LUISS

Master's Degree Program in Strategic Management

Course of Technology Strategy

Risk Management Strategies in Renewable Energy Projects:

Research Question: "Investigating risk management strategies employed by companies in countries of Northern and Southern Europe in renewable energy projects, with reference to geopolitical factors and their influence: Lessons from Denmark, Italy and Serbia."

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To the ones I have
and to the ones I lost

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ABSTRACT

Key words: renewable energy, sustainability, risk management, strategy, geopolitical impact, integrated aproach

The global shift from classical and more traditional energy sources towards renewable and more sustainable ones, such as wind and solar power, has sparked significant interest amongst people in the sector and overall has been a popular topic in the modern world. The renewable energy sector has become critical for achieving sustainable development and mitigating climate change impacts. Obviously, this shift came with number of challenges of various types and extents, associated with the development and implementation of renewable energy projects, some of which are general and some of which are connected to a specific geopolitical area. Renewable energy sources are the main engine behind the energy transition towards carbon neutrality and green economy. This transition became an international obligation, since almost every country in the world made a commitment to stop the increase of the average temperature on the planet by 2°C with respect to pre-industrial period and to reduce the greenhouse gas emission by 45% until 2030, with respect to the emission levels from 2010. The final plan Europe has is fairly ambitious – bringing the emission levels to zero by 2050.

1. INTRODUCTION

1.1 What is risk:

Put in simple terms, risk refers to the possibility of a bad outcome, often involving a degree of uncertainty about future events. It is a fundamental concept that applies across industries, and in the renewable energy sector, it takes on multiple dimensions. There are more ways in which risk is perceived in this sector, such as uncertainty and potential loss associated with investment, potential danger related to project implementation and operations or fear from the lack of acceptance by the market. The variability in how risk is defined and experienced within this sector highlights the complexity of developing comprehensive risk management strategies that are adaptable and effective in the face of evolving challenges

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1.2 Aim of the research:

The primary objective of this research is to analyze the types of risk that companies in renewable energy sector face and to evaluate the effectiveness of risk management strategies employed by these companies. The goal is to answer a few questions such as:

- What are the types of risk that occur in the sector and are there any newly emerging risks?
- What geopolitical factors influence risk and risk management and how do they influence them?
- How can collaboration between different stakeholders (government, industry, communities) be enhanced to manage risks more effectively?

It will aim to do so through a detailed literature review, a thorough qualitative analysis of both primary and secondary information resources and finally through a comparative analysis of companies operating in this sector in three different countries. Interviews will be conducted with key stakeholders of the companies in order to gather detailed data necessary to assess how they identify and mitigate risks.

1.3 Gaps in literature:

The first "gap" in the literature is that there are almost no publications on this specific topic that are not dated after 2015. Renewable energy sector is a rapidly envolving one and therefore it should be studied more frequently. Despite the sector's rapid evolution, existing literature on the types of risks faced by renewable energy companies and the effectiveness of their risk management strategies is outdated, with most relevant studies being over a decade old. We have almost no overview of the current state of risks being incurred or the way they are being managed. It is entirely possible that not much has changes and that there are general types of risk and ways that they are being managed that will always be present, however we cannot exclude the possibility of new threats and challenges arising from numerous factors.

Also, risk management strategies are often discussed in isolation, meaning that there is a need for interdisciplinary and integrated risk management approaches that consider the interplay between different types of risks and involve various stakeholders. Instead of focusing and dealing with each risk type separately (which is not a bad thing and has its advantages, but can be time – consuming and resource - intensive), there should be a perhaps more efficient way of addressing these categories simultaneously.

Finally, the literature fails to address the fact that types of risk and risk management strategies are highly

influenced by geopolitical circumstances and that they can vary from country to country or from one continent to the other. Therefore, the state of the risk and risk management is contingent on many different factors that must be taken into account when analyzing this sector and drawing any conclusions on the topic.

1.4 Problem statement:

There are a few problems that can be identified from the gaps.

- The outdated information leaves a significant gap in understanding the current landscape of risks and the effectiveness of the strategies employed to mitigate them. This gap should be filled.
- The lack of integrated approach to risk management that lead to inefficiencies and resource wastage.
- The lack of consideration for how geopolitical circumstances influence risk types and management strategies, resulting in significant variations across different countries and regions.

1.5 Methodology:

The methodology selected for this research is qualitative analysis using data obtained from literature and interviews conducted. Utilizing case study methodology gives insights into the risk management practices of selected companies, however, the goal of this comparative analysis is not only to see the different approaches to risk management but also to see the geopolitical impacts on the practices and sector itself. This will be achieved by examining the experiences of companies operating in different geographical regions and market contexts. The findings of this study will have practical implications for policymakers involved in the planning and execution of renewable energy projects and risk management strategies in this rapidly evolving industry.

2. LITERATURE REVIEW

Despite being outdated, literature offers us the insight into types of risks present in the industry and some strategies and policies that were being implemented to prevent and fight them. Therefore, to understand the problems we are facing and to determine which questions need to be asked, it is necessary to conduct a review of the publications on the relevant topic.

2.1 Identifying types of risk:

The literature gives a wide insight into the variety of risks that are being encountered in this sector. After confronting a few different papers and articles one can come to a conclusion that the types of risks present in the sector are more or less universal. The literature consistently identifies several key risk categories that are common across the sector and they not only vary in impact but also overlap significantly between different studies, underlining their importance in renewable energy projects. These are some of the most important and mostly mentioned ones:

- **Strategic and Business risk**:

  Strategic risks, such as those related to financing, market entry, and management expertise, are naturally always highlighted in the literature. Gatzert and Kosub (2014) notes that strategic risks are particularly critical in offshore wind projects due to their high capital requirements and complex operational environments. Similarly, Śpiewak and Wesołowska (2016) discuss strategic risks in the broader context and not just in renewable energy sources, emphasizing the role of high initial investment costs and long payback periods, which can deter investors if not managed appropriately. Michelez et al. (2011) also highlight strategic risks, noting that early-stage projects often face significant uncertainties in project definition and risk evaluation, which can lead to delays and increased costs if not managed effectively

- **Market risk**:

  Market risks, which may include price volatility and unpredictable capacity factors, are also widely recognized in the literature as the principal challenges for renewable energy projects. Both Lee and Zhong (2015) and Egli (2020) describe market risks as a major concern, particularly for wind and solar projects, which are directly affected by weather conditions and market dynamics, while Goh et al. (2014) further highlight that market risks are amplified when projects are exposed to competitive bidding and other market-based policies that introduce additional price uncertainty and volatility. This risk is increased if

renewable projects are exposed to market-based pricing mechanisms, such as auctions and power purchase agreements (PPAs), which introduce additional layers of price volatility.

- **Regulatory and Policy risks:**

Policy and regulatory risks are consistently highlighted across multiple studies as a critical factor affecting renewable energy investments, which makes sense because this sector directly depends on laws and regulations introduced by competent authorities. Gatzert and Kosub (2014), Lee and Zhong (2015) and Egli (2020) all exaplain that policy uncertainty (such as changes in subsidies, feed-in tariffs, and renewable energy targets) can significantly impact the financial viability of projects. For example, Egli (2020) points out that retroactive policy changes in Italy have increased perceived risks, making investors wary of investing their capital without clear and stable policy frameworks. Michelez et al. (2011) specifically note that the difference in risk perception between companies developing projects and financial institutions giving them funds is often caused by unstable policies, making stable regulatory frameworks crucial for project success.

- **Credit and Financial Risks**

Credit risks related to project financing are noted across several studies. Lee and Zhong (2015) highlight that long payback periods and high upfront costs increase credit risks, which can deter potential creditors. Gatzert and Kosub (2014) also mention that the reliance on debt financing in renewable energy projects amplifies credit risks, particularly when market conditions are volatile or policy support is uncertain, which depending on the country the company is operating in can easily happen.

- **Construction and Completion Risks**

Construction and completion risks are a major concern, especially for complex technologies like offshore wind and emerging sectors such as wave and tidal energy. Gatzert and Kosub (2014) highlight risks such as logistical issues delays in grid connection and unfavorable environmental conditions that can cause significant cost increase and delays in project execution. These risks are mentioned by Lee and Zhong (2015), who note that the complex logistics and harsh environments of offshore projects aggravate the typical construction risks seen in onshore projects.

- **Operational and Maintenance Risks**

Operational risks, such equipment failures and maintenance difficulties, as well as supply chain disruptions are also commonly cited in the literature. Both Gatzert and Kosub (2014) and Śpiewak and

Wesołowska (2016) emphasize that the technical challenges associated with maintaining equipment, especially in offshore environments, are significant. The irregularity of renewable energy sources also complicates operations, leading to higher maintenance costs and operational uncertainties. Michelez et al. (2011) add that operational risks are particularly acute for technologies that are still maturing, such as wave and tidal energy, which face higher uncertainty in performance.

- **Environmental and Social Risks**

Environmental and social risks are prominent in discussions about renewable energy projects and can include impacts on local ecosystems and the way the local community see the sector and the companies in it. Both Śpiewak and Wesołowska (2016) and Lee and Zhong (2015) identify these risks as critical, especially in terms of gaining community acceptance and managing the environmental impacts of projects. Goh et al. (2014) also mention that inadequate stakeholder behavior can lead to delays and increased costs, highlighting the need for serious environmental and social risk management practices. Social resistance, often due to perceived negative impacts on local communities, can delay or derail projects, while environmental risks can lead to strict regulatory requirements that increase project costs and make them more time-consuming.

2.2 Identifying risk management strategies:

The effective management of risks is essential for the successful deployment of renewable energy projects. The literature identifies various risk management strategies that are employed across different types of renewable energy projects. These strategies not only mitigate specific risks but also help attract and retain investment by providing a more predictable risk-return profile and give investors more certainty and assurance.

- **Insurance Solutions**

Insurance is a widely recognized tool for managing risks in renewable energy projects. Gatzert and Kosub (2014) and Lee and Zhong (2015) describe insurance as a critical mechanism for covering construction delays, equipment failures and natural hazards, especially in offshore projects where the risks of previously mentioned things happening is big. Lee and Zhong (2015) also mention the role of catastrophe bonds and other insurance instruments in transferring operational and environmental risks to third parties, thereby reducing the direct impact on project developers. Michelez et al. (2011)

emphasize the importance of insurance in covering the financial impacts of project delays and unforeseen operational issues, particularly in emerging renewable technologies.

- **Diversification**

  Diversification is generally a common strategy for reducing risk and key strategy recommended across multiple studies for managing multiple types of risks in renewable energy sector, most impotantly market, operational and financial risks. Lee and Zhong (2015) suggest that investing in a variety of technologies (e.g., combining wind, solar and biomass) and geographical locations can help spread risk and reduce the impact of specific adverse conditions. Gatzert and Kosub (2014) similarly note that diversification across onshore and offshore wind parks helps mitigate the risks associated with technological and market uncertainties.

- **Feed-in Tariffs and Power Purchase Agreements (PPAs)**

  Feed-in tariffs (FiTs) and PPAs are also very common strategies for managing market risks by providing stable and predictable revenue streams for a foreseeable future. However, Egli (2020) warns that while FiTs reduce exposure to price volatility, they are subject to policy changes, which can create new risks. In contrast, PPAs offer a market-driven alternative that locks in energy prices, reducing price risk but introducing counterparty risks if the buyer defaults or market conditions change (Gatzert and Kosub, 2014).

- **Public-Private Partnerships and Government Support**

  Government support, usually in the form of subsidies, guarantees and public-private partnerships, plays a crucial role in managing financial and policy risks. Egli (2020) and Goh et al. (2014) bot emphasize that public involvement can significantly reduce the cost of capital by providing stability and confidence to investors. Gatzert and Kosub (2014) note that such partnerships are particularly beneficial in emerging markets, where policy frameworks may be less established or subject to frequent changes.

- **Catastrophe Bonds**

  Catastrophe bonds allow project developers to transfer the financial risks associated with extreme weather events and other unforeseen circumstances to bondholders. Lee and Zhong (2015) point out that these instruments are increasingly used in high-risk projects to provide additional financial security and attract investors who might otherwise be reluctant to engage in such volatile sectors.

- **Scenario Analysis and Real Options Approach**

  Scenario analysis and real options approach provide investors with the tools to assess various possible future outcomes and make flexible decisions accordingly. Lee and Zhong (2015) and Goh et al. (2014) mention these methods as tools that allow investors to evaluate potential risks and adjust their strategies accordingly, enhancing decision-making in uncertain environments and providing more control and certainty.

3. COMPARATIVE ANALYSIS

The main source for this comparative analysis, other than the literature, will be the data collected from the interviews conducted with stakeholders of the companies operating in the sector. The scope of the interviews was not only to gain insight into what the biggest risks and threats are for each of them and how they choose to deal with them, but also to understand the difference between these three countries and be able to make a comparison that will later allow us to draw valuable conclusions and offer recommendations. The idea is to get an insight into the background of each country (including all the factors important for the analysis) which will allow us to better understand the interview results and will offer us a better and clearer perspective on things before hearing about first hand experiences.

The countries – Serbia, Italy and Denmark, were chosen strategically because of the diversity in their economic, political and energy profiles, which provides us with a context needed for a clearer comparison.

When evaluating these countries we must take into account following factors:

- **Different stages of renewable energy development**: the three countries have had a different growth path when it comes to renewable energies and are currently in the different stages of development and implementation of both technologies and policies. Mature markets often have well-established frameworks for addressing risks, while emerging markets may face greater challenges in infrastructure, financing, and regulatory uncertainty. Taking this into account allows for a more holistic understanding of how companies manage risks in both developed and developing renewable energy environments

- **Different regulatory frameworks and energy policies** - Countries have different regulatory approaches to renewable energy. Some may have robust, supportive policies that minimize risk for renewable energy companies, while others may have less developed or inconsistent regulations that introduce greater uncertainty. Examining te regulatory environments before doing the analysis helps to identify best practices and common challenges in managing policy-related risks.

- **Economic power and level of investments available in the sector:** countries with more economic power typically have greater financial stability and therefore can offer more investment capital to the renewable energy sector, can give them access to more advanced technolgies and can reduce the timelines for completing the projcets. Also, they can obtain financing options easily.

- **Geographical and climatic differences:** The geographical and climatic conditions of a country influence the type of renewable energy resources available, such as wind, solar, or hydroelectric power. These conditions also affect the risks companies face, such as variability in energy production, natural disasters, or resource scarcity.

- **Membership in different political and economic unions**: membership in unions such as European Union for example can have a significant influence on the country's policies and access to capital markets and financing. Furthermore, being part of the political and/or economical unions can affect regulatory and market stability, as well as bring several benefits including foreign investments and standardized policy frameworks. On the other hand, countries outside of the union may be at a disadvantage due to policy volatility, trade barriers, or currency fluctuations.

- **Cultural and social context**: risk management practices are often shaped by cultural norms. Also culture may influence the overall acceptance of renewable energies and can affect the easiness with which they are implemented.

3.1 SERBIA:

3.1.1 Background:

Serbia is a country located in the Balkan peninsula, in Southeast Europe. It is important to note that it is not a member of the European Union, but only a candidate for the membership. Serbia is currently in the midst of the energetic transition and its emerging market is facing economic constraints that impacts the investment levels and financial stability of the sector. In 2013 Serbian government introduced National Action Plan for Renewable Energy (NREAP, 2013), which stipulated that by 2020 the renewable energy sources in the gross final energy consumption would correspond to 27% (37% for electricity, 30% for heating and 10% for transport). In ideal scenario, Serbia would be completely energetically independent (since it possesses the capacity and potential for that) and decarbonized. This would allow for expanding the local economy, creation of new job positions and significant decrease in carbon emissions. However, currently only around 30% of energy produced in Serbia comes from renewable sources (primarily from hydropower), which does mean that the initial plan was respected (with variation of 1/2 %), but it is nowhere near the full capacity the country has. Another important thing to note is that only 54% of energy consumed in Serbia is produced domestically, which makes the country dependent on the energy imports. In the end of 2021 there has been a huge fire outbreak in the system of thermal powerplant Nikole Tesla, which caused the lowering of the production capacity and increased the need for import of electrical energy. The issue caused was so grave that Serbia went from traditional exporter of electric energy to one of the biggest importers (in the period from November to December 2022 Serbia spent around 140 million euros on the energy import).

According to the "Energy Sector Development Strategy of the Republic of Serbia for the period by 2025 with projections by 2030"[1] the total potential of renewable energy sources amounts to 5,65 million toe (ton of oil equivalent). The priorities of the strategy are implementing key policies and measures that refer to five aspects of the EU Regulation on the Governance of the Energy Union: decarbonization (greenhouse gas reduction and renewables), energy security, energy efficiency, internal energy market research, innovation and competitiveness.

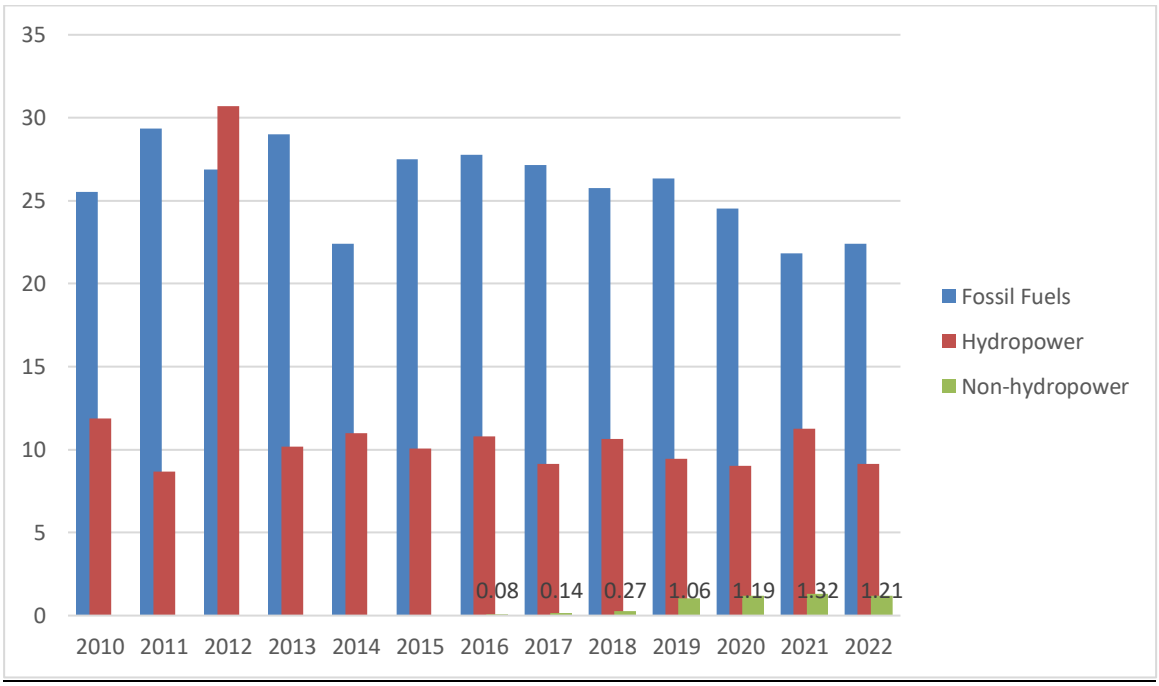

Figure 1 – Electricity production in Serbia
Source: https://aenert.com/countries/europe/energy-industry-in-serbia/

Note: "non-renewables" include wind, solar and biomass energy.

As we can see, the renewable energy production in Serbia started recently and is still at a very low level, with the fossil fuel and hydro production dominating the energy landscape.

Serbia's geographical and climatic conditions are integral to understanding the renewable energy industry here. The country has a diverse climate, with varying potential for different types of renewable energy sources, such as hydropower, solar, and wind, as well as biomass (that constitutes 61% of Serbian renewable energy potential) and geothermal energy. The variability in climate of course impacts the risk associated with energy production and project planning. Companies must account for these factors in their risk management strategies to mitigate the effects of resource variability and environmental conditions, but these resources will have to be more exploited in the future if the country wants to achieve carbon neutrality by 2050.

One of the issues that is present globally and is not exclusive to Serbia is the presence of Chinese investments and producers that are lowering the price for the local producers. The difference is that the EU is fighting this by introducing taxes for Chinese and all the other non-European producers. However, Serbia depends a lot on Chinese capital and is not in the position to introduce the same policies, so as consequence it is more exposed to this threat.

The threat also comes in the form of Russian influence in the market. In 2008 Russian company Gazprom became the majority shareholder of NIS (Naftna Industrija Srbije)[1] by acquiring 51% of their shares. They bought additional 5.15% stake in 2011, which currently makes them the owner of 56.15% of the company, while the state owns 29.9%. NIS is the main oil supplier in Serbia, which is why government is considering buying a majority stake in it with the scope of reducing country's dependence on Russian oil, especially since EU decided to ban Russian oil supplies via the Adriatic oil pipeline in Croatia as of December 2022. Serbia was in a very particular position in this case, since the people are traditionally pro-Russian but are still willing to integrate with other European countries and European Union.

The last, but not least, factor we need to consider is the presence of the NIMBY (Not In My Backyard) syndrome effect. What this means is that people look at the renewable energy sources differently if they know that power plants would be built in the area where they live. This effect was particularly strong in Serbia, especially when it comes to hydropower, since building of the hydropower plants has proven to be damaging to the environment and has therefore caused a negative reaction towards renewables in general.
Any energy transitioning strategy must take into account the NIMBY effect, because it can be a destabilizing factor along the way.

3.1.2 Interview:

The interview conducted with the CEO of S.O.K. doo Kraljevo has provided a first-hand insight into the renewable energy sector in Serbia and risks that are being encountered in it, as well as some of the strategies used to manage those risks. S.O.K. doo Kraljevo is a company that produces solar panels and the energy that is subsequently sold on the market. They currently have a few active plants and are in process of building others.
When it comes to the biggest risks in the sector, the interviewee has listed a few of them. Firstly, Serbia is still too dependent on fossil fuels and other traditional energy sources. This is partially due to the economic power of the country and the fact that even though the investments have been growing with years, they still remain modest in comparison with many other European countries. Partially, it is due to the fact that society is yet to start accepting renewable energy sources and become more open towards this transition.

[1] *NIS (Naftna Industrija Srbije) – Oil Industry of Serbia*

Another point the interviewee made is that when it comes to renewable energy sources, Serbia relies too much on hydropower, meaning that the sources are not diversified enough despite the potential our land and climate conditions offer us. We have to note that even though hydropower is a renewable energy source, mini hydropower plants, usually built on the small mountain rivers or lakes, can be extremely harmful to the environment and have in the past contributed to a certain degree of resistance that people in Serbia have been feeling.

One prevalent issue in Serbia is unfortunately **corruption** and **nepotism**. The law stipulates that whoever wants to build a plant that produces under 1MW of energy can obtain the building permits from the municipality in which they are planning to build it. However, if the plant size exceeds 1MW, the permission for building needs to be granted by Ministry of Mining and Energy and, despite the administration processes being digitalized, the final procedure must be completed in presence in the headquarters of the Ministry located in Belgrade. This opens the door for a lot of corruption that has been taking place, because the officials of the Ministry are allegedly requiring a certain type of compensation for issuing building permissions, especially if the company is small and not one of the few "giants" in the sector that hold more power and have better connections in the competent institutions. And although some try to solve this issue by building smaller plants with capacity smaller or equal to 1MW, instead of one big plant whose power exceeds 1MW, this is not a most efficient solution because once you build the plant, in order to connect it to the national distribution channels and be able to sell the energy produced, you again need a permission from Ministry of Mining and Energy and the previous process is likely to repeat itself. The corruption, combined with complicated administrative and legal procedures that almost always require traveling to the capital a few times, creates a significant barrier for entering the sector and pose a risk to everyone operating in it.

Another risk comes in the form of volatile investment costs that frequently change and therefore make it difficult to create a budget for projects or make any necessary calculations. The selling price of the energy the producers can get on the market also changes frequently, since it entirely depends on the market conditions and therefore is highly volatile as well, posing a risk of potential losses and making the financial planning hard.

When it comes to laws and regulations in Serbia, they are very similar to the ones in EU, because they were practically replicated with some adjustments. The problem is that they are not properly applied. Moreover, the sector has been lacking the government attention and assistance in the past decade. The government has introduced some policies and subventions to help boost the sector in the past, the last one being introduced in

2014, but hasn't done much recently. The intervention was in form of:

- **Feed in tariffs** (common way of risk management in renewable energy sector) which guaranteed the selling price above market value to the producers for next 12 years. The selling price guaranteed was 20 cents, which was 4 times higher than the market price at the time.
- **Auction for electric energy:** the concept where government offers a maximum selling price they are willing to guarantee for a certain amount of energy and the companies have the chance to make an offer. The idea is that the one that offers the lowest price wins and they get the guaranteed price for next 15 years.

The issue lies in the fact that only a few big and well-connected producers were able to get the feed in tarrif the last time it was introduced. When it comes to benefits offered by the state, they are almost always reserved to the big companies, people that are close to the government and the ruling party and those profiting from nepotism.
The auction is a relatively new intervention, the last one was held in 2021, but it is reserved only for those with plants bigger than 500kW and because of that only the biggest market players managed to participate and obtain the benefit.
Moreover, most of the benefits are dedicated to solar energy producers and almost nothing is reserved for wind parks or other renewable energy sources, which means that their potential is being completely ignored.

The effective strategies for managing risk in Serbia, according to the interviewee, would be:

- More thorough control and auditing of the competent institutions, that either allow certain mischiefs to happen or turn a blind eye to them, regular inspection and reporting
- More focus on small and medium size producers, since they are often overlooked and not granted the benefits or even put at a disadvantage in favor of bigger producers.
- More education and information provided to ordinary people about renewable energy sources, their potential and the best way to exploit them, perhaps in form of effective campaigns
- The energy resources in Serbia will have to be a lot more diversified as the part of its energy transition
- More focus on energy independence.
- Mor focus on domestic market and production with respect to foreign one.
- Making legal and administrative procedures easier and less time-consuming.
- Insurance policies for potential losses that may occur during building process or for potential damages to the plant that may occur due to the climate conditions.

3.1.3 Conclusion:

Serbia's renewable energy sector is at a critical juncture, marked by significant potential and considerable challenges. Despite possessing ample natural resources for hydropower, solar, wind, biomass, and geothermal energy, the country has yet to fully exploit these opportunities, largely due to economic constraints, dependence on fossil fuels, and systemic issues like corruption and complex administrative procedures. While Serbia's regulatory framework resembles EU standards, weak enforcement and insufficient government support have hindered progress, particularly for small and medium-sized producers who struggle against larger, well-connected entities.

The country's heavy reliance on hydropower and external energy imports underscores the urgent need for greater resource diversification, improved energy security, and a more transparent regulatory environment. Additionally, overcoming societal resistance to renewable projects driven by environmental concerns and the NIMBY effect, is essential for advancing the energy transition. By addressing these issues through strategic reforms, increased public awareness, and support for smaller producers, Serbia can better harness its renewable energy potential, enhance its energy independence, and work toward its goal of carbon neutrality by 2050.

3.2 DENMARK:

3.2.1 Background

Denmark is widely regarded as a global leader in renewable energy, particularly in the wind energy sector. Over the past few decades, the country has successfully transitioned to a low-carbon economy and is on track to achieve its ambitious goals for sustainability. The energy transition in this country has begun in the 1970s and is still on going. During the past five decades Denmark has introduced several plans that they successfully followed and implemented. These four national energy plans incorporated political, legislative, financial, fiscal, administrative, technological, and educational elements and were crucial for the energetic transformation that the country managed to reach. This sums up the Danish energy transition path:

- **Danish Energy Plan of 1976**: the plan with which Denmark begun its journey towards renewable energies. It was introduced as a response to the 1973 oil crisis, This plan focused heavily on reducing dependence on imported oil, which accounted for over 90% of Denmark's energy consumption at the

time. It encouraged energy conservation and diversification by promoting alternative energy sources like coal and later, wind and natural gas.

- **Energy Plan of 1981**: this plan continued the push for diversification away from oil, with a significant emphasis on the development of Denmark's North Sea natural gas reserves. The plan also, for the first time, recognized renewables as the potential energy sources and introduced more aggressive measures for energy efficiency and the development of wind energy.

- **Energy Plan of 1985**: this plan was a pivotal point in the Danish transitioning journey, as it finally rejected nucelar power as a potential alternative energy source for fossil fuels, after long consideration during the previous years

- **Energy 2000**: with this plan from1990 the clear targets for renewable energy were officially introduced, with the goal of having 10% of the country's electricity obtained from renewables by 2005. It also called for the increase in the usage of biomass as an energy source and more sustainable development practices within the sector. Finally, it introduced subsidies for construction of energy efficient regional heating systems in order to reach energy efficiency.

- **Energy 21**: published in 1996, it is a long-term strategic plan that aimed to make Denmark a leader in the sector, recognizing the crucial role renewables play in Denmark's economy. It prioritized wind energy, solar power, and biomass and laid the groundwork for large-scale offshore wind projects and further investments in renewable energy infrastructure.

- **Energy Agreement of 2012:** this agreement set one of the Denmark's most ambitious renewable energy goals: 100% of its energy supply (electricity, heating, industry, and transportation) coming from renewable sources by 2050. The plan included significant investments in wind power, especially offshore wind, energy efficiency improvements, and the development of smart grid technologies to better integrate renewable energy into the national grid.

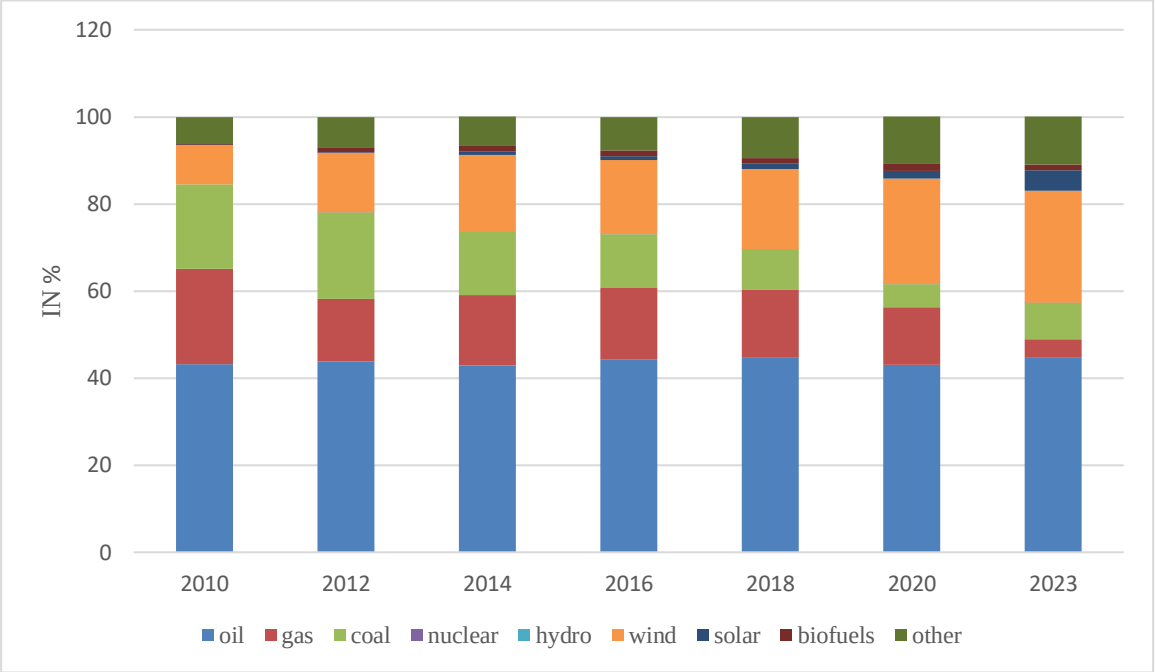

Figure 2 – Energy production in Denmark
Source: https://ourworldindata.org/energy/country/denmark

Note: "Other renewables" include geothermal, biomass, and waste energy.

We can note the stability in oil energy production over the years, but the increase in wind and solar energy production and decrease in gas energy production over the years.

In general, Denmark's strong political commitment, robust regulatory framework, and significant financial investments have positioned it at the forefront of renewable energy development. But, the key enabler of Denmark's success was its strong economic position. Thanks to the access to substantial financial resources, they have made large-scale investments in renewable energy infrastructure and research, particularly in wind energy. Danish companies benefit from stable economic environment, which allows them to operate more freely and enables the accessing to both private and public investment that they use to fund research & development activities, new technologies and innovations in the renewable energy space.

Denmark's regulatory framework for renewable energy is one of the most refined and advanced in the world. The Danish government has long been committed to achieving energy independence and its policies reflect that. Denmark's regulatory environment is characterized by clear, stable, and supportive policies that provide incentives for renewable energy projects, reduce uncertainties, and foster investor confidence and the companies operating in the sector benefit greatly from this. This regulatory framework is further solidified by Denmark's integration with the European Union's energy and environmental policies.

Country’s geographical and climate position make it very well-suited for renewable energy power plants, particularly wind. The country’s flat terrain and coastal access provide optimal conditions for onshore and offshore wind farms, which have become the backbone of its renewable energy strategy. Denmark is currently the global leader in wind turbine technology and wind farm development. They have invested heavily in the infrastructure and technology needed for this sector, but also in a electricity grid that s capable of integrating a large share of renewable energy. Grid interconnectivity allows for the export of surplus energy to neighboring countries, further mitigating market and operational risks.

Denmark's culture is deeply supportive of renewable energy, reflecting the country's strong environmental values and commitment to sustainability. The concept of "green citizenship"[2] is prevalent, with citizens actively participating in energy-saving practices, supporting policies that promote clean energy, and investing in community wind and solar projects. But, while Denmark's people are largely supportive of renewables, there are some concerns that cause resistance and NIMBY effect, such as concerns for visual and noise impact of wind turbines, particularly those located near residential areas. There is also a debate about impact of offshore wind farms on marine life and local ecosystems. Overall, public support remains strong, but these challenges highlight the complexities of balancing ambitious green energy targets with local concerns.

3.2.2 Interview

For purpose of this analysis, an interview was conducted with the head of footprint development for Siemens Gamesa in Denmark. He is also the head for the planning of plant openings around the world and a member of examining commission at Aalborg University, from which he also graduated. He has been in the company for 11 years and has had a managerial role since 2019.

Siemens is one of the biggest players in renewable energy sector in Denmark, according to the interviewee around 75% of Denmark’s windparks were built and are maintained by this company.

The projects they undertake are a very heavy investment projects, requiring at least 100 million euros of capital.

The reason why Denmark is so competitive and why they manage to maintain the highest level of development in this sector is because they are backed by a great educational system.

[2] Green/Environment Citizenship - Being an active environmental citizen includes recognizing the value of environments for humans and nature, promoting conservation and restoration of resources, and supporting nature protection and biodiversity.

The interviewee highlighted the importance of academic education for the sector, because that is where the majority of their workforce comes from. Siemens in particular closely collaborates with Aalborg University by doing a lot of projects with its students and by offering internship opportunities to them.

The number of risks companies are facing in the Denmark is lower compared to the rest of the world, since Denmark is definitely a forerunner and the fact that they sell their energy to UK and Netherlands, who are both heavily involved in renewable energy sector and wind parks, confirms that. However, there are a few risks that are of concern and that they are trying to manage, most of them are associated with the Danish government and its policies.

First and foremost, the companies in the sector heavily rely on the benefits the government grants them, which are:

- **Production tax credits**: these incentives may include reduced corporate tax rates, exemptions from certain taxes, or accelerated depreciation allowances for renewable energy assets. By lowering the overall tax burden on renewable energy companies, they improve profitability and cash flow, reducing financial risks and encouraging reinvestment in the sector.
- **Feed-in tariffs and a guaranteed prices**
- **Green certificates (Guarantees of Origin):** the concept where renewable energy producers receive certificates for each unit of electricity generated from renewable sources. These certificates can be sold to electricity suppliers, who are required to meet specific renewable energy quotas**.**

The issue is that the government is considering reducing the tax credits with the purpose of creating a clean market. Since firms need this credits in order to stay competitive and would probably not be able to stay afloat or compete with fossil fuels without them, the threat of government reducing or eliminating them completely pose probably the biggest risk they face. Another issue government creates, is that they overestimate the capacity that the energy producers in Denmark have. The government officials have signed several legally binding agreements with other countries such as Germany, Poland etc. that stipulate that Denmark will supply the energy that they simply don't have enough capacity to produce. This is also connected with some technological issues – companies are currently working on developing the batteries that will be able to store the produced energy, so the problem is not only producing capacity but also the storing capacity. Government must take this into account before signing any kind of international agreements, otherwise they would be putting the domestic industry at risk.

When it comes to technological and operating risk, there are several of them. One is, as previously mentioned, adequately storing the produced energy. Also, there are some concerns regarding the speed with which the thole industry is evolving – in the past decade the size of an average windmill increased significantly, size of blades went from 45m to 150m and the size of the turbines and towers also increased proportionally. Because scaling up in this sector is hard, manufacturing process got way harder and more costly, as well as managing and servicing of turbines, especially since a lot of onshore parks have been transferred offshore. Offshore wind parks require more effort to maintain (staff uses helicopters to reach them for example) and distribution of energy produced by offshore parks is more complex than it would be if they were onshore.

Another important thing to note is that the lifespan of a average windmill is up to 35 years, but companies usually commit to 25 years, after which the blades need to be disposed of. The problem is that traditional blades were built from a specific type of glass material that cannot be destroyed – burned, dismantled etc. So the only possible solution currently is to burry them into the ground, which sort of defeats the purpose of having renewable and sustainable energy sources in the first place. The closer they are to the deadline for disposal, the bigger the risk is. Because of this, they have recently started to produce recyclable blades, made from materials that can later be dismantled and reused.

Denmark has been the EU member state since the very beginning and as such EU has some influence on its policies. However, this influence is not big because Denmark is a leader in the sector and has been prioritizing renewable energy and green economy for a long time, therefore its policies and goals are always aligned with the EU's ones. The only risk they face is not being able to reach the set goals in timely manner. The geopolitical factors also have less influence on Danish renewable energy industry than they perhaps have on other countries, but ever since the war in Ukraine has started there has been a growing concern about the level of protectiveness the infrastructure has and how vulnerable it would be in case of a conflict. Put in simple terms, the Danish people are wondering how easy would it be to destroy their infrastructure and cut off their power supplies. The government has been working on ways to protect the plants and prevent this course of events, but the strategies they implement are, naturally, a top secret.

As we have already seen, the overall "climate" in Danish society and public opinion about renewable energy are positive. There are certain causes for complaints amongst people, some of them are the noise pollution wind parks create (one of the reasons they are trying to move them offshore as much as possible) and overall danger to the environment they create. Also, when it comes to the types of renewable energy sources, Danes are mostly resistant towards nuclear power for various reasons – lack of confidence in the security of nuclear power plants, concern for the environment etc.

Here are some risk management strategies proposed by the interviewee:

- The government should refrain from reducing tax credits and possibly consider introducing other benefits such as feed-in tariffs
- Further investments into R&D in order to develop new technologies for storing more energy and for efficient and sustainable disposal of windmills
- Government officials and politicians should be better informed on the industry and production capacities, especially before negotiating agreements and business deals with foreign governments
- More focus on protecting the infrastructure.

3.2.3. Conclusion:

Denmark is definitely the pioneer in the renewable energy sector, the country's clear legislative vision, substantial financial investments, and unwavering public support have facilitated the position they currently hold in the world.

However, Denmark's ambitious goals are not without challenges. The reliance on government incentives, technological limitations in energy storage, and local opposition to certain renewable energy projects illustrate the complexities of balancing rapid growth with sustainable practices and public concerns. Additionally, managing international commitments require careful policy alignment and technological advancements. These issues need to be properly addressed if they want to reach its target of 100% renewable energy by 2050.

3.3 ITALY

3.3.1 Background:

Italy is one of Europe's largest energy markets and has made significant strides in renewable energy development over the past few decades. However, the Italian renewable energy sector faces distinct challenges, such as regulatory complexities, economic constraints, and infrastructural limitations, which influence the approach to risk and risk management. This chapter highlights the key factors that shape risk management practices in this country. Over 1/3 of the energy produced in Italy comes from renewable sources.

First thing we must consider is geographical position of Italy. Italy is much bigger in size compared to Serbia or Denmark, the countries we previously analyzed, which makes the development and management of

renewable energy industry much more complex. Also, the population density of Italy is more than double the one of Serbia and almost double the one of Denmark. This makes the demand for energy significantly higher than in the other two countries. Italy's diverse geographical landscape includes mountainous regions (Alps and Apennines), extensive coastlines, sunny southern regions, and volcanic areas, which offers a variety of renewable energy sources. Overall the sector has a great potential for development. However, certain types of terrain can complicate infrastructure development and increase logistical and operational costs, especially in remote or mountainous areas. Every region in Italy is involved in achieving the goals established in the Integrated National Energy and Climate Plan (NECP) for 2030.

The history of renewable energy sector dates back to the early 20th century when they developed their first hydropower plant, but their journey accelerated in the 1970s during the oil crises, when they first started shifting towards renewables and in that they are similar to Denmark. In the subsequent decades, Italy invested heavily in hydropower, solar, wind, and geothermal energy, capitalizing on its diverse geography and favorable climate conditions.

This is the overview of the Italian energy transition path:

- **Response to the Oil Crises (1970s)**: The crisis spurred initial investments in renewable energy and energy efficiency, laying the groundwork for Italy's energy transition. This period was marked by the exploration of alternative energy sources, especially hydropower and geothermal energy, which were already significant parts of the energy mix.
- **Early Renewable Energy Promotion (1990s)**: In this period the first energy policies in response to growing environmental concerns and international climate commitments, such as Kyoto Protocol,[3] were formed. This is when the transition started becoming more formalized and institutionalized and the path and the steps to be taken became clearer. This period is marked by the introduction of the first feed-in tariffs and incentives aimed at encouraging the production of electricity from renewable sources.
- **Conto Energia (2005 – 2013):** this program, first launched in 2005, was Italy's first major feed-in tariff system specifically targeting solar panel energy. It provided fixed payments for solar energy producers, greatly incentivizing the installation of solar panels across the country. And even though the program eventually had to be stopped due to high costs, it turned Italy into one of the global leaders in solar energy.

[3] *Kyoto Protocol was an international treaty signed on 11th of December 1997 in occasion of United Nations Framework Convention on Climate Change (UNFCCC) in Kyoto, Japan, that commits state parties to reduce greenhouse gas emissions*

- **National Energy and Climate Plan (PNIEC) 2020**: comprehensive energy and climate plan developed in response to the EU's 2030 climate targets. The objective was to align Italy's goals with the EU ones, most important one being cutting emissions by 33% by 2030. The plan integrates renewable energy transition into Italy's broader economic and environmental strategies, emphasizing the modernization of grid infrastructure, development of energy storage solutions, and promotion of green technologies.

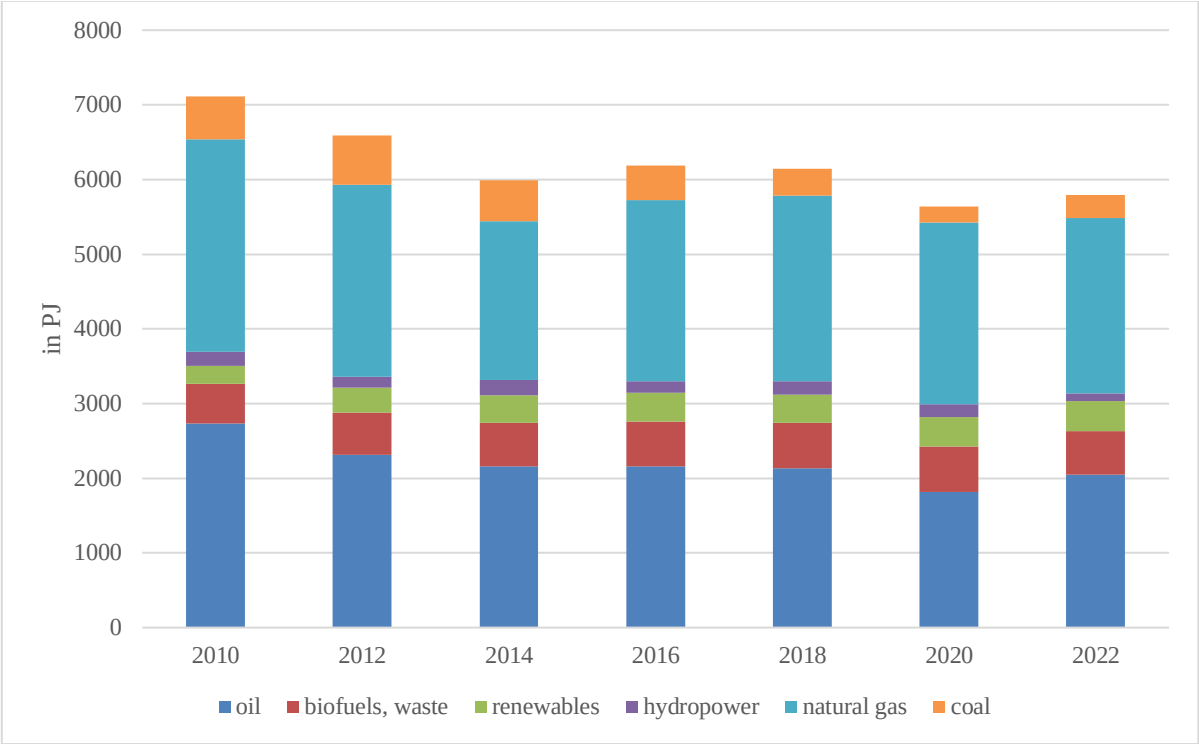

Figure 3 – Evolution of the electricity generation in Italy by source
Source: https://www.iea.org/data-and-statistics/data-product/world-energy-statistics-and-balances#overview
Note: " renewables" include wind and solar energy

We can note the slight reduction in oil energy generation and stable levels of energy generation from renewable sources that will have to be increased in the future.

One particularity about Italy is that it is divided into 20 regions that each are responsible for formulating Regional Energy Plans ("Piani Energetici Regionali"), according to Law No. 10/1991. Furthermore, in 2001 Italy enacted an important reform of the Constitution (Constitutional Law 3/2001) which modified the Title V of the Italian Constitution granting important functions to Regions over energy matters. This means that the guidelines are stipulated on the national levels, but regions and municipality act and create legislations accordingly, making the administration decentralized and the risk management strategies more

individual to each region.

EU membership has influenced Italian policies a lot. Italy is one of the members that committed to phasing out of coal by 2030 and reaching carbon neutrality by 2050, with respect to European Green Deal.[4] Policy alignment is very beneficial because it encourages regulatory stability and gives a common goal to strive to. Italy also benefits from EU through access to funding and support for its transition to renewable energy, which include investments in upgrading infrastructure, promoting sustainable mobility, and enhancing energy efficiency. One of the programs Italy is included in is Horizon Europe, a funding program for research and innovation, running from 2021 to 2027 with a budget of over €95 billion.

Italy's economic landscape plays a significant role in shaping this sector. While investment in renewable energy has been substantial, supported by both national and European Union funding, economic volatility and public debt challenges have impacted the level of available funds, influencing the financial stability of renewable energy projects. These economic constraints require companies to adopt cautious and efficient risk management practices, focusing on cost reduction, technological innovation, and securing reliable funding sources to mitigate financial risks.

Italy's regulatory framework for renewable energy has evolved significantly over the past decades, driven by EU directives and national commitments to reduce carbon emissions. The government has introduced various policies to promote renewable energy, including feed-in tariffs, green certificates, and tax incentives. However, the regulatory environment has been characterized by frequent changes, which create uncertainty and pose regulatory risks for companies operating in the sector.

The complexity of Italy's regulatory framework, including regional differences in permitting and administrative processes, adds another layer of risk for project developers. Companies must navigate these regulatory hurdles while adapting to changes in policy and compliance requirements. Effective risk management in this context involves staying updated on regulatory developments, engaging in proactive policy advocacy, and employing legal expertise to ensure compliance.

Italy has an advanced infrastructure, but still faces challenges with integrating a growing share of renewable energy sources. Infrastructure needs continuous updates to be able to manage the growing variability of the resources and to ensure the reliable energy distribution.

[4] *European Green Deal a package of policy initiatives, which aims to set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050.*

Additionally, a big risk comes from Italy's geographical structure, because complex terrain poses logicstical challenges for building and maintaining energy infrastructure. Furthermore, the development of cross-border interconnections with neighboring countries will be crucial for stabilizing the energy grid and managing excess renewable energy production.

Italy's renewable energy market is competitive, with a variety of players, including the established national players and international companies seeking to capitalize on the country's renewable resources. The market has experienced significant growth, particularly in the solar and wind sectors, driven by strong government incentives and supportive EU policies. However, this competitive landscape also increases pressure on companies to innovate and optimize in order to stay competitive and keep up with the demands the society and sector itself poses on them.

3.3.2 Interview:

For purpose of this comparative analysis an interview was conducted with one of the procurement manager of ENI (Ente Nazionale Idrocarburi), influential conglomerate originally operating in oil and gas field. ENI played key roles in setting the course of energy policy until 1990s alongside electricity monopolist ENEL (Ente Nazionale Energia Elettrica). ENI was such a powerful player that when in the 1950s and 1960s nuclear power was considered as a way to modernize the energy sector, ENI used its power to shut it and stir it towards hydrocarbons the same way they are now stirring it towards the renewable energy sources.
ENI is very involved in the renewable energy sector and its goals are aligned with EU's. Th company's long term plan is to reach carbon neutrality by 2050 and is divided as follows:

- By 2030 the carbon emissions will be lowered by 35%
- By 2035 the carbon emissions will be lowered by 55%
- By 2040 the carbon emissions will be lowered by 80%
- By 2050 the carbon emissions will be lowered by 100%

Moreover, the plan is the divided by Scope 1, Scope 2 and Scope 3. Scope 1&2 include lowering the company's carbon footprint and Scope 3 involves all of the company's stakeholders. To that end, in 2023 a project called "A just transition" was launched and it involves the careful auditing of the entire supply chain, which falls under the responsibilities of the interviewee. So, before any outside company is hired they need

to pass the process to qualify to work with any and to that they are required to provide evidence that they implement renewable energy strategies into their operations. This is ENI's way to "impose" a common goal to other entities in the country and make the transition faster.

There are several risks the company is facing. First, the energy transition projects are very complex and with the technology constantly evolving the required investments costs are growing as well, especially because such advanced technologies require specific soft skills and competent workforce. They cannot rely on support from the government, because some institutions are not yet ready to move from the traditional sources. This may have something to do with the fact that a lot of people are employed in the traditional energy sector and moving from it completely would also mean leaving them without a place to work and/or having to help them obtain new skills and move on. Renewable sector is not mature enough to accept that kind of inflow of people. The fact is, firm is currently investing alone, all the projects that they are undertaking currently are entirely funded by them, government is not supportive enough.

When it comes to the geopolitical factors, the biggest risk is definitely posed by wars and conflicts and the number one reason for that is that they are mostly funded by the traditional sources (weapon production, fuel needed for vehicles etc.) Moreover, they can interrupt the energy distribution channels and destroy the energy production plants, like in the case of Ukraine for example, which leaves all the countries dependent on importing that energy vulnerable. Finally, they move the focus from renewable energy transition to conflict itself, because when there is a war going on no one is thinking how sustainable it is or how damaging it is to the environment, they are concerned for their well-being.

According to our interviewee, even though there are some countries that are at the stages of development higher than Italian's, such as the countries in the North of Europe, Italy is working hard to catch up and in the past 5 years has made a remarkable progress.

These are some of the risk management strategies he suggests:

- More involvement from the government. The government is providing some help in form of subsidies, credits and tariffs, but more help is needed in the form of investment in the infrastructure and technology.
- More focus on energy independence, less relying on energy imports.
- Conveying the right message: people need to be more informed and educated on the topic of renewable energy sources and what they can offer the world, as well as the amount of damage the usage of traditional sources is causing.
- Forming more strategic partnerships on all levels (countries, continents..).

- Making more literature on the topic, building research centers and partnering with universities for research, development and innovation of technology and infrastructure.

3.3.3 Conclusion

Italy's renewable energy sector reflects a complex interplay of opportunities and challenges shaped by its diverse geography, regulatory environment, and economic conditions. As one of Europe's largest energy markets, Italy has made notable strides in renewable energy development and its historical commitment to renewables has positioned it as a significant player in the European energy transition.

However, there are many things that should be improved. The decentralized nature of energy regulation adds complexity to the planning and execution of national energy policies. Regulatory instability, frequent changes in incentives and a competitive market create uncertainty for investors and project developers, complicating the risk landscape. Additionally, economic volatility and high public debt levels constrain the availability of funds. The role of influential energy companies like ENI highlights the private sector's critical contribution to this transition, although further governmental support is needed for them to be able to continue with their projects.

Looking ahead, previously listed issues will have to be addressed in order for Italy to reach the goals imposed by their own strategies and by their membership in the European Union.

4. LIMITATIONS

This thesis had a goal to gain an overview of the risk types and risk management strategies through qualitative analysis. However, this study faces several limitations that have to be acknowledged:

- **Data limitations**:

  The study relies on the qualitative data obtained from literature review and interviews conducted. However, one must keep in mind that for the research to be complete it would be necessary to analyze quantitative reports from the past 50 years at least, as well as all the literature on the topic in the same timeframe. Also, the depth of insights gained depends significantly on the availability and willingness of participants to share detailed information. There also may be otential biases in interview responses, including personal perspectives or organizational confidentiality, that could affect the objectivity of

the findings.

- **Scope of the comparative analysis**:
  While the countries chosen for the comparative analysis were strategically chosen, it doesn't change the fact that for a complete overview of the state of the European renewable energy sector we would need to obtained data from every European country and compare it. If we wanted to evaluate the sector on the global level that would mean collecting data from all the countries in the world and then conducting the analysis. So, while these cases provide valuable insights, the findings of this research are still limited.

- **Limited analysis of geopolitical factor**:
  While the study addresses the influence of geopolitical factors, it does not deeply analyze the complex and often unpredictable impact of international relations and does not go into details when it comes to the types of geopolitical factors that exist. Also, we must note that changes in geopolitical landscapes can have impacts that are hard to predict and therefore hard to analyze.

- **Rapidly evolving nature of the sector:**
  As mentioned many times in this study – this sector is a rapidly changing one. It influenced by technological advancements, policy changes, and market dynamics. Therefore, we can look at this study as a snapshot in time, but we must be aware that identified risks and strategies may change and become irrelevant over time.

- **Generalization:**
  While the risks and strategies identified in the literature are general, the ones identified in the comparative analysis are more specific to the company/country. Generalizing these findings to other contexts may not be appropriate, as risk profiles and management practices can vary significantly depending on local conditions, regulatory environments, and stakeholder engagement levels.

- **Volatility of laws, regulations and policies:**
  Regulatory environments in each country are complex and subject to frequent changes. This means that the ones identified now may change over time, just as their impact and relevance may change.

5. KEY INSIGHTS

This analysis offers as the following insights:

- **Types of Risk in the Renewable Energy Sector**:.

  Across all three countries, common risks include strategic and business risks, market risks, regulatory and policy risks, financial risks, construction and operational risks, and environmental and social risks. Emerging risks, particularly related to technological advancements and geopolitical factors, are becoming increasingly significant. For instance, the rapid evolution of wind turbine technology in Denmark has introduced new operational challenges, while geopolitical tensions in Serbia have increased the sector's vulnerability to external influences.

- **Geopolitical Influences**:
  - Geopolitical factors significantly impact risk management strategies. Serbia's dependence on foreign energy imports and influence from non-EU entities like Russia and China highlights the vulnerability of the sector to geopolitical shifts.
  - Denmark's leadership in renewable energy is backed by a stable geopolitical environment and strong EU integration, but it faces risks related to international commitments and infrastructure security.
  - Italy's transition is shaped by its EU membership, which provides access to funding and regulatory stability, but frequent changes in national policies create a challenging environment for long-term planning.
  - Wars and conflicts have proven to be the biggest threat to the sector in general, because of the severity and variety of their impacts on the industry.

- **Importance of enhancing collaboration between various stakeholders**:
  - Effective risk management requires enhanced collaboration between governments, industry, and local communities. Denmark's success demonstrates the importance of a supportive regulatory environment, strong public backing, and active industry-government collaboration.
  - Public acceptance and community engagement are crucial. Strategies such as public awareness campaigns and stakeholder involvement in project planning can mitigate social resistance and prevent the NIMBY effect seen in all countries.

- **Integrated Risk Management Approaches**:
    - The research underscores the need for integrated approaches to risk management that consider the interplay between different types of risks. For example, Denmark's advanced regulatory and technological landscape allows for more comprehensive risk mitigation, combining market, operational, and environmental strategies. However, developing an integrated approach is extremely complex and time-consuming and the companies generally don't have time to do that. Some of them may resort to hiring outside council for this job, but we must bare in mind that not all of them have resources to do so.
    - Italy's fragmented regulatory framework and Serbia's inconsistent policy enforcement highlight the challenges of implementing such approaches, emphasizing the need for clear, stable, and supportive policies that align with broader national and EU-level goals.

- **Implications for Policy and Practice**:
    - Policymakers need to provide consistent and supportive frameworks that enable renewable energy companies to manage risks effectively. This includes stable incentives, clear regulations, and dedicated support for technological and infrastructure innovation.
    - For companies, diversifying energy sources, investing in new technologies, and engaging proactively with regulatory bodies can enhance resilience against emerging risks. The importance of insurance solutions, public-private partnerships, and scenario planning is also emphasized.

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