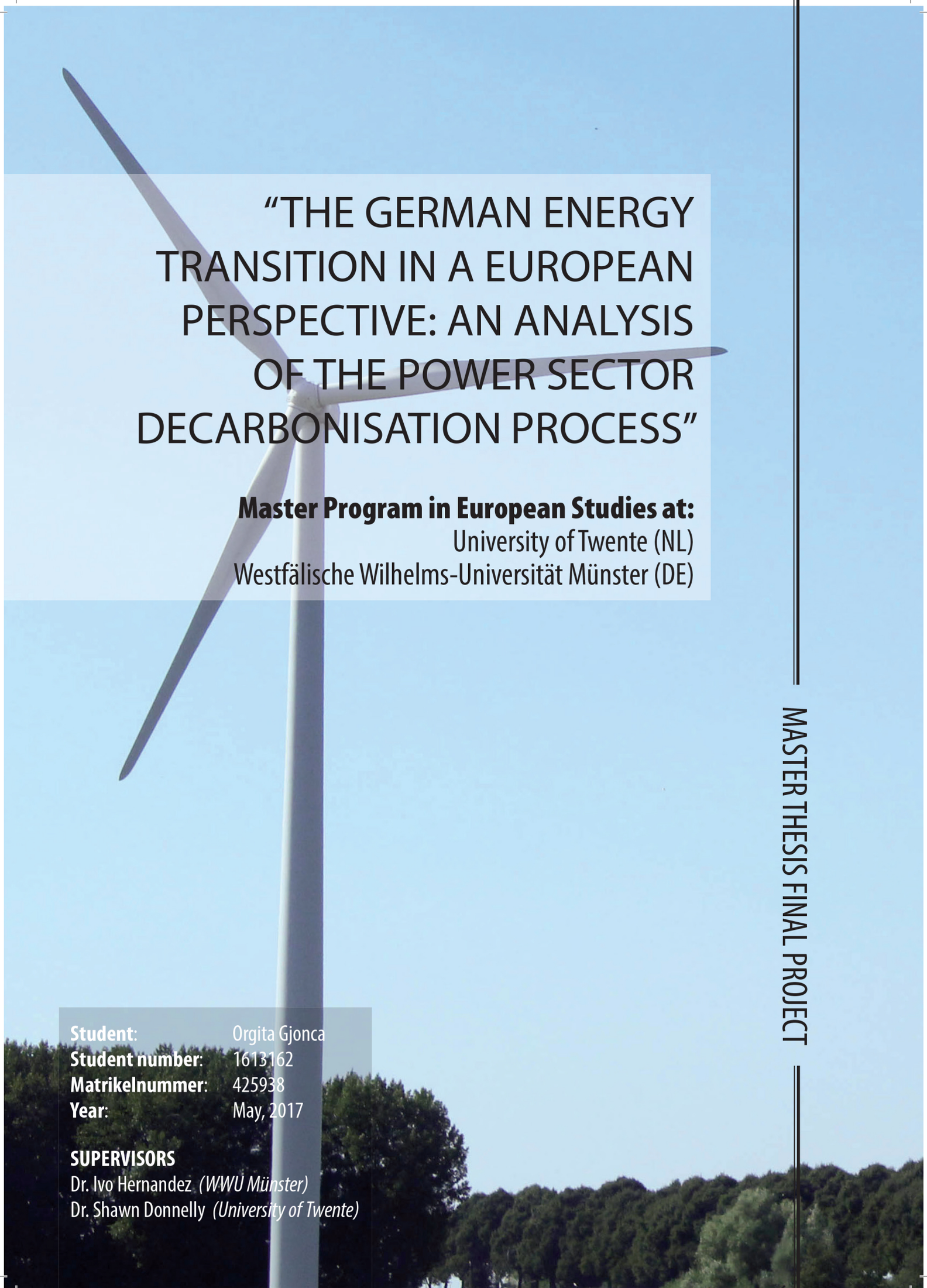

"THE GERMAN ENERGY TRANSITION IN A EUROPEAN PERSPECTIVE: AN ANALYSIS OF THE POWER SECTOR DECARBONISATION PROCESS"

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List of Acronyms

AGEB	Working Group Energy Balance *(Arbeitsgemeinschaft Energiebilanzen)*
BAFA	National Agency for Commerce and Export Control *(Bundesamt für Wirtschaft und Ausfuhrkontrolle)*
BMWi	Federal Ministry of Economic Affairs and Energy (*Bundesministerium für Wirtschaft und Energie)*
BMU	Federal Ministry of Environment and Nuclear Safety *(Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit)*
CCS	Carbon Capture and Storage
CDU	Christian Democratic Union *(Christliche Demokratische Union Deutschlands)*
COM	Communication
COP	Conference of the Parties
DDPP	Deep Decarbonisation
Dec	Decision
DG	Directorate General
Dir.	Directive
EC	European Commission
ECF	European Climate Foundation
EEA	European Environment Agency
EEG	Renewable Energy Act *(Erneuerbare Energien Gesetz)*
EP	European Parliament
EU	European Union
EU ETS	European Emissions Trading Scheme
FiT	Fid in Tariffs
FDP	Liberal Democratic Party (*Freie Demokratische Partei*)
GHG	Greenhouse Gas
IPCC	International Panel on Climate Change

IEA	International Energy Agency
KFK	Kommission zur Überprüfung des Kernenergieausstiegs
MS	Member State
MSs	Member States
SPD	Social democratic party *(Sozialdemokratische Partei Deutschlands)*
UBM	National Environment Agency (*Umweltbundesamt)*
UN	United Nations
UNFCC	United Nations Framework Convention on Climate Change

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1. Introduction

1.1 Subject of investigation

It is now consolidated common belief that the changings occurring in the global environment and climate are consequence of human activity, related in particular with the exploitation of energy generated from fossil fuels sources[1] (see IPCC 2013, IEA 2010, US National Research Council 2008, Bulkeley 2014, Akpan & Akpan 2012, Girardet & Mendonca 2009). The combustion process that generates energy causes, indeed, 83% of Greenhouse Gasses[2] (GHG) emissions worldwide (IEA 2010) and the release in the air of such pollutants tend to reduce the ozone layer and modify the global climate. Energy related emissions account for almost 80% of the EU's total greenhouse gas emissions with the energy sector representing 31%; transport 19%; industry 13%; households 9% and others 7% (EU Council 2009).[3] Since a rise of temperature above 2°C is expected to be threatening life on Earth, by irreversibly modifying the existing ecosystem (Hansen et.al 2013), a big part of the scientific community calls for coordinated international efforts in mitigation and adaptation techniques[4] (Joint Science Academies 2008:1-2). The international response to these concerns has, however, developed quite controversially during the last century because of the difficulty in measuring responsibilities on climate change and due commitments of single countries with a marked division among developed and developing economies.[5] Although the terms to achieve emissions reduction still differ among countries, a common position on the long-term strategy to achieve this reduction has been developing throughout the last decade (in particular within the Copenhagen Accord of 2010 and the COP of Paris 2015[6]) and is contained in the *decarbonisation* paradigm.[7]

[1] For fossil fuels are meant fuels formed in the Earth from dead plants or animals and include coal, oil and natural gas.
[2] As GHG are intended pollutant gases as Carbon dioxide (Co_2) Methane (CH_4) Nitrous oxide (N20) Hydrofluorocarbons (HFCs) Perfluorocarbons (PFCs) Sulphur hexafluoride (SF6) (Annex A of the Kyoto Protocol).
[3] European Council, Brussels, 29/30 October 2009, Presidency conclusions 15265/1/09.
[4] While mitigation mostly entails a reduction of pollutant emissions in the short term, adaptation foresees, instead, a shift of energetic behavior in the long term through new methods of energy exploitation and conservation (Joint Academies 2008:1-2).
[5] Is the case of various rounds of international negotiation where no collective binding agreement on emission reduction among developed economies could be reached (UNFCC COPs from 2000 to 2010) but also the case of just partial accomplishments (as the Kyoto Protocol of 1997 which second phase has not been successfully re-ratified in 2012 and the COPS of Paris 2015 in which reductions are limited to national voluntary plans).
[6] In the Copenhagen accord of 2010 was agreed that *"deep cuts in global emissions are required according to science"* (art.2 of the Draft Decision) while in the UNFCC of Paris 2015 was agreed to maintain global warming below 2°C and reduce emissions *"so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century"* (Article 4.1 of the Paris Agreement).
[7] Agreement on low-emissions development strategies are visible already in the Stockholm Conference of 1972 (with its 16 principles on energetic resource conservation), in the emission reduction target agreed in Kyoto in 1997and the subsequent conferences already mentioned.

As the term suggests, decarbonisation entails that our fossil-fuel based economies need to undertake a process of reduction of carbon emissions (Co_2)[8] in the environment leading to almost a zero-annual footprint (carbon neutrality) (DDPP 2015, Barker & Crawford-Brown 2014). This virtual phase-out of carbon dioxide in the economic system needs to occur with an *energy transition* meaning with a "*shift in the nature or pattern of how energy is utilized within a system"* (Araujo 2014:112). To this end major shifts in energetic production are needed, through the improvement of low-carbon sources of energy (best represented by renewable energy)[9] and energetic consumption, as well as improved savings and efficiency techniques (World Watch Institute 2013, Pearce 1991:11-12).

Among its biggest supporters, the European Union is engaging in the decarbonisation pathway not only for its historical responsibilities in the global warming inheritance, but also to accomplish its broader energetic objectives: firstly reducing the dependence on imported energy (53 % of energy consumed is imported) and secondly gaining competitive advantage in the green economy[10] (EC 2011). The European Council agreed already in 2009 to a deep cut in fossil fuel consumption in order to reach an 80%-95% emissions reduction by 2050 (compared to 1990 levels), but just two years later the Commission transposed this target into a long-term policy plan (EU Council 2009, EC 2011). Thus, to achieve a "*prosperous, low-carbon Europe"* the Union has presented in 2011 the *EU Roadmap 2050 project* [11] which furnishes a "*framework for dealing with the issue of sustainability and the cross-border effects of phenomena that cannot be dealt with at the national level alone"* (EC 2011:3). Based on economic modelling and stakeholders' public consultation, this Communication provides a technology neutral technical assessment of possible pathways to follow for the achievement of drastic carbon reduction. This document is further complemented by an additional assessment plan, the *Energy Roadmap to 2050* in which the Commission elaborated framework guidelines for decarbonising the power sector (EC 2011). Not of a binding nature, this long-term scenario elaborated by the Commission does not however replace Member States' (MSs) domestic legislation in energy and environmental policy, two policy fields of shared competence between the Union and the Member States[12].

[8] The attention on carbon dioxide is given because among the GHG is the one with the most severe and spread effects worldwide, and is now considered as unity of reference when fixing environmental targets (Akpan & Akpan 2012:22)
[9] For renewables are intended resources which are naturally replenished on a human timescale, such as sunlight, wind, rain, tides, waves, and geothermal heat (Ellabban 2014).
[10] Green economy can be defined as an alternative vision for growth and development;" one that can generate growth and improvements in people's lives in ways consistent with sustainable development" (World Resources Institute 2011)
[11] Roadmap was already introduced in the 7th flagship of the EU 2020 strategy and afterwards object of a Commission Communication of 2011 (COM (2011) 112 final/2).
[12] As established by Art. 4 Treaty on the Functioning of the European Union (TFUE) both fields are subject to shared competence between EU and MSs.

When looking at concrete practices among Member States, an interesting case of decarbonisation policy is furnished by the German structural reform of its energy system known as the *Energiewende* (the German term for energy transition)[13]. Initially justified by the country's resistance to nuclear energy, this transition has been then concretised in legislation between 2010 and 2011 with the Energy Concept (*Energiekonzept*) and the Rösel/Merkel resolution. As compass of this strategy, the Energy Concept provides for the first time in Germany an "*all-round strategy*" in energy policy with measurable targets and environmental objectives to be achieved in the long-term (by 2050). To provide the country with a "*clean, safe and reliable"* energy supply, this strategy envisages in the long term a shift from fossil fuel sources to renewable energy, the electrification of transport and the increase of energy efficiency and savings (BMWi & BMU 2010). An 80% to 95% decrease in emissions in comparison to 1990 level has to be achieved with a further limit in nuclear energy, supposed to be phased-out by 2022[14]. The deep cut in emissions is thus assumed to be achieved through a substantial use of clean renewable energy, which infrastructure is planned to grow considerably already by 2020 (to cover 40% of the country's energetic need). Therefore, the speed and limits required by the German energy transition increase the innovative potential of this long-term policy, which success may represent an example to follow by other industrialised countries. Indeed, the resonance of this transition, happening in the biggest economy and electricity market of the European Union, justifies the focus of this research.

The analysis proposed in this work seeks to understand how the decarbonisation objective made its way to a formal strategy in the European Union and in Germany and how it is implemented in concrete action.
In particular, the analysis aims at a) contextualising the low-carbon commitment of the Germans at the national and international level, b) at understanding and defining the relevant connections between them and c) at evaluating the concrete decarbonisation effort in German domestic policy. Using the German case, this research tries to shed light on decarbonisation policy formulation, assessment and implementation.

1.2 Research Question

With the observation of both, the supranational and national framework on decarbonisation policy, this research seeks to discover how energy transitions are formally regulated and how they develop in policy practice. To this end, the research closely analyses the decarbonisation scenarios proposed at the EU and German level in the Energy Roadmap to 2050 and in the Energy Concept. Despite the different features in regulatory nature and purpose, these two long-term plans both provide a technical assessment for achieving

[13] The term was coined in a 1980 study by Germany's Institute for Applied Ecology and then used in the 1982 publication "Energiewende, Growth and Prosperity without Oil and Uranium" (Agora 2015:5).
[14] Planned by 2022 the nuclear phase-out has been wanted after the explosion of the Japanese nuclear reactor of Fukushima in 2011 (Hübner 2013).

an almost zero-emissions (80% to 95% reduction) scenario by 2050 and both assume a shift in energy production methods. The framework strategy proposed at the EU level, although technology neutral, highlights which changes are critical for an EU-wide attainment of the decarbonisation objective and therefore can be considered as reference framework for Member States' domestic policy. Thus, for the scope of this research, the Energy Roadmap will be used as reference for the analysis of the German energy transition and a comparative policy analysis will be undertaken. Further, with a focus on the German case and with a mixture of descriptive and exploratory research intent, this research will try to address the following key research question:

RQ: "*Does the German energy transition conform to the EU energy framework of long-term decarbonisation towards 2050?*".

To provide a more detailed analysis of the issue, this research question will be also complemented by three sub questions. The first one will try to assess what type of relationship exists between the decarbonisation plans of the EU and of Germany and whether this connection depends on the membership to the European Union. Therefore, looking at the formulation phases of both decarbonisation strategies, the first sub question will address the following issue:

SQ1: "*Is there evidence of policy convergence in the formulation of the EU Energy Roadmap 2050 and the Energy Concept of the Energiewende?*"

Once assessed the nature of their relation and having contextualised the German energy transition in the European settings, the second and third sub-question will instead primarily focus on the domestic impact of the long-term policy. Through an analysis of the power sector, the research will in this way shed light on the implementation phase of the energy transition (with particular focus between 2011 and 2016).

Making reference to the policy values that drive preferences among different coalitions, the research will firstly analyse the preliminary economic and social effects of the German transition by answering the following question:

SQ2: "*Is the German energy transition performing according to the reference values it proposes?*"

Finally, the third sub question, will evaluate the internal consistency of the environmental commitment to effective policy action by analysing the following issue:

SQ3: "*Are the changes applied to the power sector sufficient to reduce carbon emissions in the short-medium term?*"

Answer to the sub questions will be find along the research and then summarised in the conclusion.

1.3 Scientific Relevance

Both the EU Roadmap 2050 and the German Energy Transition have been extensively analysed in the literature of the last six years. After their publication, both decarbonisation assessment plans have received great academic and media attention due to their high levels of political commitment. Most of this literature, however, is concerned with the evaluation of the economic and technological feasibility of these pathway strategies, showing that uncertainty on the topic is still very problematic.

Looking at the European Union's plan, most of the impact assessment studies have been carried out by the European Climate Foundation, which has provided several reports with technical measures for the adoption of the policy plan (Roadmap 2050, Power Perspectives 2030, From Roadmap to reality) (ECF 2010, 2011,2013). Successive analysis has been then characterised by evaluations or recommendations of the policy strategy. From one side supporters of the decarbonisation pathway have argued the importance of its objectives in environmental and energy security terms[15] (Streimikiene 2012, Kuzemko 2012:201, Fermann 2009:24), while from the other critiques have argued that the policy framework is rather vague and contradictory (Lorubio & Schlosser 2014:69-70), furnishes too optimistic scenarios[16] (Helm 2014:30-32), and that may result inconsistent without a coordinated effort of the international community (Kuik & Hofkes 2009:1). Additionally, part of the literature sees this decarbonisation projection of the Union as not strictly necessary in terms of emissions' global share[17], but very climate effective if the EU acts as a "*global provider of low-carbon innovation"* to allow developing countries to achieve low-carbon prosperity (Pellerin-Carlin 2016:19). Critical analysis, however, suggests to review the instruments codified in the Roadmap, by giving more priority to alternative low-carbon solutions (as nuclear energy, CCS technology[18] and the regulation of shale gas[19]) (see Capros et.al 2014, Hoglund-Isakkon et al 2012, Pfluger 2014), or by reforming the European Emission Trading Scheme (EU ETS) and the EU Energy tax directive of 2003[20] (see Erbach 2014, Tol 2012).

In the specificity of the German case, instead, most of the socio-economic analysis available has been carried out by specialised policy research centres and think tanks, mainly "Agora Energiewende" funded by the European Climate Foundation, "German Watch" and the "Energy transition, the German Energiewende" related to the Henrich-Böll Foundation[21]. Additional analysis is divided, also in this case, among supporters

[15] The policy preference for renewable low carbon sources would indeed benefit the economic advantage of the Union in the high-tech green development, and fulfill internally the security of energy supply.

[16] Helm (2014:30-32) refers to the optimistic attitude at the time of publication, when it was expected that fossil fuel prices were going to increase in the short and medium term, and that the European green products could be immediately competitive in global markets.

[17] The EU currently represents just 8,7% of global GHG emissions (World Resources Institute 2016)

[18] CCS is a technology that can capture up to 90% of the carbon dioxide (CO_2) emissions produced from the use of fossil fuels in electricity generation and industrial processes, preventing the carbon dioxide from entering the atmosphere by being stored underground (CCSA 2011).

[19] Shale gas is natural gas that is found trapped within shale formations (U.S. Energy Information Administration 2013)

[20] For details on the EU ETS and the Energy tax directive see chapter 3

[21] Affiliated to the Green Party

of the energy transition in its "green footprint" and triumph of renewables (Enkhardt 2012, Martinot 2015, Morris & Pehnt 2015, Ulrich et al. 2012, Bechberger & Reiche 2004), negative critiques which disapprove the instruments adopted to foster RES expansion and ask for a more convincing "coal phase out strategy" (see Schultz 2013, Mc Cown 2013, Birnbaum 2013 Frondel et.al 2010-2015, Jordan-Korte 2009 Bontrup & Marquardt) and concerned observers that call into question the socio-economic effects of the energy transition (Huebner 2013, Schulze & Wolf 2015, Jungjohann & Morris 2014).

Concerning their relation, there is no relevant work which compares their path of evolution or relates them somehow to each other. As a matter of fact, the literature is mostly focused on diverse policy areas, as the environmental one (with studies on the affection of EU Environmental policy instruments on the German environmental policy) (Solorio 2011:398), and the renewable energy one (see Fischer 2017 with the "Europeanization of the Energiewende") or ultimately asks for general adoption of the German transition in the rest of Europe (as Strunz et.al 2014 which assert that the *Energiewende* should be Europeanized).

Finally, in evaluating the decarbonisation effort of the Federal Republic, no independent analysis has so far reported extensively on the changes occurring in the power sector. The progress reports publicly available are indeed predominantly issue-specific (see Agora Energiewende and the Wuppertal Institute of Energy and Environment) or provided by governmental authorities, in particular by the Ministry of Economic Affairs (BMWI) and by the Ministry of Environment (BMU). Despite the high scientific value of these reports and analysis, they tend to remain rather sectorial studies, which fail to address a comprehensive understanding of the implementation phase of the policy. In particular, they omit to consider the role of organised interests and industrial partners, which behaviour is essential to understand policy preferences and policy change, and the interactions with the international and European normative instruments. The purpose of this research will be the one of closing the gap by collecting the most comprehensive information possible in order to understand and make sense of the changes occurring in the German energy sector, and evaluate them in light of their European reference framework.

1.4 Thesis Structure

After this introductory chapter, in which the topic, research question and scientific relevance have been presented, chapter 2 will provide the theoretical and methodological framework in which the research has developed. Chapter 3 will then provide background information to better understand the European and German regulatory framework on decarbonisation together with the targets and tools proposed in the EU Roadmap 2050 and in the *Energiewende*. The empirical analysis will be then carried out in chapter 4 and 5. In the former will be tested the relation among the two decarbonisation policies, while in the latter will be tested the efficacy of the decarbonisation effort in Germany. Lastly, chapter 6 will present the main findings, the limits of the study and the final conclusion.

2. Theory and Method

This chapter provides explanation of the main concepts used in the thesis, the theoretical background that leads the research, and the methodological techniques used for the analysis of data and the processing of information.

2.1 Theoretical Background

To answer the main research question exposed in Chapter 1, this section firstly explicates the differences in terminology used during the research and then presents the theories under which lenses the problem will be evaluated. It firstly provides an explication of the main concept used in the research, namely energy transition and decarbonisation, and afterwards presents two possible interpretations for the development of decarbonisation policy in Europe.

2.1.1 Conceptualising Energy Transitions and Decarbonisation

The choice of an energy system is "*a political choice that shapes our society and political regimes*" and changes in the energy system are fundamentally political (Pellerin-Carlin & Serkine 2016:18; Aklin & Urpelainen 2013). The need for an energy system change is strictly dependent on the feelings of urgency of action, trade-offs between sources and technological innovation (Aracuio 2014:113-114). When deciding for changes in the energy system, we assist to an energy "transition"[22], a regime shift that tends to modify the social, economic and technological structure of societies (Strunz 2013). The term *energy transition*, however, has no unique definition and its meaning has varied over time. Initially addressed in the 1930s as molecular process of change (changes in energy states after molecular dissociation), the term started being associated in the 1970s to fuel substitutions and resources limitations in the aftermath of the first oil crises (Aracuio 2014, Fressoz 2013). The use of the term transition under this last connotation, however, has been criticised by several energy historians, which argue that over the past centuries, energy systems have constantly undergone a form of energy "addition" rather than transition[23] (Smil 2010, Wrigley 2010). Contemporary use of the term is instead focused on the ways economies transform their energy system to reduce polluting emissions. Indeed, the mainstream expression of the term is now used to describe the "*transformation of our energy system from high-carbon systems relying on fossil fuels (i.e. coal, oil and gas) to low/zero-carbon energy systems relying on energy efficiency and renewables"* (Pellerin-Carlin & Serkine 2016: 17-18). The energy

[22] Transition assumes the occurring of gradual changes and promises eventual closure (Meadowcroft 2009: 326)

[23] This addition of a variety of energy sources, sometimes justified by political objectives rather than technological innovation, would explain why in human history a clear substitution of sources, meant as a real transition, has never taken place (Smil 2010, Wrigley 2010).

transition starts, in this way, being associated with the aim of decarbonising the economy as climate change mitigation technique (Unruhu 2000).

Decarbonisation, assumed as major objective of the long-term policy framework of the European Union (Roadmap to 2050) foresees a virtual phase out of carbon dioxide in the economic system in the long term (Aracuio 2014:112). Defined as *"the process of improving infrastructure over time by replacing inefficient and carbon-intensive technologies with efficient and low-carbon technologies that provide the same (or better) energy services"* the notion of decarbonisation has now added to energy transitions a further environmental connotation (DDP 2015:9). For this reason, it makes sense to talk of low-carbon energy transitions when handling the issue in modern societies.

The way in which decarbonisation entered the political arena in the European Union and in Germany will be analysed throughout this research. For the moment, the following paragraph will furnish some theoretical explanations that sheds light on the origins and contextualization of this policy discourse.

2.1.2 Shaping decarbonisation policy

In its long-term plan for energy and climate policy of 2011, the EU envisages a drastic reduction in energy-related GHG emission (80-95% compared to the 1990 level) to be achieved by 2050 (Energy Roadmap to 2050). A formal commitment, however, was given already during the G8 of 2009 and the EU Council of the same year. The same target is also present in the German plan of energy transition, which has been ruled in the Energy Concept of 2010 and started being applied since then. Due to the relatively small time-span of events and their similarity in approaching the decarbonisation objective, seems that neither the Union could operate without the approval of the German government, nor the Federal Republic could commit itself to such restriction in isolation. The nature of this relationship is however still unclear, and from here comes the need of addressing the first sub question of the research: *"Is there evidence of policy convergence in the formulation of the EU Energy Roadmap 2050 and the Energy Concept of the Energiewende?"*

2.1.2.1 Low-carbon transition as result of Europeanization

Whether this reciprocal influence exists, it should originate in the membership to the EU, because it is the point of contact between national and supranational policy. A possible explanation for this type of relation could be offered by the tools of the *Europeanization theory*, developed in the late 90s and gaining importance the more European integration increases. To be precise, Europeanization does not consist of one specific theory, but rather of a conceptual framework that comprehends different theoretical and explanatory schemes (Featherstone 2003:12) elaborated to make sense of the changes in domestic policies experienced by the member states of the European Union (see Andersen and Eliassen 1993, Kohler-Koch 1996, Radelli 2000, Hix & Goetz 2000, Cowles et.al 2001, Börzel & Risse 2001, Heritièr et.al 2001). Europeanization,

defined as a "*process by which domestic policy areas become increasingly subject to European policy-making"*, assumes that being part of the European Union causes the "*penetration of the European dimension into the national arena"* (Börzel 1999:574) (Gamble 2001:1). This conceptual framework assumes that European affection modifies domestic policy through an incremental shaping process of policy-making practices (Ladrech 1994:69).

In this perspective, policies, procedures, norms and beliefs '*are first defined and consolidated in the EU policy process and then incorporated into the logic of domestic discourse, political structures and public policies'* (Radaelli 2003: 30). The basic assumption is that the European Union is able to create an adaptational pressure on Member States to induce changes in line with the methods adopted at the supranational level.

Adaptational pressure depends in the first place by the *goodness of fit* between the institutional settings and decision-making processes at both levels (Börzel & Risse 2000). The lower the compatibility (misfit) of decision-making structures, the higher the adaptational pressure that the EU might exert on MSs and in turn increased the probability of change (Börzel 2005, Börzel & Risse 2007). The goodness of fit argument, although considered just as the first enabling factor for domestic change, rather than a direct casual mechanism of change[24], is generally accepted as starting point for investigation, and has been further elaborated by several authors. Schmidt (2006) for example, added a major distinction in authority concentration to predict the outcome of domestic change: *simple* and *compound polity*. Under this distinction, countries where there is a strong unitary government (simple polities) that are not used to dispersed governing activity should experience greater adaptational pressure from the EU, while regional or federal countries (compound polities), where authority is dispersed at lower levels of government and the institutional structure resembles more to the decentralised one of the EU, should be exposed to a smaller extent to adaptational pressure.

Further analysis of this adaptational pressure has been done looking at the impact of Europeanization on domestic actors and institutions, and follows two distinct logics as drivers of domestic change: the logic of consequentialism and the logic of appropriateness[25] (Börzel & Risse 2003:58).

The *logic of consequentialism* assumes that the misfit between European and domestic structures provides societal and political actors with new opportunities and constraints to pursue their interests. This approach suggests that Europeanization generates domestic change by creating the conditions for a reconfiguration of the distribution of resources at the domestic level that in turn empowers actors differentially (Dobrescu 2015:45). In this sense the Union may furnish to national actors new opportunities to exploit but requires at

[24] However, the Goodness of fit argument is just 'an enabling condition for the domestic impact of Europe, a starting point without much weight in and of itself', and whether adaptational pressure can actually generate concrete domestic change depends on a set of mediating/intervening factors (Börzel & Risse 2007:492).

[25] This conceptualisation draws on two strands of the 'new institutionalism' in political science: the first on rational choice (or rationalist) institutionalism and the second on sociological (or constructivist) institutionalism (Börzel & Risse 2002:58).

the same time constraints in behaviour. Therefore, actors, especially when it comes to the choice of membership, assume a strategic and rational behaviour and evaluate cost and benefits of needed domestic changes[26].

On the other side, the *logic of appropriateness* assumes that actors internalise institutional norms and become persuaded by their legitimacy, and therefore act accordingly. They do not initiate domestic change just to comply with EU direct and indirect regulatory requirements, but also because their beliefs and preferences have been altered by a socialisation process[27] (Featherstone 2003:7 -9). Described by Knill and Lehmkuhl (2002) as the "framing effect" on domestic beliefs, this mechanism is the most indirect way of European influence, and is considered as the "*first step to change the domestic climate in favour of particular ideas"* (Sittermann 2006:14). It is particularly useful in areas where the EU does not have full regulatory competence and is applied to issues that prepare for more far-reaching policies.

Following this reasoning, the European adaptational pressure on German domestic energy policy can be hypothesized as follows:

- Relatively to the goodness of fit argument it should have a rather weak effect on German domestic institutions because of the similarity in decentralized structures and decision making procedures (Federal states are considered as compound polities)
- Relatively to the logic of consequentialism, German domestic actors should initiate domestic change towards decarbonisation just if the long-term plan of the Union has the potential to create new opportunities and benefits
- Relatively to the logic of appropriateness, German domestic actors should initiate domestic change towards decarbonisation because of a framing effect of domestic beliefs oriented towards low-carbon energy scenarios.

However, among those arguments, the one that seems more feasible to the case under investigation is the last one. Indeed, the first two hypotheses result less useful if is considered that the policy plan of reference is the Energy Roadmap to 2050, a non-binding framework strategy published also later than the Energy Concept of the German energy transition. The framing effect argument, in this sense could operate relatively more easily, and may have exercised indirect influence in the form of socialisation and learning[28] in the policy formulation of the German energy transition.

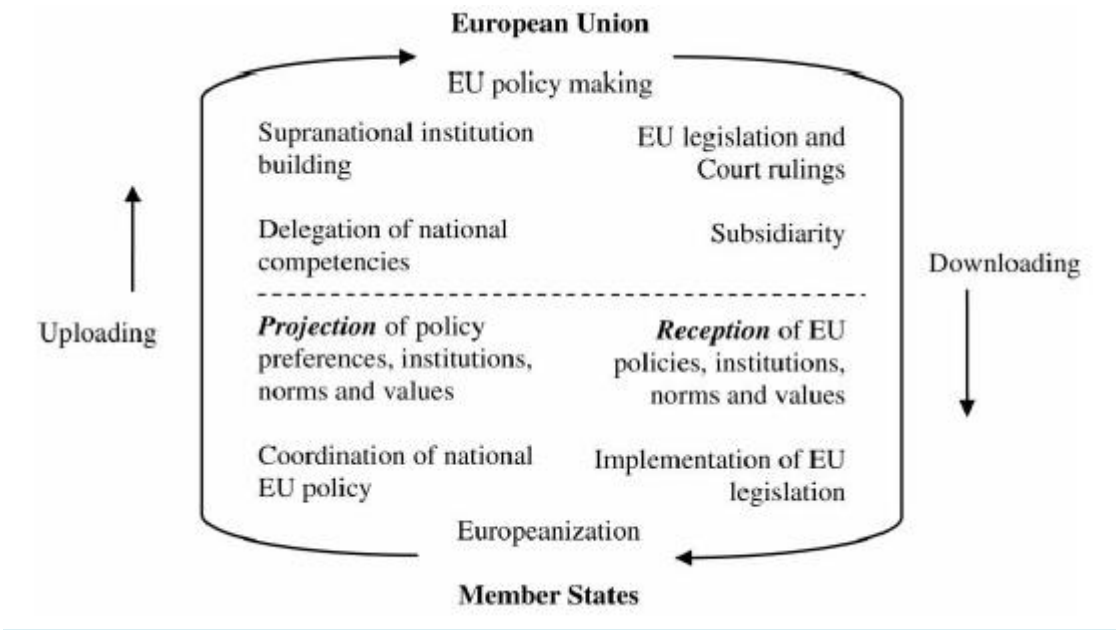
[26] The logic of consequentialism has been mostly used to analyse the behaviour of candidate countries when approaching the benefits of membership against the constraints of national reforms (see for example Dobrescu 2015).

[27] Socialisation in the context of the EU implies the *"conditions under which, and mechanisms through which, institutions in Europe socialize states and state agents, leading them to internalize new roles or group-community norms"* and implies *"multiple personal and institutional contacts, which inevitably serve as a mechanism of Europeanization"* (Checkel 2005: 804-807)

[28] Learning occurs when actors become increasingly aware of different approaches and methods elsewhere, or of their own practices and therefore change their policy orientation (Visser 2009:42).

Under this perspective, Europe exercises a "top-down" affection on Member states, which will eventually, directly or indirectly, end up modifying their own domestic rules and structures (Cowles et.al 2001). However, just like formulated policies at the EU level have an impact on domestic settings through domestic actors and/or institutions (through 'downloading'), policy ideas from the national level may likewise influence European policy making at an early stage (through 'uploading') (Van Gerven et.al 2014). Domestic actors not only "download" communitarian regulation passively, but also try to upload their preferences during EU policy development phase in order to limit the costs of change (Ladrech 2010:32). Thus, Europeanization is neither entirely a bottom-up nor a top-down linear interaction, but rather a "*continuous process of interaction between the levels"* that constantly involve national and European actors, institutions and organizations (Becker 2010:49).

Figure 1: Europeanization as top-down and bottom-up process



Source: Börzel 2005

Therefore, scope of this research will be the one of looking not just at '*the extent to which EU requirements and policies have affected the determination of member states' policy agendas and goals'* (Bulmer and Burch, 1998: 602) but also the one of determining the active role of Member States, in this case Germany, in shaping the EU policy agenda on decarbonisation. This tow-sides approach to Europeanization is indeed particularly relevant when one aims to compare two sets of legislation developed by different institutions but with similar objectives and time frames, as the Energy Roadmap to 2050 and the Energy Concept of the German Energy Transition, and understand if and how they are connected to each other.
To shed light on their reciprocal relation, the research will particularly look at:

- the dimensions of European affection (whether the MS passively download European policies and norms or also succeed in actively influencing them through an upload of preferences)
- the mechanisms of European affection (how the hit occurs: through direct legal imposition or indirect socialisation)
- the outcomes of European affection (what type of change occurs in a range of complete adaptation and no affection) (Ladrech 2010:22, Börzel & Risse 2007:485).

2.1.2.2 Low-carbon transition as shift of societal values

Despite the direct or indirect effect that the European Union may have had in the formulation of the German energy transition, the shaping of this policy demonstrates that in domestic policy increasing awareness on the themes of environmental conservation and sustainability[29] of the economic system exists. As a matter of fact, the environmental commitment has been the leading feature attached to this transition, which since its first formulation[30], asked for the gradual abandoning of nuclear and fossil fuel energy. The shift to domestic renewable energy sources has so far allowed many private citizens and communities to engage in energy production, increasing public support for the goals and objectives of the transition[31](Agora 2015:5, Jungjohann 2016). Thus, the environmental shape of low-carbon transitions may imply that a new consensus and system of core values could emerge in countries that sustain such policy.

Adopting an energy system change of this proportion can be indeed ascribed to a change in societal and political values. The discussion on political value change within society reconnects to the value shape that Ronald Inglehart has conceptualised as the *materialist/postmaterialist dimension*.

In "The Silent Revolution" (1977), Inglehart argues that industrial societies are undergoing a gradual value change from materialist to postmaterialist values, from giving greatest priority to values which reflect a preoccupation with economic security and sustenance towards a heavier emphasis on quality of life values, belonging and self-expression (Knut 1990, Marks 1997). The term "materialism" incorporates economic materialist values, such as "economic growth" and "economic stability," as well as authoritarian values, while the term "postmaterialism" incorporates typical "green" values, such as "environmental protection" and less emphasis on money and economic rewards, as well as a libertarian conception of democracy (Knutt 1990). This argument is based on two hypotheses which Inglehart labels scarcity hypothesis and socialization hypothesis. The scarcity hypothesis is based on the assumption that an individual's values reflect the socioeconomic environment and therefore people tend to place high priority on whatever needs are in short

[29] In environmental science is referred to as "the quality of not being harmful to the environment or depleting natural resources, and thereby supporting long-term ecological balance" (Dictionary.com)

[30] In the Energiewende-Wachstum und Wohlstand ohne Erdöl und Uran 1981publication

[31] Being 60% of the countries' capacity produced by farmers and homeowners increases the support and democratic feature of the transitions. Regular pools show that 90% of German citizens are in favor of its goals (Agora 2015, Jungjohann 2016).

supply (Knutsen 1990, Knut 1990). Inglehart employs Maslow's hierarchy of needs to argue that once material needs are satisfied, people value postmaterialist concerns more, and therefore non-material issues gain overtime policy priority (Maslow 1954). Instead, the socialisation hypothesis is based on the notion of basic human personality structure of individual value priorities affected by early socialization in social and political values (Knut 1990). This assumption mainly envisages also a generational clash in priorities and beliefs. Therefore, abandoned the existing opposition between labour and capital, western societies are entering a new phase where political conflicts increasingly arise from tensions between materialists and postmaterialists (Inglehart 1971,1977).

These hypotheses were tested through surveys across European countries in the 70s and brought Inglehart to contend that in societies with high standards of living, high levels of education and prosperous economies, it is visible a clash of material / postmaterial values (Berry 1999:35). In the policy context material interests typically reflect the demands of organized labour, farmers or business and refer to policy areas as subsides, market regulation and employment (Berry 1999:43). In interest group politics those who advocate policies establishing some material benefit are usually the same constituencies that derive the benefit (ibid. :44). Proponents of postmaterial values are instead public interest groups which donors will not benefit from the lobby's endeavours. Postmaterial advocacies are motivated by the simple objective of improving other people's lives and they usually refer to policy areas as environment, social equality and education (ibid.:44-45). The clash of these policy preferences should then be visible in the formulation of the public policy, which will result always more incline to satisfy one or the other side of preference.

In the specificity of decarbonisation policies as the *Energiewende* one can argue that such policy project is mostly expression of postmaterial values because it addresses quality of life issues and pursues environmental protection. However, it must be clarified which concrete aspects and instruments of the policy reform attain to which set of value and which coalitions have been formed to advocate in favour of material or postmaterial values. Once identified instruments and coalitions, this research will further analyse how the advocacy process is taking place and how it is evolving in the implementation phase. Scope of the analysis will be then proving if a clash of values exists in the formulation of the decarbonisation policy but also if it persists during the implementation phase in this work materialist and postmaterialist values will be used to furnish a clear distinction and critical perspective on the internal policy process of the German energy transition, and will help conduct the stakeholder analysis.

2.1.2.3 Formulation of Hypotheses

Since both the EU Roadmap 2050 and the *Energiewende* have the same headline targets and are created to achieve the same goal, it might be reasonable to think that a connection between the two might exist. Following the Europeanization theory line of reasoning, one could draw some hypothesis on the expected outcomes of this relationship.

In particular, the logic of downloading and uploading might be helpful to find out whether these decarbonisation plans contain some reference to each other, share some basic features, or are developing rather independently. These assumptions might be concretized into three different hypotheses:

- H1: The EU is influencing Germany by downloading its decarbonisation objectives and policy instruments into the national legislation
- H2: Germany is influencing the EU decarbonisation policy by uploading its policy preferences in order to reduce the cost of change
- H3: The two policies are developing in a parallel way and they result unrelated. Is the international context that drives policy convergence.

These hypotheses will lead to the evaluation of whether a form of reception, accommodation or independent action is driving the need for an energy transition in Germany. The criteria for investigating the hypotheses will be specified in paragraph 2.4 and then consequently addressed in chapter 4. Further, when in chapter 4 and 5 the implementation process of the German decarbonisation policy will be addresses, other aspects of the Europeanization conceptual framework might result helpful to understand the evolution of the policy process.

Concerning the analysis of the implementation phase, relative to the last two sub questions, other hypotheses have been generated to test the hierarchical composition of political values in decarbonisation policy:

- H4: Post materialist values expressed in the formulation of the German energy transition are being implemented successfully in policy practice
- H5: Materialist values may restrain in policy practice the implementation of post material values although there is high public support for the latter.

The drivers of change competing theories, indeed may further help shed light on the logics behind the implementation process and may explain the willingness of member states, in this case Germany to implement European normative standards and tools.

2.3 Research Design

The function of a research design is to ensure that the evidence obtained during the research process "*enables us to answer the initial question as unambiguously as possible*" (De Vaus 2001:9). Research design refers to the logical structure of an enquiry and its central role is the one of minimizing the chances of drawing incorrect casual inference from the data. Therefore, in this section will be clarified how the research problem has been addressed, what type of approach, what design type and what method of data collection has been used. Furthermore, details on the type of evidence collected will be furnished in the operationalization paragraph.

2.3.1 Qualitative research approach

This research project is built upon qualitative research because it is a descriptive analysis which is interested in "*process, meaning and understanding of phenomena"* rather than their quantification (Creswell 1994:145) and therefore is particularly suited to the investigation of public policy in its phases of planning, implementation and evaluation. This approach to the study, allows one to understand phenomena "*in context-specific settings, such as real world setting, [where] the researcher does not attempt to manipulate the phenomenon of interest*" (Golafshani, 2003: 600; Patton 2005:39). After the detailed description of the phenomenon of interest (low-carbon energy transitions), the study generates further knowledge by assessing the particular object or situation as accurately and comprehensively as possible (Gerring, 2011:78-80) (Verschuren et al. 2010: 107).

2.3.2 Design type: individual cross-sectional case study

The qualitative approach is then applied to a case study, meaning at the intensive study of a *"particular instance carefully selected"* (Gilbert 2008:36), focused on a "*bounded subject or unity"* (Burns 1997:364), specifically on a single country and single policy. The case study allows the researcher to gain in-depth insights into one or several objects or processes that are restricted in time and place (Gerring 2011:224-232; Verschuren et al. 2010:178) and provides a comprehensive description of specific and contemporary cases that other strategies often cannot do (Gerring 2011, Yin 1994). Analysing the *Energiewende* as a case study, further allows treating this contemporary and still evolving policy reform into its original context, which is likely to shape considerably the outcome of the policy itself. The individual focus of the research is then complemented by its cross-sectional nature, because of the interest in determining whether the units of analysis (namely the German Government and the Ministries of energy and environment) were exposed to the action of relevant agents and present the outcome of interest (Mann 2003). Concerning the first sub question, this operation will be done by looking at the Energiewende in order to find out whether the European Union (the relevant agent), with its similar policy project (EU Energy Roadmap 2050) has been able to influence the formulation of the German energy transition (outcome of interest). To answer the second sub question, instead, the cross-sectional case study will analyse whether the Energiewende has

been exposed, at the national level, to domestic agent action and whether it presents the outcome expected. This type of case study, indeed, is not only interested in the deep understanding and description of the unit of analysis, but is also used to infer causation.

2.3.3 Policy and Stakeholders analysis

To answer the main research question, *"Does the German energy transition conform to the EU energy framework of long-term decarbonisation towards 2050?"* will be then needed the use of policy and stakeholders' analysis. These types of analysis will provide details on the policy making process, and highlight the different interests that drive decisions. Indeed, policy analysis creates, critically assets and communicates information about and in the policy making process (Lasswell 1971:1-2) and is designed to provide policy relevant information about 5 components: policy problem, expected policy outcome, preferred policies, observed policy outcomes and policy performance, with policy problems playing a crucial role in the identification of the relevant information (Dunn 2012:5). By looking at the preliminary phases of the policy process, this research will try to shed light on how the policy problem has been addressed, which policy options were preferred, and which stakeholders supported which option. The policy process involves indeed not just decision-makers, but also a variety of private/public, national/international stakeholders (individuals, groups or organizations) which compete with each other for the recognition of their preferences. During the formulation phase, each of the stakeholders will try, by its own means, to advocate its own interest and to steer the final formulation. Stakeholder power analysis becomes then needed to understand the distribution of costs and benefits among stakeholders, and their relevance to the policy (Meyer 2005:3). However, understanding the role of advocacies in policy making is a rather difficult exercise, because the steering effect can be visible just with action, while if an advocacy succeeds in avoiding changes, inaction cannot be detected. This operation is particularly delicate in Federal States as Germany, where the division of power is rather decentralised and especially in supranational institutions as the European ones. From here the need of looking accurately at the process which brought to the adoption of some policy, to find out whether changes (driven by stakeholders) have been occurring during the legislative process. To this end, the analysis of legislative documents becomes crucial.

In particular, for the *Energiewende* there will be a close investigation of the Energy Concept of (2010) in its development phases (through the proposals of the German parliament known as "*Drucksachen*") while for the Energy Roadmap 2050 there will be a close investigation of the stakeholders' preliminary inquiry made before the writing of the EC communication (in March 2011). Such analysis will be conducted through *process-tracing* in order to better understand the causal mechanisms of the relationships and phenomena of interest (Gschwend & Schimmelfennig, 2007). Process tracing is indeed concerned with the tracking of events over a definite period of time and is currently the most common methodological tool used in Europeanization research (Bache 2012:76, Radaelli 2012:12).

2.4 Data Collection

This research makes use of different methods of data collection to provide evidence. It makes use of a mixture of primary and secondary collected data (collected both by the researcher and by others) because a triangulation of multiple sources confers to the study a greater level of reliability and validity (Stake 1995). The selection of the qualitative research material investigated in this thesis follows the idea of purposeful sampling, which describes the process when a "*researcher intentionally selects specific data sources that are information rich in order to learn or understand the central phenomenon under study"* (Creswell, 2013:206). The sources of evidence utilized refer to three of the six possible sources identified by Yin (1994): namely (1) documentation, (2) archival records and (3) interviews.

The first two sources are meant to provide a large amount of naturally occurring and publicly available data (that have a high level of accuracy, provide a large amount of information and cover a large time span), while the last one aims at the collection of an additional rich and in-depth account experts' insights and interpretations of the phenomenon investigated (Yin 1994:80, Fontana & Fray 2005). Documentation in this research meanly refers to policy documents (European Union's policy documents and regulation related to decarbonisation and Germany's policy document related to the Energy transition, reviewed both in English and German), prior connected literature (books, journals and articles) and specialized reports of energy and environment think tanks (as the Agora Energiewende). The archival records examined for this research also refer to national and European archives and they mainly entail the analysis of: statistical datasets (Eurostat, IEA, Destatis and Ageb), parliamentary archives of the German Bundestag as well as committee archives of the European Commission, archives of the German Ministry of energy and the one of environment (BMWi and BMU). Finally, the interviews that complement the research were conducted with experts and researchers of the field (for a total of 5 participants) selected for their specialised knowledge and for their institutional affiliation. Three of the participants are indeed policy researchers with research interest in energy transitions, in decarbonisation and in Europeanization (interviewee 1, 2 and 3), while two of them work for relevant institutions at the EU level and at the German level (interviewee 4 and 5). To the interviewed were submitted two semi structured questions relative to the possible connection of the German Energy Concept to the EU Energy Roadmap by telephone and email correspondence because of the spatial distance and limited time availability of the participants. The interviews, which took place between January and March 2017, are transcribed in the Appendix but anonymised for will of the participants.

Table 1: Interviewed experts' details

Interviewee N.	Profession	Research Area	Date & Modality
1	Researcher	Europeanisation & German energy policy	20th January 2017 - Phone call
2	Researcher	European energy policy	21st January 2017- Email
3	Researcher	German energy & environmental policy	24th January 2017- Email
4	Institutional Member (EU)	Environmental policy	10th February 2017- Phone call
5	Institutional Member (DE)	Environmental policy	24th March 2017 -Phone call

Author's elaboration

2.5 Operationalization

After having explained the type of analysis that will be conducted, this section presents the detailed variables that will guide the research. To this end, the exact procedures that will be used to measure the attributes of variables will be specified here through a technique of operationalization (Babbie 2013:195). In this section, the main issue that will be discussed is the hypothesis testing with regards to the accuracy, relevancy, and validity of the data, in order to be able to prove whether those hypotheses could be confirmed or not. To answer the first sub question relative to the relationship between the *Energiewende* and Roadmap, the type of information that will be reviewed include: (1) policy documentation relative to the *Energiewende* which focuses on the power sector and which covers the timeframe 2010-2016 (allowing for the analysis of policy documents which are prior to the publication of the Energy Concept of 2010 but also to legislative changes in the following implementation phase), (2) policy documentation relative to the EU Roadmap 2050 within the same timeframe (especially the Energy Roadmap 2050 Communication of 2011), (3) impact assessment analysis of the decarbonisation process furnished by stakeholders at the national and European level (prior or contemporary to the publication of the afore mentioned policy documents),(4) prior international agreements on decarbonisation. The policy content to which will be made reference will then include: (a) headline targets and political objectives, (b) policy instruments suggested, (c) priorities of action, (d) explicit reference to other EU/national policy, (e) reference to other EU/national institutions, (f) reference to cooperative/harmonized response to the policy issue. Further, the assessment of Europeanization drivers between the two policies will be done by considering the bottom-up and top-down affection logic as two different dimensions despite they actually represent a circular process (this distinction is meant to ease the analysability of the two processes and clarify the specific action of the actors).

Concerning the other two sub questions, relative to the implementation and performance of the German energy transition, the information that will be reviewed will firstly cover the evidence from the power sector

changes occurred in the time frame 2011-2016 (so when the *Energiewende* started to be implemented and until the most recently available data), and secondly highlight the crucial action of stakeholders in the implementation phase. Evidence from the power sector will be provided through the collection of data relative to: share in energy mix, domestic/foreign availability per source, carbon content per source, rise/fall in investment per source, increase/decrease in number of installation per source, ownership of the installations, price of electricity per source, amount of electricity imported/exported and technology development. Finally, the stakeholders that will be involved in the analysis will be:

- the German Government (in particular the ministry of Energy and the one of Environment)
- the party coalitions (especially the conservative-liberal one and the socialist-green one)
- the federal governments (Ländern)
- the "Big 4" power utilities (RWE, E.On, Vattenfall, Enbw)
- trade unions of workers in the power sector
- the environmental lobby (NGOs and renewable energy industry).

In addition to these subjects, the implications of the energy transition will be further analysed for consumers: namely industries and households.

2.6 Data analysis

The research makes use of a mixture of inductive and deductive reasoning to answer the research questions. As a matter of fact, the first sub question, which deals with the relationship of the two decarbonisation projects, makes use of deductive reasoning in testing the hypothesis of Europeanization because begins with a theoretical assumption and uses the data to confirm or negate it. Instead, the following research sub questions on the *Energiewende* implementation evaluation require a more inductive reasoning because use the data to generate ideas and generate hypothesis (Bryman& Bell 2015:14).

For the first sub question the analytical technique used is the one of pattern-matching (Yin 1994), which compares an empirically based pattern with a predicted one (Tellis 1997:15). Based on the theoretical model, the actual comparison between the predicted and actual pattern will require the researcher to furnish its own interpretation of results. A certain degree of flexibility is also needed when dealing with policy ideas and social values contained in policy projects because they cannot be easily standardized. For what concerns the second and third sub question, implementation of the German *Energiewende* will be analysed and evaluated through explanation building, a form of case study analysis carried out by building an explanation of the case (Yin 1994, Tellis 1997:16). To conduct the implementation research up to date ultimate public data will be used and a triangulation of sources will be guaranteed. Particular attention will be also given not just to numerical and quantifiable achievements but also to contextual factors and circumstances.

3. Decarbonisation regulatory framework in Europe and Germany

Since the decarbonisation objective entails drastic reduction of polluting emission from the economic system, it interferes simultaneously within multiple fields of policy and mostly within the ones of energy and environment. As already mentioned, the production of energy and the combustion of fossil fuels represent the biggest part of emissions from the economic activity, and therefore require particular cuts in the long term for the achievement of environmental goals (IEA 2010). Global in nature, these goals have been formulated within several rounds of international negotiation but rarely with binding effect. At the regional and national level, however, incremental steps brought to the formulation of long-term policy plans.

To understand the connection between the two decarbonisation projects proposed at the EU level and at the German national level, this chapter will provide an overview of the regulatory frameworks in which these two policies have developed. It will recollect the critical steps and key decisions that brought to the adoption of the two policies and will present into detail the targets, objectives and technical guidelines that they propose. This background information will be needed to answer the first sub question on the relationship between the Energy Roadmap of the Union and the Energy Concept of Germany and test the Europeanization hypothesis.

3.1 Steps towards decarbonisation: the EU arena

The path that brought to the EU commitment to decarbonisation finds its milestones in the 90s but has been speeding up its concretization in energy and environmental policy just in the decade that followed. Key to understand this evolution is the development of competences of the EU in the two fields, still today shared between MS and the Union (under art.4 of the Treaty of Lisbon). This means for the EU that interference in national policy and the right to propose supranational harmonized responses towards the decarbonisation objective need to strictly attain to the principles of subsidiarity, proportionality and better regulation.[32] Therefore, the proposal of Roadmap to 2050 derives from the incremental development of competences of the EU and from the intertwinement of energy and environmental regulation.

3.1.1 Decarbonisation between energy and environmental policy

In general terms the community method to regulation, despite its original cooperative character in the energy field[33], has been most frequently used in environmental policy due to profound differences in energy

[32] The principle of *subsidiarity* requires EU action where it adds value and leaving alone matters best done at national level; the principle of *proportionality* requires that community action should not go beyond what is necessary to achieve the objectives; the principle of *better regulation* requires that burdensome legislation must be avoided and that any legislative proposal must be widely consulted and their impact assessment previously provided. (COM (2005)535, COM (2005)97).

[33] With the European Coal and Steel Community of 1951 and the European Atomic Energy Community of 1957.

mix utilization and to the cross-border nature of climate issues. In the energy field the EU (and in particular the Commission[34]) acted overtime mostly in response to energy crises, concerns on security of supply[35] and energy investment (as the Energy Charter treaty of 1994) and liberalization of the internal energy market for gas and electricity[36] (Lequesne 2000:39-40). In the environmental field, instead, the consolidation of a European framework of action for the tackling of environmental objectives was more encompassing and found its solid basis in the international action against climate change. Indeed, while energy policy has been traditionally considered a matter of strategic national interest[37], environmental policy has been instead always considered as an area of cooperation and can be seen as the *"green driver"* for the Europeanization of energy governance (Morata & Sandoval 2012:18).

The first key-event in the EU–wide discussion on environmental action was the Stockholm conference of 1972 in which was conveyed that natural resources needed to be maintained over time and pollution could not exceed Earth's capacity to clean itself (UNCHE 1972)[38].First environmental efforts of the European Community started right after, with action programs of the Council aimed at furnishing common objectives and standards to deal with environmental stress and pollution (in 1973, 1977, 1983 and 1987)[39], and anti-pollution measures directives published in 1988 and 1994. A further ambitious legislative input of the Commission was done in 1992 with the proposal of a carbon energy tax, a EU-wide taxation on carbon emissions (EU COM (92) 26 final). The proposal, however, found strong ideological opposition among governments and the industrial sector, which claimed autonomy of taxation as a core value of national fiscal policy and outlined the severe consequences on the competitiveness of European industrial production (Ellerman et al. 2010:16). Although this attempt could not find the desired effect, the Commission, and, in general, the European arena, started since then to be considered as a privileged regional forum where transboundary cooperation but also cooperation among disciplines and methods was achievable (Dürr 1992: 59).

[34] In the development of energy policy Maltby (2012) describes the Commission as having a particular "*entrepreneurial"* role.
[35] For security of supply is meant "*the uninterrupted availability of energy sources at an affordable price*". In its long-term dimension energy security mainly deals with timely investments to supply energy in line with economic developments and sustainable environmental needs. Short-term energy security focuses instead on the ability of the energy system to react promptly to sudden changes within the supply-demand balance (IEA 2014:13).
[36] With the Single European Act of 1987 the Commission was authorized to advance single market regulation in the field of energy (Section 2 on the Internal Market art.13-19). The Internal Energy Market scheme has been created to foster competitiveness and cross-border cooperation among transmission operators and has been regulated in three rounds of legislation (Directive 68/414/EEC, EEC 1972, Decision 77/186/EEC, Dec. 77/706/EEC).
[37] Intergovernmentalists include the field of energy into the "area of high politics" where national self-reliance or even self-controlled uncertainty is always preferred (Hoffman 1996:882).
[38] At the time of the Conference was published also a very relevant study on the feasibility of human activity on Earth "the Limits to Growth" which highlighted the finite nature of Earth resources and draw possible scenarios on the future adaptation of human activity (Meadows et.al 1972).
[39] OJ no C 112,20.12.1973

The environmental negotiations that followed during the 90s saw indeed a very proactive role of the Union as a united player because a vivid climate of social responsibility and confidence in technology was spread among MS. This is visible in the support to environmental action during the United Nation conferences on climate change, the first of which was held in Berlin in 1995 then followed in 1997 by the well-known Kyoto negotiation. During the third COP held in Kyoto the EU was among the biggest supporters of the proposed cap-and-trade system[40] for the limitation of carbon emissions. Through this commodification and standardization of carbon emissions, the EU envisaged a potential competitive advantage in the development of an international green economy, expected to be the remedy for the triple global crisis of subsistence, environmental degradation and economic stagnation (Gills 2010).

3.1.2 First tools of carbon control

The system adopted internationally in Kyoto, and supposed to be applied from 2005, became then legislation in 2003[41] and created the European Emission Trading Scheme, currently the *"largest scheme globally operating"* which encompasses 11000 industrial installations under a time frame of 15 years (2005-2020). In order to achieve the 20% EU-wide reduction of emissions by 2020, the aggregate cap has been shared among MS in proportion to their economy and energetic structure, then transposed into National Allocation Plans and finally revised by the Commission (EC 2015). MS in this way could allocate pollution rights (allowances) to regulated firms for free (grandfathering or benchmarking) or against a fee (sales or auctioning) because regulated polluters need to surrender an amount of certificates equalling their physical emissions (Veith 2010:20-26).

To installations has been then permitted to save allowances for the future in case they overachieved the cap, to borrow their own emissions for the future in order to comply with present emission caps, but also to trade them with other emitters under market rules (Veith 2010:17-18). Scope of the EU ETS is the regulation of CO_2 emissions from the heavy industry (power generation, mineral oils, metals, minerals, pulp paper and board: Annex 1 Dir 2003/87/EC) which in this way creates national revenues to be spent to develop low-carbon technology for industrial or power production.

Main advantages of this scheme can be outlined by the fact that it provides a concrete compensation to the public for the polluting emissions, certainty in environmental outcome, and that it leads to emissions being reduced where it can be done most cost-effectively (EC 2015). From the other side, the system presents also important criticalities that interfere with its well-functioning. Controversies indeed, arise firstly with the

[40] The cap-and-trade system is based on the polluter pays principle as general public compensation for polluting activity (Coase 1960). Is made of maximum caps to be respected annually, and of trade of emission allowances. It firstly introduced market mechanisms into the *"new regulatory culture"* of the environmental field (Meidinger 1985:447).

[41] (2003/87/EC).

volatile price of allowances (currently fluctuating around 4,9 €/ ton of CO_2 (EEX 2017)) considered to be too low to disincentive investment in fossil fuels, secondly with issues of carbon leakage because of the possibility to shift more polluting activities in places under lower environmental scrutiny, and thirdly because the carbon cap does not cover emissions from other GHG (as Methane or Nitrous Oxide) (Erbach 2014, Stephan &Lane 2015:245). Further instruments in favour of low carbon solutions were then furnished by the EU with the regulation of alternative methods of energy production in 2001, with the directive on renewable energy and in 2003 with the directive on biofuels (Dir. 2001/77/EC and Dir. 2003/30/EC). Aiming at the promotion of sustainable development, however, both directives operate in the internal market regulation in order to introduce with harmonic rules and prices renewable sources in the internal market.

3.1.3 Commitment in climate mitigation

The issue of climate mitigation returned then promptly in the international scene when, at the IPCC of 2007, the scientific community asked for urgent climate mitigation action[42].

Describing human economic activity as *"very likely"* factor that led to the rapid increase in global temperatures, the IPCC assessment report calls for drastic reduction in GHG emissions worldwide (IPCC 2007, p. 13-15). In this context, states, grouped by regions, presented their first targets of planned reduction for 2050 (varying from 70 to 80% reduction) based on the economic models furnished by the technical studies of the IPCC[43]. Despite using different base models and base years, also several major European countries firstly expressed their intention of drastic reductions by 2050 (Germany, the Netherlands, the UK and France).

Strong of this preliminary expression of intent, the EU launched in March 2007 the plan for the 2020 energy and climate package. Negotiated for several months, the package was adopted by the EP in December 2008 and became binding with the directives emanated in 2009 aimed at the reduction by 20% the emissions of greenhouse gases, at the increase by 20% of energy efficiency in the EU and at the achievement of a 20% share of renewables in total energy consumption (EC 2009). Parallel to these targets, also another low-carbon solution has been regulated in 2009: the Carbon Capture and Storage (CCS) technology (Dir. 2009/30/EC). Experimented for the geological storage of carbon dioxide, this technique is considered as

[42] The document encourages for concrete measures of climate change mitigation in the short run in order to have medium-and long-term benefits and to avoid lock-in of carbon intensive technologies. It explains that "due to the inertia of both climate and socio-economic systems, the benefits of mitigation actions initiated now may result in significant avoided climate change only after several decades." (IPCC 2007:33).

[43] The IPCC assessment report makes predictions in the longer time frame until 2100. The reduction targets proposed by participating countries are instead until 2050. Must be noted that the percentages of reduction differ among regions and among economic models used to calculate the reduction. Detailed information can be found in Annex 3 of the Impact assessment, Available at: https://www.ipcc.ch/publications_and_data/ar4/wg3/en/ch3s3-3-6.html

potential alternative for maintaining fossil fuel combustion while not releasing CO_2 in the air.[44] The adoption of this compulsory sustainability agenda, with the well-known 20-20-20 targets, not only increased EU competences in both energy and environmental policy (directly intervening in energy choices of MS), but also gave a new sprint for the negotiation of long-term decarbonisation plans. The commitment taken in the 2020 strategy indeed, further introduced a general reference to the establishment of a "resource efficient and climate resilient economy by 2050" (under the Resource efficient Europe 7th Flagship[45]).
In 2009 also two relevant international meetings took place in the climate agenda: the G8 in L'Aquila and the fifteenth COP in Copenhagen (July and December 2009). To prevent dangerous anthropogenic interference with the climate system, both meetings recognize *"the scientific view that the increase in global temperature should be below 2 degrees Celsius"* and ask with urgency the adoption of climate mitigation techniques (UNFCC 2009:1). Further, during the G8 EU leaders announced the objective to reduce GHG by at least 80% by 1990 to support a sustainable use of natural resources (G8 Summit 2009 decl., art. 65).

The term decarbonisation entered then the EU arena when in October of the same year the EU Council sustained that it *"supports the EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, to reduce GHG emissions by 80-95% by 2050 compared to 1990 levels"* (Council presidency conclusion 15265/1/09). With this declaration, the Council also informally appointed the Commission to analyse the implication of this commitment for the European economy (Dupont & Oberthür 2015). To this end, starting in October 2010, the Commission worked towards the realisation of a technical assessment of the decarbonisation plan based on sectorial studies and public stakeholder consultation. Some sectorial studies furnished by consultancies were published already at the end of 2010 (see ECF 2010[46], EREC 2010), while the public stakeholder consultation took place between March and May 2011 and led to 140 replies from the private and public sector[47]. Based on these results, the Commission was then able to proceed with the publication of the technical economic assessment of the decarbonisation plan in the communication "A Roadmap for moving to a competitive low carbon economy in 2050" (COM 2011,112 final/2).

[44] Currently CCS technology, despite being mentioned in several EU plans to decarbonisation is not ready to be commercialized.
[45] The Resource Efficient Europe in the 7th Flagship supports the shift towards a low-carbon economy that is efficient in the way it uses all resources through: decoupling economic growth from resource and energy use, reducing CO_2 Emissions, enhancing competitiveness and promoting greater energy security (EC 2011:9).
[46] The European Climate Foundation is a private philanthropic organization with financial ties to business and strongly encouraged by the EU institutions. It contributed to the technical assessment of the Roadmap through important recommendation studies as "Roadmap 2050" (2010), Power Perspectives to 2030 (2011) and "From Roadmap to Reality" (2013).
[47] Respondents to the inquiry included: 96 industries and private sector associations, 21 MS and public bodies, 10 associations of the electricity sector, 7 trade unions, 3 non-governmental organizations, 2 consumers organizations, and 1 university ({C (2012) 3230 final} Annex 2: 11).

3.2 Roadmap to 2050 and the Energy Roadmap to 2050

The Roadmap to 2050 was published by the Commission to provide to the legislative institutions a technical assessment for the long-term goal of the Union. Not of a binding nature, this document reconnects itself to the existing legislation under the 2020 Energy & Climate package and has been complemented by the White Paper on Transport and the Energy Efficiency Plan (2011) and the Energy Roadmap to 2050 (2011). By furnishing a norm-setting in an informal way, this instrument can be categorized as "*soft law*"[48] indicative regulation (Barani 2006:10) because is deemed at fixing a common framework strategy for the achievements in energy and environmental policy and creating more coherence in areas where MS are more reluctant to concede sovereignty (Fouquet, Nysten 2014). The Roadmap to 2050 rigorously states that the 80-95% long-term target of GHG reduction entails almost full decarbonisation of the current economic model and is required from all sectors in order of emission: power sector, residential and tertiary, industry, transport and agriculture (EC 2011:6). The Commission with this communication outlines the importance of R&D for the development of various forms of low carbon energy technologies (as the Carbon Capture and Storage[49]), the need for electrification of the transportation system and the conversion of smart, efficient grids (EC 2011:6).

However, what the assessment provides, is a technology neutral strategy based on different future scenarios that may occur while transforming the economic system. The *"overall and sectorial pathways, the underlying technological and structural changes required, the investment and cost patterns and other impacts, synergies and trade-offs related to the broader sustainability and resource efficiency agenda"* are then analysed in the Annex[50] to the Roadmap and are to be assumed as guidance for further developing national sectorial policies (EC 2011: 8). In the Annex are reported the positions and suggestions of the interested stakeholders together with some economic modelling analysis (through models such as Primes and Gains) which draw provisions on the feasibility of the decarbonisation pathway. The modelling, in particular, furnishes alternative scenarios by modifying the prospects of implementation of the major variables, namely (1) the effective technology development, (2) the commercialization of CCS, (3) the electrification of transportation, (4) the coordination of the global action, and (5) the fluctuation of fossil fuels prices.

The results of the scenarios mainly connect the achievement of the 2°C threshold to the global cooperation level, while for the domestic level, despite significant variations in technological and fossil fuel prices assumptions, assure that a*" 80% carbon reduction by 2050 is technically feasible"* (EC 2011:94-95). Major

[48] Soft law, opposed to hard law made of binding legislation, is an informal way to conduct negotiation and spread standards and best practices. It is primarily motivated by the search for flexibility in decision-making but has however an ambivalent function: can either avoid or promote EU integration (Barani 2006:10-13).

[49] The geological carbon capture and storage technique has been regulated by the Commission already in 2009 (Dir 2009/30/EC) in order to furnish common safety rules for the storage.

[50] Commission staff working document. Impact assessment Accompanying document to the Communication "A Roadmap for moving to a competitive low carbon economy in 2050" {COM (2011) 112 final} {SEC(2011) 289 final}.

conditions for the reduction would be, however, (a) sufficiently stringent carbon price incentives across sectors, (b) relevant changes in technology which enable the changing of production methods, (c) and price-induced changes of behaviour among energy consumers (ibid). Concerning the way to achieve this reduction, a complementary study of the European Climate foundation recommends to make use of *"a combination of the existing technology"* namely: renewables, nuclear energy, CCS, advanced transmission-distribution infrastructure, energy efficiency, biofuels and carbon storage for the industrial production (ECF 2010:10). Industry emission reduction intensity would need to decrease by 2.3 percentage points per year to equalise at least a 95% target with a predicted average capital requirement for the transformations of about €50 billion per year (ECF 2010: 39,43,71).

For what concerns the power sector (which represents alone the 31% of EU emissions) an additional impact assessment has been prepared to promote urgent intergovernmental action in energy infrastructure changes (IEA 2011[51]). To complement the Roadmap to 2050, additional decarbonisation scenarios in the energy industry have been indeed presented in the Energy Roadmap 2050 Communication of late 2011 (COM(2011) 885 final). Aimed at exploring the *"challenges posed by delivering the EU's decarbonisation objective while at the same time ensuring security of energy supply and competitiveness"*, this document provides a technology neutral technical assessment for the operationalization of the decarbonisation objective in the power sector (EC 2011b:3). To this end, it provides five possible future scenarios based on mutually exclusive technology preferences (EC 2011b:4):

- high energy efficiency (with high shares of energy savings in buildings and utilities)
- diversified supply technologies (with assumed public acceptance of CCS technology and nuclear energy[52])
- high renewable energy sources (with a share of RES in gross final energy consumption equal to 75% in 2050 and a share of RES in electricity consumption reaching 97%)
- delayed CCS (in this case decarbonisation is driven by carbon prices rather than technology push)
- low nuclear (with no other reactors being built and higher penetration of CCS).

The technical analysis of this scenarios is then complemented by the drawing of ten structural changes needed for the transformation of the energy system and common to all scenarios. These conclusions are

[51] The decarbonisation of the power sector requires urgent action because of the longtime span that characterizes energy infrastructure investment (IEA (2011), World Energy Outlook 2011).

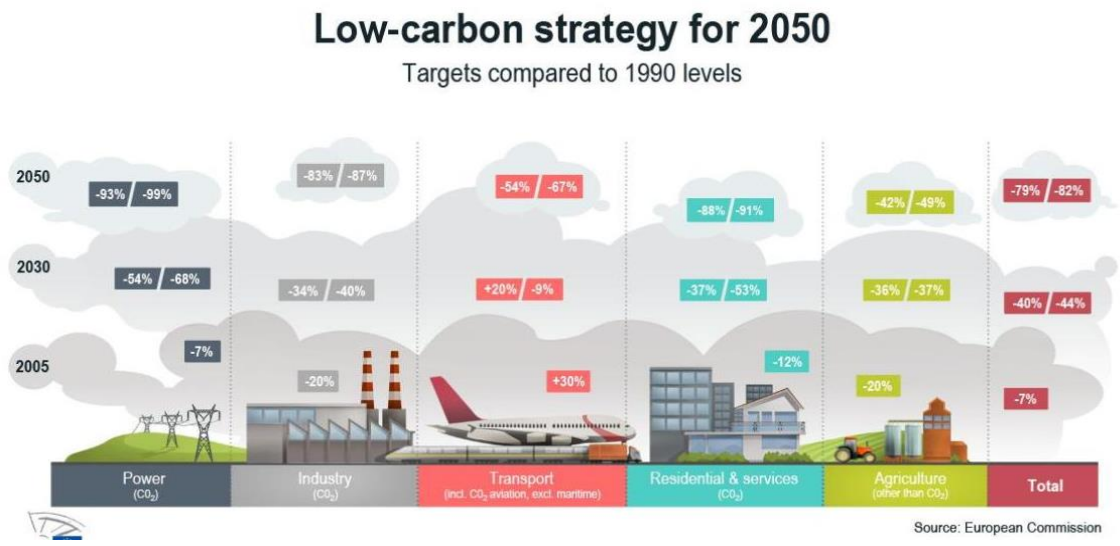
[52] For both technologies public acceptance remains low because of the risks associated with natural disasters and legal uncertainty. After the Fukushima accident in many European countries arose concern over the safety of nuclear reactors, which in some cases brought to the decision of cancelling plans for nuclear sites construction (Italy and Switzerland) or of phasing-out existing plants (Germany). The carbon and Capture technology instead, due to the novelty of its promotion and the lower degree of its commercialization, has encountered public resistance and delays in regulation, which made major companies cancel their projects (ex. Shell in the Netherlands, Eni in Italy, Fortum in Finland) (ECF 2011:36).

meant as point of reference and recommendation to MS for the implementation of whatever scenario, and state that:

1. "*decarbonisation is possible"* and that it can be less costly than current policies in the long-run
2. the average capital cost of the energy system will increase significantly and therefore new cost-competitive technologies need to prioritized,
3. electricity plays an increasing role in the transition (and its use need to rise considerably already in 2030)
4. electricity prices will rise until 2030 and then start to decline (mostly to finance the RES investment)
5. household expenditure will increase (rising to around 16% in 2030, and decreasing thereafter to above 15% in 2050)
6. energy savings throughout the system are crucial (with decrease in primary energy demand)
7. renewables will have to rise substantially (achieving at least 55% in gross final energy consumption in 2050)
8. carbon capture and storage has to play a pivotal role in system transformation (if commercialised)
9. nuclear energy provides an important contribution in the transformation process
10. decentralised and centralised systems need to interact (especially if local resources are not sufficient or are varying in time) (EC 2011b:6-8).

The Commission, throughout the analysis makes also clear that the completion of the Internal Energy market for gas and electricity will be crucial for a market-based integration of renewables in the market and that natural gas has an important role in the mid-term substitution of more polluting fossil fuels as coal and oil (EC 2011b:11).

Figure 2: EU Roadmap 2050 targets



Source: European Commission 2011

3.3 Steps towards decarbonisation in Germany

Since the first energy and nuclear crises of the 70s, environmental concerns were spread all over Europe and found in Germany a particularly fertile ground (Agora 2016). General public concern on environmental issues further gained more consensus after the publication of several scientific studies in the 80s that were arguing the possibility of economic growth with less energy consume (the energy transition "*Energiewende 1980"*) and the feasibility of a gradual abandoning of nuclear and fossil fuel energy ("*Energiewende – Wachstum und Wohlstand ohne Erdöl und Uran, 1981"*) (Öko-Institut 2016). The spread of such ideas during the decade, together with rising public awareness on environmental damages, solicited governmental action towards the energy transition objective.

In this context, the centre-right ruling coalition at the time (CDU-FDP)[53], firstly adopted a labelling system for environmental friendly production methods (1986) and then started to massively support clean energy sources for electricity production. Renewable sources were indeed firstly regulated in 1991 with the *Feed-in Act* (*Stromeinspeisungsgesetz*), an important investment scheme which stipulated the priority of green energy over conventional energy from fossil fuels, and that financially incentivized the spread of renewable sources in the entire federal territory (Agora 2016). The conservative-liberal coalition further introduced an additional system of pollution control in the legislation of 1995 with the "*Industrielle Selbstverpflichtung*" self-commitment by members of the Association of German Industry to reduce of 20% GHG emissions by 2005[54] (Laes et al.2014).

After 16 years of centre-right coalition, the left wing came to power in 1998 with a red-green coalition government of SPD and Bündnis 90/Die Grünen[55]. The government composition explains much of the immediate changes occurred at the time and may be considered as an important prioritization of environmental issues in the agenda setting. Most importantly in this respect are the introduction in 1999 of several instruments: a) the CCL climate change levy (*Gesetz zum Einstieg in die ökologische Steuerreform*) a tax to motor fuels, gas, heating oil and electricity, b) the "100,000 Solar Roofs Program" which fostered the solar market in Germany, and c) the "Market Incentive Program" a multimillion financial support scheme for renewable heating systems (Agora 2016) (Laes et.al 2014). With a fast-rising share of solar panels in the national territory, the government also decided to modify the methods of renewable energy finance from the feed-in-act to a new regulative scheme known as EEG (*Erneuerbares Energien Gesetz)* of 2000[56].

[53] The parties in the coalition represent the center-right wing of the German parliament: the CDU as Cristian-conservative party, while the FDP as liberal party.

[54] This instrument was then expanded to 14 sub associations to achieve 20% reduction by 2005 compared to 1990. However, it granted an 80% exemption to manufacturing and agriculture and further excluded coal industry because of the political sensitivity surrounding the sector (Laes et al. 2014)

[55] The SPD representing the social democratic party and the Grünen representing the environmental party.

[56] The Renewable Energy Act (EEG) of 2000, drawn up by the Social Democrats and the Greens under Chancellor Schröder, replaces the Feed-in Act. Differently from the latter this new regulation specifies that the rates paid for the electricity production have to be linked to the cost of the investment, not anymore to the retail rate. The tariff for

In the same year followed also an historic agreement between Chancellor Schröder's coalition and nuclear plant owners in 2000 aimed at the gradual phase-out of all 17 nuclear reactors in German territory in a time frame of 22 years[57]. New nuclear plants were banned altogether and the agreement became law in 2002 with the "*Atomgesezt*" (Appun 2015). Thus, at the beginning of the 21st century Germany had introduced into its legislation important and innovative instruments for a cleaner restructuring of its economy in a rather independent manner, while in the decade that followed, most of its decisions had to adapt to communitarian objectives. Indeed, at the beginning of the new century, the European Union, in accordance with international agreements, started to introduce several binding instruments and emissions reduction targets, rules to which national strategies needed to adapt. To implement the decisions of the Kyoto protocol, the European Union agreed in 2002 for an EU Burden Sharing Agreement which was meant to fairly divide among MS the efforts of emissions reduction. The aggregate emission target of 8% reduction by 2012 (compared to the EU level of emissions of 1990) was for this reason further divided into national caps (operational between 2005 and 2020) with proportional stakes and to Germany was assigned the biggest share of reduction (23%) due to its carbon intensive economic structure (Veith 2010:24).

Limits to emissions were furthermore complemented in 2007 by the EU Energy & Climate Package (with the 20-20-20 targets). Connected to such decisions, the German government, at the time ruled by a CDU-SPD coalition (black-red coalition), further proposed in 2007 in its Integrated Energy and Climate Programme a rising share of renewables in electricity production of the 25-30% to be accomplished by 2020 (BMU 2007:10). Further instruments of climate protection were then introduced in 2008 with a general climate change adaptation strategy (*Deutsche Anpassungsstrategie*) and a climate legislative package enacting the program of 2007, although both documents make no real reference to the long-term scenario (IEA 2016). A change in political direction came then with the return in 2009 of the black-yellow ruling coalition (CDU-FDP). The new conservative-liberal government, which was never in favour of the nuclear phase out[58], started to renegotiate the *Atomgesetzt* for security of supply reasons and obtained in 2010 an eight years delay for the shutdown of nuclear reactors (Jarass & Obermair 2012:22-23). Still in 2010 the government further approved a comprehensive energy policy plan known as the Energy Concept (*Energiekonzept*), in which the decarbonisation long-term scenario was firstly regulated.

renewables is meant a stimulus of investment because covers the difference between the cost of production and the market price. The act also stipulates that grid operators must buy electricity and gas generated by renewable energy producers at a fixed price.

[57] This agreement, known as "nuclear consensus" allocated to each plant an amount of electricity that it could produce before it had to be shut down and fixed just one maximum closing date in 2022 (Appun 2015).

[58] At the time of the 2000 Atomgesetz the CDU party objected the agreement calling it a "destruction of national property" that they wanted to revoke once they came back to power (Appun 2015).

3.4 The Energy Concept and the *Energiewende*

Considered as the compass legislation for the implementation of the energy transition, the Energy Concept is the first policy plan to draw a long-term decarbonisation scenario for the development of the German energetic future. Aimed at achieving an "*environmentally sound, reliable and affordable energy supply*" this plan firstly committed the federal republic to an 80-95% GHG emissions reduction by 2050 (BMWi & BMU 2010). This target has indeed been tied to the political ambition of the country to *"become one of the most energy-efficient and greenest economies in the world while enjoying competitive energy prices and a high level of prosperity"* (BMWi 2010:3). The plan implies a reorientation of the German energetic policy from demand to supply and a shift from centralised to distributed generation in order to reduce overproduction, apply energy savings and increase measures of energy efficiency. In particular, the targets proposed in the Energy Concept (*Energiekonzept)* (Autumn 2010) summarise the commitments of the German energy transition into:

- A reduction of GHG emissions of the 40% by 2020, 55% by 2030, 70% in 2040, 80 to 95% by 2050 (with 1900 as baseline)
- A growing share of renewables overtime which need to account for the 18% of gross final energy consumption[59] in 2020, 30% by 2030, 45% by 2040 and 60% by 2050.
- A reduction of primary energy consumption of the 20% by 2020 and of the 50% by 2050 (2008 baseline)
- A reduction of electricity consumption by 10% by 2020 and 25% by 2050 (with baseline 2008)
- A growing building renovation rate (from 1% a year to 2% of the total building stock)
- A considerable reduction of final energy consumption in the transport sector to fall by about 10% by 2020 and by about 40% by 2050 (with baseline the year 2005) (BMWi & BMU 2010:5).

Further statements in such document commit the Federal government to abandon subsidies for conventional energy sources (although without specifying any date) and to support the development of CCS technology at the international and national level (ibid:16). The concept classifies nuclear energy as a bridging technology for the transition to clean energy and asks for European cooperation in the fields of research and development, energy efficiency and transmission networks (BMWi & BMU 2010: 14, 28).

However, not long after the publication of this program, a major adjustment to the concept was required, and it entailed a modification of nuclear legislation. In the aftermath of the Fukushima´s nuclear disaster (May 2011), strong civil society protest demonstrations pushed for reform of the briefly changed phase-out. Thus, the summer 2011 Rösler/Merkel resolution brought the nuclear-phase out agreement to its previous

[59] Gross final consumption of energy is defined in Directive 2009/28/EC on renewable sources as energy commodities delivered for energy purposes to final consumers, including the consumption of electricity and heat by the energy branch for electricity and heat production and including losses of electricity and heat in distribution and transmission (EEA 2015).

terms (from 14 to 8 years of further nuclear reactor exploitation) backed by a common agreement of all political forces in the German Parliament (Agora 2015). This step improved considerably the political support to the objectives of the *Energiewende*, uniformly spread among political parties (85% of MPs voted in favour of energy transition policies in the Bundestag in 2011) and public consensus (showing from regular polls that 90% of German citizens were in favour of its goals) (Agora 2015:5-6). Indeed, is since 2011 that the term "energy transition" started to become popular and frequently associated to the 2010 and 2011 legislation[60] (Wettengel 2017). Summing up, the *Energiewende* as innovative integrated policy framework currently promotes four main objectives: combating climate change, avoiding nuclear risks, improving energy security, and guaranteeing competitiveness and growth (Agora 2015:5). The Federal government has proudly embraced its pioneer role in modelling energy transition solutions, and most of its representatives see this reform as Germany's *"Man to the moon"* [61] project (Federal Ministry of Economic Affairs 2015).

Figure 3: 2050 Targets of the German Energy Transition

		Status quo	2020	2025	2030	2035	2040	2050
Green-house gas emissions	Reduction of GHG emissions in all sectors compared to 1990 levels	-27% (2016)*	-40 %		-55 %		-70 %	-80 – 95 %
Nuclear phase-out	Gradual shut down of all nuclear power plants by 2022	11 units shut down (2015)	Gradual shut down of remaining 8 reactors					
Renewable energies	Share in final energy consumption	14.9 % (2015)	18 %		30 %		45 %	min. 60 %
	Share in gross electricity consumption	32.3 % (2016)*		40 – 45 %		55 – 60 %		min. 80 %
Energy efficiency	Reduction of primary energy consumption compared to 2008 levels	-7.6 % (2015)*	-20 %					-50 %
	Reduction of gross electricity consumption compared to 2008 levels	-4 % (2015)*	-10 %					-25 %

Source: Agora Energiewende 2017

[60] Despite the term was already in use among Green parties and left-wing circles when asking for a reset of the national energy policy.

[61] The definition was given by the Foreign Minister Dr. Frank-Walter Steinmeier at the "Berlin Energy Transition Dialogue", an international forum on energy policy held in Berlin on 26 and 27 March 2015.

4. Relationship between the EU Energy Roadmap to 2050 and the Energy Concept

This chapter deals with the understanding of the energetic decarbonisation policy formulation at the EU and German level aimed at drawing possible relationships among the two. The first meant as an assessment plan, while the second as a compulsory long-term strategy, they both however aspire at providing a practical framework for moving towards a drastic emission reduction by 2050 (80-95% reduction compared to 1990). Both furnishing an action plan for energy related emissions, they have been interestingly developing within a very close timespan, testified by the publication of the first *Energiewende* resolution at the end of 2010 and the Energy Roadmap to 2050 Communication in the first half of 2011 (Deutsche Bundestag 2010, EC 2011). From here the need to understand whether the respective phases of agenda setting and political discussion might have possibly been influenced by each other, or they have been developing independently. Further, to understand the conditions that brought to the adoption of both commitments it is necessary to evaluate the context in which these commitments where created, and which stakeholders took part or pushed for reform in this direction.

After summarizing and comparing goals, targets and the important steps that brought to the decarbonisation targets for 2050 from both perspectives, the European and German one, this section will proceed by analysing the "making of" the EU Energy Roadmap to 2050 and the *Energiewende* resolutions of 2010 and 2011 (relative to the *Energiekonzept and Atomausstieg* decisions) in search for correlation. In particular, it will look at the timing of consultations and resolutions preceding the publication of the commitment, the dynamics of agenda-setting and the proposals of relevant institutions.

Further, it will look at which stakeholders were primarily involved in consultation, which ones enabled the proposal to be concretized in political action, and whether in policy documents there is proof or reciprocal expressed attention. This reconstruction will be done through a technique of process tracing, the most common methodological tool used in Europeanization research (Bache 2012:76, Radaelli 2012:12). Being Europeanization a process made up of top-down and bottom-up logics, process tracing allows for the tracking of relevant events (or steps) in the time span needed (Fischer 2017:67). To this end, the analysis will refer to the drivers of domestic change as explained in chapter 2.

4.1 Targets, Goals and Content comparison

The 2050 emissions reduction target of 80-95% compared to 1990 is the one that motivates the publication of both the EU Energy Roadmap to 2050 and the German *Energiekonzept*.

This commitment, nevertheless, has significant difference in the two policy documents, due to the difference in regulatory nature and normative purpose of the two documents. In regulator terms, just the Energy Concept is formally binding and meant as concrete policy plan for a structural energy transition of the country, while the Roadmap mainly serves as technical report of the decarbonisation path evaluation. The first adopted by the ruling coalition of the German parliament in 2010 and meant to represent the comprehensive plan of action for the future legislations, while the second published by the European Commission in 2011 after stakeholder consultation as an assessment of possible pathways to be followed by national governments. In the prelude of both documents, however, the intent of developing decarbonisation strategy for the economy, sounds very similar. While explicating the goals of the energy decarbonisation strategy, the respective plans make use of very close but somehow different terminology:

- From one side the EU aspires to a *"safe, secure, sustainable and affordable"* energy system
- From the other the German government highlights the need to achieve a *"clean, reliable and affordable future energy supply"*[62] .

Both policy documents make clear that all of these goals are equally important for the long-term strategy prospected, however, the slightly different terminology used and the order in which the terms are reported, already show the points of emphasis in both documents, namely: energy security on the EU level and on clean energy at the German level. Security and sustainability, in this optic, appear to be the two main recurring features that need to be handled to assure competitiveness of a future low-carbon economy.

In order to achieve these goals, binding interim targets for 2020 and 2030 have been decided at both level, but here again, quantitative targets differ slightly. The speed of change is in this case the main difference, since the GHG emission reduction planned has in EU targets of 20% by 2020 and 40% decrease by 2030, while in Germany a 40% target is set already in 2020 and a 55% in 2030 and an additional one in 2040 of 70% (EC 2009, 2014, BMWi & BMU 2010). Further, while the EU in its Energy& Climate strategies for 2020 and 2030 adopts a tripartite nature of targets aimed at reducing emissions but also at increasing energy efficiency and share of renewable energy, the German plan adds instead other three main targets for achievements in energy consumption reduction (both in transportation and in buildings).

[62] Described as „*umweltschonende, zuverlässige und bezahlbare Energieversorgung*" in the *Energiekonzept* of 2010.

Concerning the content of the Energy Roadmap and the one of the Energy Concept basic distinctions also occur. First of all, the two programs make reference to different types and number of scenarios taken as basis for the report for the calculation of expected decarbonisation outcomes. In the Roadmap case, it refers to five scenarios constructed on predominant conditions as high share of energy efficiency, diversified supply technologies, high share of renewables, delayed CCS and low nuclear; while the *Energiekonzept* makes reference to just four scenarios that instead modify the speed of emissions reduction, the number of years of delay of nuclear power, the percentages of energy efficiency and the share of renewables in energy consumption (EC 2011d, BMWi & BMU 2010). Those scenarios are also reported in a different manner, because in the Energy Roadmap they represent the main body of information from where additional recommendations can be made, while in the Energy Concept reference to them is made but without reporting the complete outcomes and previsions of the study. Therefore, while the EU communication reports a list of possible outcomes for different future scenarios meant as framework information for national policies, the Energy Concept of Germany draws instead a specific *"all-round"* strategy[63] for the achievement of the decarbonisation objective.

Priorities of action in the transformation of the energy system are then also stated differently in both documents. In the EU case the transformation has to occur with the following priorities: 1) management of energy demand and savings, 2) switch to renewable energy, 3) substitution of coal with gas in the medium term, 4) transformation of other fossil fuels with clean technology, 5) important contributions of nuclear and 6) smart storage technologies and development of alternative fuels (EC 2011d: 10-14). In the German case, instead, the transformation has to occur with 1) a great expansion of renewables as *"cornerstone of energy supply"*, 2) energy efficiency as key factor, 3) nuclear energy as bridging technology[64], 4) flexible power plant-feet for coal and gas-fired power plants, 5) energetic upgrades of buildings and 6) electrification of transport (BMWi & BMU 2010:4-24).

Links to global climate action are made in both documents to underline that an efficient decarbonisation cannot be achieved without a coordinated global response, and that carbon leakages can be a deterrent to competitiveness (EC 2011d:9, BMWi & BMU 2010: 28).

Concerning the complementarity of the plans, in the policy documents reciprocal reference is made in the following terms:

- In the EU Communication reference to national policies is made to make clear that "*the Roadmap does not replace national, regional and local efforts to modernize energy supply, but seeks to develop a*

[63] BMWi & BMU 2010, p. 4 defines the Energiekonzept as an "all-round strategy" to combine expansion of renewables with energy efficiency, expansion of grids and construction of new storage facilities.

[64] The activity extension of the nuclear power plants is justified in the document as necessary for achieving a "dynamic energy mix" and assuring an energy policy "free of ideology and open to all technologies" (BMWi & BMU 2010: 14).

long-term European technology-neutral framework in which these policies will be more effective" (EC 2011d: 3)

- In the German strategy reference to European coordinated action is made when contextualising the energy concept in the international sphere, stating that "*the transition to a cutting-edge, low-carbon and secure energy supply can be realised only through joint European and international efforts*" (BMWi & BMU 2010: 28). Further, reference is made in particular areas of cooperation (research and development of low carbon solutions, renewable sources market integration and interconnection of the electricity markets) where a *"right division of tasks between the EU and member states"* is expected (BMWi & BMU 2010: 10,15, 26, 28).

Table 2: Comparison table Energy Roadmap and Energy Concept

	Energy Roadmap 2050	Energy Concept
Nature of Targets	Tripartite (emissions, renewables, efficiency)	Six targets (emissions, renewables, reduction of energy consumption in electricity, transportation and buildings)
2020 Target	-20% emissions, 20% share RES, +20% energy efficiency	-40% emissions,18% RES share, -10% electricity consumption, -20% energy consumption
2030 Target	-40% emissions	-55% emissions, 30% RES share
2040 Target	None	-70% emissions, 45% RES share
2050 Target	-80%-95% emissions	-80%-95% emissions, 60% RES share, -25% electricity, -50% energy consumption
Goals	Safe, secure, sustainable and affordable energy system	Clean, reliable and affordable energy supply
Reference Scenarios	Five (efficiency, diversified supply technology, RES, delayed CCS, low nuclear)	Four (speed of GHG reduction, delay in nuclear phase out, energy efficiency, share of RES)
Priorities for energy system transformation	1. Energy demand, 2. RES. 3. Gas, 4. Fossil fuel clean technology, 5. Nuclear energy, 6. Smart storage & alternative fuels	1. RES, 2. Efficiency, 3. Nuclear 4. Flexible coal-gas plants, 5. Buildings upgrade, 6. Electrification of transport
Complementarity	The Roadmap is meant as technology neutral framework to be used by Member States	The EU has to help the efficient development of the energy transition, a division of tasks between EU and MS is required

Source: Author's elaboration

4.2 Timeline and consultation comparison

Concerning the timeline for the institutional discussion and formulation of the two policy projects it needs to be handled in two dimensions, a policy-specific one and a broader contextual one. The policy specific timeframe strictly connected to the institutional discussion of the projects has started in both cases between 2008 and 2009.

In the EU case was in November of 2008 that the Commission firstly addressed the "Vision towards 2050" as a necessary step in EU-wide regulation within its Second Strategic Energy Review (EC 2008:16). At the beginning of the new year was then the European Parliament that brought again attention to the topic with the February Resolution "2050: the future begins today: recommendations for the EU's future integrated policy on climate change" (2008/2105(INI)). Later in 2009 (in June) the Commission further included the 2050 vision in the Resource Efficiency Europe Flagship of the 2020 strategy, while in November of 2009 also the EU Council supported the long-term objective *"in the context of necessary reductions according to the IPCC by developed countries as a group"* with the presidency conclusion 15265/1/09. Still in 2009 the Commission created an interservice steering group composed by the directorates of energy, climate and transportation policy (DG ENER, CLIMA and MOVE) for the creation of an energy roadmap impact assessment, and commissioned the preparation of the economic models scenario to the National Technical University of Athens (EC 2011b: 5). To develop the Energy Roadmap, the Commission further held public consultations from October to December 2010 with an online questionnaire filled by almost 300 respondents[65]. Further, the DG Energy, at time chaired by the German Commissioner Oettinger[66], also organized individual meetings with stakeholder representatives to better capture their position (EC 2011b: 5-6). These steps were therefore critical for the publication of the Energy Roadmap in December 2011.

In the German case, instead, despite integrated strategies for energy and climate were proposed already in 2007, the first concrete reference to 2050 came just with the addressing of the Energy Concept in the German Bundestag. By the end of 2008, indeed, climate legislation was mostly related to the setting of basic adaptation strategies and commitment for the mid-term (until 2020) (see DAS 2008 and Climate Legislation Package 2008). Parliamentary discussion on the Energy Concept started then in 2009 at the beginning of the 17th legislature period[67] and included in the government coalition legislative plan for the year 2010. To

[65] The questionnaire, meant to highlight major opportunities and constraints of the decarbonisation path as perceived by stakeholders, was filled in by organized stakeholders (156) and by private citizens (102 participants). Within the organized stakeholders, a major part (96) were representing companies and professional associations), followed by NGOs (32), public authorities (9), think tanks (5) and trade chains (5) (EC 2011b Annex p.5).

[66] As representative of the German conservative party, he chaired the DG energy for energy policy between 2010 and 2014.

[67] The 17th legislature period of the German Parliament (Bundestag) lasted from 2009 and 2013 and was governed by a large coalition of center-right (CDU) and center-left (SPD) parties.

evaluate the urgency and the feasibility of the policy plan consultancies as EWI, GWS and Prognos were engaged by the BMWi for the preparation of an impact assessment which was published in August 2010 (*Energieszenarien für ein Energiekonzept der Bundesregierung)* (Schlesinger et al. 2010). To the economic study preparation took part also other research institutes as the Frauenhofer IBP and the FVEE for renewable energy research[68], but no direct consultation was held with the general public for the preparation of the Energy Concept or the *Energiewende* package[69] (Sohre 2012:315). Parliamentary discussion on energy transformation came then promptly in the scene again by the end of 2009 when in the Bundestag was proved disappointment for the results of the Copenhagen accord. On this occasion, especially the opposition parties (die Linke, SPD, B90/Grünen) made further proposals for committing the country to climate mitigation policies entailing between 80-95% emissions reduction, with considerable space for renewable energy and consistent funds for climate action in developing countries[70] (Drucksache 17/522, Dr. 17/132, Dr. 17/1475). The opposition further asked for a more coherent EU and international policy to legislate for the long-term on climate policy. To such proposals, the governing parties replied with a more cautious but still positive attitude. They confirmed the intention of the country to move forward this strong emissions reduction and made clear that despite the failure of the Copenhagen summit Germany did not have to renounce to its pioneer role (Dr. 17/2318: 7). This preparatory discussion led then the ministry of energy and the one of environment (BMWi and BMU)[71] to the joint publication of the Energy Concept in October 2010.

Instead, when looking at the broader context of decarbonisation discussion at the international level, 2007 can be seen as the baseline year for political handling of the issue.

The turning point on climate policy action was indeed the Intergovernmental Panel on Climate Change publications of 2007, in which evidence of human activity responsibility in rise in GHG emissions was scientifically proved[72]. The fourth assessment report commissioned by the UN firstly required the international community to keep global temperatures below the 2 degrees threshold and firstly assessed

[68] To the scenarios assessment publication called Energiekonzept 2050 participated also other research institutes as: Frauenhofer ISE, IWES, ISFH, IZES GbmH, ZAE Bayern and ZSW (published in June 2010).

[69] Despite no direct encompassing consultation was held, the policy formulation reflects the public attention to the climate issue following breaking events as the IPCC publication, the economic crises and the Fukushima accident (Sohre 2012:316).

[70] The proposals for climate mitigation policy were diversified as follows: the SPD proposed a 80 to 95% GHG emissions target, die Linke proposed a 90% GHG target with 7 billions of climate funds, the Green party proposed the 90% target but with a lower climate fund budget (3 billions) (Drucksache Deutsche Bundestag January-Mai 2010).

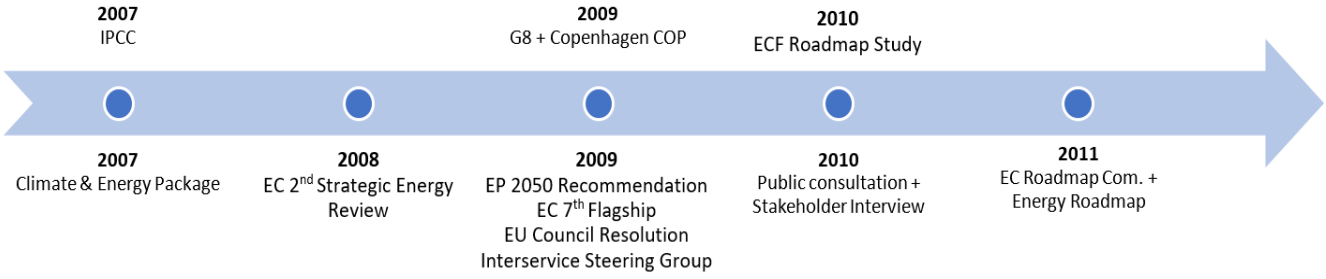
[71] The federal ministry of Economics and technology is responsible for all questions of energy policy (in particular supply security and energy markets functioning) while the one of environment is responsible for the area of renewable energy and climate protection (Fisher 2017:93).

[72]The report was prepared by a total of 676 authors from 40 countries, then reviewed by over 625 expert reviewers (IPCC 2007).

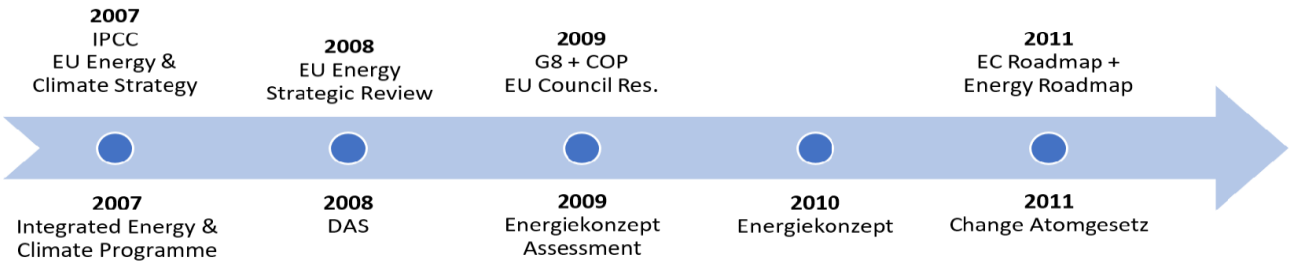
for the long term (until 2100) different scenarios for decreasing GHG emissions. Interestingly, to limit the temperature increase to 2°C above pre-industrial levels, the study recommends that *"developed countries would need to reduce emissions in 2020 by 10–40% below 1990 levels and in 2050 by approximately 40–95%"* leaving therefore a wide range of options in terms of quantitative commitment (IPCC 2007: 748). Since experts from the majority of EU countries were present, the European most advanced economies also stated a preliminary evaluation and commitment for 2050 using the models presented in the report. Among them there was also Germany, which at the time proposed an 80-90% emissions reduction preliminary commitment to be reached by 2050[73] (with base line 1990, Annex 3 IPCC 2007). Further international agreement on the 2050 plan of emissions reduction was shown during the 2009 G8 in Italy (where heads of the most advances economies reconfirmed the need for climate mitigation policies over 2050)[74] and during the 2009 Copenhagen COP on climate change (that confirmed the intent of handling mitigation policies).

Figure 4: Decarbonisation timeline comparison

The EU process



The German Process



Source: Author's elaboration

[73] The same target was also presented by the Netherlands, France and the UK (IPCC 2007, Annex 3).
[74]However this G8 intergovernmental meeting was not concerned just with climate change issue but also with more urgent discussions on the economic and financial crisis (G8 L' Aquila 2009).

4.3 Testing the Europeanization hypothesis

At the beginning of the research three main hypotheses were drawn concerning the relationship between the two decarbonisation policy plans. Europeanisation was taken as reference theoretical tool for the analysis of this relationship and a top-down and a bottom-down affection was hypothesized. The first relative to the assimilation of European rules and objectives into national policy that drives domestic change, the second relative to national political actors trying to accommodate European policy to their own needs (Bulmer & Burch 2000:4). The third hypothesis finally stated that no such relationship is evident between the two decarbonisation plans.

Evidence collected in chapter 3 and 4 shows that a connection between the Energy Roadmap and of the Energy Concept may exist because of the similarities in objectives, content and targets, but that it fails to address the extent to which the two policies converge and affect each other. The timeline comparison further shows a very proactive role of the Union in climate and energy policy between 2001 and 2009 (especially with the EU ETS, the 2020 package and the 2009 directives) and a long preparatory work for the development of a post 2020 strategy (published in mid-2011).

On the German side, it shows that the country has been instead promptly applying and complementing the European guidelines in that time span, and then has also achieved an accelerated resolution for the long-term transition strategy (already in place by the end of 2010). This speed in action depends mostly by the dynamic in which changes occur at both levels. As Fisher (2017) suggests, the process of change in national politics largely depends by the ruling coalition, party politics and mass mobilization on the issue, while in EU policy dynamics are the state of the integration project and the "*European Mood*" which drive the willingness of cooperation in certain areas (Fisher 2017:112). Considering the turbulent times of economic crises in the Eurozone, does not surprise that the Commission took a longer time for the assessment and the wide consultation preceding the proposal of the Energy Roadmap, which most likely, as the study itself assumes, will rise energetic prices at least until 2030 (EC 2011). Further, political will in moving towards a long-term strategy had been already shown in 2009 by the European Council and the European Parliament so there was no need to accelerate further the process.

For the Germans, instead, it can be assumed that the energy question had high priority at the time of the Energy Concept, especially because the 17th legislature period was governed by a conservative-liberal coalition, which was interested in revising the nuclear phase-out law[75] and integrating the rising share of renewables into the electricity market. Moreover, in the energy concept, explicit reference to an EU long-term plan is not envisaged, but rather, European cooperation is asked for an efficient delivery of the energy transition (BMWi & BMU 2010:28).

[75] The revision of the nuclear phase out was expressed already during the election campaign, but within the coalition there were still internal-disputes over the length of the delay (Fischer 2017:198).

The handling of the decarbonisation issue at both levels seems therefore to be connected to different logics and internal legitimization needs, but a framing effect in both directions could still be plausible. Knill and Lehmkuhl (2002) in this optic, argue that Europeanisation could take place also by altering beliefs and expectations of domestic actors and in this way affect their preferences. The issue becomes then whether Germany was able to adopt this energy concept with an indirect support of European environmental policy (especially for the long-term decarbonisation goal) or alternatively, whether the decarbonisation strategy of the Union was informed and accelerated by the German prior plan.
To test the effects of this indirect affection, a further source of evidence was collected for the study: expert interviews. The participants to this inquiry (5 in total) were selected for their in-depth knowledge of energy transitions, Europeanization research or for their knowledge of the decarbonisation framework. In particular, 3 of them are policy researchers (interviewee 1-2 and 3), while two of them have institutional positions in the European Union (interviewee 4) and in Germany (interviewee 5) (see Annex for details).

The questions submitted to the interviewees concerned their perception and personal opinion on a possible affection of the two policy projects. In particular, to the experts, was asked:

1. whether they perceived a European influence in the policy formulation of the German Energy concept (in particular in the fixing of the environmental objectives and emissions targets).
2. whether they detected an influence of the German policy plan in the formulation of the European strategy (aimed at orienting the Energy Roadmap for 2050 strategy more on renewables rather than other low-carbon sources)

Replies to the inquiry added different points of discussion to the topic, and argued for different methods of indirect influence, but mainly agreed on the point that connection between the two policy plans is rather loose or inexistent.

Interviewee 1 pointed out that although an informal connection between political actors and stakeholders at the EU and national level may exist (in terms of socialisation), it is not clear enough to be determined. Further, although a bottom up influence of the Germans in sponsoring renewable energy can be hypothesised, the general casual connection of the two plans is instead rather loose. He argued, indeed, that the policy process behind the two decarbonisation plans was connected to internal logics and legitimisation. In the EU case was sponsored by the will of the EU Council in the aftermath of Copenhagen, while in the German case connected to party politics and the nuclear issue. Finally, he also made clear that the EU action was mainly driven by environmental policy, the field in which the Union has more competences, while

German action was motivated by energy policy needs and the environmental component came in just later on (Interviewee 1, January 2017).

Of a different opinion was Interviewee 2, who argued for a more top-down affection in the formulation of the German plan but in delimited areas. Indeed, he pointed out that European-driven changes in German domestic policy did occur in relation to restrictions in emissions control and general commitment to environmental goals. However, since the decarbonisation objective was elaborated also at the international level, a strict binary causation cannot be satisfactory. Further, he pointed out that the German energy transition is not addressing sufficiently the decarbonisation objective, but is more concentrated on denuclearisation (Interviewee 2, January 2017).

Interviewee 3 also made reference to possible socialisation connection of actors involved in the political process, but confirmed that the nature of informal connections is difficult to prove. Further, he stated firmly, that in both cases the adoption of emissions reduction commitments depended on international agreements (in particular the Copenhagen conference) although they might not have produced binding agreements. He suggested the analysis of the international arena as starting point of formulation (Interviewee 3, February 2017).

Representing an "insider" voice within an EU institution, interviewee 4 also argued for a really loose connection between the two policy projects. He pointed out that the target of needed reduction for 2050 has to be attributed to the 2007 IPCC report and lately to the EU Council agreement of 2009. The Roadmap to 2050 and the energy roadmap were conceived as Commission's own assessment plans to be later used as reference for the MSs, and all MSs agreed on targets set[76]. He explained that obviously, the Commission was aware of the work of the Germans and that their early action might have facilitated and further supported the work of the Commission, but that it didn't justify or push for the Community assessment in the first place. Further, he argued that the work of the Commission was strictly independent from the one of the MSs, and it has not been conducted nor influenced by the political will of national governments (Interviewee 4, February 2017).

Finally, interviewee 5, being aware of the internal situation in Germany, commented on the relationship stating that no mechanical link between the two strategies can be traced. He argued that an energy transition in Germany was mainly driven by party politics and by domestic needs and that the process had

[76] Interviewee 4 points out that in the voting of the 2050 emissions reduction target within the Council opposition was made just by the Polish government, which asked for a target lower than 80%.

long-lasting roots to be found in the late 90s. He portrayed the energy concept as a big compromise between right and left coalition aimed at reassuring the left/green wing of the display of renewables and of climate goals while delaying the phase out of nuclear energy. The elaboration of a long-term energy strategy was then consequential and aided by the political momentum that the energy question had in national debates at the time. Further, he argued that the EU process towards decarbonisation could have been then a reflection of strategy planning in big member states and that a shift in paradigm was unavoidable since big countries started to discuss on this issue (Interviewee 5, March 2017).

Thanks to this further evidence, one of the preliminary results of this research is the one of rejecting the two hypotheses formulated in chapter 2 relative to the Europeanization of domestic policy on decarbonisation. Since policy documents evidence is not sufficient to prove a connection between the Energy Roadmap of the Commission and the Energy Concept of the German government, and expert judgments are in contrast with each other, it can be stated that convergence in policy formulation cannot be proved. The limits to Europeanization research, especially the one of difficulty in isolating the EU effect from other changes in the global sphere (Bulmer & Laquesne 2002:18), represent in this case a major constrain to the research. Therefore, policy formulation convergence cannot be related to the uploading or downloading hypothesis and not fully ascribed to a Europeanization mechanism. Rejected the Europeanization tie between the two policies, it can be instead supported the argument of the third hypothesis: "H3: The two policies are developing in a parallel way and they result unrelated. Is the international context that drives policy convergence". The loose connection between the two projects of energy transition may be compensated by a consolidated framing of decarbonisation policy in international agreements on climate policy (especially relative to the UN conferences on climate change mitigation). In international relations, indeed, an implicit or explicit set of principles and rules on decarbonisation policy may have been consolidating over time, leading to a policy-specific *international regime* formation (Krasner 1982, Haggard & Simons 1987). This form of patterned behaviour in international politics in which actors' expectations converge, may have in this way facilitated international coordinated action (Puchala & Hopkins 1982). Following this logic, decarbonisation policy may represent a new example of international cooperative behaviour in a specific area of policy making.
However, due to insufficient evidence, further research is needed to elaborate on this last hypothesis.

Table 3: Experts interviews results

Interviewee	Strength of connection	Type of affection	Critical issues
1	Loose	Bottom-up (RES)	EU Competence Domestic legitimisation International agreements
2	Loose	Top-down (emissions control)	Domestic needs International agreements
3	Loose	Socialisation	Difficulty to prove International agreements
4	Really loose	None	International agreements
5	Really loose	Bottom-up (big countries support)	General shift in paradigm

Source: Author's elaboration

5. Implementing the *Energiewende*

Once assessed the reasons behind the formulation of decarbonisation strategies at the EU and German level, this chapter will provide a closer look to the German situation. Having already presented the roots of the process and having contextualized the German energy transition in the European reference framework, the following chapter will finally look at the concrete implementation of the low-carbon transition. This chapter will therefore refer to the last two sub questions of the research concerned with the practical developments and emissions analysis of the German energy transition.

The ambitious policy project envisaged in the *Energiewende* assumes that to achieve decarbonisation (80% to 95% emissions reduction) a major energy transition has to occur in terms of power production, consumption and saving. Renewable energy and energy efficiency are in this optic the keys to achieve this transition, because they will lead to a denuclearisation of the economy, to a sustainable and cleaner energy system and will increase the security of energy supply by rendering it mostly domestic[77] (BMWi & BMU 2010). The transition is expected to allow in the long term for the achievement of a *"clean, safe and reliable"* energy supply, where sustainability and security of supply play a central role (BMWi & BMU 2010). In chapter 2 it was hypothesised that this transition, due to its strong reliance on renewable energy and its targets for emissions reduction could be considered as a rather post-materialist strategy. In this optic, the formulation of the *Energiewende* shows the prevailing set of environmental and quality of life values over economic stability concerns applied to energy policy. To test whether this post-material commitment is prevailing also in the concrete application of the energy transition, this chapter will provide a closer look at the developments of this strategy.

It will do so by providing a close observation of the 1) developments made in the energy industry after the adoption of the Energy Concept of 2010, of 2) the trends in carbon emissions reduction and of 3) the stakeholders' involvement in the process of change. This evidence will be then needed to prove whether the *Energiewende* is successfully addressing its decarbonisation challenge and whether its post materialist setting is sufficient to maintain a coherent and smooth application.

5.1 The German energetic mix and electricity market

When looking at sources of energy, the energetic mix that Germany proposes today is still largely dependent on fossil fuels. Its primary source of energy is indeed still oil and its derivate products, which account for the 34% of the country's energy consumption in 2016, and which is mainly utilized for the transportation sector

[77] Renewable energy together with energy efficiency are considered the key to achieve this transition. Creating power from domestic sustainable sources will make the country less dependent from imports.

and for heating purposes (AGEB 2017). However, when looking at the power sector (focus of this chapter because of the centrality of electricity production in modern economies), the share of energy sources varies considerably. In this respect, crude oil has a very marginal role, representing just the 0.9% of electricity production in Germany in 2016 due to its uncompetitive price (AGEB 2017)[78]. Oil will therefore not be included in the following analysis because the focus of the research is the one of electric power generation for industrial and household purposes.

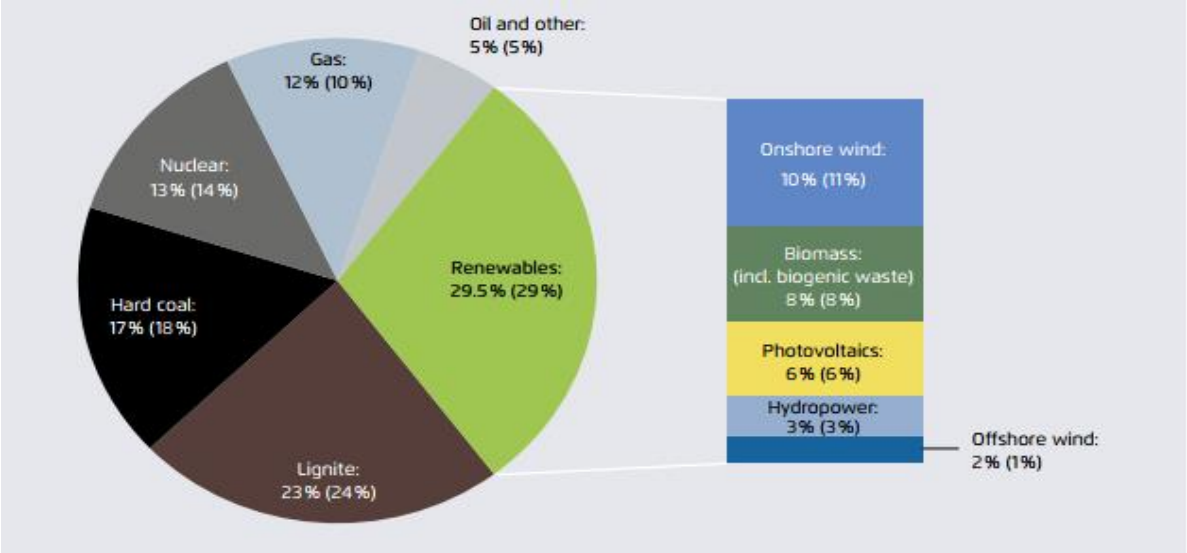
Germany represents the largest electricity consuming country in Europe (BMU,2012b), and its sources for electricity production include: gas-fired power plants, hard coal or lignite fired power plants, nuclear power plants and renewable energy sources (mainly represented by wind farms, solar panels, hydro energy and biomass). The electricity market in Germany is energy based, meaning that suppliers and consumers trade electricity in Kilowatt/hours (specific amount of energy at a specific point of time) and the price of electricity is determined in each hour by the operating costs of the most expensive plant running on the system (marginal costs) (Agora 2013:20). The German electricity system further provides that all power sources need to be deployed under a *"merit order scheme"* which states that the cheapest electricity has to be used first, and then as consumption increases, more expensive sources need to furnish their additional supply to meet demand (although their usage is allowed just as long as demand is covered) (ibid.). The merit order entails that renewable energies (especially wind, solar and hydro), enter first the market because of their low power generation price (marginal costs), and are followed with increasing prices by nuclear power, electricity from lignite, electricity from hard-coal and gas-fired power plants (the last two cases mainly depend from fossil fuel prices). An energy-based system as the German one, however, leaves responsibility of system reliability to the grid operator, who must maintain balance between demand and supply in every moment but is not obliged to provide back-up capacity (meant as emergency storage)[79] (Agora 2013:20-21).

To understand which changes in the power structure brought the *Energiewende*, the following subsections will analyse the development of every electricity source under the changes applied in the decarbonisation effort. The data reported will cover in particular the period 2011-2016 to follow the progress of the energy transition and to evaluate its low-carbon potential.

[78] Interestingly Germany is among the few large industrial powers which have no oil reserves and not even large oil corporations of its own (although it has a large refinery infrastructure). This factor influenced the countries reliance on other sources for the generation of power, especially on domestic coal and nuclear energy (Karlsch & Stockes 2003).

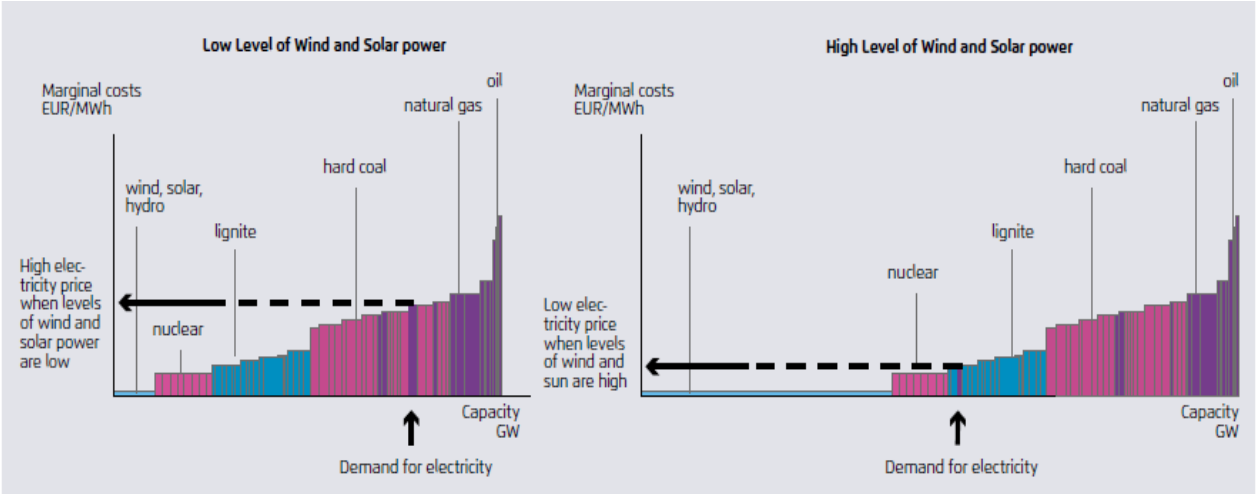
[79] The issue of backup-capacity rises in importance when we consider that with the nuclear phase-out the German system will be deprived of about 12GW by 2022 which will not be easily replaced in the market. Furthermore, since RES costs tend to decrease and push out of the market fossil fuels, grid operators may not be interested anymore in providing back-up capacity from fossil-fuel plants (Agora 2013:21).

Figure 5: The German power mix in 2016 (in brackets values of 2015)



Source: Agora Energiewende 2017 based on BMWi 2017

Figure 6: Merit order scheme and marginal cost variation in the German electricity market



Source: Agora Energiewende 2015

5.1.1 Renewable Energy

The dialectic that since the 80s brought the German government to invest always more on renewable sources was concentrated on three arguments: 1) RES would assure the country´s security of supply, 2) for Germany the early development of renewable sources would mean acting as technology leader and confer an *"early mover"* advantage, 3) by leading RES technology Germany could have a strong export potential (Jacobsson & Lauber 2006: 270). Preferred for their low environmental impact and their natural abundancy, the development of renewable sources demanded the country to further develop the green technology at

its own expenses, and afterwards to commercialize and integrate it into competitive markets. This process occurred with gradual institutional changes and the first incentives to this growth were the mid-80s expansion of R&D funds for RES development, followed by an introduction of RES technology into small niche markets in order to prevent aggressive competition from conventional sources (Jacobsson & Lauber 2006:263). Indeed, renewables were introduced into the market through incentives for investors and guarantees on the retail rate of electricity. This system, known as Feed in Tariff[80] (FiT) (*Stromeinspeisungsgesetz*) was introduced in 1991 and was meant to speed up investment in RES technology by assuring long-term minimum price guaranteed for producers with tariffs on average between 7.7/9.3 Euro/KWh (Meyer 2003: 668). This policy mechanism was financed by charges levied on electricity consumers and obliged the energy supply companies and network operators to purchase electricity from RES at an established price (above market price) and to pass on the additional costs in a compensation system (this priority of consume is known as buying-in obligation and applied just for green energy produced within Germany[81]) (ibid.). The system allowed the take-off of two main renewable sources during the 90s, wind turbines and solar panels, which started by then to penetrate the German market through a decentralized system of production, largely financed and owned by private parties (households, farmers, energy cooperatives) (Jacobsson & Lauber 2006:263-267). Initially accused of representing an infringement to European state aid rules, the *Stromeinspeisungsgesetz* was however declared valid by the European Court of Justice in 2001 because no state aid was transferred to the companies that produced power either directly or indirectly (ECJ 2001, C-379/98). In 2000 the system was then modified by the Renewable Energy Act (*Erneurbare-Energien-Gesetz,EEG*) which established an equal burden sharing between German utilities, differentiated premium tariffs among renewable sources, declining FiTs over the years (connected to the technology learning curve of every source), and the responsibility of operators for the costs of installation and update of RES (Meyer 2003:670). The investment on RES by 2000 was of 5 milliard/year and since then accelerated drastically by reaching 27 milliard/year by 2010, invested in particular for wind farms and solar panels and in citizen-owned projects[82] (Jarass & Obermair 2012:25). The share of RES in the German electricity production increased from the 3% in 1990 to 20% in 2011 (BMU,2012b) and the decentralization of production helped to maintain high public acceptance for this policy. Opposition to this system was anyhow very strong in and outside the German Parliament, where several stakeholders criticized the new policy regime. Within the legislative chamber opposition was established by a basic division of views that

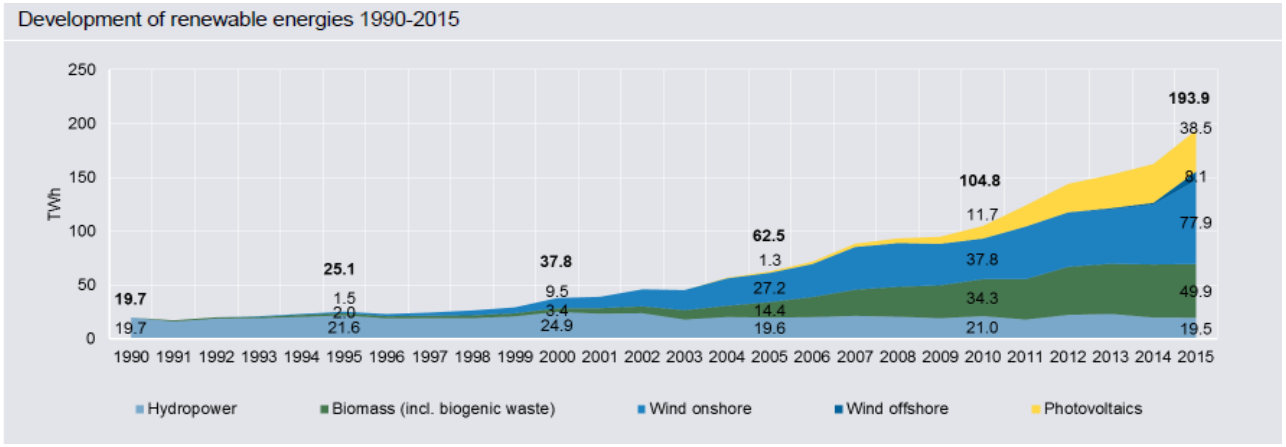
[80] Feed-in-tariffs assured 20 years price guarantees to private producers. This distribution to homeowners ad farmers created a broad coalition of RES-supporters, including traditional conservatives who had no affinity for the energy transition (Strunz 2013: 152).

[81] Although it should normally be considered as a restriction of the „free movement of goods" principle, the Maastricht Treaty art. 6 allows for exception to this rule when it entails an environmental protection goal.

[82] Citizen- owned projects accounted for 46 percent of all installed renewable capacity in Germany, while utilities only had a market share of around 13 percent. This unique ownership structure contributes significantly to the broad support of the Energiewende among citizens (Agora 2015: 13).

was in place between the conservative-liberal coalition and the red-green coalition (the first in favour of RES as a source of *complementary* energy, while the second in favour of RES as *alternative* energy sources), while outside the Parliament industry associations and conventional energy producers were opposing the green-power privilege for RES priority connection to grids (§ 39 EEG) contesting unfair competition and price increase, and the European Commission was opposing the EEG-levy exception (§ 40 ff. EEG) for energy-intensive industries by affirming strong doubts on the distortion of competition rules (Jacobsson & Lauber 2006:268-269). Despite contestations, the Energy Concept of 2010 represented a new confirm of the German RES commitment for the long term, strongly supported by the opposition parties (Greens and Socialists) RES energy consumption in the targets agreed in 2010 should indeed achieve 60% of gross energy final consumption in the energetic mix by 2050 and should represent the 80% of gross electricity consumption[83] by 2050 (BMWi & BMU 2010). The effects of these targets, combined with the decision of phasing-out nuclear in the aftermath of Fukushima, produced already in 2011 a remarkable rise in installations in German territory which interested in particular solar and wind. Just from 2010 to 2011 the installed solar power increased by 43% of potential (from 17.5 GW in 2010 to 25.0 GW in 2011) and of 65% in electricity production, while the installed wind power increased by 7% of potential (from 27.2 GW in 2010 to 29.1 GW in 2011) and 29% in electricity production (Fraunhofer ISE 2012:5-6). In the years that followed the increase in solar installations even surmounted the wind turbines, which saw a slow down until 2015, when the off-shore farms were built in the North Sea (Frauenhofer ISE 2013:4)[84].

Figure 7: Development of renewable energy capacity in Germany, 1990-2015



Source: Agora Energiewende 2015 based on AG Energiebilanzen 2015

[83] RES share of Gross electricity consumption covers not only the electricity consumed by the end user, but also the consumption of the energy sector in itself (distributional and transformation losses) (Eurostat).

[84] Despite the number of installations, wind turbines currently represent the cheapest and more productive renewable source in Germany with 41.5% share in RES energy production (2014) and the 19% share of FiT (BWE 2015).

However, the fast rise in installations and in investment did cause again concerns over the market integration of renewable sources, and therefore their regulation was subject to further changes in 2012 and 2014.

In a first moment, the amendment of the German Renewable Energy Act in 2012 introduced direct marketing practices (through a market premium, *Marketprämie*) for utilities generating more than 500 KW, which were incentivised to sell their electricity when demand was higher (demand-oriented electricity production) providing the chance for higher revenues (Gawel & Purkus 2013:601). The addition, examined by the Commission in 2013, was considered not sufficient to prevent the infringement of competition rules, because was used in parallel to feed tariffs for smaller plants, and was still exempting energy-intensive industries (EC 2014 :90). In the second and third round of legislation, the German government did instead attain its rules more closely to the EU "Guidelines on State aid for environmental protection and energy 2014-2020" (July 2014) in order to avoid single market infringements (Elspas & Mützelburg 2015: 3). Thus, in the Renewable Energy Act (EEG) revisions of 2014[85] and 2017[86] major changes in the concession of premium tariffs were introduced and allowed for a competitive bidding process of concession and for competitive tenders open partly also to EU competitors (EEG 2014, EEG 2017). The effects of these changes are not yet quantifiable because still evolving at the time of writing, but they are expected to modify the special decentralized system of installations typical of the German territory, reducing the "small players" in favour of more concentrated generation facilities[87] (Tews 2015:281). Anyhow, evidence from the period of interest, 2011-2016, does show that the incentives of the *Energiewende* have considerably prompted the rising share of renewables in the German energetic mix, conferring good prospects for the achievement of the prefixed targets. In 2016 renewable energy in Germany has accounted for 29% of total share of electricity production (one third of the total) and for the 32.6% of share in gross electricity consumption, which suggest that the 35% target of 2020 would be quite easily achieved (Destatis 2016, AGEB 2017).

The fast rise in investments however, has been sustained through extra surcharges to consumers' electricity bills, weighing mostly on private households (Agora 2015:5-6). The EEG surcharge, which added 3.53 cents/KWh to consumers' bills when the Energy concept started to be implemented in 2011, is currently set €6.88 cents per kWh (for a total of 24 billion euros in 2017) and is expected to increase moderately until 2035 and then start to decline (BMWE 2015: 16-17) (Agora 2017: 13). Further, being the increase of installation

[85] The EEG 2014 version, in particular, also reduced the industry exception privilege, extended the market premium to all installation with at least 100 KW of capacity (since January 2016), allowed the granting of additional premium tariffs but just after a competitive bidding process, and introduced competitive tenders for renewable support (starting in 2017) (EC 2014:90) (Elspas & Mützelburg 2015: 3).

[86] Starting in 2017 the financing of large wind, photovoltaic and biomass projects has been accorded to a competitive auction system. Funding for renewables is now determined by competitive bidding for a market premium that will be guaranteed for a period of 20 years from the start of energy production (Agora 2017: 31-32).

[87] Private-owned facilities, according to the analysis of Tews 2015, are likely to encounter higher transaction costs and risks for their investment due to the bidding mechanism of auctioning introduced in the EEG of 2014.

that fast, additional measures to integrate efficiently renewables in the market had to be taken (by changing frequently the renewable energy act to regulate funding investments and competitive tenders, and by introducing market-controlled pricing of electricity)[88] .

5.1.2 Nuclear Energy

Nuclear power is a source of energy production which from one side has the lowest lifecycle emissions[89] of any electric generating technology, except for wind energy (UN IPCC 2014), but that from the other is associated with long-lasting radioactive waste which can be dispersed in the environment in case of installation accidents. The nature of this source and the capital and technological potential that it requires, have historically divided countries in allowing nuclear fission.[90] Germany is among the countries that opted for Uranium exploitation after the oil crises of 1972-3 and where nuclear power plants were constructed between the 70s and the 80s (with the first being operational since 1975) for a total of 17 installations (World Nuclear Association 2016).

Until 2010 they supplied more than one-quarter of the electricity in the German market (133 TWh net with a 10.8% share of primary energy consumption by 2010) (AGEB 2015) but since the first nuclear disaster of Chernobyl, the German public opinion started to strongly oppose this energy source due to its associated risks. However, nuclear power continued to represent an important resource for the economy of the country, and to be supported by the industrial, entrepreneurial faction, aware of the scarcity of resources within German borders. This conflict of interests was visible in the changes made after the phase-out agreement of the 2000 Red-Green coalition government scheduled within 2022 which was re-negotiated by the Conservative-liberal coalition in 2010 and then re-established almost at the same conditions after the Fukushima accident of 2011 (in the latest phase-out agreement is confirmed the shutdown of all operational plants by 2022 but the decommissioning times for each installation are prolonged) (World Nuclear Association 2016). The decommissioning brought to legal claims from the country's four nuclear power utilities (RWE, E.On, Vattenfall, EnBW) which are now pressing for compensation and are suing the government over continuing with the nuclear tax introduced in relation to the 8- and 14-year license extensions agreed in September 2010[91] (ibid.). Utilities have thus suited the German government for an

[88] The "*freie Presibildung*" is part of the newly adopted Electricity Market Act *(Strommarktgesetz*) and makes the pricing system dependent on market forces (on supply and demand). Since spring 2016 scarcity pricing is being allowed and price signals are the primary instrument to balance the electricity market (Lang & Lang 2016)

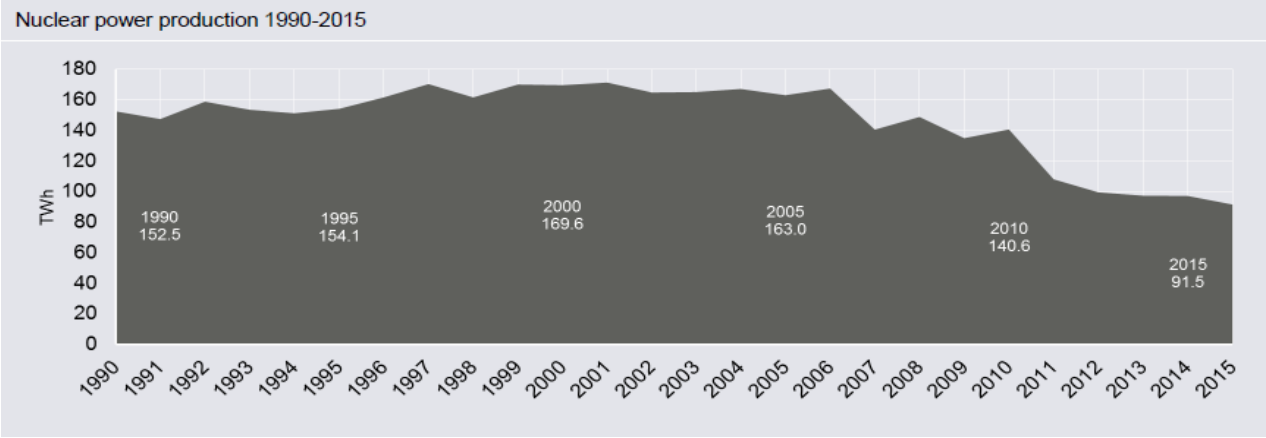
[89] Calculated as tons of Carbon dioxide equivalent per Gigawatt-hour.

[90] Main factors that impede the exploitation of nuclear energy regard: the high costs of construction, public acceptance of nuclear plants, the absence of an international supply chain and a high regulatory burden (Kidd 2013: 281).

[91] The 2011 amendment to the Nuclear energy Law (13th AtG Amendment) has been judged by the First Senate of the Federal Constitutional Court as partly unconstitutional because it violates the guaranteed right to property (Art. 14 of the Basic Law, Grundgesetz – GG) to the extent that the introduction of fixed dates by which nuclear power plants in Germany must be shut down (§ 7 sec. 1a sentence 1 of the Atomic Energy Act, Atomgesetz – AtG in the version of the

overall amount of 24 billion Euro (Bernasconi-Osterwalder & Brauch 2014), but, while the national companies (RWE, E.on and EnBW) have advances their proceedings in front of the German Federal Constitutional Court, Vattenfall, the Swedish based utility Vattenfall, has instead advanced its inquiry at the International Centre for Settlement of Investment Disputes, grounding its request on the Energy Charter Treaty[92]. Although the resolution of such disputes are still ongoing and their development is in some cases hidden into extreme confidentiality (especially for the Vattenfall arbitration), the results will most likely support the right of the investors (Pinzler, Uchatius, & Kohlberg, 2014). Additionally, a recent study of the "Commission to review the financing of the phase-out of nuclear energy" (charged by the government) has estimated the responsibilities of the government in the decommissioning process for a total amount of 23.3 billion (KFK 2016). By the end of 2015 were closed 9 of the oldest reactors producing 9611MWe of the total 20,339 MWe (6.4% of the country's generating capacity), while the remaining installations (8) are supposed to start the shut down by the end of 2017.

Figure 8: Development of nuclear power production in Germany, 1990-2015



Source: Agora Energiewende 2015 based on AG Energiebilanzen 2015

The energy transition in this sense has brought radical changes into the nuclear power sector, but leaves not few doubts on how this power source will be replaced. Nuclear power currently represents the 13.1% of Germany's electricity production and is placed in the merit order scheme right after renewables because of its low marginal costs (AGEB 2017). With the planned phase-out, access to the grid will most likely also leave

13th AtG Amendment) does not ensure that the electricity output allowances allocated to each power plant by law in 2002 will be used up within the corporations concerned before the fixed shut down dates (Federal Constitutional Law December 2016, Press Release No. 88/2016).

[92] The Energy Charter Treaty is a binding multilateral agreement on energy provisions operational since 1998 (although was first drawn in 1991 and signed in 1994) and signed by 51 countries (Riberio 2006:55). Its fundamental aim is "to strengthen the rule of law on energy issues, by creating a level playing field of rules to be observed by all participating governments, thus minimizing the risks associated with energy related investments and trade" (ECT art.14). Part III of the document provides protection norms for investors, and guarantees to foreign investors also "protection against political risks").

space of competitiveness to other (cheap) fossil fuels that despite the enlargement of renewables may still produce electricity at convenient prices. Climate mitigation and decarbonisation of the economies is considered to be possible also without nuclear power, but by excluding this source the possibility that the transition becomes more difficult and costly do considerably rise (IEA 2014)[93].

5.1.3 Lignite-fired power

Lignite, or brown coal, is the lowest rank of coal used almost exclusively as fuel for electric power generation. Is composed by 60% of carbon and its combustion releases in the air the highest share of carbon of any other fossil fuel (releasing 0,36 kg of Co_2 per KWh, compared to the 0,34 kg of hard coal, 0,26kg of crude oil and the 0,20 kg of natural gas) (Volker-Quashning 2015). However, lignite is also the cheapest power resource available in the German market since is the only fossil fuel abundant domestically, with 185 mining sites located in Western Germany (Rheinland), and in Eastern Germany around Leipzig, Helmstedt and the Lausitz area (von Bechtolshei & Kruse 2015:4). Domestic mines produce 183 million tons of lignite coal annually with economically feasible reserves of ca. 40 billion tons[94] which are exploited by 35 operating plants to produce a net capacity of 21GWe (ibid.:5). Before 2012 there were additional 12 lignite plants in German territory but due to the stricter standards on air pollution of the EU's Large Combustion Plants Directive of 2001 (LCPD 2001/80/EC)[95] German utilities had to shut down 1.8 GW of coal production (BNetzA 2012, Butcher 2012). Germany remains anyway the third largest producer of lignite worldwide (after Russia and Australia with over 14,4% of global extraction) (BUM 2016:9) and consumes this resource domestically since brown coal is hardly traded on international markets due to its low energy density and typically high moisture content which makes it inefficient to transport (Jungjohann & Morris 2014:5). Although its energetic content does not make brown coal highly efficient, its abundancy in the territory has traditionally conferred to this resource a relevant place in local politics since it represents a large source of income and jobs for the mining regions (with approximately 25 000 direct jobs and a further 63 000 indirect jobs at suppliers can be attributed to the lignite industry) (Eurocoal 2015). However, the exploitation of this fossil fuel has required over time the support of the government, which has substantially subsidized hard and brown coal over the last four decades, with $538 billion between 1970 and 2014 (for comparison, subsidies to renewables were estimated at $130 billion over the same period) (Küchler & Wronski, 2015). National

[93] In the study Energy Technology Perspectives 2014 the International Energy Agency states indeed that among the portfolio of technologies to be used for the mitigation of climate change (in particular to remain under the 2°C threshold) nuclear power would represent a critical source for countries, and ideally should account for 18% of a countries energy mix (IEA 2014).

[94] At the current level of exploitation, the reserves are expected to ensure a supply for more than 200 years (DEBRIV 2017).

[95] The Directive is applicable just to plants larger than 50 MW and implies stricter controls to non-CO_2 emissions as SO_2, NOx, and particles (LCPD 2001/80/EC)

protection to the coal industry has been evident also in 2010, when Germany created a coalition of coal producing countries (Spain, Romania, UK) to preserve the privilege of the industry (Harrison 2010). Arguing for a considerable loss in economic competitiveness, the coalition was able to defend coal subsidies EU-wide from a 4-years phase out limit proposal of the Commission[96] (EC 2010). After months of dispute, the coalition obtained a further extension for the phase out to be completed by 2019[97], the sixth of such state aid extension since 1965 (EU Council decision (2010/787/EU)) (Harrison 2010).

Afterwards, in 2014, due to concerns over rising industry emissions, and in accordance to the Climate Action Programme 2020, the CDU/SPD government decided to retire approximately the 13% of Germany's oldest lignite power plants by 2021. Through a "common understanding"[98] in November 2015 the government reached an agreement with the affected power plants operators to put part of this emission-intensive power generators into a capacity reserve (Sec. 13g EnWG-E). The stand-by of these 2.7 GW of lignite-fired power stations, meant to last 4 years before the shut-down of the power plants affected, is being assured with a scheme of capacity payment[99], a fix reward on the capacity that the facility provides, financed through consumers' bills (De Meulemeester 2014, Schlandt 2015, Agora 2015:38). In name of the long-term security of supply, the government is assuring a stable income for utilities which should maintain stable their investment in capacity of production, although the grid is thought to be sufficiently supplied until 2020 (ENTSOE, 2015, Lehmann et.al 2015). Support to the maintenance of lignite privileges is not only claimed by power utilities (RWE, MIBRAG, Vattenfall and E.ON) as a "*bridging technology*" essential for the security of supply, but also from trade unions and some Ländern, which are trying to safeguard the local economy [100](Appun 2015).

Despite some marginal plans of power plants closure, the *Energiewende* in this case does not provide clear strategies on how to decrease the usage of lignite, which remains for the moment the first larger contributor to the country's electricity production, with 23,1% of production in 2016[101] (AGEB 2017). In the merit order scheme brown coal maintains in competitiveness since the price of carbon dioxide allowances is still

[96] State aid for hard coal mining must be approved by the EU Commission based on the new EU rules governing state aid for the coal sector. Germany was able to postpone the phase out as decided on 10 December 2010 by the Competitiveness Council (BMWi 2016).

[97] To the extended subsidies was given a maximum amount of governmental support between 1,284 million euros in 2014 and 794 million in 2019 (BMWi 2016).

[98] The agreement reached in November 2015 (*Überführung von Braunkohlekraftwerksblöcken in die Sicherheitsbereitschaft*) created the so called "lignite capacity reserves" and was and then introduced in the New Electricity Market Act under the climate part (in Sec. 13 g EnWG-E).

[99] Capacity payments are a secure source of income for power utilities because they are rewarded for the MW's they can produce rather than the MW's they actually generate (De Meulemeester 2014).

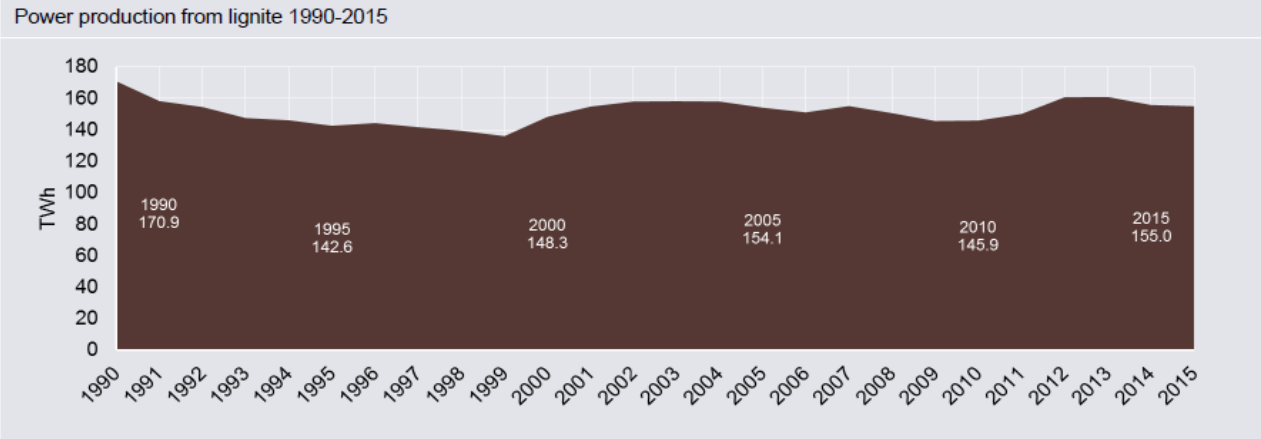
[100] The regions interested, although are trying to reduce the environmental impact of coal mining and burning, do confirm their support to this industry. In 2014, for example, the state of North Rhine-Westphalia (NRW) a traditional coal mining area, decided to cut future lignite production by 1.3 billion tonnes, saving 1,400 people from relocation, but at the same time, assuring that coal mining will continue until at least 2030 (Appun 2015).

[101] Lignite in the power generation mix further reached its highest level since 1990 in 2013, when 25.6% of electricity was generated with brown coal (Agora 2015:7).

relatively low (4,99 €/ton in 2017), and is able to enter the grid right after nuclear energy and before other cleaner fossil fuels as natural gas (EEX 2017).

Although the oldest plants were closed in the time laps considered, there are still ongoing investments in this source, and two planned projects confirmed in 2015 (Niederaußen BoA Plus of 1100 MW operated by RWE, and Profen of 660 Mw operated by MIBRAG) (UBM 2016:14). Further, inconsistent investments with the climate goals of the country are being made for other lignite power plants abroad. Striking is the example of the Plotemeida V plant in the north of Greece financed with German public money and which should become operative in 2019[102] (KfW 2013).

Figure 9: Development of lignite power production in Germany, 1990-2015



Source: Agora Energiewende 2015 based on AG Energiebilanzen 2015

5.1.4 Hard Coal-fired power

Similarly to brown coal, also hard coal has been and still is a particularly important resource for the industrial development of the Federal Republic, although its carbon intensity is likewise very high (0,34 kg of Co_2 per KWh). In this case is the Western part which provides most of the primary supply of hard coal (with mining regions in the Ruhr and in the Saarland) but the capacity of the mines and the costs of extraction do represent a limit for the supply of the country's need (Jungjohann & Morris 2014:5). Germany has an estimated 2.5 billion tons of hard coal reserves but only 37 million of these reserves will be mined until subsidies for coal mining are phased out in 2018 (ibid.).

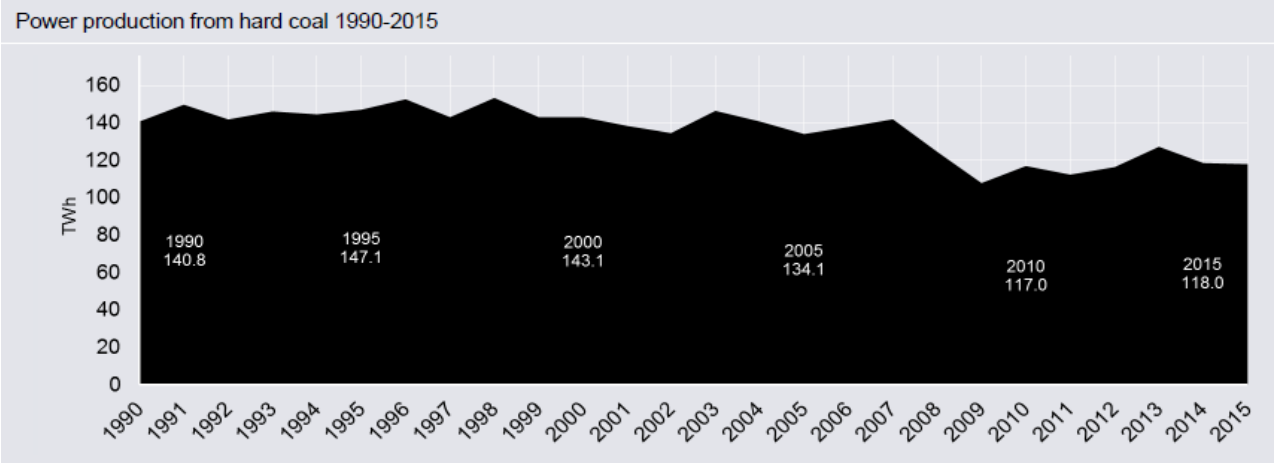
The subsidies already cited above (which amounted to $538 billion between 1970 and 2014), are furthermore complemented by an energy tax exemption for the energy production process (the 'manufacturers' privilege' or *Herstellerprivileg*)[103] and is worth on average $383 million per year (Küchler & Wronski, 2015).

[102] The funding entails 800 M€ guarantee from the German-government owned investment bank KFW for the building of the power plant, and will have a capacity of 660 MW (Sourcewatch 2017).

[103] The same exception is valid for the energy production process of natural gas and petroleum products.

Analysists sustain that without such support the hard coal industry in Germany would be largely uneconomic, and therefore is expected that with the phase out of subsidies[104] the coal industry would surrender to imported energy (Anderson, 1995). The relatively expensive domestic hard coal will be then replaced by imported sources, which are currently mostly supplied by Russia, South Africa and Poland (Destatis 2017) and purchased at particularly favourable and declining prices in international markets driven by global over-supply (the decline has started in 2011 when hard coal was traded for 13.1 EUR/MWh reaching 8.38 EUR/MWh in 2016) (BAFA 2017). Despite questions of domestic mining profitability, power production from hard coal has been continuing its business as usual practices in the aftermath of the Energiewende resolution of 2011, also with a slightly rise in power generation from 117 TWh of production in 2011 to 118 TWh in 2015 (AG Energiebilanzen 2015).

Figure 10: Development of hard coal power production in Germany, 1990-2015



Source: Agora Energiewende 2015 based on AG Energiebilanzen

There are currently 29 operating hard coal power plants in German territory, because 10 of them have been closed between 2011 and 2015, but replaced by 5 new plants that became operational between 2012 and 2015 (BNetz 2015:46). This trend of investment, can be ascribed to several factors: (1) generating electricity through hard coal is still more convenient than using natural gas (8.38 €/MWh in 2016)[105] (BAFA 2017), (2) the price for allowances in 2017 is still low (was €7,60 in 2015 and arrived at €4,99 in 2017) (EEX 2017) and (3) the EU ETS tend to maintain the incentives for new construction under the "new entrants rule" which confreres to new plants the possibility of receiving free carbon allocations, and the "transfer rule" which allows new firms to receive for 4 years of additional allocations from the decommissioned old plants

[104] Subsidies on hard coal alone account for almost the 20% of all national subsidies for energy, accounting for about 1290 Mrd.€ /year (BMWi 2016).
[105] For comparison, the price of natural gas in 2015 was 20.7 EUR/MWh, meaning with a spread of 12,2 EUR/MWh (BAFA 2015a).

(Jungjohann & Morris 2014: 15). This incentive to modernisation was in some way responsible for the building of additional coal production capacity, but was then refrained by the entering into force of the third phase of the EU ETS in 2013. As a matter of fact, the EU in 2013 rejected the National Allocation Plan made by the German authorities and conveyed that allocations had to be auctioned also for new plants (ibid.).

This change made the profitability of hard coal power plants considerably decrease, and, since the development of Carbon Capture Technologies (CCS) has encountered so far high public resistance and an unclear regulatory field[106] (which postponed the plans for testing the technology after 2017), companies are turning somewhere else their investments (Spiegel 2011). Particularly striking are the cases of the two major utilities in the hard coal business, RWE and Vattenfall, the first who decided to cancel the opening of its brand new power plant in NRW (Westfalen D) decommissioned in 2014 for questions of profitability (RWE 2015), and the second who started to sell its assets of brown coal mines in the entire German territory (Vattenfall 2016). Although the scenario of profitability decreases for big utilities, the status quo maintenance can be attributed in particular to the lobbying activity of industrial interests and Ländern with high economic reliance on this resource. Where has been decided for the phase out of the resource, the federal government was indeed constrained to assure *"socially acceptable compromises"*, which for example, in the state of North Rhine-Westphalia entailed a 10-year package of national subsidies (BAFA 2016).

In addition, both the local and federal government have agreed to cover the cost of liabilities if the sales of assets do not cover the decommissioning costs (OECD, 2013) and to provide early retirement schemes to unemployed hard-coal miners and health insurance for those still working in the sector in NRW and Saarland (*Anpassungsgeld für Arbeitnehmer des Steinkohlenbergbaus*) applicable until 2027 (BAFA 2016). In general terms, the most remarkable change that the *Energiewende* has brought into the hard coal industry entail the cutting of subsidies for coal mining by 2018, factor that is likely to compress considerably the profitability of the resource. However, the government has provided generous plans of decommissioning for old plants, and has not directly intervened to discourage the combustion of imported hard coal.

The industry has been instead, between 2011 and 2015 more dependent on market logics (the price of imported coal, and the one of carbon) and European constraints (for the auctioning of allowances within the EU ETS) and are these two factors that are more likely to shape this industry in the coming years.

[106] The European Directive on the geological storage of carbon dioxide (Dir 2009/31/EC) has been approved by the German Parliament two years later (2011) but with opt-outs for the states of Schlesnig-Holstein and Lower-Saxony. The not-in-my-backyard public contestations on its associated environmental risks of water contamination have indeed brought to the closure of the first two pilot projects carried out by the Swedish utility Vattenfall in 2008 and 2009 (Swarze Pumpe Pilot Plant 2008 and Altmark storage testing 2009) (Vattenfall 2011).

3.1.5 Natural Gas-fired power

Natural gas is a fossil fuel with high energy content and relatively low emissions (0,20 kg of Co2/KWh) (Volker-Quashning 2015) which exploitation on large scale started to be commercialized in the late 80s. Particularly used for heating purposes in households, it can be also utilized to generate electricity, as fuel for vehicles or as raw material for the creation of hybrid biofuels (as bio methane).

Gas currently represents the second largest source of energy in Europe and the second source of primary energy consumption[107] in Germany with a 22.6% share in 2016 (second just to oil with 33%) (AGEB 2017). Couldn't facing the domestic demand with national natural gas reserves (that cover just 7% of its domestic needs and are located in Lower Saxony), Germany has to import almost 93% of its gas demand mostly through pipeline connection (BMWi 2016b). Suppliers of the German market are in particular: (1) Russia, which provides the 38% of gas supply, (2) Norway, which provides the 22%, (3) the Netherlands with the 26% and then (4) other minor suppliers for the remaining 4% (BMWi 2016b).

Except for the "within Europe" pipelines which connect directly supplier and consumer (Norway and the Netherlands) the pipelines which transport the biggest volume of natural gas in Germany (and in Europe) are the ones coming from Russia, which require the involvement of third countries as transit (Ukraine) or long offshore routes in the Baltic sea (IEA 2014). In the last decade, these two factors have challenged the reliability of the system, which had to face scarcity of supply during the Ukrainian gas transit dispute of 2009 and the cut in deliveries from Russia in 2012, and severe contestations form political partners following the extension of the Nord Stream pipeline in 2015[108] (Powell 2016). Having a secure supply represents for Germany a vital interest, because the Federal Republic is the biggest gas market in Europe (followed by UK and Italy) with a gas network that reaches 510000 km (Eurogas 2016) and a storage capacity of 10,802.15 Mcm (GIE 2016)[109]. However, most of this gas is used for heating purposes, while just the 8.8% is meant for the generation of electric power (BMWi 2016b). In the power sector the importance of natural gas does instead increase due to its low emission content and to the rich pipeline and storage infrastructure that it has. Many analysts consider indeed the flexibility of gas as the perfect "ally" of renewables in assuring energy security with low emissions and low collateral risks (Odenberger et al.2013, Erbach 2014:3, Huebner 2013:8), a role that can be further developed with technological improvements. High expectations are currently focused on the role of the power-to-gas process (P2G), a technique of conversion of the daily excess of electricity production from renewables into hydrogen or methane then used to feed natural gas

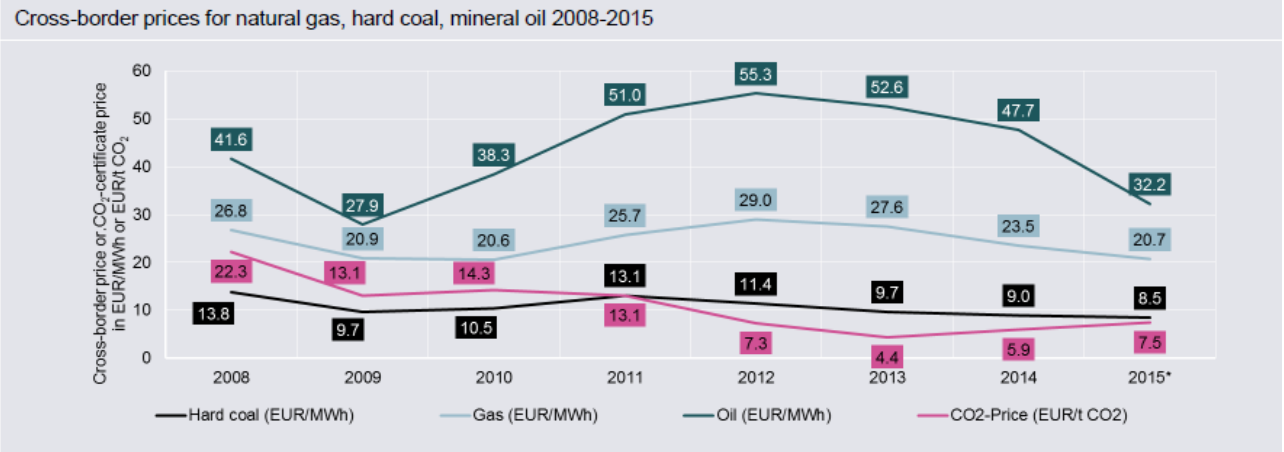
[107] This indicator refers to the total amount of energy used in a country each year.

[108] The extension of the Nord Stream pipeline was decided in 2015 with a bilateral agreement between Moscow and Berlin for an additional supply capacity of 39,1 milliard/m_3. The decision was subject of contestation since it was forwarded despite the sanctions of the European Union on the Russian partner for the annexation of Crimea, since it is considered a violation of the 3rd EU energy Package (because is not regulated through EU law) and since is interpreted as a political-economic damaging tool against Ukraine (Powell 2016).

[109] For comparison, the second biggest storage capacity in Europe is detained by Italy with 6605,22 Mcm (GIE 2016).

grids (Götz 2016). Experimented in pivotal power plants in Germany since 2013, this technique may allow the storage and transportation of a "*huge power reservoir for several billion KWh of energy*" (BMWi 2016b). Looking at current features of the natural gas industry as it is today, reasonable doubts on its positive trend do instead arise. As a matter of fact, since the *Energiewende* resolution is in place, natural gas has contributed constantly less to the country's electricity production (it was 14,5% in 2011 and just 12,4% in 2016) despite its price was also decreasing (from 25.7 €/MWh in 2011 to 19.99 €/MWh at the end of 2016) (AG Energiebilanzen 2017, Destatis 2016, Eurostat 2017). The price of gas, which is oil-indexed in the market, has indeed followed the fall trend of oil markets (albeit with a 6-9-month time lag) which are at very low levels since the US has started to considerably increase the production[110] (European Commission 2015:24, Espinasa & Sucre 2014:11).

Figure 11: Prices of natural gas, hard coal, mineral oil in international markets, 2008 -2015



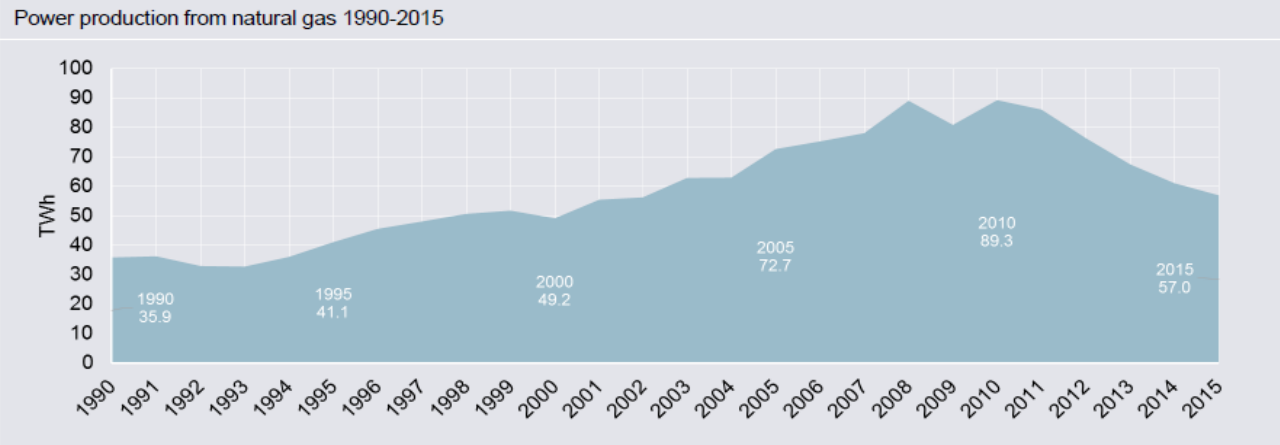
Source: Agora Energiewende 2015 based on BAFA 2015, EEA 2015, DEHst 2015

The current price leaves natural gas behind the previous mentioned power sources (renewables, nuclear and coal) in the merit order scheme and is therefore utilized just to complement them in case of need. In particular, when the two main sources of renewable power, wind and solar, are at their peak of production they tend to lower their marginal cost and push natural gas even further in the merit scheme. Despite its better environmental performances and the manufacturers privilege tax exemption, natural gas usage after 2011 has been considerably following a price discrimination logic and has therefore failed to generate big investments from utilities and in storage infrastructure (utilities investment in natural gas has been declining since 2011 with no new power plant constructed and some of the existing ones provisionally closed, while

[110] Through deep water drilling in the Gulf of Mexico and hydraulic fracturing for shale oil US production reached in 2014 3.3 million barrels per day (the same daily production of Iraq) (Espinasa & Sucre 2014:11).

the projects for storage infrastructure foresee just 2722 Mcm additional capacity) (Bnetz 2015:46, Destatis 2016).

Figure 12: Development of power production from Natural Gas in Germany, 1990-2015



Source: Agora Energiewende 2015 based on AG Energiebilanzen 2015

The *Energiewende*, with regard to natural gas, has therefore not introduced any remarkable change or incentive for its usage or development, but has rather conformed to the competition measures of the 3rd Energy Package, opening the gas market to external competitors (contrary to other power sources natural gas exploitation for power generation is conducted not just by the big utilities that manage other resources, as E.On and RWE, but also by other non-national utilities as BEB Erdgas und Erdol Gmbh, VNG, Wingas, Shell and Exxonmobile) (Powell 2016).

5.2 Considerations on the reliability and affordability of the system

The results of the energy mix analysis for the power sector here presented are meant to show how the production of electricity has varied in the years following the Energy Concept.

In the first place, what is evident from this analysis is that the German government has made an impressive effort in developing renewable sources, and their spread in Germany territory in the time laps considered (2011-2016) give good prospects for the realization of the 2020 targets. Green energy is considerably gaining ground in the German market, furnished the biggest amount of electricity in 2016 (29%), and has been so far able to cover the vacuum left by the closure of half of the nuclear plants (AGEB 2017). However, by having priority access to the grid and substantial subsidies in the long term (FiTs), renewables practically became *"base power load by law"*, pushing at the margins of the merit order scheme power sources with higher marginal costs or which do not receive the same support (that is particularly the case of natural gas) (Agora 2013:9). The later changes in the renewables schemes (EEG 2017) and in the EU internal energy market give

good prospects for a better integration of renewables in the market, but the intermittent power that they produce is still considered problematic when peak hours produce excess of power being entered into the grid or being exported into neighbours' markets[111]. Further, since most of the renewable energy is produced with the wind turbines in the northern part, electricity transmission networks remain critical for achieving the industry of the southern regions[112]. Finally, the economic effort required to consumers in the EEG surcharge not only is considered to rise for quite a lot of time still, but is also creating disparities among consumers that can be commented as "*socially unfair*" because do not interest the industry (largely exempted to maintain competitiveness) but weigh almost entirely on private households (subject to the second highest electricity prices for households in Europe, 30cts€ /KWh in 2017) and especially the low income ones (for which the electricity bill account for up to 5% of household expenditure) (Agora 2017, Agora 2015:6, Neuhoff et.al 2012:41, Dieckman et. al 2016).

Concerning nuclear power, despite critiques continue to claim that Germany is "*outsourcing its energy security*"[113] in scenarios of massive imports of electricity from nuclear power neighbours (as France or Czech Republic), current data on electricity trade balance suggest instead that Germany is since 2003 a net exporter of electricity with almost the 5% of gross domestic production exported (Frauenhofer ISE 2015). Reassuring is in this respect is also the fact that net installed capacity for electricity generation is constantly rising since 2011 (when the first drop in nuclear installations was visible) (Morris & Penth 2016, AGEB 2015). Whether this conditions will be sufficient to prevent shortfalls is however a matter of time (the country has still 6 years to adapt to the change), while what is certain is that the financial burden for the early closure of nuclear power plants will be on taxpayers. This is true not just because of the legal procedure due to the early closure, but also because the costs of dismantling the plants (which should be partly carried out by the same companies) may easily be transferred to the general public. As a matter of fact, the company which owns the majority of nuclear reactors in Germany, E.On (with 12 power plants) has recently restructured its assets leaving under the E.On brand just the assets of renewable energy investments, and dislocated its conventional assets to a new company, Uniper. This turn, analysed by the Wuppertal Institute of climate and Energy may in the end allow the company to declare insolvency of Uniper in case the costs for nuclear decommissioning would become too high for the firm, and successively discharge the bill on the general

[111] Intermittent excess in electricity generation that cannot be stored is automatically redirected into the electricity market of neighbor countries (especially France, Poland and Czech Republic). Some expert define the situation as a form of "free riding" on neighbours' markets (Interviewee 2,2017).

[112] The estimated new transmission line needed is of about 8,000 kilometers, which needs to be installed by 2025. Yet only 700 kilometers have been built to date (Agora 2017).

[113] The expression is used by Roman Kilisek in its publication at Breaking Energy on June 2015 and refers to the intra-regional agreements of energy supply cooperation among EU countries. Retrieved from: http://breakingenergy.com/2015/06/12/is-germany-outsourcing-its-future-energy-security/

public (Kiyar & Wittneben 2015:9631). The remaining 12.7 GW of nuclear that will be switched off by 2022 cause still divergent prospects, but the government on this matter sustains the renewables turn as sufficient (BMWi 2015:13).

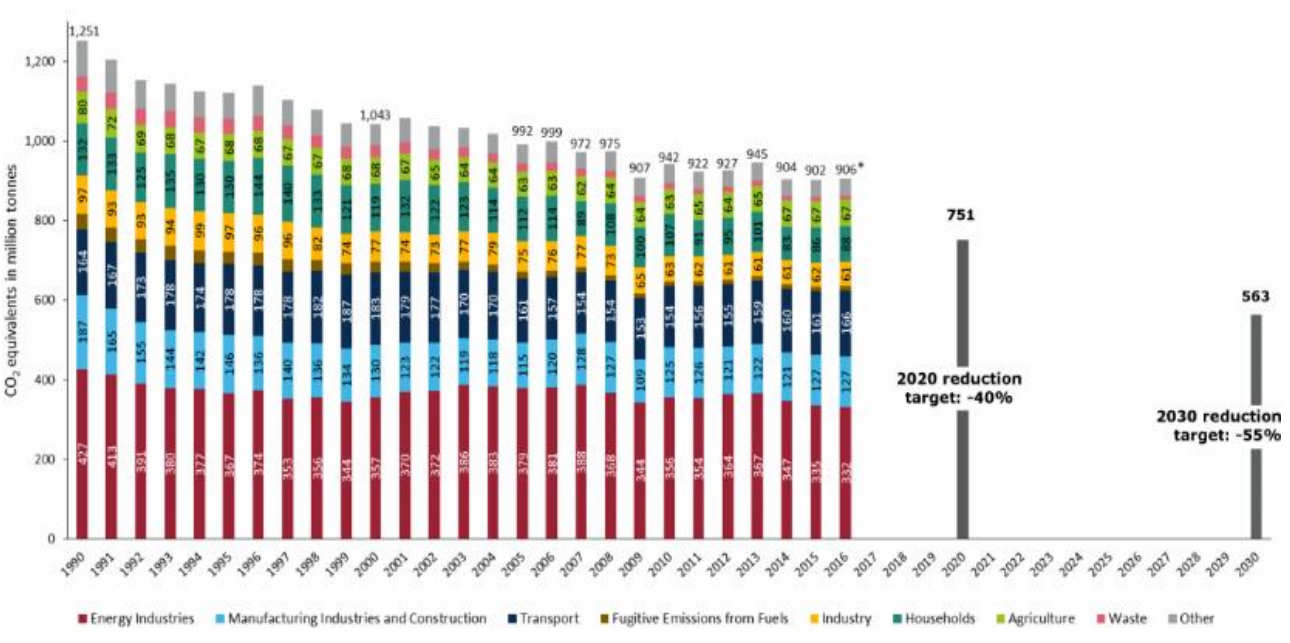
What is instead quite alarming is that coal is still producing more than 40% of the country's electricity and that the share of lignite power generation from 2010 to 2016 has remained unvaried (represented 23% in 2010 as well as in 2016), while considerably decreasing for a cleaner fossil fuel as natural gas (with 32.3 TWh less than 2010) (AGEB 2017). This shift, related to the costs of the raw material, implies that brown and hard coal are still able to access the grid before natural gas due to lower marginal costs. The rise in coal burning registered between 2011 and 2015 and slightly diminished in 2016 may furthermore be interpreted as a "*green paradox"* of this phase of the *Energiewende,* which according to Pittel et.al (2014) brings to an accelerated extraction of fossil fuels when renewables subsidies threaten to make conventional energy assets worthless[114]. This paradoxical situation may in this way speed up also polluting emissions, with severe consequences for the decarbonisation commitment, especially if the Carbon Capture and Storage technology keeps being postponed.

5.3 GHG Emissions analysis

To understand the decarbonisation effort that a country pursues is essential to look at the actual output of that economy in terms of pollution. Especially when a policy reform explicitly addresses GHG emissions reduction within concrete numerical targets, it makes sense to analyse whether the changes that it introduces do actually affect the emissions output. Green House Gases are for the biggest part represented by carbon emissions, but they do also include other pollutants (N_2O, HFKW, SF6, NF_3,Cha) that tend to arm the environment more at a local level. Indicators of GHG emissions usually include general emissions from all sectors, meaning from transport, industry, energy and domestic use and also emissions reduction targets address this comprehensive indicator. The energy transition in this respect has committed Germany to a 40% emissions reduction in all sectors by 2020 and an 80% by 2050 with baseline the emissions of 1990. This means, that from the 1248 million tons of Co_2 equivalent emitted in 1990, Germany should emit a maximum of 749 tons by 2020 and a maximum of 250 tons by 2050 (UBA 2017). Further, the energy industry, as recently decided in the Climate Action Plan 2050, is committed to a 61-62% emissions reduction (in comparison to 1990) already by 2030 (BMU 2016).

[114] Pittel et.al (2014:2) sustain that subsidies to renewables without complementary taxation on fossil fuels may incentive fossil fuel owners and producers to increase the short-term extraction to avoid asset losses.

Figure 13: GHG Emissions by sector in Germany, 1990-2016 (in Million tons Co_2 equivalent)



Source: Clean Energy Wire based on UBA 2017

As visible from the graph above, the target of 2020 requires still much effort to be achieved, because by the end of 2016 emissions show still a 155 annual million tonnes Co_2 excess (906 Mt Co_2). Interestingly, since the *Energiewende* is in place, the emissions output of the Federal Republic has diminished if compared to 2010 (941 Mt Co_2) but with a rather slow and fluctuating trend. The trend of emissions from the energy industry has been also decreasing (from 356 Mt Co_2 in 2010 to 332 Mt Co_2 in 2016) but again with a fluctuating trend, especially between 2011 and 2014.

The rapid rise of renewables from 2010 to 2016 (from a share in gross electricity production that was about 16,5% in 2010 to a 29,0% in 2016) was in this sense not enough to maintain constant the decrease in emissions of the power sector (Destatis 2017). This trend can be justified by a compensation with other more polluting fossil fuels, as the share of brown coal, which remained constant over the period (23,1% share of gross electricity production). The effects of a delayed shift in energy production model, not only maintain emissions at high levels, but also counteract the entire effort of the decarbonisation strategy, which appears still too vulnerable to market logics.

5.4 Testing the Post-Materialist hypothesis

The evidence collected in the electricity market has shown a rather controversial outcome in the delivery of a *"clean safe and reliable"* energy supply (BMWi & BMU 2010). In chapter 2 it was hypothesised that the nature of the commitment, and its roots in the anti-nuclear movement would have shaped this policy in a rather post-materialist optic (Inglehart 1977). Indeed, being the environmental cause the founding part of the energy transition ideal (original of the *Energiewende-Wachstum und Wohlstand ohne Erdöl und Uran*, 1981 publication) it can be argued that the sustainability aspect has been the one to drive policy formulation in the first place. The shape of the transition, its commitments to emissions reduction, to denuclearization and to a sustainable production of energy, have been indeed assuring to this policy high public support, which has been proved by regular pools, and by the involvement of citizens and communities in the renewables expansion (Agora 2015:13). With these premises, in chapter 2 it was hypothesised that this policy formulation has followed a rather post-materialist set of value focused on quality of life concerns and environmental responsibility. In the reconstruction offered in this research, the main policy representatives of these ideals were identified in the left-wing parties (SPD, die Linke and B90/Grünen) especially during the years of government of the Red-Green Coalition. Together with the Ministry of environment (BMU) they had a central role in shaping the nuclear phase out and the emissions commitment of the country.
The renewable energy focus of the transition has furthermore been helped by the confidence in sustainable technology development highly sponsored by agencies as IRENA (International Renewable Energy Agency with headquarter in Bonn) and think tanks as Agora Energiewende or the Öko-Institut (Berlin). Rising public awareness on the issue of climate change has furthermore created a solid base of consensus for the environmental friendly character of the transition.

However, with evidence of policy implementation until 2017, the post-materialist scenario assumes a different outlook. The evidence collected from the power sector shows indeed that the decarbonisation objective has been frequently sacrificed for materialist values of market convenience and economic security. The favourable pricing of domestic lignite and of carbon certificates in the EU emissions trading system have allowed fossil fuel fired-plants to remain competitive in the production of electricity and not enough has been done to discourage this situation. Further, the phase-out of nuclear energy has been re-negotiated for security of supply reasons by the conservative-liberal coalition in 2010 and qualified as "bridging technology" for the renewable turn of the country in the Energy Concept. The interests of conventional power producers, indeed, have been long preserved by the representation of the CDU-FDP coalition, which has traditionally supported the maintaining of atomic and fossil fuel energy for maintaining competitiveness in the industrial sector (BMWi & BMU 2010).

In particular, by pushing ahead the energy supply security concern, in 2010 the CDU-FPD government was able to extend the terms of the nuclear phase out and preserve the subsidies to the coal industry in the EU negotiations. In the case of nuclear energy, however, the extension of contracts with energy suppliers did not last long, and with the revision of mid 2011 created an unstable legal environment in which major producing companies were able to demand for onerous compensation. In the case of coal-fired energy, instead, the approach of the government remained more constant and driven by incremental changes rather than disruptive ones. Indeed, the interest of domestic coal industry and of the mining regions after the adoption of the Energy Concept has been mostly preserved for the political sensitivity surrounding the sector in the coal regions. Restrictions to coal-fired electricity after the adoption of the Energy Concept were made in two occasions: in 2014 with the decrease of subsidies and in 2016 with the creation of ad-hoc capacity reserves.
For both limitations, however the terms of compensation are considered to be very generous, firstly with consistent subsidies until 2019 and large compensation schemes for the workforce in the mining regions, and secondly for the capacity payments assured to the plants for their stand-by (capacity-reserves).

The clash of post-materialist and materialist values in this policy implementation phase is therefore evident. The conflict of interest shown among stakeholders is reduced to a sustainability-security of supply rhetoric and shows a policy development very dependent on party politics. The post-materialist connotation hypothesised at the beginning faces resistance to material concerns in policy practice. Thus, it can be argued that materialist values may restrain post materialist ones also when there is higher support for the latter.

6. Conclusion

This chapter provides a comprehensive response to the main research question and summarises the findings of the research as well as its limitations. Further, it furnishes an outlook for future possible research.

6.1 Main Findings

The intent of this research was the one of finding out whether the German energy transition was formulated and implemented in line with the European plan of decarbonisation policy, in particular by answering the question: *"Does the German energy transition conform to the EU energy framework of long-term decarbonisation towards 2050?".* The investigation was conducted through policy analysis and hypothesis testing and it provided step by step an answer to the three sub questions.

Concerning sub question 1 *"Is there evidence of policy convergence in the formulation of the EU Energy Roadmap 2050 and the Energy Concept of the Energiewende?"* this analysis has shown in chapter three and four that the two decarbonisation plans do not result directly related to each other as first hypothesised in the Europeanization argument.

Since the EU membership was conceived as driver of domestic change through imposition, learning and socialisation tools, it seemed likely that in the formulation of two decarbonisation plans with the same main target (decrease of emissions in the power sector of about 80% to 95% by 2050) and published within a really close time span, some sort of reciprocal influence could occur. However, a closer analysis of the two policy processes, have shown that the connection among the two documents is rather loose and that they have been legitimised by different internal needs.

The Energy Concept has been conceived in the first place as a tool to balance the domestic energy policy requests of the two major coalitions in the German parliament, and just successively as decarbonisation pathway strategy. In this sense, the main concern it was trying to address was the achievement of energy security of supply and to a lower extent the one of providing a plan to decrease polluting emissions. Although it supports a massive shift to renewable energy, the energy concept remains a document of energy policy with smaller interest in setting environmental objectives. It mostly focuses on the replacement of nuclear energy with green power production but with a major focus on power supply security and affordability rather than decarbonisation. Further, in the formulation of this document no particular attention is given to the need of a coordinated European action towards decarbonisation, but rather in achieving short term cooperation in specific areas (as the Internal Energy Market).

The Energy Roadmap instead, has been conceived as an encompassing evaluation plan for implementing decarbonisation objectives in energy policy. It has been firmly wanted by the European Commission to

assess the impact that decarbonisation targets may have in the European economic system and provides a technology neutral plan for the long term. Further, the focus on the environmental objectives derives from the greater competence of the Union in environmental policy rather than energy policy, and to the proactive role of environmental lobbies and institutions in Brussels. Although it has been published at a later stage, the mandate to perform this analysis was already given by the other EU institutions before the concretisation of the German plan, and therefore, also a direct agenda setting influence process could not be proved.

The interviews with experts coming from different fields and institutions, further pointed out that even if some form of top down and bottom up influence could have taken place (by imposing carbon control instruments on MSs and by promoting the use of renewables EU-wide) these mechanisms are in practice difficult to recognise and define precisely. Instead, a common position among experts emerged in ascribing a possible influencing role to the international arena. Similarity in the German and European policy formulation could have been in this way driven by the upper level of international agreements (particularly through the United Nations conferences on climate change). The gradual consolidation of a decarbonisation objective in global discussions may have indeed created a form of "International Regime" of patterned behaviour, which might represent itself the first driver of decarbonisation policy formulation.

Looking at sub question 2 *"Is the German energy transition performing according to the reference values it proposes?"* this analysis has shown in chapter five that inconsistencies between reference values exist.

While in the policy formulation stage the postmaterialist ideals of environmental protection, sustainability and social fairness seem to prevail on more materialist concerns of economic welfare due to the "green and safe" main attributes of the energy transition, the same cannot be said looking closely at the policy implementation. The post-material connotation of the energy transition formulation, after a close source by source analysis, appears to be restrained in policy practice by materialist concerns. Indeed, the resistance to change of conventional energy stakeholders (in particular the ones connected to lignite mining and burning) is currently interfering with the decarbonisation efforts made in the renewable energy development, and is causing a slowdown in the implementation of the energy transition. On the other side, the lobbying of the environmental stakeholders (from power producers to green representatives) has also produced inconsistencies in the policy implementation phase due to the accelerated installation of renewable energy power plants. Thus, the fast rise in renewables on the national territory, has also created a socially unfair situation representing a considerable financial burden on electricity consumers, penalising low income households way more than industry consumers.

Overall, the conflict of interest shown among stakeholders has been focused on a conceptual divergence in policy priorities (sustainability vs security of supply) and polarised in political discussion. Priorities of action

have been changing according to a party politics logic, which in turn have weakened the preliminary results of the energy transition.
The frequent changes in nuclear legislation have created an uncertain legal environment for power producers which may be easily exploited by big companies and will most likely represent a considerable burden on taxpayers. Although nuclear power has been successfully replaced by renewable energy, the rest of the power mix does still cause concerns. Since the Energy Concept is in place, the German transition has been fostering very rapidly renewable energy but has failed to integrate these sources accordingly in the electricity market. Indeed, market imbalances and a priority scheme for renewables have been deteriorating the profitability of other conventional sources but still allowed to the cheap domestic lignite to enter the grid easily. This situation, together with favourable emissions allowances prices in the EU ETS, have helped to maintain former privileges of conventional domestic power and have pushed investment in dirtier power plants rather than more expensive but cleaner ones (as natural gas).

These changes in the electricity market have also shown their effects in terms of carbon emissions.
The high sprint in renewable energy did not indeed produce strong decrease of polluting emissions as it could be expected and the trend of emissions have shown to be rather fluctuating, with a considerable incidence of the power sector. Therefore, the answer to the third sub question "*Are the changes applied to the power sector sufficient to reduce carbon emissions in the short-medium term?*" is not properly positive. If it is true that emissions in the short term decreased, however, the amount of reduction is still too limited as shown in chapter five. Decrease in emissions through the use of renewables have been compensated by higher emissions in dirtier industries causing a paradoxical effect in the cap and trade system. Being the price of allowances still too low in the market to discourage the use of fossil fuels, the effects of the energy transition have shown to be considerably dependent on market logics. Overall, with the current speed and trend of action Germany is likely going to miss its CO_2 reduction target for 2020 and has to apply significant changes for the achievement of its long term decarbonisation objectives.

Summing up these specific results, the answer to the main research question is also negative.
Although it is true that Germany with the *Energiewende* has formulated an innovative energy policy plan which sets limits to emissions conform to the decarbonisation objective of the European Union, the motivations behind this formulation differ from the ones of the Union. While Germany merely introduces the decarbonisation objective in connection to its energetic goals, the low-carbon connotation is handled as a primary objective by the Union in its assessment plan due to the greater competence of the EU in environmental policy.

Moreover, Germany is aiming at achieving almost full economic decarbonisation by 2050 with a very technology specific transition (based on renewables), which is actually not auspicated by the European plan, which suggests a more variegated and competitive energy market. Indeed, the reliance on intermittent renewable energy can cause not just market imbalances, but can also interfere with the low-carbon transitions of other neighbour countries due to the due to a free-riding effect of electricity export during peak hours.

In terms of policy implementation then, the inconsistent domestic choices of power production that Germany has made in the last six years are also undermining the decarbonisation potential of the transition keeping on protecting conventional energy sources sometimes at high economic and environmental costs. These choices, do not endanger just the efficacy of the domestic energy transition, but are also likely to prevent the Union in achieving its decarbonisation objective. Therefore, it would be highly beneficial having a stronger energy policy coordination among Member States and the Union.

6.2 Limitations of the research

The results of this research project are also subject to several limitations. The external validity and generalizability of this analysis can be reduced due to the contextual settings and choices made by the researcher. In particular, the theoretical frames chosen for the analysis present both some constraints to practical applicability.

Looking at the Europeanization framework, although it provided a useful and flexible tool of analysis of domestic and supranational policy convergence, it also failed to address some critical points. The first factor to consider, is that Europeanization research has been mostly used to evaluate the "*EU way of doing things*" in neighbour countries or new member states and it might not be of much help for the analysis of processes in countries already used to the EU method (Radaelli 2003). In particular, EU affection, especially when it comes to shaping beliefs, may have been already interiorised by MSs´ governments or may follow the behaviour of the dominant coalition of "old" MSs, leading to a difficult recognition of Europeanization effects. Another important limiting factor is the risk of "*conceptual stretching"* of the theory towards an encompassing explication of events (Sartori 1970: 1034-1035). Looking at EU membership as the only driver of policy change may be limiting the role of changes in other global, bilateral or national spheres (Bulmer & Laquenesque 2002:18). As a matter of fact, as the research shows, also the international context may become itself first driver of domestic change, but Europeanization fails to address this consideration. In this optic, having analysed domestic policy change as a dependent variable of European Union's membership, has reduced the spectrum of interpretation of the issue at stake with other alternative and broader explanations.

Also the second theoretical frame presents several limitations in the analysis, mainly related to its generalizability. Indeed, the conceptualisation of materialism and postmaterialism was produced with field work in Northern European countries and was dependent on personal background of survey participants (Marks 1997:53). The original intent of the researcher was the one of providing demographic trends in policy belief shapes, and at pointing out a generational clash of material and postmaterial priorities, elements that were omitted in this analysis because of a marked sociological nature. Further, when it comes to classifying policy beliefs, no precise differences in stakeholders 'positions can be outlined, because policy preferences can change over time. The confined generalizability of Inglehart´s conceptual framework, however, did not interfere with the basic use that this research makes of its value distinction. Material and postmaterial labels are still largely used terms in political science *"providing useful vocabulary for distinguishing fundamental political orientations"* (Berry 1999:44).

Finally, since the analysis was made on an evolving process and current topic in constant change, the results of this research and the main assumptions made on the data available can become obsolete with changings in legislation or market conditions.

6.3 Outlook for further research

An interesting point for further research, will surely be the one of analysing decarbonisation policy as a form of policy-specific international regime and point out whether a pattern in behaviour is actually occurring.

By closely analysing objectives and instruments developed at the international level, a subsequent research could help shed light on international coordinated action towards decarbonisation.

Further, the effects of the German energy transition in the national and international context could be constantly monitored to evaluate significant changes in policy implementation and effects on decarbonisation. In particular, the effect of the German transition on other Member States' energy policy and power markets can be evaluated.

Possible future analysis could also involve the investigation of the low-carbon transition in a wider time span, to evaluate whether an actual transition instead of an energy addition is taking place.

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8. Appendix

A. Transcript of Interviews

Interview 1

Expert: researcher with focus on the German energy Transition and Europeanisation research

20th January 2017 (21 minutes phone conversation)

R > Researcher

I > Interviewee

R: Thank you for your time and the availability to take part in the study.

I: you are welcome.

R: in order to transcribe the information I am going to record the conversation if is fine for you. However, then is up to you deciding whether the results should be kept anonymous or can be quoted. The all information is also available in the informed consent you received via email.

I: yeah, that's ok. You can also use this information as long and quote me on that as long as you let me check it before publication.

R: I am conducting this research for my master thesis in European Studies, and since I am currently living in Germany I got interested in the federal plan of energy transition and I wanted to find out more about it.

I: yes.

R: looking at the great impact that the Energiewende is having in Germany I decided to investigate what are the real effects of this decarbonisation plan and in particular how the Energiewende interrelates to other decarbonisation plans at the EU level, so for this reason I have tried to reconnect the energy concept of 2010 with EU energy Roadmap of 2011 because they seem to follow the same objectives and similar paths for the long term

I: yes

R: and what I found interesting is that the timeline for the publication of both plans is very close to each other, and that the stakeholder public consultation of the Commission initiated actually just a few months after the Energy Concept was published.

I: mmm

R: Due to your expertise in Europeanization research, and in the topic of energy transitions I would like to ask you your opinion on a couple of points that for me are not clear yet.

I: ok

R: Do you think that the strong German support to a long-term transition might have also helped to re-orient at the supranational level the attention to the decarbonisation issue? So that the early action of the Germans

might have pushed for a renewed commitment at the EU level after an unsatisfying international agreement in Copenhagen?

I: yeah so, I would argue that the roots of the process in Germany are a bit different than those that we see on the Eu level. So I mean if you look at the Energiewende, the Energy Concept here has a very strong connection to the nuclear exit and with a kind of compensation with renewable energies. So is more of a no-nuclear and pro renewables strategy and the climate aspect came up later, so was not really there in the founding moment.

R: ok

I: And if you look than at the EU level I mean you don't have an anti-nuclear policy, so that's not the case, and you have a very troubled renewables policy, where Member States don't agree, you have no specific fuel competency, or energy mix competency. So what's left at the EU level is mainly the climate perspective. I would say this is the reason why that was so strong insisted at the EU level, but from the German perspective the long-term climate thing that came on very late. The idea came really much more from the energy side than from the environmental one.

R: ok I see the point. So do you think might it also be the case that the German government, by acting before other member states may have tried to adapt the view on decarbonisation that should be taken at the EU level, so mainly preferring renewables rather than other low-carbon solutions as nuclear or CCS technology?

I: uh, this is hard to say, I am not fully sure. So I think what is important is maybe to look from a different angel and think why we have this 2050 debate. So where that comes from. So my argument would be that it was hard for everyone to fix a date in the future to start an economic analysis on that and mainly the initial point I think was the IPCC report..ehm..the forth assessment report of… 2007 if I recall well.

R: yes 2007

I: I think in that document there was one of this footnotes targets for industrialized countries 80 to 95% and that was the first moment when in the EU and also in Germany this 2050 perspective achieved kind of one angel, you know? Something from where you could start from calculating. Because before that most of calculations ended in 2020 or 2030 but they did not have anything where to focus on. So it provided where do we actually want to go from here? And that was very helpful for the debate to have as reference. And of course, I mean, what the Commission did was not only having an energy perspective but also looking into electricity and transport. The three main roadmaps.

R: yeah

I: while the German concept was much focused on electricity and basically excluded in the first round the other parts. This is also a very big difference on the two views on major transition.

R: Ok. Well, so they provided this direction afterwards right?

I: yes exactly. Later on that came also in but has been always weaker, also on the calculation base and it was not even in the public debate. So the energy Roadmap by the Commission was much more debated because it was comprehensive in the sense that it also included the other sectors for achieving decarbonisation, while in Germany much more focused on how the electricity sector should change.

Further, the Energy Roadmap was not even properly initiative of the Commission, but was a task given by the European Council to assess the 2050 target discussed in Copenhagen. While in Germany this was more driven internally by the Environment ministry, and the discussion and proposals started internally and came intrinsically. So the assessment and calculation base for the Energy Concept mainly came from another starting point.

R: ok this obviously changes the nature of their relation, I was not sure it was the Council to ask for this assessment.

I: yeah, I know is not that straightforward, but I think it was demanded in one of the resolutions following the Copenhagen summit, or could have been also in December 2009 maybe. So at the EU level the starting point of the all debate on the 2050 targets I think has to be found around these two events, the Copenhagen Summit and the Council resolutions in which the intent was firstly supported.

R: ok this in an interesting point, and it actually makes the relation between the Energy Concept and the Energy Roadmap rather blurring. Would you like to conclude with a last remark? Do you perhaps denote evidence of top down or bottom up Europeanization In the formulation of these two policy projects? Or not even?

I: ehm, is very tricky to say how much these things are connected. I would say that there is always an exchange between the levels and you see how the other level gets criticism and you try to avoid that, and I think it was on both levels decarbonisation policy was very pushed by the environmental community, so in promoting the all assessment and targets. So there might be a connection in this sense, but is difficult to prove from the outside. But in general, I have to say that in Germany were more important autonomous and intrinsic domestic drivers. On the other hand there might have been also a relevant push from Germany to the EU to do this 2050 assessment. Especially from the ministry of environment since it is an actor that in the EU scene has gained way more relevance that it has in domestic policy.

R: how exactly?

I: Is a long story but basically in general the environmental community had less power in respect to other conventional economic sectors in national policy so they always tried to compensate it overtime with greater lobbying in the EU arena. So that could be also the case.

R: ok, I see, this would certainly be another interesting point of research.

I: indeed, but it most likely will require way more time. Anyhow I hope my answers helped you already to have a better idea on the issue.

R: yes sure, thank you again for finding the time to answer.
I: good luck with your further analysis and interviews, I wish it will bring to a good result because is a very interesting topic.
R: I wish so, thank you.

Interview 2

Expert: researcher with focus on European energy policy

20th January 2017 (email correspondence)

Email with questions:

Dear X,

As a student of European Studies, my master thesis research focus is on the German energy transition, its effects in the national context but also its contextualization in the European arena. To this end, I am currently analyzing whether the formulation of the 80-90% emissions reduction target for 2050 at the national and European level has developed simultaneously, in a parallel way or may have been influenced by relevant national actors. Since at the end of 2010 Germany published its intention to move forward this decarbonisation target by 2050 in the Energy Concept, also the Commission a few months later published the results of the public consultation and technical-economic plan to achieve almost full decarbonisation contained in the Energy Roadmap to 2050 (despite at the EU level the agreement on the necessity to pursue this strategy was achieved already in 2009 by the EU Council).

What is to me currently not clear, is whether these events are interrelated to each other and whether possible causal links exist between them. In order to analyse the connection, I am using the theoretical guidance of Europeanisation theory and making hypothesis of top-down affection from the EU to the German context but also on the other way round as bottom-up affection from the German government to the EU.
Therefore, my questions to you would be:

"Might it be the case that the EU has exercised with its soft policy agreement on a long-term decarbonisation path, Energy Roadmap 2050, a top-down affection in Germany's national energy and climate objectives? And if yes, to what extent?"

or from a different perspective

"Might it be the case that Germany with its forefront position (and early publication of the Energy Concept) may seek to re-orient at the supranational level the attention on the decarbonisation topic and adjust the EU framework under its specific needs? So basically a transition mainly focused on renewables rather than other low-carbon energy sources? "
Hoping that the questions are clear enough, I thank you in advance for your participation.
Best Regards, O.G.

Expert reply:

Thank you.
In short, I think it may be more useful to look at the reverse relation, have EU objectives (which date back from Hampton Court 2005) and other factors (e.g. Kyoto Protocol) impacted the Energiewende or the Energy Concept itself?

I have no proof of what I am about to say in this paragraph, but my rough guess would be that both 2010EK and 2011 'EU2050' roadmaps have been done with loose (or without) coordination. You can try to identify who did the actual work which, at least for the EU roadmap, may have been done by a private contractor.

Also have a look at the discount rate, which is critical in approaching the inter-temporal dimension of the energy transition (and more generally, the fight against climate change). In short, the bigger the discount rate, the less you can about the future. This element is of critical importance when modelling the cost of any investment, including energy ones. As I wrote in one of my recent papers: "R.S. Tol, argue that "mitigation and adaptation should be kept largely separate", usually to promote a reduction of the mitigation effort and a stronger adaptation effort, it is clear that emphasising adaptation should definitely not be a leeway to reduce the mitigation effort, but rather a way to increase the credibility of the commitment and to establish its determination to fight climate change, whatever it takes. Combining credible adaptation policy and mitigation roadmap would reduce the incentive of free-riding in the international climate change negotiations. From an economic perspective, mitigation policy is a local cost for a global benefit, whereas adaptation policy is a local cost for a local benefit, which makes the latter easier to implement. However, this approach embeds assumptions, such as the fact that society will be able to adapt to future climate (no catastrophic risk), or the use of discount rate up to 5.5%, which leads to undermine the welfare of future

generations compared to present and nearer generations. For a more in-depth discussion, see: R. S. Tol, Adaptation and mitigation: trade-offs in substance and methods, Environment"

One limit to Europeanisation is precisely the shift between the Energy Concept and the Energiewende. With EW, Merkel decided to speed-up the nuclear phase-out, in a way that was actually recently judged to be illegal under German law. The EW is anti-climate as it prioritises nuclear phase-out over coal phase-out. With the rise of energy efficiency and renewables, there are only a few GW you can phase-out at a given moment. Then, you need to choose which power plants you phase out first, EK had some sort of balance between nuclear and coal, EW de facto means that coal power plants are temporarily saved as DE will not start to shut down coal power plants before having shut down all its nuclear power plant. Unless bold decisions are taken now, Germany will miss its national and EU target to reduce GHG by 40% by 2020 and could be fined for that if anyone (Commission or State) has the courage/willingness to attack Germany in front of the ECJ when we will have the data, so I guess by 2022.
The EU does not have a clear policy on nuclear, but it has one on GHG emissions. In the EW, the German Government clearly chose its electoral priority of speedy nuclear phase out at great financial and climate change cost, over the EU priority of reducing GHG emissions.

To answer more precisely your questions: No I do not think that the German action re-oriented the political discussion at the EU level. First of all because the transition proposed by the Germans focuses on the nuclear phase-out over decarbonisation.
EU attention to decarbonisation instead predates the Energy Concept. Before 2011, the EU actually took many steps, name the third energy package, the 2020 targets that were debated and set in 2005-2009, with a binding target of 20% RES, and binding national targets.
So I wouldn't talk of an early action of Germany because they were the first ones to massively go for renewables in the electricity mix, true, but that is it, and that is not an energy transition. That is only the addition of solar panels and onshore wind electricity without thinking of the consequences. For instance, Germany failed to provide the power grids necessary to ensure that electricity now produced in norther Germany thanks to wind power would be physically able to be sent to southern Germany where nuclear power plants are being phased out, as a result, Germany is currently free-riding on its neigbours electricity networks esp. NL, CZ and PL (we call that "loopflows"). In a more critical manner, very little was done on energy efficiency and on non-electric renewables (e.g. biomass for heating), and Germany is still investing billions of public and private money in coal and gas infrastructures in a way that is inconsistent with Germany's own national targets for GHG, as well as the EU targets and the Paris Agreement. Nordstream 2 is a good example for gas. For coal, have a look at Ptolemeida V that is a coal power plant being built in

Greece with German public money (KFW 800M€ guarantee) and should start working in 2019, meeting that it would emit millions of tonnes of CO_2 until 2060 or so, at a moment when, according to the EU's 2050 roadmap, electricity should be CO_2-free.

Interview 3

Expert: researcher with focus on German energy policy

February 2017 (email correspondence)

Email with questions: Same as Interview 2

Expert reply:

Dear O.G.,

Perhaps I can help you, even if the events, you are referring to, are already far from now. But I tried to remember me, I was not really checking my files.

In my view, the general situation was to be globally successful in Copenhagen, at CoP 15, in December 2009. Given the formally not ideal state of world government, the informal body responsible for the globe as a whole is the G8. In the run-up to Copenhagen, the presidency was, succeeding with UK (Blair) and Germany (Merkel). In my view, it has been this context, in which has been decided on:

the global aim, the industrialized countries would suggest to the rest of the world, with the intention to get their consent at CoP 15

which aim the industrialized countries have to accept for themselves, also each of them, i.e. also that of the EU

which aim for Germany would be suitable, that there is a chance, that the other European member states, which were not included formally in the G8 summit preparation would give their consent.

So, the decision is in my view not to be framed in a binary causation, that either a top down (EU induced Germany) or a bottom up (Germany induced the EU) event took place. It has been decided all together, at the right level, at global level.

But of course, that has been informal and did not produce binding decisions. So try to interpret these international meetings also at a broader level, looking just at binding decisions may reduce the importance of these events. By the way: There is in my view one person, which might be helpful for your analysis, try to contact him as well (contact interviewee 5).

Interview 4

Expert: Institutional Member in the European Commission, focus on environmental policy

10th February 2017 (14 minutes phone conversation)

R: Thank you for your time and the availability to take part in the study.

I: You are welcome. Let me know how can I help.

R: In order to transcribe the information I am going to record the conversation if is fine for you. However, then is up to you deciding whether the results should be kept anonymous or can be quoted. The all information is also available in the informed consent you received via email.

I: yes you can record it, but concerning the citation I would prefer to control the work before your submission.

R: Ok, thank you. So, first of all let me introduce you the topic and focus of my research.

I am conducting this research for my master thesis in European Studies, and since I am currently living in Germany I got interested in the federal plan of energy transition and I wanted to find out more about it.

I: yes.

R: looking at the great impact that the Energiewende is having in Germany I decided to investigate what are the real effects of this decarbonisation plan and in particular how the Energiewende interrelates to other decarbonisation plans at the EU level, so for this reason I have tried to reconnect the energy concept of 2010 with EU Energy Roadmap of 2011 because they seem to follow the same objectives and similar paths for the long term.

I: yes

R: and what I found interesting is that the timeline for the publication of both plans is very close to each other, and that the stakeholder public consultation of the Commission initiated actually just a few months after the Energy Concept was published.

So my question for you would be:

Might it be the case that the EU has exercised with its soft policy agreement on a long-term decarbonisation path, Energy Roadmap 2050, a top-down affection in Germany's national energy and climate objectives?

Or alternatively, do you think that Germany, by supporting a long-term transition might have also helped to push for a faster policy framework creation more accommodating to its model? So basically more space for renewables rather than other low-carbon sources?

R: Well let me see, the *Energiekonzept* that you are mentioning is of 2010 right?

I: yes

R: and you are interested in the relationship of the plans due to their close timing and content similarity right?

I: exactly

R: Ok so, the Germans proposed a long term plan for 80 to 95 % reduction by 2050 and it was introduced in this document.

I: yes

R: Well of course this is a target taken also for the formulation of the Roadmap assessment, but I don't think just because it was published afterwards it can be attributable to the Germans. Or not even that Germany wanted to impose its own model.

I: because of the previous international agreements and the study of the IPCC?

R: yes because of the IPCC conference projection in the first place, due to its centrality in the decarbonisation debate, which is already of 2007, and also the EU Council of 2009, which further backed up the need of cutting emissions in European economies for the long term and which saw almost full agreement on the GHG emission reduction target. Already by 2009 the Union was forwarding this commitment, and almost every Member State, except from a strong opposition of Poland, did agree on the objective for the 2050. So I wouldn't say that the target was made up by the Germans but rather attributable to the IPCC conference projections and the EU Council that stated that already in 2009. Therefore, the content of the Energy Concept target should be based on these documents, and not the other way round. The decarbonisation objective has been elaborated during the international negotiations of the last years, and was mostly targeted for industrialised countries.

I: Yes absolutely, I think in this respect the 2009 EU Council was probably the key also to German action.

R: Yeah I don't recall the year exactly but is about this time frame.

I mean, it is important for the all Union that Germany proposed an energy policy built in this way, but is still not something that they came up with.

Concerning the work for the Roadmap to 2050 we published first the EU roadmap communication and then the Energy roadmap of 2011 because it required more detailed work. And yes, at that point of time we were of course aware of the work of the Germans. In a certain way it might have facilitated the approval of the proposal and might have given a strong back up to the work of the Commission, because of course Germany is a big and strong member of the Union, but this does not mean that we acted as a result of this early action.

Actually the EC conducted this studies, impact assessment and consultations because needed its own assessment plan and needed to verify how decarbonisation could be concretely achieved domestically.
Then of course every country can envisage and plan its own way to achieve this targets but we thought of providing a framework for practical assessment using this roadmap.
At first there was not even the Council approval at first for the target of 80-90 % reduction, because of the opposition of the Polish government, which wanted a lower percentage than 80 %.
So we, from the Commission insisted on the 80-90 % target, to maintain a coherent position of the Union. And the aim of the roadmap was really to provide a credible assessment of this target and elaborate economical models based on that.
R: I see the point.
I: Then, of course at the EU level agreement is always difficult to achieve as I mentioned for the polish case, so when a coalition of countries, or big countries support some policy ideas is of course easier for us to get agreement on issues. But I would like to repeat, that although the German action might have helped create consensus on the issue, the planning and writing of the Roadmap was motivated just by a reason of providing an own impact assessment.
R: clear enough. And concerning a European influence on the formulation of the German energy transition policy?
I: well, this is hard to say. I think Germany mostly wanted to abandon nuclear, and then decided for a transition mostly renewable based. I need to admit that the Germans have been always backing up efforts in climate mitigation, but I don't really know if this results from the membership in the Union. Probably is the global attention on climate mitigation that counted more.
R: interesting point.
I: but in general I would not talk of a straight correlation among the two strategies. No.
R: ok, thank you for the comments. Your insights will be certainly valuable for my analysis. Thank you and have a good day.
I: no problem, bye.

Interview 5

Expert: member of a German institution, specialised knowledge in environmental policy

24th March 2017 (20 minutes conversation)

The expert does not want the call to be transcribed because it would need a special permission from the institution in which he is working.