure for switching energy suppliers is not complicated. (1 - Completely disagree to 7 - Completely agree).

**PEoC3.** Changing energy suppliers doesn't take too much time. (1 - Completely disagree to 7 - Completely agree).

### **Market Competition** (based on Erdogan et al. (2022))

**MC1.** High availability of alternative tariffs is offered (products of electricity retail market) in the market. (1 - Completely disagree to 7 - Completely agree).

**MC2.** High availability of alternative services is offered in the market. (1 - Completely disagree to 7 - Completely agree).

### **Past Switching Experience** (based on Hussain et al. (2022))

**PSE1.** I have switched my electricity service provider often in the past. (1 - Completely disagree to 7 - Completely agree).

**PSE2.** I have a lot of experience in switching among electricity service providers. (1 - Completely disagree to 7 - Completely agree).

**PSE3.** I have often switched to an alternative electricity service provider after staying with one provider for some time (e.g., 1 to 6 months). (1 - Completely disagree to 7 - Completely agree).

**Social Influence** (based on Kushwah et al. (2024))

**SI1.** People who influence my behavior would think that I should stay with my current electricity provider. (1 - Completely disagree to 7 - Completely agree).

**SI2.** People who are important to me would think that I should stay with my current electricity provider. (1 - Completely disagree to 7 - Completely agree).

**SI3.** My friends and acquaintances expect me to stay with my current electricity provider. (1 - Completely disagree to 7 - Completely agree).

**Switching Intention** (based on Hussain et al. (2022))

**SIn1.** It is very likely that I switch from my current electricity service provider to another [green energy supplier]. (1 - Completely disagree to 7 - Completely agree).

**SIn2.** It is very probable that I switch from my current electricity service provider to another [green energy supplier]. (1 - Completely disagree to 7 - Completely agree).

**SIn3.** I am completely certain that I would switch from my current electricity service provider to another [green energy supplier]. (1 - Completely disagree to 7 - Completely agree).

**SIn4.** It is very possible that I switch from my current electricity service provider to another [green energy supplier].

(1 - Completely disagree to 7 - Completely agree).

**Switching Frequency** (based on Neves et al. (2024))

**SF1.** I often switch from my current electricity service provider to another [green energy supplier]. (1 - Completely disagree to 7 - Completely agree).

**SF2.** I often switch my electricity service provider to better manage my energy consumption. (1 - Completely disagree to 7 - Completely agree).

**SF3.** I often switch my electricity service provider to better monitor my energy consumption. (1 - Completely disagree to 7 - Completely agree).

## Appendix C – Ethics committee approval



This is to certify that

Project No.: **INFSYS2025-2-176513**

Project Title: **Predicting Consumer Shifts to Green Energy Suppliers**

Principal Researcher: **Afonso Viana**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 2/17/2025.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 2/17/2025

NOVA IMS Ethics Committee  
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