

WHAT DRIVES THE ADOPTION OF GREEN ENERGY TECHNOLOGIES IN SLOVENIAN SMEs

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Overview

In 2023, the EU revised its energy efficiency (EE) target, aiming for a 36% improvement based on projected energy use in 2030. The updated target is now set at 11.7%, using 2020 energy use as a reference. Regarding renewable energy (RE), the original target was 32%, but it has been increased to 42.5% for 2030. According to statistics (Di Bella et al., 2023), around 24.3 million small and medium-sized enterprises (SMEs) were operating in the EU member states in 2022, representing 99.8% of all enterprises in the non-financial business sector. Additionally, the International Energy Agency (IEA, 2015) estimates that SMEs account for 13% of global energy demand and approximately one-third of energy demand in the industry and services sectors. Leading authorities (OECD, 2018; EC, 2022) emphasize that an effective green energy transition cannot occur without the active participation of SMEs.

Research often focuses on large corporations with significant environmental impacts, while the environmental behaviour of SMEs is generally perceived as lacking ambition, with these companies not investing sufficient effort in this area. Despite the high pollution levels of large companies, they typically do not constitute the main source of pollution in a given area when considered collectively. For example, a recent report by Marchese and Medus (2023) indicates that, based on employment weights, EU SMEs are responsible for 63% of business-driven direct carbon emissions at the EU level. Large companies with substantial carbon footprints can often influence external environmental decisions due to their significance to the local economy (Dell'Anna, 2021; Dragomir et al., 2023). In contrast, the behaviour of SMEs is more likely to be shaped by external environmental expectations (Triguero et al., 2013). This departs from some recommendations, such as those by Thomas et al. (2024), who highlighted the importance of corporate culture regarding sustainability over traditional incentive-based or regulatory approaches when promoting the transition toward green energy technologies.

Investments in green energy technologies typically include EE technologies and RE technologies, since they decrease the need for fossil fuels and contribute to lowering GHG emissions and promoting sustainable energy generation and use. Although there exist some studies exploring determinants of either one or another investment, there are not many studies exploring both types simultaneously as a green technology investment. One of them is Segarra-Blasco and Jové-Llopis (2019), which concludes that companies are more inclined to invest in EE than in RE, but that there are significant complementarities between the two types of investments, with energy efficiency strategies being more related to cost efficiency and regulation, and RE strategies being more related to public support programs and environmental awareness.

The objective of this study is to analyse which firm's internal and external determinants influence SMEs' decisions to invest in EE or RE technologies while determining whether different factors influence only one or both types of investments in green energy technologies the same way or whether drivers for investment behaviour differ in the two cases.

Methods

The data set consists of two data sources. The first is a self-administered survey with extensive questionnaires conducted via telephone interviews in 2019 and 2020, and the second is the Slovenian Business Register, an official statistical database of all companies in Slovenia. The final sample is a cross-sectional sample of 270 small and medium-sized enterprises in Slovenia. A probit model is used to investigate determinants of investment in EE (EEI) and RE (REI) technologies. In addition, a joint variable "investments in green energy technologies" (GEI) is constructed including both types of investments. All three dependent variables are dichotomous, with a value of 1 indicating a company's investment in EE, RE or GEI technologies, respectively, while a value of 0 indicates the absence of such investment in the last 3 years.

Based on theoretical foundations, empirical evidence from other studies, and data availability, we examine the following factors that affect investment decisions: first, firm- and business-related characteristics such as size, energy intensity, ownership (domestic vs. foreign), profitability (ROA), debt, exporting to foreign markets, innovativeness (measured by the firm's R&D activities), perceived market competition, ownership of company premises (versus leasing), and perception of investment risk; second, energy- and EE -related characteristics such as EE awareness in

the company, energy person, employee awareness of EE, energy audits, and potential for energy savings. Lastly, firm's perceptions of external regulatory factors regarding EE and RE policies are included.

Results

The probit regression results indicate some significant factors influencing investments in green energy technologies over the past three years. Ownership of premises is a strong positive predictor across all three models. Investment in R&D also shows a significant positive impact on EEI and GEI. Additionally, having a person responsible for energy in the company positively influences all three investment types. Energy audits or advice significantly increase the likelihood of investments in EEI and GEI. Conversely, firms with higher debt ratios are more likely to invest in REI, indicating that these firms are more inclined to seek external financing to support such investments since RE investments typically require larger capital outlays and longer-term commitments.

Conclusions

The study highlights the critical role of SMEs in the EU's green energy transition, emphasizing that their active participation is essential due to their significant contribution to greenhouse gas emissions. Regression results show that firms perceive ownership of premises and innovativeness (investment in R&D) are consistently significant predictors across all three models (EEI, REI, GEI), indicating that firms with these characteristics are more inclined to engage in energy efficiency improvements and renewable energy investments. The presence of a person responsible for energy management and conducting energy audits or receiving energy advice also positively influences these investments. These findings suggest that asset ownership, innovativeness and proactive energy management practices are key drivers of firms' investments in green energy technologies.

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