MSc Program
Environmental Technology & International Affairs



# The Role of the EU Taxonomy for the Energy Transition

A Master's Thesis submitted for the degree of
"Master of Science"

supervised by
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Vienna, 05.06.2022

# Affidavit

I, **DANIEL HOPKINS B. ENG.**, hereby declare

1. that I am the sole author of the present Master's Thesis, "THE ROLE OF THE EU TAXONOMY FOR THE ENERGY TRANSITION", 83 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted the topic of this Master's Thesis or parts of it in any form for assessment as an examination paper, either in Austria or abroad.

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# Abstract

We are now living in an era that is experiencing a climate catastrophe, which poses a serious challenge to the globe by influencing every aspect of our civilization. Global warming and climate change urge substantial adjustments to our current habits. Limiting climate change and its consequences need rapid action, making global decarbonisation and energy transition to a green economy an urgent priority. The energy transition necessitates unprecedented investments in order to mitigate and adapt the effects of climate change.

One of the Paris Agreement's efforts is to align financial flows with a roadmap toward low emissions of greenhouse gases and development that is environmentally friendly. Whereas in past years, the EU established the Sustainable Finance Framework to address environmental issues while increasing the awareness of sustainable economic activity. The EU Taxonomy, on the other hand, is a critical tool for achieving the European Union's ambitious EU Green Deal´s environmental goals of becoming climate neutral by 2050 and boosting sustainable finances by identifying environmentally sustainable operations and preventing greenwashing while aiming to enable and increase sustainable finances.

The goal of this thesis is to give insight into the EU Taxonomy by analysing its most recent changes and determining its impact on the energy transition. The methodology itself is a typical qualitative and exploratory research, which is based on material and publications from the European Commission but also on wide-ranging literature for the analysis of the effects of the energy transition.

The current renewable energy shift is being pushed by strong decarbonisation regulations and low-carbon technological advancements, while the EU Taxonomy is projected to distribute capital more favourably to sustainable industries. The taxonomy is intended to standardise sustainable operations, and although it has generally had some positive influence on the Energy Transition, several challenges have arisen for the commercial sector.



**Keywords:** EU Taxonomy, Energy Transition, Renewable Energy, Sustainable Investment.

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# List of abbreviations

| | |
|---|---|
| BAT | Best Available Technology |
| CapEx | Capital Expenditure |
| CBAM | Carbon Border Adjustemnt Mechanism |
| CCS | Carbon Capture and Storage |
| CEP | Clean Energy for All European Package |
| CSRD | Corporate Sustainable Reporting Directive |
| DNSH | Do No Significant Harm |
| ETS | Emission Trading System |
| ESG | Environmental, Social, and Governance |
| EU | European Union |
| GHG | Greenhouse Gases |
| IPCC | Intergovernmental Panel on Climate Change |
| IEA | International Energy Agency |
| ILO | International Labour Organisation |
| IMF | International Monetary Fund |
| IRENA | International Renewable Energy Agency |
| IR | Investor Relations |
| KPI | Key Performance Indicators |
| MSR | Market Stability Reserve |
| MS | Minimum Standards |
| NASA | The National Aeronautics and Space Administration |
| NGO | Non Governmental Organisation |
| NFRD | Non-Financial Reporting Directive |
| OpEx | Operational Expenditure |
| OECD | Organisation for Economic Co-operation and Development |
| R&D | Research and Development |
| R&I | Research and Innovation |
| SDG | Sustainable Development Goals |
| SFDR | Sustainable Finance Disclosure Regulation |
| UN | United Nations |
| UNGP | United Nations Guiding Principles |

# 1. Introduction

Climate change and global warming are the substantial threats to our communities, economy, and ecosystems that we know and have today. The National Aeronautics and Space Administration (NASA) defines climate change as "*a long-term change in the average weather patterns that have come to define Earth's local, regional and global climates."* (Shaftel, 2022). Changes in boundary conditions, such as the Earth's distance from the sun, the Earth's rotation, which affects wind and temperature patterns, the Earth's surface, and the Earth's atmospheric qualities, such as mass and composition, may all contribute to climate change (Popp, 2022, p. 55). The most relevant human activities contributing to climate change are by influencing the atmospheric properties, such as the manufacturing industries, production of energy, transportation, building sector, agriculture and land-use, and many more that utilise fossil fuels to produce greenhouse gas emissions (United Nations, n.d.-a). There is no doubt that we live in an age of extreme weather events such as dryness and wildfires, increasing ocean levels and resulting floods, and other climate-related catastrophes. Climate change has already cost our society hundreds of billions of dollars per year due to the previously listed climate change disasters, and the repercussions are only going to get worse. (Hafner & Tagliapietra, 2020, p. vi)

Many scientists and governments have concluded that slowing the rate of global warming is essential for avoiding the worst consequences of climate change and preserving a viable world. The Paris Agreement, which went into force in November 2016 and included 193 countries, was the most fundamental agreement to take actions to minimise climate change (United Nations, n.d.-b). The primary objective of the Paris Agreement is to keep global warming well below 2 degrees Celsius and to enhance responses to climate change. (IPCC, 2018). To properly implement the Paris Agreements, policymakers will need to adopt even tougher steps, as our current activities will cause the temperature to rise by three degrees Celsius or more by the year 2100 (Hafner & Tagliapietra, 2020, p. viii).

Strong decarbonisation initiatives and rapid low-carbon technology advancements are propelling the globe into a historic energy transition. The energy transition refers to the transfer from one principal energy source to another, and we are now transitioning from

fossil fuels to renewable energy sources. Evidently, it is not possible to stop using fossil fuels overnight. The energy transition from fossil fuels to sustainable solutions would need a shared vision and plan by the governments and companies among the citizens and civil society. In contrast, the divestment movement needs to be a "just transition" while ensuring sustainable economic growth (McKinnon et al., 2016, p. 5). Engineers have made it clear that decarbonisation is feasible by 2050 by shifting from oil, coal, and gas power generation to low-carbon energy sources like solar, wind, hydropower, geothermal, biomass, and other resources (Hafner & Tagliapietra, 2020, p. vii). However, simply decarbonising is not energy justice, which on the other hand, could achieve a sustainable environment, but it may lead to unwanted injustice lock-in and compromise democracy (Healy & Barry, 2017, p. 39). The energy transition would also include a shift in geopolitics, which appears to be a determining factor in whether the energy transition and global decarbonisation are successful or not (Hafner & Tagliapietra, 2020, p. v). While Europe is primarily a fossil-fuel poor continent, the EU is strongly driving the decarbonisation. Meanwhile, the oil and coal-rich countries are trying to slow down the transition in various ways (Hafner & Tagliapietra, 2020, pp. v–viii). Even inside the European Union (EU), not all Member States have the same starting point, and the energy transition needs to be fair, or it will fail. Furthermore, there are different journeys and levels of costs to be made by each Member State; therefore, it is crucial to ensure the right policies to finance a fair energy transition (Weijnen et al., 2021, p. v).

Global decarbonisation and the shift to a green economy are very important if we are to keep global warming under control (Healy & Barry, 2017, p. 3). To achieve net-zero emissions by 2050, the EU has taken a clear stand in the sustainable finance movement and advocated for long-term investment choices that take environmental factors into account. Environmental targets have recently been more engaged and linked to climate and finance policies, such as those created by the Paris Agreement and the EU Green Deal, which require funds for energy transition and sustainable projects. As a result, the economic markets must undergo an improved transformation throughout time to establish and maintain a sustainable economy. A sustainable finance framework was developed to direct monetary policy toward green technology and away from polluting sources while raising environmental consciousness and creating a common understanding of the economically sustainable activity. (Regulation (EU) 2020/852, 2020, p. 14)

As part of the Green Deal and the sustainable finance framework, the EU Taxonomy is a vital tool to achieve the EU's ambitious goal to be the first continent to achieve climate neutrality by 2050. Furthermore, while chasing climate neutrality, the EU's interest is to maintain and secure sustainable economic growth. Therefore, it is essential to involve the financial sector authorities and participants to pursue a sustainable financial system (Braun, 2021, p. 468). EU aims to lead the innovation towards environmentally sustainable solutions, and this requires a vast amount of investment shift from fossil-fuel-based economic activities towards "green" and sustainable activities. Therefore, the EU Taxonomy was developed to avoid greenwashing[1] by identifying sustainable economic activities (Corcione, 2020).

It is critical to recognise that the whole goal of the EU Taxonomy is to be scientifically sound and in accordance with the Paris Agreement. The EU Taxonomy does not state what we can do as of today but rather what must be done to attain the climate targets. Simply put, the EU Taxonomy may be thought of as a catalogue of green activities for businesses and investors. The EU Taxonomy optimally steers investments toward sustainable operations while attaining transparency by providing the investor with accurate information. This would increase awareness of the consequences of their investments and stimulate financial flow into sustainable economic activity. (Climate Bonds Initiative, 2021b)

The EU Taxonomy brings legal obligations for the companies and financial participants to report their share of Taxonomy alignment; however, while the EU Taxonomy is still under development, there are still uncertainties for the industry on how it will affect them.

### 1.1. Motivation and Objective of the research

My personal motivation was to select a Master Thesis topic that is relevant to my expertise as an engineer and my work experience in an energy sector where taxonomic regulation is critical to comprehend. From a technological and legal aspect, the EU Taxonomy legislation is a very relevant problem of our day. In addition, I included the energy

[1] Greenwashing occurs when a corporation spends more time presenting itself as environmentally friendly than really implementing efforts to reduce its environmental effect. (Corcione, 2020)

transition in my thesis to provide a comprehensive understanding of why the EU is establishing regulations to increase our engagement and actions in climate change adaptation and mitigation. I hope that this thesis clarifies the EU Taxonomy for businesses that may be affected by it while also disclosing EU policies on how they will cope with the energy transition and what roles businesses will play.

This research aims to gain awareness of the EU Taxonomy regulation and its function in guiding capital to promote climate change mitigation and adaptation. Furthermore, the objective is to get a fundamental understanding of energy transition to renewables and their driving factors. Unfortunately, the EU Taxonomy does not convey a consistent set of viewpoints since individuals who do not fulfil the regulatory standards are resistant to change. However, by directing and increasing investments toward sustainable solutions, regulation helps to facilitate financing the energy transition, giving the EU greater geopolitical power and influence, increasing energy security, and decreasing reliance on imported energy sources.

### 1.2. Research Questions

There are three research questions that this thesis explores.

1. *"How does the EU Taxonomy influence the Energy Transition?"*
2. *"What challenges does the EU Taxonomy bring for the companies, and how do they affect the companies´ Investor Relations?"*
3. *"What impact would the EU Taxonomy's mobilised public finance impact companies' R&D?"*

### 1.3. Methodological approach

This thesis will be using qualitative research and exploratory method to investigate the EU Taxonomy and find in-depth knowledge of how EU Taxonomy and the energy transition might have possible effects on the companies. The qualitative research method is selected instead of the quantitative method due to limited data availability, and the EU Taxonomy is yet to be fully implemented or tested.

The primary data for the thesis will be literature reviews of academic research and official reports. The secondary data will be gathered through the various reports, articles, and websites that relevant stakeholders provide. Notably, the EU Taxonomy is a new and ongoing process, explaining the scarcity of data on the issue.

With the literature review, the thesis should reveal for the industries how the EU Taxonomy could affect them and their possibilities to improve their position and attract more investors or investments.

### 1.4. Structure and outline

The study is structured into four sections: introduction, review of the literature (in two parts), and conclusion. The introduction drives the research and outlines its goals and organisation. The literature study in chapters 2 and 3 analyses the chosen material and serves as a foundation for the discussion, while chapter 3 attempts to address the research questions. The conclusion attempts to convey the results obtained from the study's findings.

The second chapter focuses on creating the groundwork for the current global energy transition and growth. Following that, the drivers of the energy transition will be examined via climate legislation, the energy market, and technological innovation. Finally, we will look at how the energy transition affects geopolitics, as well as the challenges and financials of the energy transition.

The third chapter examines the EU Taxonomy. First, it explores the EU Taxonomy legislation and its delegated acts, as well as the function of taxonomy. The effect of the EU Taxonomy on energy transition via political and financial influence, as well as how the taxonomy may speed up the energy transition, are then assessed. Finally, this chapter will evaluate the taxonomy's impact on firms while investigating the impact on company investor relations and investigating if the taxonomy has an impact on company research and development.

# 2. Energy Transition

## 2.1. World Driven by Energy

Energy is essential for society, and our ability to study, explore, and utilise energy has advanced our modern civilisation and is the key factor in advancing the developing nations. We simply define *energy* as the capacity to perform work, and we may discover energy in many forms, for instance, kinetic, potential, thermal, electricity, and chemical. Indeed, the use of energy resources for industries, transportation, agriculture, and a variety of other reasons has become so critical in the contemporary world that we cannot exist without it.

To grasp the evolution of global energy systems, one has to consider the extraordinary spread of fossil energy over the previous 200 years. Almost all notable progress of the world economy and civilisation has been driven by fossil energy, thanks to cheap and plentiful fossil fuels that supply meaningful energy input for various activities (Höök et al., 2012, p. 24). In short, it is fossil fuel-based energy that has become the bedrock of any developed country.

### 2.1.1. Defining Energy Transition

The nature of energy has not changed, and humans continue to generate energy primarily via burning processes, but the techniques for obtaining and using it have developed throughout time. These substantial shifts in energy are referred to as "*energy transition*". Notably, the energy transition and transformation have turned into a catchword in scientific and political communications these days (Hölscher et al., 2018). Various writers, however, have used the terms in opposition to one another and synonymously. For example, the research from Child and Breyer (2017) defined the transformation as a *"change to physical forms and systems",* and the transitions represent the *"change on large socio-technical systems".* Furthermore, the International Renewable Energy Agency (IRENA) report (2019) also refers to energy transition as a shift of one energy source to another, while the transformation stands for the change in policy, economy, and society as a broader effect. Hence, both terms suggest the need for significant changes to

achieve a balanced society (Hölscher et al., 2018); it is recommended by Child and Breyer's (2017, p. 19) research that the term *energy transition* would be preferred when expressing the higher-order perspective such as the complexities of social motive, costs and benefits, as well as the facilitation; as a result, the energy transition is highlighted in this thesis.

### 2.1.2. Development of Energy Transition

The concept of "energy transition" was established in 1973 in response to the first oil shock, and it became widely used in the 1980s during the second oil shock (Basosi, 2020). Furthermore, around the time of the oil shocks, research on renewable energy transition became widespread (Mulvaney, 2020, p.8). Smil (2010, p.17) describes two historical global energy transitions, wood to coal and coal to hydrocarbons, and at present, we are experiencing a third major global energy transition from fossil fuels to renewable energy.

Wood was the primary energy source at the start of industrialisation in the nineteenth century, but this gradually switched to coal, which then accounts for 50 per cent of the total energy supply after five to six decades, while the second switch to overpass coal did not occur until the mid-1960s (Smil, 2014).

Despite the energy shift to hydrocarbons, coal consumption was still expanding until the Covid-19 pandemic and lowered consumption in the power sector; nevertheless, it is argued that it will rise again worldwide in the post-pandemic era (IEA, 2021a). According to the International Energy Agency's (IEA) (2021a) statistics, the growth of fossil fuel consumption is being driven by a few countries, including the United States, China, and India.

The BP (2021) report stated that in 2020, the worldwide share of energy consumption mix was dominated by fossil fuels, with oil accounting for slightly over 31 per cent, coal accounting for over 27 per cent, natural gas accounting for almost 25 per cent and the renewable energy, we had set a new record high, accounting for about 6% of global primary energy consumption (BP, 2021, p. 12).

### 2.1.3. Characteristics of Energy Transition

The characteristics of energy transition vary, and with the present energy shift to renewables, one must first recognise the transition's features. First of all, an energy transition is likely to occur at several scales, including regional, national, and global. Furthermore, the energy transition involves considerably more than a change in the condition of the energy system since the transition is related to society, such as industrialisation, human development, and digitisation, among other things. We are not able to stop using fossil fuel-based energy sources overnight as follows the energy transition is a lengthy process; according to Smil (2014), it takes decades or even centuries to convert from one energy source to another.

Energy transitions are typically tough since they include breaking free from past energy source reliance and altering old behaviours and mindsets. It also necessitates a significant investment and the spread of new technologies. Moreover, it involves the energy resource phase-in vs phase-out dilemma, as states and corporations have invested large sums in fossil-fuel-based energy production, which is expected to run for decades. (Zakeri, 2022)

As Smil (2014) points out, it is not economically reasonable to expect energy producers to shut down their power plants before they are retired, which slows down investments in renewable energy phase-in. Not to mention the social and economic consequences of phasing out fossil fuels in countries that rely significantly on them, while not having alternative options in the energy sources or other circumstances when countries have a large quantity of particular fossil fuel-based resources, such as coal or oil regions. As a result, states are at different stages of the energy transition and have different aims or motivations for doing so, such as seeking greater energy security or addressing poverty rather than pursuing the energy transition for environmental reasons.

## 2.2. The 3rd Major Transition towards Renewable Energy Transition

We have reached the point where continuing to use fossil fuels and emit pollution into the atmosphere will significantly change the planet's existing environment. The energy transition to renewable energy is crucial for maintaining the world we know now. Not only the consumption of developed countries will be challenged, but an uprising

challenge will arise when emerging countries achieve economic prosperity and living standards comparable to those of industrialised nations. As a result, it has been recognised that we have to change our habits in the developed countries to address global warming and urge societies toward decarbonisation, and the emerging nations should "leap-frog" to renewables in order to avoid the fossil fuel phase. The fact that this has already been accomplished in telecommunications, with the jump straight to mobile phones, gives hope that it can be done in the energy sector.

### 2.2.1. Defining Renewable Energy

The renewable energy transition, in brief, refers to the shift from fossil fuel-based energy generation and consumption to energy production and consumption that is based on naturally renewable resources. The switch to renewable energy sources has gotten much attention and has become a global trend. Government policy actions worldwide reflect the global movement toward green and sustainable energy systems that have gained traction during the last 25 years (Lowitzsch & Croonenbroeck, 2019, p. 29).

Even though we will face some challenges along the way and may not accomplish as quickly as we are hoping, it is not out of the question to remark that it is possible. Authors like Hafner and Tagliapietra (2020) point out that engineers have demonstrated that decarbonisation is possible by 2050 by switching from fossil fuel-based energy to renewable energy sources such as hydropower, wind, solar, geothermal, biomass, or additionally with carbon capture (Hafner & Tagliapietra, 2020, p. vii).

Fossil fuel replacements are mainly for environmental reasons and are the foundation for the energy transition itself. Not only must we shift to cleaner energy sources to meet our environmental goals, but we must also focus on the other elements for a successful energy transition, such as increasing energy efficiency and lowering overall energy demand. According to Ruzzenenti and Fath (2017, p. 61), three primary parallel roads lead to a low-carbon economy: improving energy conversion efficiency, reducing energy demand, and replacing fossil fuels with renewable energy. As principal means of providing renewable energy, electrification of technologies will be essential in helping us move away from relying on fossil fuels altogether. Furthermore, we can reduce energy consumption through regulations on industry to employ the best available technology,

and in addition, it can minimise environmental consequences. Dealing with technological advancements is vital for increasing energy efficiency; however, it is not enough to enhance technology to reduce demand; we must also modify our present energy consumption habits.

### 2.2.2. The Motivation behind the Renewable Energy Transition

The motivation and drivers of the energy transition are closely linked, and today's energy transition is mainly down to environmental reasons. Concerns about the long-term implications of global climate change and concerns about the quickly coming depletion of low-cost, high-quality fossil fuels are two compelling arguments for moving toward non-fossil futures around the turn of the twenty-first century (Smil, 2010, p. 118).

There is no doubt that switching to non-fossil fuel-based energy is environmentally desirable. Within the need to minimise greenhouse gas emissions, there are several environmental reasons to decrease our reliance on fossil fuels. The burning process of fossil fuels releases sulphur and nitrogen oxides, which cause acid rain and photochemical smog, carbon dioxides, which contributes to global warming, and harmful heavy metals to human health and the environment (Smil, 2014).

In addition to the environmental advantages of the other drivers of the energy transition, it improves energy security by expanding independent energy production as well as allowing the formation of new mainstream energy markets, which creates additional jobs. Energy transition also helps the delivery of more efficient, cheap, and flexible energy services. (Smil, 2010, p. 17)

### 2.2.3. Challenges of Renewable Energy Transition

#### The Growth Rates for Renewables

The energy transition is a lengthy process, and the transition to renewable energy will likely be no different and seem to be overestimated how soon this could occur. Of course, some countries will achieve their net-zero carbon objectives faster than others, but Smil (2014) argues that a rapid global energy transition is a naive assumption.

When researching historical energy technology development rates, it was discovered that, although energy sources increased at high relative rates in the early stages, no energy source maintained a few per cent growth rate across successive decades-long transitions (Höök et al., 2012, p. 38). For example, the average annual growth rate of renewable energy production over the previous three decades has been merely 2.1 per cent (EIA, 2021), which is why Smil (2014) claims that forecasting often overestimates the expected growth rate. However, creative technology and radical policy may still be employed to speed the transition; moreover, the transition can be advanced by reducing overall energy use via energy efficiency improvements (Smil, 2014).

There are, of course, some optimistic perspectives that the energy transition may be completed in a shorter time, as Sovacool (2016) believes that in some instances, it has been shown that the technologies can be pushed in a shorter period, and it is dependent on political will. Kern and Rogge (2016) argue that the global energy transition can occur much faster than in previous energy shifts and that emphasising political commitment at all levels of governance could lead to stronger low-carbon economies and technological solutions, but that it requires increased attention to policymaking and learning and updating the policies frequently.

The renewable energy transition is a complex and multidimensional system that incorporates economic, technical, political, and social challenges, and it is by no means a simple process. Some regions and countries may be able to achieve climate neutrality with stronger political will and technological and financial capabilities; nevertheless, on a global scale, this will most likely take longer than the environmental objectives need. (Kern & Rogge, 2016)

**The Growing Energy Demand**

In addition to the slow growth rate of renewable energy sources, the scale of how much we use energy becomes a challenge. The magnitude of global energy use is enormous, with fossil fuel-based energy accounting for more than 80% of overall consumption. According to BP's world energy statistical review, the worldwide usage of fossil fuel energy was over 490 exajoules ($1 \times 10^{18}$ joules) in 2019, and it was around 460 exajoules in 2020, thanks to Covid-19. It's difficult enough to generate this much energy with any new resources (BP, 2021, p. 11).

Furthermore, according to Petit (2017, p. 30), population growth will continue to rise, resulting in new economies, increased urbanisation, growing living standards, and a dramatic increase generally in energy consumption, particularly in electricity consumption. According to the recently published world energy outlook issued by the International Energy Agency states that based on current policy settings, the total energy supply will expand by 1.3 per cent each year from 2020 to 2030 (IEA, 2021b, p. 180). Current and stated strategies are expected to increase power demand by over 30% by 2030. By 2050, the electricity demand is expected to be about 80% more than today (IEA, 2021b, p. 195).

**Technicality Challenges**

Another element affecting the transition to renewable energy is the renewable sector's technological limitations. Again, there are several factors, such as the fact that energy usage would be no easier than with conventional energy sources, and one of the significant challenges would be how to store the energy; moreover, renewables would not significantly improve the energy density or sheer availability that fossil fuels already provide (Meyer, 2020, p. 117). Meyer (2020), on the other hand, points out that when we end the fossil fuel age, we may be thankful that renewables will be there to rely on. The severity of the decline of fossil fuel phase-out is determined by how fast we begin the transition to renewable energy and how strongly we commit to it.

Brauner's (2020) study concurs that the shift to net-zero would be difficult; even if we incorporate more renewables because of technical constraints, it will be challenging.
One of the challenges he mentions is that the power grid is limited. Currently, the grids are integrated with renewable energy input without the need for significant network development; however, the grids have capacity constraints due to the unpredictability of renewable electricity generation and must manage without overloading the grid as this could cause the network to crash (Brauner, 2020, p. 101; 102). The problem is developing an efficient grid that can manage the incoming loads and transport them long distances without significant losses or efficiently store the energy; yet, despite the existing technological obstacles, he believes that when energy efficiency is included, it is possible to decarbonise our economy (Brauner, 2020, p. 38).

**Social Challenges**

Another problem that must be addressed is that the energy transition is unbalanced since fossil resources are not distributed evenly, resulting in some nations gaining greater political, economic, and military power than others (Hafner & Tagliapietra, 2020, p. viii). The energy shift to renewable energy sources has these characteristics. Individuals who rely heavily on fossil fuels will need extensive support to achieve the transition within the period specified. Change must occur globally, and a fair transition must be ensured; this issue will be discussed in the next chapter. Furthermore, rare earth minerals are even more sparsely distributed throughout the globe than fossil fuel resources, posing geopolitical hurdles to the shift to renewable energy.

Nonetheless, nuclear energy is mentioned in the argument over whether a net-zero economy is achievable. It would be difficult and time-consuming to replace fossil fuels and atomic energy. There is presently and will be more debate on whether nuclear power and natural gas should be included in renewables (Mulvaney, 2020, p. 13). In the end, it is a political decision that must be made, and the EU Taxonomy has taken a position on it, which will be discussed more in the next chapter.

## 2.3. Drivers of Energy Transition

The energy revolution is certainly being pushed by environmental concerns, as seen by recent floods in Europe, record heatwaves, and forest fires worldwide. However, there is an urgent need to adapt to climate change faster than anticipated (Pramod, 2021). The Intergovernmental Panel on Climate Change (IPCC) report states a widespread scientific consensus on climate change and the need for rapid action to limit global warming to 1.5 degrees Celsius, which needs at least a 50% decrease in global emissions (IPCC, 2018).

There are numerous significant drivers that can influence the energy transition to clean energy, such as various climate policies with environmental goals. In addition, there are several reasons why Europeans, in particular, prioritise lowering greenhouse gas emissions. While concentrating on the environment and climate change, there is a need to boost energy security and reduce reliance on imported energy since Europe is primarily deficient in fossil fuel resources. Furthermore, since regulations can affect the market due

to the anticipated demand rise, it is vital to provide funding for clean energy transition and direct the industry toward sustainable solutions and technical advancements while considering the city's contribution to the energy transition.

### 2.3.1. Climate Policies

Climate policy focuses on the urgency of dealing with climate change that drives the energy transition. Climate policies generally include environmental aims, frameworks, and recommendations for achieving such targets.

The EU's most recent environmental legislation framework is based on the Paris Agreement's globally acknowledged environmental aim. The EU Green Deal, Climate Law, and Clean Energy Package, among other initiatives, are setting roadmaps and defining progress benchmarks for nations to convert into concrete action to meet the Paris Agreement's core aim. The environmental legislation is designed to influence economic activity or market behaviour to decarbonise all economic sectors, which would not necessarily occur if we only relied on the free market or at least in the phase we need to achieve. Formulating environmental policy can be an essential driver of the energy transition toward sustainable energy sources.

Several aspects and particular attributes must be considered for environmental policies to drive the energy transition effectively. The United Nations' (UN) 2021 theme report on the energy transition emphasises the need for policymakers to consider numerous aspects of the energy transition, including social, technological, and economic ones (United Nations, 2021). According to Daszkiewicz (2020), renewable objectives have four main characteristics. Whether the aim is legally enforceable or voluntary-based, "strength and obligation status" refers to the first characteristic. Second, "structure and scope" refers to how it affects the country's economy or the whole energy supply. Third, "time scales": short-, mid-, and long-term goals are often defined in periods spans that might vary from 5 to 20 years or more. Lastly, "Context" refers to the overall energy mix, such as a country's emission reduction goals or available energy sources. (Daszkiewicz, 2020, p. 207)

### 2.3.2. Resource Availability

The availability of natural resources are geographically determined and, in return, impact geopolitics. However, the scarcity of fossil resources and dependency on other countries has prompted civilisations to seek new solutions to become more self-sufficient. Then again, some individuals have gained considerable power, and their lobbying is not entirely aligned with their desire to participate in the clean energy transition fully.

In the case of Europe, the continent is mostly experiencing a scarcity of fossil resources, particularly of the extraction and usage during the last two decades; however, there are a few exceptions, such as the few remaining pockets of indigenous coal production in Eastern Europe and Germany and Norway's oil resources, which can be seen as another significant factor driving Europe's energy transition to sustainable energy. Consequently, Europe is a net energy importer, putting it at the mercy of fossil fuel sources. Regardless, transitioning to renewable energy sources would result in more localised and decentralised energy production, lessening economic dependency and, perhaps, geopolitical issues. Furthermore, the energy transition makes sense economically because energy sectors decarbonisation results in increased energy security and independence from fossil fuel suppliers. (Hafner & Tagliapietra, 2020, p. viii)

In general, those with a large amount of fossil fuel resources are more likely to resist change because every policy change results in income redistribution, or they have investments sitting on reserves that cannot be mobilised, and some countries are concerned about the social impact of decarbonisation. As a result, it appears that there are still individuals who benefit from the existing energy system and are striving to slow or even halt the transition to renewable energy sources (Gawel et al., 2017, p. 91).

### 2.3.3. Public Opinion and Political Support

Today's effect on political decision-making on climate change helps with political support to advance the climate agenda and execution of legislation. Public opinion can play a significant part in any change, and one excellent illustration of how public opinion can influence policymaking is Germany's phase-out of nuclear power. The phase-out decision was primarily motivated by a negative judgement of nuclear power following the

Chernobyl accident in 1986 and further fuelled following the Fukushima accident in 2011, which gained the political consensus of phasing out nuclear energy (Weise, 2022).

The current energy transition towards renewable energy sources has backup from the public. Even in places where they have benefited politically and economically and are dependent on fossil fuels, the majority of the population supports the energy transition (Thomas et al., 2022). The support also can be seen in European elections; citizens' concerns and public opinion can impact policy orientation. As a consequence of the importance of debating and dealing with the climate change problem, the 2050 aim has evolved. For this transition to be socially acceptable, it must be able to help those who would be seriously impacted by it, such as low-income households and those who work in carbon-intensive industries, and it must also be able to use the energy transition to create jobs and add value in the EU as a whole. (Eyl-Mazzega & Mathieu, 2020, p. 33; 34)

Research from Thomas et al. (2022) points out the importance of considering the social influences as people are more likely to favour low-carbon energy sources if they feel the greener businesses would generate new employment and help rebuild the economy. However, the "green employment" argument has its limitations in persuading individuals who still believe that fossil fuels will continue to be a significant source of economic activity and wealth; it may not be possible to communicate the economic advantages of clean energy to them (Thomas et al., 2022).

### 2.3.4. Global Demand and Energy Market

**Increasing Demand**

There is no doubt that demand for energy will rise in the future, in part because we are making energy more accessible to people who have not previously had it, and in part because of the expanding global population. An expanding worldwide need for energy will necessitate a solution that takes account to limit global warming. To encounter the United Nations 7th of the Sustainable Development Goals (SDGs), the UN estimates that 750 million people worldwide do not have access to electricity (United Nations, 2021, p. iv). SDG 7, which calls for universal access to cheap power for everyone, would drive up energy consumption even further, not to mention the projected rise in population and

economic activity from the present 7.7 billion to a projected 9.7 billion people by 2050, according to UN projections (United Nations, 2021, p. 27). The excess electricity needs to be provided by renewable energy sources; otherwise, we will break through all our environmental and climate change limitation goals. This will be one of the reasons that will drive the energy transition toward sustainable energy sources.

**Increasing Prices**

The energy market may be impacted by several policies; one of the energy market's drivers is the energy price, which is one of the critical drivers of the energy shift. Because the EU is a net importer of fossil fuels, the recent skyrocketing rise in energy costs has prompted the EU to become more self-sufficient in terms of energy production and energy security. The challenge of rising prices will drive mitigation and other solutions and a faster transition to renewable energy to replace volatile fossil fuels. Today, the EU is making efforts to reduce its reliance on Russian fossil fuels, which the European Commission refers to as REPowerEU. The European Green Deal's goals are being boosted by the fact that we need to be more certain of our supply, while REPowerEU's goal of eliminating linkages with Russian imported energy, should strengthen the shift to sustainable energy. (European Commission, 2022a)

**Emission Trading Scheme**

To promote the energy transition, various policies are being implemented to distort the free trade energy market. The introduction of Emission Trading Systems (ETS), which is growing around the globe, including over 60 nations that have adopted or intend to implement carbon pricing schemes, is among the measures used to influence the energy market (IEA, 2020, p.7). In Europe, the ETS started in 2005, including a certain quantity of CO2 emission allowances per Member State and distributed to industry based on historical emissions. The ETS system establishes a price for CO2 emissions per tonne based on the standard trading scheme, availability, and demand, and these permits may be sold among others inside the country or within the EU. Throughout the ETS's development, it has established emission limits for nations and restricted the number of available permits via the "Market Stability Reserve (MSR) mechanism" to minimise excess allowances and influence the price to be raised. The ETS is currently being revised for phase 4, which spans 2021-2030, in order to update the limit values to align with

environmental goals while also broadening the spectrum of what is included in the ETS system, for example, the maritime transport, road transport, and thus strengthening the EU for the following decade. The aim is to develop industrial technology and reduce emissions or completely shift and invest in renewable energy generation, influencing the clean energy transition. (European Commission, n.d.-a); (European Commission, n.d.-b).

### Carbon Border Adjustment Mechanism

Worldwide there are different climate action ambitions, which raises some concerns about industries moving to countries where climate policies are lessened. Therefore, one of the mechanisms to balance out and influence the energy transition phase is to have various tax mechanisms in place. While the European Commission recognised that not all countries are as ambitious in their climate action as Europe, the European Union announced the intention of having a carbon tax system in the Green Deal. Today, the EU has already agreed on a "Carbon Border Adjustment Mechanism" (CBAM), which is essentially a carbon tax on imported goods from non-EU countries. The CBAM is intended to prevent carbon leakage, which occurs when extremely polluting firms relocate or invest considerably outside the EU, only to bring goods back into the EU later. The CBAM's mission is to promote the global climate goal and stimulate the transition to renewable energy outside the European Union. In the future, CBAM will begin operations in 2023 by mandating reporting from chosen commodities and will be completely operational in 2026. (European Commission, 2021a)

### Include Citizens

Despite the EU's large scale fund programmes, there is still a large gap between the current investments and the required investments by 2050. It is coming to the point when the private sector and individual citizens must be involved to invest in sustainable renewable energy generation and energy efficiency. The IRENA's outlook report (2022) emphasises the importance of community energy to accelerate the transition to renewable energy by including individual citizens in the economics and operations of renewable energy projects, as well as increasing public support for the energy transition. The report also highlights that there have already been some Member States in the EU that have established policies that value people's direct engagement in renewable energy projects (IRENA, 2022, p. 111).

According to Mengolini and Masera (2021), consumer involvement and cross-border participation play a vital role in the energy transition, which is empathised in the Clean Energy for All European Package (CEP). The CEP has a wide variety of regulations; nevertheless, to highlight one specific measure, "active customers" are permitted to generate and sell their energy in line with the legal framework provided by the government (Mengolini & Masera, 2021, p. 145). However, according to Eyl-Mazzega and Mathieu (2020, p. 29), people will be unwilling to make the energy shift if it places a heavy financial burden on them.

Therefore, the financial burdens of member states and their citizens must be distributed fairly. However, the energy market must evolve to be more decentralised, not only centralised, as it is currently. Consequently, of these financial encouragements, individuals are likely more willing to participate in an energy transition when people can reduce their electricity bills or earn money from selling surplus energy back into the grid. As IRENA's (2022) outlook report points out, indirect and direct electrification potential to increase flexibility and reduce greenhouse gas emissions is desirable, but it also evolves new obstacles. The new electric loads from end-users will pose challenges to the power grid if suitable precautions are not implemented. That said, authorities may persuade the energy industry to develop new solutions to handle grid loads through early-stage projects, and this is crucial in the transition to renewable energy. (IRENA, 2022, p. 191)

### 2.3.5. Technical Innovation

Electricity and energy efficiency are two fundamental drivers of a clean energy transition fuelled by renewables, policies, finances, and technical low-carbon innovation that all play an essential role. Policies and finances are critical for the energy transition because they facilitate technological innovation in the low-carbon development and can accelerate the process. According to both IRENA and the IEA's outlook assessments on energy transition, electrification of our energy mix and more efficient energy consumption and production will be critical to meeting the 2050 environmental goals. Thus, electrification will significantly reduce CO2 emissions while replacing fossil fuel energy with renewable energy sources. Furthermore, the reports suggested that our systems' electrification can accelerate the decarbonisation of the electrical mix and even future phaseout of fossil fuels (IRENA, 2022, p. 16; IEA, 2021b, p. 17). Technology innovation is critical for

lowering costs, increasing the reliability of renewable solutions, diversifying the energy mix, boosting energy security and being less vulnerable to energy markets price shocks which we are currently experiencing (IRENA,2022, p. 4; 184). As such, the innovation is crucial to any change and significantly boosts the innovation in renewables; there is a need to have participants from all stakeholders, including technology suppliers, policymakers, energy administrators, and customers (IRENA, 2022, p. 191). The energy transition is affected and pushed by technology breakthroughs, which play an essential role in steadily lowering the cost of renewable energy generation, attracting more investments toward these solutions rather than fossil fuel-based ones. However, as previously indicated, regulations, finance, and investments from the beginning have a critical role in how quickly the energy industry or other significantly polluting sectors can accomplish a sustainable transition.

### 2.4. Energy Transition and Geopolitics

Throughout history, the term "geopolitics" has been used to describe the influence of geography on the power of states and international affairs in general, with less emphasis on determinism and more on the strategic importance of natural resources and their location, transportation routes (Overland, 2019). Since the characteristics of renewable energy sources vary significantly from those of conventional fuels, it consequently drives the changes in energy geopolitics.

IRENA identifies a few actors contributing to geopolitics' energy transitions. One of the driving forces behind the shift is that fossil fuels are geographically limited; on the other hand, renewable energy sources may be found in almost any country. In fact, unlike fossil fuels, which can be described as stocks, renewable energy sources can be thought of as unending flows that can never be exhausted. Moreover, according to the IRENA (2019), the democratisation of renewable energy would be increased by the scalability of renewables. It is worth noting that renewable energy sources have almost no operating costs, and in the future, we will experience reductions in costs when the capacity increases and technology improves. The energy transition and developments in population, inequality, urbanisation, technology, sustainable development, military force, and internal politics in critical nations will be essential components reshaping geopolitics in the twenty-first century. (IRENA, 2019, p. 23; 24)

### 2.4.1. A shift in the Geopolitical Environment

Every energy transition involves a change in geopolitics and reshapes the geopolitical map. In the past two centuries, the international geopolitical landscape has been around fossil fuels, oil, coal, and natural gas and configurated the international geopolitical landscape.

**Fossil fuels and the internationalisation of the energy sector**

For centuries, fossil fuels have dominated global trade, politics, and economics; in fact, oil-rich countries have enjoyed the benefits and gained substantial worldwide influence as a consequence of oil being the first fuel to be exported in substantial volumes globally (Van de Graaf & Sovacool, 2020, p. 49). The energy transition to oil has not been equal because it relies on local fossil fuel supplies and is geographically dependent. Currently, every country in the world uses oil for different purposes, primarily for transportation or industrial usage, and the majority of the world's population (more than 80 per cent) lives in countries that are net importers of fossil fuels, according to IRENA's annual report (2019). Incidentally, that is why fossil fuels have and continue to play an essential role in the global energy system. As a response, people with access to vast quantities of fossil fuels have gained considerable political influence, and their economies have grown. (IRENA, 2019a, p. 35)

**Vulnerability of fossil fuel market**

The futures fossil fuel market, particularly the oil market, will be shaped by the energy transition, as energy consumption will rise due to electrification rather than fossil fuels. Oil-rich nations, evidently, oppose a large-scale renewable energy transition for fear of massive economic losses. Van de Graaf (2018, p. 97) highlights efforts by fossil fuel industries to promote their sources as aligned with clean technologies, such as the coal industry's efforts to market "clean coal" or promote Carbon Capture and Storage (CCS) methods so that the industry can continue as before, and another example is natural gas industries' efforts to be seen as a transitional energy source for a sustainable transition. Nevertheless, fossil fuels will continue to play a role in the energy market for some time, and those who have enjoyed geopolitical dominance owing to their access to fossil fuels will confront considerable changes in the future. As Van de Graaf (2018, p. 113) pointed out, the oil-rich nations will have to re-evaluate their objectives and future plans to replace

lost income as fossil fuel consumption and revenues drop due to the energy transition, which is likely to pressure the pricing of these resources.

**Global power shifts**

There is no reason to doubt that the emerging energy transition to renewable energy sources will result in a significant change in global power than previous energy transitions. Renewable energy sources are more widely spread than fossil fuel resources, concentrated in specific physical locations; hence, renewable energies have an advantage for the energy transition since they can be implemented merely with infrastructure expenditures. Hafner and Wochner (2020) showed that while there is a global effort to reduce greenhouse gas emissions, it is likely that those countries with strong climate policies and investments in the energy transition, such as Europe, will obtain the most benefits from becoming less dependent on imported fuels, unstable energy prices, and securing economic growth, whereas those countries relying on fossil fuels will need to transition to renewable energy sources quickly. Because of this, those who currently rely on fossil fuels to generate their power will continue to pay a high price for the energy transition. However, even though their investments may not pay off immediately, they will eventually gain more control over their energy supply because of the strong global governance. (Hafner and Wochner, 2020, 159-161)

Countries with the financial and technical capacity to spend extensively on energy transitions, such as the OECD countries and China, profit more economically and geopolitically through the energy transition. Similarly, nations wealthy in fossil resources must bear the risk of social disturbance and a reduction in revenue from fossil fuel exports (Hafner & Tagliapietra, 2020, p. 17). In the end, by being more self-reliant in energy supply and its sources and the energy market itself, states with more power and influence will be rewriting the geopolitics of the 21st-century. However, at the same time, those without such advantages will be more vulnerable. (IRENA, 2019a, p. 26; 27)

### 2.4.2. Developing a New Energy Leaders

The role of global leaders and successful energy diplomacy may drive the renewable energy transition, elevating nations' economic and political status. In addition, the transition may establish new trading alliances, and traditional energy trades may lose their role in this shift. Energy diplomacy began with oil and gas, which have always been

politically sensitive and the focus of government action; however, as nations transition to renewable energy, they must reconsider their energy diplomacy and international energy policy (Goldthau & Witte, 2010, p. 25). As a result of the global transition, IRENA (2019) predicts that the nations with strong technical skills and higher economic standing at the start of the transition can develop greater economic power by exporting renewable energy technologies and sustainably produced electricity or renewable fuels. Moreover, expanding the global energy mix toward renewable energy would also change power relations between nations, shifting the balance of power from fossil fuel-rich countries to those most developed in the clean energy sector (IRENA, 2019a, p. 39; 45). Energy transition allows the establishment of various new alliances and trade flows developing around the power grids and new renewable products (IRENA, 2019a, p. 45). Strong global environmental policies may be used to impact the demand for fossil fuels, which can undermine the countries' alliances built around these resources, speeding the energy transition and strengthening states economically and geopolitically. There will be a redrawing of the trade routes for oil and energy as a consequence of the energy shift, which may change the direction of the clean transition.

**Economic gains from renewable energies**

The EU has long prioritised having leadership in renewable energy diplomacy, while numerous EU countries and businesses have already begun to act at the forefront of the development of sustainability (Van de Graaf & Sovacool, 2020, p. 179). Technical innovation and exporting renewable energy technologies, or mineral-rich nations may potentially become part of the economic value chain or profiting from excessive renewable energy output to export power to neighbouring countries are examples of possible trade advantages.

The fast-growing market in the renewable energy sector is exciting. There are opportunities to gain economic growth by creating jobs, innovation, expertise, and clean energy technology exports. The United States, China, and Europe demonstrating the significance of the export market and global competition for the most outstanding technological solution at the lowest possible cost, would accelerate climate mitigation and economic development (Freeman, 2018, p. 196). It is vital to note that not only the global market but also the domestic market influences the energy transition, such as private investors can stimulate economic growth. Private investors are being encouraged

to sustain renewables by the cheap cost of such technologies, thanks partly to China's efforts and the regulation and incentive efforts in the renewable energy sector in Europe (Reusswig et al., 2018, p. 244). While China is now the leading player due to its dominance in manufacturing clean energy technology and as a leading investor in the world's clean energy market, both of which make it an essential player in the renewables sector (Freeman, 2018, p. 187; 188).

The mineral-rich countries, such as the global south, are commonly without the technical advantage of the energy transition, however, they can influence geopolitics and trade flows as well as create new political connections (Hafner & Tagliapietra, 2020, p. 17). These countries play a crucial role in delivering the minerals needed for the move to renewable technology. Economic growth and participation in the energy transition global production and value chain are facilitated by this strategy (IRENA, 2019a, p. 40). The world bank group statistics claim that, in order to meet the Paris Agreement's 2 Celsius degree target, mineral mining will need to increase by almost 500 per cent by 2050, with over 3 billion tonnes of metals and minerals required for manufacturing renewable technology such as solar, wind, energy storage, and electric vehicles (World Bank, 2020, p.12). Depending on the technology, several sorts of mineral resources are needed. Battery capacity, lifespan, and energy density are all dependent on lithium, graphite, cobalt, nickel, and manganese. Permanent magnets, a critical component of wind turbines and electric vehicles, need rare earth elements to function properly. Copper is a critical component of all energy-related technology and needs such large amounts of copper but also aluminium. Many of these resources are, for example, mined in Peru, Chile, Indonesia, the Democratic Republic of the Congo, China, and a few other countries, which, not surprisingly, China is responsible for the majority of mineral processing (IEA, 2021c, p. 5; 13). There will be a considerable increase in demand for minerals as a consequence of the switch to renewable energy. According to IRENA (2019, p. 40), mineral-rich nations like the Democratic Republic of the Congo, Bolivia, and Mongolia have the potential to play a critical role in global energy production and the transition value chain required for clean energy technology.

A further potential gain from the energy transition through the geopolitical sphere is by expanding the electricity exports produced from renewable energy sources. Some countries have more natural resources to provide renewable energy for producing most

of their electricity and beyond their demand. For example, Norway already exports its electricity to other neighbouring countries and is expanding its lines to the UK and Germany (IRENA, 2019a, p. 40). That said, the EU is encouraging Member States to cooperate more with the cross-border electricity exchange and build an electricity grid to have more flexibility on the electricity demand transfer, increasing the energy security (IRENA, 2018, p. 59). The share of renewable electricity production is currently over 37% in the EU (EMBER, 2022) and is increasing in the future due to the EU's climate and energy targets. The increasing supply of renewable generation requires a sufficient and flexible power system in the flexible cross-border market (IRENA, 2018, p. 23). The proposal to interconnect Europe will result in the sharing and export of Europe's renewable energy resources, enabling nations to improve their revenues by exporting sustainably generated power. In order to minimise the likelihood of supply interruptions in a single nation, grid coverage is another vital factor to consider.

### 2.4.3. Geopolitical Challenges of Balancing Energy Transition

The clean energy transition, like the hydrocarbon energy transition, is likely to be imbalanced. In order to secure a successful sustainable energy transition, uncertainties need to be addressed, such as the distribution of energy and the relative abundance of resources. In addition, the social component and ensuring a fair transition are other issues that must be attended to.

**Technological challenges**

Renewable energy carriers are almost always electric, which has certain restrictions and creates some uncertainties over how to manage them in the future. Managing electrical supply and demand fluxes, as well as long-distance losses, are the current technological limitations. As a result of these constraints, energy production is becoming more decentralised, empowering local players and introducing innovative business models to the market (Scholten, 2018, p. 20).

Microgrids for decentralisation are a solution to the technical difficulties of electrical distribution, according to Brauner, who notes that the smart grid, with its ability to coordinate electricity generation closer to consumers and control local storage, can help

issues such as grid expansion and long-distance losses, as well as dealing with high loads on distribution networks when transferring excess energy on the grid (Brauner, 2020, p. 97; 134). Furthermore, long-distance losses make electricity transmission costly and uneconomical, leading to these so-called super-grids that are linking nationwide being only continental in size rather than global in scale, as it is presently with oil and natural gas resources (Scholten, 2018, p. 23).

While developing smart grids and microgrids is a viable option for addressing technical issues related to energy network management, it will require extensive changes to the current systems, as well as regulation changes and additional investments in the grid improvement and digitalisation of the network. Digitalisation, in turn, may raise questions about cybersecurity, which is a separate but linked problem. However, Scholten believes that decentralised energy production may cut power consumption and further empower local people by increasing access to energy, jobs and profits, particularly in places where there is a general absence of these resources (Scholten, 2018, p. 21).

**Mineral Resources for Renewable Technologies**

A second consequence of the energy transitions is the relative abundance of the resources required for clean energy technology. The belief that the energy transition would release the energy market from oligopolistic dominance of energy sources (Scholten, 2018, p. 3) is not entirely true, as often, the necessary mineral resources that are required for the renewable technologies are more unequally distributed than oil or natural gas, implying that rivalry and the geopolitical struggle for these critical minerals are predicted (Hafner & Tagliapietra, 2020, p. vi).

The current reality is that the mining of critical minerals is frequently carried out by oligopolies, which has an impact on the future as the fights between states for the 21st century may indeed be conducted over mineral supplies to the new energy economy, as has been the case in the past for the oil resources (Hafner & Tagliapietra, 2020, p. vi). For example, today, two countries make up 70% of the world's cobalt supplies and 60% of the world's rare earth elements: the Democratic Republic of Congo and China. In addition, China has acquired considerable assets beyond its borders via investments. Accordingly, there is an obvious danger that one party has overwhelming power over the market and

the supply chain, gaining political clout by potentially limiting trade flows, which was recently noticed and discussed concerning the United States and China's trade war in 2019 (Schmid, 2019).

Other than the geological and possible trading issues, since it takes a tonne of material to extract a few grammes of the rare earth elements, there are substantial environmental difficulties, such as land-use changes that impact ecosystems and biodiversity and landscaping problems. In addition, these mining activities require a lot of water and electricity, and often chemical products are used for the processing, which raises concerns about wastewater disposal and other hazardous waste. (IEA, 2021c, p. 209)

These key minerals for today's multiple technologies have grown more significant in Europe and other countries, necessitating the development of new methods of requiring these resources. The EU has recognised the issue and is implementing circular economy measures to address it. According to the IEA, recycling and reusing, technologies are critical to improving mineral competitiveness since they may be a substantial secondary supply source. Furthermore, recycling and reusing resources may help to improve supply security by reducing reliance on a single exporter and has environmental benefits by avoiding the extraction of new minerals for commercial needs. (IEA, 2021c, p. 176-177)

There is a clear risk that one party gains political dominance by having a monopoly on specific elements and may potentially influence the commercial flows. Aware of the challenge, the EU introduces policies that facilitate its dependence on crucial materials. One of the measures is upraised by the IEA, such as the recycling and reuse technology, as they may provide a significant secondary supply.

## 2.5. Just Energy Transition

### 2.5.1. Background of Just Transition

It would be impossible to quit using fossil fuels and switch to renewable energy sources overnight. Identifying the shift away from fossil fuels via divestment and phase-out initiatives from fossil fuels, as well as cutting subsidies from fossil fuels, will have an impact on the communities. Diversifying the world's energy supply and expanding the renewable energy industry may lead to a carbon lock-in in certain regions or nations. While it is important for policymakers to concentrate on decarbonising and boosting energy security, they must also design policies that address climate and energy inequities on a broader scale. (Healy & Barry, 2017, p. 36)

**Defining Just Transition**

The energy transition from fossil fuels to renewable energy sources includes complex social-economic impacts, which with the just transition, is trying to encounter and avoid socio-economic injustices and inequalities (Wang & Lo, 2021, p. 1). Increasingly having input to encounter the just transition is an enormous task and requires huge political efforts, and Healy and Barry (2017, p. 7) call the just transition more a political problem and explain it as one that involves concerns of power, allocation and availability of resources, political economics, etc. On the other hand, IEA is starting the just transition and energy injustice by dealing with the issue by bringing the energy services to those that do not currently have access to electricity (Newell & Mulvaney, 2013). In order to achieve targets to limit climate change, it is important to state that the global energy transition has to be just and take into account all nations so that they can participate in the battle against climate change.

**Outlining the Reasons**

Putting the issue in a European perspective, it is important to be aware that countries and their regions face a different kind of energy transition due to diverse starting points in the socioeconomic status, development priorities and energy resources (IRENA, 2022, p. 109). For example, certain nations in Europe still rely heavily on fossil fuels, namely

eastern Europe and alternatively, some may have a lot of fossil fuels that cannot be utilised. Because of the burdensome fossil fuel energy supply and phasing-out of this infrastructure, the decarbonising will affect these industries and supplies. It is necessary to ensure a just transition for those that affect them socially, such as the workers and communities from the early retirement plans of fossil fuel-based power plants. Therefore, without proper policies and guidelines for nations to confront injustice, the energy transition can indeed create new injustices and vulnerabilities in the energy market and socio-economy (Sovacool et al., 2019, p. 1).

### 2.5.2. Challenges of Just Transition

Reframing the issue of the fair transition revolves around the possible damaging effect on labour in the energy industry and communities impacted by the energy transition to low-carbon solutions. Redirecting labour from fossil fuel industries is not a straightforward process while finding new employment in the renewables industry is likely attributable to a lack of skills or the difficulties in identifying qualified people. Furthermore, some areas and public services might be impacted more than others because of the significance of the fossil fuel industry to local tax collection. (Wang and Lo, 2021, p.1)

When social issues and costs are not included in decarbonisation initiatives, there is a danger of carbon locking. Carbon locking is easily achieved when policymakers do not justify divestments if they result in lower socioeconomic benefits. While another factor influencing carbon locking is making investment decisions on fossil fuel power plants, which influence the transition negatively due to the long operation time and making it difficult to divest from the harming operation as long as it can be socio-technologically justified to be operational. (Healy & Barry, 2017, p. 6; 17; 18)

Additional potential issues include policy formulation and assisting areas where it is not beneficial to the battle against climate change. For example, the International Institute for Sustainable Development (IISD) believes that fossil fuel subsidies are a barrier to green economic development and fair transition since they are often socially regressive (Gass & Echeverría, 2017, p. 2). This appears to be true not only for the goal of impeding the advancement of renewable energy technologies but also to restrict job development. Making renewable energy more competitive and directing the savings toward a just

transition would assist countries in achieving their environmental goals by phasing out subsidies for fossil fuel-based energy and dealing with socioeconomic issues that may arise as a result of divesting from fossil fuels (Gass & Echeverría, 2017, p. 33).

### 2.5.3. Measures for Just Transition

It is vitally desired to accomplish an inclusive and just energy transition; nevertheless, the conversation about the just transition is very much in the early stages, with many stakeholders, nations, and regions holding alternative opinions on the fair aims and strategies to achieve the just transition (IRENA, 2019b, p. 18). Despite this, it is widely agreed that proper policies must be established to support people in need and to fund the equitable transition so that individuals who are now working in the fossil fuels business may be employed and retrained for important positions in the renewable sector. The EU, for example, has developed a policy framework known as "The Just Transition Mechanism," which consists of three pillars: a new "Just Transition Fund," a "InvestEU Just Transition Scheme," and a new "Public Sector Loan Facility" backed by the European Investment Bank. The end goal is to have advisory support and to fund and mobilise close to €30 billion in investments toward a just energy transition (European Commission, 2020a). The EU is driven to include everyone in the energy transition and not leave anybody behind, as they are taking steps to break down the climate barrier that separates eastern and western Europe (Eyl-Mazzega & Mathieu, 2020, p. 35).

## 2.6. Financing Energy Transition

### 2.6.1. Finance Background for the Energy Transition

**The Importance of Finance**

Effective investments and financials are essential for the renewable energy transition to succeed. Clean energy projects are driven by finance, but if the financial institutions are still reluctant to invest in green projects because of the risks associated with new technologies and having lower rates of return, the energy transition will not be achieved at the required pace (Sachs et al., 2019, p. ii). That said, to meet climate change goals, new financial instruments and new policy schemes are needed to increase investment in

clean energy projects. Achieving inexpensive, clean solutions and keeping expenses under control while diversifying financial resources are critical for the transformation (IEA, 2021d, p. 41).

**Investors' Awareness and Attitude**

Investors' views are shifting as they become more aware of the urgency of acting in the face of climate change. The millennial generation's shift in investment behaviour, which includes not only looking for financial gains but also being responsible with investments and having a positive impact on the Environment, Social welfare, and Governance, is known as the (ESG) factor, and it has sparked global interest as well as involvement in the sustainable investment movement alongside the financial returns (Van de Putte et al., 2020, p. 259). This is undoubtedly a positive indicator; however, the growing overall energy consumption, as well as the increased demand for fossil fuels, would need far greater efforts, making it challenging to meet the climate change objectives just via investments.

**The Scale of Renewable Finance**

To get an indication of what type of expenditures are necessary for the renewable energy transition and to meet the 1.5 degree Celsius target, we're talking trillions of euros or dollars every year. According to IRENA's research, between 2021 and 2050, there is a considerable need for investment in the energy industry, up to USD 98 trillion (IRENA, 2022, p. 102). This indicates that we must more than double our existing investments from the stated USD 2.1 trillion to over USD 6 trillion per year by 2030 (IRENA, 2022, p. 56), and the yearly sum will continue to climb if the pace is not accelerated. To gain sufficient additional funds, measures must be taken, starting with redirecting fossil fuel subsidies toward enhancing the renewable energy sector. It is also essential to integrate policies that produce and mobilise funds in the energy transition in order to raise annual investments in the sector, with the goal of increasing the volume of clean energy (IRENA, 2022, p. 102). As previously indicated, merely changing the energy source is insufficient; gains in energy efficiency throughout all sectors must also be assured (IRENA, 2022, p. 24). The good news is that there is enough money in the world; the difficulty is to direct it toward the renewable energy transition since global wealth is expected to exceed $400

trillion by the end of 2020, according to a Credit Suisse Research Institute analysis (Shorrocks et al., 2021, p. 5).

### 2.6.2. Challenges of Financing the Energy Transition

**The Investment Gap**

The most evident challenge in financing the energy transition is to bridge the gap between existing status and necessary investment. There has been a rise in the use of green bonds and banks in the EU in recent years as a means of funding the transition and renewable technologies. For example, improved financing conditions for clean energy projects are among the benefits of green banks, as they are the potential to aggregate smaller projects to attain a competitively appealing size, the development of new financial instruments, and a wider market for sustainable energy commodities. (Sachs et al., 2019, p. 5)

**The Investment Pace**

As we are experiencing difficulties with the investment gap, the pace of filling the gap is relatively slow. Efforts and promises to meet the objectives of the Paris Agreement on climate change have been inadequate, and the transition movement of major polluters is weak (Van de Putte, 2020, p. 264). Energy transition investments aren't efficient enough, and to expedite the speed of the shift, most expenditures must be made upfront (IRENA,2022, p. 102). In order to meet the aims of climate neutrality, not only does renewable energy production need financing, but so must also research and development efficiency on power generation and end-use (IEA, 2021e, p. 48).

**Subsidies and Policy Setting**

Another factor responsible for slowing the pace of energy transition to the renewable energy source is the fossil fuel subsidies, and according to the International Monetary Fund (IMF), in 2020, global fossil fuel subsidies were $5.9 trillion, representing about 6.8 per cent of global GDP; furthermore, subsidy levels are expected to rise to 7.4 per cent by 2025. (Parry et al., 2021, p. 2). In order to hasten the energy transition, moving subsidies from fossil fuels to renewables would be a good beginning to start balancing

the competition and making renewable energy sources more appealing (IRENA, 2022, p. 107). While it's clear that the absence of policy formulation is due to a fear of the economic and social consequences that would be produced, if such subsidies can be useful for long-term sustainable development, then it's worth the effort (OECD, 2017, p. 18).

### 2.6.3. Engaging the Finance in the Energy Transition

**Promoting the Energy Transition to be Financed**

To attract private and public investment toward low-carbon solutions, it is vital to encourage governments, regions, corporations, and individual citizens to invest in the energy transition and promote less polluting economic activity. The publication from the Organisation for Economic Co-operation and Development (OECD) (2017) emphasises that in order to support investments in the energy transition, economies must be flexible, adaptive, strong, and open to competitive investment, which is critical for promoting and recruiting investors. In addition, it is necessary to restructure policies to consider the socio-economic development by including the labour markets, which provide access to re-education and training for those who need it. As a result of pro-growth initiatives, the OECD points out that investors may more easily begin or extend current investments that help transition to a low-carbon future. To further promote energy transition, it is important to increase energy efficiency through norms and requirements for technology and performance standards that have been proven to promote the upgrading beneficially. (OECD, 2017, p. 187; 202)

**The Policies Drive the Finances**

Policies have boosted progress toward a net-zero-carbon economy, but they are not ambitious enough to keep us on track to meet our 2050 targets. In fact, policies that support the deployment of the technology, procurement mechanisms, financial and fiscal incentives, scaling up, cutting technological prices, and boosting investment levels are required to meet the needs of the energy transition. The energy transition will be aided by public and private funds for renewable technologies, both necessary and critical. In addition, removing fossil fuel subsidies will help restore market equilibrium, and further actions to raise carbon prices will make transition-related solutions more competitive. As

a positive side effect, carbon pricing generates funds that may be used to fund energy transition-related initiatives, but if not correctly analysed, it might result in burdens for low-income people and exacerbate socio-political issues. (IRINA, 2022, p.50; 56; 106; 107; 124).

**Mobilising the Funds Towards Energy Transition**

To mobilise funds for the energy transition, public finance institutions are viewed as playing an important role in the development of supply mechanisms that de-risk financials and provide instruments to co-finance the energy transition with the private sector. Green bonds and other capital market alternatives could help the public fund attract further private finance (IRENA, 2022, p. 107).

Recently, the EU has introduced stimulus packages to promote investments in the green transition, which is one example of mobilising public funding toward energy transformation in Europe. The EU's Recovery Package was created to assist with the recovery from the consequences of Covid-19, the most significant long-term budget connected with NextGenerationEU, totalling €2 trillion, 30 per cent of which is committed to combatting climate change (European Commission, n.d.-f). The European Commission has proposed a new stimulus package, the Social Climate Fund, with the purpose of providing financial assistance to the Member States and their populations who are most sensitive to the energy transition. A €72 billion investment would help the country's economy develop and create new employment, and support individuals finance their energy efficiency measures (European Commission, 2021f).

It is expected that public finance institutions, such as development and green banks, and clean energy funds, would play an essential supplementary role in organising mobile financing toward the energy transition. The capital should be regulated and controlled to ensure that it flows to the appropriate destinations and endorses a sustainable economy rather than merely being pushed into the market. Over this, the EU Taxonomy plays an important role in ensuring that funds are channelled successfully towards a sustainable economy.

# 3. EU Taxonomy

## 3.1. Introducing the EU Taxonomy

### 3.1.1. The Platform on Sustainable Finance

To meet the environmental targets outlined in the Paris Agreement and the EU Green Deal, capital must be channelled into long-term sustainable investments. As a result, the financial system must evolve and improve throughout time, as well as be tailored to support a sustainable economy. To combat greenwashing, a sustainable finance framework directs economic policies toward green technical solutions and away from polluting sources. The purpose of the sustainable finance framework is to raise awareness of the environmental effect, provide a universal concept of sustainable activity, and bring attention to sustainable economic operations. (Regulation (EU) 2020/852, 2020, p. 14)

Under the Taxonomy Regulation, the European Commission has created a Platform on Sustainable Finance. Experts from civil society, academia, and the financial markets which will serve as the European Commission's permanent expert group. For the purposes of technical screening, the Taxonomy Regulation mandates that the Commission consult the platform before establishing any Delegated Acts. When it came to developing technical criteria for screening, the platform played an important role. The expert group delivered its final report to the Commission, which was tasked with convening a thoughtful conversation among the experts and taking into account input from diverse stakeholders. Additionally, the expert group serves as an advisory body to the Commission in regards to the technical screening criteria, which the expert group examines and amends as needed.

In addition, the sustainable finance platform consults on the applicability of the standards and evaluates the implications and potential outcomes of the EU Taxonomy, as well as the advantages and costs of the technical screening criteria. Furthermore, the sustainable finance platform is working on developing a Green Bond Standard that will be linked to the Taxonomy, designing corporate sustainability and climate-related disclosures, including disclosure guidelines concerning the Taxonomy and regulations on climate change-related investment baselines. (European Commission, 2021b)

### 3.1.2. The EU Taxonomy

The EU Taxonomy has caught the curiosity of people all around the globe, and other nations are looking to see how it affects the banking industry and leading other nations in creating their own taxonomy. For example, the United States is now contemplating the development of a comparable taxonomy system, while China is extending its present taxonomy. The first taxonomy was created in China by the suggestion and collaboration of those who are now working on the EU Taxonomy. China's taxonomy varies from that of the EU, which focuses more on pollution prevention. The EU Taxonomy, on the other hand, aims to capture the contribution of economic activity to achieving the EU's environmental goals. (Climate Bonds Initiative, 2021a)

It is worth understanding that the whole aim of the EU Taxonomy is to be scientifically sound and in accordance with the Paris Agreement. The EU Taxonomy does not state what can be achieved as of today but rather what must be performed to meet the climate targets. Simply put, the EU Taxonomy may be thought of as a catalogue of green activities for businesses and investors. The EU Taxonomy optimally steers investments toward sustainable operations while attaining transparency by providing the investor with accurate information. This would make individuals more conscious of the consequences of their investments and encourage capital to flow toward more sustainable economic activity. (Climate Bonds Initiative, 2021a)

Companies must invest in the transition and in their operations to become more ecologically friendly if we are to achieve a sustainable environment. Policymakers and the creators of the taxonomy are indicating that the EU Taxonomy can be seen as providing greater rewards to organisations who are striving to accomplish sustainable objectives rather than penalising them for failing to comply with the EU Taxonomy. For example, providing funding and lower-interest loans to businesses that participate in green operations. (Climate Bonds Initiative, 2021a)

### 3.1.3. What is the Taxonomy Regulation

Green activities are characterised according to the EU Taxonomy for investment purposes by describing their sustainability performance. The EU Taxonomy classifies an economic

activity as "environmentally sustainable" if it is particularly ecologically sustainable, contributes to the achievement of EU environmental goals without causing significant harm to any other environmental objectives, and provides the required social protections. A significant contribution to environmental goals is laid out and detailed in the Delegated Acts for the EU Taxonomy. (European Commission, 2021b)

The EU Taxonomy is a step in increasing transparency by requiring certain corporations and investors to disclose information. Companies and financial institutions would be required to disclose the proportion of their activity that is taxonomically aligned. The share of Taxonomy-aligned activities would allow companies and investment portfolios to be compared. The EU Taxonomy would provide greater alternatives for guiding investment and market involvement toward a more sustainable economy. (European Commission, 2021b)

Companies are not required under the EU Taxonomy to be compliant with the Taxonomy. However, environmental performance objectives must be reached in order to align with the Taxonomy; hence the drive to reach the alignment with the Taxonomy is expected to aid the transition and future sustainability. Furthermore, economic activities that are not classified as making a significant contribution in the Taxonomy may not always imply that they are ecologically damaging or unsustainable. Furthermore, it is important to recognise that not all activities which might be recognised as making a significant contribution to environmental goals are presently included in the EU Taxonomy. The EU Taxonomy is intended to evolve and be updated as needed. (European Commission, 2021b)

### 3.1.4. Why there is a need for Taxonomy Regulation

The EU Taxonomy is a helpful resource for firms seeking to make the transition to a low-carbon economy. In this regard, the EU Taxonomy translates the climatic and environmental goals into defined criteria with the purpose of developing a common vocabulary across all green activities. Companies and investors may use the Taxonomy as a framework for their attempts to develop and fund the shift to be more sustainable. In addition, the EU Taxonomy aims to decrease market complexity, guard against greenwashing, and improve funding for both already sustainable and sustainable-in-

transition enterprises. Taxonomy is also an important aspect of the sustainable finance system. In order to achieve the goals of the Paris Agreement and the European Green Deal, the Taxonomy may assist increase the investments in green initiatives, which are critical. (European Commission, 2021b)

### 3.1.5. Evolving Regulation

The EU Taxonomy is dynamic in nature and will change over time. The first delegated act is known as the Climate Delegated Act for sustainable climate change adaptation and mitigation activities. The second delegated act is the Disclosure Delegated Act, which supplements article 8 of the Taxonomy Regulations. These first two acts become effective on January 1, 2022. Currently, the Commission has approved a Complementary Delegated as the inclusion of natural gas and nuclear energy into the EU Taxonomy. However, it is expected that additional acts will be introduced in the near future since it was not feasible to set criteria for all industries that may make a significant contribution. Nonetheless, the Taxonomy will gradually evolve and incorporate additional economic activities from many economic sectors. In article 26, the Taxonomy Regulation establishes a periodical review process during which the expert group will analyse the regulation's performance and the creation of technical screening criteria. (European Commission, n.d.-c)

### 3.1.6. Environmental Objectives & Technical Screening Criteria

The Sustainable Finance Platforms Expert Group of the European Commission has produced a 67-page Technical Report on the EU Taxonomy (Comte and Hay, 2020, p. 1). The EU Taxonomy defines the technical screening criteria, which are clarified and defined by the Delegated Acts as "Taxonomy Aligned" activity and what it is not. Furthermore, the criteria establish the standards for environmental performance, ensuring that the activity makes a significant contribution to the environmental goal (European Commission, 2021b). Ideally, this should motivate businesses to undertake new initiatives in order to meet stricter screening standards (European Commission, 2021c).

**Technical Screening Criteria**

Today there are six environmental objectives; climate change mitigation, climate change adaptation; sustainable use and protection of water and marine resources; transition to a circular economy; pollution prevention and control; protection and restoration of biodiversity and ecosystems. In December 2021, the Climate Delegated Act was the first EU Taxonomy's delegated act to be published in the Official Journal, which included climate change mitigation and adaptation. The Recent adoption of the final four environmental objectives is anticipated to be followed by a Delegated Act concerning the remaining environmental objectives (European Commission, n.d.-c). To ensure that economic activity does not inhibit the achievement of environmental goals, "Do No Significant Harm" (DNSH) standards must be applied to in all six areas of Taxonomy environmental objectives while developing new Taxonomy Aligned projects or activities. Economic activity must also provide the minimum social safeguards (European Commission, 2021b, p. 4). The EU taxonomy goals must relate to economic activities in order to ensure that one environmental purpose does not conflict with another. The technical requirements for screening are based on research and are continually re-evaluated and improved. Criteria based on current technology identify economic activities that are in line with EU environmental and climatic objectives. (European Commission, 2021b)

According to Article 9 of the Taxonomy Regulation, environmental goals are spelt forth, and the major contribution to these goals is described in paragraphs 10 to 15. To grasp the context and idea of considerable contribution, these goals do not expressly specify the actions under the Taxonomy Regulation. The Delegated Acts are based on these principles and contain a range of economic activities that would meet the criterion of substantial contribution, and the Delegated Act establishes the requirements for the particular activities that qualify as green under the EU Taxonomy. Some actions aren't classified as an environmental activity since they don't fit all the criteria laid forth in the Taxonomy Regulation. However, this does not always indicate that the activity is unsustainable. Based on the Technical Expert Group work, the activities offer major contributions when the activity fulfils specific parameters. For example, when the activity has a minimal effect on the environment and substitutes hazardous actions, such when renewable energy sources are recognised as a considerable contribution towards climate

change mitigation. In addition, whether the economic activity could minimize the negative impact of other activities, or it has an ecologically favourable impact, it may be recognised as a major contribution to the environmental goals.

**Climate Change Mitigation**

As a result of the Paris Agreement and the EU Green Deal, the mitigation of climate change refers to economic operations that are in line with the goals of climate neutrality. The major contribution to climate change mitigation must show coherence across the medium and long-term climate targets. Sectors with high emissions must provide a route to low-carbon solutions and also comply with the EU Taxonomy principles by avoiding asset lock-in that would conflict with mitigation objectives. Furthermore, in order to make a significant contribution to climate change mitigation, the environmental performance must be reached considerably above the sector's average, necessitating the deployment of the best available technology while being economically feasible. For the greatest available technology, the activity must be financially feasible. For example, when zero-carbon manufacturing does not make economic sense, it is not required to invest a substantial sum of money in order to achieve it. (European Commission, 2020b, p. 19)

**Climate Change Adaptation**

To cope with the effects of climate change, we must find ways to lessen the most common threats, such as drought, wildfires, and storms. It is important that adaptation measures be taken to minimise the effects of both the present and future climates. A significant contribution must be made without putting the environment, humans, or possessions in danger of harm. Without the lock-in assets effect, environmental objectives are not compromised, and a large positive environmental impact is accomplished throughout its life cycle. (European Commission, 2020b, p. 22)

**The Sustainable Use and Protection of Water and Marine Resources**

The third environmental objective of the EU Taxonomy is the sustainable use and protection of water and marine resources, with the goal of ensuring that economic activity does not harm the marine ecosystem or the environmental status of marine water. To

contribute to this environmental goal, economic activity must either contribute significantly to attempting to achieve the good status of bodies of water, including water bodies of surface water and groundwater or contribute significantly to preventing the deterioration of bodies of water that already have a good status. Among the activities are ensuring that urban and industrial wastewater is adequately collected, treated, and discharged, implementing water reuse measures, ensuring the progressive reduction of pollution emissions into surface water and groundwater, and increasing people's access to safe drinking water. The aim is to achieve good water status and ecological potential for heavily modified water bodies, as defined by the EU Water Framework Directive 2000/60/EC, which is linked to article 2 of the EU Taxonomy regulation, which states that the directive's definitions shall be applied. (Regulation (EU) 2020/852, p. 27; 31; 32)

**The Transition to a Circular Economy**

The fourth environmental objective of the EU Taxonomy is the transition to a circular economy, where the circular economy should be adjusted to individual sectors to guarantee that economic activities do not lead to inefficiencies in resource usage or lock in linear production patterns, that waste is avoided or minimised, and that, when inevitable, waste is treated in accordance with the waste hierarchy. These criteria should also guarantee that economic activities do not jeopardise the goal of moving to a circular economy. The purpose of the circular economy is not only to recycle and reuse but also to improve the efficiency of using primary raw materials in production and other efficiency measures such as increasing the durability or reparability and prolonging the use of products, including the fundamentals of this criteria. As long as those fundamentals are met, the transition to a circular economy will go smoothly. (Regulation (EU) 2018/852, p. 32; 33); (Regulation (EU) 2021/2139, p. 10).

**Pollution Prevention and Control**

Pollution prevention and control is the EU Taxonomy's fourth environmental goal. It is important to note that pollution prevention and control are actually regulated in the industrial emissions directive 2010/75/EU, which is now integrated into the EU Taxonomy delegated act, given the operation permits, emission limit values, and defining the use of Best Available Technology (BAT) in the given industrial sectors, as well as

exchanging information between member states. The goal is to prevent or reduce pollutant emissions into the air, water, or land while minimising adverse environmental effects in areas where economic activity qualifies as substantially contributing to pollution prevention and control when that activity contributes substantially to environmental protection from pollution. While addressing the relevant sources and types of pollution, sector-specific issues should be taken into account. (Regulation (EU) 2020/852, p. 33); (Regulation (EU) 2021/2139, p. 10).

**The Protection and Restoration of Biodiversity and Ecosystems**

The final environmental objective is the protection and restoration of biodiversity and ecosystems, and all actions that may have an impact on habitats, species, and ecosystems should be subject to environmental impact assessments or appropriate evaluations. This environmental objective highlights that a significant contribution can be made by conserving nature and biodiversity by having a favourable conservation status and safeguarding as well as restoring ecological conditions. Furthermore, through sustainable land use and management, agricultural methods, and good forest practice and management. Even if no environmental impact assessment or other relevant review is required, criteria like these should ensure that operations do not disrupt, capture, or kill legally protected species or degrade legally protected habitats. (Regulation (EU) 2018/852, p. 34); (Regulation (EU) 2021/2139, p. 10)

**The Do No Significant Harm Criteria**

In addition to making a significant contribution toward one or more environmental goals, one must also satisfy the other requirements outlined in the EU Taxonomy in order to be in compliance with that classification. Article 3 of the Taxonomy Regulation outlines the additional requirements that must be met for an economic activity to be considered sustainable.

The "Do No Significant Harm" standard is the first of the extra criteria, and it applies to all the environmental goals that are outlined in Article 17 of the Taxonomy Regulations. Second, the economic activity in question has to be compliant with article 18 of the laws' "Minimum Social Safeguard" requirements. The DNSH criteria are designed to ensure

that economic activity is not preventing the achievement of other environmental goals or having a negative impact on environmental goals. In principle, if a certain sector were to innovate a new method for the prevention of air pollution, but that system had a harmful impact on the local water resources and marine life, then the new activity would not be allowed and would not be aligned with the taxonomy.

**The Minimum Social Safeguard Criteria**

In accordance with the final requirements of the EU Taxonomy, the economic activity must satisfy the "Minimum Social Safeguard" outlined in Article 18 of the regulation. The minimum safeguards to be implemented and ensured of the alignment are from the following, UN Guiding Principles on Business and Human Rights, the OECD Guidelines for Multinational Enterprises, the principles set out in the declaration of the International Labour Organization (ILO) on Fundamental Principles and Rights at Work, and the International Bill of Human Rights all serve as the foundation for the minimum social safeguard criteria. Companies based in the EU already comply with these accords; therefore, meeting these standards is not anything new for them. (Regulation (EU) 2020/852, p. 35)

### 3.1.7. Functioning of the EU Taxonomy

**Classification of the Economic Activities**

The EU Taxonomy distinguishes three types of economic activities. The first is "Taxonomy Aligned" or Ecologically Sustainable" activities that are already green or low carbon. Second, under Taxonomy Regulation article 16, the "enabling" action may qualify as significantly contributing to environmental goals provided it does not generate a lock-in of assets that would undermine the long-term environmental purpose. The "transitional" activities with thresholds are the third activity. (Schuetze & Stede, 2020)

The EU Taxonomy addresses green and enabling activities, which may be found in all economic activity areas. The major goal of these green activities is to emit none or just a minimal quantity of CO2; however, green activities may also capture CO2 from the atmosphere or help decrease emissions in other areas. Reafforestation, for example, is

seen as a green activity since it enhances CO2 capture. When an economic activity qualifies as green in the manufacturing sector, it must use low-carbon technology. (Schuetze & Stede, 2020)

The Taxonomy Regulation art. 10 specifies "transitional" actions in climate change mitigation. According to the article, transitional activities are not quite low-carbon, but they use the best technical performance and are economically possible. However, there are two more requirements that must be met. First, they must not stall the development of a low-carbon alternative. Second, the transitional activity should not result in a carbon-intensive resource lock-in. It is the transitional activities that are being disputed politically, namely what can or cannot be considered a transitional activity. Transitional activities may be on the correct track towards climate neutrality, but they have not yet reached the green level required to be classified as green activity. There have been discussions over this categorisation approach and what may and cannot be considered transitional. There are disparities in the consultation process with stakeholders between the industry and Non-Governmental Organisations (NGOs) or environmental organisations. The emission levels and categorisation are widely agreed upon by NGOs and environmental organisations; however, the industrial sector is more sceptical of these classification standards. (Schuetze & Stede, 2020)

However, advancement has been achieved well within EU Taxonomy in what might be considered a favourable direction for sustainable development. Previously, established businesses (for example, the steel or concrete industries) were not considered green activities; however, the EU Taxonomy permits these sectors to be included in green investment if they match the EU Taxonomy's transitional criteria. Allowing transitional sectors into the EU Taxonomy is critical since these industries have the greatest need for technological advancement. Furthermore, these transitional economic activities would be constantly monitored, and the best available technology would be assessed by the Technical Expert Groups every three years. (Climate Bonds Initiative, 2021b)

Article 19(3) of the Taxonomy Regulation specifies the sole economic activity that does not come under this classification: solid fossil fuels. These include coal and peat, which cannot be considered as transitioning towards the environmental objective of climate

neutrality by 2050 even with the finest current technologies. (Regulation (EU) 2020/852, p. 36)

**Application of EU Taxonomy**

The EU Taxonomy is essential to three main disclosure instruments within the sustainable finance framework, leading with the Sustainable Finance Disclosure Regulation (SFDR), which harmonises sustainability-related information and enables investors to make better-informed investment choices. The Non-Financial Reporting Directive (NFRD) was established to foster a responsible corporate attitude and enhance transparency. The recently proposed Corporate Sustainable Reporting Directive (CSRD) aims to update the NFRD and enhance sustainability reporting at the least cost achievable (European Commission, 2021d, p. 4). The Taxonomy will be amending these reporting requirements, which are intended to be in accordance with the Taxonomy Regulations. The modifications add the essential elements from the EU Taxonomy, ensuring that these rules are in sync and highlighting the overlaps between them, thereby preventing duplication of effort in data collecting and reporting, which is essential (Vehrey & Abraham, 2021). The EU Taxonomy establishes just a few rules for enterprises or investors, and its primary legal obligation is financial reporting.

**SFDR – Sustainable Finance Disclosure Regulation**

As part of the energy transition and recognition of the need for massive investments in sustainable activities, the EU initially adopted the SFDR to reorient capital flows toward sustainable financing. SFDR is a framework that supplements corporate disclosures with an enhanced reporting structure for financial products and financial enterprises. The purpose of SFDR is to increase transparency in the financial system and thus avoid greenwashing. The SFDR applies to more significant economic market players such as investment companies, credit unions, banks, and other institutions. The term "environmentally sustainable economic activity", or in other words, sustainable investment in the SFDR, encompasses environmental and economic activities as defined by the EU Taxonomy Regulation. (Regulation (EU) 2019/2088, p. 1; 5; 17)

**NFRD – The Non-Financial Reporting Directive**

The current NFRD aims to increase transparency and promote ethical corporate activity. The NFRD demands yearly non-financial reporting from businesses with over 500 employees, which would include over 11,000 businesses in the EU (European Commission, n.d.-d). The NFRD is intended to assist businesses in analysing their environmental and social impacts and risks by offering a vast assortment of primary and secondary data sources. Environmental, Social, and Governance (ESG) disclosures must be included in the non-financial statements of significant public-interest organisations, according to the NFRD. According to the EU Taxonomy, organisations subject to the present NFRD are expected to give information about the sustainability of their activities.

**CSRD – Corporate Sustainable Reporting Directive**

The European Commission released the Corporate Sustainability Reporting Directive proposal in 2021. The proposal was seen as necessary because there is currently no legislative structure to guarantee that these users' information demands are being addressed. This is because some firms from whom customers want sustainability information do not disclose such information, and many of those that report sustainability information do not publish all the information essential to customers. When companies report, data is often neither accurate nor comparable across businesses (European Commission, 2021d, p. 2). The CSRD proposal includes all significant enterprises, regardless of whether they are publicly traded or not; this would consist of more companies; additionally, the new CSRD would also include non-EU companies listed within Europe. All significant corporations are now publicly responsible for their effect on people and the environment due to this shift in scope from 11,600 to 49,000 (European Commission, 2021d, p. 10).

Listed microenterprises would be exempt from this proposal, but small and medium-sized businesses with shares listed on regulated exchanges would be included. The usefulness comes from having more available information; therefore, the better the investor's assessments can be by having more and better information from the companies (Climate Bonds Initiative, 2021b). Businesses that come under the scope of the CSRD will be required to report on environmental performance and economic activities following the EU Taxonomy and are to provide proof of the claims of sustainable activity (Directive p.

5). Having scientific evidence to back up the claims of sustainability is to avoid greenwashing. (European Commission, 2021d, p. 2; 5; 10)

**Disclosures of the EU Taxonomy**

According to the Taxonomy Regulation, articles 5 to 8 are the ones that are significant for reporting and disclosure purposes. However, under Article 8 of the Taxonomy Regulation, there is a need for the disclosure of three Key Performance Indicators (KPIs). The first metric is the amount of revenue generated by the company's goods or services that can be traced back to efforts to support the environmental objectives. The last two indicators are the expenditures on assets or processes associated with economic activities that qualify as sustainable activities in terms of capital and operating expenditures (CapEx and OpEx). Product and service offerings that support environmentally sustainable activity contribute to the company's OpEx revenue. (ESMA, 2021, p. 9)

The Capex application is used to assess the corporation's climate compliance on new investments such as a new power station, a new facility, or a new manufacturing unit. The application for OpEx is produced by examining the portfolio performance of the firm and its present performance, such as a power station or a building. The choice of the corporation to invest in stock, facilities, or bonds is an important metric that examines how well the company is aligned with the EU Taxonomy. The corporation's information is provided to assist analyse if the company's climate objective can be met and to promote transparency. (Schuetze & Stede, 2020, p. 4)

**Investors and Companies Applying the EU Taxonomy**

The EU Taxonomy's Delegated Acts include more specific information about which activities are included; however, in a broader sense, the following sectors are included in the EU Taxonomy which can make a significant contribution to climate change: agriculture and forestry, manufacturing, electricity sector (including gas, steam, and air conditioning supply), water sector (including sewerage, waste, and remediation), transportation, buildings and lastly information and communication technologies sector (European Commission, 2019, p. 15).

Companies and investors must take five steps to determine eligibility and alignment with the EU Taxonomy. Figure 1 depicts a simplified version of the five steps for corporations for taxonomy alignment disclosure, beginning with identifying eligible economic activities in the companies' portfolios.

The first step is to identify the company's portfolio; in this example, the company that produces energy has three separate power generation facilities in its portfolio. The second step is to identify economic activities that make a significant contribution to one of the environmental objectives; in this case, coal is not aligned with the taxonomy. Hydropower can be seen as contributing to climate change mitigation, however, under certain conditions, such as life-cycle GHG emissions from energy generation must be less than 100gCO2e/kWh; in this case, it is assumed that the criteria is not met due to unverifiable factors; The majority of energy output comes from wind-powered energy generation, which contributes significantly to climate mitigation. The third step is to determine whether it meets the DNSH standards, which are detailed in the Delegated Acts of specific actions to be done to mitigate impacts such as biodiversity. The fourth step is to comply with the OECD standards, the UN Guiding Principles on Business and Human Rights guidelines (UNGP), the International Labour Organization on fundamental principles and rights at work, and the International Bill of Human Rights. The final step is to describe the economic activity's turnover, CapEx, and OpEx and publish the taxonomy-aligned activities in KPIs, which in the shown figure demonstrates to be 50% aligned with the taxonomy.

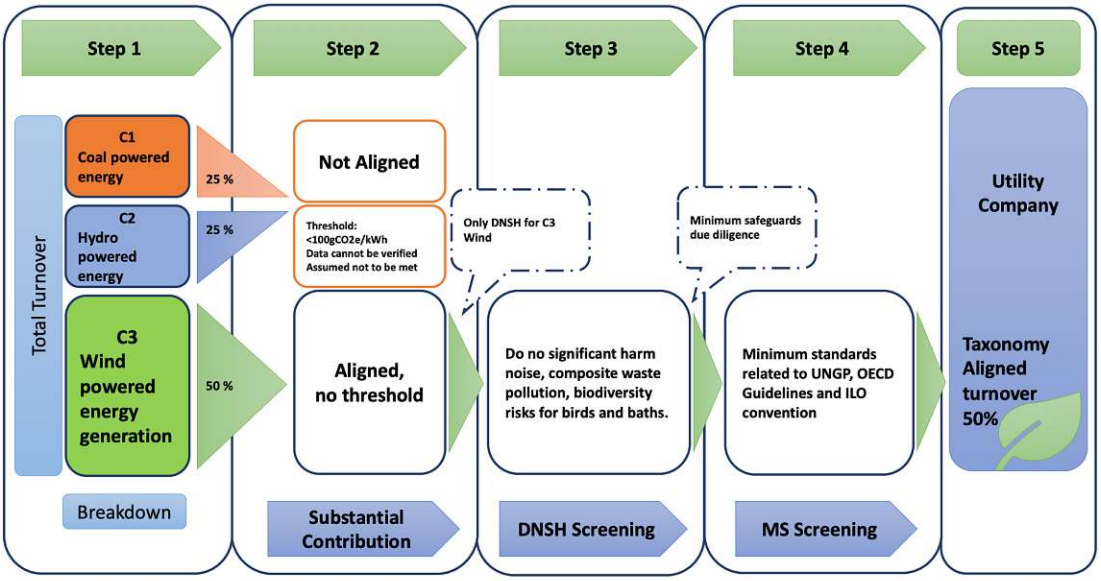


*Figure 1 Company's Taxonomy Alignment [Based on European Commission,2020c]*

Financial market participants and investors must disclose how and to what extent their investments are underlying in environmentally sustainable economic activities, as well as the proportion of underlying investments that are taxonomy eligible expressed as a percentage, while also specifying which activities are considered enabling and transitional (European Commission, 2020c). Figure 2 illustrates the investors' portfolios and identifies how they are taxonomically aligned. The evaluation begins with determining the company's economic activity and whether it significantly contributes to one of the taxonomy's environmental aims. Similarly, assessments must be performed for the company's DNSH screening and Minimum Standards (MS) screening. In order to facilitate investor decisions, companies must give this information so that investors may evaluate their taxonomy alignment by just glancing at the key information. Following the identification of the company's taxonomy-aligned investments, the next section of the investments is weighted to achieve ultimate total portfolio alignment with the taxonomy.

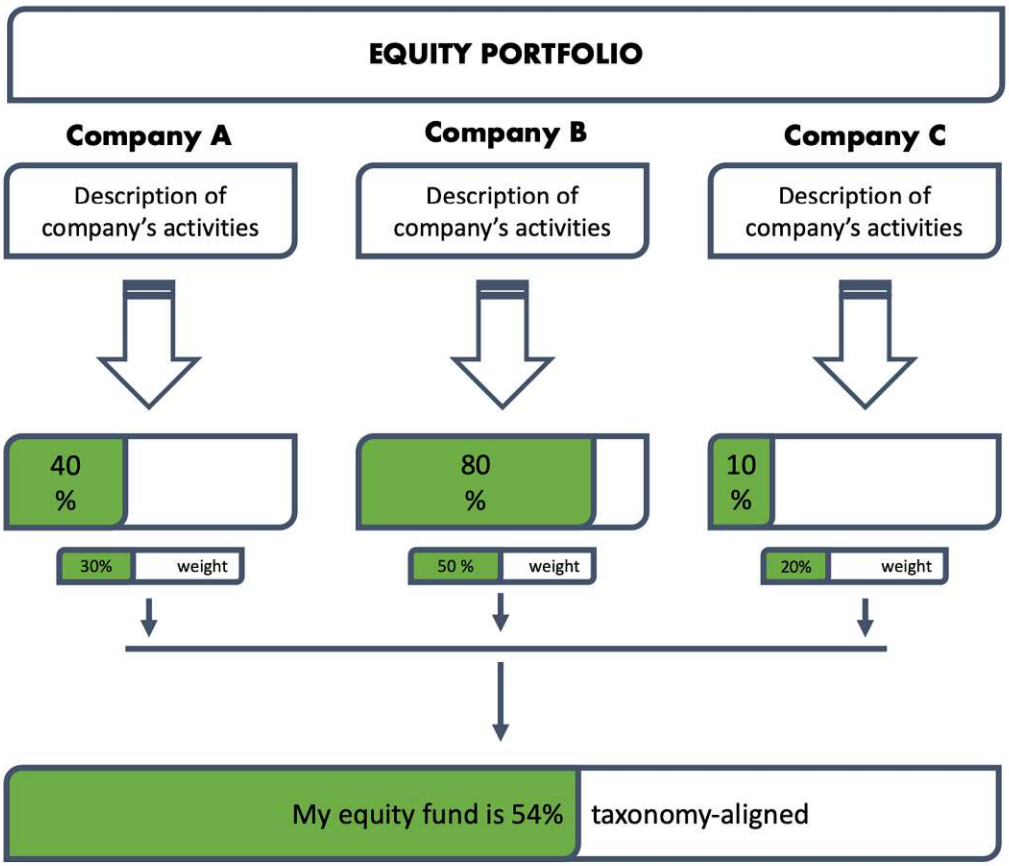


*Figure 2 Investors Portfolio [Based on European Commission, 2020c]*

## 3.2. The EU Taxonomy's influence on Energy Transition

### 3.2.1. Political influence

The Paris Agreement's goal of limiting global warming is a worldwide political settlement, and in Europe, the Green Deal and Fit to 55 goals, which aim to achieve carbon neutrality by 2050, have also been agreed upon. As a result of these policies, the EU's member states are obligated to take the necessary measures to meet these goals, which need enormous financial commitments.

While the EU Taxonomy is a tool for EU energy policy, it is also meant to promote financial market transparency for private sector sustainable investments, which is why it has little political influence. (European Commission, 2022b)

Since the EU Taxonomy does not impose how much investments have to be arranged in the sustainability, neither does it stop any economic sector from receiving investments. It is merely to clarify and avoid greenwashing by categorising the green activities, to make it clearer for investors and companies to know how they are contributing towards sustainability. The EU Taxonomy is an essential part of the funding of the Green Deal since it will enable people who want to invest in a sustainable way. (European Commission, 2022b)

States have complete responsibility and authority to choose their own energy mix, establish a proper balance between environmental aims, and work toward climate neutrality. Articles 21 and 22 of the Taxonomy Regulation establish the sole authority the Taxonomy has over the Member States. When it comes to the Taxonomy Regulation, Member State authorities are first and foremost responsible for ensuring that financial markets are adhering to the only legally enforceable aspect of it. Articles 5, 6, and 7 of the Taxonomy Regulation provide the information that must be disclosed. (Regulation (EU) 2020/852, p. 38.) The second role is played by the Member State's decision to set measures and penalties for actors who violate disclosure regulations. Member States might also play a role in shaping the public financial sector and encouraging investment in environmentally-friendly forms of funding.

Whereas the classification of activities is based on science, the ultimate application for legislation and delegations is a political choice and may be affected by lobbying from governments and corporations, and the EU Taxonomy can be politically influenced. The controversy over whether or not to include nuclear energy and natural gas in the Taxonomy is an example of this. The European Commission's Complementary Delegated Act has designated natural gas and nuclear energy as transitional activities. The inclusion of these in the Taxonomy is not universally agreed upon since they involve problematic environmental implications. As an example, we can show that nuclear energy contributes to carbon-free energy, but the difficulty is that it's not renewable and that nuclear waste can add significantly to the environment's pollution.

Several countries, including France, have been accused of vigorously advocating for the inclusion of nuclear energy in the Taxonomy. This is because demand for energy is on the rise, and France has a vested interest in including nuclear energy because the country relies heavily on nuclear energy for its energy supply. On the other hand, those opposed to nuclear energy said that it would undermine taxonomy's primary principle of being scientifically grounded. Nuclear energy may be included in the EU taxonomy if it complies with safety standards and waste management criteria under EU Member States' legislative framework, which assures a high degree of environmental and human protection. (European Commission, 2022b)

Similarly, the inclusion of natural gas is based on the fact that each member state is at a different stage of the energy transition and that natural gas serves a specific function as a transitional or bridging technology for a limited time. Since its importance in terms of consumption and production is predicted to continue until 2030, while it is expected to begin shrinking until 2050. According to the Delegated Act, the Taxonomy requirement may be satisfied with as long as gas is used instead of more damaging activities like burning fossil fuels. (European Commission, 2022b)

What is included and what is left out from the EU Taxonomy's "bath" of benefits for the energy transition are influenced by political power. When it comes down to it, the EU Taxonomy does not actually have an impact on government policymaking, but rather the EU Taxonomy is influenced by lobbyists from the governments and companies, which in turn affects the energy transition.

### 3.2.2. Financial influence

The EU Taxonomy has a greater impact on the financial industry than on the political arena. The purpose, as previously mentioned, is to devote financial resources toward supporting the EU Green Deal and other environmentally beneficial activities. Recovery plans and social funds for a just transition have mobilised hundreds of billions of euros for sustainable investments, but it is necessary to have a common understanding of what is regarded as carbon-neutral activity and the EU Taxonomy's role to classify the activities to provide investors with security and safeguard them against greenwashing and then it is possible to reorient the financial flows towards sustainable economic activities. (UNEP FI & EBF, 2022, p.11)

Insofar as sustainable economic activities are concerned, the EU Taxonomy may be considered as enabling and establishing them. However, there is no legislation in the Taxonomy dictating investment methods or amounts. In fact, these are determined by the EU's distribution of public finances. Investors and businesses benefit from the EU Taxonomy's role in helping to increase sustainable investments by defining what is green and how they are contributing to the sustainable environment and energy transition. As a result, they may be able to get lower-cost loans by increasing their percentage of alignment with the EU Taxonomy. (European Commission, 2021e)

Financial market players may utilise the EU Taxonomy to match their investment plans with the EU's climate and environmental objectives while providing more openness and clarity. A foundation for future sustainable finance advancements is provided by the EU Taxonomy, as long as the market is aware of what constitutes sustainable behaviour and how much it contributes to environmental objectives. ESG benchmarks and minimum sustainability standards will be considered by the European Commission as a means of attracting financial support for intermediate stages toward sustainability. The inclusion of small and medium-sized businesses in the inclusive sustainable financing framework will help speed the transition to a more sustainable economy. Economic activity must be encouraged and recognised in order for the transition toward sustainability to be successful. (European Commission, 2021e)

Member states contribute to the development of the financial system by influencing its structure and environment. On the one hand, the state is responsible for investing in public expenditure in a sustainable manner and in accordance with the sustainable objectives. State, on the other hand, may require sustainability certificates and set sustainability standards. As a result, the government may be a pioneer in a variety of fields, helping to spread new norms and technology. (Kemfert & Schmalz, 2019, p. 240)

### 3.2.3. Accelerating the Energy Transition

The EU Taxonomy's purpose is to assist investors in identifying economic activities that are in accordance with our environmental and climatic goals while also avoiding greenwashing of any kind. Net-zero emissions need an energy transition to renewables and a thorough knowledge of the economic activities that contribute to achieving carbon neutrality in order to speed the shift.

There are a few ways to speed up the transition, starting with by including increasing number of activities that contribute to this objective, which is problematic for some but also allows for a more inclusive changeover. Additional climate delegated legislation would include stricter rules for activities to qualify as taxonomy aligned activities, including nuclear energy and natural gas as taxonomy aligned activities, accelerating the energy transition from coal generation to low-carbon gases or renewable sources, and thus toward a climate-neutral future. (European Commission, 2022c). Second is the forthcoming CSRD regulation, which will increase the number of organisations required to publish KPIs related to the EU Taxonomy in order to participate in the energy transition, which is highly desirable.

Furthermore, not only accelerating phase-in environmental activities but also phase-out is crucial to accelerate the energy transition. According to a recent report from the expert group, the European Commission should include Significantly Harming and Neutral activities in the EU Taxonomy in order to identify which activities need to be phased out and which activities are not harming nor contributing to climate change but can be improved to not be as significantly harmful, even if they don't meet the green performance levels in the taxonomy. Incorporating new activities into the EU Taxonomy and broadening its scope such that no activity is excluded or misconstrued as negative in order

to prevent being eliminated from future investments. (European Commission, 2022d, p. 5)

There are some restrictions of influencing the energy transition, as the EU Taxonomy does not impose any limits or standards on how much the enterprise must contribute to the energy transition. Currently, it simply selects and integrates the most environmentally friendly activities while minimising greenwashing. The taxonomy influences the transition by cleaning the economic activity portfolio of the most polluting activities, resulting in companies are attempting to get rid of these types of activities and selling them to those who do not have environmental targets, meaning the activity itself could possibly continue to pollute the environment (Tabuchi, 2022). To address this problem, a consistent worldwide taxonomy might help accelerate the shift to low-carbon or renewable energy sources rather than selling the polluting business while keeping the harmful activity operating (European Commission, n.d.-e).

Only at a certain level is the Taxonomy capable of accelerating the energy transition. As previously noted, the causes of a shortage of fossil fuels, price fluctuations in energy, and acquiring geopolitical power, as well as environmental rules that establish targets and benchmarks to be met, may all have more of an impact on the energy transition. The EU Taxonomy, on the other hand, is likely to be used as a foundation for other environmental policies and public finances to apply these criteria for directing the fund and investments in the proper destination. While the EU Taxonomy makes efforts to accelerate the energy transition by guiding and clarifying to investors and companies how they are sustainable and attempting to achieve the environmental target of being climate neutral, it may have only a limited impact on the energy transition.

## 3.3. The EU Taxonomy's influence on the Companies

### 3.3.1. Private Sectors influence

**Taxonomy's Positive Influence Through its Obligations**

The EU Taxonomy only requires the disclosures for those who qualify under NFRP and, in the future, also the CSRD, to disclose the proportion of turnover, capital expenditure (CapEx), the operation expenditure (OpEx) that are linked to the taxonomy's environmental objectives, referring to the appropriate Technical Screening Criteria, Do No Significant Harm and the Minimum Social and Governance Safeguards. This means that the companies need to consider how the taxonomy could potentially influence their business and consider how aligned they are with the taxonomy.

Companies are not required to fulfil the EU Taxonomy requirements with their activity if it is not regarded to contribute to sustainability. Nevertheless, the EU Taxonomy encourages businesses to strive towards ecologically friendly and green standards. One reason to be linked with the EU Taxonomy is the policy effort EU Ecolabel, which is presently being developed to conform with the EU Taxonomy. The Ecolabel would make it easy to identify ecologically beneficial retail or financial items. (European Commission, 2021b, p. 10)

The EU Taxonomy offers enterprises with parameters on which they may depend when doing green transition choices. When organisations recognise their existing performance levels, the EU Taxonomy encourages them to establish transition strategies. Businesses may profit from the Taxonomy by executing measures to reach the levels from the criteria when comparing their performance levels. The Taxonomy's disclosure of capital expenditure associated with transition plans may assist firms in attracting investors looking for taxonomy aligned investments, hence assisting companies in accelerating the transition to sustainability. Retail investors, institutional investors, and banks are all interested to invest in firms that comply with the EU Taxonomy. Larger institutions may also be motivated to fund this Taxonomy-aligned economic activity via loans. As a result, when asking for credit facilities, these firms may benefit from a lower interest rate if the credit is used to pay Taxonomy alignment initiatives. (European Commission, 2021b, p. 10)

## Taxonomy's Challenges in the Private Sector

### Reporting

The challenge for companies is that the reporting has an uncertainty of what its relevant data and which is increasing the unnecessary costs of reporting. The European Commission has acknowledged that the current situation with the expanding gap of sustainable information between companies providing the information and the needs of intended users of that information is not ideal for the companies and produces unnecessary business costs. The regulations requiring disclosures have been too broad and lack precision with the requirements as to what information exactly should be reported and experiencing difficulties in getting the information from the suppliers and clients and investee companies. Moreover, there have been requests from the companies to provide more detailed sustainability information over what is legally required. The European Commission is therefore driving the new disclosure regulation to undertake the problems of the reporting and aiming to reduce the unnecessary costs of sustainability reporting for companies and to enable them to meet the growing demand for sustainability information in an efficient manner by bringing clarity and certainty on what information to prepare and what information to gather from the suppliers, clients, and investee companies. (European Commission, 2021d, p. 3; 4)

The EU Taxonomy standards apply to all businesses and projects in the same way, regardless of their size or possible negative environmental impact. With the CSRD, more businesses are required to report their alignment, and smaller businesses, who likely lack in-house knowledge, may be especially disadvantaged, for example, when analysing the alignment of the EU Taxonomy and associated implementation issues and costs. A lack of consideration for project size and greater expenses for smaller initiatives might make green projects less appealing.

### Acting Globally

The EU taxonomy will impact non-EU companies, given the global nature of financial markets and trade flows. For example, a non-EU investor or financial advisor offering products in Europe is subject to the SFDR, which requires alignment with the EU

taxonomy of investment products. In addition, a non-EU company with EU-based investors will likely be required by these investors to provide information about the company's alignment with the EU taxonomy. (BNP Paribas, 2021)

Another challenge in evaluating the alignment with the EU Taxonomy would be a result of European firms' strong presence on the world stage, as the taxonomy regulation itself depends on European law, labelling and certification systems, and environmental regulations, which adds complexity to the reporting process. There is a barrier to providing data and acquiring the taxonomy alignment. Because of the challenge of worldwide comparability, the rules are not generally accessible everywhere. Furthermore, not all third parties have signed the ILO Declaration on Fundamental Principles and Rights at Work, which is one of the foundation requirements for taxonomy alignment, which may make it difficult to obtain reliable information from these parties and, if received, may not be directly comparable. The risk is seen if economic activity's information cannot be proven the alignment would have to be disregarded. (ICMA, 2022, p. 14)

Reporting and comparing challenges arise not just with enterprises operating abroad, but also inside the EU, due to differences in local regulations or even calculating procedures. While the EU Taxonomy should give clarity and unify assessments of sustainability, due to differences in methodology, it can be difficult to compare key performance indicators from one organisation to another. Furthermore, indicators may not always include sufficient explanations to allow for a fair assessment of the data's quality and breadth. Because, even if data is available, it may not be integrated across a single firm's multiple economic operations or across the various companies in an investment fund's portfolio. (OECD, 2020)

### 3.3.2. Impact on the Investor Relations

**Investor Relations**

Traditionally the capital market participants have tended to make decisions only based on factual and accurate financial facts; however, in light of today's increased awareness of non-financial variables have a greater effect on corporate market success and hence affect investment decision making today. If a company wishes to enhance its market

performance by acquiring investor trust, it should consider its Investor Relations (IR) function to be more than just a reporting tool. The number of media sources reporting on the corporation has increased, as has the frequency of trade. Increasing media attention is seen as critical by IR practitioners. It is generally said that media coverage improves the company's reputation, making it a useful tool for communicating with retail investors and recruiting as well as maintaining buy-side investors and analysts (Bushee & Miller, 2012). The image-shaping function of investor relations practitioners must understand which parts really reach and affect their target audience, in other words, IR's image shaping function. By seeing investor relations as the management of essential stakeholder interactions - those between a business and capital market participants - it is feasible to have a clearer understanding of its strategic role and responsibilities. Indicating that IR's image-building role is more involved than just revealing financial information. The capital markets analyse a company's worth based on information from the IR department on customer and employee satisfaction, branding, customer service, staff turnover, and lobbying actions. (Hoffmann & Fieseler, 2011)

As a result, in order to meet the climate objectives, businesses must be upfront about their long-term environmental goals and sustainability concerns. (Kemfert & Schmalz, 2019, p. 240). Environmental, social, and governance (ESG) factors are all taken into account when making an ESG investment decision, such as a company's annual report on its resource use and emissions, its social structure and behaviour, its anti-corruption and diversity initiatives (Lentfer et al., 2021, p. 17). ESG has emerged as a clear trend in financial markets, putting a greater emphasis on social and environmental factors than just financial ones (European Commission, 2022e, p. 5). Indeed, there has been a shift in investor behaviour, with many increasingly believing that it is in their best interests to invest in long-term solutions. Pension funds are now extensively involved in the fossil fuel industries; however, there has been a shift in investing behaviour as a result of the fossil fuel divestment campaign. The market's expectation of the risk of fossil fuel return has decreased. As a consequence, these invested capitals are seeking a higher return-on-risk investment in products like sustainable economic activities. (Carlin, 2021).

The goal of the EU Taxonomy is to give data to investors to assist them in making investment choices, to establish a standard terminology and common understanding for green operations, and to be really science-based. The data given by the corporations will

be made public, and anybody with interest in them will be able to view it. The EU Taxonomy attempts to give a portfolio that assists in identifying the transition sector since those operations that do not attain a low carbon or green level are those that need transformation. The EU Taxonomy is the first of its type to cover transitional activities, with the goal of assisting those economic activities in reaching near-zero levels. This enables investors to engage in areas that are usually seen as non-sustainable and therefore would not generally be included with the green funds, such as the steel or concrete industries. Because the Taxonomy has sparked great interest throughout the globe, there is a need to make it more internationally compatible. When future taxonomy regulatory advancements occur in other nations throughout the globe, the EU Taxonomy should be adopted as a framework. While having uniform taxonomy rules, investors all around the globe may depend on data that is comparable to other taxonomies. This might, for example, assist investors in comparing various corporations or financial institutions. (Climate Bonds Initiative, 2021b)

The EU Taxonomy poses various hazards to businesses, one of which is that if their activities are not included, they may be mistakenly interpreted as not being environmentally friendly, making it more difficult to attract investors. While some activities are now seen as environmentally friendly because they meet certain criteria that are expected to become more stringent in the future, the risks associated with suppliers based outside of the EU who are unable to meet those criteria and/or provide sufficient information about their activities could pose significant reputational and business risks in the long term. If environmental standards are not followed, companies run the possibility of being fined, which hurts their image. Regulations and initiatives related to climate change could alter the availability and use of certain energy sources, such as gas, nuclear energy, or biofuels, and raise the cost of raw materials and energy. They could also lead to new taxes and tariffs and alter the attitudes of our stakeholders, all of which could have an impact on the operations and business environments of the company and its customers. Taxonomy regulations might have a negative impact on investors' interest in the long run if economic activity and services are not regarded as ecologically sustainable.

Because of the risk, investors are likely to invest in areas where there is more granted to be green in the future, such as wind and solar, rather than areas where the decarbonising is more urgent. (Economist, 2022)

### 3.3.3. Effect on the Research & Development

**Background**

Energy system transition entails more than just switching to a new source of energy; it also entails ensuring that energy is utilised effectively in all sectors. Demand-side management, in addition to resolving current difficulties, may help to maintain the long-term security of energy and material supply. Efficiency will be enhanced in the medium and long term via the utilisation of new technologies, recycling, and a circular economy. Some of the factors restricting the development of sustainable technology include high capital expenditures, ageing power infrastructures, and a scarcity of appropriate land and water supplies. The energy transition requires significant R&D and public investment to drive innovation in all domains, lower prices, and increase the amount of renewable energy in the energy mix. To meet the environmental objectives, R&D efforts must be increased to improve material and product efficiency, create alternative resources, improve the efficiency of mining critical minerals, improve the efficiency of material processing and production, and advance recycling technologies. In addition to supporting the green energy transition and international collaboration, policymakers should concentrate on strengthening research and innovation by encouraging green funds devoted to R&D. (IRENA, 2022)

Carbon neutrality plans to place a high value on supporting new ideas and technologies, but in the years leading up to 2020, government and business expenditure on energy R&D began to diverge. As part of their efforts to achieve net-zero emissions, major economies have emphasised innovation and increased financing. When it comes to protecting the global economy from the pandemic, governments have an important role to play. Spending on public energy R&D, including demonstration projects, is expected to rise to USD 32 billion in 2020, a modest increase of roughly 2%. All energy technologies continue to expand at a slow pace, but investment in low-carbon energy is increasing at a quicker rate. In 2020, corporate research expenditures in energy-related sectors are expected to fall by roughly 2%, totalling around USD 89 billion. The impact of the Covid-19 pandemic on other energy innovation investments has not yet been established. To speed up innovation cycles and achieve net-zero objectives, universities, businesses, governments, and the financial sector will need to work together closely. To complete a

portfolio of demonstration projects by 2030, the IEA states that USD 90 billion in public investment must be mobilised now. (IEA, 2021e, p. 50-58)

**What traditionally drives R&D**

Traditionally companies R&D is influenced by the market, as pointed out earlier about the Covid-19 negative impact on private sectors investments in R&D. This results in lower R&D investments when product market uncertainty is high; however, this influence diminishes when market strategy rivalry is more intense and major enterprises are involved. It is more advantageous for businesses to wait and do nothing if they face a greater degree of demand uncertainty when it comes to R&D investment, which is why enterprises' responsiveness to demand shocks is substantially lower at higher levels of uncertainty in this area. Investment is projected to fall after a negative demand shock because each business would spend less. (Bontempi, 2016, p.254)

**How EU Taxonomy drives R&D**

In light of how the EU Taxonomy can drive R&D investments, we arrive at the very foundation of the taxonomy. The EU Taxonomy's technical screening criteria for determining whether economic activities may be called ecologically sustainable are heavily reliant on practical knowledge from science. The European Taxonomy's aim, reliability, and neutrality will be enhanced further if the scientific and research community is involved. With respect to climate change mitigation and adaptation, Research and Innovation (R&I) has been designated under the Delegated Act as an "enabling activity," referring to its ability to enhance another economic activity via the use of the technology it offers. Greater private investment in ecologically friendly economic activity will be pushed on by the EU Taxonomy. Due to the growing availability of green financing, Research and Development (R&D) focused on those economic activities would benefit. (European Commission, 2021f)

While getting more public funds involved in activities research and innovation, it has been announced that the European Investment Bank's Climate Awareness Bonds would be expanded to include research and development initiatives that focus on climate change adaptation and mitigation. Enabling and transition activities need the inclusion of R&I

within EU Taxonomy, in order to provide a degree of flexibility, classification and reporting will be critical. R&D will play an important role in establishing and determining the criteria, notably in terms of transition activities. As a result, both private investors and the public sector will have a more favourable environment in which to make long-term investments. Environmental protection is a key component of the Green Deal, but it is also a growth strategy that includes investments in R&D and new markets for low-carbon technology. The success of the industry's climate transition towards the goals of the Paris Agreement depends on innovation. Furthermore, the EU Taxonomy and sustainable finance framework will play a vital role in supporting technological innovation under the Green Deal through mobilising private financing for sustainable industrial R&I and filling the funding gap toward EU climate and environmental targets. (European Commission & Directorate-General for Research and Innovation, 2021)

Because R&D has always been driven by the market, it is more vulnerable to the uncertainties that surround it. However, an increase in public funding may have a positive influence on R&D, and when harmful activities are included in the EU Taxonomy, this may help identify areas that require rapid development and additional funds for R&D in environmentally friendly activities.

# 4. Conclusion

## 4.1. Discussion and Results

The final chapter will summarise the study's findings in light of the study's objectives, research questions, usefulness, and contribution to the field. It will also discuss the study's weaknesses and offer future research directions. The study's purpose was to get an understanding of EU Taxonomy legislation and how it affects the private sector, as well as to investigate the energy transition and how the EU Taxonomy can influence it. This thesis demonstrated that the EU Taxonomy has the ability to speed the energy transition both directly and indirectly by analysing how energy transitions in different eras have developed and been influenced across time. The results were achieved by analysing how the EU Taxonomy will evolve in the future as the framework for other environmental policies and by the development of the Taxonomy regulation itself, by including more businesses in the sustainable standards and directing more investments toward environmentally sustainable development.

The energy transition has received a great deal of attention during the last two decades. In fact, the energy transition is defined as a transformation from one energy source to another with a greater effect on social, economic, and regulatory development. Today, we are seeing a shift to renewable energy, which is driven by environmental concerns since burning fossil fuels contributes to climate change and global warming. The global challenge is to limit climate change and global warming in line with the Paris Agreement, which necessitates quick adjustments and solutions; nevertheless, the features of any energy transition are that it takes decades to completely migrate from one energy source to another.

To accomplish and accelerate the energy transition, effective climate policies that establish benchmarks and road maps towards climate neutrality and mobilise funds towards renewable solutions are critical. Furthermore, policymaking may influence the energy market to favour renewables by pushing technological advances to increase energy efficiency and move toward renewable energy sources, as well as public opinion urging greater measures and involving people in the energy transition. The energy transition is required due to rising global energy demand caused by expanding population

and urbanisation. The supply must be done in an ecologically friendly manner, which cannot be reached by burning fossil fuels.

The energy transition will alter the geopolitical landscape, resulting in winners and losers. Empowering mineral-rich countries that are critical for renewable technologies, enhancing energy security by being more self-sufficient in energy production and being less dependent on imported energy, and therefore less sensitive to price fluctuations. Increasing economic power through exporting renewable energy technology and experience, as well as surplus renewable energy power that may be exchanged with neighbouring nations. As fossil fuel energy sources grow less essential and countries become less dependent on fossil fuels, the energy transition affects those nations that have large fossil fuel resources and rely on income from them. This means that these nations will have to reconsider how to replace their earnings or risk stagnating their economies. Those that rely significantly on fossil fuels are likely to experience socioeconomic challenges and will need extensive assistance to change.

There are obstacles associated with the energy transition, one of which is that the energy transition must be a just and fair transition, or it will be impossible. Climate change and climate disaster are global issues that must be addressed by everybody. Everyone is at a different stage of the energy transition, and the meaning of the energy transition is distinct for each nation. The fundamental goal is to transition to ecologically sustainable energy production and consumption. Some countries will make the renewables transition quicker than others, while others will need to frog leap over petroleum energy resources directly to renewables. Just transition is ensuring that the energy transition does not result in carbon locking, where the socioeconomic burden would be too big to overcome, negatively impacting regions and communities. The fair transition must be considered while developing policies and recognising complicated socioeconomic concerns.

One of the transition's primary obstacles is financing the energy transition. The present trend of investment in economic activities that contribute to the energy transition and environmental objectives falls well short of what is required to achieve global carbon neutrality. Policies will help to boost finance for the energy transition, but they will also slow it down; for example, fossil fuel subsidies are postponing the shift. Subsidies are distorting the energy market, and the reasons for them are largely socioeconomic in

nature. Instead of subsidising the fossil fuels industry, policymakers should focus on diverting subsidies to address the socio-economic challenges that arise from the elimination of the fossil fuels sector, as well as fostering job creation and helping in the energy transition. It is vital to remember that public monies cannot replace the investment gap alone; policies that attract private equity to engage in the transition are also required. The Sustainable Finance Framework and the EU Taxonomy are steps taken by the EU to encourage corporate investment in ecologically sustainable industries.
EU Taxonomy, in short, helps investors invest in sustainable operations by offering clarity and transparency regarding sustainable information. EU Taxonomy recognises environmentally friendly economic activities that contribute to EU environmental goals. There are four conditions that must be completed to achieve the taxonomy's alignment.

First, the EU Taxonomy includes six environmental objectives, and the economic activity must contribute significantly to one of the environmental objectives, climate change mitigation, adaptation, sustainable water and marine resource use and protection, the shift to a circular economy, pollution prevention and control, and biodiversity protection and ecosystem restoration. From this viewpoint, the most important aims are mitigation and adaptation. For the rest three conditions, the economic activity or project must meet Do No Significant Harm (DNSH) criteria, basic social safeguards, and technical screening standards (TSC). The TSC defines "substantial contribution" for each environmental aim and creates thresholds for each environmental goal. Based on DNSH, economic activities must not impair other environmental goals to be linked with the taxonomy, even if they contribute significantly to one or more of those goals. If this is the case, they cannot be aligned. Finally, the activity or project must meet the requirements of minimum social safeguards. The minimum social safeguard criteria are based on the UN Guiding Principles on Business and Human Rights, the OECD Guidelines for Multinational Enterprises, the principles outlined in the International Labour Organization's Declaration on Fundamental Principles and Rights at Work, and the International Bill of Human Rights.

The only legal requirements set by the EU Taxonomy are the disclosure reporting from relevant participants. Starting with the EU's Sustainable Finance Disclosure Regulation (SFDR) requires market participants to notify when a financial stock is offered as a sustainable investment. Currently, companies with more than 500 employees are

obligated to report their taxonomy alignment under the Non-Financial Reporting Directive (NFRD). However, in the future, this will be extended to include Small and Medium-sized Businesses by the upcoming Corporate Sustainable Reporting Directive (CSRD).

According to the research findings, the EU Taxonomy can help speed up the energy transition by creating a foundation for other environmental regulations that use the taxonomy as a guide to what is in line with the environmental target and directing funding toward activities that are truly contributing to the European environmental goals. It is likely that the inclusion of additional businesses and the inclusion of more transitional activities would speed up the transition under the impact of EU Taxonomy. With tougher EU taxonomy standards in place, the energy transition may be observed to be accelerated by the development and upgrade of less polluting technology. This may be considered as quickening the process of improving their operations to make them less harmful and more sustainable, especially when the regulation includes neutral and harmful activities.

The findings suggested that the EU Taxonomy is not yet completely ready since the relevant parties are having difficulty providing specific information due to the lack of clarity in the law. Lack of clarity, and greater inclusion of small and medium-sized businesses may raise needless reporting costs due to a lack of in-house knowledge. The taxonomy is particularly difficult for enterprises that are not linked with or within the scope of the rule since they are mistakenly seen as not environmentally friendly, incurring reputational harm, and making it more challenging to recruit investors. Furthermore, for European enterprises that operate and trade outside of the EU, the taxonomy burdens them with data collection and comparability, posing additional obstacles. If there is no way to validate information, it cannot be complied to be aligned with the taxonomy. Finally, the evolving taxonomy includes some future risks, particularly in transitional economic activities. If companies are looking for long-term investments, they are included in the taxonomy, but if the criteria change and they will not be there in the next revision, risking operation and business costs and making it more difficult to attract investors.

An essential part of the energy transition is Research and Development (R&D). In times of disruption and uncertainty, like the recent epidemic of Covid-19, private sector

spending for R&D is affected, according to the study's findings, mostly by market demand. An important function of the EU Taxonomy is to include Research and Innovation (R&I) as an enabling activity, which may help to address the shortfall in finance for the energy transition.

## 4.2. Limitations of Research & Future Research Direction

There are two significant limitations to this research; first, as a result of the amount of time that was dedicated to research was limited, leading to limited results for the impacts of the EU Taxonomy. Second, since the EU Taxonomy Regulation is a new regulation, there is a scarcity of information and study on it as a whole. Delegated acts and revised rules are routinely published by the EU for the EU Taxonomy as it is currently being developed. Based on the European Union and its taxonomy, this study is focused on the EU. An in-depth investigation of the EU Taxonomy's effects and effectiveness is limitedly feasible at this time. The EU Taxonomy Regulation has had a limited impact on the financial market. However, further study on the impact of the EU Taxonomy Regulation and the status of global taxonomy synchronisation are still viable alternatives because of these restrictions.

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