21st Century energy and legitimation of new industries: Innovating for and legitimating the bio-economy – A study of the European Green Transition

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Abstract

The literature around legitimation explores the creation and implementation of change at several levels. Associating legitimation to the green transition allows us to understand when it was created and where the implementation has occurred, or not, why, and who is responsible for it. Since legitimation is such an important topic in the academic world of business, the exploration of its association to such a current issue as the implementation of the green transition is a very relevant approach to understand it further. The connection between the green transition and legitimation is what is explored in this thesis, through the energy sector.

To do so, this research focused on identifying the historical presence of the green transition through an analysis of the most important documents and strategies affecting it. Associated to these documents are actors who create and implement them at several levels of society. Considering the transition affects all planes of society, including industry and institutions, the research tried to gather the insights from actors of said planes. Thus, regulators, innovators and integrators were defined and engaged with in order to understand how the green transition is being perceived by experts. Interviews were set up with representatives of the energy sector from higher international institutions and governments; successful, green-oriented businesses; and activist or media-related NGOs or institutions.

The insights from these experts showed the main factors associated with a potential delay in the green transition. Time and reaction are considered, in this thesis, as the two main factors contributing to the delay of the green transition's energy sector. As such, the research focused on understanding the underlying events that cause such delays and whether the processes can be improved through the exposition of their framework.

Alongside the actors' inputs, the theoretical lens of the institutional genealogy took a front seat in the observation and guidance of the train of thought in this research. Focusing on understanding the history of incumbents and their effect on allowing the current green transition to flourish, the institutional

genealogical lens synergized with the profiles chosen and with the historical approach that set up the research. It gives a historical categorization, via policy proxies, of the events that marked the green transition and how the current events contrast with older ones.

Therefore, this research tries to look at the green transition's energy sector through the eyes of the current actors' insights while keeping in mind the incumbents that generated the current issues and which are still present in the transition. Without attributing any fault, this thesis attempts to show the current progress of the green transition's energy sector and uncover potential factors that affect its speed. As a final contribution to knowledge, the thesis provides a tentative framework of the influential actors and their relationship with legitimation regarding the legitimation of the green transition through the energy sector.

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Author's Declaration

"I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution."

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Signature:

Chapter 1: Introduction

This thesis explores the actors and factors that affect the legitimation of the green transition while providing a historical overview of the energy mixes and associated policies. The topic of the green transition emerges from the development trajectories of many western industrialized countries. Much of the terminology associated with the energy transition, such as climate change, greenhouse gases, fossil fuels, carbon neutrality, bioeconomy, have emerged as constituent parts of what constitutes a change in our behaviors towards the generation of energy and economic production. Consistent within this is the recognition that carbonized growth has resulted in significant environmental damage which cannot continue.

The European Green Deal is one of the major policies created by the EU as part of transitioning the main type of energies used for electricity where decisionmakers have established limits and steps towards the adoption of the best possible scenarios while maintaining commodities as the population is used to. The movement towards the green transition began in Europe through the implementation of policies at both international and national levels. Funding was also promoted to instigate innovative approaches to the problems found and to involve the scientific community as one of the most the most vocal groups in the process. As part of this process of legitimation, the scientific community played a critical role in establishing the need for the transition, but it requires more than just scientists to ensure it continued. As a result, policymakers, businesses, and advocates are critical components of the shift towards this transition.

The shift towards the green transition started initially with the Kyoto Protocol, which defined legally binding greenhouse gas limits for the signing parties. This was the first global initiative to advocate and recognize climate change as a planetary concern and which was recognized by the world's powers. Though the Kyoto Protocol started an important step regarding the green transition, its full realization has not yet been achieved. Several current events have triggered a greater response from the world leaders and, especially, from the EU, in the green transition. This response at the EU-level has been somewhat

uncharacteristic due to the usual tendency to be slower and more resistant to big paradigm shifts. However, the conditions of energy availability and the population's discontent with rising energy costs have caused the EU to move faster than usual. As such, we have seen policymaking focusing on the energy sector and on how to transition to new energy mixes that guarantee more energy security and independence (e.g. Fitfor55 package and REPowerEU).

Policymaking plays a crucial role in legitimizing the green transition and is a key focus in transition and sustainability research. In addition to policy, other important factors—such as financial support for innovation and considerations of social justice and fairness—are also integral to the green transition. Given the significance of these three elements in legitimating the energy sector, this thesis aims to explore whether they were truly essential to the transition, how frameworks incorporating these factors can be identified, and ways in which they could be improved.

The assumption this thesis makes is that the actors – who are termed as regulators, innovators, and integrators – highly involved in the identified factors – abovementioned aspects - are essential to achieve the full legitimation of the green transition in the energy sector. In identifying these actors as critical to the green transition, the work underpinning this thesis sought to engage the representatives of those factors in order to provide insights into their experience regarding the importance and impact of said factors. To determine the importance of the factors and associate the relevant actors to the legitimation of the green transition's energy sector, the thesis proposed the following questions:

- *What are the strategies used for the legitimation of the energy sector?*

Addressing this question means exploring the means through which institutions and global leaders have developed strategies for the new energy paradigm, alongside the events and documents that generated enough disruption to cause change. To answer this, this thesis explores the historical definition and representation of the several types of energies considered for the green transition and how they are represented in the literature and several EU

countries. To do this, the research focuses on secondary data analysis through reports, literature and policies.

- *In what way, if any, do policymakers and other relevant profiles help legitimize the energy sector?*

Although policymakers are critical in legitimation frameworks, given the inability to fully legitimate the implementation of the new energy sector for the EU's green transition, it could be implied that policymaking is insufficient in delivering on such a big ask. This research theorizes that the involvement of other actors is necessary for policymaking to achieve its full potential in a continuous gestalt which reinforces itself through the various actors' involvement. To evidence this, the research for this thesis collected data from actors directly involved in the energy sector and who represented each of the three profiles/sectors: policy, industry, and society.

- *How has society adapted to the new energy sector?*

The implementation of a new energy paradigm requires major changes to the *status quo,* including how society received it and the institutions and powers that govern it. Since society and its preservation is what this change is for, showing how it reacts towards the transition is valuable. The communication among the actors involved in all the steps towards the green transition culminates in how society adapts and incorporates those new strategies. Thus, it is important to understand how the institutional policymaking and the innovative energy ecosystem take into consideration societal response to such change. As part of the primary data collection for the profiles' effects, data was also collected in that same sample regarding this question.

Addressing these questions requires a multi-system and multi-factorial analysis that incorporates a temporal element. Based on this, the thesis sets up the historical context of the green transition in order to provide guidance towards the influential actors. It then proceeds to present a fully-fledged framework describing the processes (i.e., factors) that occur in the green transition's ecosystem which potentiate the appearance of actors that can have impacts in

the legitimation of the new energy sector. This is done via the actors' reactions and the impact of time and temporality in the actors, their reactions and in the legitimation effects themselves.

1.1 What the legitimation of the energy sector needs

1.1.1 Continuous & Adaptive policymaking

To understand the legitimation of the energy sector in the context of the green transition, we need to consider the policies supporting this transition. The European Commission's ambitious "Fit for 55" initiative represents a comprehensive strategy aimed at enabling the European Union (EU) to achieve a 55% reduction in greenhouse gas emissions by the year 2030. This policy came about in the summer of 2021, and it includes legislative proposals designed to guide the EU and its 27 Member States. This legislative pack encompassed proposed laws on renewable energy, energy efficiency, energy taxation, the EU Emissions Trading System, alongside other areas. Several of the changes have already occurred throughout the course of this thesis. One such example is the Renewable Energy Directive II (REDII) being revised into REDIII as part of the REPowerEU's initiative. The Energy Efficiency Directive (EED) is yet another example of a revised document that reflects the changes needed for the transition to occur. The EU initially committed to sourcing at least 32% of its energy consumption from renewable resources and achieving a 32.5% improvement in energy efficiency by 2030. However, in 2022, Europe set even more ambitious targets: increasing the renewable energy target to 45% and aiming for a 40% reduction in final energy consumption, with a 42.5% reduction in primary energy consumption (based on 2007 projections), by 2030.

The European Green Deal (EGD) set the stage for the transition in December 2019. Initiated under the leadership of then Commission President Ursula von der Leyen, the EGD marks a pivotal commitment by the European Union towards prioritizing the energy and climate transition. This ambitious plan, however, faces substantial challenges. One concern is how Member States are able to pursue it while possessing differing priorities, in turn threatening to compromise the unified pursuit of the European energy transition. These divisions are further

exacerbated by the varied interests of the Member States, especially in the context of the post-COVID-19 economic recovery, which has sparked debates over the role of the energy transition in Europe's future.

Another dimension of the Green New Deal's impact lies in its potential to reshape the EU's external relationships, particularly with sovereign energy suppliers like Russia. In addition to setting the ambitious targets set by the Green Deal, the EU is coupling its internal efforts with a strategy of "climate diplomacy" (Aguilar & Patermann, 2020; Hafner & Raimondi, 2020). This approach aims to extend the reach and effectiveness of its climate actions by fostering positive engagement with other regions and countries. The need for such a rationale stems from the realization that, without global cooperation and similar commitments from other parts of the world, the EU's efforts might not achieve their desired global impact. The United Nations Climate Change Conference of the Parties (COPs) that occurred after the policymaking events have been a stepping stone towards these goals, with COP26 and COP28 providing examples of such efforts becoming legislative, global commitments. Moreover, there's a risk that, in isolation, these efforts could inadvertently place the European economy at a disadvantage by increasing energy costs. Therefore, the EU''s strategy seeks not only to lead by example but also to encourage a worldwide shift towards sustainable practices, ensuring that its pursuit of climate neutrality contributes to a broader global movement and mitigates potential economic drawbacks. Legitimation of the green transition and energy is therefore a key plank of this work.

The transition offers both challenges and opportunities for redefining these energy dynamics, suggesting pathways for collaboration, such as the conversion of natural gas into hydrogen and the subsequent storage or utilization of CO_2. This approach not only maintains the energy dialogue between the EU and Russia but also aligns with the broader objectives of the Green New Deal by promoting sustainability and reducing carbon emissions. Furthermore, the EU is positioning itself at the forefront of the global energy transition, with the ambitious goal of becoming the world's first climate-neutral continent by 2050. The vision of a carbon-neutral Union remarks a profound transformation for both European

society and its economy, reflecting a deep commitment to scientific knowledge by addressing climate change and reducing greenhouse gas (GHG) emissions.

It was in response to the urgent need to reduce dependency on Russian gas, particularly highlighted by the REPowerEU initiative, that the EU further pushed forward with the energy sector of the transition. The European Commission increased funding for decarbonization projects under the Innovation Fund, aiming to double the funding for its 2022 Large Scale Call to approximately €3 billion. This increase in funding is part of facilitating the transition to greener energy alternatives across key industries such as energy production and storage, iron, steel, and cement and their production. While the Green New Deal sets a course for Europe's climate and energy future, its successful implementation has made progress through the complex interplay of internal divisions, public sentiment, and international relations. A further requirement of more support that is essential to the energy transition is in policy, industry and society.

Amidst these developments von der Leyen emphasized the importance of addressing current energy challenges, including soaring energy prices and the necessity for an electricity market reform. von der Leyen outlined forthcoming measures aimed at reducing electricity consumption and proposed a cap on the revenues of low-cost electricity producers to support citizens financially, with more current speeches having focused on European security and defence. The European response through initiatives is part of a broader response to the correlated challenges of the Ukraine conflict, energy security, and the climate agenda, signalling a pivotal moment in the EU's journey towards decarbonisation and enhanced energy security. As the EU navigates the complexities of these initiatives, the collective effort to reshape its energy architecture in the face of geopolitical tensions and climate imperatives is significant in its attempts to a sustainable and secure future

1.1.2 Societal Involvement & Acceptance

At the heart of the energy paradigm transformation is the significant shift from carbon fuels such as coal and natural gas towards cleaner, more climate-friendly, energy sources. Despite the increase in renewable energy usage from

4% in 1990 to 14% in 2017 within the EU-28, fossil fuels still accounted for 74% of the primary energy supply in 2017 – a major source of these emissions - seeing its share in the primary energy supply drop from 26% in 1990 to 13% in 2017 (Hafner & Raimondi, 2020).

The European Green Deal possesses certain complexities that are associated to technological and economic factors which directly impact socio-political dimensions, thus leading to societal and policy change. In this context, the role of society and social movement in the energy transition can have an impact in its legitimation. “Energy citizenship” is a concept that was born with the EU’s new energy direction and emphasizes the role of the public in actively engaging with the energy transition, highlighting the importance of awareness, responsibility, equity, and justice (Ryghaug et al., 2018). It provides a framework for understanding the various ways in which citizens are becoming involved in the energy transition, whether as consumers, participants in protest and support movements, or as prosumers contributing to a decentralized energy system.

However, the involvement of social movements in the energy transition remains an underexplored area within the sustainability transition’s research. A deeper understanding of the influence of social movements is essential, especially given their potential impact on future energy systems through mechanisms like protests and community energy landscapes. Social movements play a crucial role in the political and cultural processes that lead to the destabilization of existing socio-technical regimes, advocating for energy democracy and energy justice, and emphasizing the human aspects of the transition.

The impact of military conflicts in shaping energy transitions has an effect in all the identified essentials of the legitimation of the green transition: policy, industry, and society. The two world wars significantly accelerated the shift towards oil-dependent societies, driven by the demands of total war via technology developments, infrastructure growth, and institutional frameworks. This period marked the first deep transition, illustrating how external shocks, such as wars, can dramatically influence the direction and pace of sociotechnical transitions. The war-induced imperative for oil integration at several levels of society disclosed the interconnectedness of energy, food, and

mobility, catalysing the post-war economic boom fuelled by fossil fuels, especially the intense reliance on oil sources.

The European Green Deal, as a revolutionary and pioneering plan, faces hurdles from popular opposition, highlighted by protests such as those by France's *gilets jaunes* (or "yellow jackets) or the more current farmer protest movements in several EU countries against what is viewed as an unfair energy transition. These movements underscore the fears among certain segments of the population that the energy transition, along with the accompanying economic and industrial shifts, may negatively affect their livelihoods and job security. The challenges presented by the transition away from carbon-based energy sources highlight the potential socio-economic impacts, notably job losses in traditional energy sectors. Estimates suggest that job losses in power plants and mines could reach 160,000 by 2030 due to European climate policies (Hafner & Raimondi, 2020). This and other factors impacted the decision of the EU's speech regarding the energy transition to always include a "fair transition". Only under a fair transition can coal-dependent regions (such as Poland) be allowed to be able to, economically and socially, support their national paths towards more climate-friendly energy sources. The achievement of new energy systems can only be through comprehensive strategies to mitigate negative employment effects and social resistance.

As a response to the "fair transition" issues, part of the big EGD implementation policy efforts mentioned before, the Modernisation Fund, a European policy tool that supports the energy system modernisation efforts of Member States with lower GDP per capita, played an essential role in aligning Member States' expectations with national reality. With proposals to increase the fund's size to accommodate the heightened climate ambitions of the EU, this initiative shows the commitment to multi-area support across Member States, particularly in addressing energy efficiency and energy poverty, thus combating fears of the public and political domains.

1.2 Research gaps

Whilst significant policy action from the EU is required to improve the environment, the continuously shifting conditions and new challenges require a constant policy reaction in order to keep up with such a change (e.g. REPowerEU; (European Commission, 2022; Kuzemko et al., 2022; Mathiesen et al., 2022)). The same can also be said for industry and society, as they also must react in order to keep the policymakers in check regarding their ambitions and how those affect the lives and livelihoods of many sectors and populations (Andersen & Geels, 2023; Hatch et al., 2017; Rodríguez-Pose & Bartalucci, 2023; Skjølsvold & Coenen, 2021). The green transition is part of a complex network of actors and documents, and the literature posits that there is yet to be a full body of research that connects these dots (Bitektine & Haack, 2013; Firdaus & Mori, 2023; Fischer & Newig, 2016; Köhler et al., 2019; Thompson, 2018). Thus, focusing on the interactions and how actors behave within the institutional arrangements they operate within is key to understanding the legitimation aspect of the transition. It is therefore important to understand the institutions directly responsible for legitimating the transition, how they change throughout the decades of the legislative action regarding energy, and how they are acting and reacting in the current context.

This thesis focuses on legitimation of the energy sector in the green transition while focusing on the trinity of actors that are essential for its implementation: policymakers, industrial players, and society (Andersen et al., 2023; Andersen & Geels, 2023; Fischer & Newig, 2016). As such, this research considers a) the legitimation strategies' application to the integration of different types of energy sources in the new energy mix (special focus on the policies legitimating the transition up until now); b) the identification of actors and their roles in the legitimation of the new energy sector; c) the identification of factors that influence the actors and their legitimation capacity; d) how actors and factors relate with legitimation within the ecosystem of the green transition's energy sector. The research uses an institutional genealogical lens in order to provide a historical overview of the incumbents and new players that are affecting the legitimation of the green transition (Foucault, 1977; González-Santos, 2020; Lockwood et al., 2017; Phillips, 2002; Pike et al., 2015).

a) The legitimation strategies' application to the integration of different types of energy sources in the new energy mix (special focus on the policies legitimating the transition up until now)

Addressing gap a) is best approached through examples of national implementation of policies supporting the various types of energy accepted in the green transition. This requires establishing the connection between global strategic policymaking (for example at the UN level) and the European level (Energy Transition Commission, 2020; Furness & Keijzer, 2022; Hafner & Raimondi, 2020), and, finally, at the Member-State level (De Besi & McCormick, 2015; Dietz et al., 2018; Sareen et al., 2020). The importance of this gap in the literature is that, as is oftentimes mentioned, the transition is a multi-factorial, multi-level, and multi-dimensional endeavour (Andersen & Geels, 2023). To find out what needs the scientific community's attention, one must show other pathways have already been tested and the relationship between such pathways to current approaches and policies. Many forms of alternative greener energies were applied at varying levels of success in various EU countries, but the importance of this gap is to demonstrate that there were successful attempts at national implementation through policymaking and associated funding, thus connecting the several actors and factors involved in the energy sector's legitimation to date (Sareen et al., 2020; Thompson, 2018).

b) The identification of actors and their roles in the legitimation of the new energy sector

In uncovering the ways in which legitimation activities connect to contribute to the green transition's implementation, the logical path is to understand who is able to do what and via which institutions. This is because, given the theoretical lens of institutional genealogy, understanding the institutions' evolution with the green transition as a chronological background and influence on the legitimation of the transition can help unveil otherwise potentially missed dynamics. As institutions are made of human capital, there is a connection between the actors and the institutions themselves (Bejinaru et al., 2018; David, 1994; Énergies, 2016; Lockwood et al., 2017). Actors represent institutions and their intents, so the roles and adopted strategies are also a reflection of the actions that represent the legitimation of their outputs, with the green transition being one of them (Di Maria et al., 2017; Garud et al., 2011; Li et al.,

2017; Morgunova & Shaton, 2022). This gap is essential to determine the actors that are actively legitimating the green transition via the energy sector. Actors can come in many forms, and the segregation in literature of each type of actor is in contradiction with self-reflections that indicate a lack of communication and interaction between the affected sections of society and the catalysers of change (Köhler et al., 2019; Sareen et al., 2020). This gap, in this research, underpins the analysis of the interconnectedness of legitimation actors via the factors that unite their actions.

c) Identifying factors that influence the actors and their legitimation capacity

Actors legitimate the energy sector of the green transition by themselves, but, unaware of it, they are, sometimes, driven by similar motives. Legitimation, as a concept, is already complex and multi-factorial as is, but when applied to an even more complex ecosystem such as the green transition, it is necessary to break it down in a contextualized way. In the energy sector of the green transition, the actors involved are varied and have varied impacts in its legitimation (Bolton & Hannon, 2016; Iskandarova et al., 2021; Köhler et al., 2019; Kuzemko et al., 2022; Sareen et al., 2020). This gap requires identifying what were the major factors pushing forward the energy sector's representatives towards ones worthy of the green transition's requests. The importance of collecting and cross-referencing the factors affecting the major actors in the transition's energy sector is called upon by literature as essential to better understand the multi-factorial concept that is legitimation in this context (Andersen & Geels, 2023; Fischer & Newig, 2016; Wang et al., 2022)

d) How actors and factors relate with legitimation within the ecosystem of the green transition's energy sector

Finally, connecting the relevant gaps into a conclusive framework that represents the multi-factorial, multi-actor and multi-dimensional aspects of the legitimation (via the energy sector) of the green transition allows for a better understanding of the both the theoretical and practical gaps in knowledge.

1.3 Thesis structure

The thesis is structured as follows: the chapter presented here, Chapter 1: Introduction, provides a contextual view of the current situation of the research targeting the legitimation of the European Green Transition and its energy sector. As such, an overview of the needs and gaps surrounding legitimation research in this context are exposed and a brief introduction is made to concepts that will undergo further scrutiny in the following chapter.

Chapter 2: Legitimation and Energy builds on Chapter 1 by providing an in-depth literature review covering legitimation (and its challenges), institutional genealogy, energy markets and policymaking, and the way in which this study contributes to knowledge. The direction Chapter 2 gives is toward a conceptual framing and practical setting of this work. Consistent within this is an exploration of the different institutional arrangements that have been posited within academic research which underpin much of the considerations of the green transition. The main actors and influences are described here as part of the importance of several types of profiles in the transition's implementation.

Chapter 3: Methodology follows with the methodology section, indicating, based on the exploration made in the previous chapters, the objectives of this research, the type of data, its collection and thinking behind it, and a brief section on interview factual data. This exploratory research utilizes the philosophical paradigms of interpretivism and qualitative methodologies to apply to secondary (policies, reports and other documents pertaining to the Green Transition) and primary data (semi-structured interviews) analysis through an institutional genealogical lens. Following the description of the work in Chapter 3, Chapter 4: Policymaking for the Energy context: Historical Context and New Energy Mix, dives into the complex world of policy documentation for the EU's energy sector. In it, this research focuses on the importance of policymaking for the legitimation of the green transition and its energy sector. An effort is made to provide strategic examples of all types of relevant energy in the green transition context and their implementation at different EU levels through policy analysis and other influential factors.

With a tight connection with the historical results found in Chapter 4, Chapter 5: Time and temporality is the first result from the primary data analysis. The resulting factors of time and the exploration of its facets by the different actors interviewed allow for an integration with the institutional genealogy lens. This integration consists of understanding time and its importance in the legitimation of the green transition via the energy sector.

Directly following Chapter 5 is Chapter 6: Reactions to the green transition as forms of legitimation. Chapter 6 provides the other factor found through the analysis of the interviews with experts, giving another dimension to the previous chapters and providing an intersecting understanding of how the main actors react to events and to each other, thus becoming legitimating forces.

The final chapter of this thesis, Chapter 7: Discussion & Conclusion, brings together all the analyzed data into frameworks which explain the green transition through the eyes of its legitimators but also exposes what actions make the green transition move forward. It also dives into the complexities of the analyzed systems but also into the important work that is to be able to provide studies which focus on several fundamental elements of a system. It will also offer the conclusions of this research, addressing the research questions, assessing the contributions, presenting the broad implications for practice and policy, and future research considerations.

The Annex represents a document produced as an output of this research's fellowship which dives into the policymaking of the green transition and the key impacts of such activity, leading to recommendations for the EU's consideration.

Chapter 2: Legitimation and Energy

Everything in our social world can be legitimated (Zalta, 1995). Opinions, ideas, rhetorics, arguments, theories, theses, poetries, articles, conspiracies, documents, religion, languages, traditions, engagements, friendships, technologies, sports, techniques, music, fashion, artists, etc., the concept of legitimation itself is present in all things we accept in our everyday reality, and so are its sources (Deephouse et al., 2016; Tost, 2011). The fact that they are available to the general public means they went through a process of being legitimized by the population and the bodies that regulate it (Buchanan, 2002; Deephouse et al., 2016; Granovetter, 2005; Singh et al., 1986).

The term legitimacy is derived from the latin "legitimus", meaning lawful (Zalta, 1995). The descriptive form of legitimation is manifested in a stable social order endowed with legitimacy not focused on fulfilling self-interests (Weber, 1964). The normative form of legitimation associates the concept of legitimation to political power, i.e., the social order is legitimate if the coercive power's use is justified (Rawls, 1993); or to political authority, where the claim of legitimacy is enough to legitimate political action if enough people recognize it as such (Raz, 1987). However, the caveat in the political authority view suggests legitimation might need more conditions being met for it to manifest in a social order (Buchanan, 2002). These conditions were identified as the legitimation of political institutions being (not just about their gained legitimacy but also) about the justifiability of their legitimacy being granted to them by the social order's beliefs (Beetham, 1991; Granovetter, 2005). As Weber stated, "the basis of every system of authority, and correspondingly of every kind of willingness to obey, is a belief, a belief by virtue of which persons exercising authority are lent prestige" (Weber, 1964).

The power of attributing legitimacy is a characteristic of the individuals and they are the ones whose power is transferred to society, thus endowing political institutions with legitimacy (Hobbes, 1651; Locke, 1698). Natural law, a state in which all are free to act without being constrained by another's will and only by natural law, is ubiquitous in the social order and it is the individual's consent (i.e., transfer of legitimation) that allows for the natural law to be constrained

by a political institution (Locke, 1698). However, a political institution that attacks the natural law is illegitimate because the natural law cannot enforce its respect in a social order (Locke, 1698; Simmons, 1976). Thus, legitimation is unable to exist if it breaks natural law or ignores consent. A finalized form of legitimation is, then, limited by consent, the natural law and by its representatives eliciting morally binding obligations (Edmundson, 1998). The finalized form of legitimation in a state of natural law (i.e., of vulnerability) allows granting legitimacy to a sovereign body for the protection of the rights of the individuals who transferred said power, further limiting the concept of legitimation (Hobbes, 1651). Furthering these limitations is the idea that political authority receives legitimation from the people based on a need for collective resolution of coordination and cooperation problems (Hampton, 1997).

To ignore the limits of the legitimation concept is to exercise coercive power (rather than authority), which is a feature of the social order and a precursor issue leading to the creation of legitimacy (Rousseau, 1762). To Rosseau, and unlike Locke, the transition from the natural law is a process which involves justifying the rule of law democratically, instead of it being a power possessed by the individuals that is passed on to other individuals or council of individuals.

To invite a democratic justification to the transition from a state of natural law into a civil state, there needs to be an establishment of political authority via political institutions (Kant, n.d.). As holders of moral authority, but not political authority, it is the individuals' task and ability to allow a state transition and to establish rights as necessary steps towards a moral order of secure equal freedom (i.e., "ethical commonwealth"). Authority, however, can be both legitimate and effective, according to Kant, and there is an obligation of the civil state to obey public reason and to establish law consented upon by all individuals. Should this be violated, then authority would become illegitimate, though still effective as the authoritative figure still holds said authority (Kant, n.d.). The position of having to obey the established effective authority (legitimate or not) is related to the fact that the individual members of a civil state are to obey the established head of state (Flikschuh, 2008). Coercion, then, becomes a way for the state to guarantee the states' members needs are met, thus granting it political authority, which can be just (legitimate) or unjust

(minimal legitimacy; (Buchanan, 2002; Hampton, 1997)). Currently, the illegitimacy of authority has never been more present than in the USA's, Russia's and Africa's election activities, where the illegitimate actions of the politicians have proven that, though the public sentiment is of non-agreement, they still possess power and authority to exercise said power (i.e., coercive power; (Easton & Hess, 1962; Raz, 1987; Zalta, 1995)). Due to these events, the acceptance and integration of the public's approval and coaching has become more present in contemporary policies as mandatory for the their success (Easton & Dennis, 1975; European Commission, 2019; Hampton, 1997; Lipset, 1960; United Nations Framework Convention on Climate Change, 2015; United States Congress, 2019).

The sources of legitimacy have varied throughout the philosophical discussion of legitimacy (see above), however,(Weber, 1964)) identified a specific logic to them which he categorized as:

- Rational: based on the rule of law (legality) and the right of those with authority, under said rules, to issue commands.
- Traditional: based on tradition as the legitimation power behind the status of exercising authority.
- Charismatic: based on devotion of faith to an exemplary, exceptional, or heroic character of a specific individual.

The logic of the source material for legitimation described by Weber is incomplete without the typing that was later described by Easton and Dennis in their 1975 study, which divided legitimation in the following types:

- Ideological: moral convictions about the validity of the regime and the incumbents of the authority. Aims and states of the objectives of the political system;
- Structural: independent belief in the validity of the structure and norms of the incumbents of the authority. The goals of the system are strictly related to authority and political power;
- Personal: direct relationship between the validity of authority roles and the personalities exercising them.

Currently, the term of legitimation, following the descriptive and categorizing attempts by the above mentioned authors, has been broadened to include a system capable of maintaining society's belief in the defined political context and institutions (Lipset, 1960). However broad the definition of legitimation, the sources and criteria assessing legitimation are ever-changing, in spite of the organizations' attempts at maintaining legitimacy (via these sources) and, therefore, rooting themselves in the system (Deephouse et al., 2016; Stinchcombe, 1965).

One approach to legitimation is to study and describe everyday events rather than institutions or organizations in order to go beyond the obvious (Hilgartner, 2007; Weick, 1980). Here are some examples of everyday events I have come across in the new light of the concept of legitimation:

1. As children, a lot of us legitimate the concept of Santa Claus, and many institutions, at several levels, provide us with the materials to continue this belief. Our families, usually the greatest legitimation tool in our early years, lead us to accept the existence of a man donned in red clothes who leaves gifts on the house's concept of a Christmas tree via a chimney (Easton & Hess, 1962). Even with no chimneys, we still believe it, because commercials, actors, movies, comic books, videogames, all very interactive forms of legitimation lead us to believe it is a reality that affects all. For these legitimation sources to exist, though, it means that a higher level is providing them with the legitimation to do so, both economically and psychologically. The association with Christmas and consumerism in holidays has seeped into the industries unsustainably in several ways, mostly via the manipulation of price ranges and the excessive packaging that have negative economic and bioeconomic impacts in society but that have been perpetuated and solidified in us since our early ages and in society as a whole via religious beliefs.

2. A more direct example is a show that plays around with the concept of legitimation called "American Gods". This show focuses on divine entities as rulers of a specific topic, which are brought to life and receive life force based on the fluctuation of the belief of humans and societies. Aphrodite, for example, the Greek Goddess of Passion, is represented as needing to be wanted or desired by humans, or for humans to express such passion and desire to each other, to be able to continue existing. Other old Gods struggle with their current existence due to not many people or institutions (i.e., temples or locations of belief) believing in them, whereas new age Gods, related to technology, media or other modern day concepts, are legitimized by the belief or reliance of the population in them (Hampton, 1997; Lipset, 1960; Raz, 1987). And belief can be legitimation (Beetham, 1991; Weber, 1964), but when the legitimation of the new age Gods entails technology or media, both concepts which have a lot of governmental and global support

via institutions, companies, policies, regulations, etc., then the legitimation via belief gains a new dimension (Galatzer-Levy, 2002). For the old Gods, the legitimation was levelled in the same way, with national and supra-national legitimators in the form of the explorers and conquerors that spread out the culture and traditions of the populations from which the initial legitimation stemmed or the places of prayer and adoration that were built.

3. Relating more directly to the bioeconomy concept and argumentation for the green transition, associated with the idea of generational knowledge and legitimation (Bejinaru et al., 2018; Easton & Dennis, 1975; Easton & Hess, 1962; King & Soule, 2007), some campaigns in the early 90s took heed of science's warnings regarding biodiversity and climate change and promoted the spread of knowledge for those children via cartoons like "Captain Planet" and "Widget, the World Watcher", amongst many others. These cartoons used their successful design and storytelling to disseminate the issues acknowledged by science, whilst defying lobbies and traditional industries, in order to raise a whole generation's scientific- and self-awareness towards anthropogenic climate change and loss of biodiversity (Buchmann-Duck & Beazley, 2020).

2.1 Theorising with Institutional Genealogy

Legitimation requires many actors at various levels of influence: self, family, friends, community, society, companies, government, media, etc. (Deephouse et al., 2016; Energy Transition Commission, 2020). Therefore, our approach must attempt to include an interplay of these aspects, to avoid falling into the traps of institutional research that focuses theories on specific or dramatic events (e.g., crises) or points in time, rather than on the process itself (Weick, 1980). All these sources of legitimacy are strictly necessary for the process of legitimation (Deephouse et al., 2016).

History and legitimation go hand in hand when integrated in institutional research by providing strategic advantages to organizations using them wisely (Suddaby et al., 2010). Stinchcombe's observations were among the first that determined the influence of history in defining and maintaining the organizations' structures and morals, such as unique practices and traditions: "organizations formed at one time typically have a different social structure from those formed at another time" (Stinchcombe, 1965).

The ability to use history manifests via organizations that are given access to specific resources arising from their "history" or "past" or "origin", resulting in a competitive advantage (e.g., liability of newness) by allowing institutions to be

able to enhance their ability to learn and adapt to current situations, or by providing more rigidity to the organizations' core values and strategies (Corradini, 2019; David, 1994; Stinchcombe, 1965; Suddaby et al., 2010). Thus, the interpretations of history stemming from Stinchcombe's approach mentioned earlier drove two main philosophies to come forth: history as inertia and history as "path dependence", i.e., something narrowing the path outcomes of an organization (David, 1994; Suddaby et al., 2010). Path dependence is determined by an organization's historical circumstances which limit some branches of possibilities and, in doing so, allows for others to be formed (Steen & Hansen, 2018; Suddaby et al., 2010). Literature classics of path dependence consist of the analysis of the adoption of the QWERTY keyboard and the VHS platforms, both corresponding to an analysis of how interdependencies or interrelatedness can generate suboptimal solutions (David, 1997; Suddaby et al., 2010; W. Brian Arthur, 1989).

In some literature approaches, history, as a resource, is highly valuable due to being considered of immutable nature, i.e., it is a powerful tool because it happened, it cannot be changed and it is beyond the control of most actors (Suddaby et al., 2010). History, however, cannot be reduced to such a simplistic nature when it is the product of objective and subjective realities, being intensely manipulated by powerful actors and interests (Suddaby et al., 2010). The case for history as a part of the constitution of new institutions with a genealogy context is easily seen in terms of the impact international bureaucrats have on the creation of new governmental institutions (Johnson & Urpelainen, 2014). The effect of pre-existing institutions on newer ones can even be seen at a global level, with the legitimation interactions of different global actors showing how they affect each other at levels that influence the future of higher-level policymaking and governmental decision-making (Johnson & Urpelainen, 2020).

The reason for the representation of legitimation via this genealogy metaphor is inspired by my culture and by the phrase mentioned by Weick in his 1989 paper: "It is argued that interest is a substitute for validation during theory construction, middle range theories are a necessity if the process is to be kept manageable, and representations such as metaphors are inevitable, given the

complexity of the subject matter." It is a reality that the topic of legitimation is broad, deep, old and ingrained in opinions and reflections by authors with timely perspectives. As such, the complexity of this concept and its altercations are clear, thus, our mechanisms for dealing with complexity come into play, and one can summon the ones most close to their realities and most comfortable to them, which is why I have chosen the metaphor (Cornelissen et al., 2008). As with all decisions and situations present in human life, there are several benefits to the use of the metaphor and several caveats. It is my belief the benefits outweigh the caveats seeing as I am able to simplify my exposure of the connections I have found in the literature and modern authors' speeches in regard to the concept of legitimation and its inner workings.

For legitimation to appear, it is my understanding that three main levels (global, supra-national and national) are engaged (Table 1). These different levels are interconnected and have repercussions on one another, which tend to result in effects that surpass the original sources producing, therefore, gestalt effects, a characteristic seemingly natural to legitimation (Galatzer-Levy, 2002).

Table 1: Legitimation levels and factors.

Legitimation Process	Actors	Regulation	Time descriptors
Global	Continents Countries	Agreements Commitments Strategies	Slow Multi-generational Historical Irrelevant
Supra-national	Unions Councils	Strategies Policies Protocols Recommendations	Slow Semi-generational Political Relevant
National	Governments Institutions Foundations Lobbies	Laws Policies Decrees Regulations	Fast Human lifespan Political Urgent

Legitimation has a precursor, which is path creation, a concept intertwined with the evolutionary economic geography hypothesis (Binz & Anadon, 2018; Njøs et al., 2020). Path creation is a part of a set of phases responsible for the emergence and establishment of a new industry and which include many of the

factors necessary for legitimation to appear, such as the abovementioned actors, agency and policy, and, additionally, regional capabilities and multiscalar dynamics (Njøs et al., 2020; Sotarauta & Suvinen, 2018). Path creation is defined as "the emergence of new development trajectories in a region based upon the growth of new industrial sectors or new products, techniques and forms of organization" (MacKinnon et al., 2019; Njøs et al., 2020)

A multi-dimensional system including time in its parts such as this one requires different approaches to be considered, and one such is a historical one, especially cultural history, which grants researchers the tools to analyse several levels of complex systems over time and including the interplays at work amongst the agents that directly influence them (Wadhwani et al., 2020). As context is extremely important for legitimation and change, the historical levels of legitimation also play a part in the understanding and development of a theoretical approach to newness, especially regarding the connection between actors and legitimation efforts (Demil, 2020; Patermann & Aguilar, 2018). In this sense, history becomes the paradoxical precursor and partner of environmental constraints on legitimation and change, as it is "the set of antecedent facts and decisions that establish these constraints (…)" whilst coexisting with the changes and newly formed or emerging contexts, effectively becoming a limiting factor in the entrepreneurship ecosystems (Wadhwani et al., 2020).

The control that is mentioned above pertains to the ability of the system to produce strategy elements that allow guidance, from a top-down approach to all the levels below the ones producing said elements. A global commitment to a specific strategy is materialized in a commitment or agreement that links the wills of the greater actors with the guidance supra-national and national actors need in order to institutionalize and legitimize the efforts of implementing those strategies (Grossauer & Stoeglehner, 2020; Patermann, 1999; Schütte, 2017). The actors refer to the players and their roles in the legitimation of strategies at the different "nationality" levels. This variable is essential to form a moral representation of the ideas and strategies that are to be legitimized by communities at whatever level via the control options.

Time is a variable that this work attaches to the concept of the "nationality" levels of influence of the levels of legitimation because of the inherent human condition of most of them. All the actors are composed of humans and contain the human spirit and intellect as the sole force driving their existence and, thus, they reveal a lot of human characteristics, i.e., institutions manifest their creators in their own context. Yet, some institutions are able to transcend what humans have not yet been able to (e.g.: the global level attaining a sort of immortality via its multi-generational existence), though this is debatable as the concept of generational units is present in the literature indicating some human ability to maintain ideas and movements alive via generational transfer (Lippmann & Aldrich, 2015).

The inclusion of time and of the interaction of several actors at different hierarchical levels is indicative of a connection that goes beyond the present and current institutions. As is historically prevalent in the evolution and appearance of the different types of energies, institutions have been created as a reaction to many changes at the global, supra-national and national levels (Garud et al., 2010; Markard et al., 2016a). This creation of new institutions was infused with specific political or categorical motivations, such as changes in the narratives or categorical descriptions, which is a representation of the past influence of the institutions that created them (Garud et al., 2010).

The several factors influencing legitimation can influence the development of new industries based on the industries that were there in the past, thus generating a genealogical connection (David, 1994; Garud et al., 2011) and also a fitness scale based on their ability to survive (i.e., liability of newness). However, the emergence of new industries isn't, necessarily, associated exclusively to past, traditional or established industries, rather, the path creation hypothesis states that new industries can be direct descendants of traditional ones but also the result of radical changes in the structures that govern the sphere of existence of the earlier industries (Aarset & Jakobsen, 2015; Trippl et al., 2020). The literature debates whether to consider former practices and other genealogical factors as the main link, especially within a regional context, shaping industrial development trajectories or whether the fact that regional contexts can be both catalysts or hinderers of new industry

establishments (Corradini, 2019; Njøs et al., 2020). Besides this debate, there is the growing literature inciting the exploration of factors previously outside the scope of the evolutionary economic geography in order to grasp at the understanding of the emergence of new industries and the factors that were determinant for their appearance and legitimation (Njøs et al., 2020; Trippl et al., 2020). Out of the many factors that are explored, the evolutionary economic geography hypothesis states that the region or local lock of factors is the main contributor to the growth and emergence of new industries, giving special attention to the fact that the potential is to be unlocked within a regional or local sphere and considering that the industries are there already, just latent in their expectancy for the prime conditions to allow for their reveal (Aarset & Jakobsen, 2015; MacKinnon et al., 2019; Trippl et al., 2020). However, recent research has begun to question the full veracity of the evolutionary economic geography hypothesis based on the fact that regional institutional settings appear to be but a single aspect of the emergence of new climate-friendly industries, and giving growing importance to the influence of multiscalar dynamics, which allow for the comparison of a region with the geographical country it belongs to plus how it measures up to the world (MacKinnon et al., 2019; Njøs et al., 2020).

Connecting time with the green transition from non-renewable energies to renewable ones, one of the bioeconomy's global goals, helps understand how the greener technologies have been legitimated and how different actors were important in the legitimation of new technologies (Markard et al., 2016b). A chronology of the events that lead to the adoption of specific types of different energies is an exercise that intertwines the effects of factors such as time, social impact, policy impact and how these movements support the adoption or rejection of certain types of energies, as is the case with biogas or nuclear energy (Garud et al., 2010; Markard et al., 2016a). Plus, adding the concept of time also allows us to realize whether there are fluctuations on the importance or relevance of the several factors affecting legitimation (Iskandarova et al., 2021; Markard et al., 2016a; Thelen, 2000).

If the factors that are part of the legitimation process, as a whole, stop, at any point, the legitimation process most likely comes to a halt or becomes

illegitimate albeit effective (Kant, n.d.). This is not to say that some levels will not take longer to start engaging than others – it is assumed that the legitimation process does not immediately engage all of its factors at the same time without the proper inputs, but the different components inside of it move as a unit once all are given enough momentum to engage. In the legitimation process, it is a maximum efficiency requirement that the higher levels start turning for the smaller ones to do so as well. This is because, for the lower levels to activate the system, more momentum and traction must be generated by them, rather than if the engagement is started by the higher levels. However, as is stated, if the lower levels stop engaging, so will, eventually, the higher ones, as such is their interconnectedness (Zelli et al., 2020). It is also possible that if the higher levels try to continue engaging while the lower ones are not, the process will be damaged (Rousseau, 1762; Zalta, 1995). Therefore, the legitimation effort is a constant one of maintaining all the levels engaged and symbiotic if such is the strategy of the higher levels.

Another important component of legitimation that is necessary throughout its process are narratives. In and of itself, legitimation is a narrative that gains enough traction to receive the attention of the strategizing actors that, then, produce the components that bring such a narrative into the obligatory spheres of society. Making a narrative legitimate involves time, actors, and control. Time for the narrative to gain traction and to exist in all of society; actors for the narrative to be expressed in all levels of society and via the many forms of communication associated to current societies; and control for the narrative to be bound by definition to the strategies and rules of the society it is trying to be a part of.

The process has a constant flow and symbiosis among the different levels, on one hand. These levels, on the other hand, empower each other via feedback loops and continuously interact in order to fuel the necessary mechanisms for the livelihood of the legitimation process (Bejinaru et al., 2018; Zalta, 1995; Zelli et al., 2020). Considering the genealogy analogy, it is the power and connections of the several levels that allow many others to engage (if following a maximum efficiency paradigm), giving the process the power to engage with several levels by initiating just one greater one. However, for the major levels

to start their engagement, all the other levels must be adequately allocated and ready (i.e., possess potential energy) as well. Once they do start their engagement, the transformation of potential into kinetic energy is manifested as the legitimation process.

Much like an energetically dynamic system, the legitimation process is permeable, meaning it can expel components or be disrupted or forced out of its cycle by both internal (unexpected or unobserved, e.g. lack, damaged or low amount of a component) and external (unexpected and observed; e.g. bureaucracy or social drivers) forces. One example of such forces is the interconnectedness of non-economic and economic activities: corruption is the best case of such, where the social context of some activities leads to an increase in costs and procedures to achieve an objective (Granovetter, 2005).

To explain the permeability and flexibility of legitimation process affected by past, and, therefore, static genealogical relationships, we must look at the nature of legitimation, which is ever-changing (Deephouse et al., 2016). The different facets of time can give us the flexibility we need to explain all the connections the legitimation process has within itself: more variables can be added and variables can be replaced in order to increase the efficiency of the process; thus, this process requires continuous care and attention regarding the components that affect and define it due to its responsive nature to the huge amount of variables that directly impact it (Deephouse et al., 2016; Pelkmans & Renda, 2014).

2.2 Legitimation Levels

Once set in motion and with the availability of the levels and variables necessary for the legitimation process throughout its expected action course, the genealogical approach is bound to be a framework that can be used to ensure the successful explanation, implementation and acceptance of new governance strategies in specific geo-political and specific timeline contexts, such as the European Union in 2030 (European Commission, 2019).

The flow of the legitimation process comes from the measures applied for and against it. In a democratic society, the governments, or governmental bodies,

have the greatest impact (Zelli et al., 2020) and are able to provide the process with the necessary variables for the process' intricate cascade of feedbacks and potential circularity. The legitimation process begins with the legitimation of a government as the representation of its people. In the case of the EU and other democratic countries, an elected official body, representative of a fraction of the voting population, is legitimized in the populations' eye in the form of a government. Once legitimized, an EU national government is given recommendations on how to proceed towards a common goal, usually a supra-national goal set by the EU, as is the case with the current European Green Deal (European Commission, 2019; Schütte, 2017). The EU itself is a part of the levels that are engaged and influenced by greater levels, such as global institutions like the United Nations (UN).

The way in which the governments are able to proceed with the legitimizing of concepts is via documentation and dedicated, specialized human capital, of which the UN's subordinate entity is an example: United Nations Framework Convention on Climate Change, which, along with the Paris Agreement, bind the global signatories to specific climate goals (United Nations Framework Convention on Climate Change, 2015). Other actors can come into play when legitimizing specific concepts, as was the case with former US President Albert Gore Jr., who advocated for the implementation of new policies regarding climate change via the movie he produced ("An Inconvenient Truth") and via the global attention he received with this movie with the attached Oscar and Nobel Prize. The policies and regulations generated are the governmental means that provide legitimation efforts (process) with funding, policies, approvals (variables of the process) and which dictate how the legitimation is to be implemented. These are mandatorily associated with specialized human capital (i.e. councils, institutions, governmental bodies) for the development of such documents (Bejinaru et al., 2018; De Besi & McCormick, 2015).

Specialized human capital is produced by integrators (e.g., universities, institutions; (Bejinaru et al., 2018). Integrators connect higher entities (i.e., governments and unions) and their produced knowledge or documentation with the specialized human capital (i.e., graduates or post-graduates) and the pre-specialized human capital (e.g. undergraduates). The resulting specialized

human capital produce more knowledge and policies which are, then, transferred to more pre-specialized human capital which, in turn, will continue the cycle of producing more knowledge and/or transforming knowledge into outputs (e.g., innovation or policies), a concept known as **knowledge spillover** (Bejinaru et al., 2018; Corradini, 2019). This represents a feedback loop, where the positive feedback of the knowledge that is passed on is, then, received by integrators with new value (added in by its initial receivers; (González-Santos, 2020)). A similar concept is found in the relationship between regulation and innovation, where one of the specific implications of regulations at the education level affect the entrepeneurial's capacity and opportunity factors, thus increasing or decreasing the probability of innovation outputs (Pelkmans & Renda, 2014). Human capital and knowledge are "recycled" back by integrators and the cycle restarts but is boosted by a positive feedback loop. For example, universities create scholars or policymakers or innovators who, then, can either contribute to knowledge (research directly as part of the university) or go on to other positions and transform that received knowledge into outputs that indirectly affect the university (e.g., going on to the EC and being a project reviewer or a policymaker). There is a gestalt element here to the role of integrators - human capital creates an accumulation of produced knowledge and then adds more to integrators who recycle this back into the system.

The foregoing can be applied to the example of how governmental bodies and institutions, like universities, transfer knowledge into a generation of students (Bejinaru et al., 2018); this knowledge would, then, when in the appropriate settings, transform into both specialized human capital and policies; in turn, specialized human capital would provide a positive feedback to the institutions by returning knowledge to them and engaging with this circular cycle. On the other hand, policies (developed by the institutions and by the resulting specialized human capital) would allow for innovation and commercialization of the institutions and the specialized human capital's results, providing a positive feedback to the human capital and allowing products to be expelled from the system and into the market for a multi-level legitimation process. It can, thus, be said that integrators are recycling and producing new knowledge, which is, in turn, essential for a circular legitimation. The importance of integrators in the legitimation process is also found in the innovation ecosystem (one of the main

targets of legitimation efforts), as entrepreneurs and their outputs are highly affected by knowledge-producing entities and the policies affecting them (Pelkmans & Renda, 2014). As is being developed by global and supra-national protocols, the legitimation paths must be expressed, nationally, in several ways, being one of those the research and development on centers and specialized institutions to promote a sustainable and lasting green transition (European Commission, 2019; Schütte, 2017).

The legitimation process can work in a circular fashion if given the adequate variables and if these have the correct nature, as was exposed above. In that system, a component starts the process, and through positive feedback loops of its own creations, it provides the system with the necessary paths towards a successful legitimation at a specific point in time (Zelli et al., 2020).

2.3 Challenges to Legitimation

The documents and specialized human capital, both external but essential to the system, provide the legitimation process with the lifting or imposition of barriers. After a century of increasing bureaucratization, it is globally recognized that this is considered a barrier rather than a driver of legitimation (DiMaggio & Powell, 1983). Overcoming these implemented barriers is the current EU struggle, where the synchronization and open symbiotic relationships between policymakers and the specialized human capital (e.g., innovators and investors) is a goal the EU is after (González-Santos, 2020; Pelkmans & Renda, 2014). Apart from these barriers, a higher level of barriers exists that sit at the global level (Energy Transition Commission, 2020). This means that, for the changes implemented by the EU to be legitimized, these changes must have been legitimized at a global scale first, otherwise the EU might lose its competitiveness.

Bureaucracy is a well-known constraint on innovation, as the implementation of higher complexity regulation (i.e., lower flexibility), confines and hampers progress and the efficient use of resources (Pelkmans & Renda, 2014). Innovation is defined as efficient resource allocation working towards progress, which can be disruptive or incremental, thus either completely replacing processes or

adding small changes to them (Pelkmans & Renda, 2014). Entrepreneurs, the agents of innovation, are intrinsically connected and bound by regulation, as innovation only occurs when they meet certain conditions: willingness, opportunity/motivation and capability/capacity to innovate – all aspects highly defined by regulation (Pelkmans & Renda, 2014). Regulation, as a force used by institutions to achieve goals and compliance to specific targets set by institutions like the EU, comes from the need of the markets to address specific issues like market failures, regulatory failures, equity reasons and long-term policy goals (Pelkmans & Renda, 2014). The way with which regulation affects innovation is, according to Pelkman's analysis of the literature, by increasing or decreasing flexibility, information, policy scope uncertainty and compliance stringency (Pelkmans & Renda, 2014). These factors influence entrepreneurs and, thus, innovation, at several levels, considering that the reaction and preemptive action to new regulations veiled in uncertainty can lead to economic and management actions that might not be the most efficient or adequate, including the uncertainty levels associated to future content and scope of policymaking (Pelkmans & Renda, 2014).

Mapping the relationship between regulation and innovation entails the creation of policy, its intervention effects and how the changes implemented in the innovation-related factors (e.g., competition, skills, productivity and investment) affect it and, in turn, how the changes in the innovation ecosystem might influence future policymaking (Pelkmans & Renda, 2014). Regulation is, therefore, an ambivalent "sword" when it comes to innovation, as case studies are required to determine whether the impacts of it were stimulating or not towards a specific ecosystem, especially considering all the stages of innovation development at which regulation can have an effect and according to the various types of regulation that can be influential at several points during innovation development (i.e., general, innovation-specific and sector-specific (Pelkmans & Renda, 2014)). The case of "red tape" (i.e., administrative burdens) in the innovation ecosystem can affect the ability of SMEs or entrepreneurs to allocate vital resources to innovation, as is the case with foods, supplements and GMO-related foods, which have, on their own, double the administrative charge due to food security and quality, apart from the innovative process-related bureaucracies (Pelkmans & Renda, 2014).

The growing concern of the impact of administrative burden on innovative ecosystems has led some governments to the inclusion of programmes that promote the reduction or the identification of the ways in which bureaucracy is affecting innovation, as was the case with MISTRAL, a Dutch measurement system of administrative burdens, which, due to its success, was adopted by several countries as a standardized version of itself - the Standard Cost Model (SCM; (Pelkmans & Renda, 2014)). Other measurement systems were created by The Conference Board to include indicators on the ease of doing business and entrepreneurship, which are responsible for identifying the EU *ethos* that is hampering entrepreneurship while not contributing noticeably to social benefits, possibly indicating the need to generate a regulatory framework that defines paths for innovative entrepreneurs (Pelkmans & Renda, 2014). The stringency or hampering effects of regulation and the creation of innovation are not, necessarily, related, as balance can be found in more restrictive regulation via achievable targets when the ability for stakeholders to pursue flexible, non-prescriptive, neutral technological outcomes is granted, leading to effective innovation compliance (Pelkmans & Renda, 2014).

This is cause to summon the fact that legitimation is, as is bureaucracy, in a lot of cases, promoting homogeneity of organizations (DiMaggio & Powell, 1983; Zelli et al., 2020), though in different operational contexts (e.g. coal-based vs bioenergy). If all organizations are legitimized by the same institutions, then they will fall in the same bureaucratic paradigm as the ones before them (including if they are part of a standardization process of regulatory actions – (Pelkmans & Renda, 2014)), though the context in which they appear might be incredibly distinct. In addition, it has been found that the objects of legitimation develop a stronger, more lasting type of legitimation if gaining it by different types of institutional structures and if these structures maintain a balance of power and importance in the object of legitimation throughout the legitimation process (Markard et al., 2016a). The effort to homogenize the birth of new organizations in different or similar settings is a way to promote the incremental nature of knowledge produced by previous councils or policymaking organs, however, that might not be the most beneficial method for the resiliency of legitimation. The issue is maintained because the continuous presence of these same entities or their spirit, even if under different names, will continue

promoting the same barriers as before, though small changes can occur (Njøs et al., 2020; Steen & Hansen, 2018; Zelli et al., 2020). For a paradigm shift on the imposed barriers to come about, an option is to disengage with the homogenization of institutions and the perpetuation of the same bodies which led to this current state, unless proven they have the flexibility to access different types of knowledge previously only vicarious in their spirit. It is noticeable that the public and private institutions that are created around the topic of renewable energies are mostly focusing on specific activities and adding to the saturated ecosystem of knowledge transfer instead of focusing on the parts of it that are lacking, such as the financing sphere (Zelli et al., 2020). Some proposed solutions come via the implementation of human capital to administrative processes in order to decrease bureaucratic burden and facilitate the entry of investment and innovative actors (Energy Transition Commission, 2020).

Intimately connected with the homogenization issue is the fact that, historically, institutions connect previous building blocks with new institutions that serve the purpose of responding to new environmental pressures via a historically incremental process (Wadhwani et al., 2020). Thus, it is important to understand the connection in the "family tree" regarding institutions that are created as responses to new environmental pressures. A connection that is the precursor of generations can be expressed as "time", an important variable in determining the quality of relationships found in the collective memory of all levels of actors and their resulting actions in the entrepreneurial ecosystems (Mcmullen & Dimov, 2013). Time, in this sense, cannot be seen as a unit of measurement of a specific variable, rather, it is an expression of sequenced actions and a collection of samples of both memories and experiences shared by actors and other legitimators (Demil, 2020; Wadhwani et al., 2020). However so, time still has a mathematical expression which coexists with the notion actors have of it, i.e., the actual stretch of the accepted measurable units of distance between the past and the present. The punctual aspect of time can be represented, depending on the context, via specific events, such as the creation of policies, the birth of institutions, the acceptance of new concepts, among others (Wadhwani et al., 2020). This coexistence is especially relevant in legitimation, as the mismatch in the innovator and regulator relationships plus the different

paces at which private and public narratives unfold lead to lag effects in policies which, consequently, generate the concept of environment as a constraint to innovation and progress due to them not representing the immediate future but a farther off one (Lockwood et al., 2017; Markard et al., 2016a; Pelkmans & Renda, 2014).

Institutions are, therefore, "keepers of order and time" because they are provided such powers by humans, who have control of neither and require larger entities or concepts to carry them out (David, 1994). In such a way, institutions have developed, due to their inherent human nature, human abilities, such as the ability to provide offspring. Their offspring are heavily influenced by the parents' perspectives and goals, such are the boundaries unto which they are born (Njøs et al., 2020; Pelkmans & Renda, 2014; Pike et al., 2015). That the offspring is roped and enclosed in the parents' objectives could mean a dismaying future to being anchored by the imposed regulations and environment for which the offspring was brought upon to engage with (David, 1994; Pike et al., 2015). It is recognizable that an act of prosperity and of "handing the torch" should become a power trip which guarantees the continuous glorification of the grandiosity of the multi-generational institutions that echo the ego of their creators and, therefore, have a timeless wish to maintain their existence in severed parts of their being represented by their institutional progeny (David, 1997; Phillips, 2002).

Policies and large institutions' actions provide binding effects on the ecosystems they exist in, while moving slowly and carefully in order to promote the best change at the lowest cost, a concept very well known in biology – fitness landscapes. These landscapes demonstrate why species cannot obtain different evolutionary paths, and it is related to the trajectory a species can take and how, if there are unfavorable characteristics or changes (i.e., reducing their fitness), they will not move over a location that represents a reduction in fitness. This prevents, for example, humans from developing wings as such a variation would first require us to lose our hand and arm architecture (an obvious reduction in fitness, even if temporary) in order to evolve to the biological adaptation of wings. The same could be happening in the effects of innovation on policymaking: innovation can challenge the local optima of

policymaking (i.e., the location where policy sits comfortably in the fitness landscape not expecting to have to lose efficiency, to then regain it so as to best suit new environments) in order to achieve new variations, via amendments or even new policies, that best fit the current status of the ecosystem they're in. How reactive policymaking is to these challenges is, however, a main aspect to consider when understanding the path towards the bioeconomy and its legitimation.

Legitimation is not just about policies and human capital. It also sprouts aided by the economic support that investors provide, allowing companies to become available in the market for further levels of public investment (Markard et al., 2016a; Rhodes et al., 2014; Zelli et al., 2020). The concept of the economic support of legitimation is relative to market and policy pushes and pulls that take a big part, alongside main actors, on how innovators are perceived and how their innovations are implemented in the planned futures (Markard et al., 2016a; Rhodes et al., 2014). The innovators responsible for new technologies are usually setting standards by conforming to the market and working around the incentive to investment that is resulting from the publicity of some markets and even from insider knowledge (Markard et al., 2016a). Innovators are, however, also following sets of standards which, usually, have the role of being supportive and informative, contrary to the belief that standards, associated to the idea of constraining regulatory documents, are actually inhibitors of innovation activities (Pelkmans & Renda, 2014).

Policies take more measurable time to catch up to innovation in the sense that the establishment of innovation, especially from a bottom-up view, can sometimes establish itself long before policies are able to bound it by all of the angles that are required for innovation to be purposefully integrated in the governance strategies (European Commission, 2018b; Markard et al., 2016a). The mismatch in timings can sometimes lead to imbalances in regulation regarding new innovations that can heavily disrupt the market (e.g., UBER). Time in policymaking and regulatory actions, therefore, has a strong impact on the stimulation of new markets and innovative endeavours, and it should be the regulator determining how the compliance burdens can be affected by the time

requirements to make the most efficient regulations on innovation (Pelkmans & Renda, 2014).

The territories and the geographical impact on the emergence of new industries also plays a major role in the legitimation of these industries, especially when taking into consideration territorial and technological dynamics in path creation processes (Corradini, 2019; Njøs et al., 2020). As mentioned before, some of the building blocks of path creation are manifested as private investment, new industries emerging or the branching of pre-existing industries, and the creation of knowledge via integrators (e.g. spin-offs; (MacKinnon et al., 2019). The proxies that are used to determine these building blocks, such as innovative green start-ups' patent applications, can be varied and serve the important purpose of allowing for the measuring of the legitimation of new technologies and innovations, especially in the climate-friendly industry (Corradini, 2019; O'Brien et al., 2017). The influence institutional genealogy has in emergence and legitimation is represented in many concepts and hypotheses, such as the idea that local and regional precursors are responsible for the determination of future development trajectories of emerging industries and innovative agents, commonly known as the evolutionary economic geography (Njøs et al., 2020; Steen & Hansen, 2018). The evolutionary economic geography hypothesis has mostly focused on the effects of regional capabilities and how local factors have an impact in emergence and legitimation, especially indicating the strength of the impact of past practices in industrial development (Njøs et al., 2020). Concomitantly, the effects of bureaucracy and policymaking are also quite important in the process of legitimation, as they affect the innovation ecosystem by generating uncertainty and compliance burdens (i.e., costs and administrative tasks), which, in turn, affect whether legitimation will have innovative ventures to be applied to or not (Pelkmans & Renda, 2014; Wood et al., 2021). Uncertainty, from a legitimation and innovation standpoint, can have catalytic or hampering properties by, for example, allowing stakeholders to anticipate or avoid future regulation while exploring alternatives (Pelkmans & Renda, 2014; Wood et al., 2021).

The responsible bodies for legitimation are many and their influence can be divided in public and private. The public sector is affected mostly by

governmental and union motives, being a direct representation of policies, institutions or organizations and other governmental bodies. The private sector represents the companies, SMEs and the people who are affected by the policies and institutions and which need to abide by the rules resulting from governmental bodies (Zelli et al., 2020). Companies, much like other market concepts, must be legitimized in order to survive (Suddaby et al., 2010). However, it has been observed that, as of 2017, the majority of institutions dedicated to knowledge transfer and networking were public, whereas the operational aspects were left mostly to private institutions, going against what is stated above regarding the vertical relationship between the public and private sectors (Zelli et al., 2020).

Nonetheless, the legitimation process requires risk assessment and management strategies to identify potential disruptors and define their efficacy in engaging with the system and effectively influencing it. An ominous, looming threat to legitimation in the EU are the global actors and their acceptance and compliance with a standardized set of regulations (European Commission, 2019). The EU must be efficient in the sets of rules it endows its players with, so that EU players can compete economically with the global players. On the other hand, the EU must also prepare effective measures to face the risk of unexpected competitiveness from the global market.

The quality of the legitimation itself is to be debated as well. Not all legitimations will prove to be the one bringing positive social action or positive results for investors or institutions backing it. The example of the Bioeconomy and the Coal-based economy are a good model of this and how the market of “lemons” can be applied (Akerlof, 1970). According to this model, good and bad (lemon) products are sold at the same price because, initially, buyers have no idea how to distinguish them and only through product experience can they gain the insight of a seller to determine whether they have a good or a bad product in their hands (Akerlof, 1970; Granovetter, 2005); hence, these products exist at the same time in the market, but one is being resold often, the lemons, because the buyers see they can sell a bad product (i.e., coal-based) at the same price as a good one (i.e., bioenergies), whereas the buyers with good products hold on to them. The flow of the products in the market leads to a high volume of lemons

with a similar value to good products with naïve buyers ready to invest in them. An example of this are all the ads on social platforms that sell subpar items because the lemon sellers invested in marketing rather than product quality. The aggravate in the case of this distinction comes in the form of the bioenergy sector being of a higher value than the coal-based one, meaning that the good product is not the same value as a "lemon", which increases resistance to the markets that are interested in it. This is only made worse by the dishonesty in the coal-based market, which sold "lemons" when they were legitimized, thus creating a lemon monopoly, driving out the possibility of a market for other products (Akerlof, 1970).

Adding the concept of trust and information in the digital age should be a deterrent for these market flows, as the consumers are more informed and have easier access to a lot of legitimated information, but if legitimate information can be wrong, then how can the market work if the naivety of the consumer is manipulated by all the sources of information it has access to? To make matters worse, Akerlof describes how some countries might suffer even more greatly in the integration of good products in their market flow when a dishonesty model is in place, seeing as the "quality variation is greater in underdeveloped countries" (Akerlof, 1970). Contradictorily, reports state that technologically advanced countries can achieve a transition to the green economy at low economic cost, then what is stopping them (Cao et al., 2021)? This all connects to the idea of all the factors having to be in place for legitimation to occur and that the idea of a positive impact on social life was not, previously, a requirement for the legitimation of energy sources.

2.4 Legitimation of Energy Sources

To legitimize new energy sources, global, supra- and national commitments and governmental bodies must, in unison, define how the countries will provide its inhabitants with the infrastructure that supports basic means of survival (Energy Transition Commission, 2020; Schütte, 2017; United Nations Framework Convention on Climate Change, 2015; Zelli et al., 2020). The example of Biomolecular Engineering Programme (BEP), in 1982, was an initiative at a supra-national level (EU) which lead the countries in Europe towards the development

of a more technologically focused research and policy push, eventually leading to frameworks where ambitious proposals abounded and which boosted scientific mobility across borders (Aguilar et al., 2013). The current drivers of change are the interest in listening to scientific research and defining strategies that promote long-term sustainability via more resilient and carbon-free economic and energetic strategies (Energy Transition Commission, 2020; Schütte, 2017).

The prior legitimation of fossil fuel energies and their connection to geopolitical contexts arose from fears of oil embargos or gas shortages, which lead to coalitions and wars. The same model can be expected from a world of climate tech, with new power shifts happening and changing the geopolitical dynamics as we know them. The main providers of climate tech components or energy itself, concurrently the main legitimators of this type of energies, will also have a greater economic hold of others dependent on them for their populations' energy needs. The concept of "renewable superpowers" is arising as countries race to become main exporters of renewable energies and engage with the latest climate tech to best capture and sell energy.

Under the legitimation of the new institutions for renewable energies, complex systems of institutional relationships arise. The legitimation systems, with several actors and levels interplaying, are directly associated to institutions and their relational legacies which are the providers of vertical (i.e., global, supra-national and national) and horizontal (i.e., public, private and civic sectors) communication pathways for newer institutions (Pike et al., 2015). The ways in which institutions allow newer ones to define themselves and their relationships with policymaking are varied, but they all relate to the amount of freedom from previous institutions' legacies (David, 1994). Examples of these institutional actors' relationships can be found in the early days of the EC's interest in technological research, going back to the BEP, where the programmes started by hiring external, independent actors to the EC recognized as national scientific policymaking experts as part of the Advisory Committee for Programme Management (ACPM) and, later, tending towards national ministerial officials backed by scientific organizations which eventually lead to the integration of scientific experts in the EC's administration for the development of new, more administratively holistic initiatives (Aguilar et al., 2013). Taking into

consideration that there's a new style of energetic governance being implemented globally, new institutions will come into play to make this a reality, as many have already (Zelli et al., 2020). Such a context requires an analysis of how the new institutions are affected by the one which created them, giving historical context to the institutional genealogical interactions (Garud et al., 2010; Pike et al., 2015).

New energy sources being legitimized, especially in the context of an energetic transition, also implies that the levels of legitimacy of several types of interconnected industries, like the tech industry, will show their volatility (Garud et al., 2010; Markard et al., 2016a). Factors influencing this volatility include public discourse, regulatory support, industrial relationships, lobbying, financial support, global and governmental strategizing, amongst others (Lockwood et al., 2017; Markard et al., 2016a). Technology legitimacy for the green transition is a sub-category of legitimation that is intimately connected to the global efforts of reducing carbon emissions and improving our quality of life and that of the planet. The fact that new regulation has appeared for the transformation required in the carbon-based energy economy, and that this regulation is imposing significant changes to most companies' behaviors or requesting that new technologies are introduced to support the transition, means the stringency levels of these regulatory actions are quite high, indicating heightened compliance costs, and potentially leading to inability to comply if the "distance between regulatory requirement and the *status quo* is excessive" (Pelkmans & Renda, 2014).

The current situation regarding climate tech, a concept that arose to separate this type of technology from the previous disastrous initiative of "clean tech", shows global policy support, with policies from China, Europe, the US, Australia and South America providing market certainty and boosting the investments made in clean tech. Some European countries are also managing to increase investors' interest by direct investment in venture funds. Another important actor for the legitimation of these technologies are consumers, who have become more interested in buying products that are climate-friendly or low carbon, such as new types of synthetic food from multi-million-dollar companies)e.g., Beyond or Impossible Foods), which, in turn, increases innovators trust in

the reception of climate-friendly products. Consumers have also become empowered by the ability to boycott and to spread such boycott via social media, effectively leading companies which are considered “dirty” to feel like riskier endeavours which, conversely, generates more corporate demand for greener, more climate-friendly innovation.

More recently, the technology behind energy sources has suffered some changes regarding how it is perceived and the kind of output that it will generate. The users have started taking into consideration more than just the basic need for energies, rather, they now associate themselves and their moral beliefs to the types of energies they consume and the supply chains that provide them (Hatch et al., 2017). The policymakers generate regulatory support with innovators and the public in mind, having to specifically compromise enough to make the process of transitioning and useability viable for all. The entrepreneurs and innovators that seek to enter the market and expand the technological limits currently impeding the full immediate green transition are met with barriers at several levels, such as bureaucracy or financing, which are interconnected with the compromises from the regulatory support (Pelkmans & Renda, 2014). As an example of such barriers, the chairman of Fortescue Metals Group took advantage of the pandemic lockdowns to scour dozens of countries, across most continents, in search of the most profitable ones for hydropower and geothermal energy, because, during such times, the governmental officials were much freer. Technology legitimacy is, therefore, a complex web of relationships within an already complex ecosystem that is the legitimation of newness (Corradini, 2019; Markard et al., 2016b).

The legitimation of technologies follows a complexified structure in which, apart from all the levels and actors previously mentioned, there is a necessity for the technologies to commit to the ability to disrupt at a scale that remains stable throughout their lives, otherwise risking the loss of legitimacy for “stretching too thin” or following other paths that are misaligned with the original legitimizing properties or connections (Markard et al., 2016a). The case of biogas shows how institutional conflict led the technology to be delegitimized in Germany, after many years of growing legitimation, due to two of the institutions relevant to biogas (i.e. agriculture and energy) finding the technology to favor one over the

other and due to more specific factors such as rapid growth/expansion, financing and regulatory support, and lobbying powers (Markard et al., 2016a).

The issues brought up by the biogas case in Germany also showed that policy-making failed to accompany the rapid growth and shifting nature of the initial object of legitimation, indicating that policy lag also contributed to the delegitimation, though as a consequential factor rather than a concurrent one and only because of the particularly strong regulatory dependency (Lockwood et al., 2017; Markard et al., 2016a). On the other hand, the case with the 1970 Clean Air Act in the USA, which targeted vehicles and a reduction in tailpipe emissions by 90%, lead to breakthrough innovation for compliance to occur, however, this innovation also lead to an increase in distances traveled by vehicles, therefore having very little net impact (Pelkmans & Renda, 2014). These two examples indicate that the new green transition proposed and agreed upon at a mostly global level might have similar effects on the new institutions, industries and entrepreneurs that are affected by this particular push for a paradigm shift and how they react, but the full impact and the unexpected consequences of the regulatory pushes will only be fully determined “once the dust settles”.

One way via which the market is responding to the green transition push is via the production and development of electric cars and the infrastructure to support them (Hafner & Tagliapietra, 2020; Tzankova, 2020). These are a clear statement of many companies that the company and its buyers are climate-responsible, sustainable and at the forefront of the technology frontier. The fact that these companies state they are following these pushes for the sustainability aspect of it is, however, not the whole truth, as stringent targets have been set for their companies and severe penalties will follow in case there is no compliance, indicating the already present regulatory support at a governmental level in place for these types of technological companies. Considering vehicles are one of the most responsible factors for the climate change crisis but, concurrently, one of the most indispensable commodities of modern human life, it makes sense that the paradigm shift would affect this industry at a very publicly visible level. Despite sustainability claims, it is important to keep in mind that new electric cars and other electric motors (e.g. solar panels,

offshore wind farms) bear the weight of using more metals and rare metals (with even more vital roles within their mechanisms) than their fossil-fuel based antecessors. An exponential growth in mining for these metals essential for the production of the new green energies and products is to be expected, with the current issues this mining has being amplified to a great extent. This might be indicative of some new possible challenges to the legitimation of these technologies that will, eventually, be included in the narratives and discussed accordingly, albeit them not being the most spoken about at the moment due to the profits that extracting these minerals will bring to many countries instead of exploiting fossil fuels. Some experts are already stating that inducing this change will simply delay and redirect the current issues, becoming the initial voices of delegitimation of the renewable or green energies with the current technologies that extract and produce the raw materials used in them.

The legitimation of green energies in the context of the green transition has also led to delegitimation attempts at the concept of the new energy sources (Markard et al., 2016a; Schoon, 2022). At a business level, several companies have already used fearmongering narratives regarding the loss of modern commodities due to the changes being too radical or even used greenwashing as tactics that, once figured out, delegitimize the sustainability logic behind them. As a matter of fact, however, the main component leading us towards this paradigm shift (i.e., climate change) will not end as soon as we switch to green energies, as there are centuries of mismanagement that will have to be dealt with and future issues with green energies that might not be fixable. The fact that climate change will not be disappearing immediately is also a logic used by industries to try and delay their own transition (which directly translates to them not wanting a temporary loss of profit): “If climate change won’t end, then why must we transition now? Should we not find solutions within the scope of what is already established? Is pollution not going to continue existing? All products use minerals and metals, are we going to stop mining as well?”. Unfortunately for these companies, their delegitimation efforts, aside from being treacherous, are also much weaker than the legitimation already provided by the greater levels of strategizing at a global level. These attempts, however, are proof that there are conflicting interests within this transition and that the

commitments by the countries can be volatile, as was previously found when the USA retracted from the Paris Agreement (Sareen et al., 2020).

Challenging the current *status quo* of the non-renewable industries, however, requires a multi-dimensional approach, even if it is an innate characteristic of legitimation, due to the innovative paradigm shift of the green transition (Hanewinkel et al., 2017; Wadhwani et al., 2020). The EU has made efforts to facilitate this as part of their grand scheme of improving innovation and tangible outcomes of R&D by reducing the amount of regulation it creates (Pelkmans & Renda, 2014). As stated by (O'Brien et al., 2017), "the core challenge of a sustainable bioeconomy in the EU seems to be finding a balance between the demands of the economy for food, energy and materials on the one hand and the sustainable supply capacities of natural systems (nationally and globally) on the other hand."

The emergence of green industries is also determined by the concept of evolutionary economic geography as a subset of factors that have a major influence in the regional and local technological and entrepreneurial development, and in how the new activities generated by it can reduce environmental burden (Corradini, 2019; Njøs et al., 2020). What has been found at a EU level is that the regional impact of past actions and activities leads to a better environment for the legitimation and emergence of new and innovative industries if under the right conditions, such as an ecosystem which promotes knowledge spillover and high technological activities (Corradini, 2019).

Institutional spillover is also considered a major factor in the way some types of energies are perceived (Corradini, 2019; Garud et al., 2010). The spirit infused in new institutions and the way they reflect their creators' wishes is a way of legitimation of the characteristics or intentions regarding the topic which led to the creation of said institutions. Legitimating a new energy, for example, by creating an institution that regulates it, defines it and gives it visibility and applicability has been the way for most types of energies in the current bioeconomy scheme (Garud et al., 2010). The opposite concept of the members of institutions becoming important in shaping the institutions' themselves, such as the EC being shaped by member states, was also reported as a struggle during

the evolution of the research frameworks of the biotechnology initiatives during the 90s and, later (2012), of the bioeconomy (Aguilar et al., 2013). However, an anecdotal event within the EC for technological initiatives came from a member from a committee who, during the proposals' evaluation phase, defined the first instance of international collaboration which then became the standard for most EC programmes regarding technology development (Aguilar et al., 2013).

The concept of bioeconomy consists of transitioning our economy to a sustainable one by changing our previously heavily carbon-dependent activities, supply chains and sectors to others that support the planet and its resources while protecting biodiversity and providing fair opportunities to all affected by the planned changes (De Besi & McCormick, 2015; European Commission, 2019; Hilgartner, 2007; Patermann & Aguilar, 2018; Sareen et al., 2020). Climate commitments are better for business because green committed companies have performed better than fossil fuel stocks, therefore, government funding should be conditional to these commitments by companies (e.g. clear decarbonization targets by 2030), distinguishing between major corporations and SMEs to guarantee proportional administrative burden (Energy Transition Commission, 2020).

In the context of fairness, the transition becomes a move into the context of people and how they will be affected by the planned changes, with the added responsibility of national and supra-national actors to legitimize these efforts (Energy Transition Commission, 2020; European Commission, 2019). The creation of jobs, for example, is an essential component or for the successful implementation and legitimation of the green energetic transition, as a transition in the energy will come at a loss of millions of jobs (Energy Transition Commission, 2020; European Commission, 2019; United States Congress, 2019). Similarly, the guarantee that governments are working to increase the feasibility of investments in the green transition by decreasing the market risk of the investment and creating market confidence for investors is also essential to fairness, especially for developing economies (Energy Transition Commission, 2020).

In past times, legitimation included components, as the ones mentioned above, that aided in the institutionalization of the goals (e.g. European Economic Community, the European Atomic Energy Community or the more recent Europe Energy Union; (Schütte, 2017); (Énergies, 2016) but left out the public's very impactful influence on the legitimation process. Current supra-national and national efforts legitimized the public as an essential component for the functioning of their legitimation efforts (Cao et al., 2021; De Besi & McCormick, 2015; European Commission, 2019; Li et al., 2017). Organizations that cannot accompany the ever-changing social memes and regulations are eventually punished by the legitimation criteria that accompany the changes social movements impose on it (Deephouse et al., 2016; King & Soule, 2007; Markard et al., 2016a). The public legitimation has a component of time associated to it because of the fact that it seems to lag behind the contextual legitimation (i.e., experts) and how that can affect the process of gaining legitimation by causing significant disruptions in it, as was the case with the biogas industry in Germany (Markard et al., 2016a).

The implication of the economic effects of the bioeconomy and its success can lead to an exercise of attempted parametrization of a successful bioeconomy (Hilgartner, 2007), much opposite to the notion presented by Raul Kirjanen in a Bio-Based Industries Joint Undertaking (BBIJU) conference in 2020 of a failed attempt of Bioeconomy integration by the EU in the past. To predict the success of the bioeconomy, one must also understand the ecosystem of acceptance or stalling generated by the actors and control of the clockwork in the legitimation process, further emphasizing the importance of legitimation in this nascent energetic governance strategy (Hilgartner, 2007). A successful bioeconomy should encompass visibly influential parameters such as in the socio-economic realm (e.g.: creation of jobs, market development, competitiveness and turnover), scientific (e.g.: measurable effects on climate, biodiversity and resources) and political (e.g.: policy targeting and push; market push; effectiveness of policies and relationship with innovation).

The current and long-standing governance strategy for obtaining and providing electricity is based, mostly, on a centralized distribution of fossil fuels, though other sources exist, like natural gas, biofuels and nuclear energy. The issue of

homogenization, as was mentioned above, is especially relevant here (DiMaggio & Powell, 1983). The current prominent energy resources are unable to adapt to the global requirements of the legitimation bodies (Cao et al., 2021). Therefore, if the new efforts to abandon previously damaging or inefficient systems fall into the same pit of bureaucracy and homogenization, especially if under surveillance of the same governmental bodies or ones with different names but the same spirit, then all the goals that will be legitimized now could prove to be fruitless in the following decades, as the current systems have now come to the conclusion they are.

Once it is established, in the governance of the union or country, what the energetic system and sources will be, the legitimation process is set in motion. Barriers, however, are still present at all levels of legitimation, including the new bioenergies, with an imbalance in the roles of public and private institutions in legitimating new energy sources and defunding previous harmful ones (Zelli et al., 2020).

The sources of bioenergy can be color-coded, as stated by Lene Lange in a speech for the BBIJU, in blue, green, yellow and red, much like biotechnology (blue, green, red and white) during the 15 years (1985-1998) of major growth of this area in the EC (Aguilar et al., 2013). Some of these colors already have some literature associated to them, such as the blue and green bio-economies. The associations to yellow and red are not so easily found in the literature, though the concept exists. Each color refers to the most influential resources in the green transition: red for meat, yellow for agro-waste and biofuels, blue for maritime resources and green for energy and forestry. One color I would like to add that is a counterpart to all the others is the “black” bioeconomy regarding all the coal and petroleum-based industries. In the case of this research, the focus is on the green bioeconomy, especially in the energetic sector, as the green transition is defined as the transition to a more sustainable approach to energy sourcing, consumption and the supply chains that provide access to it.

2.5 Contribution to Knowledge

The work explores the role of policymaking in the legitimation of new energy sources for the green transition in the European bioeconomy context. The questions representing this are:

- How does policymaking help legitimate new energy sources?
- Are previous bureaucracies inherited by new institutions in the context of the bioeconomy?
- Are there procedural synergies in the legitimation of the bioeconomy?

Through an institutional genealogy lens, the methodological approach will follow the regulation, the financing and the adoption of the bioenergy sources, respectively, via:

1. creation a chorological demonstration of the documents used to legitimate the bioeconomy and alternative bioenergy sources;
2. and provide the views of 30 consumers, suppliers, and regulators (10 of each) via semi-structured interviews regarding the operationalization of the legitimation of the bioeconomy (financially and policy-wise).

The expectation is to provide a historical view of the institutional and economic efforts made regarding the bioeconomy and how those factors have contributed to the current paradigm shift in energy sources.

Chapter 3: Methodology

3.1 Introduction

The design approach to the study of the bioeconomy and its legitimation at several levels of actorship revolves around the use of qualitative research. The inductive angle to this social research is derived from its exploratory nature, given that the objective is to find insight into the context rather than to generalize or extrapolate from the results. Conducting qualitative analysis introduces the ability to uncover rich, in-depth accounts of actors able to describe the experience and evolution of the respective context of interest in a manner that is representative, and which provides several points of discussion to be targeted and developed freely. Semi-structured Interviewing, as the chosen method of primary data collection, is the direct result of the decisions based on the qualitative and inductive approaches to this thesis' development. As such, this style of interviewing provided the necessary insights into the researching of the legitimation of bioenergies in the context of the bioeconomy. The process was built around the engagement with actors willing to share the experiences and changes noticed throughout the years that affected their work protocols frameworks, and decision-making. Of particular interest to this thesis are the effects of the creation of new institutions and respective policies and other institutional regulations that brought significant changes to the energy sector and new ventures therein willing to engage with the new changes and implementing them at societal and institutional levels. Furthermore, also of interest are the financial infrastructures and opportunities built around the new energetic and economical conceptualization of businesses and societies. In this way, the businesses, institutions, and other types of organizations were able to express the influences, new opportunities and limitations associated to: the appearance of new enforcing institutions; the integration of new policies

regarding alternative energy sources; and the national and regional energetic goals that had to be introduced into the strategizing and management workflow in order to fully incorporate them. Taking a context of the influence of institutions in the legitimation of alternative bioenergy sources into

consideration, this thesis positioned itself in the data collection by framing the research with the following three research questions:

1. *What are the strategies used for the legitimation of the energy sector?*
2. *In what way, if any, do policymakers and other relevant profiles help legitimize the energy sector?*
3. *How has society adapted to the new energy sector?*

The research questions are best supported by a qualitative research design because, as is mentioned above, the target of this research is in-depth, rich and contextual insights into the actors, institutions, ventures and policies supporting the legitimation of the green transition's energy sector.

The types of data used for this thesis focused mostly on secondary and primary data. Secondary data in the form of archives, reports, policies, and data directly from businesses. Primary data focused mainly on semi-structured interviews from three types of actors based on the nature of their involvement with the empirical context: regulators, innovators, and integrators. The secondary data was then used to generate a typology based on the idea of the chronological events that lead to the current situation regarding the bioenergy sector and how its legitimation and implementation has been affected and financially supported through time. This analysis provides the foundations for the connection with the current situation of the bioenergy context by connecting the past with the present.

In order to complement the chronological typology created from the secondary data, the primary data is used as an insight into the actual context of the actors (and respective businesses or activities), that are being affected by the resulting actions of new institutions and their policymaking actions and financial support initiatives, and how the implementation of such actions and initiatives was made at the economical, business, institutional and societal levels. To investigate the several types of opinions and experiences, the interview questions focused mostly on the actors' experience of the policymaking around the energy sector and the implementation of the changes at a business or institutional level as well

as the access to the purported changes at a societal level. In addition to these topics, the idea of dedicated, new financial aid/institutions/opportunities was also explored in order to understand the several levels of actual attempts at implementation of the proposed energy changes. The actors that were engaged with belonged to several countries in Europe and the UK (more specifically, Scotland). The institutions these actors were involved with at the time or had been involved with prior to the interviewing were connected to: policymaking towards implementation of alternative energy sources or had knowledge of the objectives and strategizing necessary to integrate the new energy goals in Europe and the UK; businesses and innovation hubs which derived their current business management and strategies from the energy sector and the new policies emerging from the transition; NGOs or other types of community-driven societies which were involved with connecting the new policies with societies and governments.

The selection of the participants was made via purposive and snowball sampling. All the interviewees were a part of the three previously mentioned actor groups directly involved in the green transition, having the knowledge to talk about such impact and how it affected them, and the businesses they were part of or aware of. The interview data was analyzed via transcription and textual tables for each participant. The resulting data was organized to demonstrate how the decision-making of each of the actors had been affected by the introduction of the green transition policies. The analysis of the data relied on the applied organization scheme via thematic analysis, which is the most suitable to uncover themes and patterns in large datasets. Using this type of analysis and data structure allowed for the interviews to be cross-checked and to provide multiple level thematic analyses in order to aggregate theoretical dimensions and provide simpler forms of the complexity of narrative correlation. Thus, the legitimation of bioenergies in the context of the bioeconomy is given a historical context and the current insights of the actors which are leading the implementation of the green new deal via the changes to alternative sources of energy.

The exploration of the legitimation of the bioeconomy and alternative bioenergy sources through relevant actors are explained via the research methods used for this research. The study’s objectives and aims are restated and revisited while

the research questions are presented contextually. Explanations on the ontology of the study are also provided, with the logical epistemology path, thus providing the philosophical context of this research. The philosophical underpinnings of the study will give way to the qualitative research design. Included in the research design are the sampling approach, the types of data that were collected and how such collection came to be, and, finally, how the analysis and interpretation of the data were made. To conclude, the focus is on the ethics, reliability, validity and limitations of the presented research design.

3.2 Objectives

This research focused on understanding the historical and current influence of policymaking in bioenergies as capable, alternative sources of energy for the green transition. The academic contribution of this research addresses three main questions.

1. What are the strategies used for the legitimation of bioenergies?

Overcoming the barriers applied to a paradigm change in one of the most reliable sources of power - carbon fuels - appears in several forms of legitimation. The legitimation of alternative sources of power, especially bioenergies, consists of a plethora of methods and strategies with several different types of spheres of influence (Panoutsou et al., 2021). A focus is put on the historical influence of institutions and the current influence they had in the creation of new institutions and the policies that prevailed in a mostly oil-based economy and society (Bennett, 2012; Pike et al., 2015). The historical influence, known as institutional genealogy, was chosen as an approach with the potential to generate greater and deeper knowledge on how traditional institutions affect the ability to make immense societal and economic changes via the creation of progeny, i.e., newer institutions with clear objectives (Corradini & Vanino, 2021; González-Santos, 2020; Pike et al., 2015).

2. In what way, if any, do policymakers help legitimate bioenergies?

The knowledge and human capital are dimensions of the institutional genealogy with an effect on the decision-making processes and, consequently, the effects

on the legitimation and implementation of alternative sources of bioenergies (Bejinaru et al., 2018). The importance of different types of knowledge capital and how they influence the transition via the use of bioenergies is also an impactful way of determining the legitimation avenues of bioenergies. The focus on policymakers comes from the positioning these figures have in affecting the speed at which new technologies and ideologies are able to be adopted and implemented (Rhodes et al., 2014). Policymaking is a double-edged sword, with the power to remove obstacles for new innovations to come to market; incentivize the market to develop alternative forms of growth via innovative solutions; increase the rate of disruptive technologies; and generate a financial flow into new markets and ventures (Rhodes et al., 2014). However, policymaking can also generate lag effects in the implementation and deployment of innovative solutions; complexify the development and integration of innovative technologies; and generate economic and time burdens too great to bear (Aghmiuni et al., 2019). Considering how policymaking strives for stability, the quest for a better connection with innovation is at hand with the study of the emerging market of alternative bioenergy sources and how they are legitimated.

3. How has society adapted to the use of bioenergies?

Considering the institutional levels of adoption of bioenergies, the knowledge derived from such sources would be incomplete without an actual observation of the implementation of its initiatives. Therefore, it is crucial to observe whether the attempts of legitimation and implementation at a policymaking and institutional levels actually reveal themselves at the societal level (Imbert et al., 2017a). In this way, it is relevant to study the businesses and how the industries are able to relate their activities alongside the policymaking that defines their paths and the financial opportunities that promote their growth. The policies and capital that the institutions provide are, in turn, reflected in the businesses' ability to enter the market and implement their innovative ventures, thus revealing a societal impact and adoption (Corradini, 2019).

3.3 Research Philosophy

The philosophical perspectives in academic research provide the guidelines to understanding the universe that is being studied. To study and define the universe or reality, the researcher engages in ontology and epistemology paradigms, which are the definition of truth and what that truth looks like or how it can be unveiled. The definition of what the reality can be like and the ways in which we can perceive it gives us the philosophical underpinnings to research. The ontological and epistemological approaches give the reader the ability to perceive the world through the researcher's eyes and establish a logical connection as to why the approaches used define the world the researcher sees, thus establishing the assumptions and implications of such a reality. In the same way, the research itself is affected by the interpretation of the collected data that is made. In social research, the standard form of generation of knowledge is via the inductive approach (Jørgensen, 2016; O'Reilly, 2014). Inductively assessing a reality indicates that, rather than testing a formulated hypothesis about previously gathered knowledge, the information that is received is analyzed with no prior testing or hypothesizing in mind. Once analyzed, the data reveals a hypothesis, which is applicable to that research's observed reality alone (Silverman, 2008).

The analysis of the universe the research is undertaken in, then, is affected by the definitions of categorized organization research, which are presented in the form of research philosophies: radical humanism, radical structuralism, interpretivism and functionalism (Burrell & Morgan, 1979). The four categories of research are a representation of two dimensions: subjective-objective and regulation-change. The subjective-objective dimension defines how the world is perceived and how the perceptions of such a world are established and divulged. The concept of ontology and epistemology are used to define this reality and correspond, respectively, to the said perception of the world and the ways in which the inhabitants of said reality know or perceive it (Zalta, 1995). This approach is important for the research in this topic, as it is used to explain why the methodology chosen helps the reader and the researcher understand the reality that was studied. The second dimension relates to the pinnacles of societal structures and how the swaying movements of such structures balance

each other out on the two sides of the spectrum: unity and solidity vs change and conflict.

Legitimation, as a concept, is an umbrella term that suffers from too many affinities with other concepts, giving it a fluid usage throughout literature without proper indication of where the concept lands, specifically, when discussing different types of ecosystems (Bitektine & Haack, 2013; Easton & Hess, 1962; Foster et al., 2017). As legitimation, in and of itself, is a concept that is thoroughly defined in classical literature, the fact that is has suffered changes and additions as the literature surrounding it grew is anything but unexpected. Considering the growth of the concept as a paradigmatic factor in the establishment of businesses and institutions, and its major contributions to and synergy with institutional theory, the concept of legitimation can be considered a standard in most literature that explores innovation and institutional change (Binz et al., 2016). Legitimation is also a serious consideration for organizational research, as it is considered as a requisite of survival in the innovative and institutionalized ecosystems (Snihur & Zott, 2013). Thus, the study of legitimation remains highly contextual and so does its definition and what it entails as determining factors to survival of both institutions and companies.

The original ecosystem in which legitimation occurs (e.g., institutional research) is mostly considered to follow a positivist philosophical paradigm (Easterby-Smith et al., 2018; Molina-Azorin et al., 2017; Shepherd & Suddaby, 2016), though some authors consider different approaches should be taken (see, e.g., Swedberg, 2016). The way in which positivism reflects the research regarding these topics is by explaining the world with a set of rules and expectations about the behaviors of the inhabitants of said world. Thus, it is a philosophical approach that, ontologically, expects rules and hypothesis to be tested, continuously, and to ensure that the patterns in the world it studies are identified, defined and provide a general understanding of most who are part of that reality (Bennett, 2012). Positivism removes the ability to have a subjective understanding of the reality being studied, thus removing individuals' perspectives and experiences from the sets of rules that determine predictable behaviors as the paradigm. Ontologically, positivism defines the worlds with

rules and predictions, and, epistemologically, it established that all rules and predictions are based via scientifically or mathematically proven hypotheses.

The ecosystems in which legitimation has been mostly studied with a mixed approach methodology elevate the implications of qualitative and quantitative research, which have sparked debates on which to follow or whether to combine them (Easterby-Smith et al., 2018; Molina-Azorin et al., 2017; Turner et al., 2017). Due to the historical nature of research and how it was mostly based on hard sciences and mathematical evidence, legitimation often follows a positivist tendency through requisites and indicators determining baseline success or failure to legitimate the object (O'Brien et al., 2017; Schoon, 2022). Similarly, the deconstruction of legitimation as a concept has also been done in a similar positivist fashion, with several determining factors that define legitimation and that indicate how legitimation is applied and where it has an influence in the establishment or implementation of organizational paradigms (Schoon, 2022). The current literature, however, has developed the importance of several approaches to organizational research and establishes the approach to the study of legitimation as mostly interpretivist, indicating that the way in which the world is built is via those living in it and their interpretation of such a reality alongside their social experiences (O'Reilly, 2014; Suddaby et al., 2017).

The reason why the literature has shifted into a more holistic approach, which allows both positivist and interpretivist epistemologies to coexist when defining legitimation, is because of the fact that legitimation is such a large concept, that affects so many areas and has so many terms under it that it would be impossible to have it be defined by one philosophical approach alone without incurring in a risk of incompleteness and lack of representativeness (Molina-Azorin et al., 2017; Turner et al., 2017). Thus, it is the complexity of the phenomena that has pushed research to thoroughly explore the cases that allow for a fuller, more holistic understanding of legitimation. The importance of the study of legitimation via different types of research comes from the fact that some occurrences are not easily (or even at all) explained by some more traditional approaches.

To uncover reality via interpretivism, then, a researcher must explore the ideas and concepts that those living in said reality have developed as a logical response to their environments and social interactions, which, then, define the world they live in (O'Reilly, 2004). The fact that only the research involving said actors can uncover such truth about the reality they live in indicates the social variable that is also necessary for the understanding of said reality, giving way to the approach that connects the researcher and the actors. The ontological approach to this concept, or rather, the way in which the world is perceived for this concept's ecosystem, indicates that the reality is subjective and built upon the subjectivities of most of the inhabitants that deal with and live in this truth. Regarding legitimation, the subjectivity of its truth stems from the fact that the human capital within the institutions that provide legitimation are the one group who can, individually, define reality, making each of them a whole world on their own to be explored by the researcher via social engagement (Bejinaru et al., 2018; David, 1994).

Considering the reality is, therefore, multiple; the predictability of it based on single realities is extremely low, which leads the researcher to look for several truths, through a qualitative methodological approach, in order to build a world that is more complex, rich and descriptive. The perspective of a world that is defined by the participant, rather than the observer, is a statement as to one of the dimensions that is essential to the study of legitimation: the legitimator's actions and perceptions of the actions that might lead to legitimation; the outsiders who observed the legitimator act and who were aware of how other factors contributed or hindered the legitimator's efforts. The connection between the phenomenon that is observed and the actors which are living the changes caused by the implementation of legitimation, rather than the observer's point of view being the definition of the phenomenon, is how the interpretivist approach manifests. Consequently, the use of interpretivism in the study of the reality within which the phenomenon of legitimation is studied, especially when associated to the institutional genealogy lens, provides an insight into the research's ecosystem with the participant as the only frame of reference of the phenomenon and its connection to the applied theoretical lens. Legitimation research which opts for an interpretivist approach leads an ontological perspective of the world created by the actors implementing

legitimation strategies and processes the research's goals by epistemologically following the construction of theses using the interaction between researcher and the actors mentioned above.

Indicative of the effort of the interpretivist philosophical underpinning definition is the engagement with several types of actors, an engagement which is used to describe the experiences and social interactions that define the institutional world they live in. To find ways to enrich the information provided by these actors, the researcher may follow several paths of methodological approaches to best define the direction that entails the connections to the proper arguments of the defining thoughts that embrace the actors' logics and interpretations (Jimenez-Luque, 2021; Lippmann & Aldrich, 2015). In this way, avenues such as scenario building, futureproofing, historical contextualization, traditional studies and other approaches can be used as modest additions to major philosophical underpinnings. The case of this particular research was that the interpretivism approach was enriched with a term that encompassed the passing of time and evolution of institutions while considering the changes to the inner workings of the institutions as reflected by the actors that lived through them and passed them onto newer members (Iskandarova et al., 2021; Jimenez-Luque, 2021; Pike et al., 2015). Institutions are, therefore, considered keepers of time and order, but to what extent is what the case of institutional genealogy proposes to study (David, 1994; Sotarauta & Suvinen, 2018).

As a concept, the study of the genealogy of institutions, and the consequences of time and the inevitable changes it brings to them, uncovers the moral transformation of institutions and explores how the creation of newer ones can be influenced by traditional or prior morals from the "parent institutions". Institutional genealogy, therefore, brings light to the processes with which parent institutions and their progeny interact amongst themselves and with the world, and, additionally, provides insight into the moral and agency the newer institutions inherit or are imbued with (Pike et al., 2015; Zelli et al., 2020). It is the role of the research approach in this thesis to connect the past and the present, especially in the context of great change and greater departures from the types of behaviors and mentalities which originated the "parent institutions" (Bennett, 2012). Connecting two types of time is a proxy for evolution and, in

the context of legitimation, how the newer institutions are legitimated but also how they, themselves, legitimate the new concepts and morals brought forth by their creation and justifying their appearance.

Associated to the method which connects different points in time and explores their relationship via the effects the institutions feel is the integration of the factor of extreme change or extreme need for change. In times where there is a necessity to transition to different strategies regarding governance or fundamental sectors in society, the creation of new institutions that carry out such a mission is inevitable (Corradini & Vanino, 2021; Steen & Hansen, 2018; Thompson et al., 2015). These institutions are, in themselves, a new beacon of ideals and paths which will determine the implementation of the objectives they were created to fulfill. In these conditions, new institutions carry the legacy of time and the responsibility of self-sufficiency. It is only via legitimation that the new institutions can thrive and fulfill their objectives, but the factors influencing their ability to become legitimate are not the current characteristics they possess alone, rather, it is also determined by the legacy they carry (Aarset & Jakobsen, 2015; David, 1994; MacKinnon et al., 2019). Thus, it is necessary to involve the process of adaptation alongside the morals and ideals that are carried over from the time before the need for change. In this way, the institutions are studied regarding the chances of survival, i.e., the techniques that are used to legitimate innovative spheres of influence and what factors (e.g., legacy) are taken into consideration during the study of the institutions and their role in the ability for societal change. Therefore, to study institutional genealogy during the unfolding of great change is to ensure the connection of time and legitimation as independent but coexistent processes which naturally come together and influence the survival of newer institutions and, consequently, new ideologies and innovative paths to crisis management.

Regarding institutions, studying them through their legacies and their ability to be brought into this world and surviving with the sole purpose of fulfilling objectives given by their “parent institutions” requires the methodology previously presented. As can be seen in Fig. 1, the impact of “new triggers” in incumbent or “older” institutions has some potential consequences, such as the creation of “newer” institutions or the direct legitimation attempts of the “new

objectives and ventures" associated to the "new triggers". New institutions being created by "older" ones usually entails some sort of "legacy", which can be understood under the theoretical lens of institutional genealogy. The "legacy" entrusted to "newer" institutions allows them to then have their own legitimation effects on the "new objectives and ventures" arising from the "new triggers".

Interpretivism, ontologically, allows for the insights of the human capital that constitutes institutions, providing the researchers with an inside look into the given abilities of the institutions. The context of great change provides the researchers with an environment prone to new institutions and innovative ventures, both of which require legitimation as part of their birth and life processes. Institutional genealogy wraps the concepts together, alongside the contextual background, to provide insights into the successes and failures of new and old institutions, both at the legitimation level, and at the ideals and morals level.

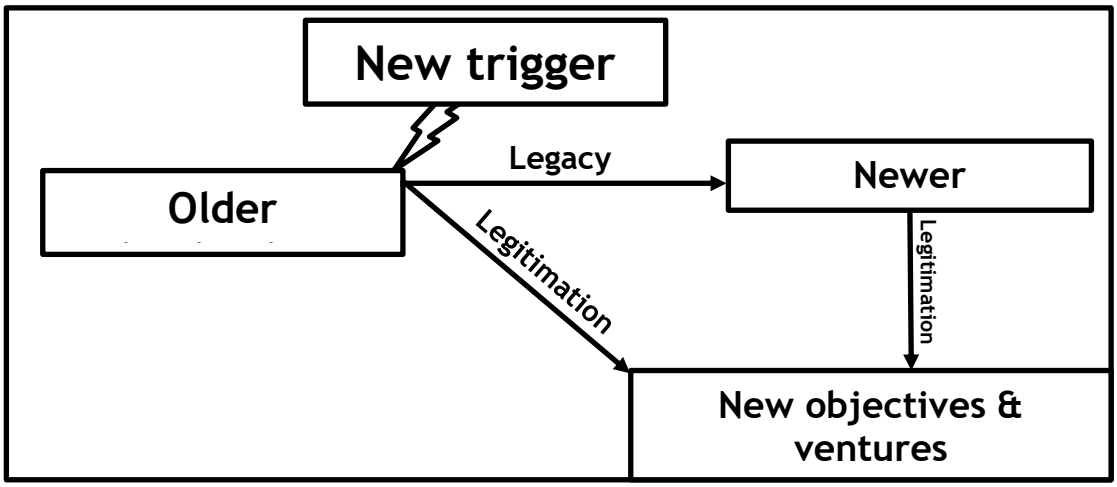

Figure 1: Effects of newness in incumbent institutions and their response according to an institutional genealogy lens.

This thesis adopts the interpretivist approach explored earlier. The thesis uses this approach to identify the connection between legitimation, change and institutional genealogy, which are representative of parts of the ecosystems surrounding institutions and policies. The following sections explore why institutional genealogy and institutional theory were both taken into

consideration for this thesis and why, ultimately, the institutional genealogy was selected as the theoretical lens for the analysis of the data collected with the interpretivist approach guiding said collection.

3.4 Research Strategy

The research conducted in this thesis was considered exploratory due to the preliminary nature of the object of study. The relationships found within the legitimation and change nexus alone are a topic that has been explored in literature (Easton & Hess, 1962; Johnson & Urpelainen, 2020; Zelli et al., 2020), but adding the concept of institutional genealogy as a theoretical lens has the potential to put this research at a very nascent point, considering the historical approach that is added and the two other factors it connects via change and legitimation (David, 1994; Énergies, 2016).

Considering the objectives qualitative data collection typically fulfills are related to the gathering of insights and understanding regarding a phenomenon and the interactions associated to its research, rather than trying to extrapolate data at a general level and to other fields which are not related to the phenomenon, qualitative techniques are the ones mostly used in exploratory research (Amy C. Edmondson & Stacy E. Mcmanus, 2007). Qualitative research also fits more properly with the research questions posed, as they mostly focused on “how” rather than a “how many”, and with the way the phenomenon of legitimation was approached. The results from qualitative methods are focused on producing rich, in-depth accounts and extracting insights from the interactions between actors and the phenomenon or phenomena being researched (David Silverman, 2008; Easterby-Smith et al., 2018), which connects to the research philosophy that was adopted. Within the legitimation sphere, the types of strategies that can be used with qualitative research are very diverse and no specific one holds precedence when engaging with legitimation literature, as a great range has been previously employed on different types of legitimation research (Schoon, 2022). A quantitative research strategy, hence, was inapplicable in these conditions and approaches, as the purpose of the research questions was not to enumerate or attempt to mathematically define the phenomenon, nor was it to generalize the results from the data to other

phenomena or ecosystems. Rather, the suitability of qualitative data to defining this research's phenomena in an intricate way is justified due to the complex institutional and organizational contexts mixed with the social aspect of the interactions being studied. Additionally, the actors' perspective on the phenomena is also taken as the most important piece of evidence for the definition of the reality within which the phenomena are included in, thus providing further arguments for the use of a qualitative research strategy.

Following the literature review and a dive into the potential theoretical lenses explained earlier, the researcher followed through with the definition of the data strategy and approach in order to provide the best rounded venue of information for the topic that was being explored. The definition of such a strategy came easily as the literature is very straightforward regarding the kind of data collection that can be chosen and which provides the best insights into the contexts that are to be explored (Amy C. Edmondson & Stacy E. Mcmanus, 2007). Therefore, the researcher chose to explore mostly primary data via the form of semi-structured, in-depth interviews and documents (such as policies, reports and other sources of data). The types of data were to be representative of the past and the present of the contemporary contexts. Therefore, via the documents, the researcher built a typology which was representative of the past and how it culminated into the current context (Énergies, 2016). The current context, explored in tandem with the past, was provided via the interviews with relevant actors in the sector that could provide information which was representative of the past and present of the context and how their lived through the changes that occurred as well as the institutions they were a part of.

3.5 Data Collection Approach

This researcher designed the methodology to begin with a literature review of the topic of legitimation and the empirical context defined as the project's setting. In that sense, the concept of legitimation was studied from its philosophical origins up until the current present day regarding how it is approached in literature and what types of research contexts it is involved in as well as other concepts it is usually associated with. The other concept that was

explored was the bioeconomy and the bioenergy within the context of the green transition and all the policies that provided the strategies and overall goals for the institutions and global governments. The legitimation of the bioeconomy was the focus of the research. The interactions with the different types of energies regarding its legitimation were what allowed the researcher to explore the several energy sectors and focus on the bioenergies and biofuels with particular focus on policymakers and businesses, and the policy evolution via document analysis.

The collection of research materials pertaining to document analysis was made via google scholar, personal contacts, policy archive websites and the university's repository. This data is usually considered secondary data, but in the case of this research, it adopts a double role: documents are analyzed on their own as part of an ecosystem, thus being secondary data; but they are also primary because their analysis is intertwined with the contextual information from the interviews, granting it an extra layer of detail and actuality. An example of this would be the analysis of the Paris Agreement, which has different connotations when it was first made but has, currently, other interpretations and analyses which pertain to its effectiveness as a policy document (Bombelli et al., 2019).

Regarding the interviews, to select and identify candidates, two approaches were combined: purposive and snowball sampling. Purposive sampling is when the researcher uses their own network, social or academic events and other media (e.g. LinkedIn) to contact potential candidates appropriate for the interviews regarding the energy sector (Onwuegbuzie & Leech, 2007). To do so, the researcher used several levels of categorization criteria to define the type of actor to be interviewed. Associated with the actor's selection criteria were the consent forms and other types of bureaucracy needed to be accepted in order for the interview to take place and for the ethics committee from the University of Glasgow to be respected. Therefore, the researcher contacted the candidate profiles based on a bespoke database of potential respondents. The participant database contained the initial pre-selection criteria and, upon successful contact with the actor, the means of contacting for the scheduling of the interview. The initial pre-selection criteria were designed based on the actor profiles that the

researcher and his team found to best represent the context that was to be analyzed. Hence, the pre-selection criteria were defined as “Workplace”, “Position at Workplace” and “Type” of actor.

The “Workplace” and “Position at Workplace” are two terms that are interconnected and are dependent; the inclusion of both is also related to the fact that a person could be unemployed recently and, therefore, not have a current position but have a position that they occupied for many years or in which the amount of experience they gained in the field made them potential candidates for the data collection. Thus, the “Workplace” defines the current institution, organization, company or business that they are a part of. However, “Position at Workplace” is defined as either the current role an employed person (who is to be contacted to be a part of the interviewee list) has or the position someone who is considered a potential candidate for interviewing had that gave them the experience and knowledge to be interviewed for proper knowledge and insight extraction. The types of institutions, companies, organizations and other workplaces that provided a proper environment for the actor to be in and to be chosen for the interviews were mostly workplaces where the actors had to deal with a lot of regulatory documents and European *ethos* regarding the green transition and the energy sector. Special consideration was given to actors working with biofuels and other alternative energy sources; or ones where the main focus of the business was to ensure the proper green transition (at the several levels of the transition that are delineated in the Green Deal) and/or provide new energy innovations or technologies which had to go through the processes of being legitimated, thus, ideated, developed, emerged and established. According to these descriptions, examples of said “Workplaces” can be found in the Table below.

Table 2: Interviewees factual data.

Participant #	Gender	Times interviewed	Workplace	Profile
1	Male	1	International institution	Regulator
2	Male	1	Business	Innovator
3	Male	1	Business	Regulator/Integrator
4	Male	1	Research institution	Regulator

5	Male	2	Business	Innovator/Integrator
6	Male	1	Business	Innovator
7	Male	1	Business	Innovator
8	Male	2	International institution	Regulator/Innovator
9	Male	1	Business	Innovator
10	Male	1	Business	Innovator
11	Female	1	NGO	Integrator
12	Male	1	NGO	Integrator
13	Male	2	Business/Governmental institution	Innovator/Regulator
14	Female	1	Business	Innovator
15	Male	1	Research institution	Innovator
16	Female	1	Business	Innovator
17	Female	2	Business	Innovator/Regulator
18	Male	2	International institution	Regulator
19	Male	2	Business	Innovator
20	Female	1	International institution	Regulator
21	Male	2	Governmental institution	Regulator/Integrator
22	Male	1	Research institution	Regulator
23	Female	1	Business	Innovator
24	Female	1	International institution	Regulator
25	Male	1	International institution	Regulator
26	Female	1	NGO	Integrator
27	Female	1	NGO	Integrator
28	Male	1	Governmental institution	Regulator
29	Male	1	Research institution	Regulator
30	Male	1	Governmental institution	Regulator

The roles the actors took while employed in those workplaces were also considered: more senior roles were more interesting for the researcher in terms of the institutional genealogy theory and its connection to legitimation at the institutional level; of the access to regulatory documentation and a more closely invested personal insight into the different regulatory environments that built the current paradigm; of having a better overview of the success and failure of businesses and ventures' several levels of innovation and preparedness; of

having the ability to provide a historical context with proper highlights regarding relevant eventful points in time. Less senior or other types of roles were also considered because of their ability to provide insights into the current barriers (or perceived barriers) regarding the legitimation of new ventures, innovations, technologies or businesses without the biases of having historical perspectives; of their perception on the influence of new and older institutions on the marketplace for new innovations and technologies; of their knowledge on the actual effectiveness and synchronicity between the regulatory efforts from the relevant institutions for their survival and their ability to thrive in markets; of providing insight into the current legitimation efforts at the emergent or early levels. Despite this, the context and experiences of the actors were always taken into consideration and advice from the mentors was always sought after regarding the decision to include some interviewee once informed of their role in the workplace that was being looked at.

The other criteria used to define the interviewees and determine their contribution to the data collection was “Type” of actor. The “Type” of actor criteria was mostly related to the research questions mentioned above, as they were inspired by the types of influences that new ventures are affected by. Therefore, to find out the strategies that are used for the legitimation of bioenergies, the researcher planned to investigate new ventures and emerging innovative institutions that were trying to become legitimized businesses or projects in the new frontier of the energy sector, bringing for the profile of “Innovator”. Thus, engaging with new ventures in the energy sector meant that the researcher would have to connect with successful and unsuccessful businesses and projects, at any stage of the legitimation process, to understand what kinds of actions and barriers they had found to be the most influential on their journey, be that journey lengthy, relatively new, or even over. Despite the fact that the researcher chose to find “Innovator” as a “Type” of actor, these descriptors are not meant to be reductive, rather, they are reflexive of a specific side of the actor that was interviewed and how that side was considered valuable intel for the research into the new energy sector.

The researcher also sought to consider the regulatory side of the legitimation efforts of the new energy sector. To research the regulatory side, the profile of

a “Regulator” was chosen. This profile, though apparently defining someone responsible for being a “Regulator” includes, however, actors that were highly involved in the definition of projects and other initiatives which resulted directly from regulatory events. Consequently, the role of a “Regulator” includes policymaking profiles, i.e., actors that were directly involved in the policymaking activities that resulted in academic or bureaucratic capital used for the definition and limitation of activities from “Innovator”. A “Regulator” also includes profiles that were very aware of the administrative and bureaucratic burdens necessary for new ventures to begin their journey into legitimizing themselves and their efforts to follow the new policies within their limits and within the limits of their own creations and technologies. Finally, this profile also includes those that were not responsible for the policymaking and production of documents but that were directly involved in the processes of reviewing and accepting new ventures via several different processes (e.g. project funding, investment capital).

Finally, the researcher chose to include the actors responsible for ensuring that the regulatory and innovative energy solutions were implemented in a way that allowed for society to use them and integrate them in the daily lives of the people for whom the regulations and innovations are made. Actors responsible for operating in later stages of research in the green transition are highly requested as part of the future developments and trends of research (Köhler et al., 2019). The role of the “Integrator” is one that relies on the precedence of innovation and regulation being fully legitimized. These actors add an extra step into the legitimation process due to their ability to cause both legitimation or delegitimation movements based on the perceived social norms and impacts of new innovation (Köhler et al., 2019). The “Integrator” provides legitimated businesses, products and projects with the access to society and other venues which are for societal purposes, therefore taking another step in the process of full legitimation: continuity. The role of intermediaries in the transitions are those of ones who either promote the smoothness of the transition or disrupt the mechanisms which are deterring the transition, e.g. incumbent regimes (Köhler et al., 2019).

Characterizing the research respondents in this way allows for the whole process of the legitimation of new ventures in the bioeconomy's energy sector would be covered: the innovators representing the innovative side of the energy sector, the regulators representing the bureaucratic processes and influences in the emergence and establishment of the energy sector, the integrators representing the strategies that define the implementation and establishment of the results of innovation and regulation in society, and their combination for defining the connection among them to help identify areas of conflict and areas of symbiosis, thus providing further insight into the new institutions and their relationships with older ones (i.e., institutional genealogy). The representative context also took into consideration potential outliers to the definition of "Regulator", "Innovator" and "Integrator", such as actors which could represent a combination of profiles, having been in many of the situations described above for each of the types. The profiles with combo typing and, therefore, the ability of providing rich insight into the connection between regulation/innovation/integration strategies were also included in the interviewee list and, when interviewed, prior mention of the types of themes in the questions that were to be answered was made in order for the actor to be given the option of deciding whether they would want to fit into one "Type" or go through with the combination typing approach.

Building on the purposive sampling approach deployed, the researcher also applied a combination tactic for the method of collecting data mentioned above in the form of snowball sampling. This type of sampling requires the researcher to have access to participants in the study who, then, are able to provide the researcher with an introduction to other potential participant candidates (Biernacki & Waldorf, 1981). The way the snowball sampling happens is via the participant, which takes part in an interview, identifying that the questions asked, and the themes mentioned by the researcher would benefit from the insights of another actor that is within the network of said participant. Therefore, it is part of the interview process, even if it doesn't naturally occur within the interview, for the researcher to ask the participant whether they are aware of any institution, project or academic that would be suitable for a discussion on the topic of the green transition's energy sector regulatory and innovation legitimation efforts (Biernacki & Waldorf, 1981; Onwuegbuzie &

Leech, 2007). Snowball sampling provides the researcher with an increased sampling number, ensured that the participants met the selection criteria and provided the initial participants with a topic to explore their relationship with the suggested participant and their opinion on the connection of said participant to the interview's topics and questions, thus enriching the data with the linking of participants who might have engaged in similar activities together (Onwuegbuzie & Leech, 2007).

Once the pre-selection criteria, the methods for participant selection and the information on potential candidates were finalized, the researcher started working on the final questioning series, via a semi-structured interview approach, and the sample size and distribution based on the profiling described above that was previously agreed upon by the supervisory and project team and approved by the University of Glasgow's Business Ethics Committee.

3.6 Interviews

The line of questioning was inspired by the information uncovered by the literature review but also strategized around the research questions. Thus, based on the research questions, the baseline of the research was to find out about how financing and policymaking helped to legitimate new sources of energy and how that was reflected upon society (Iskandarova et al., 2021). The questioning also included the notion of the profiles that were interesting for the topics. Therefore, the questioning was broken down into three types of profiles and the topics that reflected both the research questions and the theories applied within them. The three types of profiles consisted of policymakers, businesses and integrators (with the specifics already mentioned above) and the distribution of the questions focused on: "Green transition", "Institutional Genealogy", "Finance and Regulation" and "Research and Development". Each of the titles was attributed to a total of one to three questions, some with direct follow-up questions (e.g., example giving). The "Green Transition" topic basically covered questions related to how the green transition, and the emergent policies and institutions, had affected the business and policymaking and, additionally, how the individual perceived the transition and felt about it. Secondly, the "Institutional Genealogy" section of the questions provided an

insight into the effects of the institutions and policies that most affected the morals and ideals that businesses and policymakers act upon and whether they had perceived any moral or narrative changes in their workplaces and results as per the green transition policies and their enforcing institutions. Thirdly, "Finance and Regulation" looked at specific policies and frameworks that were developed to provide support and enforce the green transition and how they had affected the workflow of the participants and their workplaces. "Finance and Regulation" also provided insight into what kinds of opportunities the businesses were given and whether those were advantageous, fluid and representative of the market's needs and demands. Finally, the "Research and Development" section was one which focused on understanding the focus of the participant and its workplace and how that was reflected upon by the policies and institutions that were most impactful to them. One characteristic that was shared by all the questions was how they delve deeper into the legitimation process, and all had a legitimation focus, even if at different stages of legitimation.

Considering there were three research questions, the researcher included several participants that were considered (by the ethics committee) as representative of each reality and allowed for the reliability and validity of the themes provided by the participant's insights. Therefore, a total of 30 participants (N=30) were interviewed for this research. The participants were divided into three profiles, though the flexibility within each profile was mandatory and some participants could have easily filled in both profiles as per their workplaces and positions at said workplaces throughout their work lifetime. The three profiles, as mentioned above, pertained to business owners or shareholders, policymakers or policy enforcers, and integrators or societal communicators. To guarantee the participants interviewed fit whichever profile and were comfortable with the line of questioning associated to that profile, some question samples were shared with them, both verbally or virtually, prior to the interview. Once confirmed by both parties that the line of questioning was okay for the participant and that they felt they fit the profile attributed to them, the researcher would make a background check on the business or institution they belonged to or had been a part of in order to best direct the questions and, also, to ensure the interviewee's introduction was mostly for

potential viewers or readers of the interview to have an idea about the participant's background.

The line of questioning and the timings for the interviews followed best practices which received additional proofing prior to the initial data collection as a way to trial the interview protocol (Bosman & Rotmans, 2016; Jørgensen, 2016). These tests, or pilot interviews, were made with non-participants who were also fitting of some of the profiles or had experience with the methodology applied for this research. The researcher provided these non-participants with the line of questioning beforehand and set up a mock interview in order to understand whether the questioning fit with the profile's knowledge and experience, and whether the line of questioning allowed for respecting the aforementioned time slots requested of the participants. The mock interview consisted of an informal exchange regarding the line of questioning and an assessment of the questions themselves and the amount of time the non-participant needed to provide both a quick and a more developed answer. In total, four pilot interviews were conducted, with one policymaking profile, two business profiles and one integrator profile. The time dedication to each interview varied between thirty to sixty minutes, and the researcher always made it clear that, in line with the University's code of ethics governing research interviews, were the participants to want to leave the interview earlier than expected that they were free to do so. The researcher also gave the participants the space to comment on the line of questioning and ensure the participants always felt like the statements made in the forms sent to them prior to the interview were respected. From the feedback given during the pilot interviews, the researcher made changes to the questions to ensure the issues mentioned were taken into consideration. The main feedback the researcher received was regarding the potential conflicting personal values and company values, and with the financial and funding opportunities having the need for more specificity regarding the sources and the validity of the structure of the financial aids. No major changes were required of the questions (especially considering they had already been approved academically and ethically) as the feedback was used to make sure the targeted information was retrieved more efficiently, rather than changing the content of the information being asked.

Upon completion of the pilot interviews, the final stage of the data collection protocol began. A total of 30 semi-structured interviews were conducted. The use of semi-structured interviews, as is seen in other studies (Charles et al., 2016; Giurca & Späth, 2017; Gustafsson & Anderberg, 2021; Imbert et al., 2017a; Iskandarova et al., 2021; Markard et al., 2016b; Thompson et al., 2015), allows for the insight into legitimation strategies regarding the energy sector, and it explores the connection between the innovation and regulation and how they are implemented at an institutional and societal level. The semi-structured interviewing provides the researcher with the tools to explore the in-depth experiences of the participants regarding the context of the legitimation of bioenergies. In this legitimation context, the business emergence and policymaking during the green transition were the perspectives relative to the institutional genealogy that were explored, providing a more institutional and organizational perspective of the research. The integrators, which were also included as part of the sampling, provide the legitimation processes that comes after the funding and policymaking already established the proper practices and opportunities for the emergence of bioenergy businesses and institutions (King & Soule, 2007). Aside from the perspectives provided by the businesses and policymakers, the integrators give the societal perspective of the inclusion of the bioenergy businesses and institutions and how the implementation of these have been realized at the social level.

The semi-structure nature of the interviews gave the researcher the opportunity to expand on questions and to come back to some topics to explore other venues of the answers. The interviews focused mainly on the exploration of the research questions via the profiles that were previously presented, thus granting information on legitimation of alternative energy sources in the context of the green transition through the lenses of the people engaged at an institutional, business or societal level in making the transition happen via different types of strategies and venues. More concretely, business owners or shareholders, project leaders and innovation experts were asked about their experience on how European institutions provided regulatory and financial aid in initiating and developing their sectorial ventures over time. Additionally, policymakers, policy enforcers and other similarly bureaucracy-driven profiles were given the chance to provide their insight on the effects of policy on the emergence of climate-

friendly energetic innovation and the stable and efficient institutionalization of the knowledge capital regarding climate-friendly energy and its societal exposure. The final type of profiles, that of the ones responsible for integrating the innovative climate-friendly energy solutions in society, were engaged regarding how policies and funding were promoting such implementation and at what level of society it was happening, be it academic, interactive, etc. The context of all these profiles indicated the connection between legitimation at several levels (institutional, business, and societal) for the context of the bioenergies during the green transition. The participant's experience was explored via their responses and created the opportunity for the researcher to capture the socially constructed reality representing the legitimation processes behind the current bioenergy sector. The adaptable framework of the semi-structured interviews allowed for flexibility and fluidity in the conversation, giving the participant the ability to expand, backtrack, repurpose, enrich, or revisit responses, thus creating the possibility to explore several lines of enquiry (Saunders et al., 2009). The series of interviews, considering it gathered multiple opinions and multiple backgrounds, provided a complexity and overarching view of the legitimation system that was only managed due to the multiple cases analyzed. The interviews lasted from 45 to 60 minutes and were conducted between 2022 and 2023.

The nature of the topic of the bioenergy sector within the legitimation of the bioeconomy has a global nature, albeit its importance at specific macro levels (i.e., EU) for this research (Boldt et al., 2020; European Commission, 2017). The researcher followed through with the main target of the research by engaging mostly with European businesses, policymakers and integrators. However, participants from other countries outside the EU were brought in to guarantee that the views about the EU policies and businesses were also considered from an international standpoint. The participants have highly varied backgrounds and most had delved in research, business and policymaking, especially considering the sector they work in, and represented institutes, businesses, non-profit organizations, councils and organizations. The sectors were mostly related to bioenergies and sectors related to sustainability (e.g. alternative energy research institutes, sustainability promoter companies, funding institutions for innovation). This heterogeneity is beneficial for the research as the interest is to

guarantee that, not only some contexts are explored and developed regarding their experience, but also that the several backgrounds provide the ability to enrich the contexts and to look for connections in the experiences amongst the participants that are representative of different contexts.

As part of the interviewing workflow, the researcher also engaged in the development of fieldnotes. These are notes taken after the data collection via interview from a participant and provide the experience of the researcher during the event. The importance of the fieldnotes is as a preliminary analysis from the researcher, with the researcher's interpretations of the interaction and the connection between topics.

3.7 Reflections on interviews

The challenges for an interviewing *naïf* were definitely one of the important steppingstones for the completion of this thesis. From researching the companies, institutions or associations that fit with the goals of the thesis to finding ways of contacting the people who would be most interesting (and interested in) to interview, the process was new, challenging but exciting and fulfilling.

Having no prior experience in interviewing, previous skills such as stakeholder engagement, public speaking, review and reporting procedures, and active listening were essential for proper data collection. Considering the very complex and dynamic results that were collected from the interviews, the feedback received from the interviewees and the connections that lingered after the interview process, the researcher considered his steps in interviewing as a successful endeavour.

There was a slight learning curve considering the diverse profiles would sometimes create more or less formal environments. Where some interviewees would require more formal addressing and attire, others were more informal. Developing a quick reflex to how the interviewees responded to certain formalities or informalities was essential to be able to allow them to speak as freely and as comfortably as possible.

The interviewees' availability and openness was quite unexpected, but something which the researcher is highly grateful for. It is a testament to the fact that several professionals are willing to provide their insights towards the betterment of science, no matter their position or concrete schedules.

The interviews provided an ocean of information regarding the topic at hand. It was very challenging to be able to peruse the conversations and find the links that connected them to more umbrella concepts. Learning to be less detail-oriented in such an analysis and focusing more on the bigger, broader message has become a part of the researcher's professional approach and their capacity to provide a wider spectrum of feedback.

3.8 Data analysis approach

The research's data collection led to a total of 30 participants, 37 interviews and 36 types of profiles (6 double profiles). The participants were 9 females (30%) and 15 regulators (41,7%), 14 innovators (38,9%) and 7 integrators (19,4%).

The analysis of the primary and secondary data followed a standard approach for this sort of research. Secondary analysis focused on going through documentation from the European Commission's websites where policies and associated funding programmes could be found. Primary data was analyzed via thematic analysis and resulting coding.

Qualitative research methods vary based on the nature of data collection and the means of analysing that data. In legitimation and green transition research, the most popular qualitative data collection methods include semi-structured interviews, focus groups, direct observation, participant observation, and document analysis. Narrative-based work is recognized as a valid approach for both understanding and communicating real-life experiences, which are necessarily subjectively interpreted, and which are the context in which energy transitions must ultimately occur. The qualitative and interpretative approach is particularly well-suited for analysing small samples of sources, such as textual or visual content or transcriptions of interviews or audio recordings, from an empirical sociological perspective.

In the initial phase, the researcher mapped the materials, outlining a chronography of the secondary data and associating it to each type of energy. Following suite, the interviews were analysed to provide a preliminary set of thematic categories, which were subsequently consolidated into the two main findings chapters 4 and 5, where the analysis and categorization process are detailed. Thematic analysis was operationalized using an inductive approach to ensure themes emerged organically from the data, free from preconceived theoretical frameworks. This process began with data familiarization, where transcripts from the semi-structured interviews were read and analysed to allow the researcher to dive into the participants' narratives and providing context for the generation of initial codes. The initial codes were associated to meaningful or relevant comments made by the participants which focused on the three main questions of the research. The researcher started by creating a table with the identifiers of the participants. The questions that were asked during the interviews (as seen in Annex 2) were then associated to the interviewee. Following that connection, the initial coding would start from the gathering of full sentences or paragraphs, which included synonyms or ideas that corresponded to the concepts being studied in this thesis, and the association to a code (e.g., policy implementation, policy lag, crisis response, fear-mongering, consumer activism). The repeated identification of similar opinions or patterns in answers would provide the thematic grouping. Themes were defined by analysing the dataset with the defined themes in mind, to understand their coherence and relevance to the content and codes. The definition of the themes was done to capture the complexity of the data and provide clarity to the main discussion points that were targeted by the interviewees. To enhance reliability of the coding and thematic analysis, the discussions with other researchers (namely, my supervisor) were made so the analysis happened via a comparison of the results of the analysis of the provided data. Increasing the validity of the analysis allowed for two points: the interviewees, when first approached, were informed of the thesis topic and what the interview questions were akin to, and only after their approval and acceptance of the validity of the questions did the interviews proceed; the data collected from interviews was also cross-checked with other policy documents and some earlier notes to verify whether an alignment with literature and secondary data was present. As part of the researcher's process, a hand-written journal was kept which provided an insight

into the development of the thought processes behind the creation of the thesis and the elements that stood out from the literature and data analysis.

3.9 Limitations

The use of qualitative data and applied research entail some classic criticism. Although this research focused on using qualitative data and deemed it the most appropriate, the potential limitations of it can still be argued. As such, this thesis focused on ways of combatting these limitations. The limitations are as follow:

- subjective interpretation of results by researcher;
- over-reliance on textual data.

The subjective interpretation of results by the researcher was leveled by means of external reviewers and by the involvement of several types of professional roles in the primary data. The preliminary results of the data were presented at 3 conferences, where the researcher received important feedback from other researchers and industry experts. The data was also analyzed and corroborated by the researcher's supervisor. Alongside these external analyses, the researcher also contacted the interviewees with the preliminary results of the study, in order to gather their feedback and reassure the proper use of their insights.

Aside from the external reviewing processes in which the researcher engaged to provide an answer to the first criticism, there was also an effort made by the team to provide several sources of data. The use of several sources of data provides the study with more in-depth and extensive knowledge of the research landscape. In this study, interviews, webinars, policy documents, reports, external evaluators and conferences were used as part of the enrichment and immersion of the researcher into the field of study.

Regarding the over-reliance on textual data, since policy documents are mostly textual, there were no issues regarding this kind of analysis. However, the researcher recognized the importance of the unspoken rules, agreements and compromises that happen within the policymaking sphere. As such, the use of the institutional genealogical lens provided an insight into the unspoken rules

which were then corroborated or contradicted by the interviewees and by the researchers' observations at the gatherings of the actors being studied.

Chapter 4: Policymaking for the Energy Context: Historical Context and New Energy Mix

4.1 Importance of policymaking

The global goals towards greener targets have come up in the past decades in response to major calls from the research community paired with increased issues with climate and biodiversity, as was initially stated in the Paris Agreement (European Commission, 2018a; United Nations Framework Convention on Climate Change, 2015). Global greener targets have led to a proposed transition to alternative energy sources, which leads to an innate complexity and depth of interactions that are hard to capture due to the multi-dimensional characteristics of its ecosystem (Köhler et al., 2019). As such, the obstacles to a transition come in various forms and shapes which only manifest once their effects are seen. Studying a complex system like that of the green transition implies a recognition of the need for a multi-disciplinary approach (Köhler et al., 2019). Though there is a complex ecosystem surrounding a transition, the green transition has seen a relative simplicity in its several traditional industries and players and the role they played in its delaying, thus influencing adoption and implementation or even the policy design itself (Köhler et al., 2019). On the other hand, traditional industries might suffer an influence from new, innovative ones, as part of transitions, through a potential decline or loss of space in the market (Köhler et al., 2019). The previous push back and the slow pace at which the transition was happening have, recently, softened and quickened, respectively, due to the nature of some world events and as a result of pressure from the scientific community and public (Hausknost et al., 2017a; Köhler et al., 2019; Mathiesen et al., 2022). The slow pace is, however, still a concerning topic for this specific transition, considering how long it's been around and how damaging it is if the changes aren't rapidly implemented (European Commission, 2018a; Köhler et al., 2019; Mathiesen et al., 2022).

To ensure that this research provides proper tools for its potential use in more general and broader studies that depict the full extent of transition ecosystems and the legitimation process within them, there was a standardization process to

the language found in literature (Köhler et al., 2019). This is part of this research's efforts to be replicable and to produce content that is valuable for the field's ecosystems. As such, the concepts used are described based on the literature. This research attempts to expose the connections between the concepts and how they materialize in a complex web of relationships which could, potentially, uncover the major and minor effects of each actor. Since the complexity of the study of the green transition associates to a need for multi-disciplinary approach, such was attempted here as well (Köhler et al., 2019). The need for comparison of structures and actors alongside the emergence of new policies and innovative processes through the legitimation lens provides an essential insight into the internal systems of the transition (Köhler et al., 2019). Alongside these current research trends are the lines for future work, which include "further developing the study of policies in the context of transitions" or "how do emerging and declining industries interact", that being the case of this research (Köhler et al., 2019). Besides providing an insight into the current and past policies, this research associates them to other perspectives of actors and institutions involved in the process via the theoretical lenses that explore the relational context of institutions and legitimation during periods of newness. As such, this research attempts to incorporate historical views, current trends and incorporate potential future ones for the development of a solid comparative transitions' framework. Despite the current interest from policymaking institutions towards more forward-looking approaches, the insights provided from a historical view are still essential to contextualize the current policy pushes and pulls, and to understand the involvement of the different actors and institutions (Köhler et al., 2019). The resulting framework should provide a system that facilitates both the analysis of past periods of newness as well as current and future ones, as is common in research that focuses on transitions to deliver more holistic perspectives on systems' analysis (Andersen et al., 2023).

4.2 Why not just Bioenergies?

Acknowledging the complexity of the legitimation of a whole ecosystem such as the green transition, the focus on the energy sector helped guide the research towards a more approachable and understandable contextual analysis.

Bioenergies are a part of the energy mixes already found in the current EU energy paradigm, therefore, the results from the interviews showed that the interviewees did not pay attention to those types of energy as the most representative of the changes that the green transition policy and industry landscape were going through. Biomass is already a major provider of energy at a European scale and biofuels are already part of the energy mixes used, as shown in the literature (Gustafsson & Anderberg, 2021; Markard et al., 2016a; Panoutsou et al., 2021; Sareen et al., 2020). Biofuels, though, are still part of the discussions surrounding the energy mixes because they are being used as replacement for previous fossil fuels, particularly, in the transportation industry (i.e., cargo and aviation - Panoutsou et al., 2021). Biomethane and bioethanol are part of the EU's policies in terms of new uses of previous energy sources (European commission, 2022; Panoutsou et al., 2021). This part of the bioenergies, however, is still not the most prevalent in the discussions due to less resource-intensive alternatives such as hydrogen, which is receiving more funding than these biofuels at an EU level (Energy Transition Commission, 2020; European commission, 2022; Hausknost et al., 2017b). Building up on the literature, the participants gave insights into the energy sector which manifested this same tendency: the constant pull towards the more overall topic of the energy mix in the green transition gave an indication that the participants themselves, though experts and actively working in the specific areas of energy policymaking, innovation and social integration, did not separate the discussion on bioenergy from the energy mix as a whole in the green transition. Considering the interviews were semi-structured with energy specialists, and given the intention of not forcing the focus of any sort of answers, though some of the questions specifically mentioned "bioenergies", the topic would be brushed aside in favour of discussing the energy mix as a whole. There was one exception to this, but the discourse ended up being about the history of biomass rather than its impact on the legitimation of the energy sector in the green transition context.

The fact that the energy sector is such a major influential system for the green transition and that the green transition is so interconnected and dependent on the energy sector also influenced and gave shape to the research. The focus on the impact of the energy sector as a whole in the ecosystem that legitimizes the

green transition was necessary in order to show the complexity of the transition, rather than a focus on a specific type of energy such as the bioenergies. The complexity of the transition is also what is at stake when analysing the different societal spheres that influence the energy sector, previously metaphorically referred to as the "holy trinity", otherwise, it would be a micro-level analysis of a specific sector. As is expressed in legitimation literature, such as by Bitektine et al., "qualitative research on social judgments could explore (…) micro-level communication and action yield macro-level outcomes reflected in judgments expressed by the media, government authorities, and judges". Hence, this research focused on providing qualitative data that expressed the views on energy legitimation of the selected profiles at the micro-levels to understand how they affected and were affected by both micro- and macro-level institutions.

This kind of approach is also found in the literature, which also provided more reasons for this research to focus on the legitimation of the green transition with the energy mixes, including bioenergies, as part of the analysis. Energy legitimation literature rarely focuses on just one type of energy if analysing at an EU level, which is because of the fact that it is impossible to single out a single type of energy if the whole EU is being analysed considering its fostering of diverse energy mixes. Since this research focused on the EU-level legitimation of the green transition via the energy mix, it was not possible to focus on a single kind of energy without excluding the several countries that do not deal or focus on it. Examples of this are nuclear power, hydrogen, biomass, biomethane, bioethanol, wind power, solar power and ocean power. Many countries do not possess the natural resources to explore wind or ocean power, whereas others do not have the investment capacity to suddenly erect large-scale biorefineries for bioethanol or biomethane or even new nuclear plants.

There are pros and cons to removing the spotlight from the specific sector of bioenergies in the green transition, but this was due to the data not directing the research towards it. The pros are the fact that the access to a multi-system analysis provides a better overview of the system, and considering the institutional genealogy lens, that kind of overview also provided more opportunities to identify the effects and actions that this kind of lens is able to

pinpoint. Alongside the institutional genealogical lens, the varied sources of data collected, despite sometimes working directly with this type of energy, did not seem to be particularly focused on these types of energies due to the policy justification of diversifying the energy mixes. Since hydrogen is a considerably new type of energy and how biofuels are also new in their scaling to the transportation sector, the focus is on these areas rather than the sector of bioenergies as a whole. Considering these observations, the legitimation of the bioenergies did not seem to be what was causing the effects based on the thematic concepts uncovered, rather, bioenergies, such as biomass, seem to be part of the EU energy paradigm and, therefore, are not considered, in the context of this thesis, as sole justifications or single solutions to the climate and energy crisis. The discussions surrounding bioenergies seem to be more around how some of them, like biofuels, can be introduced into the system as an alternative form of energy to carbon fuels in transportation. However, these efforts are in high competition with other types of energies, thus potentially not granting them as much perceived relevance due to the lower perceived innovative aspect of them. However, the exploration of this conceptual analysis is beyond the full scope of this thesis and other data from other sources might reveal different and enriching results to the world of the energy sector, therefore being highly supported by this research.

4.3 Policy effects on the green transition

The global goals regarding a greener world have materialized in international public policies presented by countries or institutions representing them, which have pushed for energy efficiency and transition (Köhler et al., 2019; Mathiesen et al., 2022; Wolff et al., 2020). The relevance of public policy is apparent for several concepts surrounding newness, like acceleration and upscaling of innovative endeavours (Köhler et al., 2019). Some examples include, at an international level, the Green Deals from Europe and the US, the Bioeconomy strategy from China, among others; whereas at a national level, the landscape of policies and of governmental reports and documentation generated for the transition is undeniably large and any endeavour at encompassing it all would be highly inefficient due to constant amendments or new documents.

The study of policies as part of the green transition is not new, but the inclusion of their relationship with other actors and instruments is still lacking in research (Köhler et al., 2019). The green transition goals have manifested themselves, outside of the policymaking ecosystem, in the companies and businesses that have targeted a wide market and became recognized worldwide, both via products and narratives and accompanied by policy pushes (Köhler et al., 2019; Thompson, 2018). One obvious example of this is Tesla, whose worldwide adoption has led to the building of an ecosystem surrounding electric vehicles, thus providing new venues for innovation and the ease and growth of adoption of a solution to the supposed support of a greener world (Sareen et al., 2020). In this way, this company has pushed forward an agenda of electric vehicles and, using several methods of legitimation (e.g., charismatic by associating the person to the product; political by targeting governments as the ones impeding solutions like electric vehicles from protecting the environment; etc.) and has managed to generate public and private interest in the development and commercialization of electric vehicles and the infrastructure associated with them (Shao et al., 2021). The legitimation techniques used by this actor are very common in the literature and show how actors can affect the legitimacy of technologies, businesses and institutions through "discursive activities and framing, political coalition and lobbying" (Köhler et al., 2019). The success of Tesla has, of course, been accompanied by a global discourse and demand for alternatives to the fossil fuel based automobile industry (Sareen et al., 2020; Shao et al., 2021). One such example is the concomitant development of Norway's policies regarding Norway's Zero Growth policies, which demanded better infrastructural development of cities in order to accommodate less carbon traffic led to the perfect environment for the integration of electric vehicles (Sareen et al., 2020). The fact that Norway was one of the earliest adopters of the EVs is curious on its own due to the country's dependence on the oil industry, having one city fully dedicated and with an economy circulating around that exact industry (Steen & Hansen, 2018). Other industries have been severely affected by this shift in narratives by governments, especially, as mentioned before, the energy sector and the supply chain sector.

One way in which the green global goals have been presented and updated according to global needs has been via conferences like the 26th Conference of

the Parties (COP) in 2021, which ensured a major conversation between all countries ensued regarding the new targets of decarbonization and the transition to greener sources of energy (*COP26 Outcomes*, 2021; Net Zero Strategy: Build Back Greener, 2021). Considering the sensitivity of this topic, it is expected that such discussions, where so many political leaders gather, would require longer periods of time in order to properly adjust and to take into account all the needs of such a global effort. The results from COP26 were, nevertheless, palpable and provided the countries with renewed hopes for the continued decarbonization efforts, albeit with severe pushbacks and alterations which reflected the needs and hesitancies of certain countries (*COP26 Outcomes*, 2021). Documents resulting from the COP26 provided concrete commitment to achieving targets that were, previously, not thought possible to certain countries (*COP26 Outcomes*, 2021). The surveillance and accountability of such statements and promises are, however, necessary, as the governments that provided such agreements might change and, with changes in the governance might come a de-legitimation of previous accomplishments (Köhler et al., 2019). An example of such actions, especially regarding the green transition and climate action, was the US and the Paris Agreement, where the Trump administration forfeit their participation in said agreement only for the new Biden administration to revert said statements and commitments back to what the Obama administration had solicited. Situations like this are simply part of the defining governance of transitions, which deals with uncertainty and its chaining to innovation processes, which can affect several levels, like the political governance in the previous example, but also at the social or policy levels due to the several types of actors involved (Köhler et al., 2019).

4.4 Energy policies' impacts on innovation and social action

To allow for the transition to happen, the countries have tried to ascertain which sources of energy to back and how to back them properly for the goals to be met (European Commission, 2018a). Some types of policies were produced in order to promote a specific transition towards types of energy which are less carbon intensive (Mathiesen et al., 2022). Regarding the specific study of

policies - the ways in which they interact and provide new spaces for ones associated to the promotion of the green transition - one current form of analysis is by determining their push/pull effects on the transition and its ecosystem (Köhler et al., 2019). One such example is the REPowerEU policy, which strategizes the way in which Europe can find and use alternative sources of energy, focusing especially on the reduction of the EU´s Russian gas dependency and introducing other measures regarding the acceleration of energy paradigm shifts, thus clearly pushing for the green transition (European commission, 2022). Alongside this more recent policy, others have been implemented throughout time and as a response to the climate action's needs and requests for accelerated change (Köhler et al., 2019). Apart from the EGD and REPowerEU mentioned previously, the EU has generated other policies targeting the energetic side of the green transition, such as the: Energy System Integration Strategy, Offshore Renewable Energy Strategy, Hydrogen Strategy, Energy Efficiency Directive, Renewable Energy Directive (RED), Energy Union Strategy, National Energy and Climate Plans, and Trans-European Networks in Energy (TEN-E; (Mathiesen et al., 2022).

The policies that target energy sources and types are important for companies and businesses to realize where they have to develop new efforts or what kind of economic strategies need to be implemented so that the required targets can be followed, therefore providing "directionality to the transition via normative statements" (Bolton & Hannon, 2016; Köhler et al., 2019; Lange et al., 2021). Innovation (i.e. businesses and industry) has a parallel impact on the transition due to its ability to produce new types of technologies and other services while influencing the legitimation of those same results (Bolton & Hannon, 2016; Köhler et al., 2019; Rhodes et al., 2014). In that sense, the policies, as is often criticized, can be out of touch with innovative and entrepreneurial sectors by requesting changes that are unfeasible or require considerable effort from the market. This disconnect is typically studied when trying to research the effects of the interaction between new innovators and traditional players (Firdaus & Mori, 2023; Köhler et al., 2019). Not only that, but also the discussion around policies having too short-term impacts and objectives considering that the industry innovates and strategizes over longer periods of time and requires the

policy support for technologies that might take longer to develop and which include processes of trial and error (Köhler et al., 2019).

The changes that new policies bring about can be rooted in the social or cultural changes that affect the normative or legal landscape regarding "production and use of technology" (Jimenez-Luque, 2021; King & Soule, 2007; Köhler et al., 2019). In a way, a fractured relationship between policies and innovation can make sense when looked at through the lens of the kinds of power dynamics found within them (Hausknost, 2020; Köhler et al., 2019). When innovation emerges, it might be argued that the new resources it brings are independent and unaffected (directly) by prior ones, which is based on Avelino's typology concept of niches and regimes (Köhler et al., 2019). The power dynamics between older institutions and new entrepreneurial efforts might be disconnected due to the different power pieces each bring to the table: one bringing older resources and one bringing new, independent resources unaffected by older ones (Köhler et al., 2019). The older institutions might fail to grasp the newer ones because it is in their nature to be so different they are in different realms, therefore, the higher the disconnect and the harder the connection between the two (Garud et al., 2011; Köhler et al., 2019; Morgunova & Shaton, 2022; Trippl et al., 2020). Though this view is increasingly being contested in research, the majority of it has found that the impact of delaying or obstructing new innovative routes is clearly mostly deriving from incumbent players (Halttunen et al., 2022; Köhler et al., 2019; Morgunova & Shaton, 2022).

In the interactions amongst old and new institutions with innovation as a trigger point for contact and change, the importance of roles which provide innovation with a protective space for growth are necessary (Köhler et al., 2019). These protective spaces, which are also essential for supporting the policies surrounding innovation, are often achieved via social movements, which are "networks of individuals and organizations that have the goal of changing established institutions in the state, private sector and/or civil society" (Canal Vieira et al., 2022; Köhler et al., 2019). Additionally, the social aspect of transitions is also essential in the impact the individuals can make themselves if socially motivated while part of relevant companies, industries and networks (Köhler et al., 2019). The necessity and role of these actors is recognized in this

thesis and given similar importance to policy and innovation via the role of "integrators"

Policies themselves mention the importance they possess in the long-term establishment of frameworks essential for alternative sources of energy, as is the case with the deployment of alternative Sustainable Aviation Fuels (SAF; (Köhler et al., 2019; Lockwood et al., 2017; Wolff et al., 2020). The market needs the policies to be supportive of the efforts requested of the market, thus providing solutions and frameworks to the new challenges they provide the market with, especially if a paradigm shift is the objective. The REPowerEU policy also brings forth its intention of complying with the global green targets, making statements regarding its commitment to how its strategy is to follow through with the Global Gateway for a faster green and more just transition (Furness & Keijzer, 2022; Rodríguez-Pose & Bartalucci, 2023). The cumulative effects of policies and how they interact is quite visible here and shows the effort that has happened at a global scale to drive the shift into alternative energy sources in a way which upholds past endeavours while adapting to the current geopolitical, societal and economical needs (European Commission, 2022). There is also a summoning of external policies within the description of REPowerEU, which serve as a reminder to other countries of the fact that the effort is to be made as a diplomatic group and that it requires everyone's influences and policymaking to achieve the goals that global policies have set up (European commission, 2022). The influence of several different types of actors at different levels of impact and actuation also brings about an extra level of complexity, considering the interests that are brought to the discussion as part of the argumentation for and against the transition (Köhler et al., 2019).

These policies are typically supported scientifically as well, seeing as there is an evident scientific legitimation effort regarding serious concerns linked to traditional energy usage like the climate crisis (European Commission, 2018b; Köhler et al., 2019; Sareen et al., 2020; United Nations Framework Convention on Climate Change, 2015). The goals set out by scientific knowledge are able to incorporate changes in the approaches taken by policymakers when writing policies, effectively affecting the policies and the implications they set (Köhler et al., 2019; Sareen et al., 2020). Policies at the macro-levels, like the Paris

Agreement or the European Green Deal, were fundamentally implemented due to the raising concerns of the scientific community regarding the long-term, continuous dependence on traditional sources of energy and the impact such dependency had had on the planet's health (European Commission, 2019; United Nations Framework Convention on Climate Change, 2015). Parallel to these concerns are the scholarly responses to the policies that respond to the world's and EU's demands, as did Mathiesen et al. when discussing alternative scenarios to the potential changes introduced by the REPowerEU and many other policies involved with a climate-friendly EU.

4.5 Energy policy challenges and paradoxes

As part of the discussions surrounding the policies built by the EU is the polarized criticism regarding the types of energies to be used for the transition, which are explored with concrete examples below. The scientific knowledge's influence on policymaking affects all levels of policy production and legal binding, as is with the example of Norway's Zero Growth Objective, which became a fund-shaping, policy-deciding factor regarding the country's green transition (Sareen et al., 2020). Other examples of the scientific influence in policymaking derive from the areas that the global leaders have set out as the main concerns regarding the energy transition, such as biodiversity (European Commission, 2019; Hausknost et al., 2017b; Lange et al., 2021). The speakers and moderators at the World Bioeconomy Forums, like Christian Pattermann, speak of the importance of biodiversity in the national strategies for the green transition and climate action goals, which is also related to the fact that there are some authors discussing whether the climate strategies are being built for harmonization with the economic paradigms or whether they are truly targeting the causes of climate change and all its effects (Buchmann-Duck & Beazley, 2020; Lange et al., 2021).

Policies at the micro-level, especially the case with climate policies, have been criticized regarding their "simple-mindedness" in the process of the climate crisis by setting targets as its main production, be it for temperatures, CO2 emissions, carbon neutrality or amount of green energy produced (O'Brien et al.,

2017; Sareen et al., 2020). The policies, therefore, lead to a sort of competitive ecosystem, where cities and governments try to reach the lowest levels of one climate-friendly target or the highest levels of another in order to comply with policies and global initiatives (Firdaus & Mori, 2023; Sareen et al., 2020). The policies that generate these targets aren't necessarily, however, the most transformative ones leading to actual overall changes in the institutional and industrial structures of the cities and governments that are accomplishing goals (Sareen et al., 2020).

Thus, a crisis in legitimation could be at hand, as governments establishing climate targets might not be focusing on transformation per se, rather, on the outsider's perception of their race towards being more "climate-friendly" (Bressand & Ekins, 2021; Sareen et al., 2020). This lack of transformative action from climate policies stems from the ideological train of thought that the policymaking changes implemented regarding the goal setting are a façade made to, rather than support climate action, promote the current economy while allowing the fossil fuel industry to maintain their business. The façade is made less debatable when looking at the fact that the effectiveness of the climate targets does not effectively or institutionally target or dismantle the underlying issues generating the climate crisis in the first place (Halttunen et al., 2022; Sareen et al., 2020). The context of power struggles between traditional and innovative industries is highly involved in the transitions context due to their political nature (Canal Vieira et al., 2022; Köhler et al., 2019). Introducing the concept of changes being a part of complex and ubiquitous interactions between actors as part of the power dynamics that revolve around transitions can help define what the transitions and their actors are experiencing (Köhler et al., 2019).

Among the actors involved in the politics of transitions are the ones holding the most power and influence, like governments and traditional institutions (Köhler et al., 2019; Morgunova & Shaton, 2022). The idea of a hegemonic governmental order seems to imply that the climate goals would have been a part of the strategizing of futile policies which work solely for the continuous maintenance of the previous structures by introducing concepts that fit into them rather than ones that would potentially lead to substantive societal change (Sareen et al.,

2020). One way to unmask these goal-seeking policies and practices is by identifying how the varied methodologies with which they are implemented at a local scale represent such differences amongst them that the actual production of information makes it unfeasible to then suitably compare the accomplishments of the several actors and their established practices at a horizontal level (Sareen et al., 2020). Even so, the importance of the local scale of policy implementation reveals certain positive aspects, such as the ability to develop regional policies and initiatives (Köhler et al., 2019).

The solution to this problem relies on standardization of methods but, considering the description of urban governance as characterized by "weak institutions, non-binding commitments and uncoordinated efforts", it is hard to believe such a simple solution could be easily implemented without severe legitimation efforts at grander scales and institutions without sovereignty and independence conflicts emerging (Sareen et al., 2020). Bearing in mind the roots of climate policies being scientific knowledge, it stands to reason that the methodologies applied there would infiltrate the climate action and targets as well. Therefore, what brings the governmental and other climate actions together is the measurements taken to identify them and to identify the accomplishment of targets set by the climate policies, much like how science itself determines its own discoveries (Hilgartner, 2007). The fully measurable side of climate policies was a side effect of the transition from sustainable transformation to the carbon mindset, where the carbon "counting" methods are the true representatives of a greener transition whereas the sustainability one was regarded as more easily absorbed into the hegemonic and economic growth stasis narrative, albeit it being subject to some quantification as well (Sareen et al., 2020). The carbon measurability, due to its more deterministic and rational nature, is also a better candidate for influencing regulatory action and a financial one as well. The financial side of the carbon measurability is related to the influence that cities which reach targets implemented by climate-friendly policies have on financial availability and private investment. The fact that a city is seen as "green" is also seen as a city that will attract more future public and private investment and which will also be more lenient and open to the introduction of new companies and experts on the fields that are required for the green transition, therefore promoting this migration and the benefits

associated to it (Corradini, 2019; Sareen et al., 2020). The conclusion of the whole set of ecosystem changes associated to the legitimacy of climate policies and the venues through which the legitimacy occurs is, therefore, vast and has effects at several levels of society and institutions.

4.6 New energy mix alternatives

The alternative sources of energy that the countries are looking to adopt for the green transition are of varied types. Some advocate the return to nuclear energies, like Finland, others have maintained and relied on nuclear power throughout the years and hope to continue doing so, like France, and some countries have long abandoned and discontinued the functional ones, like Germany, due to public perception, focus on alternative energy mixes and poor policy infrastructure supporting them (Garud et al., 2010). Some countries have confirmed the building or reactivation of plants (e.g. Poland), whereas other countries are against such an implementation or use and have actually shut down lots of their previously active plants (e.g. Germany). Others, like Sweden and Finland, advocate for alternative sources of gas and electricity, such as Europe's push for biogas and biofuels via policies like REPowerEU and the Renewable Energy Directive (RED) III (Gustafsson & Anderberg, 2021; Panoutsou et al., 2021).

No matter the type of energy, and especially controversial ones, the public opinion has had an influence in the legitimation of some energy sources. Berlin is an interesting microcosm of these debates. The case of Berlin is one of political imbalances and regime shifts, which affected the way in which traditional institutions, much like the energy sector, responded (Köhler et al., 2019; Sareen et al., 2020). Berlin's evolution in the sense of public acceptance of several issues surrounding the energy policy debates, and accountability and transparency led to reframing of said energy policies and the creation of initiatives like the Energy Roundtable or the Citizen Energy Berlin (Sareen et al., 2020). The creation of these initiatives came as a legitimacy crisis happened at the governmental level when the public manifested against the electricity grid having been privatized and petitioned a re-municipalization of the grid. The

initiatives were partly owned by the consumers, giving them a say in the decisions made regarding the distribution of electricity around the city, which resulted in successful efforts towards changing the city's policies. The crisis of accountability and transparency was aided by the creation of the initiatives, which were direct criticizers of the private ones, due to politicians being held accountable by the consumers. Even regarding less controversial ones, examples of the public's perception and influence on the governmental decisions can be found in the policymaking, especially when the measures affect the public financially or directly. The resistance found here is both attributable to incumbent actors but also societal arguments regarding ownership and fears of the effects of social and governance structural impacts (e.g. corruption or inequality) (Köhler et al., 2019)

Renewable energies have received most of the focus regarding the potentially new types of energy that would allow us to survive the full shift to sustainable energy sources (Tzankova, 2020). The innovation and policymaking behind renewable energies has permitted growth and accessibility, making them a preferred method for many countries and households. Bioenergies, like hydrogen, biomass and biogas, have received less attention but are still part of the solutions present in the way towards a greener energy ecosystem. One example is found in the history of how biogas has been through a cyclic process of legitimation in Germany, where centrals were installed and then uninstalled depending on the government's wishes regarding this source of energy (Markard et al., 2016b). The current situation in the EU has lent itself to another part of this cycle where biogas is being considered once again by Germany after the access to other more prominent sources of it have been cut off due to geopolitical occurrences.

4.7 History of energy mix policymaking in the EU

Table 3: Examples of policies that have affected several types of energy, social and ecosystem landscapes.

Year production	Revisions	Year term	Energy Policy	Ener
1997		2012	Kyoto Protocol	
2015		2025	Paris Agreement	
2019			European Green Deal	
2022		2030	REPowerEU	Natu
2012		2024	Energy Efficency Directive	
2009	2018, 2023		Renewable Energy Directive	
2015	2019, 2022		Energy Union Strategy	
2019	2021	2030	National Energy and Climate Plans	
2013	2019, 2020		Trans-European Networks in Energy	

As mentioned before, several important European policymaking events have provided high impact into the transition to greener sources of energy. Documentation like the Energy Efficiency Directive (2012), the European Green Deal (EGD - 2019), the Fitfor55 (2021) and the new REPowerEU (2022) have been proven to bring purposive goals for the green transition. Other global policies, like the Kyoto Protocol (2005) and the Paris Agreement (2015), have also provided goals towards a more sustainable future via the creation of new, legally binding objectives and by providing nations with new information and guidance. The ambition of these policies is reflective of the goals at each nation's level but also at the global scale regarding the scientific community's climate concerns. The EGD, for example, committed to carbon neutrality by 2050 and raised the EU's 2030's ambition of having cut greenhouse gas emissions by 40% to 55% compared to 1990, which was followed up by the Fitfor55 policy, which references the 55% commitment and establishes new goals to be able to reach said levels (Mathiesen et al., 2022). The global policies and their subsequent national implementation are also an indicator of the global expectations not corresponding to local realities of their ability to implement technologies or other necessary tools alongside the proper infrastructures (Köhler et al., 2019). In a parallel fashion to the creation of energetic policies, the EU also created specific ones for the implementation and transition to renewable sources of energy, like the EU Solar Strategy and the European Solar Rooftop Initiative to increase solar energetic production by 2025.

The infrastructures that policies have created for the green transition via new or alternative types of energies has generated new innovation and reinvigorated efforts to galvanize the production of energy and create more energy security

and independence (European commission, 2022). In the EU, specifically, new political events have provided the proper drives towards more varied forms of addressing consumers' energetic needs. One such policy was the REPowerEU, which came as a response to the lack of availability of gas as an energy source due to high dependencies from a specific influx of this type of energy. The REPowerEU came as a way to accelerate the process of European energy independence from Russian exports by imposing stricter energy decarbonization targets to countries and promoting the transition to different types of energy by replacing gas in some industries and increasing the roll-out of renewable gases (European commission, 2022). The types of energy affected by this kind of policies were both renewables but also other types of alternative bioenergies, such as hydrogen, biogas, nuclear, biomass and biofuels.

4.7.1 Renewable energies

Huge international and national pushes have led the transition via the investment and legitimation of renewable energies, with a focus on innovation and upscaling. Regarding the renewable energies and their relationship with policymaking, we have several examples of them being well represented in the documentation and lawmaking at both international and national levels (European Commission, 2019; European commission, 2022).

The fact that these types of energies have been included in international and national policies leads to examples of its adoption, as is the case with wind power in the United Kingdom and the massive international investments made towards its establishment (when it was part of the EU) but also the example of solar energy uptake in Portugal (Sareen et al., 2020).

Despite Portugal's lack of assets in terms of carbon-intensive energies, an impressive amount of solar irradiation and the progressive approach to policies targeting the promotion of renewable energies, the implementation of solar powered energy has been modest at best. Thus, decarbonizing efforts in Portugal by means of a seemingly ideal type of renewable energy have been low. The reasons found to impact this ability to implement this sort of energy are "lack of policy visibility, a restrictive regulatory framework, limited licenses,

grid constraints and limited credit access", among others (Ministry of Environment, 2017; Sareen et al., 2020).

An unstable government with worries concerning the economic and political stability of the country prioritizes the establishment of the fundamental sets of rules when a new government emerges, leaving some issues for later times. In the case of Portugal, it is also affected by the international meddling in the energy sector, largely monopolized by Energias de Portugal (EDP), which is not only privatized but has large shares held by foreign countries like China, which took advantage of the recession in 2009 to take as much control of EDP as possible. With solar assets from EDP being held abroad and with Portugal meeting targets set by the EU, the rush to move solar implementation is limited, from an international standpoint, because the potential loss of money prevents international investors from action, seeing as they do not have the country's growth as their main concern, rather, their investments and profits drive their interest in alternative types of energies, also known as carbon capitalism.

Therefore, in Portugal, though policymaking is good for renewable energies, several other factors outside the hands of national and international policymaking are affecting the country's ability to develop its solar energy production capacity. Unfortunately, based on this quick exposure of the situation, the issue seems to derive from accountability and legitimation issues, which are only ever solved with proactive ambition and relevant and transparent materialization of outcomes. Instead, as is the case for this particular example, of awarding a country or city (e.g., Lisbon as European Green Capital 2020) for practices which are conducive to stagnation, rather than a focus on bringing the discussion to the public and make transparency the main goal of the investments made in this sector. To bring the real motivations behind stagnation to light, such as predatory practices of delay which have but the powerful actors' interests, political and economic, in mind, would answer many of the international requests to ensure this issue is faced with the real critical condition that it is in.

The clear impact of incumbents is present here, where traditional sectors and institutions affected the ability of new policies and new institutions to move

forward towards the green transition's objectives, thus focusing on the maintenance of traditional markets instead of focusing on several new paradigms in order to bring forth a new *status quo* (Köhler et al., 2019).

The fact that many green innovative businesses and practices coexist with traditional businesses and funding schemes for traditional, carbon-based energies shows the duality of the green transition and the relevance of actors with rivaling interests (Köhler et al., 2019; Morgunova & Shaton, 2022). When such a powerful sector like the energy sector is affected, the influence is most noticeable, as mentioned before, by more established actors who managed to amass power during times of vulnerability and now exploit that power by ensuring the sectors they have control over progress at the speed most economically viable for the investments previously made but also at a speed that allows for their international political agendas to be fulfilled (Köhler et al., 2019).

The commitment to the energy transition is, however, evident, especially within an institutional genealogical lens, considering the shifts in ministries' names and structures, indicating that new orders are receiving an attempt at implementation with the aid of new regulatory bodies. The commitment to the energy transition is also necessary, especially when viewed from an institutional genealogical perspective, because it is clear that traditional authorities and regulators are not yet donned with the knowledge and expertise to properly deal with these issues, leading to their inevitable action in creating new institutions that better support and represent these new values and targets (Braunerhjelm & Eklund, 2014; David, 1994). The institutional genealogy lens is also relevant in this type of research dealing with transitions and analyzing policymaking because it provides a view into policy politics and the impacts these have on transitions like the green transition (Köhler et al., 2019).

The importance of social movements is present even in the current adoption of these renewable technologies and is prevalent in the case of wind energy (Köhler et al., 2019). Social movements may prevent the adoption of wind farms and similar innovative endeavors due to a disconnect from the innovative and

policymaking landscape with the societal one, hence the important role of integrators (Köhler et al., 2019).

4.7.2 Nuclear energy

As was mentioned before, the case for nuclear energy has become a hot topic, yet again, considering the way in which this type of energy and its infrastructure had been previously considered a potential common use source of energy. Due to different political agendas, an accidental disaster and the public perception and activism of such a type of energy, the EU saw the popularity of nuclear energies sway from its inception to the current day.

The initial definition of nuclear energy was associated to an economic and a sustainable view, where the energy was defined as “too cheap to meter” and considered emissions free at some points in time (Garud et al., 2010). The concept of this type of energy being emissions free is associated to the definition of the issues pertaining to the climate crisis, hence, emissions free is not free of emissions but, rather, free of CO2 emissions (Garud et al., 2010). Defining these concepts to reflect society’s goals is a part of the institutional abilities and, as we will see, the institutions are major contributors to the legitimation of this type of energy throughout its history, as are other actors. As part of the institutions, there are policymaking and scientific efforts at work towards the legitimation and delegitimation actions towards this type of energy, as these two types of acting are the ones considered most influential in such a dense and rich field as physics and the impacts of using physics as a technological solution to societal and economical problems (Garud et al., 2010; Sareen et al., 2020).

As is expected in a competitive market such as the energy sector, it is only natural that the race amongst the different types of energies throughout time has led to different evaluations, at different points in time, of the performance and adequacy of said energetic solutions to societal and political demands. The historical peaks and valleys of the nuclear energy sector demonstrates how even ripe environments for it are impacted by several types of factors that are influential in the development of said technologies (Garud et al., 2010; Sareen et al., 2020). The concept of a safe and cheap source of eternal energy was

substituted by a lack of belief in the technology and energy as a viable source, which has changed again recently to the definition of nuclear energy as sustainable and an important alternative source of energy.

The current geopolitical and sustainability situation is requesting the energy mix to be broadened (even experimented with) in order to have a consistent response to the issues created by the climate crisis and the resource abuse that has been characteristic of the period prior to this energetic transition. However, the current situation is not a new one to the nuclear energy sector, considering how it was used as a potentially revolutionary energy to be added to the energy mix after the Second World War (Sareen et al., 2020). The initial attempts to introduce and establish nuclear energy as a standard energetic resource stemmed from the USA with the establishment, in 1947, of the Atomic Energy Commission (AEC). The AEC was built upon institutional and scientific bases, giving it unprecedented institutional support as a source of energy. The creation of the AEC came as the result of an attempt to change who were most important figures driving nuclear growth, which had been mostly conceded to the military so far and could now find a new management under civilian control, where this type of energy would find new purpose as a promoter of "world peace". As part of the AEC's establishment, it was given law status, thus providing a greater context and purpose to nuclear energy by defining its societal benefits towards public welfare, standard of living and entrepreneurial invigoration, apart from the world peace aspect that was previously mentioned. The reaction of traditional sources of energy to the fact that the AEC was expanding the use cases for nuclear energy was very slow and feeble, seeing as the oil and coal industry barely reacted to the nuclear developments towards electricity use in the US. As such, nuclear power, during the years following the Second World War, was considered a "non-issue" and expanded given the availability of the market space for it.

The reactions outside the US accompanied the evolution of nuclear energy as a viable alternative and, in 1946, the UN created its own AEC (UNAEC) as its response to the rise in nuclear. Upon the creation of the UNAEC, the gatherings and results weren't as unanimous as initially expected, which led some countries (e.g. USA, USRR and UK) to develop their own ideas of how the nuclear market

would develop and, therefore, reacted accordingly, initiating a race to nuclear energy to ensure the establishment of a monopoly thus turning the nuclear energy into a geopolitical race (Sareen et al., 2020). With geopolitical tensions rising, the US intervened with President Eisenhower's speech in 1953 which defined nuclear energy as a peace envoy – "Atoms for Peace" – and the creation of a new institution for a purposeful and peaceful development of nuclear energy – International Atomic Energy Agency (IAEA), which still exists today and upholds the same values. As time went on, the development of the amount of nuclear power became nearly 10x greater, albeit it not being initially competitive when put against the rest of the energetic alternatives be the end of 1960s. In a turn of events, a situation that is very similar to the current geopolitical context happened: the "oil embargo", which left many wondering about issues that are echoed in today's age as well regarding energy security and independence.

Due to this energetic crisis in the 1970s, the AEC was disbanded, and its powers and values were distributed to other institutions, but this did not mean that nuclear energy was considered non-viable, quite the contrary. Nuclear power's acceptance had maintained a relatively stable to high level throughout its inception and development, but upon the conception of the Rasmussen Report, which described the risks associated to nuclear power as low, the criticism from the scientific community associated to a failure regarding energetic independence led to one of nuclear's legitimation valleys. It was during this valley that "The China Syndrome" movie came out, in 1979, which, alongside the anti-nuclear movement and a radioactive incident, left a huge mark in the perception of nuclear energy, one that is still seen today. With this shift came an institutional and regulatory response in the form of safety regulations and new economic analysis, to which nuclear plants all around the world responded to with proper improvements while lots of cancellations for new ones came about as well. Thus, the 1980s defined a valley in the nuclear power legitimation with the anti-nuclear movement, the institutional strictness and the economic viability all playing a role in it, but none played a bigger role than the Chernobyl accident in 1986.

Following the nuclear power's decline in popularity, the scientific community started developing on the issues associated to nuclear power and the environmental concerns associated to its use, such as acid rain, pollution and its connection to hydroelectric dams, even arriving at, and institutionalizing, a complete opposite definition of nuclear as non-renewable. At this time, the same scientist community was working on the institutional characterization and implementation of renewable energies by creating governmental programs and funding for them.

It was in the 1990s that nuclear saw yet another shift with the discourse and the way it was addressed, which was due to its quality of not producing CO2 as a result of its activities. Considering this was the decade in which the Kyoto Protocol was implemented, which determined legally binding green house gas limits, then countries were already aware of the climate crisis and used CO2 and other green house gases as measures of such. This time period brought yet another controversial discussion surrounding nuclear, with the public and scientific forum debating the institutional one regarding the viability of nuclear as a renewable energy source due to the waste, the use of non-renewable sources of energy (uranium) and potential for catastrophic accidents. The IAEA attempted to counter the trend surrounding nuclear energy by promoting it as a non-renewable sustainable energy resource, in order to decouple nuclear energy from carbon-based fuels, and it did so by proposing an alteration of the definition of sustainability as based on outputs, thus leaving out issues such as radioactive waste disposal.

Another cinematic impact in the energetic and climate crisis scheme came in 2007 with the movie "An Inconvenient Truth", thus removing most of the doubts regarding the warming of the climate and its causal relationship with anthropological action. The EU also took action during the 2000s, initiating its fight against climate change by implementing renewable energy source schemes and highly ambitious targets for CO2 reduction, which have only increased and broadened with time. With the current geopolitical situation and previously set goals via policymaking, such as the European Green Deal, the climate crisis is now a priority and so are the measures to combat, to which nuclear energy is an alternative. And considering the fact that the changes to the energy system

require the exploring of as many alternatives as possible, it is sensible to consider nuclear as one such alternative and to study its viability as one at the risk of being accused of neglecting potential sources of energy to attempt to fix the energetic crisis. As such, many nuclear plants were shut down or put in phase-out strategies, however, now that the energetic needs are high in demand again, some countries are delaying the shutting down or reopening their plants and making the decision to balance some of the energy deficit with this kind of energy (Mathiesen et al., 2022).

4.7.3 Renewable biogas

The topic of renewable biogas has been important for the energy transition as well considering it has defined some countries' targets in terms of the energy distribution and the types of energy available for broader coverage of the population.

As an industry, the renewable or green biogas is sustained through different mechanisms, such as the new REPowerEU policy, which makes direct statements regarding goals and targets for renewable biogas and biomethane in the EU (European commission, 2022; Gustafsson & Anderberg, 2021)

The relationship with green biomethane is specifically solidified via the financing promoted by the new policies regarding the 2030's targets, the Biomethane Action Plan, with a predicted 37 billion euro investment in unison with other agricultural policies and institutions, such as the Common Agricultural Policy, the Connecting Europe Facility and the Cohesion Policy and Recovery and Resilience Facility. The European Biogas Association (EBA) made a statement regarding the EU's efforts regarding REPowerEU's directives at green biomethane and biogas, including the fact that it had produced a Biomethane Action Plan and the Biomethane Industrial Alliance. EBA's statement came to reiterate the idea of stimulation of the green biogases as part of the green transition but also as a reminder of the fact that REPowerEU's green biogas strategy also included revisions regarding energy efficiency and renewable targets set in the previous policy Fitfor55 (Mathiesen et al., 2022). The promotion of these policies and institutions is also characterized by an interest in partnering biogas and biomethane in order to stimulate the renewable gases

value chain and accelerate the timely injection of renewable biogases in the EU's energy infrastructure. As such, especially regarding biomethane, the European establishments have made decisions leading to the creation of new policies and new institutions for the implementation of new economic and institutional infrastructures designed for the green transition (Aguilar et al., 2013).

Thus, the EU is advocating and stating, as was also stated by EBA, their intent towards having green biogases as part of the strategy to achieve the ideal energy mix required for the green transition and to provide a safe energy supply infrastructure in the EU and for the EU (European commission, 2022). EBA also indicates how the creation of these policies and institutions has an impact in the capacity for policymakers and innovators to work more cooperatively with the biomethane value chain in order to foster the acceleration of the growth of the sector. Thus, EBA is recognizing the connection between policymaking and financing with the ability to create innovation and promote the growth of a sector, stating as well that the laws coming from European institutions need to have long-term goals in mind in order to set sustainable frameworks for the green biogas case (Sareen et al., 2020).

The case of biogas is particularly prominent in some countries, such as Germany, where it has suffered from a mismatch in policymaking and actual business making (Gustafsson & Anderberg, 2021). The case of legitimacy in the agricultural biogas from Germany showed the volatility of the legitimation of new technologies and new investments regarding energy sources. The legitimation of this energy source also brought to light the fact that legitimation is fluid and does not necessarily have to apply to new institutions or endeavours, rather, it can re-emerge and disappear considering how new factors can resurface needs previously abandoned to arguments that no longer apply (Sareen et al., 2020). The fact that so much investment and professionalization was targeted at this sector, during the period of 1990-2012, only for it to then be abandoned from public and private support and now, in 2022, retaken as part of the new initiatives and policies for the green transition implies that the stability of institutionalized sectors is highly affected by geopolitical and other international issues, apart from the inherently institutional ones (Köhler et al., 2019). The

initial mismatch between the efforts made for legitimating this technology and the abandonment that ensued led to an initially governmentally and legislatively supported energetic alternative that was left economically unsupported by the financial sector and ecosystems, albeit its increased visibility to the public sector, to a now much sought-after sector to allow for alternatives to natural gas and fossil fuels.

Currently, the case has, therefore, once again shifted, with Germany looking for new forms of alternative energy and understanding the fact that the earlier investments into biogas could be turned into current investments due to the necessity of increasing the energy supply mix (Sareen et al., 2020). However, it is also known from Germany's side that the REPowerEU strategy is prioritizing biomethane as the ideal green gas for the transition, with the previously stated 37 million euros of support brought upon by the REPowerEU policy (European commission, 2022). The fact that biomethane is considered as part of the taxonomy of the green energy mix does not, however, indicate the preparedness of Germany to adopt such a gas into the previous infrastructure it had built for biogas. The changes required to the infrastructure that is already present in Germany require time and funding, which are two variables the country is short on regarding the carbon neutral targets and the biogas industry.

4.7.4 Hydrogen

Another important case comes in the form of hydrogen, which was also affected by the search for alternative sources of energy. Hydrogen has two forms that have been used as arguments to make it a proper transition energy: green and low carbon (Mathiesen et al., 2022). Green hydrogen is one whose electrolysis results from the use of renewable energies. Low carbon hydrogen is one resulting from the use of low carbon industries, thus relying on the supply chain to justify its use.

The newly created REPowerEU policy reacts to some geopolitical events surrounding Europe which greatly affected its gas supply by generating new information surrounding several types of energy, including hydrogen (European commission, 2022). Within REPowerEU are details of how the EU has decided to

proceed regarding hydrogen as an alternative energy source that supports the green transition, including how to fit said gas within the targets previously set for production and determining in which ways this type of alternative energy will be financed and supported institutionally (European commission, 2022; Mathiesen et al., 2022; Wolff et al., 2020). The integration of hydrogen will be ensured via the Hydrogen Accelerator and its associated institution, the European Green Hydrogen Accelerator Center (EGHAC).

The official planning for the case of the hydrogen pipelines have been agreed upon by the state members involved in the production of hydrogen and the distribution of it. Albeit the consideration that hydrogen is still in its development phase, the EU is pushing its hydrogen agenda via projects like the relationship between the EU and green hydrogen is, therefore, established by a policy but operationalized by an institution which is, then, responsible for the integration of new European and global partners to provide solutions for hydrogen production and trade (Energy Transition Commission, 2020; Panoutsou et al., 2021). The policy support is also the receptor of additional legal acts which increase the institutional robustness of the frameworks required for the appropriate sequential production, consumption and industrial developments necessary for the implementation of this type of energy. It stands to reason that the whole endeavour is financially supported by the policies creating it, where Horizon Europe plays a major role in providing 200 million euros for renewable hydrogen projects and by accelerating the approval of these kinds of projects listed under the Important Projects of Common European Interest (IPCEI).

These institutions have goals regarding the increase of the green gas ecosystem by helping new industrial players enter the green hydrogen, ammonia, methanol or aviation fuel industry by providing financing routes for early-stage businesses and via the implementation of acceleration services with other relevant actors as chaperones (Wolff et al., 2020). The main workflow of financing and acceleration services is complemented by support given to these businesses via expert assessment of business cases, team assessments and proper advisory committees. The support that is provided aims at harmonizing with the rest of the actions to reduce the risks of the projects and increasing the speed with which they enter the market and their relevance in said market. This is just an

implemented and functioning example of how the EU has promoted hydrogen as an alternative energy and what kinds of measures resulting from policy demand were built and are now geared towards the shift in the energetic paradigm.

The efforts by these institutions, created for the green transition and for the energetic shifts it requires, are also aligned with other strategies and have goals which follow the EU goals regarding the transition. One such example is the EGHAC's commitment to 2025 investment and energy goals, as we have seen other policies and countries abide to due to the EU's 2025 goals as well. The relationship with EU goals and strategies doesn't stop here though, as the EGHAC is also connected to the European Institute of Innovation & Technology (EIT), which is yet another body of investment working towards the green transition and towards the use of European funds in the energetic sector (and others). EIT InnoEnergy is the main correspondent regarding the hydrogen's industry, alongside many others, as it is an institution responsible for financing and solidifying the markets in many sectors of innovation and entrepreneurship, all within the goal of sustainable energy production and security in the EU.

The matter of hydrogen is debated by some literature as not being considered essential for the current transition because of the low impact on short-term goals of energy security and climate effects (Mathiesen et al., 2022). The cycle of interrelationship within the EU institutional ecosystems seems endless and highly labyrinthic, which is one of the criticism the EU has received regarding the bureaucratic procedures and the proper funds for the green projects, considering how hard it is to ensure the adequate procedures are followed for so many different institutions.

4.7.5 Biomass

One other type of energy being considered as an energy source that supports the green transition is biomass and biowaste. These two types of resources are not new resources regarding alternative sources of energy from fossil fuels, as they have been used throughout the industrial ages alongside carbon-based fuels. The Sustainable Aviation Fuel market is known to have followed the policy recommendations of the EU via the Renewable Energy Directive (RED-I) and became a keen user of biofuels as part of their transition to climate-friendly

energy sources (Wolff et al., 2020. The implementation of RED-I led to the growth in biofuel-specific plantations in the EU due to an increased demand for biofuels and the import of said biofuels (Wolff et al., 2020). RED-I, and the demand for biofuels, was implemented in 2009 and went through a contradictory (regarding biofuels) revision in 2019's RED-II, which limited the use of crop-based biofuels due to issues of deforestation, biodiversity loss and other resource abuse practices (Desing et al., 2020; O'Brien et al., 2017; Pülzl et al., 2017; Wolff et al., 2020).

RED-II also defined the use of residual and waste lipids, which provide the best solution for biofuel use in the short-term and are already implemented with low cost and a standardized protocol for conversion via the HEFA process (Wolff et al., 2020).

The sustainability criteria introduced for the use of biofuels was mostly related to indirect land use change (ILUC), a concept which was associated to biofuels failing to comply with reduced net greenhouse gas emissions due to the previously mentioned issues of deforestation and land abuse (Wolff et al., 2020).

Considering the impact of aviation on the climate, to have land use increased, with all its consequences, for the sole production of SAF was unsustainable and led to the decision of excluding SAF from crops competing with others used for food and feedstocks (Wolff et al., 2020). The limitations imposed by RED-II on land use left the possibility of biofuel production from biomass that was gathered from double cropping or unused degraded land, despite the fact that these forms of energy still need more researching and can only provide approximately 10% of total EU SAF supply (Wolff et al., 2020). One criticism pointed out at these types of energies, especially biomass, is how policies should be promoting a conservative and capped recourse to them considering the impacts on resource availability and land use (Mathiesen et al., 2022; Wolff et al., 2020).

4.7.6 Ethanol

The ethanol surge as part of the transition is also important, especially in terms of reusing biorefineries and the development of alternatives for the transport

sector. The fact that the EU 2030 targets are likely to not be met, as was currently discussed in the COP26, leads to the recourse of sustainable biofuels as essential to ensure the energy mix used is promoting a renewable and sustainable transition and, more importantly, the carbon neutrality associated to the energy consumption (*COP26 Outcomes*, 2021).

Ethanol, as a derivative, is an alternative biofuel that cannot be denied its space in the market as part of the transition. The ethanol is connected to the energy transition, especially in Europe, through its potential as a biofuel converted from biomass or other types of wood-based products, which are very relevant for many countries in Europe like Finland, Sweden and Germany (Giurca & Späth, 2017; Pülzl et al., 2017). It is already used as an established fuel source in countries like Brazil, which has used it since the 1930s and started using it for vehicles due to the 1970s oil embargo and energy crisis (Taylor et al., 2019).

In the chemical industry, biomass is used to form ethanol as bioethanol as part of the objectives to promote the use of renewable raw materials in this industries' energy mix, especially as a climate-friendly action (European Commission, 2018b). The EU has established a need by 2030 of 310 biorefineries of which 185 would be for the production of 2nd generation ethanol, according to the Industrial Biotech Research and Innovation Platforms Centre project, which indicates the EU is aware of its need and has predicted a scenario of ethanol as part of the energy mix (*Final Report Summary - BIO-TIC (The Industrial Biotech Research and Innovation Platforms Centre - towards Technological Innovation and Solid Foundations for a Growing Industrial Biotech Sector in Europe) | FP7 | CORDIS | European Commission*, n.d.). A region in Germany, the Saxony-Anhalt federal state, contributes to the bioeconomy as the region that produces most of German bioethanol and is promoting the EU's climate targets with this exact energy source and the implementation of renewables in its developed chemical industry (Chaiyapa et al., 2018). Germany has already established a paradigm for bioethanol and other biofuels as part of their innovation ecosystem through biorefineries and the conversion of fermentable carbohydrates produced from cellulose and hemicellulose, which are plant- and wood-based components (Giurca & Späth, 2017). Besides its use as a renewable fuel source, the production of ethanol is also associated to the

production of protein for animal nutrition, thus allowing for a substitution of carbon intensive practices for sustainable ones.

One argument made against the generalized introduction of ethanol into the fuel business is that its main applicability would be in markets that cannot be electrified, especially in Europe, where ethanol fuel use borders 1%. Associated to the expected growth of the ethanol market as part of the green transition is the sustainable aviation fuel market, which involves renewable jet fuel, alcohol-to-jet and gasification (Panoutsou et al., 2021). The volume of ethanol necessary for 2030 is predicted to be short by 20 billion liters (L), considering the 140 billion L goal. The lacking in total amount of available ethanol is, however, not because of a lack of policymaking or a high pace of innovation. If ethanol is ignored for the transition as an alternative type of biofuel, the fact that this alternative option was available and was not used would mean a potential conspiring bad faith in the transition's motives.

Chapter 5: Time and temporality

5.1 The facets of time

As outlined in the previous chapter, policy has been one of the major drivers of progress of the green transition. The effects of policy can be traced back to the 1900s, such as the Kyoto and Montreal protocols, which affected society and nations directly by implementing specific strategies regarding climate issues, with the Montreal protocol banning chlorofluorocarbonates, which were gases responsible for the depletion of the ozone layer. Policies like these address the struggles with the climate crisis that are, currently, still affecting the world. New policies are now addressing the pace and adoption of new types of energies as well as the dismantling of older carbon-intensive industries as part of the same fight for the climate. However, as mentioned before, the energy sector has many ways in which to grow and to find new types of energy as substitutes for older industries. The matter of energy choice mentioned previously showed us a long list of the many cons and pros surrounding the many types of energies currently available, and it is surely not an exhaustive list considering the evolution of innovation and political energy decision-making (Sareen, 2020). The fact that the green transition is, paradoxically, a time-consuming endeavour that has very little time (institutionally speaking) to be fully implemented is the major justification for this research work on the legitimation of bioenergies in the green transition. As such, the legitimation of the green transition through the use of time is of considerable importance and provides a strategy that can affect the speed at which the transition occurs by reducing the time it takes to implement it at the several levels of society: institutional, industrial and societal. This chapter will explore in which ways time can be used as a source of legitimation for the green transition and how using it can impact the speed of the transition. Considering the fact that time is, in and of its own, a complex concept, riddled with history and associations, the definition used in this work is based on the premise of its multi-dimensional and multi-factorial nature.

Stinchcombe's observations were an early attempt at determining the influence of time on the development of organizations: "organizations formed at one time

typically have a different social structure from those formed at another time" (Stinchcombe, 1965). The fact that organizations change with time and reflect different social structures is directly related to actors responsible for creating the frameworks and strategies within which those same organizations are created:

> *"…long-term policy is key, which is quite a challenge when you have a change in government every 3-4 years." (Participant 18)*

The green transition that the global powers have initiated is a *"very exciting time and there's huge change taking place"*, says Participant 1. This Participant interprets this facet of time as a representation of their feelings towards the context in which they are currently involved. Soon after, the same Participant uses another facet of time "*we're passionate about the climate agenda obviously and it's something I have personally been involved in for a long time now."* Now, the Participant uses time as a descriptor of a chronological representation of their career achievements and experience. Still during this interview, the Participant mentions time as a component of financial and contractual commitments by affirming that *"legal obligation can sometimes not follow with what the market is actually going through"*, thus stating a sort of "jetlag" between the two. Time is also used as currency in the interview, indicating that "spending" time is an act associated to a basic requirement and value when running an organization: *"we do spend quite a bit of time on these issues cause we've gotta run a global company."* The several concepts of time mentioned by Participant 1 can be found throughout the other interviews and literature. The concept of time is one that is subject to many interpretations and metaphors (Bucheli et al., 2013; David, 1994; Foster et al., 2017). As such, including time as a factor influencing the green transition comes with a heavy load of discussion surrounding the types of approaches used to make such an inclusion (see more in Bucheli et al., 2013). The usage of time and temporality in this chapter follows the combination of historical time, i.e. chronological, and its mixing in use with the Participants' perception of time and of how time becomes action.

5.2 The relationship of time with institutions and policymaking

Historically, institutions connect prior developments on all levels with new institutions through a response to new impacting factors via an incrementality of past processes (Wadhwani et al., 2020). Thus, it is important to understand the several perceptions in the individual units that make institutions and how those perceptions are created as responses to new environmental pressures (Bucheli et al., 2013; Lippmann & Aldrich, 2015; Wadhwani et al., 2020). "Time", as an important variable in determining the quality of relationships found in the collective memory of all levels of actors and their resulting actions in the entrepreneurial ecosystems, helps establish the connections of its perception from individual actors with institutions (McMullen & Dimov, 2013). Following the Participants' perception and responses, time is used in this chapter to describe its utility and influence as part of the policymaking associated with the green transition.

The connection between policymaking and time comes in many forms and some are suggested in the literature, such as lag (Di Maria et al., 2017), efficiency (David, 1994; Suddaby et al., 2010), dates (Wadhwani et al., 2020), urgency (Lippmann et al., 2015), transactional (Hoppmann & Vermeer, 2020), etc. These sorts of time representations are very similar to observations of how humans describe time and how the Participants relate to time, as explained above. Time, in this sense, cannot only be seen as a unit of measurement of a specific variable, rather, it is an expression of sequenced actions and a collection of samples of both memories and experiences shared by actors and other legitimators (Demil, 2020; Wadhwani et al., 2020). However so, time still has a standard mathematical use which coexists with the notion actors have of it, i.e., the actual stretch of the accepted measurable units of distance between the past and the present (David, 1994). The mathematical aspect of time can be represented, depending on the context, via specific events and their dates, such as the date of the creation of policies, the date of birth of institutions, the date of the acceptance of new concepts, among others (Wadhwani et al., 2020). In the context of actors' understanding of time and the capacity to react to

different timelines regarding the production of policies and other documents reveals how actors and their policymaking, alongside other document-producing activities, can create temporal pockets for each activity ("polychronicity" (Garud et al., 2011). The coexistence between mathematical and perceived time is especially relevant in legitimation, as the mismatch in the innovator and regulator relationships plus the different paces at which private and public narratives and actions unfold lead to the abovementioned lag effects in policies which, consequently, generate the concept of the policymaking environment as a constraint to innovation and progress due to them not representing the immediate future but a more distant one (Bucheli et al., 2013; Markard et al., 2016a; Pelkmans & Renda, 2014). The importance of the lag effects on green innovation become visible when connected to the legitimation through time of the green transition, as is observed by Participant 6,

"If the level of urgency (...) is not on par with the level of investment and targets, it's a big discrepancy. Obviously, there's always lag." (Participant 6)

and the importance and impact of traditional actors in the development of said transition (Di Maria et al., 2017).

5.3 Weaponizing time

The importance of one of the facets of time towards justifying the energy sector for the green transition are not shadowed by the others. The weaponization of time is still present in many of the forms previously mentioned. Time is still an important transactional weapon used by traditional players to delay the substitutions required by the transition and, therefore, maintaining their businesses and profits for longer (Di Maria et al., 2017; Hoppmann & Vermeer, 2020; Sareen, 2020). Participant 18 is quite aware of this and reveals these insights:

"Especially the petrol companies, the gas ones as well, but mostly the multinational petrol ones. I can guarantee you, Gonçalo, that they do not

have a position of denial regarding the climate change, they are not that [uninformed]. (...) What they are defending is a delaying strategy regarding the energy transition measure through the enormous power they hold over the media. I see it everywhere in Europe, where they are continuously sending messages that the energy transition is going too fast, that you have to go slower, that this is endangering the industry and loss of jobs. [...] This delay collides with the urgency set by the scientific community, which is what many of the objectives in Europe are based on, because the scientific community is telling us that you have to go very fast regarding the transition." (Participant 18)

The delegitimation of the green transition provides traditional industries with time and, therefore, money, thus leading to a feedback loop where further delegitimation allows for more time in the market (Di Maria et al., 2017). The way this strategy works is through delaying the transition and the implementation of energy technologies associated to it, in turn maintaining the *status quo* of fossil fuel usage. Through this strategy, fossil fuel incumbents keep their profits for longer and do not have to compete with new types of technologies and industries.

Transactional time functions differently for start-ups and emerging businesses due to the fact that their required actions are immediate, considering these organizations need a lot of nurturing to survive (Aldrich & Yang, 2012). Time is, then, a unit of survival for them, due to the depletion of resources, considering the more they are left unattended and the more delegitimation attempts target them, especially from established businesses, the likelier they are to fall (Brown, 2020). In this interaction, it is visible how the relationship between time and financial stability can cause very different responses. There are potential disruptors operating at this level, namely, policymakers. The response of policy to the forces of lobbying can impact the value of transactional time by causing major shifts in how time affects traditional industries, e.g. by increasing taxing

or reducing availability of resources and supply chains, but also by introduction of slowing of decision-making due to actors with vested or incumbent interests (Di Maria et al., 2017; Lockwood et al., 2017).

5.4 Time as a measurement of efficiency

The interrelation of other facets of time such as efficiency and lag are exposed phenomena in the institutions' ecosystem, especially regarding the communication between policymakers and innovators. Greater efficiency, i.e., assuming a faster reaction regarding necessary processes, is directly and inversely tied to the lag that these two types of players experience (Giurca & Späth, 2017). For an innovator to be efficient in releasing a technology that can be used, is approved and has funding to escalate its endeavours, policymakers must react before the needs arise. Lag is the time taken by policymakers and policies to provide an institutional answer to innovation's needs (Di Maria et al., 2017). The different facets of time can give us the flexibility we need to explain all the connections the legitimation process has within itself: more variables can be added and variables can be replaced in order to increase the efficiency of the process; thus, this process requires continuous care and attention regarding the components that affect and define it due to its responsive nature to the huge amount of variables that directly impact it (Deephouse et al., 2016; Lippmann et al., 2015; Pelkmans & Renda, 2014).

Still within the realm of efficiency, time is also a factor when we consider the bureaucratic burdens that affect many of the emerging companies (Braunerhjelm & Eklund, 2014). These burdens are responsible for both time and economic challenges which are, as previously mentioned, interconnected, thus providing insight into the several levels of impact that time has as a concept. Participants 16 & 17, who were jointly interviewed, had this to say about the bureaucratic burdens and their effect on innovative processes:

> *"And all these new material, new technologies for bioenergy cannot be materialized or commercialized if there is [no] support. They need the support from the government and the policy and they needed actually for*

long time. And then all these obstacles, like the heavy regulation, don't know that are actually restricting the growth in a chemical industry and for this, chemical industry needs bioeconomy, it very much needs bioeconomy." Interviewer: "So high regulation promoted but also stunted growth?" Participant: "In a sense, yes, yes, because they cannot use the materials and the processes that they use for many years. And so they have to adopt new. But obviously then products and materials are at the of course at the expense [of the business]. They have to comply with even stricter rules every day and that's why policies have to support." (Participant 16)

The concept of bureaucratic burdens is one that legitimizes the use of time as a factor towards legitimation, considering the contexts in which this phenomenon is observed: survival (Braunerhjelm & Eklund, 2014; Di Maria et al., 2017). The survival of start-ups and emerging businesses, as mentioned previously, is highly related to the availability of funds and resources (Brown, 2020). The bureaucratic burden is a factor that lowers the amount of time and resources a company has for their focus on innovation and creates a barrier of entry that highly affects the survival of companies (Giurca & Späth, 2017). In this sense, a branch of the economic facet of time is found via the efficiency of companies decreasing with the increase in bureaucratic burden, which leads to a loss in funds and lowers chances of survival.

Another interpretation of time and how it is used by companies, especially in the context of innovation, is the concept of "*kairos*", driven from the mythological name of the "Greek god of the favourable moment" (Garud et al., 2011). This concept of time idealizes action as strategized vs opportunistic, stating that *"kairos"* pertains to an opportunistic moment of action whereas *"chronos"* represents the strategic and scheduled actions the business is to take. The two concepts can coexist in institutions and actors regarding their actions and the production of documents, where the priorities shift continuously based on essential needs and emergencies alongside strategized and planned continuums (Garud et al., 2011). As part of the transition, one the most important aspects of

it is that, considering the amount of change it brings, it also opens up the amount of opportunities as new markets emerge or branch out from pre-existing ones (Mason & Botelho, 2021). As Participant 11 stated regarding a *"kairos"* moment regarding the green transition:

> *"If you don't get on the train now [regarding early battery market] it will be late for the next train as well, which again turned out to be very successful and with what we are seeing in the whole Europe with the managing of factories are being built and now we are working on doing the same for the sort of PV [photovoltaic] industry bringing it back." (Participant 11)*

In this sense, time is seen as an opportunity or a scheduled approach, indicating that it has the versatility of being identified as both and working in line with the companies as part of their developmental process (David, 1994; McMullen & Dimov, 2013). The strength of using the concept of time in such a flexible manner within the business' strategies is a booster towards the inclusion of more innovative endeavours while maintaining the original strategies running. This is very clear when looking at the statements made by Participants 16 & 17 regarding their business, which has stuck to its initial objectives while adapting to the new transition:

> *"So I would say we are getting more attention and to our mission basically because again all these things happening also especially in very recent years that has been of course Increasing awareness around the environment, especially on the energy topics, but now with the recent Russian war against Ukraine also increased a lot of focus on the energy safety and it's so, so again in that sense, I don't think that we have changed but we see that and our message comes across much more easily now than the past." (Participant 17)*

5.5 Time as legitimator of the green transition

The issues surrounding this crisis have been long exposed and defended by the scientific and international communities, so how are we, after decades of trying, still struggling to legitimize alternative energy sources (Sareen, 2020)? As Participant 7 mentions, "*the transition was born from the connection between industry and academic research*". The role of the scientific community in exploring and exposing this crisis is highly regarded and praised by the EU in its transition strategies. The time factor on this transition is parallelly important considering that time has been a major factor for all other legitimized and established traditional energy empires. In this sense, time can be analysed as one of the legitimation forces impacting the progress of alternative energy sources and how those have become integrated as a part of the narrative of the green transition, according to Participant 6:

> *"Things take time, but I think there is a big need for politicians and civil servants to really understand the magnitude of the [green transition] problem and different solutions needed to solve it." (Participant 6)*

Participant 18 echoes this thought:

> *"You have to take into consideration… that energy is the backbone of the economy. The economy, since the industrial revolution, has been built around the fossil fuel energy system of carbon, petrol and gas since 250 years ago. So, to transform this system in 30 years, 25, 30, 35 years, is a true energy revolution with huge implications of the social, technological, entrepreneurial, amongst other things, type, because renewables are the ones that are coming, including all of them, not just solar or PV, but biofuels, biomass, all that supposes a redefinition of the energy models." (Participant 18)*

Time has had an impact in many countries regarding their struggles to follow up on a climate crisis narrative and have been long-term endeavours, as is mentioned by Participant 6:

> *"In [European country] it's [energy transition] been a journey that has been going on for quite a long time" with "quite a long history of looking for [energy] alternatives that could replace the fossil ones." (Participant 6)*

Although a myriad of factors are part of the analysis of the transition, the focus on time has special relevance when looking at legitimation, particularly as it is highly correlated with policies and innovation (Energy Transition Commission, 2020). In the case of policies, time is invoked as a factor with a highly influential force due to the importance of policymaking in promoting the transition and the innovation that drives the transition. In this sense, policies, according to Participant 2, have been a part of the reason why in *"(…) recent 10 years it [European Green Deal] intensified the discussions in countries all over the world. What resources do we have? How can we make this societal transition in a good way? Which kind of biproducts/waste products?*".

5.6 Time variance in policymaking geographical impacts

The time element of actors is highly dependable on their area of effect, i.e. both geographically (e.g. nationally) and by type of organization (e.g. institution) (MacKinnon et al., 2019). The resulting time factor is, then, affected by the several factors that influence the area of effect. Given that the time factor, for actors, can have several dimensions, it becomes a multi-dimensional factor on its own for the specific category of "actors". The definition of time as a multi-dimensional factor comes from the previously explored facets of time in the policymaking and innovation ecosystem, especially amidst the green transition, where it has its own multi-factorial definition in tandem with the actors' one. Actors are naturally restricted by time as part of their human nature and as part of the process of the creation of documents and undertaking action (Iskandarova et al., 2021; Köhler et al., 2019). Unless we were reliant on other forms of intelligence and knowledge for the creation of documents, the

fact is that humans still take variable amounts of time in their iterative process of policymaking and other types of strategizing that require an output. The constraints that time imposes on actors are only expected, and so are the constraints those imply on the actions taken by the individuals that are so greatly affected by time. The process is, however, mostly affected by the actors' ability to produce outputs and release strategies which, given their geographical relevance and the institutions they belong to, will take variable amounts of time to produce and remain influential for variable amounts of time as well (Di Maria et al., 2017). Following up on that and using Table 2 as a visualization tool, this research explores actors' relationship with time regarding its association to the geographical level at which their work takes effect, and the profile of their work and their ability to provide certain outputs within their work environment. As discussed in the literature review chapter, the actors involved in the legitimation process all have several ways of acting and several factors affecting their actions as seen in Table 2.

Table 2: Legitimation levels, regulatory types of actions and associated timeframes.

Legitimation Process	Actors	Regulation	Time descriptors
Global	Continents Countries	Agreements Commitments Strategies	Slow Multi-generational Historical Irrelevant
Supra-national	Unions Councils	Strategies Policies Protocols Recommendations	Slow Semi-generational Political Relevant
National	Governments Institutions Foundations Lobbies	Laws Policies Decrees Regulations	Fast Human lifespan Political Urgent

Regarding the level of impact of the actors' outputs, these can vary, as seen in Table 2, from regional to global, with other levels in-between. The outputs considered here are ones that basically have effects at a regional, national, international or global level, indicating various depths of strategizing and of

policymaking. From a time perspective, these levels also house the potential to have very different timeframes and long-term or short-term immediate or direct impacts. Usually, it would be assumed that a lower geographical level (e.g., regional) would be associated with a shorter termed strategy and, therefore, have an impact for smaller amounts of time. And this does happen, as is described by Participant 15:

"Due to the heat in 2022, we had less available energy from infrastructures like the nuclear plants' lack of water and more energy consumption with air conditioning. At the political level, they are not that sure of what to do, so they make decisions on a short-term basis." (Participant 15)

This expectation, in the EU's case, would be resulting from the fact that regional policymaking usually reacts to an international one with the production of several smaller documents to befit all the international targets and strategies at the several regions of the countries. This means that regional policymaking encompasses the time that it took global strategies to be decided and implemented plus the time it took for supra-national actors to do the same as a response to the global ones. However, this is not necessarily how the policymaking at a regional level works, according to Participant 15, because of the sovereignty, the degrees of independence from the EU institutions, and influence on them that each country possesses:

> *"The Commission, many times, or almost during all crisis situations, reacts to what the Member States request. In some cases, it reacts to what big companies request. (...) This shows the pressure of Member States and certain companies (have)." (Participant 15)*
>
> *"The Commission isn't completely independent, neither from the Member States neither from the system, I don't know whether to call it a cooperation between the Council and the Commission, a system of pressures." (Participant 15)*

Provided with these sovereign and executive powers, some countries define their own strategies and follow through with them at speeds that might rival those of international strategies (Pike et al., 2015). Regions are also, sometimes, given more independence in several fields and, thus, might opt for different types of policies that fit within their economic and social models better than other national or international ones. The expected association between time and geographical scale of policies, however, is not necessarily the case for all the green transition documents, as regional and national-level policies do not have full freedom to decide on which international targets and guidelines to follow, especially when regarding the timings and objectives of the sustainability goals (Pike et al., 2015). One such example comes from legally binding documents that set targets on the climate crises, such as GHG emissions and fossil fuel consumption. These legally binding policies resulting from the international community's activities have had a relevant impact, according to Participant 18:

> *"The Paris Agreement is the most important policy we have achieved in these last 30 years. (...) The changes provided by the Paris Agreement makes it a historical agreement because, for the first time, it allows for a solid institutional architecture for all countries in the world, be they developed, emerging or developing countries. So, of course, the Paris Agreement is not perfect, but it is the best we have managed regarding institutional architecture." (Participant 18)*

This discrepancy in adoption of policy measures isn't big enough to generate gaps between the international strategies and the national or regional ones, however, it may create barriers for the implementation of new policies and, thus, increase the amount of time needed for them. The time needed for the implementation of new policies at a national and regional level counts on factors like the economic and financial availability for specific sectors and the governmental goals for the region. If such factors are disrupted by previous investments and goals, then the implementation of new policies will suffer, timewise, and potentially create a cascading effect of a slowdown in the implementation of new measures and targets.

The policymaking happening at higher actor levels, like the EU, can have impacts at varying levels of actuation, which are then reflected on their scale and impact, as is seen by the statements of Participant 18:

> *"In COP26, as I was telling you, 140 countries made a commitment regarding their climate neutrality. This is a very important change considering where we were just 10 years ago. Those changes are huge whereas a program or a plan like the REPowerEU is specific for the EU to accelerate its energy transition. It's a very important plan, but at a smaller scale." (Participant 18)*

5.7 Time lens: the EU's legitimation of the green transition

The EU and its daughter institutions have built up and made the European *ethos*, thus providing the population (and the world), with life-changing documents. In these policymaking activities, and as a policymaking coalition, the EU and its member states, with the intervention of the Council, Parliament and Commission, have produced the greatest historical changes regarding the climate crisis. According to Participant 18, the EU built policies that have carved the path of world economies regarding the energy sector:

> *"I believe the European Green Deal (EGD) is an extraordinarily important agreement. In fact, it has character, historical character, because, for the first time in the EU, which has been for many years involved in the climate response, since 1992, but Europe accelerates its climatic response starting from 2007. (...) But still, during 13 years the policies are sectorial: on the one hand there's energy policy, on the other is climate and then there are the environmental policies. So, the EGD, for the first time, brought us a strategy that is comprehensive, understanding, integrative for the whole development of the economy." (Participant 18)*

As they mention, the EU provides an acceleration to the climate response that was not present or initiated by any other country until the production of the European Green Deal. The importance of the acceleration factor is especially relevant, as it is one of the time components used to legitimate the energy transition: the speed. In this sense, time is, once again, used to describe something that was done in a shorter amount of time than expected, considering the change of energy systems, as was observed beforehand, is a task of immense proportions and affected by vast amounts of barriers. Considering all the barriers that can be translated into time terms, such as lag, that were previously explored in this chapter, the fact that the EU has taken them into consideration and provided a policy that not only targets the climate crisis but also integrates, in a coherent manner, a whole new economy, is living testament of its impact.

The issues that can cause a disconnect between sectors, much like the lack of communication and synergies between policymakers and innovators, is not overlooked in the EGD and it is a part of its core to integrate previously sectorial discussions. The EU brought the sectors together in order to have a more comprehensive or holistic approach to the energy transition (Andersen et al., 2023; Sareen, 2020). This role the EU plays directly impacts the speed at which the transition can happen, as it is crucial that time can be cut where possible to allow for the transition to happen. This is not to say that the transition is going smoothly. Participant 6 states that *"if you're going to reach the 2030, 2040 and 2050 targets that we have set up, the policy is not supporting enough to reach those targets."* This is a pretty strong statement considering all that has been analysed here. Although the EU has managed to create so much and push forward the green energy transition, it appears it is not yet enough, given the targets and objectives set out by the policies. The dissatisfaction with EU policies is, once again, related to time.

The targets have a timeframe that Is very ambitious, and the policies have to be able to respond to that timeframe. The EU is trying to be a pioneer in the energy transition and to provide a strong example of policy leadership towards the goals that follow the scientific community's warnings and research. In fact, the EU has inspired other countries and businesses to follow suit, as Participant 18 and, subsequently, Participant 11 describe:

“A continent of 450 million people, which represents a very important part of the world economy, has said: “let’s go towards carbon neutrality in 2050 and this will expect all our economic development models to work around this strategic objective.” Of course, other parts of the world that need to interact economically and technologically with Europe see that there’s a force that’s taken off and follow that direction as well.” (Participant 18)

"But the reason we have so many different experts working in these topics [energy] is so that we can have a little bit of a more educated guesses than I think many others and also help it [European Commission] work with them." (Participant 11)

The strategic development of the energy transition is represented easily if the chronology of it is analysed, and Participant 18 gives a proper answer to how the EU has planned this long-term strategy and has started implementing it, not only via the policies but also regarding the ambitions and actual accomplishments. And the EU only managed to do so because it is made of a collection of environmentally conscious member-states which also worked towards an agreement together, as is stated by Participant 18:

“And we have to understand that this increase in the climate ambition by the EU is also the result of seeing that member states like Spain, which are important and big, a member state with almost 50 million people, its climate and energy objectives were very ambitions, therefore it becomes an interaction, meaning, we receive ambitious objectives from Europe but we give those back to Europe. (...) Because somehow there were many member-states, amongst which is Spain, that had been requesting greater climate and energy ambitions from the EU.” (Participant 18)

In a similar light, Participant 15 provides a view of how changes in policy strategy have shown the engagement of member-states in the development or

enrichment of previous policies for more accurate and precise definitions in the climate-energy nexus:

> *"In the Fitfor55 package, there's a new reform on the sustainability criteria as they [criteria] were deemed insufficient, with more supporting scientific evidence, more pressure from citizens and media and NGOs and so they reinforced the criteria further in this proposal. (...) The Commission proposed more precise criteria. One example is to not convert a forest into a plantation. Another novelty introduced by this proposal was article 3, which states that the funding systems in the member states must take into consideration the principle of biomass usage to ensure there's continuous added value throughout their manufacturing and final product. So the question member states need to ask regarding the creation of biomass is whether it also provides added value besides the fuel properties, such as the produce chemicals or raw materials." (Participant 15)*

The criticism towards the EU's ability to decrease the time needed for the transition are divisive, especially considering what was previously analysed in terms of what the EU has achieved and committed to. One important factor to consider when analysing the impact the EU has had in climate change is how other countries have reacted to the scientific community, and whether they listened to their warnings or not. Once again, Participant 18 has managed to capture the essence of the EU's strategizing and how it dealt with managing such a massive challenge:

> *"Could Europe have gone faster [regarding climate response]? Of course, but it could also have gone slower. What I mean is that I believe that, in Europe, the issue isn't that Europe didn't go fast enough, that would be an analysis error. The issue is that Europe went at a very important cruising speed. But the real problem is that the rest of the world has not followed the speed at*

which we [Europe] have been going at to decarbonize the economy. Europe now represents just 7% of the GHGs emissions worldwide. Which means the rest 93% are coming from the rest of the world? For as well as we do things inside the EU, if we do not manage to drag other big economies with us towards a coherent climate policy regarding the climate emergency, the Europeans alone cannot solve it." (Participant 18)

The onus on the rest of the world is a contentious issue, but the speed at which the EU has gone is something that has sparked others to follow and has also given everyone a taste of what the new economy could look like. This glance into the future is only provided by the fact that the EU dared to tackle such a big change with a strategy that, as mentioned earlier, is comprehensive and cohesive, otherwise it wouldn't be providing us with the ability to transition at all. This is a testament to the use of time as a legitimation tool, because the EU managed to shorten the amount of time needed for the transition by setting highly ambitious targets and making others believe in those objectives. A good example of how the EU acted regarding the acceleration of the green transition is seen in COP-26, where it, alongside other world powers, defined the goals for the next 10 and 30 years. Of course there have been setbacks, such as COVID-19 and the war in Ukraine, which took prevalence over the transition, yet the EU managed to readjust its strategy to include those and still pursue a green economy, which Participant 18 corroborates: *"I personally think that it is true that with Ukraine's crisis the topic [energy transition] has been left a little suspended, but it is still the strategic project of the EU at medium- and long-term."*

The case for the green transition is different than other previous ones, where more time was given for the implementation of policies with sanctions being held back due to mutual understandings. Though the time given for the transition is lower, the EU has kept a secular strategy involving a vision regarding the energy usage and its impact on the planet that is revealed in Participant 18 and Participant 1's words:

"The EU is the only big world leader that has kept up a strategy, a vision, and a strategy of clear responsibility regarding the climate crisis." (Participant 18)

“In the recent 10 years it [energy transition] intensified the discussions in countries all over the world. What resources do we have? How can we make this societal transition in a good way?” (Participant 1)

The difference lies on another factor associated to time, which is urgency, as is shown above by many comments regarding the necessary speed of the transition and which can be concluded with Participant 18’s simple yet ambitious statement, echoed by the EU’s ethos:

"The energy transition has to be made in the next 30 years." (Participant 18)

It is in this association-expectation realm, especially with the added influence of urgency, that we see the importance of integrators. This profile works as an accelerator profile, thus responding to the crisis of urgency and providing catalysing approaches to the implementation of new policies. Integrators work at the two levels previously mentioned regarding potential barriers emerging for the integration of new policies: governmental and social.

5.8 Interaction between time and social legitimation

The social dimension of the implementation of new strategies is extremely relevant at a regional level. The importance of the social dimension, especially at a European level, was remarked by Participant 9:

"Everyone must be in on it [energy transition] (...). That's what we observe in Europe and that is why things work, because there is an urgency from society for things to work." (Participant 9)

There are several ways in which changes to prior goals might affect the population and cause them to lift artificial, but powerful, barriers to implementation. All these have one factor that affects them in common: time.

Regional powers might feel pressured to increase investment in areas that are unrelated to the actual policy implementation but that reveal new paths for the international policy to be integrated faster and more easily. Thus, the urgency with which policies need to be implemented, at a regional level, often comes down to the impact they will have on populations and governments. The complexity of such interactions shows how important it is to maintain a balanced relationship between policy goals and the concept of a “fair transition”. The concept of fairness is used as meaning a change that is achievable for all sectors and people, rather than it being facilitated for some whilst proving extremely hard and costly for others. This concept was added to the green transition exactly as a way of expressing the need to take into consideration all countries and sectors, especially the most vulnerable ones, for such a grand change as is the one encompassing the whole energy sector.

The importance of integrators becomes very clear here, where we understand the impact of the population in the ability of governments to peacefully and efficiently make necessary changes to accommodate international targets and goals for the transition. As previously mentioned, the impact populations can have leads to the need of a profile that is able to fully inform the population of the international strategies for the future. This way, the population can make informed decisions on whether to intervene in their local governments regarding changes or policies which will impact them. It is a form of advocacy that provides strength to the implementation of policies through population education and political action.

Picking up on the concept of “fairness” in the green transition and how the balance of impact in different sectors needs to be achieved, the connection it has to self-containing systems is quite blatant. A self-containing system, by definition, is a system in dynamic equilibrium that is forced out of said equilibrium due to external forces or new variables. This concept is further explored in the following chapter where the “reactiveness” of such a system are characterized and covered.

5.9 The transition's velocimeter: actors and institutions

In the context of an energetic transition as grand as the green transition, alongside the importance of stable organizations' goals and strategies, policies need to exist to provide a sense of security to the actors that push forward innovative endeavours:

> *"Energy in my view is extremely driven by policy and lack of policy is always a risk to investors…" (Participant 18)*

Private investment is, indeed, a factor for the success of the green transition (Energy Transition Commission, 2020; Iskandarova et al., 2021). Investment security and risk are a topic mentioned by several Participants and are explored in the reaction chapter as part of an "action-reaction" policy-financial analysis.

Actors and institutions interact directly to define the speeds at which their outputs are revealed to the public as finished products. It is part of the responsibilities of the institutions and the actors within them to be able to define the necessary speeds to accommodate for the changes in the requests from society. As part of a "reaction profile", which is explored in the next section, actors and institutions are able to change the speed at which they produce outputs needed for the progression of certain agendas. Regarding agendas of change, especially with the current green transition, the several factors affecting the speed at which official decisions are made all play an important role in the speed, and therefore, the time they take to release such documents. It is in these conditions that one can observe how the different urgencies of certain periods lead to higher considerations regarding several of the influencing factors in the decision and policymaking aspects of a period such as this energy transition. The impact of the energy transition being one that dismantles a lot of the previously built energy infrastructure, where lots of traditional players have invested unimaginable amounts of time and money, reveals how massive the change is. By association, it also stands to reveal the biggest actors in the delegitimizing of such a transition due to the previously mentioned amounts of investment already made throughout the decades. The

contrasting actions taken by traditional powers when exposed to the scientific community's concerns are highlighted by Participant 15:

> *"The [fossil fuel] economic model that has been created is very hard to undo, especially when backed by such an incredibly intense lobbying. Science has yet to be listened to, that's first, because since the beginning, science started by stating "You have to be very careful because what you do can have disastrous consequences".” (Participant 15)*

It is in the revealing light of the scientifically justified urgency of the green transition that the speeds at which actors and institutions operate show their true potential, which is when the urgency outbids the lobbyists and other traditional powers that held the grip of change. This speed is one that moves a lot faster than Europe is accustomed to, where its high administrative abilities shine with the caveat of generating a slower output speed for documents such as policies and directives. However, in the context of the green transition, Europe has shown that, once the ability to move onwards from the impact of traditional actors increasing the time burden on policymaking regarding the energy sector, its responses are faster and more precise.

Although the decrease in time burdens is welcome to accelerate the transition and protect the planet and our livelihood, this speed may come with some sacrifices made in the outputs. One such example is decreasing the precision of the longer-term strategizing ability, where the necessary goals might prove too ambitious for the market's reactions and for the adaptation of the traditional players, who are also necessary for the transition to function. Other examples come to mind, such as the necessity for amendments more frequently as issues emerge that the risk management was unable to predict due to the urgency of the statements and targets. These are trade-offs that are necessary to rush the process and initiate the transition, albeit the criticism promoted by traditional players. The actors and respective institutions are also aware of the hardships that these might bring to the targets of their documents: innovators. Innovators are the ones who really suffer the bulk of the changes in directives and policies

the most, especially ones dependent on funding. One criticism made at the funding schemes was that there was a lack of “grandparenting”, which is when there is initial investment for innovation (i.e., low Technology Readiness Levels – TRLs) that isn’t followed through once the innovation is ready for pilot testing and eventual commercialization. This is mentioned by Participants 16 & 17:

> *"Surely this policy support should be higher and should be continued through the years? To help all these new technologies become an industrial reality."*
>
> *(Participant 16)*

Considering all this, it is also to be expected that new forces are generated in terms of lobbying and interests that work towards the increase in speed (lowering time burdens) in the production of policies directed at the green transition (Di Maria et al., 2017; Lockwood et al., 2017). These are the forces that will, eventually, replace the traditionally carbon-based ones, but not in full. The replacement of traditional actors is happening from within as well, considering some of the greatest carbon fuel supporters and industries have also started their journey transitioning into other types of energy producing technologies (Canal Vieira et al., 2022; Firdaus & Mori, 2023). This shift is moved, especially in Europe, by the funding opportunities, which have been diverging steadily from traditional carbon fuels and industries, and have seen increasing tendencies in the sustainable and renewable technology sector (Iskandarova et al., 2021). As such, traditional players are faced and forced upon this new energy market due to the need to navigate the investment plains and secure funding for their technologies and to ensure their subsistence and relevance.

The newer lobbying powers are, then, a mix of actual new innovators, who are either entering the green race now or were already a part of this ecosystem, albeit in a smaller scale due to the lack of urgency and seriousness with which the transition was faced, and older players moving to new types of technology. New lobbying powers will have effects on the speed of the transition as they have appeared as a response to the transition’s needs, therefore, they will work towards reducing the time needed for the new technologies and new institutions to promote the energy revolution. The power of new lobbyists allows for new

pressures to be put under the strategizing towards the transition, thus disrupting previous delegitimation attempts by incumbent carbon fuel actors and industries which, naturally, caused an increase in the time needed for the transition's planning due to the conflicting values. The new lobbying powers work in the opposite way as their counterparts did before: by legitimating the green transition and speeding it up instead of delegitimizing it by delaying it. The fact that these two types of players will coexist in the new green order will generate a curious form of relationship that would likely prove to be very interesting if studied throughout the development of the transition.

5.10 *"Innovation is key"* for the green transition

Becoming efficient in the creation of innovation is intrinsically connected to the ability of time to legitimate innovation within the several temporal dynamics that arise when the two are observed (Garud et al., 2011). And the importance of innovation for the green transition is so immense that the studying of all potential influencing factors provides a broader view of the potential impacts driving or impeding innovation which, then, affects the green transition.

Another example of how time and innovation are connected is if we look at the effects time has through the existence and acts of the innovative industry, i.e., how the past and future of the company's innovation are affected by time events (Firdaus & Mori, 2023; Garud et al., 2011). The fact that time is also important for innovation illustrates how deeply connected the two are and how the many factors influencing both can create a web of interactions, thus generating complex ecosystems and relationships (Garud et al., 2011). Events in innovation can lead to cumulative effects on its development within a company, therefore creating more potential preparedness and responses to transition period requests (Bolton & Hannon, 2016; Garud et al., 2011; Morgunova & Shaton, 2022). Time in policymaking and regulatory actions, therefore, has a strong impact on the stimulation of new markets and innovative endeavours, and it should be the regulator determining how the compliance burdens can be affected by the time requirements to make the most efficient regulations on innovation (Canal Vieira et al., 2022; Pelkmans & Renda, 2014).

As part of the connection between different actors and powers in the green transition, the ever-important relationship between policymakers and innovators gains new scale. The demand for a more efficient interaction between policymakers and innovators is an investment towards the future of all policymaking but it is especially important for the current transition. The certainty policies can provide via their power to provide the industry with foresight and its length is an essential component for industry strategizing and provides start-ups with confidence to emerge with innovative solutions (Energy Transition Commission, 2020; Iskandarova et al., 2021):

> *"Someone [entrepreneur] starting now should have the confidence they [policies/funding] will be there for them." and regarding low TRL funding in biofuels "doing a new technology, it's not gonna be perfect at the start". (Participant 3)*

Innovators are important for the transition because *"innovation is key"* in this context (Corradini, 2019; Iskandarova et al., 2021). The effects of innovation are also associated to the momentum gathered by innovators, as they are also aware of the importance of the market and how challenging the targets and implementation of new technologies are (Energy Transition Commission, 2020; Hoppmann & Vermeer, 2020):

> *“I have spent 18 years in this sector [energy] and I still don't understand the complexity of it. it's very, very challenging." (Participant 6)*

The connection between innovation and time is, as per the previous paragraphs, also multi-faceted, granting further confirmation of the complexity mentioned by Participant 6. The connection to institutional genealogy becomes even greater when we determine the fact that the accumulation of events throughout the existence, and beyond, of the business leads to a faster response to demands and an easier shift to meet new requests (Cooper et al., 1996; McMullen & Dimov, 2013). Legitimation of innovation through time is, then, part of the ecosystem and grants time yet more legitimation powers within the context of the green transition due to the crucial influence of innovation on it.

5.11 Conclusion

The inclusion of time and of the interaction of several actors at different hierarchical institutional levels is indicative of a connection that goes beyond the present and current institutions. As is historically prevalent in the evolution and appearance of the different types of energies, institutions have been created as a reaction to many changes at the global, supra-national and national levels (Garud et al., 2010; Markard et al., 2016a). Actors within those institutions become part of the institutional genealogy and are affected by the previously built *ethos*. As such, the conjunction of effects at the hands of actors inside impactful institutions is a set created by the generational policymaking that reflects the strategizing set for the long-term (Garud et al., 2011; Lockwood et al., 2017).

Considering the actors' impact in the transition explored in this chapter, alongside the institutional powers and policies that arise alongside them, the complex relationships between time, legitimation, institutional genealogy and the responsible actors for the transition is brought to light. In all its complexity and multi-factorial/multi-dimensional characteristics, covered in this chapter, the ecosystem provided by these concepts is rooted in the need for change due to the climate crises and the scientific community's calls for action. Due to the context in which these mentioned concepts are brought together, the interactions between them and how they produce legitimation or affect the timeliness of the transition becomes more apparent, especially when embedded with the insights from professionals in the area.

In conclusion, time, as the amount of time necessary for the transition to occur, can be sped up or slowed down by actors and institutions. The effects on time are direct consequences of legitimation or delegitimation of the transition, two concepts which act as contradictory forces towards the final goal of the transition. Legitimation or delegitimation are, themselves, influenced by institutional genealogy, which corresponds to the historical policymaking and strategizing that institutions possess, and which, in turn, actors follow. Actors are the materialized form of the effects of institutional genealogy and represent the forces of legitimation and delegitimation.

Chapter 6: Reactions to the green transition as forms of legitimation

Policies, as mentioned in the previous chapter and throughout this thesis, are one of the transition's major drivers. The fact that policies are one of the major mechanisms for pushing the transition agenda has deep implications in the industry landscape and the actors within the same affected industries alongside actors whose interests align with the industry more so than with the policymaking (Morgunova & Shaton, 2022; Schütte, 2017).

As was explored in the policy chronology chapter, different types of energy were promoted by policies throughout the past five decades (Sareen et al., 2020). The effects of policies on promoting the different types of energies have been very disruptive in markets and public perception, however, attempts at a clear path were established but never fully achieved, given the ever-changing nature of the consequences of exploring different types of energies (Bressand & Ekins, 2021; Canal Vieira et al., 2022). The policy chronology chapter explored the energy policies throughout the past decades and gives some insight into the historical timeframe of the multitude of reactions that nations, institutions and the industry have had regarding specific types of energy mixes and the policies integrating them (Genus & Iskandarova, 2020; Sareen et al., 2020). The importance of energy mixes is essential for the green transition to happen and the urgency with which it needs to happen is essential to combat the climate crisis and ensure the planet's life supporting ecosystems (European commission, 2022; Hausknost, 2020).

In this chapter, the main focus is exploring and understanding the way institutional systems alongside the ecosystem of industries, actors and other bodied systems are reacting to the current transition in energy in the EU. The type of analysis this research applies uncovers the ways in which actors might affect not just the direction and speed of the transition but also the way in which governments, societies and institutions may need to adjust or adopt certain behaviours to fit in with the new demands. The behaviours, then, are

responsible for impacting, or not, the green transition in different ways, leading to it gaining momentum or increasing its inertia.

The analysis herein deploys an institutional genealogy lens to explore the manner in which incumbent institutions and players affect the transition at several levels and systems (Pike et al., 2015). Deriving from the evaluation of the systems' reactions, the chapter considers and analyses how the different types of actors defined in the research questions and methodology sections, i.e., regulators, financial and industrial bodies and society, whose expert opinions were gathered, have witnessed, become involved, and contributed to the action-reaction events of the energy system in the EU. This chapter also details the types of relationships that arise from a reaction to a specific trigger (e.g., policy) and from the demands imposed by said trigger.

The chapter culminates by attempting to aggregate all the data and profiling the actors and systems as part of, and based on, the collection of the potential relationships and behaviours as reactions to the relevant concepts, thus resulting in the creation of a "reaction profile". A reaction profile is provided for each and all types of actors. The actors' reaction profile is based on the quotes analysed from the interviewees in each actor section to determine the type of effect that a reactive actor may have in the legitimation of the green transition. The reactions from actors within the energy system typically stem from, as we will see by the end of the chapter, new demands (e.g. targets), new documents (e.g., policies or strategies), governmental pressures (e.g., lobbying), the energy market, social activism and from the scientific community (e.g., academic publishing and reporting).The reaction profile for each section, depicted via a table, provides a summary of the identified effect actors have on the green transition. The identified effect is based on the Participants' perceptions of actors' reactions to certain overarching topics and concepts. Institutional genealogy analysis provides a perspective on the effects of incumbent institutional and player actions on the energy system, including new institutions, new players, and society.

The overarching topics and concepts provided for the reaction profiles derive from the analysis of Participant quotes and research literature used to

determine the effects of actors' behaviours, based on the Participants' opinions, on the green transition. All the sections will have a table showcasing the three major actor types in the green transition, according to this research. The tables also include what kind of effects the reactions to the concepts in the section, identified by the Participants, had towards the green transition. The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect on it (0) or increase its inertia (-).

The multitude of systems and actors included in this chapter is illustrative of the complexity of the transition to a sustainable energy economy but also how essential it is to consider the interactions and the amount of the components of these complex systems (Desing et al., 2020; Köhler et al., 2019), as was said by Participants 8 and 14:

> *"The dialogues and discussions related with sustainability in the corporate sector are rare, linear and reductionist which, in reality, contradicts what sustainability really is. It is a complex system." (Participant 8)*
>
> *"I think everything's interconnected because the creation of urgency and credibility [by European institutions] makes investors interested, who can actually develop projects and that interest generates the need for new policies and financing, so, this ecosystem creates the possibility of expansion of the renewable energy ecosystem." (Participant 14)*

6.1 Legitimized systems: energy and action-reaction

The energy nexus consists of action-reaction mechanisms which revolve around the interaction amongst industry, society and policymakers, leading to results (e.g., new targets, new policies, new strategies, etc) based on the proper representation of each but also the synergies between them (Desing et al., 2020; European commission, 2022). The results from the interaction between different sets of actors are important, as the action-reaction nexus is a complex

interconnection of several actors that represent the attempt to legitimate the transition to a greener economy, culminating in the examples mentioned above, of new documents, among other sources, providing a way forward (European Commission, 2019; Mathiesen et al., 2022). The several actors include participants in both private and public sectors, which are both considered essential for the transition's success via public-private partnership strategies (Lange et al., 2021; Mathiesen et al., 2022; Patermann & Aguilar, 2018). The reactions from the several actors can be seen as legitimation attempts towards the transition based on the triggers that initiate actor reactions. As such, there has to be an attempt to analyse this action-reaction system as a multi-factorial and multi-actor system, as was discussed in the previous chapter regarding the complexity of time in its effects in the green transition and the systems it affects and with which it interacts (Köhler et al., 2019).

One of the objectives of this chapter is to try to pinpoint where connections between actors and the reaction triggers, which are what provokes a reaction, occur, albeit positive or negative, and how these might be affecting the transition itself, thus legitimating it or not. This is an interest corroborated by the participants, who developed an inclination towards participating in this research due to the research's nature as an attempt to connect several spheres of influence in the transition process to determine where improvements on speed and efficiency could be found and added. As such, Participant 3 commented:

> *"There should be a holistic evaluation of the green transition. Otherwise, doing everything green might not end up green at all." (Participant 3)*

What Participant 3 means is in regard to the arguments stated above: the green transition involves a very complex network of connections and interactions that sit at the base of a new energy nexus driven by an action-reaction nexus that manages to either legitimate it, or not, through different means (Aguilar & Patermann, 2020; Andersen et al., 2023; European Commission, 2018a). It is only by attempting to analyse the fragments of each part of this complex system that insight into how they interact might begin to emerge (Schütte, 2017). As such, this research focused on providing the fragmented analysis of the reactions to

triggers from several parts of the complex systems that push and legitimate the transition while fighting the inertia and resistance that more well-established industries are known for (Canal Vieira et al., 2022).

6.1.1 Higher institutional reaction

As a multi-level system, the energy nexus requires legitimation at the higher institutional levels, such as policymaking and global institutions, as well as at lower levels in the system, like society and industry (Loeffler et al., 2017). The reactions from the higher institutional levels to the global requests for the green transition relate to the use of policies and strategies to legitimize the changes required from global leaders to respect certain values and ideals for the world (European Commission, 2019). The speed and complexity of such actions was covered in the previous chapter, however, the reaction profile of said institutions has changed for the green transition, as exemplified by Participant 15's comment:

> *"Clearly the [international institution]'s position is that you have to accelerate permits and place renewables everywhere because we need more energy considering we are no longer using Russian gas." (Participant 15)*

The reaction profile of big, incumbent institutions, such as the European Commission, to the green transition has been of high speed and responsiveness, as opposed to its usual speed of reaction, due to the urgency associated to the climate crisis (European commission, 2022; Hanewinkel et al., 2017; Mathiesen et al., 2022). The legitimation avenues taken by incumbent institutions are in direct correlation with their reaction to the society's needs and to the global strategies: reaction equals legitimation, but of what? Going back to our chapter where we chronologically analysed the types of policies that came out for the green transition, it becomes apparent that the legitimation efforts by supra-national and international institutions are associated to the production and implementation of policies.

The context that accelerated the reaction of some supra-national institutions was one of crisis which caused such disruptions that, either the institutions adapted or the population would suffer a tremendous loss of quality of life (European commission, 2022). Supra-national and international institutions are often subjected to severe pressures, hence their usual responsiveness being slower, but even in times of crisis, they must maintain their ethics and react to requests from all sides, as Participant 15 points out:

> *"The [supra-national institution], many times, or almost during all crisis situations, reacts to what the members request. In some cases, it reacts to what big companies request. (...) This shows the pressure of members and certain companies." (Participant 15)*

Luckily, despite all limitations and pressures, our system adapted fast enough by generating targeted and agreed policies to allow for minimal damage to our current energetic *status quo* while still promoting lots of changes for the future of energy systems (European commission, 2022). From an institutional genealogy perspective, the global need for the transition was what permitted this reaction speed, ensuring that the international and supra-national institutions had room to respond, considering the crisis from which the need stems (Canal Vieira et al., 2022; David, 1994; Köhler et al., 2019). The usual associations of lobbying, incumbent pressures and established policies as contributing to lower speeds of reaction to the transition were all overruled over the need for response to the climate crisis (Hausknost et al., 2017b). This indicates that the institutional genealogical effect on the green transition, albeit being a usual deterrent, is mostly overcome in situations of crisis.

As part of the policy reaction from supra-national institutions, the targeting of the energy source paths to take towards achieving a new energy system varied, along with opinions:

> *"The fundamental key is decarbonizing the economy, meaning, the progressive and consistent removal of fossil fuels, carbon, petrol and gas must be let go from the energy systems in the next 25 years. Those will be*

replaced. As a matter of fact, they are already being replaced, especially by renewable energies in the energy generation sector. (...) And then there will, effectively, be other second or third-generation biofuels that will, surely, play their part in that replacement of the energy mix." (Participant 18)

"One is the nuclear energy even though we haven't done it. I have never given any opinions because I'm not an expert [on nuclear power]. I'm considering myself as a professional in the energy [field] and I don't find it very reasonable or clever? How most European countries are talking [about] not using nuclear energy. I think it is crucial. I think it's this kind of a Holy Trinity [of the energy mix]." (Participant 19)

"I think there's been an incremental shift [regarding development of bioenergies] and it's very difficult looking back at any specific one. I would say going from a different framework programmes, there has been a progressive move towards a implementation and actually producing real results that can be delivered. So there's been a greater drive across the board on actually making something that happens." (Participant 12)

"Our bet in the EU nowadays is hydrogen and all of its derivatives." (Participant 9)

The varying opinions on what energy mixes to focus on are also present in the transition's policies, and it is to be expected that the highest variety of energy sources available is used towards achieving the carbon neutrality goals that have been set for 2030 and 2050 (European commission, 2022). The inclusion of the accepted energy types in policies indicates how the supra-national and international institutions defined their legitimation avenues for the green transition through the specific types of energies needed for it (Sareen et al., 2020). The appearance of the bioenergies in the policies, especially biogas and biomass, are indicators of how the policies were centred around the availability of alternative sources of energy to the ones the EU was previously

internationally dependent on (European Commission, 2018a; European commission, 2022). As such, the bioenergies, such as biogas and biofuels, are considered a fundamental part of the legitimation process of the green transition through alternative energy sources (Gustafsson & Anderberg, 2021; Panoutsou et al., 2021). The inclusion of biogas and biofuels in the policies promoting the green transition also imply that they are part of the energy nexus and, therefore, the action-reaction nexus. This assumption, then, leads to the fact that both industry and society might have an impact, be it direct or indirect, in the legitimation of these sources of energy for the green transition's progress.

The industry, especially, being responsible for innovative responses to policy requests, has a major impact in the development of options for the implementation of biogas and biofuel technologies as part of the green transition (Panoutsou et al., 2021; Wolff et al., 2020). Examples of the legitimation of the green transition through bio-based energies at institutional and industry levels are found in some of the participants' responses:

> *"Well, the thing is that, currently, policy supports the bioenergy industry very much. So, in this sense, it is a beneficial to be working with companies in the area of bioenergy. For them, surely, all this policy helps them grow and find their way in the industry. And all these new materials, new technologies for bioenergy cannot be materialized or commercialized if there is no support. They need the support from the government and the policy and they actually needed it for a long time." (Participant 16)*

> *"The national projects that we had were specifically for certain industrial purposes and processes after this turning point in 2004. Even our national project started to shape around bio products, around bioenergy and biomaterials, circular economy." (Participant 17)*

As part of this section, the analysis of the quotes and the concepts discussed can be attributed to a reaction profile of each type of component or actor of the

action-reaction nexus in the green transition. Below, Table 4 tentatively summarises the participants' insights on the reactions of the energy nexus actors when faced with certain relevant concepts to the green transition. Table 1 includes the topics of legitimation and delegitimation in the green transition and how those are associated to several parts of the green transition's complex energy system. Given the institutional genealogy lens, it is expected to find that the obstacles to the green transition's momentum at the higher institutional level are associated to incumbent tactics of "lobbying and sovereign pressures". The reactions posed by incumbents are associated to the potential loss of profitable benefits due to a great change such as the one with the green transition (Firdaus & Mori, 2023), These incumbent reactions are natural, as was discussed, due to the change and economic impact. However, considering the greater number of reactions promoting the transition's momentum, it appears that, according to the Participants and at this level, policymakers' reactions are granting momentum to the green transition.

Table 4: Summary of the concepts, reaction triggers and reactions involved in the reaction profiles of the "High Institutional Reaction" section.

Concept for action-reaction	Reaction triggers	Regulator	Innovator	Integrator
Legitimation of green transition	Global policies and strategies	+	0	0
	Reaction speed and responsiveness	+	0	0
	Crisis response	+	0	0
	Alternative energies	+	+	0
Delegitimation	Lobbying and sovereign pressures	-	-	0

Explanatory note: The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect (0) or increase inertia (-).

6.1.2 National institutional reaction

The complex action-reaction system of the energy transition involves interactions between and reactions from policy, industry and society. Having focused on the supra-national institutional reactions, another level shows up:

national/governmental reaction. The actions of international strategies formed at the higher levels are not free of consequence and posterior adaptation to said strategies, a constant of the unavoidable impact of institutional genealogy. As Participant 1 said, regarding the reaction to energy security in current European policies:

> *"Government's gonna get more interventionist on certain fronts; more resource protected, more nationalist." (Participant 1)*

Alongside the institutional and policy mediums of reaction is governmental reaction, usually representative of a sovereign nation, that is also a part of the action-reaction nexus that surrounds the energy system in the green transition (Canal Vieira et al., 2022; Thompson et al., 2015). This governmental reaction is one that, according to Participant 1, is responsive to policymaking claims and documents that represent a shift towards the recognition of the need to ensure energy security at the supra-national and national levels (European commission, 2022).

The triggers affecting governmental reaction are based on the reactions that allow for a more legitimate energy market and policymaking ecosystem to occur, that is, the new energy market attempting to establish itself generates responses from the actors in the system. Those actors' responses and reaction are attempts at affecting the legitimation of the energy market and, consequently, the green transition (Bosman & Rotmans, 2016; Sareen et al., 2020). From an institutional genealogy perspective, the legitimation of the energy market is related to the triggers that cause a reaction, seeing as a member state's governmental reaction will only occur at the national level once the international strategies are laid out via policymaking (Canal Vieira et al., 2022; Schütte, 2017).

The reaction as changes to "personality", or governmental morals or strategies, mentioned by Participant 1 is an example of how one actor can have a systemic effect and alter the contexts of several types of actors that engage in society. A government that is interventionist differs from one that is less so, therefore, society and industry would react differently in the several possible scenarios,

which would also affect the strategy of their legitimation attempts (Hausknost et al., 2017b). The same goes for a nationalist government versus one that is more focused on their international impact, of which some examples were covered in the chronology chapter, where we saw how different governments had legitimized different types of energy under the same EU policies.

However, governmental reaction is limited by the enormity of the task that is to transition a whole energy economic system (Schütte, 2017). The complexity of governmental reaction is clear when it comes to the energetic transition, according to Participant 6:

> *"I have huge respect for the number of decisions and the number of or the magnitude of knowledge that they [politicians] need to be able to pull through and understand in order to make [energy] policy." (Participant 6)*

The complexity of the required knowledge is reflected in the amount of expert help (both in academic and governmental institutions) that is required to be able to react to the requests from the policy's urgent targets, as is remarked, firstly, by Participant 11 (governmental level) and, finally, by Participant 15 (supra-national institutional level):

> *"But the reason we have so many different experts working in these topics [energy] is so that we can have a little bit of more educated guesses than I think many others and also help it [European Commission] work with them [industry]." (Participant 11)*

> *"In the Fitfor55 package, there's a new reform on the sustainability criteria as they [criteria] were deemed insufficient, with more supporting scientific evidence, more pressure from citizens and media and NGOs and so they reinforced the criteria further in this proposal. (...) The Commission proposed more precise criteria." (Participant 15)*

The governmental response that shows the implicit systemic level of response is also identified by Participant 1 when they observe that:

> *"[regarding politicians' involvement] (…) industries create value out of the government relationships as well as make money." (Participant 1)*

This statement is one of the many indicators that the action-reaction nexus possesses several levels of interactions, where the Participant is remarking that the industry and the government interact in order to promote each other at different levels and that each benefit in more than one way from that interaction, thus mutually legitimizing each other's attempts at the transition (Thompson, 2018). It is a common tactic of lobbying where vouching for political interests is associated with economic benefit, and the green transition is no different in using this strategy to legitimate new energy sources (Loeffler et al., 2017; Thompson, 2018).

In fact, the green transition has already brought about new players and new lobbying powers, which is part of the system's reactivity and adaptability contributing to its legitimating powers as well (Sine & Lee, 2009; Thompson, 2018). The integration of lobbying is part of the process of any transition, as is observed by Participant 18:

> *"Big changes, small changes have to go through people, flesh and bones like you and me. Therefore, people with clear ideas and at the right place at the right time have to be there. So that governments can say what interests them and what doesn't. "Come, sit with us. Let's plan, let's strategize, let's lay it out formally with detailed planning and corresponding models." You have to be there. The talent that is there, with clear ideas, is the one that ends up driving public policies in the right direction. (...) In the end, the people, Gonçalo, are very important. Things don't fall from the sky, they come from people." (Participant 18)*

New players and lobbying powers emerging and interacting with governments are indicators of the attempts of the system to move towards a different system, and considering the policymaking push towards the legitimation of the new sustainable energy markets, then that move is towards a new energy system (Canal Vieira et al., 2022). Viewed from an institutional genealogy lens, the lobbying actors at the national level are a normal part of the transition's ecosystem, as it is an inherited strategy from the economic and institutional models that still operate today (Hausknost et al., 2017b; Köhler et al., 2019; Sareen et al., 2020). And the new players are active in ensuring their survivability in the new environment, as Participant 19 indicates:

> *"We try to participate on those forums where the actual calls are made so that our interests... I think it's kind of a lobbying, in the sense that we try to participate and affect the actual calls and have the things that we find important on those calls and then we apply for the funding." (Participant 19)*

Albeit the new players and lobbyists, the institutions promoting the transition are responsible for listening to all the stakeholders to ensure the requests from the policymaking side are acceptable for the industry and other players, as Participant 20 summarizes very clearly:

> *"First of all, the [policymaking institution] is always in discussions with stakeholders. All the stakeholders. Whether these are private or other institutions and then the member-states, of course. What I see is that, more and more, the oil and gas industry is embracing the new policies and then they try to adapt into this Fitfor55 legislative proposal requirements. So you see that the oil industries, they change from oil to energies to be versatile and, as I said, also embrace renewable energy technology. Of course, as I said, policy affects the business environment and the business tries to adapt into the new policies in order to have some progress made." (Participant 20)*

The governmental reactions to the several concepts analysed in this section are varied and involve the other actors in many ways.

Table 5 provides a tentative assessment of the Participants' perception of reaction and attempts to demonstrate how each actor reacts to it and how said reaction affects the green transition. Table 5 indicates that, according to the Participants, the only forces promoting inertia in the transition are coming from incumbent industries, who then provoke two divergent reactions: an increase in momentum for the transition from the policymakers and an increase in inertia from the industry. This can be explained by the fact that policymaking is focusing on innovation, for the green transition, while new industries feel limited in their ability to react due to the economic and lobbying strength of previous incumbent industries (Canal Vieira et al., 2022; Firdaus & Mori, 2023). The two conflicting forces of innovation policymaking and incumbent industries are slowly tugging at each other and making the transition pend in a stalemate that is slowly (slowly considering the whole history of the green transition but quickly if considering current responses) moving in favour of the green transition.

Table 5: Summary of the concepts, reaction triggers and reactions involved in the reaction profiles of the "National institutional reactions" section.

Concept for action-reaction	Reaction triggers	Regulator	Innovator	Integrator
Government	Interventionism	0	0	0
	Knowledge complexity for energy policy	+	+	+
	Industry-policy synergy	+	+	0
	Green energy lobbying	+	+	0
Energy market	Decentralization	0	+	+
	Security	+	0	0
	Incumbent industries	+	-	0

Explanatory note: The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect (0) or increase inertia (-).

6.1.3 Societal reaction

The remark by Participant 6 indicates how society, at the individual and industry level, reacts to policymaking and other strategies regarding the green transition, is synchronized with Participant 1's comment regarding governmental reaction:

> *"(…) energy market is becoming more decentralized and people are getting more off-grid because of cost." (Participant 6)*

The two observations are indicative of how there are several levels of interaction happening in the green transition and how each reacts in its own way, creating a complex network of reactivity (Canal Vieira et al., 2022; Köhler et al., 2019; Loeffler et al., 2017; Morgunova & Shaton, 2022). The remark by Participant 6 focuses on the societal response and how the citizens also have a role in legitimizing parts of the new energy nexus in the green transition (King & Soule, 2007). It is a statement that also vouches for a *de facto* change that happens as more strategies and policies come out and prepare the world for the transition.

Following the societal reactionary testament, Participant 6 exposes the context that causes such reaction, alongside the second comment by Participant 9, which focuses on the role of society in providing venues of change, and the third comment by Participant 20 observing how the public can influence the transition while being considered by the policies:

> *"We're actually seeing a lot of people moving into energy poverty. That is increasing motivation for us." (Participant 6)*

> *"The debate surrounding the energy transition has changed. It was altered the moment that civil society became a non-passive agent in the transition (e.g. Greta)." (Participant 9)*

> *"Another thing is what the president announced about the just transition fund, to be sure that the society is engaged and it is not left behind. They*

are measures in these policies that foresee the engagement of the society." (Participant 20)

The interjections by Participants 6, 9 and 20 state the importance and impact of societal actors: passive actors who suffer from the changes in the policy and economic landscape and, thus, spark activity to protect society; and active actors who are responsible for elevating the discussions towards the green transition from the bottom up, impacting industry and policymakers (King & Soule, 2007). The impact of the societal actors is noticeable, as is mentioned by Participants 10 and 20:

"Energy poverty was not discussed in media two years ago but now [2022] it is clearly associated to a social issue." (Participant 10)

“And [my hierarchical superior] mentions sustainability via social awareness and social engagement. There's a concept of the "prosumer". For example, using the energy, producing the energy, and putting it back into the energy system. That's an idea that was developed to involve the society into this transition.” (Participant 20)

As was just shown, one reaction leads to another reaction and the reaction profiles of the actors involved respond quite rapidly in order to adapt to the needs of each of the system’s components and to provide synergies that move the green transition forward. Considering the participants’ statements, the fact that the societal reaction has also caused the media to change its approach to the discourse regarding a specific energy social topic (i.e., energy poverty) ensures that there is legitimation both via the media but also via governmental knowledge of the issue, which increases the probability of a reaction (Brauers & Oei, 2020; Bressand & Ekins, 2021; King & Soule, 2007). Once again, the role of media and society on impacting and guiding the policymaking activity is discussed and presented as including these actors as part of the action-reaction nexus, further consolidating their power as legitimators of the green transition (Brauers & Oei, 2020).

Apart from media, the power of knowledge is also discussed and here we find academic institutions as a great part of the new energy system's legitimation (Bejinaru et al., 2018). The ability to create, propagate and legitimate new energy systems and sources comes, in part, from the work of the scientific community, which is part of the justification for the use of specific types of energy for the green transition (European Commission, 2019). However, the way in which governments react to the need for this justification is through the institutions responsible for producing knowledge and providing it to humans capable of using said knowledge to generate and legitimize change (Bejinaru et al., 2018). The societal reaction is, once again, brought into play here because, although governments are responsible for the guidelines that increase the technical expertise required for their implementation, it is the societal workforce that must be willing to invest in this knowledge to acquire it and use it (Bejinaru et al., 2018).

The knowledge produced by institutions is essential for the green transition. That is because, despite the clear impact means of communication have had in the green transition, it is fundamental to remind ourselves of the important role of the scientific community as fact-checkers. As Participant 19 mentions:

> *"The whole soul and core of our research organization is to provide science-based facts because the problem of today, like you know, it's these alternative facts and how everybody is an expert on social media."*
> *(Participant 19)*

The dangers of misinformation are also present in the green transition and the role of specialized and trustworthy experts is essential in this context, especially when considering the legitimation needs for this change. In the previous chapter, we analysed how integrators have an impact on governments and other policymaking and policy-implementing institutions. Greenwashing, fear mongering and lobbying tactics are usually part of the arsenal that some actors are willing to use in order to promote their agendas regarding new energy systems (Loeffler et al., 2017). As such, the role of actors who are involved in maintaining the information factual and ensure that society receives such

information in a way that is understandable is essential for policies and other strategic documents.

This chapter also analyses the role of integrators in guaranteeing that the information that feeds the transition is safe and scientifically accurate, considering that is one of the bases for the transition (European Commission, 2019, 2021). This is one of the ways in which the integrators reacted to the green transition – by accessing the proper channels of information that affect their target population, be it society or governments. As part of the strategies implemented by the integrators, reaching social media is essential because: *"You have to go where the people are, and that's social media."* (Participant 5). The integration of policies within society is important for the consumer and citizen to be able to understand how it is that they are to be affected by new strategies. As Participant 5 said:

> *"I think it would actually be fundamental to create a kind of profession that would be the translator of policies for people." (Participant 5)*

The ease for understanding policies via a sort of "translator" is already done at some institutional levels, however, it is still hard to grasp the full picture for the ones who are not involved in the policymaking process and are just a part of the implementation of policies, according to the Participants. This difficulty in grasping the totality of the policies is due to their innate complexity but also due to their vagueness, as Participant 3 mentioned:

> *"Policies to date haven't been concrete and easily understandable [for bio-based products]." (Participant 3)*

The justification for these issues to be present in policies is part of the compromises that need to be made in order for policies to come to life and to ensure they tackle the details and avoid loopholes, as was said by Participant 10:

> *"The language used [in policies] is a very specific topic because the language they [policymakers] use is trying to be less ambiguous. Firstly, because the policies must be made in a way that is not confusing for anyone. I know the*

language could be clearer and less complex, but all the chemistry formulas showing up in those gigantic word documents are also used to guarantee that there is no way to use and abuse [the language in policies]." (Participant 10)

The small ecosystem that is starting to form here is an example of how a system that has diversity inside of it can react to pressures being put into it, in this case: policies are hard to understand due to their innate, but warranted, complexity and vagueness, so a part of the system reacts by creating translators that help "digest" the policies, thus legitimizing the content of the policies at the societal level.

The societal level of reactions is indeed complex, as are the others. Considering that each participant is a human being in a society, it is unsurprising to find there was a lot of information coming from them in this section. Table 6 shows this and, as previously, an attempt to summarize the reactions affecting the green transition from each profile in certain contexts. From the analysis of this Table 6, it is possible to see that almost all societal reaction triggers have a perceived positive impact in the green transition's momentum via policymakers' reactions. This is related to the fact that policymakers are striving to ensure quality of life for society (European Commission, 2018a; European commission, 2022).

Table 6: Summary of the concepts, reaction triggers and reactions involved in the reaction profiles of the "Societal reactions" section.

Concept for action-reaction	Reaction triggers	Regulator	Innovator	Integrator
Energy market	Off-grid movement	0	0	+
	Energy poverty	+	+	-
	"Prosumer"	+	0	+
Social activism	Social representatives	+	+	+
	Media	+	0	+
Policy inclusion	Just Transition Fund	+	0	+
	Policy translation	+	+	+
Academic institutions	Knowledge capital	+	0	+
	Misinformation	0	0	+

Explanatory note: The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect (0) or increase inertia (-).

6.1.4 Industry's reaction

The experience and insight of the Participants demonstrates, repeatedly, how one reaction leads to another. The prior section provided insights into how the development of the public's understanding of certain energy transition concepts lead to changes in the industry and government (King & Soule, 2007). The connection between societal and governmental actors is echoed by other Participants mentioned before. This connection, where the two types of actors reacting to the same changes brought about by the green transition, becomes an established assumption, in the participants' experience, as part of the green transition. In a similar manner, the industry is highly affected by the other actors as well, and the "holy trinity" of institutional theory is maintained: industry, society and policymakers actively affecting each other and influencing each other's decision-making (Deephouse et al., 2016). The cue given by the last quote mentioned by Participant 10 includes the role of industry in the reactions found to be a paradigm in the green transition. The role of industry and innovators in the green transition is, then, undeniable (Morgunova & Shaton, 2022; Thompson et al., 2015).

The previous chapter explored the influence innovators and entrepreneurs have on the speed of the green transition, but they are also a part of the action-reaction nexus of the transition. The agency the industry possesses, albeit limited by some of the barriers identified through the institutional genealogy lens such as policy and sovereignty of the governmental agencies, is highly influential in the ability of policies to survive and thrive by establishing the policies' relevance (Köhler et al., 2019). One way in which industries react to news of emerging policymaking that affects them is by designing strategies which take into consideration the changes or challenges proposed. As pointed out by Participant 11:

> *"We are [a] very dynamic organization so we see what is, how the world is evolving, how are the needs and the interests are evolving and we kind of position ourselves accordingly." (Participant 11)*

The observation by Participant 11 is describing how the industry reacts and changes their profile based on the needs and interests of the market, especially during a period where a huge task such as the green transition is being achieved at an appropriate pace.

However the players in the industry describe their motivations, the way Participant 9 puts it sums the industry's reactiveness very well: *"We are innovators but we are moved by necessity." (Participant 9)*. Necessity, be it economic or societal, is a powerful force. The industry's reactiveness is often associated to what kinds of incentives exist for the innovators to make changes, often requiring new investments and new strategies, as is mentioned by Participant 9:

> *"...when speaking of implementation [alternative energies] there has to be something called the "market instruments". We pull on those market instruments to understand the existence of direct financing and incentives behind policies." (Participant 9)*

One of the major drivers for innovators to change and fight the inertia that the systems they had already implemented have is through economic incentives and policies that generate and guarantee economic sources of revenue (Morgunova & Shaton, 2022). This exemplifies the many faces of institutional genealogy within the green transition, because the fact that economic incentives are yet another factor related to a continuity of previous institutions and policymaking shows how the institutional past continues to drive and affect new transitions, even when they attempt to depart from previous systems (Firdaus & Mori, 2023; Köhler et al., 2019; Trippl et al., 2020).

Although the national institutional powers may struggle to legitimate the energy system's transition, the demands imposed on the industry to react to such changes are also immense and incur in heavy investment (Morgunova & Shaton, 2022; Pettus et al., 2018). Naturally, there is pushback from the incumbent industries which might require a lot of changes to their strategizing and loss of capital to make the proposed changes (Firdaus & Mori, 2023). Considering the industry's survival is based on the capital they generate and their ability to keep

a steady economic growth via established goals and strategies, abrupt changes to those can cause intense disruption (Firdaus & Mori, 2023). Consequently, the industry's statements are usually around financing and funding, as is mentioned by Participants 9, 14, 17 and 20, respectively:

"Policies are not enough. If we are trying to make a radical change in the market through policies, the funding needs to be there as well." (Participant 9)

"Since it's the businesses that are looking for the funding, we are the ones that have to adjust ourselves to the way we fit the calls." (Participant 14)

"The funding, of course, is not always enough. And this is not only for us, it's also for everybody." (Participant 17)

"And [policies] are implemented by the industries that want to make the investments. And yes, the industries comply with those [policies]. They tried complying with those and have delayed the investments and for that reason, because the policy changes and says all the time what the direction is in which these technologies will go, then the industries try to comply because the environment is not known, and it takes time for the investments to be made." (Participant 20)

Since the impact of funding and financing the industry for the green transition is such a relevant force, it is also considered to be one of the legitimating pushes for the implementation of new energy mixes (European commission, 2022; Mathiesen et al., 2022). Some of the criticism to the funding provided to the context of bioenergy innovation is apparent in the requests for early-stage technologies, which innovators and industry players suggested needed more support, even through failure. Some examples include:

"If we're confident that what they're [policymakers] saying now, they'll still be saying in five years and 10 years and 15 years, at least for someone who

starts up at this time, then it would be good but policies tend to be very sort of, they can change at the whim based on the latest trend or the latest objection, or hysteria in some cases. And that's the concern that these things [funding] can be taken away as easily as they are brought in." (Participant 3)

"At this moment we are proofing our prototype and most EU funding is for the development of technology, so since we are arriving at a pre-commercial product, from here on out, it becomes more complicated [to get funding]." (Participant 14)

One controversial side of the economic support that innovators require is represented by a statement made by Participant 10:

"It's hard providing financial support that is correct for the climate issues because it would have to be one that would make people not buy more things... We're always providing a new purchasing trend and people want the option that is environmentally friendly but not lose any qol [quality of life]." (Participant 10)

Industry is shown to have a lot of dependency on policies and the economic drivers in the green transition. From an institutional genealogy point of view, this is to be expected, as the transitions to new systems accommodate for so much change that the means through which the transition is legitimated changing as well could prove to be overbearing and overwhelming for the systems.

As was mentioned previously in this chapter and prior chapters, the relationship between industry and policy is very close, which is also seen in the table below (Table 7). The representation of the industry's concepts is based on the participants' interventions, and it is possible to understand that the previous statement of the industry's heavy dependence on policy and funding is apparent. The impact of the green transition on the industry's reaction to it is also shown.

Table 7: Summary of the concepts, reaction triggers and reactions involved in the reaction profiles of the "Industry's reactions" section.

Concept for action-reaction	Reaction triggers	Regulator	Innovator	Integrator
Policy-induced motivation	Policy emergence	+	+	0
	Policy-driven strategies	0	+	0
	Financial incentives	0	+	0
Transition-induced motivation	Necessity	0	+	0
	Transition demands	+	-	0
Quality of life		-	+	+

Explanatory note: The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect (0) or increase inertia (-).

6.2 All systems: Go!

As this chapter has established so far, several actors have impacts and reactions regarding the policymaking surrounding the green transition and all the changes that the transition has established via policies, strategies and other means (European commission, 2022). A connection between industry, governmental and societal responses to changes in policy can be found in Participant 10's input:

> *"People understanding the concept of circularity makes businesspeople or government officials more prone to talking about it at meetings in their own work environments, and it's when they do talk about these topics that they're not considered weird or unusual." (Participant 10)*

The interconnectedness of the previously mentioned "holy trinity" is on display in this statement, especially how each individual part ends up legitimating the other(s) in the context of the green transition. The connection between all these actors is one that is also well established in the mindsets of the actors themselves, who each take the others into consideration when making new decisions, as we have seen exemplified in this chapter with industry and innovation reacting to policy, policy reacting to social engagement, etc. Given the context of this chapter, the following table (Table 8) represents the interactions aggregated from all the actors analysed in prior sections and how they showcase the reaction of each of the identified components of the system.

Table 8: Summary of the concepts, reaction triggers and reactions involved in the reaction profiles of the identified sections on the first row.

Section	Concept for action-reaction	Reaction triggers	Regulator	Innovator	Integrator
High institutional reaction (Regulator)	Legitimation of green transition	Global policies and strategies	+	0	0
		Reaction speed and responsiveness	+	0	0
		Crisis response	+	0	0
		Alternative energies	+	+	0
	Delegitimation	Lobbying and sovereign pressures	-	-	0
National institutional reaction (Regulator)	Government	Interventionism	0	0	0
		Knowledge complexity for energy policy	+	+	+
		Industry-policy synergy	+	+	0
		Green energy lobbying	+	+	0
	Energy market	Decentralization	0	+	+
		Security	+	0	0
		Incumbent industries	+	-	0
Integrators' reaction	Energy market	Off-grid movement	0	0	+
		Energy poverty	+	+	-
		"Prosumer"	+	0	+
	Social activism	Social representatives	+	+	+
		Media	+	0	+

	Policy inclusion	Just Transition Fund	+	0	+
		Policy translation	+	+	+
	Academic institutions	Knowledge capital	+	0	+
		Misinformation	0	0	+
Innovators' reaction	Policy-induced motivation	Policy emergence	+	+	0
		Policy-driven strategies	0	+	0
		Financial incentives	0	+	0
	Transition-induced motivation	Necessity	0	+	0
		Transition demands	+	-	0
	Quality of life		-	+	+

Explanatory note: The actors can have reactions to the concepts that give the green transition momentum (+), have a neutral effect (0) or increase inertia (-).

Participant 18 made the following observation:

> *"The economy, since the industrial revolution, has been built around the fossil fuel energy system of carbon, petrol and gas since 250 years ago. So, to transform this system in 30 years, 25, 30, 35 years, is a true energy revolution with huge implications of the social, technological, entrepreneurial, amongst other things, type." (Participant 18)*

The reality of the complexity of the transition, at the systemic levels of impact, is clear in this statement, which mentions all the innards of the energy system that are affected by policies such as the European Green Deal or the REPowerEU (Aguilar & Patermann, 2020; European Commission, 2018a). As such, the components inside the system, i.e., the actors and energy sources, are legitimating the system (energy system) which, in turn, is targeting the legitimation of yet another higher system (green transition).

In the case of this research, the insights gathered lead us to believe the industry, society and supra-national and national institutions are all legitimating a new energy system (via different types of energy resources) in order for the

green transition to occur (Hausknost et al., 2017b). The contribution that each component provides the system with can be a debatable topic, but some opinions, like that of Participant 19, are already established:

> *"We have the technology, but we don't have the political will. If we should change the system, we would do this kind of systemic level changes."*
>
> *(Participant 19)*

Participant 19 states that the new energy system already has the innovation that the industry provides, but that it is limited by the regulatory powers associated with politicians. As explored in this chapter, the whole system responds to the components themselves, such as innovation, industry and political will, which, in turn, are also affected by social and scientific communities. The statement that the changes have to be systemic is an indicator of the fact that the components of the systems themselves changing or adapting isn't enough because the connection amongst the systems that are part of the green transition also need to adapt and change with each other in order to achieve new forms of more appropriate systems (Hanewinkel et al., 2017; Hausknost, 2020).

The green transition holds within it more than just the transition to a new energy system, as the amount of goals within it are not just regarding new and sustainable energy resources (European Commission, 2018a; European commission, 2022). Hence, it is here that we are able to see how this new energy system is but a part of a larger system and how it is legitimating this even larger system (Hausknost et al., 2017b). From an institutional genealogy perspective, the legitimation of the energy system being a way to legitimate a larger system is sensible. Institutions and policies can work incrementally, and often opt to, in order to build upon what was already there (David, 1994). This is the case with the green transition, where the energy system is changing, but a lot of the means to legitimate the change are like the previous incumbent system. As mentioned earlier in this chapter, the incumbent systems need to be assured of their ability to transition, and providing them with familiarity in the terms of the transition is one way to help guide their reactions (Morgunova & Shaton, 2022).

Throughout this chapter, it is tentatively established that the new energy system is legitimized by actors and by the energy mix, therefore, the final form of the actors and energy mix combined legitimize the new energy system which, as a whole, is part of the legitimation of the green transition. The green transition, however, is not legitimized by just this new energy system, rather, it relies on the combined efforts of other systems in order to be legitimized and come to be (European Commission, 2019; Hausknost et al., 2017b).

6.2.1 Systems react

The current energy system, alongside all the other systems that it entails, forms a well-structured and well-known ecosystem (European Commission, 2018a; Sareen et al., 2020). This ecosystem was in "dynamic equilibrium" up until the will to change towards a new energy mix became expressed at the global level via legally binding policies and targets, such as the European Green Deal (European Commission, 2019). This meant there were, now, new forces acting on the previously relatively stable ecosystem (Genus & Iskandarova, 2020; Köhler et al., 2019). The impact of these new forces provides the system with several options: adapt and return; adapt and substitute; or adapt and collapse. The common denominator of the adaptation is part of the system's natural response, as dynamic systems will naturally try to adapt to new conditions before giving up their previous unsustainable equilibrium (which are so only because of new conditions). Therefore, systems take the first step by attempting to adapt to the new conditions. The potential outcomes of these attempts are what vary:

1. When a system manages to "return", this means that it manages to incorporate the new variables into the old equilibrium dynamics that characterized it, thus "returning" to its original equilibrium where the system had space to incorporate new forces without falling so far out of equilibrium that it could not "return".

2. A system that processes new variables by "substitution" is one that finds a new equilibrium that it did not have the potential to have before, where this new equilibrium is provided by the conditions that the new variables produced. These systems "substitute" their previous equilibrium into a new equilibrium dynamic where they abandon certain previous conditions from the old equilibrium and, in that vacant space, insert the new variables.

3. Finally, systems that "collapse" are ones where the energy cost for the transition from one equilibrium state to another was too much for the system

to maintain itself. This might happen when the new variables appear very suddenly or require efforts from the system that the system is not able to provide. In such cases, the systems fail to provide a new equilibrium and the entirety of the system "collapses". When a system "collapses", the elements that compose it might "collapse" along with it, while some elements might find an opportunity to "substitute" and be absorbed by a new system or force themselves onto it for survival. Participant 8 has an interesting take on this, especially when talking about traditional powers and their impact on the climate crisis agenda:

"Maybe the business sector has to die, given the way it's been behaving, in order for it to become a positive [sector], a sector that is really at the service of species and the planet." (Participant 8)

The statement that one incumbent system or practice needs to "collapse" in order for a new one to replace it isn't unheard of (Canal Vieira et al., 2022). However, it is not through "collapsing" that this transition is being made, considering the impact of uprooting such an established ecosystem could prove fatal to the whole (European commission, 2022; Morgunova & Shaton, 2022).

Policy has defined that the transition must happen with overall fairness, which is a statement that protects the incumbent systems, amongst others, from changes so great the systems could collapse (Mathiesen et al., 2022). Therefore, the transition opted for an approach that, albeit being legally binding, gave the incumbent systems enough time and manoeuvrability to "substitute" the original systems they were attached to with new systems that favoured the objectives of a circular and sustainable economy (Firdaus & Mori, 2023). This is echoed throughout this chapter in the ways most actors have legitimated the transition, where no action is too radical or too extreme, but where most reactions are perceived as contributors to its momentum.

6.3 Conclusion

The holistic approach to the systemic changes required for the green transition reveal the complexity of the change and how many levels are affected by it (Andersen et al., 2023; European Commission, 2019; Hausknost et al., 2017b). Several actors and the systems they belong to are analysed in this chapter via

the participants' insights. The identified reactions reveal the triggers that cause a reaction and how that reaction affects the green transition. The resulting tables ensure a global view of the most important concepts mentioned by participants regarding the way they have identified reactions from systems involved in the transition.

As Fig. 2 illustrates, the concepts within the proposed energy reaction system, i.e. reaction triggers, are part of what turns legitimation agents into reaction agents, as the reaction triggers make actors react. Legitimation agents can all turn into reaction agents, but only given the appropriate reaction triggers. As the previous tables show, the concepts in which all actors react are related to the conditionally identified overarching concepts of "Government", "Energy market", "Social activism" and "Policy inclusion", and the corresponding reaction triggers. The suggestion that this analysis provides is that the reactive forces that legitimate the green transition are found within these concepts. This means that a part of the legitimation process is related to the actions that the reaction triggers initiate and about the kinds of effects those actions have on the legitimation of the systems they are included in.

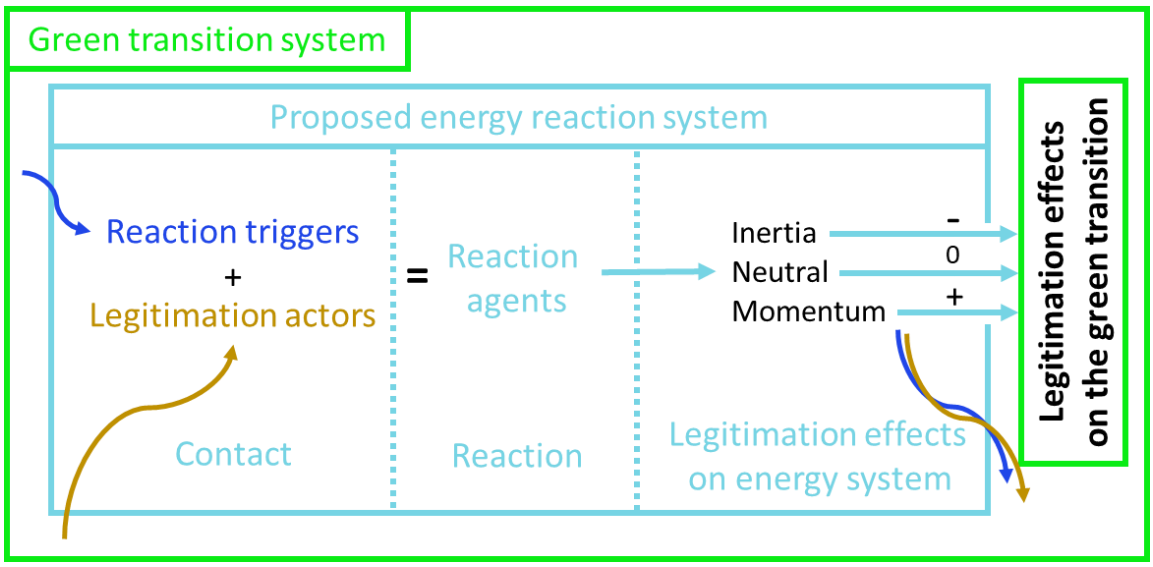

Figure 2: Representation of the systems proposed by this research and the common reaction triggers.

For each actor type, specific concepts have greater impact. For policymakers, the analysis appears to indicate that this type of actors is mostly involved in most reaction triggers to all concepts. According to this research, the reaction

triggers where policymakers potentially hold all the legitimation ability are within: “Global policies and strategies”; “Reaction speed and responsiveness”; “Crisis response”; and “Security”. Policymakers, then, will be the ones to react when these concepts emerge or become part of the system. Society reacts often when the policymaker profile does and, when it does not, it could be related to the fact that the spheres of influence are too high for its reach, such as with “Global policies and strategies” and “Green energy lobbying”. However, the reaction triggers “Off-grid movement” and “Misinformation” appear to have convinced some participants that society is, perhaps, the only one reacting to them.

Unlike the policymaker and society profiles, innovators do not interact as much where the other two do. This is potentially indicative of a more passive role of the industry in the eyes of the participants. Considering that industry, especially when emerging, usually has few resources, it’s sensible to accept that it would be more selective regarding its involvement, for otherwise it could risk losing an effective management of its operations. Despite this apparent passive role, innovators react to “Policy-driven strategies”, “Financial incentives”, and “Necessity”. What this could potentially mean is that innovators react out of pure necessity, where policies force a reaction due to their legal nature and their ability to establish markets, and the continuous search for resources forces them to react to financial incentives.

Chapter 7: Discussion & Conclusion

7.1 Introduction

This thesis analysed and discusses the legitimation efforts by policymakers, industry, and advocates towards the implementation of the new energy mixes in the context of the green transition. Legitimation is a concept that can have many facets (Deephouse et al., 2016; Zalta, 1995); in this thesis, it represents efforts towards the implementation of certain new energy mixes based on the international goals set out for the green transition (European Commission, 2019; European commission, 2022). To determine the different types of legitimation and the factors influencing it, the concepts of time and reaction were identified as important variables through interviewing different respondent profiles in the EU context of the transition. The profiles were defined by the concepts drawn from the literature including regulation (Avelino et al., 2016; Imbert et al., 2017b; Sareen et al., 2020), financing (Canal Vieira et al., 2022; European Commission, 2018a; Iskandarova et al., 2021) and societal adaptation (Corradini, 2019; Rodríguez-Pose & Bartalucci, 2023; Rohe, 2020; Trippl et al., 2020). Profiles were thus characterised as Regulator, Innovator and Integrator, respectively. Considering the inputs of the actions of each of these profiles, this thesis focused on incorporating them all into a framework that provides analytic power towards decision-making for the green transition's legitimation.

An institutional genealogy perspective was used as the main conceptual lens for the research due to its ability to provide insights into the development of legitimation powers over time and the inherited institutional landscape that underpins policy development which is key in itself to understanding the green transition's slow progress (Firdaus & Mori, 2023; González-Santos, 2020; Morgunova & Shaton, 2022; Phillips, 2002; Pike et al., 2015). It was established through analysis of the primary data that the energy sector has a necessity for diversity within it for the legitimation of the green transition, which led to the focus on understanding why the timing of the green transition is as is currently, and who were the actors whose reactions were having effects on its legitimation (Andersen & Geels, 2023; Firdaus & Mori, 2023; Köhler et al., 2019; Sareen et al., 2020).

This research, therefore, connected the two concepts of time and reaction and explored how each affects legitimation, and through which actors along with the triggers that caused actors to react. It also, however, explores how the multi-system aspect of the legitimation of the green transition is made of factors such as these two (Andersen & Geels, 2023; Karni et al., 1992; Köhler et al., 2019; Wang et al., 2022). Thus, the impact they have on the legitimation of the green transition can be analysed and provide an understanding as to whether:

1. They have been able to combine their effects in the legitimation processes;
2. They are able to have an effect on their own and, therefore, have isolated niches of effects on legitimation that are not multi-systemic;
3. Their combined effects have conflicting, neutral or synergistic properties.

In order to position the research, a mapping of the major policies that affected the types of energies being used by the global and international leaders was presented (Sareen et al., 2020). This chronological representation of the most important and impactful policies, alongside a historical case analysis of several types of energies, provided the base for the answer to the initial research question of the strategies used to legitimize the energy sector but, mostly, to the second one regarding the policymaking impact on this sector.

This historical chapter captures the policymaking attempts at an energy transition through the number of policies and their in-depth replies to the scientific community's urgency requests. The histories and analyses of certain countries and their struggles with different types of energies were used to contextualize the issues and benefits that those types of energies were prone to and how those experiences are teaching grounds for the newer attempts (Imbert et al., 2017b; Sareen et al., 2020). The impact that policymakers, innovators, and societal actors have on these policies and their implementation are discussed here, as well as which factors cause these actors to react and impact the legitimation of the green transition.

Finally, using the results of the interviews made with the three types of profiles that are the most influential in the legitimation of the green transition, two principal findings were established: the study of time and the study of reaction.

The importance of time and reaction was uncovered through analysis of the participants' responses, which led the research towards the exploration of said concepts. The data chapters were used as part of the answers for all the research questions, as they provided insights into the actors and the ways in which they affected the legitimation of the energy sector but also how those effects were revealing of the international strategies put forward by the responsible institutions.

7.2 Key Findings

This thesis' focus is on answering the following research questions:

- *What are the strategies used for the legitimation of the energy sector?*

- *In what way, if any, do policymakers and other relevant profiles help legitimize the energy sector?*

- *How has society adapted to the new energy sector?*

To answer these questions, the research herein focused on analysing how the legitimation of the green transition and, within it, of how the several types of energies used for the new energy mix have been affected by several factors, such as policies, policymakers, institutions, businesses, innovation, entrepreneurs, social activists, and social organizations, in the context of the European Union (EU). This thesis focused on building on previous literature that explored the roles of policymaking, financing and social intervention on the green transition efforts (Avelino et al., 2016; Bolton & Hannon, 2016; Garud et al., 2011; Imbert et al., 2017b; Li et al., 2017; Rodríguez-Pose & Bartalucci, 2023; Schütte, 2017; Trippl et al., 2020; Yamahaki & Marchewitz, 2023). As the concept of time is a very large and abstract one, the effort to define it and use the literature and research data as a way to guide its understanding regarding its use in the legitimation of the transition was undertaken, following in the footsteps of established authors Bucheli et al., 2013; Di Maria et al., 2017; Hoppmann & Vermeer, 2020; Iskandarova et al., 2021; Lippmann et al., 2015; Lockwood et al., 2017; Mcmullen & Dimov, 2013; Thelen, 2000; Wadhwani et al., 2020. Regarding its legitimation efforts, time can take on the names of "urgency", "acceleration", "speed", which this thesis defined as "momentum", considering the goal of "rapid implementation". However, time in legitimation can also have an "inertia" effect, with concepts associated to it being "lag" or "delay".

As such, this research goes beyond the current literature on understanding the impact actor profiles and their reactions have on the legitimation of the green transition by identifying the triggers that cause them to react, and associating

their reactions to effects on legitimation through time concepts such as “momentum” and “inertia”. The full realization of this thesis comes to fruition when the concepts of time and reaction are taken into consideration in tandem with strategies for legitimation and with the effects of the three profiles in the green transition. With the contextualization of the bioeconomy and, within it, the energy sector’s impact in achieving a fully functioning bioeconomy through the green transition, the path was set towards understanding the legitimation’s pushes and pulls.

The main contribution of this thesis is that of the impact of time on the legitimation of the energy sector associated to the reaction profile of the same actors which enforce time as a legitimation force and realize the potential of the powers behind the speed of the transition (revealed through an institutional genealogical lens). Reactions that trigger a more effective transition would have to be associated to the specific time elements that have legitimation effects on the green transition for its most effective and efficient effects on legitimation to occur. Those effects on legitimation can be considered as the effects on the time it’s taken to implement the green transition (i.e., its speed - (Andersen & Geels, 2023; Köhler et al., 2019)). Hence, considering how time is established in this thesis as a condition and a factor in the green transition, a strategy on how to use a blend of concepts of time and the most important reaction triggers that best fit with the use of time towards the legitimation of the green transition, is one of the principal contributions the work herein outlines.

Research Question 1: What are the strategies used for the legitimation of the energy sector?

The strategies identified by this thesis are conceptualised as involving the use of time and reaction. The concept of actors (ones with potential legitimation power) having an associated reaction to certain triggers, and the reactions that connect with the ways in which time is used as a legitimation tool for the green transition, is how it forms a network of reactions that potentially affect the legitimation of the green transition. Identifying the matrix of reactions connected to their effect on time towards the legitimation of the green transition creates a tentative framework that indicates a potential route for a

more efficient and effective establishment of the legitimation routes for the green transition. The effect on the legitimation of the green transition, if measured by its speed of implementation, can, thus, be attributed to a certain set of factors, such as those of time and reaction. The factors identified by this thesis are then enacted by the actors involved in the several sources of legitimation associated to the green transition: policies and other regulatory documents (European Commission, 2019; Geels et al., 2017; Imbert et al., 2017b; Pelkmans & Renda, 2014); financing and funding sources towards the promotion of innovation (Bolton & Hannon, 2016; Iskandarova et al., 2021); social implementation and interpretation of the green transition strategies established by other institutions and actors (Andersen & Geels, 2023).

As such, the findings indicate that a strategy to more efficiently legitimate and implement the green transition can be designed from the synergetic conjunction of:

1. The identification and implementation of the reaction triggers which cause a reaction from the largest potential legitimator representatives in the green transition;
2. The application of time concepts used as legitimation tools by the primary data profiles.

In that sense, an example of an overall strategy effort resulting from this thesis' findings would be: if reaction trigger A causes representatives A, B and C to react in a way that affects the legitimation of the energy sector (through the mechanism exposed in Fig. 3), then adding a time element that is associated to altering the speed of the green transition creates a higher chance of causing legitimation effects on the green transition. An illustrative example of this would come from several excerpts from the data, which corroborate each step found in this framework:

- Older institutions converting or evolving into new institutions: Participant 9 had a particularly good insight when asked about how past incumbents had affected their workflow and decision-making, stating that "*It's a generational war*" (Participant 9). To showcase the progeny of older institutions through evolution, Participant 11 said "*[Institution] was founded by a European organization and the idea was that the UK would*

create these knowledge innovation communities in different areas and fund [them] for some time as they [are] supposed to be self-sustainable in the future.” The transformation of a European organization into an institution is an evolutionary process that is responding to new needs, similarly to how it was presented in Fig. 1.

- Legitimation actors are within institutions: As was said by Participant 18: “(…) *they [incumbent institutions] do not have a position of denial regarding the climate change, they are not that [uninformed]. (...) What they are defending is a delaying strategy regarding the energy transition measure through the enormous power they hold over the media.”*, showing that any type of legitimation actor can be found within institutions, even delegitimation ones (in relation to the green transition’s context, considering the ones mentioned in this quote are, in fact, legitimating another type of energy sector). Another statement mentioned earlier in this thesis by Participant 6 is regarding “(…) the magnitude of knowledge that they *[politicians]* need to be able to pull through and understand in order to make policy", connecting the arguments in this thesis for the importance of policy for legitimating the green transition and its energy sector alongside the politicians, usually associated to governmental institutions, being the legitimation actors through policy creation.

- Reaction triggers allow potential legitimation actors the opportunity to react, becoming Reacting agents: In this excerpt from the data, Participant 3 shows us how reaction triggers can cause regulators to react by creating or changing policies, as “*policies tend to be very sort of, they can change at the whim based on the latest trend or the latest objection - or hysteria in some cases.*” (Participant 3), thus leading innovators to have to react as well by looking for funding, as *“(…) that's the concern, that these things [funding] can be taken away as easily as they are brought in. And, for a business, you have to have [funding]”* (Participant 3). Another type of reaction by the innovator profile is seen in Participant 6’s mention of *“(…) a lot of people moving into energy poverty. (...) ...that is an increasing motivation (...) for us*” (Participant 6), showing

the type of reaction trigger that can occur and cause a reaction. Participant 9 came up with a straightforward way of representing the reaction triggers that move innovators, saying that "We are innovators, but we are moved by necessity" (Participant 9).

- Reactions from Reacting agents cause legitimation effects on the energy sector: Participant 7 stated that one of the main causes of legitimation are the innovators through his remark that "*The transition was born from the connection between industry and academic research*" (Participant 7). And the innovators didn't just come up with the transition, it was a response not only to scientific experts' concerns but to regulators as well. Participant 9 provides insight into how the regulators, innovators and integrators are all a part of the big legitimation action happening towards the green transition, by stating that "*Everyone must be in on it. (…) that's why things work, because there is an urgency from society for things to work*" (Participant 9).

- Legitimation effects on the energy sector affect the legitimation of the green transition: When Participant 1 from the energy sector was asked "*Did the European Green Deal have any kind of effect on your business?*", they answered "*That's [European Green Deal] the EU policy they most discussed at my organization.*", showing that the EGD was legitimated by an energy sector innovator as it became the basis of discussions for the business' strategizing.

Taken together, these create the framework, which is a result of the collected data and its analysis. Thus, Figure 3 visually represents the dynamic interplay between reaction triggers, reacting agents, and legitimation effects in the context of the energy sector and green transition. The figure maps out how specific reaction triggers activate different agents—such as policymakers, innovators, and regulators—who then respond in ways that influence the legitimation of the energy sector and, through it, the green transition.

As such, it is possible to say that this research contributes to the requests from legitimation literature (Andersen & Geels, 2023; Bitektine & Haack, 2013) not

only by providing macro-level insights into the legitimation of the green transition via the uncovering of factors that affect its speed and potential for implementation; but also by including the effects that macro-levels have on micro-level actors and how the actors' reactions to those affect the macro-level outcomes (i.e., legitimation of the green transition (macro) via energy mixes (micro)). To answer the question of the types of strategies that are used for legitimation and better understand the framework proposed, the factors this research focused on are explored in greater detail, along with their associations to each other and the relevant actors.

One factor is, as mentioned before, "time", but as an umbrella term. This has been identified by several scholars as having an impact on legitimation efforts (Bucheli et al., 2013; McMullen & Dimov, 2013; Wadhwani et al., 2020; Wood et al., 2021). This research explains that if the concept is an umbrella term and can be defined by terms such as "lag", "urgency", "efficiency", "inertia" or as an expression of transactional or economic power (Lippmann et al., 2015), then those "time" concepts can have more widespread impacts in legitimation than previously thought when considered as a holistic concept rather than as individual ones (such as Sareen's description of the evolution of the "sustainability" concept). The terms used for "time" in this research were based initially on the literature (Lippmann et al., 2015), then further developed from the data analysis of interviewed primary data profiles. As such, the concepts are highly related to the contextual topics of the research: legitimation and energy. The literature usually assumes the word "acceleration" or "urgency" of the energy transition when referring to the process of legitimizing the green transition in a speedy fashion (Andersen & Geels, 2023; Rodríguez-Pose & Bartalucci, 2023; Skjølsvold & Coenen, 2021). However, what this research shows is that whilst there are elements of immediacy at play, the transition is beset by slowness in various different ways underlining that legitimation is not a quick process and in fact is subject to a bumpy road with multiple roadblocks en route.

These two concepts are also reflected in the regulatory documents and the language used (European Commission, 2018; European Commission, 2022; Sareen, 2020). As concepts, they are rather vague and, to fully grasp their

effects, effort is required to understand the parts that cause said acceleration or urgency and what other concepts can fit, implicitly, under their lexicon. Acceleration is, of course, associated with time (as is urgency), with these concepts pertaining to something that is to be achieved in a shorter amount of time than the current one (Lippmann et al., 2015). As such, this research attempted to do just that in combining the effects of concepts that are highly relatable to time and that, through the interviewing process, were often used instead of "time" by the experts. As such, it is apposite to combine into one umbrella term what the experts themselves already use interchangeably.

This research provides insights into strategies to legitimize the energy mixes for the green transition and how they are influenced by, and based on, time-related terms that can, potentially, explain the speeds at which the transition has been occurring. The importance of discriminating the concepts that fit under the umbrella term of "time" is mostly associated to the fact that the concepts were identified as having an impact on legitimation but rarely being brought together in a contextual analysis effort (Bucheli et al., 2013; Lockwood et al., 2017). As part of the definitions of time, the literature usually engages in the analysis of institutions and other associated concepts as part of historical analyses (Énergies, 2016; Lockwood et al., 2017; Wadhwani et al., 2020). The literature also focuses on other types of impact in the quickness of the transition, focusing on the effects of particular actors in speeding it, rather than focusing on multiple actors or on the multiple forms of time that influence the legitimation outcome (Andersen & Geels, 2023; Lockwood et al., 2017).

The value of historical analyses is important for the development of the state of the art and to provide this field with an overview of the effects of time in institutions and other associated concepts. However, although the importance of historical analyses provides relevance and promotes the insights necessary for institutional theory research, there is a lack of certain topics to be involved, simultaneously, in those research attempts, such as "institutional evolution" or "reproduction" or "conversion" or "temporal consensus", as well as a more integral view of the contribution of exogenous factors and actors (Andersen & Geels, 2023; Lippmann et al., 2015; Lockwood et al., 2017; Thelen, 2000). In a context of such high complexity as that of the green transition (Andersen et al.,

2023), bringing together institutional evolution and institutional conversion (Thelen, 2000) with the concepts of time that the interviewed experts consider affect it, alongside the impact of actors and the reaction triggers that cause the actors to appear, provides a holistic view of the legitimation of the green transition.

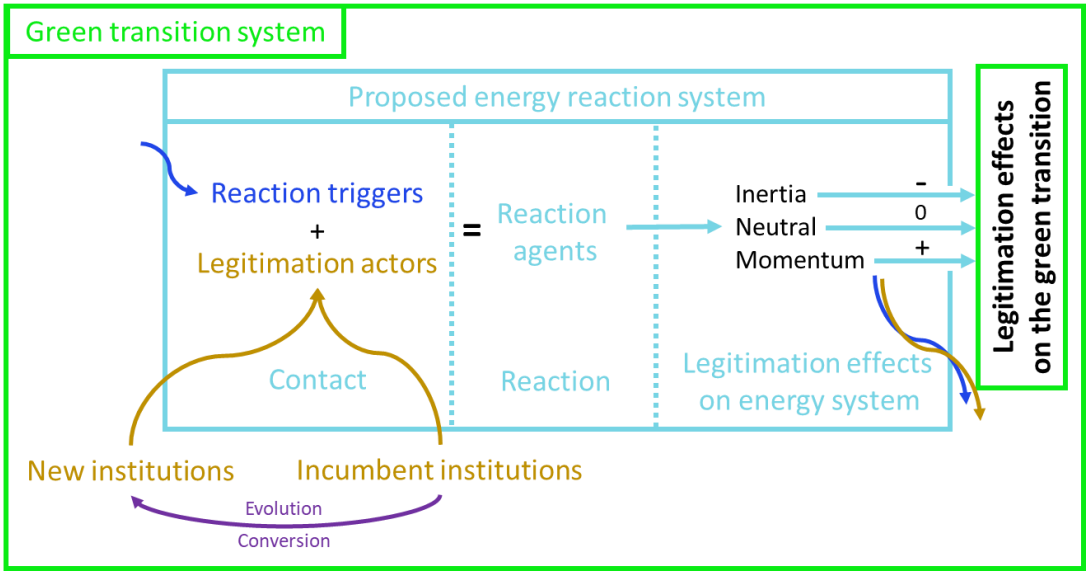

Figure 3: The complex nexus of legitimating the green transition with the important actors and institutions involved.

Policies are one of the strategies used for legitimation, and are heavily influenced by time and, from an institutional genealogy point of view, by the weaponization of time (Andersen & Geels, 2023; Lippmann et al., 2015; Lockwood et al., 2017; Morgunova & Shaton, 2022). Since time can be comprised of so many constituent parts and interpretations, the interviews were poised as the boundary setters for what terms and what sort of influence they could be perceived to have in the legitimation efforts for the energy mixes under the guise of "time". Participants mentioned many concepts and issues that related directly to time which were singled out as such through an institutional genealogical lens. Through this lens, time was seen both as a weapon used for delegitimation and a blessing used for legitimation. Delegitimation (also an umbrella term for "veto", "inertia", "vested interests" or avoiding "temporal consensus") can be targeted or a part of the previously built systems (Lockwood et al., 2017). This means delegitimation can be techniques using time as a weapon but also a natural part of the systems in which legitimation is found,

such as the green transition and the energy sector (Canal Vieira et al., 2022; Suddaby et al., 2017). The delegitimation techniques this research found in interviews and literature were associated to:

- maintaining fossil fuel market control (Morgunova & Shaton, 2022);
- keeping a profit with a high-carbon intensive business (Di Maria et al., 2017);
- lobbying against non-carbon-based energy;
- promoting business techniques such as “greenwashing”;
- delaying policy action (Köhler et al., 2019; Sareen, 2020);
- disconnecting policy from innovation;
- reducing efficiency in decision-making (Sareen, 2020);
- invalidating and ignoring scientific warnings for urgency (Köhler et al., 2019);
- targeting start-up and innovation survival rates;
- bureaucratic burden impact on SME survivability (Firdaus & Mori, 2023);
- coexistence of *“kairos”* and *“chronos”* (Garud et al., 2011).

The complexity about multi-factorial and -level systems is replicated at the scale of the analysis of each factor (Wang et al., 2022). Time is, on its own, a multi-factorial concept, as was shown here, and it gains even deeper levels of complexity when it is associated to the various actors that might enforce it (Lippmann et al., 2015). Policymaking is done by humans, which are bound by time constraints, even with the aid of technology (Iskandarova et al., 2021). Institutions, organizations, businesses, and academies are all composed of humans, therefore, the factor of time is present in their endeavours and there is no escaping it (Köhler et al., 2019; Lippmann et al., 2015). Some institutions are able to transcend what humans have not yet been able to (e.g.: the global level attaining a sort of immortality via its multi-generational existence) through institution “evolution” and “reproduction”, though this is debatable as the concept of generational units is present in the literature indicating some human

ability to maintain ideas and movements alive via generational transfer (Lippmann & Aldrich, 2015).

Though the impact of time is obvious in policymaking, and policymaking is essential for the new energy sector, the connection between the two is also made via the actors that are impacted by the reaction triggers and the delegitimation techniques explored earlier. As such, the exploration of the actors themselves is essential in order to connect the concepts with the actionable strategies.

Research Question 2: In what way, if any, do policymakers and other relevant profiles help legitimize the energy sector?

The historical overview of the documents leading up to the current policies on the green transition provided us with a perspective on how the global and international long-term strategies for the energy sector, alongside its many impacts in society, have been shaped. The importance of exposing these documents and their effects, even if the effects were not deeply explored, is due to the importance of regulation in the energy sector and, especially, in its legitimation and that of the green transition (Énergies, 2016). Exposing all the attempts, throughout the years, to implement a global and international strategy for a new energy sector is highly important when considering the fact that only now, decades after initial attempts, are there actual energy paradigm changes happening (European commission, 2022; Mathiesen et al., 2022). The historical importance of the regulations exposes, through the institutional genealogical lens, the factors that contributed to the delays in the current energy paradigm shifts and helps to identify patterns that might have repeatedly, and even contemporaneously, affected the green transition (Andersen & Geels, 2023; Lockwood et al., 2017). Due to the importance of policymaking for the green transition and the energy sector, the chapters were divided into a historical data dive into the most important energy policies for the legitimation of the green transition through the energy sector and following suite, through data analysis, the most important factors found to influence the legitimation of the green transition.

Analysis of the energy sector within the green transition provides the empirical base for this research. The two factors of time and reaction that were identified based on the thematic analysis of the primary data (semi-structured interviews) involved three profiles of actors: regulators, innovators and integrators. As a reminder, the definition for each is as follows:

Regulators - policymaking profiles, i.e., actors that were directly involved in the policymaking activities that resulted in academic or bureaucratic capital used for the definition and limitation of activities from "Innovator"; it also includes profiles that were very aware of the administrative and bureaucratic burdens necessary for new ventures to begin their journey into legitimizing themselves and their efforts to follow the new policies within their limits and within the limits of their own creations and technologies; and, finally, it also includes those that were not responsible for the policymaking and production of documents but that were directly involved in the processes of reviewing and accepting new ventures via several different processes (e.g. project funding, investment capital);

A) Innovators - new ventures and emerging innovative institutions that were trying to become legitimized businesses or projects in the new frontier of the energy sector;

B) Integrators - provides legitimated businesses, products and projects with the access to society and other venues which are for societal purposes.

As part of the initial sections of the thesis, the focal point was to make a connection to the policymaking and other sections of society as well as explaining why the policies were so important for the study of the energy sector as legitimation tools. The multi-level effects that policies can have was also explored, showcasing how industry and society may be affected by them and how they, themselves, shape the policies (Köhler et al., 2019; Li et al., 2017). This provided an initial step into the interconnectedness of what this research considers the "holy trinity" of legitimation, and which was expressed with the types of profiles actors that were interviewed fit into. This research focused on this connection because of the fact that, considering the European policy messages and spirit, the three types of actors are often mentioned as essential

for the transition, but studies gathering all three in one are not often found (European Commission, 2019; Köhler et al., 2019). As such, this research provides insight into policymaking in the energy sector for the legitimation of the green transition through the lenses of three types of actors that represent the three societal pillars of legitimation in this context.

Considering the importance of the three actors in policymaking, uncovering their effects in the green transition and, especially, in the energy sector provides insights into the legitimation activities essential for the green transition to be legitimized through the different sectors that compose it. Focusing on the energy sector does not invalidate the importance of the other sectors of the green transition. It is essential that other research efforts build upon this multi-factorial approach towards analysing the current state of the green transition. In order for the green transition to move forward, the several sectors must cooperate, as is mentioned by European policies (European Commission, 2018b, 2021; European commission, 2022). The green transition, being, itself, a multi-factorial endeavour, requires multi-factorial approaches (Köhler et al., 2019). The inclusion of the three types of profiles representative of the "holy trinity" provides a three-way view to the effects of policymaking on the green transition through its effects on the three pillars of the legitimation of the green transition. Combining these profiles' perspectives into one is an insight that can provide a more comprehensive understanding of the branching effects of policymaking on the legitimation of the energy sector. Trying to achieve the green transition, the energy sector being legitimized at its most optimal potential is essential, and bringing together the expert views of these profiles provides guidance into how to achieve that optimal potential.

Regardless of the policies' importance, one argument that was essential was to expose that they are not enough, and that the literature is lacking in cross-sectional, multi-system analyses (Andersen & Geels, 2023; Köhler et al., 2019). These analyses can connect several actors and documents to the legitimation attempts of the green transition via the energy sector. Multi-system analyses can also justify the gaps found among the existence of pro-transition policymaking and social activism coexisting with a lack of a full throttle transition, such as the world is experiencing now (Mathiesen et al., 2022; Wang et al., 2022). As such,

this portion of the text laid bare some of the issues and gaps in studying the legitimation of the energy sector as part of a green transition in order to attempt to provide answers to them later on. The answers would combine the policymaking historical knowledge with the secondary data available on the current status of the several types of energies in the green transition's energy mix and add in the primary data analysis for the identification of the factors and actors behind the lagging in the transition to then conclude with potential ways to have an effect on its legitimation efforts.

Research Question 3: How has society adapted to the new energy sector?

In the "Time and Temporality" chapter, it was identified that the green transition and, in it, the energy transition, had affected the social structures. This is since the green transition and the energy transition are also a societal transition. The impact that they have had on society is apparent in many forms, from social media to communities. The ways in which society is affected by the green transition equally comes from several levels. As explored in the "Time and Temporality" chapter, one of such levels is the geographic: global, international, national, and regional policies affect society at different levels and at different speeds. The reaction from society involves its ability to respond to the changes that happen at a regional level, which have the most potential for affecting the communities and social structures directly (Rodríguez-Pose & Bartalucci, 2023).

An adaptation that has been observed regarding the societal level's response and its geographic regulatory efforts is associated to the increase in regional implementation of the energetic industry. The implementation of new energy production affects the transition via the ways in which communities get access to energy but also the jobs and infrastructure necessary for their implementation (Rodríguez-Pose & Bartalucci, 2023). And implementation is only possible through regulatory frameworks that facilitate and regulate the ways in which such can be achieved. As part of the green transition, Member States have moved towards a faster and smoother implementation of different energy mixes, based on the countries' best interests. This was explored in Chapter 3: The importance of historical context in energy policy.

As discussed in the "Reaction" chapter, alongside the "Time and Temporality" chapter, data was collected and presented regarding the impact of the new energy sector in society's adaptation to the green transition efforts. The legitimation of the green transition's new energy nexus via society is present at many levels (Fischer & Newig, 2016; Hatch et al., 2017; Sonetti et al., 2020), such as was identified in the chapters: motivating community-level changes; motivating entrepreneurial and business action due to changing circumstances (e.g., energy poverty); motivating policy action and macro-level action through activism (e.g. Greta); motivating national-level engagement through economic benefits.

The identification of passive and active social roles also represents a specific societal reaction associated to the legitimation efforts of the green transition. As a reminder, these roles are described in the data and represent: "*passive actors who suffer from the changes in the policy and economic landscape and, thus, spark activity to protect society; and active actors who are responsible for elevating the discussions towards the green transition from the bottom up, impacting industry and policymakers.*" Passive and active actors in the societal range of actors are two forms of response to the issues surrounding the legitimation and implementation of the green transition.

Highly relevant to the role of social actors is the societal impact defined as the resistance that society has put up regarding some of the implementation strategies associated with the green transition and the energy transition. This is principally through defining compromises with policymakers or resisting changes which are perceived as negatively impacting the communities' social structures are ways in which society has adapted or reacted to this transition. The importance of the geographical level becomes even more apparent here. It is very noticeable how, although the international strategy was defined via policies, the implementation at the national and regional levels varies wildly even in an international community like the EU. One such example can be found in the implementation of windmills for eolic energy or biorefineries for the production of biofuels, where some communities highly opposed it while others accepted it (Rodríguez-Pose & Bartalucci, 2023; Sareen, 2020).

The role of the dissemination of proper and digestible policy information has an important role in the communities' perception of the importance and limitations of the implementation of new energy sources. The effects new energy infrastructure can have in communities are not to be forgotten, therefore, the communities and their representatives should be well informed, which is why this thesis argues for the necessary role of the "integrator". Identifying profiles that match with this role and provide communities and their municipalities with accurate and direct information regarding the new policy efforts in the green transition, especially regarding the energy mixes, can prove to be an asset for a faster green transition.

Another significant side of the societal impact in the green transition comes from the needs which society expresses towards their governance. Through these, and alongside the other international and national determinants and variables, the decision-makers are better able to establish compromises to represent the needs of each regional level. These compromises might not always be the best representation of the needs expressed by society, thus leading to the previously mentioned reactions of resistance to new implementation strategies. As before, the role of integrators is important here, as they are a link between the decisionmakers and the societal representatives, which grants them a position where they can act as a voice towards a more socially acceptable implementation of certain transition goals. In the case of the energy mixes, the impact of changing a community's access to energy should be well established as well as responsive to the needs and requests of the community itself. The integrator playing a role of communicator can, potentially, put a lot of onus on it, but it is a pivotal need for the transition to achieve its goals in the internationally defined timeframes.

As discussed, one way of adapting to a new energy sector is by the creation of social roles which work towards the legitimation of the societal needs in the green transition. Ensuring these needs are taken into discussion and implementation at several levels, such as institutional or entrepreneurial, is an essential strategy to adaptation. In this context, the relevant actors can take many forms, including for example academic institutions, which provide society with a voice towards the policymaking that affects them. Universities and other

research institutions are not new to our world and are not new as a response mechanism to societal change, but they are integral parts of societal adaptation to new systems through “institutional evolution” (Bejinaru et al., 2018). The role of these institutions in producing human capital which possesses the knowledge essential for the representation of society at several levels of society is nuclear to the guarantee that policymaking is reflecting the public’s needs and providing appropriate changes to societal capacity for it (Bejinaru et al., 2018).

Another example is media, which, currently, has a major impact in any sort of controversial topic in society due to the rapid propagation of reactions through social media and other means of communication. Associated to media is the precariousness of opinions due to misinformation and disinformation, two concepts that grew exponentially alongside social media outlets. The role of integrators here is also essential for the perceptions associated to the role of new energy mixes in the implementation of the transition.

7.3 Contributions to knowledge

The historical perspective chapter contributes to the literature as it connects the policy chronology with the energies implemented and used for national power in certain countries. This chronological connection is also made due to the historical exploration of the implementation of said energies in the countries, where the perspective given provided dates and observations regarding policy connections and financial incentives that promoted said implementation (Rodríguez-Pose & Bartalucci, 2023; Sareen et al., 2020). Considering the connection between a policy chronology and the implementation of energies had usually been done at a specific country level, rather than including several countries, this chapter provides a much larger overview of the policy influence in implementing different types of energy in different countries (Sareen et al., 2020). Another contribution in this chapter is the chronological presentation of the policies, which could prove essential for future studies. And lastly, the final contribution is the fact that this chapter connects policy to the actors and demonstrates that they each affect each other and, in doing so, the legitimation of the energy sector, thus also highly influencing the legitimation of the green transition (Andersen & Geels, 2023; Iskandarova et al., 2021;

Lockwood et al., 2017; Morgunova & Shaton, 2022; Wainstein & Bumpus, 2016). Clarifying this connection addresses an important research gap in the literature that calls for academics to start treating legitimation and the context it is used in (in this case, the EU's energy sector in the EU green transition) via a multi-level, multi-factorial and multi-systemic approach (Genus & Iskandarova, 2020; Sareen et al., 2020; Wainstein & Bumpus, 2016).

Another of the contributions present in the historical perspective chapter was an exposition of the several types of energy considered for the energy mix within the context of the green transition. In this part, the research focused on the literature which explored the legitimation and implementation of energy initiatives from their inception until current times (Énergies, 2016; Sareen et al., 2020). As was mentioned before, this research focused on the EU context and avoided specific national initiatives in its primary data analysis, however, for secondary data, the research did not actively avoid them. This decision was made as the ecosystem of the energy type in question was not being studied but, rather, examples of its implementation and legitimation were being exposed to show whether the energy types suffered impacts from the previously chronological analysis of policies (Bosman & Rotmans, 2016; Imbert et al., 2017b; Ministry of Environment, 2017; Sareen et al., 2020). Thus, specific country literature on specific energy types was analysed since some countries had more investment capabilities and resources to exploit different sources of energy (e.g., Portugal with solar; UK and Nordic countries and wind; Nordic countries with hydro and biomass).

The analysis of the primary data provided one component which had already been a part of the writing in the chapter before it: time. The primary data revealed this aspect of the legitimation of the energy sector, but the concept of history and chronology, both of which are highly associated to time, were already being explored. This was a reassuring form of research, where there was a naturally occurring connection between not only the exploratory lens but also the contextual purposes of the secondary data analysis. Not only that, but it was also a connection that made sense according to the literature, which describes the need for more historical and time-focused analyses of the legitimation process in order to ensure that the various facets of time can be linked to

legitimation effects (Bucheli et al., 2013; Foster et al., 2017; Lockwood et al., 2017; Wadhwani et al., 2020). Besides, through the institutional genealogical lens, there was also an importance given to time through the idea of a generational effect based on previous agendas at the levels of the several types of actors analysed and the institutions they represented (Firdaus & Mori, 2023; Garud et al., 2011; Lippmann & Aldrich, 2015; Pike et al., 2015; Yang, 2016).

The paradoxical nature of the green transition and its legitimation has a strict relationship with the concept of time. This is because the green transition is, paradoxically, a time-consuming endeavour that has very limited time (institutionally speaking) to be fully implemented to avert what is commonly identified as environmental catastrophe. Time is, therefore, a concept that should be used in strategies pursuing legitimation of the energy sector in order to further the green transition agenda (Wood et al., 2021). The rhetorical use of time in the definition of the legitimation process is always providing new ways of exposing research and new perspectives on the path towards a better understanding of the complexities of legitimation (Foster et al., 2017; Suddaby et al., 2010; Wadhwani et al., 2020).

Considering time is still an abstract concept that is used in very many ways throughout our daily lives, one of the purposes of the time and temporality chapter was to begin by demonstrating the several ways in which time was interpreted by the chosen types of actors. The purpose behind this exercise was to ensure that the definitions of time and how it was used in discourse fit with the concepts that are also used for legitimation but that may fall into the umbrella term that is “time” (Bucheli et al., 2013). One such example is how one single participant, Participant 1, used time as a way to describe: their feelings; the morals that guided their business strategy; their achievements and career exploits; and the discrepancy between two parts of the business world moving at different speeds. The purpose of this short introduction was to show the versatility of our speech when the word “time” or associated terms are used and how they can vary in their actual meanings due to context. Time isn’t always a chronological description of an event, and that is an important premise for the study of it as a factor in the legitimation process (Bucheli et al., 2013).

The reason behind this exploration of the concept of time is to prime the reader to understand the great variability that time has, as a concept, in the legitimation context. Especially regarding institutions, time is a topic that has been discussed over a long time period (Bucheli et al., 2013; Stinchcombe, 1965; Wadhwani et al., 2020). The subtle influences of time in the institutional ecosystem have become apparent due to words like “lag”, “efficiency”, “inertia” having temporal conditions and falling under this umbrella term when scrutinized, as is clear by many of the participants’ responses. The fact that time can have such a myriad of uses is useful for the purpose of this chapter in its demonstration of how time can affect policymaking in many different ways. The many concepts that are directly related or generate from specific understandings and interpretations of “time” have an influence on the actors responsible for the development of policies, innovation and social action (Andersen & Geels, 2023; Bitektine & Haack, 2013). The participants’ responses all led to the belief that time wasn’t simply time, rather, it was an amalgamation of several other concepts which were used untethered and uncategorized even though they belonged under the same umbrella. The objective of this chapter was to argue that they can all be brought together under the same umbrella term of “time” and demonstrate that they all may culminate in an action or influence that affects the legitimation of the green transition, when viewed with an institutional genealogical lens.

The importance of the several concepts that are described in the chapter and that can fall under the umbrella term of “time” is due to their ability to explain certain events in the legitimation efforts, such as the mismatch between innovators and regulators or the temporal pockets that policymakers might attach to the different policies in development (Garud et al., 2011; Markard et al., 2016a; Pelkmans & Renda, 2014). These, of course, can have major effects in legitimation efforts but, without a category uniting them, they are considered separate effects and not viewed as a being a part of a multi-factorial and multi-level system, which is, as mentioned before, something legitimation literature claims as necessary (Lippmann et al., 2015; Lockwood et al., 2017; Wadhwani et al., 2020). Therefore, this chapter united these concepts under the umbrella term of “time” by gathering the participants’ discourse which alluded to a concept which was a direct manifestation of time and identifying how all the

comments by the participants indicated an effect on the legitimation of the green transition.

The additional level of analysis that this chapter focused on was on how time, in legitimation processes, could be considered how "fast" legitimation can happen. The speed of the green transition is a topic that is highly contentious in the extant literature (Andersen & Geels, 2023; Corradini, 2019; Trippl et al., 2020). The discussions surrounding this context are associated to the fact that the green transition has been going on for decades without real advances (Köhler et al., 2019; Sareen et al., 2020). However, as is known, in the past 6-8 years the transition's speed has changed drastically, with many supporting policies and international committees coming together to commit to the changes required to save our planet and its resources (European Commission, 2017, 2019; European Commission, 2022; United States Congress, 2019). In an attempt to uncover the factors that have changed since the inception of the green transition in the 60s, this research focused on "time" and all the actions falling under this umbrella term to attempt to determine where the changes occurred and why there was a gear shift so great at a certain point in time (Sareen et al., 2020). For that, the use of institutional genealogy as the theoretical lens was essential, given that it provided insights into the "time" that institutions had spent promoting a carbon-based energy sector, the effect of these efforts, and, now, that the same institutions were promoting a controlled and adjustable destruction of their previously successful endeavour (Pike et al., 2015; Stinchcombe, 1965).

Regarding the notion of "Reaction", the contribution to the legitimation and the green transition literature is based around the different types of profiles that were analysed and that their combined reactions were also exposed. The literature suggests that "different types of structural couplings influence each other" and asks "whether all three types are needed to stimulate new resource flows" (Andersen & Geels, 2023). To provide some insight into such demands, this research focused on three types of actors, representing three types of levels associated to the transition, and provided the experts' opinions into whether the results were indicative of influence and stimulation. The tables provided in the chapter are a representation of the connections found amongst the actors and which factors led to a higher potential for a common response or a lower one.

Another important contribution found in this research is the influence of a potential type of actor in the new energy transition: the integrator. As is also requested by the current literature, once the connections between the different types of actors have been established and solidified, the role of integrators may play a role in furthering their influence in the legitimation process. Though the literature indicates the need for an "intermediary to manage the institutional and technological couplings", this research argues that, rather than managing, the role of an active communicator body is necessary for the policy-public, policy-government and policy-innovation realms. As such, this kind of actor is able to readily and steadily provide the civil society, or governments or businesses with an effective summary of the results of decisionmakers in order to promote a faster reaction. Not only that, but the role of this actor would be to also provide the information of the direction in which discussions are moving, to engage with the identified issues of responsiveness and consistency in policymaking.

7.4 Limitations and Further Research

As with any research endeavour, there are certain limitations which must be taken into consideration. Systems like those involved in the green transition present high levels of complexity and are affected by multiple factors and comprised of multiple systems (Andersen et al., 2023; Andersen & Geels, 2023; Wang et al., 2022). Attempting to analyze such systems is a challenge due to their complexity, so this research recognizes it cannot describe the systems in full, thus focusing on the attempt at providing a holistic overview of the current status based both on present data and an historical overview of the data, as requested by the literature (Andersen & Geels, 2023).

Since the analyzed data included regulation, it was important to determine that the research did not analyze every piece of regulation that came out due to the immense volume of documents. As such, this research does not claim to be omniscient of the regulation for the energy mixes in the green transition, rather, it uses some of the most discussed ones as examples to direct the analysis and discussion efforts.

One last consideration is attributed to the role of time as a variable. The concept of time has been debated in literature and analyzed in various forms, and this research attempted to take as much into consideration regarding the future endeavours of this concept requested by earlier authors (Bitektine & Haack, 2013; Bucheli et al., 2013; Lockwood et al., 2017). Thus, the thesis focused on understanding time and the concepts that the research's data indicated to be proxies of time.

7.4.1 Complexity: multi-system, multi-level and multi-factorial

A multi-system transition including time in its parts such as this one requires different approaches to be considered (Andersen & Geels, 2023). One such approach is a historical one, especially cultural history, which offers researchers the tools to analyse several levels of complex systems over time and includes the interplays at work amongst the agents that directly influence them (Andersen et al., 2023; Wadhwani et al., 2020). As context is extremely important for legitimation and change, the historical levels of legitimation also play a part in the understanding and development of a theoretical approach to newness, especially regarding the connection between actors and legitimation efforts (Demil, 2020; Patermann & Aguilar, 2018). In this sense, history becomes the paradoxical precursor and partner of environmental constraints on legitimation and change, as it is "the set of antecedent facts and decisions that establish these constraints" whilst coexisting with the changes and newly formed or emerging contexts, effectively becoming a limiting factor in the entrepreneurial ecosystems (Wadhwani et al., 2020). Alongside the historical limitation, there are sets of conditions that affect the legitimation of complex systems, such as a transition, which are analysed over time with the purpose of identifying general operational mechanisms (Andersen et al., 2023; Bucheli et al., 2013; Lippmann et al., 2015). These mechanisms are derived from the evolutionary analysis, which defines, historically, the contextual factors that have made organizations different from one another (Bucheli et al., 2013).

Multi-system, multi-level and multi-factorial approaches or acknowledgements were used in this research due to several reasons:

1. Legitimation is a complex topic and concept where several authors have discussed, for decades, its multi-faceted complexity and attempt to tackle it by breaking it down into several types of complexities only to find those complexities are multi-faceted complexities themselves – it is a losing battle to ignore the complexity while trying to simplify our approach (Andersen et al., 2023);

2. The observations found within the literature review and data analysis that suggested the complexity of the systems in which the energy sector is included and which it has an effect on, as a whole and as individual parts;

3. The data indicating that the energy sector was more relevant for the green transition than singled out energy types or clusters, like renewables or bioenergies, meaning that the interviewees rarely ever held the final judgement that one energy solution was the "silver bullet", rather, most believed that the highest form of diversity in the energy mix was essential, especially in light of current geopolitical events;

4. The policies that came out from the EU regarding the overall ecosystem investments to be made and what types of energy and respective investment schemes were mentioned and included in the latest policies, like RED's typology and REPowerEU established goals;

5. The conclusions from the data analysis that indicated how the actors were influencing and having an effect on several layers of the green transition and how one of those layers was the energy sector which interconnected with other layers in a complex matrix;

6. The subtleties found within the data that indicated the potential for an immensity of factors to be analysed;

7. How this research decided to focus on the factors that, viewed from an institutional genealogy lens, were considered to be the most relevant for the impacts they sustained on the energy sector and, therefore, on part of the ecosystem of the green transition.

The multi-system systems that were analysed correspond to a fraction of the whole ecosystem, thus providing but one form of overview, which is, in itself, limited to the system that it represents, and which is also limited by the factors that were discovered and analysed. By this, it is clear that that the energy sector cannot provide a full overview of the legitimation of the green transition because it is a part of a much greater ecosystem, and that within the energy sector are other relational systems (Andersen & Geels, 2023). The complexity of multi-systemic analysis, however, should not deter research because it is a necessary component of the interdisciplinary requirements for the transition

(Andersen & Geels, 2023; Lockwood et al., 2017). The systems mentioned are working to legitimate the next order of magnitude, meaning, each energy type industry is attempting to legitimize the new energy sector and the energy sector, as a whole, is attempting to legitimize the green transition's ecosystem.

The multi-level approach taken in this research came as part of the identification of the relevant actors for the legitimation of the energy sector and its components. As such, there was an attempt to represent several levels of society in the data collection to be able to represent their legitimation attempts in the energy sector, during the green transition. Therefore, the profiles that were engaged with are an attempt at providing insights into each societal level, such as governmental, industrial and community, but not fully represent the whole of the ecosystem surrounding the transition.

Additionally, the multi-factorial aspect of this research took form as time and reaction were explored as legitimation concepts within the energy sector and during the green transition. Though there is a multi-factorial approach in this research because of the data analysis, it is not fully representative or can be used to extrapolate a full ecosystem such as that of the green transition. However, the attempt to underpin how this sector was affecting the green transition, through which factors and actors, and how it was doing so, was made. This is relevant because, although the green transition is an ecosystem that encompasses many systems, the energy sector is a critical one for the green transition, having effects on multiple levels of society (Andersen & Geels, 2023). Therefore, it is possible to assume that by studying this sector and its greater impact in the transition, one would uncover more baseline data regarding the actors and institutions potentially causing changes in the green transition.

7.4.2 Time as a linear and predictable variable

Relying on time to be a variable that is constant is considered to be a standard for lots of research focusing on this topic (Lippmann et al., 2015). It is a criticized standard due to the complexities that are left out of a variable which, as was explored in this thesis, has such a vast span over its potential uses and meanings. Taking this into consideration, this research attempted to gather the ways in which time is represented and produce a valid approach to its concept as

an umbrella term to accommodate for the complexity of the term. However, it is undoubtedly a reality that, although this effort to represent time as fully and categorically as possible, in the research's context, was made, it is limited to this research's interaction with actors and literature. Therefore, it cannot be assumed that this is a comprehensive definition of time, rather, it is a reactive attempt towards the goal of providing as much contextual information towards the definition of time as possible within the constraints of the available data.

7.4.3 Magnitude of produced policy documents

One important caveat of the green transition policy chronology chapter is the fact that, naturally, it is a complex task to find exactly all the initiatives that affected the energy sector, because the existing materials that provide details on these were not made for research. Not only that, but the repositories that do exist are often incomplete, or even outdated to the point where previous iterations of certain documents are not found. Relatedly, the energy sector is highly complex and has a long history. All the documents that have affected the energy sector are likely in the thousands, and this is only at an international level, because at a national level, we could be looking at thousands of initiatives (just in the EU). The work herein then is not based on a comprehensive analysis of everything as a full and complete consideration of all the documents is beyond the scope of this thesis proposal. Instead materials were selected and analysed in line with the legitimation considerations that the thesis explores, and consistent with the conceptual lens adopted.

7.5 Concluding remarks

This research has analysed the green transition's legitimation through the use of time and reaction as per the primary data's results. For contextualizing the research, a historical overview of the most important pieces of policymaking were exposed and their implementation analysed at national levels. A genealogical institutional lens was used to better raise awareness to the complexity of interactions and inheritances on new institutional players for the transition. The discussion following up on the data collection and analysis provided results regarding how time and reaction are variables that can interact

in the multi-systemic green transition and affect its legitimation. The influence of international strategies and of policymaking in legitimating the new energy mixes alongside the social adaptation to the green transition were explored in order to address the principal research questions.

Firstly, it was found and confirmed that the strategies towards the legitimation of the new energy mixes in the green transition are highly associated to the development of policymaking, with ample examples of how such legitimation occurred at international, national and regional levels (Rodríguez-Pose & Bartalucci, 2023; Sareen et al., 2020). As one of the research pillars of this study, confirming the influence of policymaking in the legitimation of the energy sector is perhaps unsurprising. However, given the institutional lens applied to this analysis, policy is provided with alternate views and impacts, being associated with positive and negative impacts. Considering policies are a major influencing factor into the legitimation of the energy sector within the context of the green transition, the initial question that prompted the exploration of their influence is now answered: why has policymaking not been able to drive forth a full transition? The institutional lens helps reveal several aspects of policymaking that imply several forces that work at the policy level and effectively reduce its independent ability to push forward the green transition: incumbents and lobbying powers (Canal Vieira et al., 2022; Firdaus & Mori, 2023). The blind faith in policymaking towards the legitimation of the green transition is an easy fallacy to fall prey to, considering the amount of literature that indicates how much we can rely on it. This study showed that policymaking cannot be the silver bullet for the legitimation of such a complex system as the green transition, even though its impact is crucial for it.

Policy needs other elements to fully realize its legitimation powers in the time-reaction legitimation nexus of the energy sector. This study found that certain actors are relevant in the time-reaction nexus due to their reactions to certain triggers providing the basis for the legitimation effects on the green transition. As such, this work identifies the intersections between relevant actors and how they become reactive when presented with certain topics or discussions (see Table 5). Becoming reactive indicates that those actors can affect the legitimation of the new energy sector and, thus, have an effect on the green

transition. Such actors affect (and synergize with) policies by potentiating the legitimation of the energy sector within the green transition. The concept of actors becoming legitimators based on reactions to certain triggers is a form of transformation that could be considered new due to the fact that actors are not considered to have said duality in them. Though legitimation is considered an asset that actors can achieve, the transformation from non-legitimizing to legitimizing actors is, to this research's knowledge, not a thoroughly explored phenomenon.

The time effect is associated to whether the effects by reactive actors allow the legitimation effects to produce momentum or inertia in the green transition, therefore either accelerating or delaying it. A concept of a multi-factorial and multi-actor profile analysis associated to legitimation effects on the timely manner of the transition through the energy sector is a rich combination of data that provides a novel insight and approach to legitimation components necessary for the transition's potential success. Requests for multi-factorial and multi-systemic analysis in the legitimation and energy transition literature are present, and this thesis is an attempt at addressing those requests (Andersen et al., 2023; Köhler et al., 2019).

Secondly, analysing policymaking, as a result of institutional efforts, has legitimation effects that can vary according to time, the actors involved, and their reactions to certain triggers. Policymaking is one of the most well-known tools towards the legitimation of the green transition through the multi-systemic approach that defines it. Energy mixes require policymaking in order to be legitimized and in order for the investment profiles and/or incumbent players to be able to discern the directions of their endeavours (Firdaus & Mori, 2023; Iskandarova et al., 2021). As such, policymaking creates its own nexus with incumbents, entrepreneurs, and other legitimating actors by initiating a set of reactions that can determine the speed of the transition through legitimation effects. The interconnectedness of the actors involved in the legitimation of the transition was exposed as an essential part of the multi-factorial legitimation efforts. The discussion around policymaking and its multi-faceted relationship with actors and other factors brings a perspective that is multi-factorial and, as mentioned before, provides insights into requests by the literature towards the

connection that legitimation concepts can have. Identifying the factors that might be obscured by a hyper focus on other concepts surrounding legitimation and its discussion is one of the contributing factors for the utility of this research. Apart from the unearthed factors in the form of reaction triggers, the way in which they affect actors, and, in turn, legitimation is another contribution that makes this contribution more cohesive.

Thirdly, the societal impact of the legitimation of the green transition was also exposed, determining in which way social adaptation to the green transition has occurred. As such, the concepts affecting the societal reaction to the implementation of new policies, new energy types, new overall changes, were explored. It was determined that civil society, as an actor, has major impacts in the legitimation of the new energy mixes for the green transition (Rodríguez-Pose & Bartalucci, 2023; Sareen et al., 2020). Societal factors, such as resistance and activism, have an impact in the shaping of the implementation of the changes required by the green transition (Rodríguez-Pose & Bartalucci, 2023). The fact that the green transition is a societal transition is invocative of the interconnectedness between the two, but the fact that there is an interaction between several types of actors in it indicates its high complexity. The impacts found at the societal level were essential to discern how policymaking is affected by several actors and factors, but also how it has different influences when considering different parts of the multi-dimensional energy nexus. The social impact of policymaking is an essential side to be explored due to the importance of the transition encompassing the concept of a “just transition” (European Commission, 2019; Newell et al., 2022). Often, the societal impact of the transition is focused on industry-based sectors, like agriculture or energy, rather than on communities and their own transition. Due to this, this research explores the role of the “integrator” in order to facilitate societal access to digestible information regarding the new policies and how those affect their lifestyle. Considering the several levels at which society can become triggered into being a legitimizing actor, an integrator can facilitate action by providing targeted and concrete information towards efficient societal activism.

All things considered, legitimation in the green transition is a complex matter that involves the interaction of several institutional systems, alongside societal

ones, and the impact of several sectors. This thesis focused on looking specifically at the energy sector as one of the legitimation pathways that complete the green transition. Through an institutional genealogical lens, this research determined how the legitimation of the green transition can be achieved through the energy sector and what the impact of relevant actors, at various levels of influence, is towards this goal. In order to understand what actors are important in this sector, the thesis analysed the most impactful factors in legitimation and the actors associated to them. It, then, associated the actors to triggers that caused them to have an impact on the legitimation of the energy sector. As such, it was identified that Regulators, Innovators and Integrators have specific and shared triggers that cause them to become actors who legitimize the energy sector, specifically. The legitimation impact is based on their ability to affect the timeliness of the energy sector's policy and innovation implementation. It was found that they all can have impacts through various types of triggers and that they all have specific sensitivity regarding specific triggers. Using this knowledge, the policymaking landscape can best decide which specific triggers to direct at each type of actor in order to produce the expected response in the energy sector's legitimation. The energy sector, thus, can contribute towards the legitimation of the green transition based on the policymakers' decisions regarding the conjugation of triggers and actors.

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9 ANNEX 1

9.1 White Paper

9.1.1 Acceleration of the Green Transition

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Executive summary

Policy is a major driver of the green transition, alongside other economic, institutional and social factors. Despite the European Union's policy efforts and context, the transition is not moving fast enough, with implementation lagging behind expectations and policymaking actions and packages. Therefore, researching the factors influencing the speed of the transition, and the reasons behind some of the laggard agents, is in order for policy action to be optimized. As such, time and temporality play a major factor in understanding the standing of the green transition and how fast we can achieve the intended results for carbon neutrality through policymaking in the energy sector.

Considering the EU's interest in establishing an alternative energy mix to the current fossil fuel one, the policy context of the types of energies, with a special focus on bioenergies, was taken into consideration. The implications for the energy mix involve several actors within the policy actions towards the green transition. Therefore, three types of actors were identified as essential for the green transition and their expertise and insights were used as baselines for the recommendations necessary, according to them, for the green transition to accelerate through policy action.

This research presents the results of my inductive qualitative research via 31 interviews with regulators, innovators and social profiles (called integrators) in the EU working in bioenergy and in the implementation of the green transition at a holistic level. This research also analyses the data with an institutional genealogy theoretical lens, which “provides a worthwhile means to grasp the historical evolution of the institutional landscape and the ways in which continuities, endowments and legacies from past and existing institutional environments and arrangements prefigure and shape new and emergent settings during periods of change and transition.” (Pike et al., 2015).

The results uncover mechanisms that show reasons for the delay in implementation of the green transition and how the several actors identified as crucial for the green transition can help expedite it.

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9.2 Introduction

9.2.1 EU policy context

9.2.1.1 Policy overview

The European Green Deal, alongside other policy aiding policies like REPowerEU, RED and the Fitfor55 package, resets the Commission's commitment to tackling climate and environmental-related challenges that is this generation's defining task. The atmosphere is warming and the climate is changing with each passing year. One million of the eight million species on the planet are at risk of being lost. Forests and oceans are being polluted and destroyed. The European Green Deal is a response to these challenges. It is a new growth strategy that aims to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use.

The EU has the collective ability to transform its economy and society to put it on a more sustainable path. It can build on its strengths as a global leader on climate and environmental measures, consumer protection, and workers' rights. Delivering additional reductions in emissions is a challenge. It will require massive public investment and increased efforts to direct private capital towards climate and environmental action, while avoiding lock-in into unsustainable practices. The EU must be at the forefront of coordinating international efforts towards building a coherent financial system that supports sustainable solutions.

9.2.1.2 Key regulatory and non-regulatory trends and challenges

The global goals towards greener targets have come up in the past decades in response to major calls from the research community paired with increased issues with climate and biodiversity, as was initially stated in the Paris Agreement (European Commission, 2018a; United Nations Framework Convention on Climate Change, 2015).

Though there is a complex ecosystem surrounding a transition, the green transition has seen a relative simplicity in its several traditional industries and players and the role they played in its delaying, thus influencing adoption and implementation or even the policy design itself (Köhler et al., 2019).

Policies themselves mention the importance they possess in the long-term establishment of frameworks essential for alternative sources of energy, as is the case with the deployment of alternative Sustainable Aviation Fuels (SAF; (Köhler et al., 2019; Wolff et al., 2020). The market needs the policies to be supportive of the efforts requested of the market, thus providing solutions and frameworks to the new challenges they provide the market with, especially if a paradigm shift is the objective. The REPowerEU policy also brings forth its intention of complying with the global green targets, making statements regarding its commitment to how its strategy is to follow through with the Global Gateway for a faster green and just transition (Furness & Keijzer, 2022). The cumulative effects of policies and how they interact is quite visible here and shows the effort that has happened at a global scale to drive the shift into alternative energy sources in a way which upholds past endeavours while adapting to the current geopolitical, societal and economical needs (European commission, 2022). There is also a summoning of external policies within the description of REPowerEU, which serve as a reminder to other countries of the fact that the effort is to be made as a diplomatic group and that it requires everyone's influences and policymaking to achieve the goals that global policies have set up (European commission, 2022).

9.2.1.3 Key legitimacy or legitimation challenges

The importance of the lag effects on green innovation become visible when connected to the legitimation through time of the green transition, as is observed by Participant 6,

"If the level of urgency (...) is not on par with the level of investment and targets, it's a big discrepancy. Obviously there's always lag." (Participant 6)

and the importance and impact of traditional actors in the development of said transition (Di Maria et al., 2017).

Time is still an important transactional weapon used by traditional players to delay the substitutions required by the transition and, therefore, maintaining their businesses and profits for longer (Di Maria et al., 2017; Hoppmann & Vermeer, 2020; Sareen et al., 2020). The delegitimation of the green transition provides traditional industries with time and, therefore, money, thus leading to a feedback loop where further delegitimation allows for more time in the market (Di Maria et al., 2017). Transactional time functions differently for start-ups and emerging businesses due to the fact that their required actions are immediate, considering these organizations need a lot of nurturing to survive (Aldrich & Yang, 2012). Time is, then, a unit of survival for them, due to the depletion of resources, considering the more they are left unattended and the more delegitimation attempts target them, especially from established businesses, the likelier they are to fall (Brown, 2020). In this interaction, it is visible how the relationship between time and financial stability cause very different responses. There are potential disruptors operating at this level, namely, policymakers. The response of policy to the forces of lobbying can impact the value of transactional time by causing major shifts in how time affects traditional industries, e.g. by increasing taxing or reducing availability of resources and supply chains (Di Maria et al., 2017).

The concept of bureaucratic burdens is one that legitimizes the use of time as a factor towards legitimation, considering the contexts in which this phenomenon is observed: survival (Braunerhjelm & Eklund, 2014; Di Maria et al., 2017). The survival of start-ups and emerging businesses, as mentioned previously, is highly related to the availability of funds and resources (Brown, 2020). The bureaucratic burden is a factor that lowers the amount of time and resources a company has for their focus on innovation and creates a barrier of entry that highly affects the survival of companies (Giurca & Späth, 2017). In this sense, a branch of the economic facet of time is found via the efficiency of companies decreasing with the increase in bureaucratic burden, which leads to a loss in funds and lowers chances of survival.

The time factor on this transition is parallelly important considering that time has been a major factor for all other legitimized and established traditional energy empires. In this sense, time can be analysed as one of the legitimation forces impacting the progress of alternative energy sources and how those have become integrated as a part of the narrative of the green transition. Although a myriad of factors are part of the analysis of the transition, the focus on time has special relevance when looking at legitimation, particularly as it is highly correlated with policies and innovation (Energy Transition Commission, 2020). In the case of policies, time is invoked as a factor with a highly influential force due to the importance of policymaking in promoting the transition and the innovation that drives the transition. In this sense, policies, according to Participant 2, have been a part of the reason why in *"(…) recent 10 years it [European Green Deal] intensified the discussions in countries all over the world. What resources do we have? How can we make this societal transition in a good way? Which kind of biproducts/waste products?*".

The speed at which the EU has gone is something that has sparked others to follow and has also given everyone a taste of what the new economy could look like. This glance into the future is only provided by the fact that the EU dared to tackle such a big change with a strategy that, as mentioned earlier, is comprehensive and cohesive, otherwise it wouldn't be providing us with the ability to transition at all. This is a testament to the use of time as a legitimation tool, because the EU managed to shorten the amount of time needed for the transition by setting highly ambitious targets and making others believe in those objectives . A good example of how the EU acted regarding the acceleration of the green transition is seen in COP-26, where it, alongside other world powers, defined the goals for the next 10 and 30 years.

Events in innovation can lead to cumulative effects on its development within a company, therefore creating more potential preparedness and responses to transition period requests (Bolton & Hannon, 2016; Garud et al., 2011; Morgunova & Shaton, 2022). The connection to institutional genealogy becomes even greater when we determine the fact that the accumulation of events throughout the existence, and beyond, of the business leads to a faster response to demands and an easier shift to meet new requests (Cooper et al., 1996;

Mcmullen & Dimov, 2013). Legitimation of innovation through time is, then, part of the ecosystem and grants time yet more legitimation powers within the context of the green transition due to the crucial influence of innovation on it.

9.3 Effects on the speed of the Green Transition: A framework

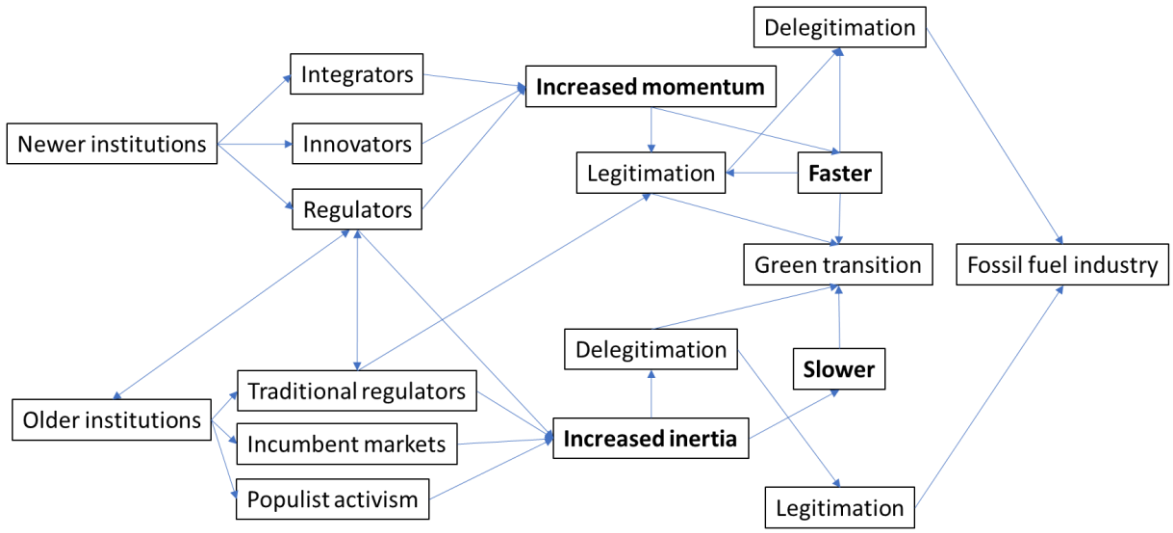

Figure 1: Actors and their relationship with the speed of the green transition and legitimation.

The speed of the transition is characterized via this framework, including the forces and actors that create the opportunities for acceleration, or the opposite, via the concepts associated to legitimation. This framework exposes the importance of the actors in the regulatory opportunities, alongside industrial and societal, for the legitimation and enhanced velocity of the green transition. The increase of the green transition comes at the cost of the decrease in legitimacy relevance of the fossil fuel industries. The green transition can only fully happen once the fossil fuel industry is overthrown, which is represented here in the legitimation effects that each of the two concepts have on each other. The role of institutions is crucial in the sense that they generate the human and knowledge capital necessary for the legitimation and, therefore, speed of the green transition to be affected. The legitimation efforts by each type of institutions is a direct result of the actors through which they act.

The greatest challenge for the transition is to understand how to fully transition without compromising the quality of life of the citizens affected by the transition. As such, the importance of international treaties and policies can only take the transition so far. The national and local efforts are also essential for the transition to happen smoothly. Though international efforts can understand the best way to proceed at a larger, longer term scale, the national and local efforts understand the contexts and the needs of the citizens inhabiting their sovereign domains. That is why to achieve the green transition, the change cannot be sudden, rather, it has to be a “phase out”. All current strategies to achieve the green transition have counted on the phase out from previous types of energy to newer or greener types of energy. The energy mix for these new or greener energies has shifted the percentages of each type of energy with which countries count on for their consumption needs. As such, the legitimation of the green transition is only achieved through the addition of new or green energies to the mix to the point where the adding of these completely replaces the others. Of course, this replacement can only be fully achieved once the costs of the new energy mix is similar or lower to the previous one while being able to sustain the same amount of population.

How it works, how it can contribute to address the above regulatory / non-regulatory trends and challenges and associated legitimation and legitimacy challenges and issues.

Its relevance and applicability to address the above identified challenges and issues.

9.4 Recommendations

9.4.1 Legislative/regulatory

The previous push back and the slow pace at which the transition was happening have, recently, softened and quickened, respectively, due to the nature of some world events and as a result of pressure from the scientific community and public (Hausknost et al., 2017a; Köhler et al., 2019; Mathiesen et al., 2022). The slow pace is, however, still a concerning topic for this specific transition,

considering how long it’s been around and how damaging it is if the changes aren’t rapidly implemented (European Commission, 2018a; Köhler et al., 2019; Mathiesen et al., 2022).

There are a number of pathways for achieving a climate neutral net-zero greenhouse gas emissions in line with our vision: all are challenging, but could be feasible from technological, economic, environmental and social perspective. Reaching this objective requires deep societal and economic transformations within a generation touching every sector of the economy. Applying the principles of a competitive, inclusive, socially fair and multilateral European approach, a number of overriding priorities, fully consistent with the Sustainable Development Goals, should be guiding for the transition to a climate neutral Europe:

Accelerate the clean energy transition, ramping up renewable energy production, high energy-efficiency and improved security of supply, with increased focus on reducing cyber security threats, while ensuring competitive energy prices, all of which power the modernisation of our economy;

- Recognise and strengthen the central role of citizens and consumers in the energy transition, foster and support consumer choices reducing climate impact and reap collateral societal benefits improving their quality of life;

- Roll out carbon-free, connected and automated road-transport mobility; promote multi-modality and shifts towards low-carbon modes such as rail and waterborne transport; restructure transport charges and taxes to reflect infrastructure and external costs; tackle aviation and shipping emissions using advanced technologies and fuels; invest in modern mobility infrastructure and recognise the role of better urban planning;

- Boost the EU's industrial competitiveness through research and innovation towards a digitalised and circular economy that limits the rise of new material dependencies; start testing at scale breakthrough technologies; monitor the implications on the EU's terms of trade, in particular for the energy intensive industries and suppliers of low carbon solutions, ensure competitive markets that attracts low carbon industries, and in line with international obligations alleviate competitive pressures that could lead to carbon leakage and unwanted industrial relocation;

- Promote a sustainable bio-economy, diversify agriculture, animal farming, aquaculture and forestry production, further increasing productivity while also adapting to climate change itself, preserve and restore ecosystems, and

ensure sustainable use and management of natural land and aquatic and marine resources;

- Strengthen infrastructure and make it climate proof. Adapt through smart digital and cyber-secure solutions to the future needs of electricity, gas, heating and other grids allowing for sectoral integration starting at local level and with the main industrial/energy clusters;

- Accelerate near-term research, innovation and entrepreneurship in a wide portfolio of zero-carbon solutions, reinforcing the EU's global leadership;

- Mobilise and orient sustainable finance and investment and attract support from "patient" capital (i.e. long-term venture capital); invest in green infrastructure and minimise stranded assets as well as fully exploit the potential of the Single Market;

- Invest in human capital in the next decade and beyond, equip current and future generations with the best education and training in the necessary skills (including on green and digital technologies) with training systems that quickly react to changing job requirements;

- Align important growth-enhancing and supporting policies, such as competition, labour market, skills, cohesion policy, taxation and other structural policies, with climate action and energy policy;

- Ensure that the transition is socially fair. Coordinate policies at EU level with those of Member States, regional and local governments allowing for a well managed and just transition that leaves no region, no community and no worker and citizen behind;

- Continue the EU's international efforts to bring all other major and emerging economies on board and continue creating a positive momentum to enhance global climate ambition; share knowledge and experience in developing long-term strategies and implementing efficient policies so that collectively the objectives of the Paris Agreement are accomplished. Anticipate and prepare for geopolitical shifts, including migratory pressure, and strengthen bilateral and multilateral partnerships, for instance by providing support to third countries in defining low carbon resilient development through climate mainstreaming and investments.

9.4.2 Non-legislative/non-regulatory

Raising public awareness, interaction with the sector – key non-regulatory stakeholders, how, cooperations, etc.

The importance of the social dimension, especially at a European level, was remarked by Participant 9:

"Everyone must be in on it [energy transition] (...). That's what we observe in Europe and that is why things work, because there is an urgency from society for things to work." (Participant 9)

There are several ways in which changes to prior goals might affect the population and cause them to lift artificial, but powerful, barriers to implementation. All these have one factor that affects them in common: time. Regional powers might feel pressured to increase investment in areas that are unrelated to the actual policy implementation but that reveal new paths for the international policy to be integrated faster and more easily. Thus, the urgency with which policies need to be implemented, at a regional level, often comes down to the impact they will have on populations and governments. The complexity of such interactions shows how important it is to maintain a balanced relationship between policy goals and the concept of a "fair transition". The concept of fairness is used as meaning a change that is achievable for all sectors and people, rather than it being facilitated for some whilst proving extremely hard and costly for others. This concept was added to the green transition exactly as a way of expressing the need to take into consideration all countries and sectors, especially the most vulnerable ones, for such a grand change as is the one encompassing the whole energy sector.

The importance of integrators becomes very clear here, where we understand the impact of the population in the ability of governments to peacefully and efficiently make necessary changes to accommodate international targets and goals for the transition.

Picking up on the concept of "fairness" in the green transition and how the balance of impact in different sectors needs to be achieved, the connection it has to self-containing systems is quite blatant. A self-containing system, by definition, is a system in dynamic equilibrium that is forced out of said equilibrium due to external forces or new variables. This concept is further explored in the following chapter where the "reactiveness" of such a system will be characterized and covered.

9.5 Impact

9.5.1 EU policy/agenda for change

My recommendations have slowly, but surely, been implemented as I delved into my research, uncovering the intricacies of our changing climate and the imperative of sustainable action. The REPowerEU initiative and the recently established RED (Renewable Energy Directive) directives have emerged as significant milestones, injecting fresh impetus into the transition. These regulatory measures reflect the fusion of newfound institutions with established ones, collectively acknowledging the critical need for an energy metamorphosis and comprehending the far-reaching consequences this shift entails. Yet, it's crucial to acknowledge that the dynamic nature of progress within the ambit of the green transition defies a static definition of "achievement." Instead, it's an ongoing voyage, a continuous commitment to recalibrating resource utilization and curbing the release of greenhouse gases, all to ensure the preservation of life and the intricate equilibrium of our planet's ecosystems.

The stakes of failing to expedite this transition or neglecting its integration into policy frameworks have swiftly materialized in our reality. A surge in unprecedented weather events, triggered by climate instability, has left thousands dislodged or tragically deceased. The long-term reverberations resonate across the planet, their complexity underscoring the challenges of precise risk assessment. The effects are tangible: biodiversity losses deemed implausible not too long ago; the inexorable rise of sea levels, encroaching on habitable lands; wildfires raging uncontrollably, crossing geographical boundaries; thousands succumbing to the relentless onslaught of heatwaves, with vulnerable populations enduring cardiac and vascular afflictions; extended spells of water scarcity and its associated upheavals.

Furthermore, these repercussions find an echo in local communities, magnifying the magnitude of the dilemma. The urgency to address these multifaceted challenges stands as a testament to the interconnectedness of scientific insights, policy formulation, and international cooperation. It's within this intricate interplay that we can chart a course toward a sustainable, resilient future.

At the heart of this endeavour lies the core understanding that climate change transcends mere environmental concerns; it permeates every facet of our society, from economics to public health, and from social justice to geopolitical stability. As temperatures rise and weather patterns grow more erratic, vulnerabilities emerge, straining existing systems and exacerbating inequalities. Inequitable access to resources amplifies the impact of climatic shifts on marginalized communities, deepening socio-economic disparities.

One cornerstone of this transition is the transition from fossil fuels to renewable energy sources. Solar, wind, hydroelectric, and geothermal power hold the promise of clean, abundant energy that doesn't contribute to the greenhouse effect. Technological advancements have propelled the cost-efficiency of these alternatives, making them not only environmentally sound choices but also economically viable options.

Equally pivotal is the need to embrace sustainable land use and conservation practices. Deforestation, for instance, not only contributes to carbon emissions but also disrupts intricate ecosystems that have evolved over millennia. Reforestation efforts can help sequester carbon and restore biodiversity. Moreover, innovative agricultural practices, such as agroforestry and regenerative farming, can rejuvenate soil health, enhance crop resilience, and reduce the carbon footprint of food production.

Cities, being hubs of population and economic activity, play an outsized role in the climate equation. Urban planning that prioritizes efficient public transportation, green spaces, and energy-efficient buildings can significantly curb emissions. The concept of "smart cities," leveraging technology for sustainable urban management, holds immense promise in this regard.

Addressing the climate challenge requires a global perspective. International collaborations like the Paris Agreement underscore the unity of purpose among nations to combat climate change. By setting emission reduction targets and fostering information exchange, such agreements serve as blueprints for collective action. Yet, to be truly effective, they require commitment not only

at the governmental level but also from the private sector and individual citizens.

In conclusion, the green transition embodies a paradigm shift that transcends ecological considerations to embrace a holistic transformation of our societies and economies. The REPowerEU and RED directives are indicative of this evolving landscape, where innovative policies intertwine with established institutions to catalyse change. The evolving nature of climate change demands a flexible approach to achievement, as we continually recalibrate our efforts to harmonize resource consumption and environmental equilibrium. The urgency of this transition is manifest in the mounting toll of extreme weather events and ecological disruptions. The path forward necessitates collaborative endeavours, blending scientific understanding with forward-thinking policies, while recognizing that climate change is not just a challenge – it's a call to shape a future that is sustainable, equitable, and resilient for all.

9.5.2 Ethical considerations

Navigating the complexities of climate change and the green transition involves numerous ethical considerations that are firmly rooted in accurate information and real-world facts. Here are some key ethical considerations to keep in mind:

Intergenerational Equity: Recognize that the consequences of climate change and environmental degradation disproportionately impact future generations. Ethical responsibility requires us to act today to ensure a habitable planet for those who will inherit it.

Global Equity and Justice: Acknowledge that vulnerable communities, often in developing countries with the least historical responsibility for climate change, bear the brunt of its effects. Ethical action demands addressing these disparities and ensuring that policies do not exacerbate existing inequalities.

Mitigation vs. Adaptation: Balancing efforts between mitigation (reducing emissions) and adaptation (coping with existing changes) is ethically complex.

Striving for a just equilibrium between the two is crucial, as some regions may need to adapt more due to irreversible changes.

Responsibility of High Emitters: Countries and industries historically responsible for a significant share of greenhouse gas emissions bear ethical responsibility to lead in emissions reduction efforts, acknowledging their role in creating the problem.

Technology Transfer: Ethical considerations extend to sharing sustainable technologies with developing nations, helping them leapfrog past carbon-intensive development and promoting global progress toward sustainability.

Conservation and Biodiversity: Protecting biodiversity is an ethical imperative, as species have intrinsic value and ecosystems support human livelihoods. Acknowledging the moral responsibility to prevent mass extinctions is crucial.

Informed Consumer Choices: Ethical consumption choices, including supporting sustainable products and practices, drive market demand and influence industries toward greener alternatives.

Worker Rights: The transition to renewable energy and sustainable practices must prioritize the rights of workers in industries affected by these changes, ensuring a just transition with retraining and new job opportunities.

Transparency and Accountability: Ethical considerations entail holding governments, corporations, and institutions accountable for their environmental impact. Transparency is essential for informed decision-making and progress assessment.

Collaborative Action: Recognize that the climate crisis requires collective action. Ethical engagement involves collaborating with individuals, communities, governments, and organizations to foster a united front against climate change.

Precautionary Principle: Ethical responsibility includes adhering to the precautionary principle, which states that in the absence of scientific consensus, if an action or policy has the potential to cause harm to the public or the

environment, in the absence of scientific consensus, the burden of proof falls on those advocating for the action.

Economic and Social Considerations: Acknowledge the interconnectedness of climate action with economic and social well-being. Ethical decision-making requires assessing potential impacts on employment, poverty, and social stability.

Educational Initiatives: Ethical engagement encompasses spreading accurate information about climate change and sustainability, empowering individuals to make informed choices and advocate for meaningful change.

Long-Term Thinking: Ethical responsibility involves considering the long-term consequences of decisions and avoiding short-term gains that could lead to irreversible environmental damage.

9.5.3 UN SDGs

Sustainable Development Goal 7: Affordable and Clean Energy:
This goal aims to ensure access to affordable, reliable, sustainable, and modern energy for all. The emphasis on transitioning to renewable energy sources, such as solar, wind, hydroelectric, and geothermal power, as mentioned in the text, aligns closely with SDG 7. By promoting the shift away from fossil fuels, the framework contributes to mitigating climate change and advancing clean energy adoption.

Sustainable Development Goal 13: Climate Action:
SDG 13 focuses on urgent actions to combat climate change and its impacts. The framework highlights the risks of delayed climate action, the consequences of extreme weather events, and the need for a comprehensive green transition. These elements directly resonate with the objectives of SDG 13, which seeks to promote climate resilience, adaptation, and mitigation efforts.

Sustainable Development Goal 15: Life on Land:
SDG 15 centers on protecting, restoring, and sustainably using terrestrial

ecosystems. The text's mention of biodiversity losses, deforestation, and their far-reaching consequences align with this goal. The emphasis on reforestation and innovative agricultural practices contributes to the conservation of biodiversity and the restoration of ecosystems, addressing both land degradation and climate change.

9.6 Conclusion

In conclusion, the journey towards a sustainable and resilient future is characterized by intricate interplays between scientific insights, ethical considerations, and the global framework of Sustainable Development Goals. The gradual implementation of recommendations, as explored in this discourse, echoes the incremental progress made towards a greener world. Initiatives like REPowerEU and the RED directives exemplify the synergy between innovative policies and established institutions, galvanizing the momentum of the green transition.

Central to this endeavour is the recognition that achieving sustainability is not a finite destination but an ongoing commitment. It's a continuous process of recalibrating our resource consumption, curbing greenhouse gas emissions, and adapting to the evolving realities of climate change. This dynamic perspective reinforces the need for adaptability and vigilance, as climate change's multi-faceted impacts continue to unfold.

The ethical considerations woven throughout the discussion serve as a moral compass guiding our actions. From intergenerational equity to global justice, these considerations underscore the profound responsibility we bear towards the planet and its inhabitants. The imperative to prioritize vulnerable communities, facilitate just transitions, and ensure equitable access to sustainable solutions echoes the essence of a collective endeavour.

Amidst the ethical considerations, the United Nations' Sustainable Development Goals stand as beacons of holistic progress. Sustainable Development Goal 7 beckons us to champion affordable and clean energy, weaving renewable sources into the fabric of our energy landscape. Goal 13, on climate action, resonates

powerfully with the discourse's emphasis on acknowledging the urgency of the climate crisis and forging a path towards resilience. Meanwhile, Goal 15 encapsulates the imperative of conserving terrestrial ecosystems and biodiversity, echoing the concerns raised about biodiversity loss and land degradation.

As the consequences of inaction materialize in the form of extreme weather events, rising sea levels, and loss of biodiversity, the imperative for collective action is undeniable. Collaboration remains pivotal in addressing this global challenge. Whether through international agreements like the Paris Agreement or through partnerships between governments, businesses, and civil society, the power of collaboration in achieving sustainable progress cannot be overstated.

In contemplating the journey ahead, it is essential to recognize that the pursuit of sustainability is an endeavour that transcends the realm of environmentalism. It is a call to reshape our economies, societies, and mindsets. By acknowledging the intricate interconnectedness of various elements — from economic considerations to social justice — we pave the way for a future that is not only environmentally sound but also inclusive and equitable.

The discourse explored here is a testament to the multifaceted nature of climate change and sustainability. It beckons us to adopt a comprehensive perspective, weaving together accurate information, ethical considerations, and the guiding principles of the UN Sustainable Development Goals. The text's narrative mirrors the complexity of the challenge we face, while also underscoring the profound potential for positive change that emerges when science, ethics, and global collaboration converge. Through this harmonious interplay, we can aspire to navigate the uncharted waters of climate change, leading humanity towards a future defined by its resilience, adaptability, and commitment to the well-being of both our planet and its inhabitants.

9.7 Disclaimer

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10 ANNEX 2: Interview questions

10.1 Innovators

Green transition

How do you feel about the transition of main sources of energy to alternative energies like bioenergy? Has this impacted your business?

Who/what has motivated you to pursue/evade the Green Deal approach? Do they still affect you?

Institutional genealogy

Have the ideals with which you started the company changed? Were there any influencing factors on why that you'd be willing to share?

What external factors (e.g. regulations, laws, policymaking, financing) do you feel have had the greatest impact on your company? Why? Have your goals changed over the course of the company's lifetime as a result of any of the previously mentioned external factors?

Regulatory

Did the European Green Deal have any kind of effect on your business?

How has the EU, as a supra-national institution, impacted your decision-making? How about the EC?

How do you feel your business has been impacted by the rise in the narratives promoting alternative sources of energy, like bioenergies? If so, can you give an example?

Do you believe there are frameworks set in place for your company and innovations to thrive in any specific markets? Can you give me an example?

Financial

What sort of financing would you believe is more effective for your company's path towards alternative sources of energy? Were there any institutions you felt more effectively provided that (e.g., EU or EC)?

Have there been any financial benefits that have lead you down towards the pursuit of bioenergy sources?

What would you change in the financing opportunities given to you?

Is there a connection between the policymaking and the financing opportunities available for you to develop R&D? How about for you to develop innovation?

Research & Development

Did the green transition and its policies bring new opportunities for you? Were those opportunities timely and advantageous? What other regulatory events provided you with opportunities?

If you had to percentually describe your company regarding efforts made towards R&D, innovation, commercialization and bureaucracy, how would you?

Do you feel this represents the market's needs or the governing entities' narratives?

Has innovation been a central focus of your research? How has the EC impacted this type of progress?

10.2 Regulators

Regulatory

Did the European Green Deal have any kind of effect on your activity's focus? At what levels?

How do you feel policymaking has been impacted by the shift to alternative energy implementation?

How timely have the changes you've implemented or worked on been regarding the implementation of climate-friendly energy sources?

Do you feel you have motivated others to pursue the Green Deal's proposed market?

Do you feel you have generated new content? Or do you feel your impact is incremental?

At what level do you feel your policymaking is making an impact? Universal, institutional, governmental, business or consumer level?

Have you ever felt like policies are made with a validation date?

Financial

What sort of financing would you believe is more effective for climate-friendly businesses' development? Has the EU or the EC provided that?

How do you feel policymaking has affected the EU's capacity for commercialization and innovation?

Research & Development

Have you worked on promoting the academic development of climate-friendly businesses and types of energies? Have you promoted industrial and academic connections?

Is there a harmonious and communicative connection between the policymaking and the financing opportunities available for R&D? How about for innovation?
Has innovation been a central focus of your work? How has the EC impacted this focus?

Institutional genealogy

Has the past had an influence on your workflow and decisions made by your consortiums?
Do you feel there is a foundation from which your decision-making is required to start and not question?
Have your consortiums' results and workflow changed with the climate-friendly policies and interests?
Have the ideals of the institutions you've worked for changed? Were there any influencing factors you'd be willing to share?
For the most important policy in your career, can you describe what the pathway was to arrive where it was/is? How has this affected your own profile and policymaking techniques?

10.3 Integrators

Regulatory

Why do you believe it is important to educate the consumers about the bioeconomy and other circularity concepts?

Do you believe consumers are easily made aware of policies and financing options to help them transition in their households?

You exist because others aren't properly informing and engaging directly with consumers about circularity options, but who do you think should be informing them in a first instance?

Do you feel you need to provide a "translation" of policy language for the public? Should policymakers make consumer-friendly versions of policies so the contents could be more accessible and appealing to the public? Why?

Would you be comfortable saying "the consumers' needs are taken into consideration in policymaking."?

Financial

How do you feel about the financial aid given to consumers for the transition? Do you believe there should be more of it? Do you believe it is well publicized?

Do you believe the governments and international institutions are supporters of your organization? Why?

Have governments, in your opinion, done enough to secure a fair transition for all?

Would be comfortable saying "the consumers' needs are taken into consideration in financing aids."?

Institutional genealogy

Could you, please, describe your organization? Was its creation inspired or a branching of a different institution? Public or private?

Who do you believe are your greatest institutional supporters?

How do you feel about cooperating with other organizations like yours? What about with private companies?

How do you feel about your organization's relationships with international institutions working towards the green transition? For example: European Commission, Circular-Based Economy Joint Undertaking, European Innovation Council.

11 Appendix: Research method

The research conducted in this thesis was considered exploratory due to the preliminary nature of the object of study. The relationships found within the legitimation and change nexus alone are a topic that has been explored in literature (Easton & Hess, 1962; Johnson & Urpelainen, 2020; Zelli et al., 2020), but adding the concept of institutional genealogy as a theoretical lens has the potential to put this research at a very nascent point, considering the historical approach that is added and the two other factors it connects via change and legitimation (David, 1994; Énergies, 2016).

Considering the objectives qualitative data collection typically fulfils are related to the gathering of insights and understanding regarding a phenomenon and the interactions associated to its research, rather than trying to extrapolate data at a general level and to other fields which are not related to the phenomenon, the qualitative techniques are the ones mostly used in exploratory research (Amy C. Edmondson & Stacy E. Mcmanus, 2007). Qualitative research also fit more properly with the research questions posed, as they mostly focused on "how" rather than a "how many", and with the way the phenomenon of legitimation was approached. The results from qualitative methods are focused on producing rich, in-depth accounts and extracting insights from the interactions between actors and the phenomenon or phenomena being researched (David Silverman, 2008; Easterby-Smith et al., 2018). Within the legitimation sphere, the types of strategies that can be used with qualitative research are very diverse and no specific one holds precedence when engaging with legitimation literature, as a great range has been previously employed on different types of legitimation research (Schoon, 2022). A quantitative research strategy, hence, was inapplicable in these conditions and approaches, as the purpose of the research questions were not to enumerate or attempt to mathematically define the phenomenon, nor was it to generalize the results from the data to other phenomena or ecosystems. Rather, the suitability of qualitative data to defining this research's phenomena in an intricate way is justified due to the complex institutional and organizational contexts mixed with the social aspect of the interactions being studied. Additionally, the actors' perspective on the

phenomena is also taken as the most important piece of evidence for the definition of the reality within which the phenomena are included in, thus providing further arguments for the use of a qualitative research strategy.

The other criteria used to define the interviewees and determine their contribution to the data collection was “Type” of actor. The “Type” of actor criteria was mostly related to the research questions mentioned above, as they were inspired by the types of influences that new ventures are affected by. Therefore, to find out the strategies that are used for the legitimation of bioenergies, the researcher planned to investigate new ventures and emerging innovative institutions that were trying to become legitimized businesses or projects in the new frontier of the energy sector, bringing forth the profile of “Innovator”. Thus, engaging with new ventures in the energy sector meant that the researcher would have to connect with successful and unsuccessful businesses and projects, at any stage of the legitimation process, to understand what kinds of actions and barriers they had found were the most influential on their journey, be that journey lengthy, relatively new, or even over. Even though the researcher chose to find “Innovator’s Innovator” as a “Type” of actor, these descriptors are not meant to be reductive, rather, they are reflexive of a specific side of the actor that was interviewed and how that side was considered valuable intel for the research into the new energy sector.

The researcher also decided to investigate the regulatory side of the legitimation efforts of the new energy sector. To research the regulatory side, the profile of a “Regulator” was chosen. This profile, though apparently defining someone responsible for being a “Regulator” includes, however, actors that were highly involved in the definition of projects and other initiatives which resulted directly from regulatory events. Consequently, the role of a “Regulator” includes policymaking profiles, i.e., actors that were directly involved in the policymaking activities that resulted in academic or bureaucratic capital used for the definition and limitation of activities from “Innovator”s; it also includes profiles that were very aware of the administrative and bureaucratic burdens necessary for new ventures to begin their journey into legitimizing themselves and their efforts to follow the new policies within their limits and within the limits of their own creations and technologies; and, finally,

it also includes those that were not responsible for the policymaking and production of documents but that were directly involved in the processes of reviewing and accepting new ventures via several different processes (e.g. project funding, investment capital).

Finally, the researcher chose to include the actors responsible for ensuring that the regulatory and innovative energy solutions were implemented in a way that allowed for society to use them and integrate them in the daily lives of the people for whom the regulations and innovations are made. Actors responsible for operating in later stages of research in the green transition are highly requested as part of the future developments and trends of research (Köhler et al., 2019). {Citation} The role of the "Integrator" is one that relies on the precedence of innovation and regulation being fully legitimized. These actors add an extra step into the legitimation process due to their ability to cause both legitimation or delegitimation movements based on the perceived social norms and impacts of new innovation (Köhler et al., 2019). The "Integrator" provides legitimated businesses, products and projects with the access to society and other venues which are for societal purposes, therefore taking another step in the process of full legitimation: continuity. The role of intermediaries in the transitions are those of ones who either promote the smoothness of the transition or disrupt the mechanisms which are deterring the transition, e.g. incumbent regimes (Köhler et al., 2019). This way, the researcher believed that the whole process of the legitimation of new ventures in the bioeconomy's energy sector would be covered: the innovators representing the innovative side of the energy sector, the regulators representing the bureaucratic processes and influences in the emergence and establishment of the energy sector, the integrators representing the strategies that define the implementation and establishment the results of innovation and regulation in society, and their combination for defining the connection among them to help identify areas of conflict and areas of symbiosis, thus providing further insight into the new institutions and their relationships with older ones (i.e., institutional genealogy). The representative context also took into consideration potential outliers to the definition of "Regulator", "Innovator" and "Integrator", such as actors which could represent a combination of profiles, having been in many of the situations described above for each of the "Type"s. The profiles with combo typing and,

therefore, the ability of providing rich insight into the connection between regulation/innovation/integration strategies were also included in the interviewee list and, when interviewed, prior mention of the types of themes in the questions that were to be answered was made in order for the actor to be given the option of deciding whether they would want to fit into one “Type” or go through with the combination typing approach.

A total of 30 semi-structured interviews were conducted. The use of semi-structured interviews, as is seen in other studies (Charles et al., 2016; Giurca & Späth, 2017; Gustafsson & Anderberg, 2021; Imbert et al., 2017; Iskandarova et al., 2021; Markard et al., 2016; Thompson et al., 2015), allows for the insight into legitimation strategies regarding the energy sector, and it explores the connection between the innovation and regulation and how they are implemented at an institutional and societal level. The semi-structured interviewing provides the researcher with the tools to explore the in-depth experiences of the participants regarding the context of the legitimation of bioenergies. In this legitimation context, the business emergence and policymaking during the green transition were the perspectives relative to the institutional genealogy that were explored, providing a more institutional and organizational perspective of the research. The integrators, which were also included as part of the sampling, provide the legitimation processes that comes after the funding and policymaking already established the proper practices and opportunities for the emergence of bioenergy businesses and institutions (King & Soule, 2007). Aside from the perspectives provided by the businesses and policymakers, the integrators give the societal perspective of the inclusion of the bioenergy businesses and institutions and how the implementation of these have been realized at the social level.