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**Sustainable Business Models
in the European Energy Sector**

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Abstract

The present article investigates the sustainable business models (SBMs) of the two largest renewable energy producers (Iberdrola and Ørsted) in the European Union (EU) and a Romanian renewable energy company (Hidroelectrica). The study area focuses on wind or hydroelectric energy. The goal of the study is to conduct a comparison of the strategies, trends, differences, and best practices held by these organisations. In addition, the research proposes to carry out a comparison between the investment areas of each of the three organisations and the Non-financial Reporting Directive (NFRD) and the EU Taxonomy. The research involves multiple case studies and comparative analysis. The research findings enhance the comprehension of the conjunct tendencies existing in the industry that is placed under study, together with the regulatory framework. The sustainable business model (SBM) concept is frequently kept in the theoretical realm, the article standing as the basis through which its real characteristics are placed under investigation and are indicated. Overall, the information provided in the article will supplement understanding of the present landscape of the industry in the context of current environmental initiatives.

Keywords: sustainability, green energy, sustainable business model, EU Taxonomy.

JEL Classification: M14, M40.

1. Introduction

From the financial year 2024, every company in the European Union (EU) that is classified as a public interest entity (according to size criteria and listing on the stock exchange) needs to issue a sustainability report as part of their annual mandatory reporting. Thus, now it is a critical time for every large firm that meets the Corporate Social Responsibility Directive (CSRD) criteria to prepare and adapt

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its sustainability reporting structure based on the CSRD. The aim of issuing such a report will not only match the trend of environmental and social responsibility but also the EU perspective on sustainable economic activities. As a result of climate change difficulties and the increasing costs of energy, EU renewable energy firms are transitioning their approach to cleaner and greener business. Thus, the article will analyse the EU Taxonomy and its impact on the renewable energy sector in Europe (Hummel & Bauernhofer, 2024; Hummel & Jobst, 2024; Paccès, 2021).

Green technology is at the heart of sustainable business models in the energy sector. Through information-intensive services (Gitelman & Kozhevnikov, 2023), the principles of sustainable business models (SBMs) help businesses not only reduce their environmental footprints but also make profits and contribute to local taxes (Guo et al., 2024). The levels of complexity of regulatory statutes and the pressure to secure the leading position in the market can be seen as major factors encouraging firms to introduce sustainable business practices (Malinauskaite & Jouhara, 2023; Gitelman & Kozhevnikov, 2023). Renewable energy also fits the concept of a circular economy, considering that some inputs serve as outputs. In the context of sustainable energy development, this thinking is gaining ground (Dragomir & Dumitru, 2024).

The EU Taxonomy (Regulation (EU) 2020/852) is a tool that provides a classification framework to help identify which activities contribute to environmental sustainability, as well as to assist the company in having sustainable activities (Velte, 2024; Ringel & Mjekic, 2023; Abraham-Dukuma, 2021). This article will explain the investment strategies of these companies and their growing role in the adoption of the EU taxonomy to achieve the environmental objectives of the EU. One of the main reasons for focusing on taxonomy-aligned activities is to provide a better understanding of corporate strategies (Ciasullo et al., 2019) and the extent to which they could inspire the transition to cleaner energy sources in Europe (Dragomir & Dumitru, 2024).

This article describes the SBMs of major renewable energy companies operating in the European Union by analysing the data and integrating these models into the EU Taxonomy (Malinauskaite & Jouhara, 2023; Gitelman & Kozhevnikov, 2023). Being on the path of sustainable development is the top priority for nearly every country in the modern world (Guo et al., 2024; Moshood et al., 2022; Comin et al., 2020; Malinauskaite & Jouhara, 2023; Gitelman & Kozhevnikov, 2023). Consequently, the transition to renewable energy becomes a significant challenge and, at the same time, a solution. However, it is not easy to choose a strategic path due to the share of costs involved and the current underdeveloped areas that use fossil fuel energy (Gani et al., 2023; Mukoro et al., 2022; Ehrtmann et al., 2021).

In the context of the current article, attention will be paid to the sustainable business models of two of the largest European players in renewable energy and a medium-sized Romanian company in the sector of hydro energy generation. It is essential to compare strategies and draw parallels and differences to understand the most efficient approaches in the industry. At the same time, since the regulatory situation around SBMs is still unclear due to the modifications taking place, it is

crucial to analyse how sustainable, from the perspective of existing approaches, are the cases analysed (Dragomir et al., 2022; Ciasullo et al., 2019).

The remainder of the paper is divided into five sections. The literature review summarises the existing literature that is relevant to SBMs in the energy sector, as well as the EU taxonomy papers. The methodology describes the data that were gathered and the analysis and comparative approach. The findings of the paper include the empirical results of the study concerning the SBMs of selected European renewable energy companies (Iberdrola, Hidroelectrica, and Ørsted) and whether they comply with the EU Taxonomy. The discussion and conclusion summarise the main findings of the article, highlight the contributions, and provide recommendations for future research.

2. Literature Review

The development of SBMs in the energy field represents a new perspective from traditional fossil-based forms of energy. Given the very serious dangers associated with climate change and other types of pollution, it can be argued that the transition to renewable energy is vital (Gitelman & Kozhevnikov, 2023). Such business models are not only environmentally responsible due to the use of green energy, but also more efficient, which can allow companies to achieve success in the long run (Gitelman & Kozhevnikov, 2023). As far as energy companies are concerned, such models include the use of green technologies within energy production, as well as digital technologies for a personalised knowledge-intensive service (Herrera, 2023).

Another characteristic of SBM is the attention to the organisational learning process. In other words, this approach recognises that business reality is constantly changing and the company must learn about it to remain sustainable and competitive (Bocken et al., 2019). As a result, companies can become more capable to respond to emerging environmental, social, and economic challenges through a focus on the learning process and adapting their strategies. SBMs in the EU energy sector are innovative, environmentally friendly, stakeholder-engaged, and accountable. The details of the company's strategies and activities differ, but the goal of integrating sustainability into business practices is a common language. Therefore, the adoption and refinement of SBMs will be crucial for long-term profitability and sustainability as organisations deal with the energy transition (Mont et al., 2019).

There are many challenges that companies in the energy sector face when trying to implement sustainable business models or shift to sustainable energy technologies (Bocken et al., 2019). Regarding economic considerations, the benefits of sustainable business models appear clear, such as higher profits and sustained competitive advantages over nonsustainable companies (Gani et al., 2023; Mukoro et al., 2022; Ehrtmann et al., 2021). However, upfront investments are quite substantial, making this approach unaffordable for many companies, except the largest. This is a considerable challenge; for example, while renewable energy sources do not produce CO₂ emissions, the issue of land use and its effects on wildlife and ecosystems remain. Similarly, keeping closed-loop systems is an idea at the heart of the so-called circular economy concept (Gitelman & Kozhevnikov,

2023). The technological aspects related to the implementation of sustainable business models for energy companies add to the overall challenges. Increasing the utilisation of new ways to produce and consume energy requires the capacity for continued innovation.

The EU Taxonomy Regulation is very important for companies to follow, especially for the energy sector, because it can guide business activities in a more structured way to be in accordance with environmental targets. It focuses primarily on climate change mitigation and adaptation by requiring companies to account for specific proven or quantifiable measures as well as to disclose environmental results. Among other things, considering and recognising the importance of this initiative, the obligation to report seems to be the strongest. This trend is particularly important for the energy sector (Ringel & Mjekic, 2023). By analysing different provisions of the regulation, it describes a relationship between a proven measure and a related activity, ensuring their credibility and relevance.

Another benefit of the EU Taxonomy Regulation is that it is a supranational solution way to drive investment and ensure that businesses with environmentally sustainable criteria become the norm (Abraham-Dukuma, 2021). In the energy sector, for example, such a provision may motivate companies to switch to more renewable resources and stop using fossil fuels in favour of wind or solar energy. However, high costs of implementation not only require initial capital to launch new projects but also involve the need to finance them in case they take longer than initially anticipated. Overall, there is a clear link between the EU Taxonomy Regulation and the energy sector regarding the description of such business models.

3. Research Method

The purpose of this study is to elaborate on the exploration concerning the adoption of SBMs by companies in the European energy sector. Accordingly, the study will use the comparative analysis method. The key attributes of different companies refer to existing patterns, similarities, and differences. Furthermore, by using the method, researchers will be able to make more precise interpretations regarding the way investigated factors work in relation to the adoption and implementation of SBMs (Sunderland et al., 2016).

The main data source for the article is represented by the 2022 sustainability reports issued by the selected companies. All documents have been accessed online on the companies' webpages, as of April 20, 2024. Moreover, the use of the 2022 reports has been chosen based on the principle of accessibility and importance of the most recent information. Not all companies have published their 2023 reports until the completion of this study.

The sample selection has been determined by the sizes of the companies and their importance in the regions of the European Union. Key companies are chosen to represent the main players within the European Union in the renewable energy sector. The selection of these companies was performed based on their size and impact on the regions of deployment.

- Iberdrola: Standing as one of the greatest renewable energy production companies in the world, Iberdrola is headquartered in Spain and holds most of its power plants there. United Kingdom and Germany, Turkey, Qatar, and the Americas, USA, Brazil, Mexico, and Colombia, host other energy facilities of this organisation.
- Ørsted: The company, originating in Denmark, is mainly committed to wind and solar energy, and is one of the greatest offshore wind developers at European level. Ørsted was part of a case study regarding a flourishing shift toward a green energy economy (Abraham-Dukuma, 2021).
- Hidroelectrica: As the greatest hydroelectric power producing company in Romania, it can supply certain information concerning SBMs, that are characteristic to a particular country of the EU. Hidroelectrica reached a market capitalisation of 9.45 billion euros at the time of its IPO in 2023 on the Bucharest Stock Exchange.

The comparative analysis approach involves systematically analysing investment plans, growth dynamics, and the compliance of the two companies with the specific EU taxonomy criteria. According to EU Regulation 2021/2139, eligible activities should contribute unequivocally to the mitigation or adaptation of climate change. However, some industrial activities can still be considered sustainable even if their contributions are not entirely clear and proven scientifically.

The methodology can be described in several steps: (a) identification of key metrics in sustainability reports of the companies that were considered relevant in the study. Data are associated with their financial arrangements concerning renewable energy sources, initiatives to reduce the carbon footprint, and alignment with the specific EU taxonomy requirements. (b) Data extraction from sustainability reports for the financial year 2022 that are focused on particular initiatives, financial commitment, and certain outcomes were extracted to review the SBMs of companies. (c) Comparative evaluation of SBMs regarding their investment plans and growth dynamics in relationship with the taxonomy criteria set by the European Union.

The research is based on a case analysis approach, instead of employing the standard case study approach delineated by Yin. It allows one to study the subject in detail and explore the most relevant SBMs to identify industry best practices. A comparative method was also implemented to examine the accuracy of Non-Financial Reporting Directive compliance by the market actors selected for the study. The researcher conducted an analysis of non-financial disclosures as they were exposed in the sustainability reports to understand to which extent the companies met the NFRD requirements.

4. Findings

4.1 Iberdrola, a Giant in Renewable Energy in the EU

Iberdrola, the largest wind power producer and the world's second largest electricity generator or distributor in terms of market capitalisation, stands out in the

field of new energy. The company has 62 GW of installed capacity, more than 41.75 GW being green generation. The circular economy model is one of Iberdrola's main sustainable strategies. This approach reduces emissions, uses renewable resources in production and resource efficiency, and actively promotes all elements of the value chain. Over the decade 2015-2024, the company has made significant investments in energy generation and grid investment projects: decarbonisation of electricity production, development, and integration of smart grids, and electric demand. Iberdrola's SBM aligns with the objectives of the European Union's Circular Economy Action Plan. Iberdrola, by taking a holistic approach from suppliers to customers throughout the value chain, can satisfy the rapidly increasing demand for clean energy and reduce the environmental footprint.

In addition to adhering to the principles of circular economy, Iberdrola is also committed to further innovation as a driver of sustainability. By 2025, a total of € 2 billion will be directed for inventive effort and research, while for the 2030 figure, this goes up to € 4 billion. By focusing on a few key areas such as decarbonisation, smart grids, and demand electrification, Iberdrola drives the transition of energy systems toward sustainability. As a successful and well-established player in the European energy sector, Iberdrola has created its own set of guiding principles and maximum values (Sinthupundaja et al., 2020). The company specified that they wanted to have a selective investment strategy.

4.2 Ørsted Pioneering Offshore Wind Energy

The Danish renewable energy business is famous for its offshore wind energy initiatives and overall focus on sustainability – Ørsted invests in green and sustainable financing to facilitate its green transformation and expansion. Ørsted is known as the leader in offshore wind power and a trailblazer in renewable energy in the EU, with a determination to keep to end-orientated standards and regulatory requirements. Ørsted's sustainable strategy concentrates on large-scale cost-competitive offshore wind energy solutions. The sustainability objectives reflect its target of 40% reduction in freshwater withdrawal intensity by 2025 and the net positive biodiversity of all new renewable projects commissioned from 2030. Moreover, Ørsted has pledged to adhere to the EU taxonomy for all future projects.

In addition to these measures designed to conserve the environment, Ørsted plans to eliminate coal and reduce emissions in all its operations. Ørsted is actively working on its strategy for green financial innovation. Ørsted declares the sustainable goal to create real value for society while earning long-term returns on behalf of its shareholders (Ciasullo et al., 2019). It invests in research and development and is motivated to create new technologies and business solutions not just to tackle the issues arising from climate change, but also to accelerate the global shift away from hydrocarbon fuels, with more than 250 such projects dedicated to decarbonisation. Ørsted's 1st publication of taxonomy-aligned activities was in 2013 with 73% of turnover, 99% of CAPEX, and 80% in relation to OpEx. At the same time, 27% of sales, 1% of CAPEX, and 20% of OpEx are not compatible with EU taxonomy.

4.3 Hidroelectrica Sustaining Green Energy at the National Level

Hidroelectrica implements a different type of SBM in its strategic plan and its business model relies on hydro energy (SDGs 7 and 13). This is relevant as companies generating hydropower contribute to the national clean energy goals and climate change mitigation. Corporate governance, climate protection, green energy transition, nature conservation and ecology, corporate culture, occupational safety and health, staff benefits, creating customer value, and communicating with local communities are goals that represent its sustainable development approach. In some respects, Iberdrola and Ørsted will be far ahead of the Romanian company, but even the fact that the latter has made the SDGs part of its operational model makes Hidroelectrica one of the important actors in the race to decarbonise the energy industry.

When comparing the sustainable strategies of Iberdrola, Ørsted, and Hidroelectrica, there are several key differences which are relevant for the study of SBMs. Iberdrola is the leading organisation in its industry at the European Union level. When conducting an assessment of the organisation's strategies, it can be clearly noticed that the organisation enacted different strategies intended to foster sustainable development. Pillars such as the introduction of circular economy principles, innovation, and ambitious targets regarding the majority of its programs constitute points that the organisation proved to manage in an appropriate way. Ørsted operates in the clean energy sector and it is a role model for value chain inclusion. Hidroelectrica is a traditional supplier of hydroelectric power that is based on hydroelectric dams from the Communist era in the main rivers and the Danube in Romania. Thus, these three firms should continue their development in all directions with respect to sustainability, innovation, and programs.

4.4 Analysis of the Alignment between the Investment Plans of the Three Major European Energy Companies with the EU Taxonomy

The EU Taxonomy was designed to make companies sustainability reports which activities contribute to the achievement of EU's environmental goals (Rotondo et al., 2019). In the context of our sample, Iberdrola analysed its activities to understand whether they qualify for the EU Taxonomy. According to Annex I and II of Delegated Regulation 2020/852, the company has a list of qualified activities. The most relevant are hydrogen production, photovoltaic solar, and onshore wind power, electricity transmission and distribution, energy storage, electricity produced from heat from the environment, and energy efficiency measures. Iberdrola analysed whether these activities comply with the Taxonomy by examining to what extent they satisfy considerable contribution, do not significantly harm other environmental objectives, and meet social safeguard requirements.

Table 1. The taxonomy-aligned activities and indicators of Iberdrola

Economic activities	Proportion of turnover (%)	Proportion of CapEx (%)	Proportion of OpEx (%)
Eligible activities according to the taxonomy			
A1. Environmentally sustainable activities (that comply with the taxonomy)	36.5	86.5	52.2
A2. Eligible but not environmentally sustainable activities according to the taxonomy	19.8	3.2	40.9
Total (A1 + A2)	56.3	89.7	93.2-
Non-eligible activities according to the taxonomy			
B. Non-eligible activities according to the taxonomy	43.7	10.3	6.8
Total (A+B)	100	100	100

Source: summary based on the company’s annual report.

For our analysis on EU Taxonomy indicators for Ørsted, it is important to mention that the company did not provide a split of the eligible activities according to the Taxonomy. Previously, I argued that the company still demonstrates its commitment to sustainability, but Ørsted is aware that it must, at least partially, engage in taxonomy-aligned activities if it wants to move toward the environmental needs and requirements. More specifically, the company gets benefits from KPI linked products and, hence, is interested in achieving the declared targets. Consequently, the financial rewards are closely related to sustainability performance. Ørsted reported that a significant part of the turnover, CAPEX, as well as OpEx were in line with the Taxonomy. However, the sustainability report of 2022 shows that a substantial portion of its sales, CAPEX, and OpEx were not compatible with the Taxonomy. It is expected to be corrected in the upcoming report, but Ørsted is interested in future improvements and aligning more activities with the Taxonomy. Despite being nontaxonomy compliant, the company is interested in improving its long-term sustainable performance.

Table 2. The taxonomy-aligned activities and indicators of Ørsted

Economic activities - Ørsted	Proportion of turnover (%)	Proportion of CapEx (%)	Proportion of OpEx (%)
Eligible activities according to the taxonomy			
A1. Environmentally sustainable activities (that comply with the taxonomy)	not specified	not specified	not specified
A2. Eligible but not environmentally sustainable activities according to the	not specified	not specified	not specified

Economic activities - Ørsted	Proportion of turnover (%)	Proportion of CapEx (%)	Proportion of OpEx (%)
taxonomy			
Total (A1 + A2)	73	99	80
Non-eligible activities according to the taxonomy			
B. Non-eligible activities according to the taxonomy	27	1	20
Total (A+B)	100	100	100

Source: summary based on the company’s annual report.

Hidroelectrica examined the impacts of its operations and activities on climate change. It held workshops with internal management and workers relevant to the company’s business model to gather requirements for Taxonomy reporting and to assess the proportion of the qualifying economic activity in the company’s revenue, CapEx, and OpEx. Hidroelectrica identified that wind and hydro power generation met the EU environmental objectives. The company mentioned that more assessment was required to comply with Taxonomy technical specifications and to demonstrate the Taxonomy’s relevance to its business model.

Table 3. The taxonomy-aligned activities and indicators of Hidroelectrica

Economic activities	Proportion of turnover (%)	Proportion of CapEx (%)	Proportion of OpEx (%)
Eligible activities according to the taxonomy			
A1. Environmentally sustainable activities (that comply with the taxonomy)	0	0	0
A2. Eligible but not environmentally sustainable activities according to the taxonomy	0	0	0
Total (A1 + A2)	0	0	0
Non-eligible activities according to the taxonomy			
B. Non-eligible activities according to the taxonomy	100	100	100
Total (A+B)	100	100	100

Source: summary based on the company’s annual report.

5. Conclusions

Comparing the investment plans and taxonomy alignment of Iberdrola, Ørsted, and Hidroelectrica reveals performance statistics and avenues for improvement. Iberdrola owns a widespread transmission network, and many of its investments in renewable energy make it one of the top sustainable energy corporations. The company maintains this competitive position by investing in activities and initiatives that assist in the fight against climate change and environmental degradation, as well

as in energy efficiency gains. Ørsted is a leader in green financing of projects, highly detailed reporting and maintains the commitment to ESG performance. By aligning financial activities with sustainability objectives and reporting on Taxonomy-aligned ventures, it also helps stakeholders recognise its sustainability projects and the movement to global renewable energy (Rotondo et al., 2019). Hidroelectrica has limited capacity for other power sources in the business portfolio and is unable to comply with the taxonomy-based development of similar power plants. The investment in hydropower plants was significant and the company's ecological and sustainability goals have been met, but renewable energy sources must be further pursued and the company must comply with EU requirements.

The employment of elements such as sustainability, innovation, and regulatory conformity in the case of the three organisations is a strategy that will assist in addressing climate change (Ciasullo et al., 2019). Iberdrola, Ørsted, and Hidroelectrica can utilise their inherent strengths to cope with or compensate for certain areas of inaction. The energy industry in Europe requires the collaboration of stakeholders, government, and regulators (Sinthupundaja et al., 2020). Such responsible and shared processes will allow the low carbon economy to be realised and sustainable development goals to be achieved. The approaches used by Iberdrola, Ørsted, and Hidroelectrica all contributed a good improvement for the future of the European energy system towards sustainability. Despite the manifestation of various advantages and drawbacks by these entities, they prove ongoing concern toward renewable energy and environmental responsibility. Steps that need to be conducted to achieve progress in the long run and an efficient mitigation of climate change are represented by augmented capital investments in green technologies and a steady alignment with legislation, for instance the EU Taxonomy (Sletten et al., 2023).

Iberdrola, Ørsted, and Hidroelectrica find themselves on the road to sustainability, and there is still room for growth. In what regards Iberdrola, it needs to nurture the generation of innovative sustainable solutions that extend past renewable energy so that market-related risks are addressed. Ørsted can enhance development by including supplementary social value propositions. Concerning Hidroelectrica, the entity has to operate a risk management system to better manage risks pertaining to its reliance on a sole power source. Advantages such as innovation and the adherence to the circular economy model stand among the circumstances that the organisation will rejoice. As a result, in the current landscape of the energy market, each of these companies may benefit from further enhancing their resilience and sustainability.

6. Limitations and Future Research Areas

The major limitation of our study relates to the nature of the sustainability reports utilised. We used the reports for 2022, which follow the Non-Financial Reporting Directive (NFRD). As a result, the findings may be less relevant due to less demanding requirements. Specifically, the sustainability reports provided may not reflect the requirements of the Corporate Sustainability Reporting Directive (CSRD).

Therefore, it is suggested that future research take a closer look at these issues, utilising the recent requirements. On the one hand, it is possible to mention that further analysis of corporate sustainability issues may be performed on the basis of the most recent EU requirements. At the same time, it is suggested that examining the transition from NFRD requirements to the new CSRD framework may provide a valuable foundation for research. Analysis of the perceptions of stakeholders, exploration of their experience during the transition to a green economy, and reflections of companies on the changes may be a valuable direction for research. However, research on the sustainability topic can be conducted with a focus on the growing credibility, comparison, and transparency of the reports.

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